Severity of Borderline Personality Disorder Symptoms as a Moderator of the Association Between the Use of Dialectical Behaviour Therapy Skills and Treatment Outcomes
Abstract

A core aspect of Dialectical Behaviour Therapy (DBT) is the acquisition and use of DBT skills to replace maladaptive behaviours. However, it is unclear whether DBT skill use is associated with differential reductions in psychological distress across individuals with varying severities of borderline personality disorder (BPD) symptoms. In the current study, moderated mediation analyses were conducted to examine the relationships among perceptions surrounding DBT skill use, pre-treatment BPD symptom severity and changes in psychological distress over the course of a 12-week DBT-informed skills training program in a sample of outpatients with mixed psychopathology, including a minority with BPD (N = 102). It was predicted that (i) self-reported use of the four types of DBT skills (mindfulness, emotion regulation, distress tolerance and interpersonal effectiveness) and (ii) patient perceptions surrounding these skills (confidence and perceived effectiveness) would be associated with greater improvements in psychological distress in individuals with higher levels of BPD symptoms compared to individuals with lower levels of BPD symptoms. Results supported this hypothesis, indicating that self-reported DBT skill use and attitudes towards DBT skills are associated with differential patterns of reductions in psychological distress.
Severity of Borderline Personality Disorder Symptoms as a Moderator of the Association Between the Use of Dialectical Behaviour Therapy Skills and Treatment Outcomes

Dialectical Behaviour Therapy (DBT) was originally designed to treat chronically suicidal individuals with borderline personality disorder (BPD), but is now used in the treatment of a wider range of clinical disorders including depression (Neacsiu, Rizvi, & Linehan, 2010), and eating disorders (Chen, Matthews, Allen, Kuo, & Linehan, 2008). DBT is a principle-based treatment that aims to address emotion dysregulation by emphasizing patients’ need for acceptance, as well as the urgent need for behavioural change (Linehan, 1993). A key aspect of DBT is its inclusion of skills training that focuses on teaching patients new behavioural skills to replace the maladaptive behaviours associated with BPD. The first module taught in the skills training group is mindfulness, which aims to reduce confusion about the self by teaching patients to observe their internal state in a non-judgmental manner. This is followed by the emotion regulation skills, which aims to decrease emotional instability. Distress tolerance targets impulsive behaviours. Finally, the interpersonal effectiveness module aims to reduce the interpersonal chaos often experienced by individuals with BPD. The generalisation of these four core skill areas to patients’ natural environments may potentially underlie positive treatment outcomes in DBT (Lynch, Chapman, Rosenthal, Kuo, & Linehan, 2006).

Since its inception, many adaptations of DBT have arisen. Standard (comprehensive) DBT programs consist of individual psychotherapy, skills training groups, telephone consultation, and therapist consultation groups over the course of 12 months. While DBT has been shown to be effective in reducing symptoms and
increasing functioning, briefer adaptations of DBT may offer similar improvements. Studies have demonstrated the efficacy of six month (Koons et al., 2001; Stanley, Brodsky, Nelson, & Dulit, 2007), and three month (Bohus et al., 2000) adaptations of DBT. Similarly, studies have also shown that three month DBT-informed treatments consisting of skills training as a standalone treatment may be effective in reducing internalising and externalising symptoms (Bohus et al., 2013; Gibson, Booth, Davenport, Keogh, & Owens, 2014; Nelson-Gray et al., 2006).

Consistent with expectations, the use of mindfulness, emotional regulation, distress tolerance, and interpersonal effectiveness skills has been shown to increase over the course of DBT for individuals with BPD (Lindenboim, Comtois, & Linehan, 2007; Neacsiu, Eberle, Kramer, Wiesmann, & Linehan, 2014). Interventions that include skills training have been shown to be more effective than adaptations of DBT without a skills training component (Linehan et al., 2015). Several studies have also indicated that DBT skills use accounts for a significant proportion of improvement in BPD symptoms (Harley, Baity, Blais, & Jacobo, 2007; Stepp, Epler, Jahng, & Trull, 2008). Furthermore, Barnicot, Gonzalez, McCabe, & Priebe (2015) found that more frequent DBT skill use was associated with lower levels of self-harm in a sample of patients with BPD, independently of common treatment processes such as self-efficacy. Therefore, the extent to which patients report using DBT skills may be linked to symptom improvements over the course of DBT.

