

The Organization of Irrational Beliefs in Posttraumatic Stress Symptomology: Testing the Predictions of REBT Theory Using Structural Equation Modelling

Philip Hyland,¹ Mark Shevlin,¹ Gary Adamson,¹ and Daniel Boduszek²

¹ *University of Ulster*

² *University of Huddersfield*

Objective: This study directly tests a central prediction of rational emotive behaviour therapy (REBT) that has received little empirical attention regarding the core and intermediate beliefs in the development of posttraumatic stress symptoms. **Method:** A theoretically consistent REBT model of posttraumatic stress disorder (PTSD) was examined using structural equation modelling techniques among a sample of 313 trauma-exposed military and law enforcement personnel. **Results:** The REBT model of PTSD provided a good fit of the data, $\chi^2 = 599.173$, $df = 356$, $p < .001$; standardized root mean square residual = .05 (confidence interval = .04–.05); standardized root mean square residual = .04; comparative fit index = .95; Tucker Lewis index = .95. Results demonstrated that demandingness beliefs indirectly affected the various symptom groups of PTSD through a set of secondary irrational beliefs that include catastrophizing, low frustration tolerance, and depreciation beliefs. **Conclusions:** Results were consistent with the predictions of REBT theory and provides strong empirical support that the cognitive variables described by REBT theory are critical cognitive constructs in the prediction of PTSD symptomology. © 2013 Wiley Periodicals, Inc. *J. Clin. Psychol.* 70:48–59, 2014.

Keywords: rational emotive behaviour therapy (REBT); irrational beliefs; posttraumatic stress disorder (PTSD); structural equation modelling (SEM)

Rational emotive behaviour therapy (REBT; Ellis, 1994) is the original cognitive-behavioural model of psychopathology. REBT theory built upon Ellis' "ABC" model of emotional distress that states that cognitive-emotional-behavioural-physiological responses or consequences (C) are not the direct product of the adverse activating events experienced in our internal or external environments (A), but are rather the result of our evaluative or appraisal beliefs (B) about these activating events. According to REBT theory there are two main classes of evaluative beliefs; rational beliefs and irrational beliefs.

Rational beliefs reflect flexible and nonextreme evaluations of the events we experience in our day-to-day lives, whereas irrational beliefs reflect rigid, absolutistic, and extreme evaluations of various kinds of activating events (Dryden & Neenan, 2004). REBT theory predicts that if a person responds to a negative activating event with a set of rational beliefs, a series of functional and adaptive cognitive-emotional-behavioural-psychological consequences will arise. Alternatively, if a person holds a set of irrational beliefs about a given negative activating event, then a series of dysfunctional and maladaptive cognitive-emotional-behavioural-psychological responses will develop.

Contemporary REBT theory (see David, Ellis, & Lynn, 2010) describes four basic irrational belief processes that are hypothesised to interact with each other in a specific manner to bring about a psychopathological response. According to the model, the core psychological process in the emergence of psychopathology is the transformation of flexible "preferences" for goal fulfilment (rational beliefs) into rigid "demands" (irrational beliefs; Ellis, 1994; Wallen, DiGiuseppe,

Please address correspondence to: Philip Hyland, University of Ulster Magee, Northland Road Londonderry BT48 7JL, Northern Ireland. E-mail: philipehyland@gmail.com

& Dryden, 1992). This process of escalating flexible preference beliefs (e.g., “*I want to succeed at this task*”) into rigid demandingness beliefs (e.g., “*I must succeed at this task*”) is hypothesised to represent the core psychological process in the development of psychopathology (David et al., 2010; Soloman, Arnow, Gotlib, & Wind, 2003).

Demandingness beliefs as such are viewed as the primary irrational belief process and are predicted to give rise to a set of secondary irrational appraisal beliefs which are *extreme* in nature. These include catastrophizing beliefs, which describe the process of evaluating an event in the most extremely negative manner possible, low frustration tolerance beliefs, which involve a person terrifically underestimating his or her own ability to tolerate or cope with the distress of not having their demand met, and depreciation beliefs, which involve a person making overgeneralized, global negative evaluations of the self, others, and/or the world. REBT theory is explicit in stating that demandingness beliefs should affect various states of psychopathology indirectly through catastrophizing, low frustration tolerance, and/or depreciation beliefs (David et al. 2010; Ellis, 1994).

There is a great deal of evidence supporting the role of these irrational belief processes in a variety of psychopathological states (see Browne, Dowd, & Freeman, 2010 for a full review); however, substantially less empirical evidence exists with regards to the organization and interrelationships among irrational belief processes, despite the centrality of this issue in contemporary REBT theory.

David, Schnur, and Belloiu (2002) attempted to examine the interrelations of the irrational beliefs within the paradigm of Lazarus’s (1991) Appraisal Theory of emotions and found that demandingness beliefs were highly correlated with primary appraisals, and more strongly associated with primary appraisals than with catastrophizing, low frustration tolerance, and depreciation beliefs. Furthermore, catastrophizing, low frustration tolerance, and depreciation beliefs were highly related to secondary appraisals. Their results suggested that demandingness beliefs are better represented as a primary appraisal mechanism, and catastrophizing, low frustration tolerance, and depreciation beliefs are better represented as secondary appraisal mechanisms. This study was then replicated within both clinical and nonclinical samples and similar patterns of results were observed (David, Ghinea, Macavei, & Kallay, 2005). Such results offered tentative support that the impact of demandingness beliefs on psychological distress may be mediated by catastrophizing, low frustration tolerance, and/or depreciation beliefs.

