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Modeling the Structure of the Attitudes and Belief Scale 2 using CFA and Bifactor Approaches: Toward the Development of an Abbreviated Version

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Abstract. The Attitudes and Belief Scale-2 (ABS-2: DiGiuseppe, Leaf, Exner, & Robin, 1988. *The development of a measure of rational/irrational thinking*. Paper presented at the World Congress of Behavior Therapy, Edinburg, Scotland.) is a 72-item self-report measure of evaluative rational and irrational beliefs widely used in Rational Emotive Behavior Therapy research contexts. However, little psychometric evidence exists regarding the measure's underlying factor structure. Furthermore, given the length of the ABS-2 there is a need for an abbreviated version that can be administered when there are time demands on the researcher, such as in clinical settings. This study sought to examine a series of theoretical models hypothesized to represent the latent structure of the ABS-2 within an alternative models framework using traditional confirmatory factor analysis as well as utilizing a bifactor modeling approach. Furthermore, this study also sought to develop a psychometrically sound abbreviated version of the ABS-2. Three hundred and thirteen ($N = 313$) active emergency service personnel completed the ABS-2. Results indicated that for each model, the application of bifactor modeling procedures improved model fit statistics, and a novel eight-factor intercorrelated solution was identified as the best fitting model of the ABS-2. However, the observed fit indices failed to satisfy commonly accepted standards. A 24-item abbreviated version was thus constructed and an intercorrelated eight-factor solution yielded satisfactory model fit statistics. Current results support the use of a bifactor modeling approach to determining the factor structure of the ABS-2. Furthermore, results provide empirical support for the psychometric properties of the newly developed abbreviated version. *Key words: attitudes and belief scale-2 (ABS-2); bifactor modeling; rational emotive behavior therapy; irrational beliefs; confirmatory factor analysis*

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Introduction

Rational Emotive Behavior Therapy (REBT) is the original form of what is today generally referred to as Cognitive Behavior Therapy (CBT). REBT theory is therefore congruent with the wider field of CBT in that it hypothesises that cognition mediates the impact of internal or external activating events on the development of cognitive, affective, behavioral, and physiological responses (Ellis 1958, 1962, 1994). What differentiates REBT from other schools within the field of CBT (such as Cognitive Therapy or Dialectical Behavior Therapy, for example) is the nature of the cognitive variables which are theorized to represent the proximate antecedents of psychological distress or disturbance, namely evaluative or appraisal cognitions (Ellis 1994; Hyland & Boduszek, 2012; Walen, DiGiuseppe, & Dryden, 1992). According to REBT theory, these appraisal/evaluative beliefs can be held in either a rational (flexible and non-extreme) or an irrational (rigid and extreme) manner. Rational beliefs about negative activating events will produce functional and adaptive cognitive, affective, behavioral, and physiological responses, while irrational beliefs about negative activating events will give rise to dysfunctional and maladaptive

cognitive, affective, behavioral, and physiological responses (David & Szentagotai 2006). The practice of REBT is predicated upon the principle that individuals who experience psychological disturbances can access and modify their irrational beliefs and formulate new, alternative rational beliefs, which will serve to modulate their cognitive, affective, behavioral, and physiological experiences toward more functional and adaptive responses.

In Ellis's (1962) original conceptualization of REBT theory, he proposed 11 key irrational beliefs which were deemed to be central in the development of various forms of neurotic disturbance. The theory later underwent significant revision (Walen et al., 1992; Ellis 1994; David 2003; David, Szentagotai, Kallay, & Macavei, 2005) and REBT theory now describes four main irrational evaluative belief *processes* including (i) demandingness beliefs, (ii) catastrophizing beliefs, (iii) low frustration tolerance beliefs, and (iv) depreciation beliefs. These irrational belief processes exist alongside their rational counterparts: (i) preference beliefs, (ii) non-catastrophizing beliefs, (iii) high frustration tolerance beliefs, and (iv) acceptance beliefs.

The Attitudes and Belief Scale 2 (ABS-2; DiGiuseppe, Leaf, Exner, Robin, & 1988) was constructed to be consistent with the current theory of REBT and includes 72 items that attempt to measure the four rational and four irrational belief processes (David et al., 2005; Dryden & David 2008). The ABS-2 is useful for both researchers and clinicians, given that total scores may be computed for global irrationality and rationality, respectively, along with total scores for each of the four irrational (demandingness, catastrophizing, low frustration tolerance, and depreciation) and rational (preferences, non-catastrophizing, high frustration tolerance, and acceptance) belief processes.