Other factors that could be associated with symptom change in DBT are patients’ confidence in practising skills, as well as the extent to which they perceive practising skills to be effective in achieving good treatment outcomes. However, there is limited knowledge on how these patient-related variables relate to outcomes in DBT. Studies have demonstrated comparable outcomes among a number of
different types of treatments aimed at reducing BPD symptomology, such as schema focused therapy and mentalisation based therapy (Clarkin, Levy, Lenzenweger, & Kernberg, 2007; Zanarini, 2009). Thus, while it is possible these treatments achieve similar outcomes through treatment-specific processes, processes that are common to all of these treatment modalities may also be associated with symptom change. Wampold (2001) proposed that self-efficacy, the degree to which patients feel confident in their ability to complete a task, and treatment credibility, the extent to which patients perceive participating in their treatment as an effective way of improving their health, are two key processes that are common across treatments. A number of studies have demonstrated that self-efficacy predicts treatment outcomes in a number of areas, including depression and substance use (Clarke et al., 2014; Kadden & Litt, 2011). Consistent with the theory that onepeople’s belief in their ability to perform treatment tasks successfully is linked to treatment outcomes, Barnicot et al., (2015) also found that higher self-efficacy was associated with lower concurrent levels of self-harm over the course of a DBT program for individuals with BPD. In addition, patients’ perceptions of the effectiveness of treatment have been identified as important predictors of the quality of therapeutic alliance, as well as psychotherapy outcomes (Clemence, Hilsenroth, Ackerman, Strassle, & Handler, 2005). For example, Meyer et al., (2002) found that patients who expected treatment to be effective were more likely to engage constructively in sessions, which resulted in symptom improvement. Thus, factors such as patients’ perceptions of the degree to which using skills will be effective in reducing their distress, as well as their confidence in practicing DBT skills may also be linked to symptom change, and be useful indicators of progress in DBT skills training programs.
If the use and perceptions of DBT skills have the potential to be related to patient improvement, it could also be the case that factors such as symptom severity may also be associated with patient change over the course of DBT. The severity of individuals’ BPD symptoms in particular may moderate the potential mediating influence of the perceptions and use of DBT skills on patient change (Sanislow et al., 2002). Symptoms of BPD include emotion dysregulation, impulsivity, identity disturbance, interpersonal difficulties, as well as self-damaging and suicide behaviours (Selby & Joiner, 2009). While researchers have commonly used samples with diagnoses of BPD to evaluate the effectiveness of DBT skills training (Neacsiu et al., 2010; Soler et al., 2009), it may also be important to assess whether varying levels of underlying BPD symptomology in clinical populations are associated with differential levels of symptom reduction throughout the course of DBT programs. Several studies have demonstrated that many young adults who do not meet diagnostic criteria for BPD, but still endorse significant BPD features, still experience significant levels of distress in a number of functional domains (Bagge et al., 2004; Trull,Useda, Conforti, & Doan, 1997). In addition, individuals deemed to have recovered from BPD tend to experience continued functional impairment in domains such as social functioning (Gunderson et al., 2011). Furthermore, the presence of even a single BPD feature is associated with negative outcomes including increased psychiatric hospitalisations and suicide risk (Ellison, Rosenstein, Chelminski, Dalrymple, & Zimmerman, 2016; Zimmerman, Chelminski, Young, Dalrymple, & Martinez, 2012). As such, there could be merit in exploring the effects of BPD symptom severity on the association between DBT skills training and patient outcomes.
Although DBT has increasingly come to be associated with targeting pervasive emotion dysregulation in a range of disorders rather than BPD specifically, the skills training component of DBT may potentially be more effective in addressing symptoms in individuals with high levels of BPD symptomology. Patients with higher levels of BPD symptoms have been shown to have deficits in areas such as interpersonal functioning, emotion regulation and distress tolerance, which could be ameliorated via skills training (Conklin, Bradley, & Westen, 2006; Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006; Skodol et al., 2002). Thus, these patients may have a greater need for skills training and practice to reduce such deficits, relative to individuals with lower levels of BPD symptoms. In addition, higher pre-treatment BPD severity has been found to predict greater symptom change, although, this finding could potentially be due to the tendency for individuals with BPD to display particularly elevated levels of distress, thus leading such individuals to be more likely to experience improvements at the end of therapy (Barnicot et al., 2012). On the whole, these findings suggest that DBT skills use may potentially be associated with larger improvements in psychological distress over the course of DBT in individuals with more severe BPD symptoms, compared to individuals with less severe BPD symptoms. These predictions are synthesised in Figure 1, which depicts a conditional process (i.e., moderated mediation) model.

It is currently unclear as to whether the mechanisms through which DBT exerts its putative effects are the same for individuals with different levels of BPD symptom severity. The use of certain skills taught in other therapies such as cognitive behaviour therapy has been shown to be associated with differential symptom alleviation (Hawley et al., 2017; McCart, Priester, Davies, & Azen, 2006). For example, Hawley et al., (2017) found that higher levels of behavioural activation use
in patients with mild to moderate levels of depression who completed 14 sessions of cognitive behavioural therapy was associated with a higher decrease in depressive symptoms. Given increased emphasis on tailoring treatment approaches to different individuals (Cuijpers & Christensen, 2017), it may be useful to elucidate how individuals’ BPD symptom severity relates to the association between DBT skills use and patient improvement over the course of DBT. Examining these associations in a treatment-seeking sample may help to improve understanding on whether self-reported compliance with and attitudes towards skill use during short-term DBT programs is related to changes in psychological distress.

The aim of the current study was to examine the relationships among DBT skills use, attitudes towards skills use, and BPD symptom severity over the course of a transdiagnostic 12-week DBT-informed skills training program in a sample of outpatients with mixed psychopathology, including some individuals with BPD. It was first hypothesised that DBT skills use (i.e., mindfulness, emotion regulation, distress tolerance, and interpersonal effectiveness), as well as non-specific therapy factors such as patient confidence and perceived skills effectiveness would mediate changes in psychological distress from pre- to post-treatment. Second, it was hypothesised that the mediating roles of DBT skills use, along with patient confidence and perceived skills effectiveness would be moderated by BPD symptom severity. More specifically, it was anticipated that the association between perceptions of DBT skills and reductions in psychological distress from pre- to post-treatment would increase as individuals’ BPD symptom severity increases.