DiLorenzo, David, and Montgomery (2007) then specifically investigated the proposed mediational relationships between the irrational beliefs using mediational analytic methods suggested by Baron and Kenny (1986). DiLorenzo et al. (2007) conducted their analysis within a longitudinal research design that included 99 students experiencing exam-related anxiety measured at two time periods. Their analysis found that the effect of demandingness beliefs on psychological distress were fully mediated by catastrophizing beliefs and depreciation beliefs at both time periods, while low frustration tolerance beliefs fully mediated the relationship between demandingness beliefs and exam-related anxiety at time 1 but not at time 2.

Past research findings therefore offer support for the predictions of REBT theory regarding the organization of the irrational belief processes; however, given the central nature of this prediction to both REBT theory and therapy, far greater research is warranted. The purpose of the current study is to directly test this key prediction of REBT theory within a sample of trauma-exposed participants who are experiencing symptoms of posttraumatic stress disorder (PTSD), utilizing latent variable modelling techniques. No empirical work could be found that has directly assessed the role of irrational beliefs, as outlined in REBT theory, in the development or maintenance of PTSD symptomology. Given that these cognitive variables are unique and distinct from the types of cognitive variables described in the field of cognitive therapy (CT; see Hyland & Boduszek, 2012), which have informed current cognitive models of PTSD (e.g., Ehlers & Clark, 2000; Clark & Beck, 2011), the current study will add valuable and unique data to the scientific literature regarding the importance of irrational beliefs in PTSD. Additionally, the current study will be the first to utilize latent variable modelling procedures to assess the organization of the irrational beliefs and their direct and indirect effects on psychopathological outcomes.

Table 1

Descriptive Statistics, Cronbach Alpha, and Correlations Between Demandingness, Catastrophizing, Low Frustration Tolerance, Depreciation, Intrusions, Avoidance, Dysphoria, and Hyperarousal

	M	SD	1	2	3	4	5	6	7	8
1. Demandingness	7.06	3.71	(.88)							
2. Catastrophizing	7.30	3.75	.81	(.86)						
3. Low Frustration Tolerance	7.84	3.72	.84	.80	(.84)					
4. Depreciation	6.17	4.18	.81	.81	.73	(.95)				
5. Intrusions	3.52	3.28	.73	.71	.69	.69	(.86)			
6. Avoidance	1.34	1.62	.51	.56	.53	.52	.63	(.77)		
7. Dysphoria	5.12	5.41	.69	.69	.68	.67	.79	.60	(.90)	
8. Hyperarousal	1.44	1.78	.63	.63	.59	.60	.76	.54	.71	(.88)

Note. M = means; SD = standard deviation. All correlations are statistically significant ($p < .001$). Scale reliabilities are reported on the diagonal.

Method

Participants and Procedures

The sample included 212 males (67.7%) and 101 females (32.3%) and these individuals ranged in age from 23 to 65 years, with a mean age of 38.18 (standard deviation [SD] = 8.70). Participants were informed of the nature of the study being undertaken either by a member of the research team or an assigned liaison for a particular organization, and each participant's involvement in the research project was voluntary. Obligations were not placed upon potential respondents nor were any inducements employed to recruit the sample. Each participant was assured about confidentiality and those who chose to take part in the research project had the option of completing either an anonymous self-administered paper-and-pencil version of the questionnaire or an electronic version that was completed and returned via e-mail. The majority of respondents chose the paper-and-pencil option (63.26%, $n = 198$).

Materials

The Posttraumatic Stress Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997) is a 49-item self-report measure of the severity of posttraumatic stress symptomology related to a particular traumatic event. The PDS assess all aspects of a PTSD diagnosis from Criteria A to F as outlined in the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV; American Psychiatric Association, 1994). The PDS measures the nature of the traumatic experience, the duration of the experienced symptoms, the effect of the experienced symptoms on daily functioning, and the severity of the symptoms. Seventeen items measure each of the identified symptoms of PTSD along a 4-point Likert scale. Respondents rate the severity of each symptom from a score of 0 (*not at all or only one time*) to 3 (*5 or more times a week/almost always*). This produces a total range of scores from 0 to 51 with higher scores indicating higher levels of posttraumatic stress symptomology. The PDS possesses strong psychometric properties with Griffin, Uhlmansiek, Resick, and Mechanic (2004), demonstrating that it shares a strong correlation with the Clinician-Administered PTSD scale (Blake et al., 1995). Cronbach alpha levels for each subscale of the PDS are reported in Table 1.

The Abbreviated Version of the Attitudes and Belief Scale 2 (AV-ABS2; Hyland, Shevlin, Adamson, & Boduszek, 2013) is a 24-item self-report measure of rational and irrational beliefs, as defined by current REBT theory (David et al., 2010). The AV-ABS2 measures all four irrational belief processes (demandingness, catastrophizing, low frustration tolerance, and depreciation) and their corresponding four rational belief processes (preferences, noncatastrophizing, high frustration tolerance, and acceptance). Each subscale is measured via three items. Items of the AV-ABS2 include: "I must do well at important things, and I will not accept it if I do not do well" (demandingness); "It's awful to be disliked by people who are important to me, and it

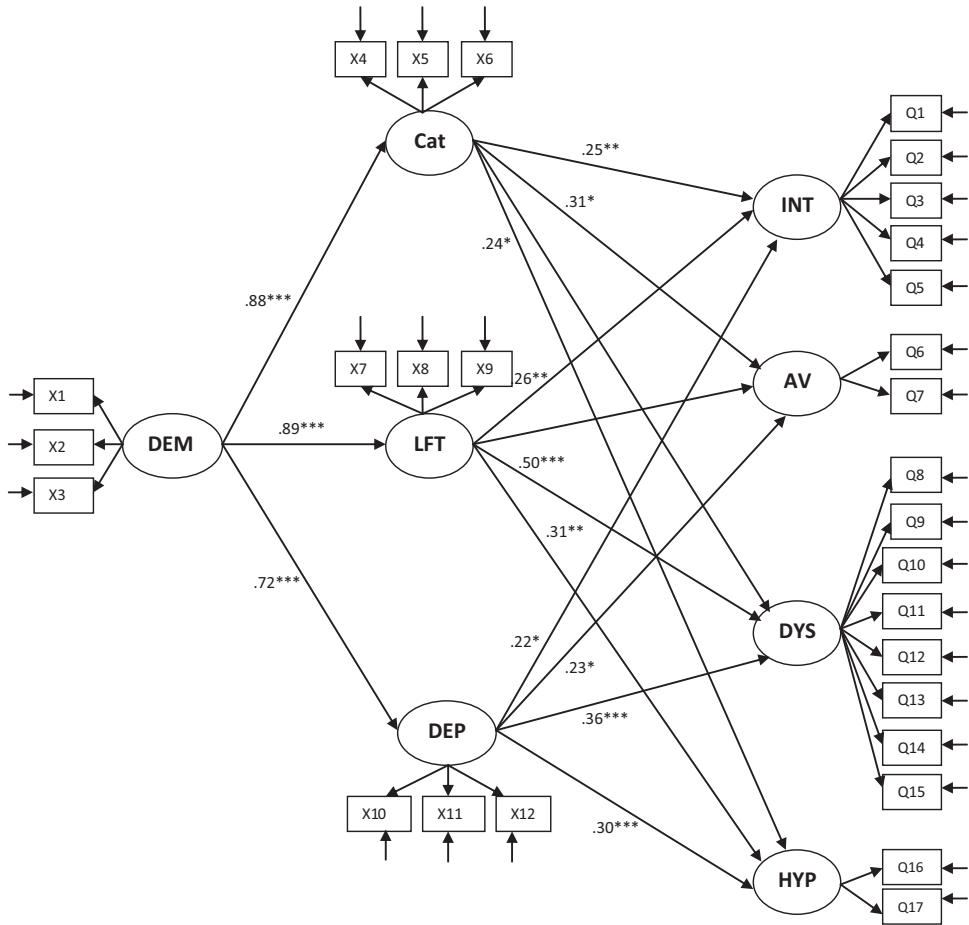


Figure 1. REBT model of posttraumatic stress symptomology.

Note. DEM = demandingness; CAT = catastrophizing; LFT = low frustration tolerance; DEP = depreciation; INT = intrusions; AV = avoidance; DYS = dysphoria; HYP = hyperarousal. X1- X12 = items included in the Abbreviated Version of the Attitudes and Belief Scale 2, Q1- Q17 = items included in Posttraumatic Diagnostic Scale. Statistical significance: *p < .05 **p < .01 ***p < .001.

is a catastrophe if they don't like me" (catastrophizing); "Its unbearable being uncomfortable, tense or nervous and I can't stand it when I am" (low frustration tolerance); and "If I do not perform well at tasks that are very important to me, it is because I am a worthless bad person" (depreciation).

The AV-ABS2 produces a total composite score for both rational and irrational as well as producing total scores on each of the individual rational and irrational belief processes. Item are scored along a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*), with higher scores in each case indicating higher levels of the respective variable. Possible scores for each subscale range from 3–15 with higher scores indicative of higher levels of each belief process. The AV-ABS2 exhibited satisfactory internal consistency with all subscales recording a Cronbach's Alpha level above .80 (see Table 1).

Analysis

As can be seen in Figure 1, the model under investigation in the current study represents the predictions of REBT theory in which demandingness beliefs are modelled as the primary

irrational belief process, and exert an indirect effect on posttraumatic stress symptoms (PTS) via catastrophizing, low frustration tolerance, and depreciation beliefs. Structural equation modelling (SEM) techniques were utilized to test this model. SEM is a combination of two analytical procedures: confirmatory factor analysis (CFA), which assesses the measurement component of a theoretical model, and path analysis, which assesses the relationship between latent variables. Within an SEM framework, the structural and measurement elements of analysis are estimated simultaneously (McCallum & Austin, 2000). A number of other features make the use of SEM procedures appropriate for the current analysis. These include controlling for systematic and random measurement error and the ability to simultaneous test for both direct and indirect effects within a model (Bollen, 1989; Kline, 2005). The SEM analysis was conducted in Mplus version 6.0 (Muthen & Muthen, 1998–2010) with robust maximum likelihood (MLR) estimation.