Method
Participants

Participants were 102 patients at a private psychiatric hospital located in Australia. Ages of participants ranged from 18 to 68 years ($M = 37.23$, $SD = 13.02$, 72.41% females). The sample consisted of day patients, who came to the hospital each week for their weekly group skills training and individual sessions. Patients who attend the hospital have private health insurance, and therefore, 80% of patients typically fall in the top 50th percentile of indicators of economic advantage (Hope, Hooke, & Page, 2009).

Patients were diagnosed by their treating psychiatrist according to criteria in the 10th Revision of the International Statistical Classification of Diseases and Related Health Problems. 17.65% of patients received personality disorder diagnoses. Of these patients with primary personality disorder diagnoses, 86.67% received a diagnosis of BPD. The remainder of patients received diagnoses of mood disorders (41.18%) and anxiety disorders (25.88%). A minority of patients received diagnoses of substance use disorders (11.76%). A small number of patients received primary diagnoses of behavioural disorders and schizophrenia (3.52%).

Materials

**Borderline Symptom List – Short Version (BSL-23; Bohus et al., 2009).**

The BSL-23 is an abbreviated version of the original Borderline Symptom List. Patients rate their experience of symptoms such as mistrust of others over the previous week on a five-point Likert scale ranging from 0 (not at all) to 4 (very strong). Higher scores on the BSL-23 indicate greater severity of BPD symptoms. The BSL-23 has been shown to have high convergent validity (Bohus et al., 2009). The Cronbach’s alpha associated with the BSL-23 was .76.
World Health Organization’s Wellbeing Index (WHO-5; Bech, Gudex, & Staehr Johansen, 1996). The WHO-5 is a self-report measure that assesses positive mental health. It consists of 5 items, each rated on a six point scale ranging from ‘all of the time’ to ‘at no time’. Higher scores indicate more positive ratings of wellbeing. The WHO-5 has been found to be a valid measure of wellbeing in primary care samples (Bonsignore, Barkow, Jessen, & Heun, 2001; Henkel, 2003). The internal consistency of the WHO-5 in the current sample was $\alpha = .87$.

Five Item Daily Index (DI-5; Dyer, Hooke, & Page, 2014). The DI-5 is a self-report measure designed to monitor five aspects of psychological distress: depression, worthlessness, anxiety, coping behaviours and suicidal ideation. Participants rate items on a six-point Likert scale ranging from 0 (at no time) to 5 (all the time). Scores range from zero to 25, such that higher scores indicate greater levels of psychological stress. A score of six can be considered the cut-off for a ‘functional’ population (Dyer, Hooke, & Page, 2014; Jacobson & Truax, 1991). The DI-5 correlates strongly with other measures of mental health and therefore has been suggested to be an measure of symptomology that is appropriate for us in psychiatric settings (Dyer et al., 2014). The internal consistency of the DI-5 in the current sample was $\alpha = .89$.

Health of a Nation Outcome Scale (HoNOS; Wing et al., 1998). The HoNOS is a 12-item clinician rated measure designed to assess patient health status. The questionnaire consists of items that cover several domains: physical health, life functioning and mental health symptoms. All items on the questionnaire are rated from 0 (no problem) to 4 (severe problem); thus low scores indicate healthier functioning, and a score of 2 indicates clinically significant distress. The HoNOS has good content, concurrent and predictive validity (Newnham, Harwood, & Page, 2009;
The internal consistency of the HoNOS in the current sample was $\alpha = .65$.

**21-Item Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995).** The DASS-21 is a self-report measure that assesses depression, anxiety and stress. Patients rate items such as ‘I found it hard to wind down’ on a 4-point Likert scale 0 (did not apply to me at all) to 3 (applied to me very much). The DASS-21 has excellent reliability and validity in clinical samples (Page, Hooke, & Morrison, 2007). The internal consistency of the DASS-21 in the current sample was $\alpha = .83$.

**DBT Progress Questionnaire.** The DBT progress questionnaire is a brief, self-report measure that was designed for the purposes of the current study to assess patients’ compliance with skill use over the 12-week DBT program. The DBT Progress Questionnaire consists of six items. There are four items that assess patients’ use of the four main skill domains covered in DBT skills training (i.e., mindfulness, emotion regulation, distress tolerance, and interpersonal effectiveness), as well as two items that assess their confidence in using such skills and perceived effectiveness of these skills. Patients respond to questions such as ‘I have been able to bring my attention to the present moment over the past week’ and ‘I have felt confident in using my DBT skills in challenging situations over the past week’ on a six-point scale ranging from 1 (at no time) to 6 (all of the time). Higher scores on the progress indicate greater levels of self-perceived progress.

To explore the structure of the DBT Progress Questionnaire, the six items of this questionnaire were subjected to principal axis factoring. First, the number of factors to extract was determined using on a parallel analysis of 1000 datasets, with the critical eigenvalue for the parallel analysis set at the 95th percentile. The parallel
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analysis was conducted in SPSS based on O’Connor’s (2000) syntax. The eigenvalues generated by the parallel analysis were 2.55, .08, .02, -.10, -.14 and -.20, indicating a one-factor solution. As such, principal axis factoring was conducted with one factor. Since there were no factor loadings below .40 (Table 2), none of the items needed to be removed (Costello & Osborne, 2005). An internal consistency reliability analysis was then performed to determine whether it would be appropriate create a single total score based on the items in the DBT Progress Questionnaire. This yielded a Cronbach’s alpha estimate of .84, suggesting that it was appropriate to form a single total score. Test-retest reliability was $r = .66$.

Treatment

This present study collected and analysed naturalistic data from patients who were assigned to the 12-week DBT program based on the referral of their treating psychiatrist. Psychiatrists assign patients to this 12-DBT week program on the basis of clinical judgment of whether patients will benefit from learning skills to improve emotion dysregulation. In addition to the 12-week DBT program, psychiatrists can also refer patients for acute inpatient admissions, as well as outpatient cognitive behaviour therapy or art therapy programs. Patients’ ability to enrol in other psychotherapies at the time that they were undergoing DBT-12 was restricted. However, some patients may have completed treatments outside DBT-12 in exceptional circumstances. Some patients also received medication over the course of the 12-week program upon the recommendation of psychiatrists, however, medication intake was not strictly accounted for as investigating the effects of medication was not a primary objective of the study.

The 12-week program that all patients in the sample attended is an abbreviated and adapted version of comprehensive DBT. This treatment consists of weekly group
skills training sessions, weekly individual therapy sessions and telephone consultation on an as need basis. Skills training is administered by therapist dyads in weekly group sessions that last for three hours each. Patients attend these sessions in groups of ten on average. A comparable amount of time is spent instructing patients in each of the core DBT skills modules (mindfulness, emotion regulation, distress tolerance and interpersonal effectiveness) over the 12 weeks. Patients are expected to attend all 12 sessions. Therapists who facilitate the DBT skills training groups are senior clinical psychologists and occupational therapists. Therapists’ experience with DBT ranges from three to 20 years, with most of the therapists having practiced DBT for over ten years.

In addition to the group sessions, patients also attend one-hour weekly individual psychotherapy sessions. These individual sessions are aimed at helping patients to generalise DBT skills to their daily lives. Patients are also able to phone the hospital 24 hours a day to assist with crisis management. However, in contrast to comprehensive DBT, patients consult with a mental health nurse, rather than their individual therapist. Hospital crisis managers work in collaboration with DBT therapists. In contrast to comprehensive DBT programs, there is no formal therapist consultation arrangement due to logistical issues relating to scheduling and resources. As such, therapists consult with each other informally as required.

**Procedure**

Data were collected as part of an ongoing process of evaluation and clinical improvement at the hospital. Informed consent was obtained from patients at
admission. Study procedures were approved by the relevant institutional ethics review board. Patients were asked to complete the DBT Progress Questionnaire at the end of each of the 12 weekly group skills training sessions. Patients were asked to complete the DI-5, WHO-5, BSL-23, and DASS-21 at the end of the first and last group skills training sessions of the program. Therapists completed the HoNOS during the first session of the skills training program and then again at the final session.

**Data analytic strategy**

Moderated mediation analysis, or conditional indirect process modelling, was conducted using the PROCESS macro for SPSS (Hayes, 2012). Six models were constructed to examine whether the mechanisms of change over the course of the 12-week DBT program would change based on differences in the severity of individuals’ BPD symptoms. This analysis allowed for the examination of direct and indirect effects of independent variables on the dependent variable through a mediator, along with the conditional effects proposed to moderate these relationships. Consistent with recommendations for conducting moderated mediation analyses, bootstrap confidence intervals were generated for conditional indirect effects at the 16th, 50th, and 84th percentiles of BPD symptoms based on 5,000 bootstrap samples. Point estimates were counted as significant if zero was not within 95% confidence interval.

It was important to account for the possibility that differences in patients’ general mental health status at pre-treatment, as opposed to BPD symptom severity specifically, could explain the differential associations between skill use and improvements in psychological distress over the 12-week DBT program. Therefore, additional moderated mediation analyses were conducted to assess the likelihood of the explanation that patients with poorer general mental health status at pre-treatment
would naturally experience a greater level of improvement in their symptoms than those with less severe mental health problems, since such patients begin treatment with higher baseline psychological distress. In these additional analyses, self-reported wellbeing levels and clinician ratings of mental health status at pre-treatment were used as moderators instead of self-reported BPD symptom severity.

Missing data

The results of Little’s Missing Completely at Random test indicated that missing cases in the dataset did not deviate from randomness. This suggested that no systematic pattern was associated with the missing data, given the variables tested for relationships. Multiple imputation was chosen to reduce the potential of bias due to selective attrition (Asendorpf, Van De Schoot, Denissen, & Hutteman, 2014). Missing values were imputed using the SPSS expectation maximisation algorithm using 10 iterations. This resulted in five imputations. The variables in the imputation model consisted of patients’ pre- and post- DI-5 ratings, and ratings on the DBT Progress Questionnaire, as well as some auxiliary variables correlated with these two questionnaires to improve the accuracy of the multiple imputation model (Hardt, Herke, & Leonhart, 2012). These auxiliary variables included DASS-21 scores (pre- and post-treatment), BSL-23 scores (pre- and post-treatment) and gender. The percentage of missing cases in the original dataset for each of the imputed variables is shown in Table 1. Analyses were then conducted on the imputed data sets.