The overall fit of each model and the relative fit between models were assessed using a range of goodness-of-fit statistics and assessment of the appropriateness of the model parameters. The chi-square (χ^2) statistic assessed the sample and implied covariance matrix and a good fitting model is indicated by a nonsignificant result. However the chi-square statistic is strongly associated with sample size, and, as such, good models tend to be overrejected. Therefore, Tanaka (1987) suggested that a model should not be rejected simply on the basis of a significant chi-square result. Accordingly, it is recommended that researchers examine the ratio of the chi-square value to the degrees of freedom (df), and according to Klein (1994), any model with a χ^2 -to-df ratio of less than 3:1 indicates a good fitting model.

The comparative fit index (CFI; Bentler, 1990) and the Tucker Lewis index (TLI; Tucker & Lewis, 1973) are measures of how much better the model fits the data compared with a baseline model in which all variables are uncorrelated. For these indices values above .90 indicate reasonable fit, while values above .95 indicate good model fit (Bentler, 1990; Hu & Bentler, 1999). In addition, two more absolute indices are presented: the standardized root mean square residual (SRMR; Joreskog & Sorbom, 1981) and the root mean square error of approximation (RMSEA; Steiger, 1990). Ideally, these indices should be less than .05; however, values less than .08 also suggest adequate fit (Bentler, 1990; Hu & Bentler, 1999; Joreskog & Sorbom, 1993). Furthermore, Akaike information criterion (AIC; Akaike, 1974) was used to evaluate the alternative models, with the smaller value indicating the best fitting model. The CFI, RMSEA and the AIC all have explicit penalties for model complexity.

Results

Descriptive Statistics and Correlations

Descriptive statistics including means, standard deviations, and range for the all variables are presented in Table 1, together with Cronbach's alpha reliability results (Cronbach, 1951). Correlations between all variables are also presented. Results suggest that the current sample experienced relatively low-to-moderate levels of posttraumatic stress symptoms overall. Furthermore, moderate levels of each of the irrational belief process were observed among the current sample. Correlations between all measured variables were positive, statistically significant, and ranged from moderate to strong.

Measurement Models

Anderson and Gerbing (1988) state that it is necessary to determine the appropriate factor structure of any measure used in a study prior to investigating the structural model. Based on extensive findings regarding the factor structure of posttraumatic stress indicators (Yufik & Simms, 2010), three alternative model conceptualizations of the PDS (Foa et al., 1997) were specified and tested using CFA techniques. Model 1 is a four-factor solution (intrusions, avoidance, emotional numbing, and hyperarousal) first suggested by King, Leskin, King, and Weathers (1998). Model 2 is an alternative four-factor solution (intrusions, avoidance, dysphoria, hyperarousal) first suggested by Simms, Watson, and Doebbeling (2002). Model 3 is the DSM-IV's

Table 2
Fit Indices for Factor Models of the PDS and AV-ABS2

Measure	χ^2	<i>df</i>	CFI	TLI	RMSEA	SRMR	AIC
<i>PDS</i>							
King et al.	208.115*	113	.96	.95	.05	.04	10357.414
Simms et al.	152.937*	113	.98	.98	.03	.03	10257.512
DSM-IV	269.955*	116	.93	.92	.07	.05	10439.115
<i>AV-ABS2</i>							
4 factor model	844.996*	246	.86	.84	.08	.09	21337.153
8 factor model	488.908*	224	.94	.92	.06	.05	20955.071
2 nd order model	733.998*	243	.88	.87	.08	.08	21201.614

Note. PDS = Posttraumatic Stress Diagnostic Scale; AV-ABS2 = Abbreviated Version of the Attitudes and Belief Scale 2; DSM-IV = Diagnostic and Statistical Manual of Mental Disorders; *df* = degree of freedom; χ^2 = chi square goodness of fit statistic; RMSEA = root-mean-square error of approximation; CI = confidence interval; AIC = Akaike information criterion; CFI = comparative fit index; TLI = Tucker Lewis index; SRMR = standardized square root mean residual.

*Indicates χ^2 are statistically significant ($p < .001$).

three-factor solution (intrusions, avoidance and emotional numbing, and hyperarousal). As outlined in Table 2, the Simms et al. (2002) dysphoria model was found to be most accurate model solution demonstrating the most impressive fit statistics and the lowest AIC value.

Three distinct factorial models of the AV-ABS2 were compared. Model 1 is an eight-factor model represented by the four irrational belief processes (demandingness, catastrophizing, low frustration tolerance, and depreciation) and the four rational belief processes (preferences, non-catastrophizing, high frustration tolerance, and acceptance) with each factor measured via three items. Model 2 is a four-factor phenomenon comprised of the four irrational belief types with six items loading onto each factor. In this model the three items measuring the rational beliefs are expected to load onto their opposing irrational belief process. Model 3 is a second-order variation of Model 1 in which the four irrational belief factors load onto a single irrationality factor, and the four rational belief factors load onto a single rationality factor. CFA results suggested the intercorrelated eight-factor solution represented acceptable model fit across all indices and was superior to the other factorial solutions (see Table 2).

Additional support for both the PDS (Foa et al., 1997) and the AV-ABS2 was obtained through inspection of the model parameters. Standardized factor loadings were all statistically significant ($p < .001$), positive, and above .40 with the majority exceeding a value .60, thus generally satisfying the strict recommendations of Hair, Anderson, Tatham, and Black (1998) for factor loading requirements.¹

Structural Model

The REBT model of PTS (Figure 1) was developed based upon the results obtained from the previous CFA analyses and included eight latent variables: demandingness, catastrophizing, low frustration tolerance, depreciation, intrusions, avoidance, dysphoria, and hyperarousal. The REBT-based model of PTS produced satisfactory model fit statistics— $\chi^2 = 599.173$, $df = 356$, $p < .001$; RMSEA = .05 (confidence interval [CI] = .04–.05); SRMR = .04; CFI = .95; TLI = .95—and explained 67% of the variance in intrusions, 50% of variance in avoidance, 67% of variance in dysphoria, and 56% of variance in hyperarousal.

Table 3 displays the standardized and unstandardized (direct and indirect) regression weights for the specified REBT SEM of PTS. As can be noted, demandingness beliefs had a strong,

¹Standardized and unstandardized factor loadings (and standard errors) for the PDS and AV-ABS2 are not included for the sake of brevity but can be obtained by contacting the corresponding author.

Table 3
Standardized and Unstandardized Regression Weights (With Standard Errors) for the REBT-Based Structural Equation Model of Posttraumatic Stress Symptoms

Variables	β	B	SE
Direct influence			
Demandingness \Rightarrow catastrophizing	.89***	.91	.05
Demandingness \Rightarrow low frustration tolerance (LFT)	.89***	.94	.04
Demandingness \Rightarrow depreciation	.72***	1.01	.05
Catastrophizing \Rightarrow intrusions	.25**	.27	.18
LFT \Rightarrow intrusions	.26**	.16	.15
Depreciation \Rightarrow intrusions	.22*	.08	.06
Catastrophizing \Rightarrow avoidance	.31*	.26	.15
LFT \Rightarrow avoidance	.26	.09	.16
Depreciation \Rightarrow avoidance	.23*	.06	.08
Catastrophizing \Rightarrow dysphoria	.05	.02	.08
LFT \Rightarrow dysphoria	.50***	.15	.06
Depreciation \Rightarrow dysphoria	.36***	.05	.03
Catastrophizing \Rightarrow hyperarousal	.24*	.34	.23
LFT \Rightarrow hyperarousal	.31**	.08	.18
Depreciation \Rightarrow hyperarousal	.30***	.09	.09
Indirect influence			
Demandingness \Rightarrow intrusions via catastrophizing	.22**	.14	.05
Demandingness \Rightarrow intrusions via LFT	.23**	.15	.06
Demandingness \Rightarrow intrusions via depreciation	.30***	.20	.04
Demandingness \Rightarrow avoidance via catastrophizing	.28*	.18	.09
Demandingness \Rightarrow avoidance via LFT	.23	.15	.08
Demandingness \Rightarrow avoidance via depreciation	.16*	.11	.05
Demandingness \Rightarrow dysphoria via catastrophizing	.04	.01	.02
Demandingness \Rightarrow dysphoria via LFT	.44***	.13	.03
Demandingness \Rightarrow dysphoria via depreciation	.26***	.08	.02
Demandingness \Rightarrow hyperarousal via catastrophizing	.21*	.16	.07
Demandingness \Rightarrow hyperarousal via LFT	.27**	.21	.08
Demandingness \Rightarrow hyperarousal via depreciation	.21***	.16	.05

R²

Intrusions $R^2 = .67$, $SE = .04$, $p < .001$; avoidance $R^2 = .50$, $SE = .06$, $p < .001$; dysphoria $R^2 = .67$, $p < .001$; hyperarousal $R^2 = .56$, $SE = .06$, $p < .001$;

Fit indices

$\chi^2 = 599.173$, $df = 356$, $p < .001$; RMSEA = .05 (CI = .04–.05); SRMR = .04; CFI = .95; TLI = .95)

Note. SE = standard error; RMSEA = root-mean-square error of approximation; CI = confidence interval; df = degree of freedom; CFI = comparative fit index; TLI = Tucker Lewis index; SRMR = standardized square root mean residual.

* $p < .05$. ** $p < .01$. *** $p < .001$.

direct effect on catastrophizing beliefs ($\beta = .89$, $p < .001$), low frustration tolerance beliefs ($\beta = .89$, $p < .001$), and depreciation beliefs ($\beta = .72$, $p < .001$). In terms of the direct effect of the secondary belief processes on intrusions, catastrophizing beliefs ($\beta = .25$, $p < .01$), low frustration tolerance beliefs ($\beta = .26$, $p < .01$), and depreciation beliefs ($\beta = .22$, $p < .05$) were all found to make positive, statistically significant contributions. With respect to avoidance symptoms, both catastrophizing beliefs ($\beta = .31$, $p < .05$) and depreciation beliefs ($\beta = .23$, $p < .05$) exerted a weak-to-moderate direct effect. In terms of symptoms of dysphoria, low frustration tolerance beliefs ($\beta = .50$, $p < .001$) and depreciation beliefs ($\beta = .36$, $p < .001$) were identified as strong and moderate direct predictors, respectively. Finally, catastrophizing beliefs ($\beta = .24$, $p < .05$), low frustration tolerance beliefs ($\beta = .31$, $p < .01$), and depreciation beliefs ($\beta = .30$, $p < .001$) all directly affected hyperarousal symptoms to a weak-to-moderate degree.