Descriptive statistics

Patients presented with a range of symptom severities at pre-treatment. Scores on the DI-5 questionnaire ranged from 0 (the lowest possible score) to 25 (the highest
possible score). The mean score on the DI-5 was high ($M = 8.74$, $SD = 5.55$), indicating high levels of psychological distress. Similarly, the mean score on the WHO-5 was lower ($M = 8.24$, $SD = 4.55$) than the baseline score of 11, which suggested low levels of wellbeing. Mean pre-treatment scores on the depression ($M = 19.81$, $SD = 11.85$), anxiety ($M = 13.76$, $SD = 9.27$) and stress subscales ($M = 21.36$, $SD = 9.62$) of the DASS-21 were associated with moderate symptom severity. The mean pre-treatment score on the BSL-23 was 35 ($SD = 21.45$). Scores on the BSL-23 ranged from one to 84. The BSL-23 data were roughly normally distributed- (skewness = .45, kurtosis = -.30).

One-way repeated measures analyses of variance (ANOVA) were used to assess changes between pre- to post-treatment. A Bonferroni corrected p-value of .01 was used (.05/7 tests). There were significant decreases in BPD symptoms, general symptoms of psychological distress, as well as depression, anxiety and stress. Clinician-rated health status and self-reported wellbeing scores appeared to increase from pre- to post-treatment. The Cohen’s $d$ estimates indicated moderate to large effect sizes, and these were in the range of those reported other studies that have examined the effectiveness of DBT programs (Bohus et al., 2000; Kliem, Kröger, & Kosfelder, 2010). Descriptive statistics are presented in Table 1.

Results

Tests of simple mediation

Six separate regression analyses were used to assess the hypothesis that all four core skill areas taught in DBT (mindfulness, emotion regulation, distress tolerance, and interpersonal effectiveness) as well as attitudes towards skills use (i.e., confidence and perceived effectiveness) would mediate reductions in general
psychological distress over the 12 sessions. Results from these mediation analyses are presented in Table 3. Mean scores on the DBT progress questionnaire over the 12 sessions of the program were used as mediators in the moderated mediation analyses. For example, the mediating variable, ‘mindfulness skill use’ was the mean of patient ratings (12 in total) of the extent to which they felt that they used mindfulness skills over the course of the past week, which were collected at the start of each group skills training session.

Improvement in psychological distress between the start and end of the DBT program was mediated by increases in self-reported use of mindfulness, emotion regulation, distress tolerance, and interpersonal effectiveness skills. Similarly, patients’ self-reported confidence and perceived effectiveness associated with using DBT skills also mediated changes in psychological distress from pre- to post-treatment. The $R^2$ change values associated with including these variables as mediators ranged from 5% to 8%.

**Tests of moderated mediation**

To examine how pre-treatment BPD symptom severity influenced a combination of all six skills related variables, an additional moderated mediation model was tested with the mean of patients’ scores on the DBT progress questionnaire over the 12 weeks as the mediator (Table 4). The results are presented in Figure 2, which illustrates that pre-treatment BPD symptom levels moderated the effect of skills use on post-treatment psychological distress ($\beta = .26, [−.20: −.32]$). For those with moderate to high levels of BPD symptoms, greater skills use and more positive perceptions regarding skills use were linked to lower levels of psychological distress at post-treatment ($\beta = −.31$ and $\beta = −.54$, respectively, $p < .001$). In
contrast, there was no significant relationship between skills use and post-treatment psychological distress in patients with low levels of BPD symptoms at pre-treatment.

Following this analysis, six separate moderated mediation analyses were conducted to examine the associations between each of the six skills-related variables, BPD symptom severity and symptom improvement. First, pre-treatment BPD symptoms were found to significantly moderate the indirect effect of pre-treatment psychological distress on post-treatment psychological distress through mindfulness skills ($\beta = -0.05, [-0.07; -0.03]$). Examination of different percentile levels of BPD symptoms showed that this effect was significant at moderate (50th percentile) and high levels (84th percentile) of BPD symptoms ($\beta = -1.00$ and $\beta = -2.29$, respectively, $p < .001$). However, this effect was not significant at low (16th percentile) levels of BPD symptoms.

BPD symptom levels at pre-treatment also moderated the relationship between pre- and post-treatment psychological distress via emotion regulation skill use ($\beta = -0.06, [-0.08; -0.04]$). At moderate and high levels of pre-treatment BPD symptoms, the relationship between pre- and post-treatment psychological distress was mediated by emotion regulation ($\beta = -1.45$ and $\beta = -2.93$, respectively, $p < .001$), but not at low levels of BPD symptoms.

Similarly, pre-treatment BPD symptom levels moderated the indirect effect of pre-treatment psychological distress on post-treatment psychological through interpersonal effectiveness skill use ($\beta = -0.06, [-0.08; -0.04]$). Further analysis revealed that this effect was significant at moderate and high levels of pre-treatment BPD symptoms ($\beta = -1.34$ and $\beta = -2.76$, respectively, $p < .001$), but not at low levels.
Pre-treatment BPD symptom levels also moderated the conditional indirect effect of pre-treatment psychological distress on post-treatment psychological distress via distress tolerance ($\beta = -0.06, [-0.08: -0.04]$). At moderate and high levels of pre-treatment BPD symptoms, the relationship between pre- and post-treatment psychological distress was mediated by distress tolerance skill use ($\beta = -1.50$ and $\beta = -2.95$, respectively, $p < .001$). However, this effect was not significant at low levels of BPD symptoms.