A number of positive, statistically significant, and indirect effects were also observed. An indirect relationship existed between demandingness beliefs and intrusions via catastrophizing beliefs ($\beta = .22, p < .01$), low frustration tolerance beliefs ($\beta = .23, p < .01$), and depreciation beliefs ($\beta = .30, p < .001$). Statistically significant indirect effects were also observed between demandingness beliefs and avoidance via catastrophizing beliefs ($\beta = .28, p < .05$) and depreciation beliefs ($\beta = .16, p < .05$). Additionally, statistically significant indirect effects were observed between demandingness beliefs and dysphoria via low frustration tolerance beliefs ($\beta = .44, p < .001$) and depreciation beliefs ($\beta = .26, p < .001$). And finally, statistically significant indirect effects were identified between demandingness beliefs and hyperarousal via catastrophizing beliefs ($\beta = .21, p < .05$), low frustration tolerance beliefs ($\beta = .27, p < .01$), and depreciation beliefs ($\beta = .21, p < .001$).

Discussion

The primary objective of the current study was to investigate the theoretical predictions of REBT with regards to the organization of the irrational beliefs hypothesised to be crucial in the pathogenesis of psychopathological symptoms. Moreover, the current study was performed to assess for the first time the importance of the cognitive variables outlined in REBT in the experience of PTSD symptomology.

To test REBT's theoretical model it was necessary to first establish the dimensionality and construct validity of both the PDS (Foa et al., 1997) and the AV-ABS2 using CFA techniques. This analysis was conducted to accommodate the required variables within an appropriate latent variable framework. Results of the CFA indicated that the PDS was best represented by the Simms et al. (2002) four-factor model, a finding consistent with the overall literature regarding the symptom structure of PTSD (Yufik & Simms, 2010). The AV-ABS2 was found to be most accurately explained by an eight-factor solution comprising the four irrational belief processes (demandingness, catastrophizing, low frustration tolerance, depreciation) and the four rational belief processes (preferences, noncatastrophizing, high frustration tolerance, acceptance). For the purposes of the current study, however, we considered only the four irrational beliefs within the respective structural model as we are concerned with establishing the organization of these variables in the emergence of psychological distress.

SEM results demonstrated that the REBT model of PTSD was a good fit of the data. The χ^2 -to-df ratio was less than 2:1, and the CFI, TLI, RMSEA, and SRMR results were all within ranges indicative of good model fit. This REBT model explained an impressive amount of variance in each of the four PTSD symptom groups. The irrational beliefs were found to explain 67% of variance in Intrusive symptoms, 50% of variance in avoidance symptoms, 67% of variance in dysphoria symptoms, and 56% of variance in hyperarousal symptoms. These findings strongly suggest that the cognitive factors described by REBT are critical cognitive constructs in the development and maintenance of PTSD symptomology.

In addition to identifying the importance of irrational beliefs in the prediction of posttraumatic stress symptomology, this study was primarily interested in identifying the organization of the irrational beliefs by investigating the indirect pathways between demandingness beliefs and the various symptom clusters of PTSD. Multiple indirect effects were observed from demandingness beliefs to intrusions, avoidance, dysphoria, and hyperarousal.

In the case of the relationships between demandingness beliefs and the intrusions and hyperarousal symptom clusters, respectively, indirect effects were observed for all three secondary irrational belief processes. Whereas in the relationship between demandingness beliefs and avoidance symptoms, indirect effects were observed for catastrophizing and depreciation beliefs, and in the relationship between demandingness beliefs and dysphoria symptoms, indirect effects were observed for low frustration tolerance and depreciation beliefs. These results are consistent with the predictions of REBT theory (David et al., 2010; Ellis, 1994; Wallen et al., 1992) and are generally in line with previous research findings.

Current results lend support to the view that demandingness beliefs appear to be the primary irrational belief process and affect the various symptom groups of PTSD in an indirect manner via a variety of the secondary belief process. DiLorenzo et al. (2007) previously found the

catastrophizing and depreciation beliefs served to mediate the relationship between demandingness beliefs and exam-related anxiety. Past and current results thus indicate that the relationship between demandingness beliefs and various psychopathological states will likely not always be mediated via all three secondary irrational belief processes, but rather unique and distinct patterns of relationships between the primary and secondary are likely to exist depending upon the nature of the psychological distress under investigation.

David et al. (2002) have previously presented theoretical predictions of the nature of the relationship between the irrational beliefs in the development of anxiety and depressive disorders and current results offer novel evidence that each of the four irrational belief types are critical cognitive variables in posttraumatic stress symptomology. Identification of the critical irrational beliefs in the prediction of psychopathology has important clinical implications as clinical strategies can be focused only on the most relevant irrational belief processes. Based on current results, intrusion and hyperarousal symptoms may be best treated through the targeted modification of demandingness beliefs along with all secondary irrational belief processes. Alleviation of avoidance symptoms could be best achieved through the reduction of demandingness, catastrophizing, and depreciation beliefs; while symptoms of dysphoria may well best respond to the reduction in levels of demandingness, low frustration tolerance and depreciation beliefs.

Ellis (1987, 1994) consistently argued that demandingness beliefs lie at the core of all forms of psychological disturbances and should affect various states of psychopathology through catastrophizing, low frustration tolerance, and depreciation beliefs. This hypothesis courted considerable criticism from many within the cognitive-behavioural therapy (CBT) community (e.g., Brown & Beck, 1989; Padesky & Beck, 2003), who asserted that while demandingness beliefs can sometimes play a role in the emergence of some forms of psychopathology, demandingness beliefs by no means represent a core psychological construct in all types of psychopathology. Little evidence currently exists to either support or refute this rather grand claim; however, Soloman et al. (2003) previously produced evidence to support the primacy of demandingness beliefs in the major depressive disorder, and current results provide tentative evidence for the importance of conceptualizing demandingness beliefs as a critical core psychological construct in PTSD.

Currently, cognitive models of PTSD (e.g., Clark & Beck, 2010; Ehlers & Clark, 2000; Resick & Schnicke, 1993) and measures of specific cognitions relevant to PTSD (e.g., Foa, Ehlers, Clark, Tolin, & Orsillo, 1999; Najavits, Gotthardt, Weiss, & Epstein, 2004; Vogt, Shipherd, & Resick, 2012) make no explicit accommodation of demandingness beliefs. Because empirically validated CBT treatment protocols derive directly from these theoretical models, current results suggest the possibility of improving theoretical understandings and potentially developing more efficacious treatment approaches if consideration of demandingness cognitions were included within relevant theoretical and therapeutic models of PTSD; however, substantially greater research would be required to better establish the validity of this possibility.

The current study contains a number of limitations that ought to be considered. The nature of the sample is limited to a very specific strata of the population (law enforcement, military, and emergency service personnel), thus generalizations of current findings to the wider population is problematic. In particular, the professions from which the sample were drawn may have influenced the level of demandingness beliefs observed; therefore, future research efforts should seek to replicate the current study among more diverse population groups to develop more robust and reliable conclusions.

Additionally, a self-report measure of PTSD symptomology was used and although self-report measures of PTSD such as the PDS (Foa et al., 1997) used in the current study have been shown to highly correspond with clinician-administered measures (Griffin et al., 2004), clinician-based measures would have been preferable as they are considered the gold standard method of assessing PTSD symptomology. Given the cross-sectional design of the current study, it was possible to investigate only indirect effects rather than testing mediational pathways, which REBT theory specifically states. Although current findings provide good support for the REBT model, longitudinal research designs will be necessary to more fully establish the mediational effects of catastrophizing, low frustration tolerance, and depreciation beliefs in the relationship between demandingness beliefs and PTSD symptomology.

In conclusion, this study substantially contributes to the scientific literature in a number of important ways. The current study is the first of its kind to apply latent variable modelling techniques to determine the organization and interrelations of the irrational beliefs described in REBT theory, and as such offer additional and methodologically rigorous support for the core predictions of REBT theory. These findings are also the first to provide empirical support for REBT theory regarding the importance of the irrational beliefs in posttraumatic stress responses. Findings from the present study also offer the possibility that theoretical and clinical improvements to current CBT models of PTSD might be obtained by considering the important role played by demandingness beliefs in the development and maintenance of posttraumatic stress symptoms.

References

- Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, 19(6), 716–723.
- American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders*. (4th ed.). Washington, DC: Author.
- Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103, 411–423.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173–1182.
- Beck, A. T. (1987). Cognitive models of depression. *Journal of Cognitive Psychotherapy*, 1, 5–37.
- Bentler, P. M. (1990). Comparative fit indices in structural models. *Psychological Bulletin*, 107, 238–246.
- Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, G. D., Charney, D. S., & Keane, T. M. (1998). *The Clinician-Administered PTSD Scale for DSM-IV*. Boston, MA: National Centre for PTSD, Behavioural Science Division.
- Bollen, K. A. (1989). *Structural equations with latent variables*. New York, NY: Wiley.
- Browne, C. M., Dowd, E. T., & Freeman, A. (2010). Rational and irrational beliefs and psychopathology. In David, D., Lynn, S. J., & Ellis, A. *Rational and irrational beliefs: Research, theory, and clinical practice* (pp. 3–22). New York, NY: Oxford University Press.
- Browne, M. W., & Cudeck, R. (1989). Single sample cross-validation indices for covariance structures. *Multivariate Behavioral Research*, 24, 445–455.
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newsbury Park, CA: Sage.
- Brown, G. B., & Beck, A. T. (1989). The role of imperatives in psychopathology: A reply to Ellis. *Cognitive Therapy and Research*, 13, 315–321.
- Clark, D. A., & Beck, A. T. (2010). *Cognitive therapy of anxiety disorders*. London, UK: The Guilford Press.
- Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd Ed.). Hillsdale, NJ: Erlbaum.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297–334.
- David, D., Ghinea, C., Macavei, B., & Kallay, E. (2005). A search for “hot” cognitions in a clinical and non-clinical context: Appraisal, attributions, core relational themes, irrational beliefs, and their relations to emotion. *Journal of Cognitive and Behavioral Psychotherapies*, 5, 1–42.
- David, D., Lynn, S. J., & Ellis, A. (2010) *Rational and irrational beliefs: Research, theory, and clinical practice*. New York, NY: Oxford University Press.
- David, D., Schnur, J., & Belloiu, A. (2002). Another search for the “hot” cognitions: Appraisal, irrational beliefs, attributions, and their relation to emotion. *Journal of Rational-Emotive and Cognitive-Behavior Therapy*, 15, 93–131.
- David, D., & Szentagotai, A. (2006). Cognition in cognitive-behavioral psychotherapies (CBT): Toward an integrative model. *Clinical Psychology Review*, 3, 284–298.
- DiLorenzo, T. A., David, D., & Montgomery, G. H. (2007). The interrelations between irrational cognitive processes and distress in stressful academic settings. *Personality and Individual Differences*, 42, 765–777.