A similar pattern was also observed when patients’ confidence in using skills was included as a mediator of symptom change from pre-to post-treatment. Pre-treatment BPD symptom levels significantly moderated the relationship between pre- and post-treatment psychological distress via confidence ($\beta = -0.07, [-0.08: -0.04]$). This effect was significant at moderate and high levels of BPD symptoms at pre-treatment ($\beta = -1.87$ and $\beta = -3.26$, respectively, $p < .001$) but not low levels of BPD symptoms.

Finally, BPD symptoms at pre-treatment were found to moderate the effect of pre-treatment psychological distress on post-treatment psychological distress via the extent to which patients’ perceived DBT skill use as effective ($\beta = -0.06, [-0.09: -0.05]$). This effect was again significant at moderate and high levels of BPD symptoms at pre-treatment ($\beta = -1.41$ and $\beta = -2.27$, respectively, $p < .001$). However, this effect was not significant at low levels of BPD symptoms.\(^1\)

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\(^1\) The moderated mediation analyses were also conducted with the DASS-21 and WB-10, and yielded the same moderated mediation pattern.
There could a possibility that the moderated mediation pattern found in the analyses was due to the general tendency for patients with severe symptoms to improve more than patients with less severe symptoms, simply because patients with greater levels of general psychological distress at the beginning of treatment start with higher baseline symptoms than others and therefore have more room for symptom improvement. To address this potential problem, another moderated mediation analysis was performed with the sum of all six skills-related variables on the DBT progress questionnaire as the mediator, and clinician ratings of patients’ overall symptom severity (on the HoNOS) at pre-treatment as the moderator.

Unlike the previous moderated mediation analyses, self-reported ratings of wellbeing at pre-treatment did not moderate the mediating relationship of skills use to psychological distress ($\beta = .07, [-.03:.17]$). In addition, clinician ratings of patient symptom severity did not moderate the mediating effect of skills use on psychological distress ($\beta = 1.15, [-.10: -2.39]$). These findings provide evidence for the hypothesis that the effectiveness of DBT skills use on general psychological distress on skills arguably differs based on patients’ pre-treatment BPD symptom severity, as opposed to patients’ non-specific symptom severity at the start of treatment.

Discussion

The current study sought to examine the relationships among pre-treatment BPD symptom severity, DBT skills use, and attitudes towards using DBT skills on treatment outcomes in an abbreviated and adapted DBT-informed program for outpatients with a mixed range of diagnoses, including a minority with BPD. It was first hypothesised that patients’ self-reported compliance with mindfulness, emotion
regulation, distress tolerance and interpersonal effectiveness skill use would mediate changes in psychological distress from pre to post-treatment. It was also hypothesised that the degree to which patients reported feeling confident using DBT skills and perceived the skills as effective would mediate changes in psychological distress over the course of the DBT-informed program. Lastly, it was anticipated that for individuals with more severe BPD symptoms prior to treatment, self-reported skill use, confidence in and perceived effectiveness of using DBT skills would be associated with lower levels post-treatment psychological distress compared to individuals with less severe pre-treatment BPD symptoms.

Consistent with the first hypothesis, higher levels of self-reported skill use in mindfulness, emotion regulation, distress tolerance and interpersonal effectiveness were indeed associated with greater reductions in emotional distress. The mediating effects of skill use in the four core DBT skill areas on general psychological distress were similar in size to those reported in previous studies that examined whether DBT skills use accounted for reductions in various outcome measures (e.g., suicide attempts and anger) (Neacsiu, Eberle, Kramer, Wiesmann, & Linehan, 2014). The mediation of changes psychological distress through DBT skills use provides more evidence that to support the theory that remediating skills deficits serves as a mechanism of change in DBT (Lynch et al., 2006). The current results suggest that this may even be the case in short-term DBT programs like the one examined in the present study. Furthermore, patients’ self-reported confidence and perceived effectiveness surrounding the use of skills taught in therapy were also associated with improvements in psychological distress. Future studies may therefore seek to examine whether patient compliance with and perceptions of DBT skill use exert a causal influence on treatment outcomes. While this finding provides further evidence for the
importance of taking into account patient attitudes towards skill use when administering DBT, the strength of the relationship between DBT skill use and treatment outcomes may also depend on patient-related factors such as BPD symptom severity.

In line with the second hypothesis, the current study also found that the strength of the association between perceptions relating to DBT skills use and changes in psychological distress differed based on the severity of individuals’ BPD symptoms. More specifically, individuals with higher levels of BPD symptoms who used the DBT skills tended to report greater reductions in psychological distress over the course of the DBT-informed skills training program. In contrast, for individuals with lower BPD symptom severity, no significant relationship was found between perceived skills use and post-treatment psychological distress. Thus far, most studies have only examined whether DBT skills use reduces BPD symptom severity (Stepp et al., 2008). The current study provides some evidence for the possibility that BPD symptom severity may also be linked to the relationship between DBT skill use and patient improvement. In addition, the finding that BPD symptom severity is associated with differential responses to skills use in DBT highlights the potential for treatment matching in the vein of personalised medicine (DeRubeis et al., 2014). Personalised medicine in mental health involves the identification of pre-treatment patient characteristics that predict differential responses to interventions and the systematic use of this intervention to optimise patient outcomes (Emmelkamp et al., 2013). If it is found to be the case that patients with more elevated BPD symptom severity improve to a greater extent than individuals with lower levels of BPD symptoms as a causal result of using DBT skills, more emphasis can be put on adapting aspects of treatment to ensure that these particular individuals are able to
practice DBT skills in an effective manner. Future research may also seek to examine the effectiveness of interventions that tailor skills training to individuals based on the severity of their BPD symptoms and provide regular feedback to clinicians on patients’ skill use.

Some limitations of the study also need to be considered. First, the skills were only measured using self-report, which means that the extent to which patients were actually using the skills matched what they reported is unclear. Future studies may seek to incorporate clinician ratings of the degree to which they see patients applying the skills taught into therapy into measurements of skills use. Second, the average severity of BPD symptoms in the sample was low compared to that of the validation sample for the BSL-23 (M = 51.75) (Bohus et al., 2009). Furthermore, only a small proportion of patients in the current sample had a diagnosis of BPD. As a result, the finding that increased BPD severity is associated with better treatment outcomes via DBT skill use may not necessarily generalise to a sample consisting of individuals with high BPD symptom severity. Another limitation of the current study is that the presence of other diagnosable mental illness was not controlled for. Thus, the extent to which individuals’ comorbid psychopathology influenced the current results is unclear. In addition, since the aim of the current study was to examine the association between BPD symptom severity and treatment outcomes via skill use, the analyses conducted did not control for the amount of time patients spent in the 12-week program. The dose-response relationship is a well-known predictor of psychotherapy outcomes (Stulz, Lutz, Kopta, Minami, & Saunders, 2013), and it may have influenced the paths tested in the moderated mediation model. However, the extent to which the dose-response relationship affected the results is unclear.
A further limitation of the study is that results were derived from a sample that typically contains a large number of individuals who display indicators of high levels of socioeconomic advantage. Higher socioeconomic status is associated with greater recovery rates (Delgadillo, Asaria, Ali, & Gilbody, 2016), and thus it is uncertain as to whether the current findings can be generalised to populations with lower levels of socioeconomic disadvantage. Finally, the lack of comparison group could also mean that the current findings may not be specific to DBT programs, but any other types of skills training program. To test the specificity of the effects of DBT skills use on patient outcomes, future studies could compare the effects of skills use in DBT skills training vs. another type of skills training program.

The finding that DBT skill use was associated with differential reductions in psychological distress for individuals with varying levels of BPD symptom severity increases confidence in the possibility that BPD symptom severity impacts the extent to which DBT skill use is effective in improving patient wellbeing. Taken together, the results of the current study provide evidence for the benefits of considering the ways in which DBT skills use and BPD symptom severity may relate to patient improvement. Doing this may provide clinicians with more ideas on how to adapt treatment so as to optimise patient outcomes and reduce risk of treatment failure both before and throughout the course of DBT skills training programs.
References


https://doi.org/10.1176/ajp.2007.164.6.922


schizotypal, borderline, avoidant, or obsessive-compulsive personality disorder. 


https://doi.org/10.1176/appi.ajp.159.2.276


https://doi.org/10.1080/1381110701542069


https://doi.org/10.1521/suli.2008.38.5.592


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https://doi.org/10.1037/a0033589

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Figure 1

Proposed conditional process model depicting how BPD symptoms may moderate the extent to which skill use mediates DBT outcomes.
Table 1

Effect sizes and mean pre-treatment and post-treatment outcomes with standard deviations in parentheses. Percentages of missing cases in the original data are also presented.

<table>
<thead>
<tr>
<th>Variable</th>
<th>% Missing</th>
<th>Measure</th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
<th>Effect size (Cohen’s d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-treatment DI-5</td>
<td>42.20%</td>
<td>BSL-23</td>
<td>33.81 (22.31)</td>
<td>22.32 (19.69)*</td>
<td>.55</td>
</tr>
<tr>
<td>Post-treatment DI-5</td>
<td>55.90%</td>
<td>DI-5</td>
<td>8.67 (5.55)</td>
<td>5.86 (5.73)*</td>
<td>.50</td>
</tr>
<tr>
<td>Mindfulness skill use</td>
<td>44.47%</td>
<td>WHO-5</td>
<td>8.24 (4.55)</td>
<td>14.43 (5.82)*</td>
<td>1.18</td>
</tr>
<tr>
<td>Emotion Regulation skill use</td>
<td>48.6%</td>
<td>DASS (Depression)</td>
<td>19.63 (12.12)</td>
<td>13.73 (10.74)*</td>
<td>.52</td>
</tr>
<tr>
<td>Interpersonal effectiveness skill use</td>
<td>43.24%</td>
<td>DASS (Anxiety)</td>
<td>13.46 (9.31)</td>
<td>9.12 (8.78)*</td>
<td>.48</td>
</tr>
<tr>
<td>Distress Tolerance Skill use</td>
<td>50.37%</td>
<td>DASS (Stress)</td>
<td>21.59 (9.64)</td>
<td>14.24 (8.78)*</td>
<td>.80</td>
</tr>
<tr>
<td>Perceived effectiveness</td>
<td>47.29%</td>
<td>HoNOS</td>
<td>9.38 (2.31)</td>
<td>7.00 (3.85)*</td>
<td>.75</td>
</tr>
<tr>
<td>Confidence</td>
<td>50.37%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .001

Note: BSL-23 = 23-Item Borderline Symptoms List, DI-5= 5-Item Daily Index, WHO-5= World Health Organisation Wellbeing Index, DASS = Depression, Anxiety and Stress Scale, HoNOS = Health of a Nation Outcome Scale.
Factor loadings from the exploratory factor analysis of the DBT Progress Questionnaire using principal axis factoring.