- Dryden, W., & Neenan, M. (2004). *Rational emotive behavioural counselling in action* (3rd ed.). London, UK: Sage.
- Ehlers, A., & Clark, D. M. (2000). A cognitive model of persistent posttraumatic stress disorder. *Behaviour Research and Therapy*, 38, 319–345.
- Ellis, A. (1987). A sadly neglected cognitive element in depression. *Cognitive Therapy and Research*, 11, 121–145.
- Ellis, A. (1994). *Reason and emotion in psychotherapy* (rev. ed.). Secaucus, NJ: Birch Lane.
- Foa, E., Cashman, L., Jaycox, L., & Perry, K. (1997). The validation of a self-report measure of PTSD: The Posttraumatic Diagnostic Scale. *Psychological Assessment*, 9, 445–451.
- Foa, E. B., Ehlers, A., Clark, D. M., Tolin, D. F., & Orsillo, S. M. (1999). The Posttraumatic Cognitions Inventory (PTCI): Development and validation. *Psychological Assessment*, 11, 303–314.
- Griffin, M. G., Uhlmansiek, M. H., Resick, P. A., & Mechanic, M. B. (2004). Comparison of the Posttraumatic Diagnostic Scale versus the Clinician-Administered Posttraumatic Stress Disorder Scale in domestic violence survivors. *Journal of Traumatic Stress*, 17, 497–503.
- Hair, J. F., Jr., R. E. Anderson, R. L. Tatham, & W. C. Black (1998). *Multivariate Data Analysis with Readings*, 5th Edition. Englewood Cliffs, NJ: Prentice Hall.
- Hu, L., & Bentler, P. (1998). Fit indices in covariance structural modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, 3, 424–453.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1–55.
- Hyland, P., & Boduszek, D. (2012). Resolving a difference between Cognitive Therapy and Rational Emotive Behaviour Therapy: Towards the development of an integrated CBT model of psychopathology. *Mental Health Review Journal*, 17, 104–117.
- Hyland, P., Shevlin, M., Adamson, G., & Boduszek, D. (2013, in press). Modelling the factor structure of the Attitudes and Belief Scale 2: Toward the development of an abbreviated version. *Cognitive Behaviour Therapy*.
- Joreskog, K., & Sorbom, D. (1981). *LISREL V: Analysis of linear structural relationships by the method of maximum likelihood*. Chicago, IL: National Educational Resources.
- King, D., Leskin, G., King, L., & Weathers, F. (1998). Confirmatory factor analysis of the clinician administered PTSD Scale: Evidence for the dimensionality of posttraumatic stress disorder. *Psychological Assessment*, 10, 90–96.
- Kline, P. (1994). *An easy guide to factor analysis*. London / New York: Routledge.
- Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd Ed.). London, UK: The Guilford Press.
- Lazarus, R. (1991). *Emotion and adaptation*. New York, NY: Oxford University Press.
- MacCallum, R. C., & Austin, J. T. (2000). Applications of structural equation modeling in psychological research. *Annual Review of Psychology*, 51, 201–226.
- Muthen, L. K., & Muthen, B. O. (1998–2010). *Mplus – Statistical Analysis with Latent Variables. User's Guide* (6th Ed). Los Angeles, CA: Muthen and Muthen.
- Najavits, L. M., Gotthardt, S., Weiss, R. D., & Epstein, M. (2004). Cognitive distortions in the dual diagnosis of PTSD and substance use disorder. *Cognitive Therapy and Research*, 28, 159–172.
- Padesky, C. A., & Beck, A. T. (2003). Science and philosophy: Comparison of cognitive therapy and rational emotive behaviour therapy. *Journal of Cognitive Psychotherapy*, 17, 211–224.
- Resick, P. A., & Schnicke, M. K. (1993). *Cognitive processing therapy for rape victims: A treatment manual*. Newbury Park, CA: Sage.
- Simms, L. J., Watson, D., & Doebbeling, B. N. (2002). Confirmatory factor analyses of posttraumatic stress symptoms in deployed and nondeployed veterans of the Gulf war. *Journal of Abnormal Psychology*, 111, 637–647.
- Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioural Research*, 25, 173–180.
- Tanaka, J. S. (1987). “How big is big enough?” Sample size and goodness of fit in structural equation models with latent variables. *Child Development*, 58, 134–146.
- Tucker, L. R., & Lewis, C. (1973). The reliability coefficient for maximum likelihood factor analysis. *Psychometrika*, 38, 1–10.

- Vandenberg, R. J. (2002). Toward a further understanding of an improvement in measurement invariance methods and procedures. *Organizational Research Methods*, 5, 139–158.
- Vogt, D. S., Shipherd, J. C., & Resick, P. A. (2012). Posttraumatic maladaptive beliefs scale: Evolution of the personal beliefs and reactions scale. *Assessment*, 9, 308–317.
- Wallen, S., DiGiuseppe, R., & Dryden, W. (1992). *A practitioner's guide to rational-emotive therapy*. New York, NY: Oxford Press.
- Yufik, T., & Simms, L. J. (2010). A meta-analytic investigation of the structure of posttraumatic stress disorder symptoms. *Journal of Abnormal Psychology*, 119, 764–776.