<table>
<thead>
<tr>
<th>Item</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mindfulness skill use</td>
<td>.41</td>
</tr>
<tr>
<td>Emotion regulation skill use</td>
<td>.69</td>
</tr>
<tr>
<td>Distress tolerance skill use</td>
<td>.58</td>
</tr>
<tr>
<td>Interpersonal effectiveness skill use</td>
<td>.72</td>
</tr>
<tr>
<td>Confidence</td>
<td>.73</td>
</tr>
<tr>
<td>Perceived effectiveness</td>
<td>.69</td>
</tr>
</tbody>
</table>
Table 3

Results of mediation analyses, with skill use and perceptions as mediators of symptom change between the start and end of treatment. A is the coefficient of the independent variable (pre-treatment psychological distress) predicting the mediator (mean DBT skill use over 12 weeks). B is the coefficient of the mediating variable (mean DBT skill use over 12 weeks) predicting the outcome variable (post-treatment psychological distress) when the pre-treatment psychological distress is also included in the model.

<table>
<thead>
<tr>
<th>Skill domain (Mediator)</th>
<th>A (SD)</th>
<th>B (SD)</th>
<th>Mediated effect</th>
<th>95% CI</th>
<th>R² change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mindfulness</td>
<td>-.04 (.01)</td>
<td>-1.38 (.23)</td>
<td>.05 (.01)</td>
<td>[.02 -.08]</td>
<td>5.32</td>
</tr>
<tr>
<td>Emotion Regulation</td>
<td>-.05 (.01)</td>
<td>-1.80 (.25)</td>
<td>.08 (.01)</td>
<td>[.05 -.12]</td>
<td>8.92</td>
</tr>
<tr>
<td>Interpersonal Effectiveness</td>
<td>-.04 (.01)</td>
<td>-1.55 (.23)</td>
<td>.07 (.01)</td>
<td>[.04 -.10]</td>
<td>6.56</td>
</tr>
<tr>
<td>Distress Tolerance</td>
<td>-.05 (.01)</td>
<td>-1.63 (.24)</td>
<td>.08 (.01)</td>
<td>[.05 -.11]</td>
<td>8.63</td>
</tr>
<tr>
<td>Confidence</td>
<td>-.04 (.01)</td>
<td>-1.79 (.23)</td>
<td>.07 (.01)</td>
<td>[.05 -.10]</td>
<td>5.94</td>
</tr>
<tr>
<td>Perceived effectiveness</td>
<td>-.04 (.01)</td>
<td>-1.56 (.22)</td>
<td>.06 (.01)</td>
<td>[.03 -.08]</td>
<td>4.12</td>
</tr>
</tbody>
</table>
Conditional indirect effects of pre-treatment general psychological distress on post-treatment psychological distress via mean skills use at different levels of BPD symptoms.

<table>
<thead>
<tr>
<th>BPD symptom level</th>
<th>Post-treatment psychological distress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Point estimate</td>
</tr>
<tr>
<td><strong>Mindfulness</strong></td>
<td></td>
</tr>
<tr>
<td>16th percentile</td>
<td>.12</td>
</tr>
<tr>
<td>50th percentile</td>
<td>-.10</td>
</tr>
<tr>
<td>84th percentile</td>
<td>-2.29</td>
</tr>
<tr>
<td><strong>Emotion Regulation</strong></td>
<td></td>
</tr>
<tr>
<td>16th percentile</td>
<td>-.15</td>
</tr>
<tr>
<td>50th percentile</td>
<td>-.45</td>
</tr>
<tr>
<td>84th percentile</td>
<td>-2.93</td>
</tr>
<tr>
<td><strong>Interpersonal Effectiveness</strong></td>
<td></td>
</tr>
<tr>
<td>16th percentile</td>
<td>-.10</td>
</tr>
<tr>
<td>50th percentile</td>
<td>-1.35</td>
</tr>
<tr>
<td>84th percentile</td>
<td>-2.76</td>
</tr>
<tr>
<td><strong>Distress Tolerance</strong></td>
<td></td>
</tr>
<tr>
<td>16th percentile</td>
<td>-.24</td>
</tr>
<tr>
<td>50th percentile</td>
<td>-1.51</td>
</tr>
<tr>
<td>84th percentile</td>
<td>-2.95</td>
</tr>
<tr>
<td><strong>Confidence</strong></td>
<td></td>
</tr>
<tr>
<td>16th percentile</td>
<td>-.15</td>
</tr>
<tr>
<td>50th percentile</td>
<td>-1.60</td>
</tr>
<tr>
<td>Percentile</td>
<td>Perceived Effectiveness</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
<td>16th</td>
</tr>
<tr>
<td></td>
<td>-.10</td>
</tr>
<tr>
<td></td>
<td>-1.41</td>
</tr>
<tr>
<td></td>
<td>-2.92</td>
</tr>
</tbody>
</table>

*Point estimates are considered significant if 95% confidence intervals based on 5000 bootstrap samples do not contain zero.*
Figure 2

Relationships among post-treatment psychological distress, DBT progress (use and perceptions of skills combined) and pre-treatment BPD symptom severity.