Despite being developed upon a clear theoretical foundation and being widely employed in REBT research, there is a paucity of psychometric research investigating the underlying factor structure of the measure. DiGiuseppe, Robin, Leaf, and Gormon (1989) first attempted to identify the factor structure of the ABS-2 through the use of exploratory factor analysis (EFA) among a total sample of 1135 participants which included participants drawn from clinical and non-clinical populations. The EFA results indicated that a 24-factor solution accounted for 66.5% of variance. Further analysis indicated that the 24 factors could be explained in terms of four higher-order factors termed "General rationality/irrationality," "Rationality," "Comfort," and "Irrationality." However, Fulop (2007) argued that the items comprising the general rationality/irrationality factor reflected the depreciation beliefs and as such this factor could be better understood if termed 'Depreciation'.

Bernard (1998) extended the ABS-2 (DiGiuseppe et al., 1988) by introducing an additional 24 items in order to measure the context of fairness. Like DiGiuseppe et al. (1989), Bernard (1998) sought to investigate the underlying factor structure of the items through the use of EFA. Bernard (1998) used an item-factor loading criteria of 0.40 for item retention and as such retained 55 items for analysis. The EFA that followed revealed seven factors, which Bernard (1998) termed "rationality," "self-downing" (equivalent to "self-depreciation" beliefs), "need for achievement," "need for approval," "need for comfort," "demands for fairness," and "other-downing" (equivalent to "other-depreciation" beliefs).

The results of these studies are inconsistent in terms of identifying the correct number of latent variables that are needed to explain ABS-2 (DiGiuseppe et al., 1988) scores. This poses significant problems in terms of formulating an appropriate scoring scheme for the questionnaire. The inconsistency of the factor analytic findings may be largely attributable to the use of EFA procedures. EFA is a method that allows for the reduction of a large body of data; however, it does not allow for the testing or falsification of a particular model. There are no objective statistical criteria to determine the solution with the optimal number of factors. Confirmatory factor analysis (CFA) is a more powerful statistical method that allows the researcher to specify, a priori, a number of theoretically plausible models deemed to describe the underlying structure of a particular measure (see Bollen 1989 for discussion on the relative strengths and benefits of EFA and CFA). To date, only one CFA has been conducted on data from the ABS-2.

Fulop (2007) carried out this analysis on the Romanian translation of the ABS2-R (Macavei 2002) using a sample of 300 Romanian undergraduate students. The analysis compared five alternative models derived from theory and previous research findings. These models included a one-factor model in which all 72 items loaded on a single latent variable of global irrationality; a two-factor model representing global rationality and irrationality; a three-factor model reflecting the domains of context in which each belief statement is presented (comfort, achievement, and affiliation); a correlated four-factor solution representing the four major irrational beliefs (demandingness, low frustration tolerance, depreciation, and catastrophizing); and finally a model consistent with the findings of DiGiuseppe et al. (1989) EFA results. In this model, the 72 items load onto 24 first-order factors, which are then specified to load onto four second-order latent variables (general factor, rationality, comfort, and irrationality).

The results indicated that both the two-factor model of rationality and irrationality and the higher-order model proposed by DiGiuseppe et al. (1989) generated adequate model fit. Fulop (2007) concluded on the basis of these results that the DiGiuseppe et al. model was the better fitting model of the two. This conclusion could be questioned on the basis of a number of statistical and methodological issues. First, although both models yielded adequate fit statistics, Fulop did not report any fit statistics that allowed models to be compared, such as information criterion indices which can be used in order to compare alternative models. Normally, the Akaike Information Criterion (AIC; Akaike 1974) values and/or χ^2 difference tests are reported which provide an objective method for determining which of a series of alternative models best fits the data. Second, the DiGiuseppe et al. (1989) model was the least parsimonious, and such complex models tend to fit sample data better than simpler ones. Statistical assessment of fit should consider and correct for differences in the relative complexity of alternative models. Finally, in addition to the methodological problems associated with the model of DiGiuseppe and colleagues, the solution itself fails to make sense on purely theoretical grounds, as it is not congruent with the current theoretical formulation of REBT (David, Lynn, & Ellis, 2010).

In addition to the inadequate psychometric research currently available with regards to the ABS-2 (DiGiuseppe et al., 1989), two further methodological and practical limitations associated with this measure need to be addressed. Methodologically, the indicators of each of the eight belief processes included in the ABS-2 are contaminated by contextual factor. The ABS-2 does not distinguish between the process of belief (demands, low frustration tolerance, etc.) and the contexts in which these beliefs are presented. The various rational and irrational belief processes are presented in three contextual areas; those that are related to issues of (i) comfort, (ii) achievement, and (iii) affiliation. While rational and irrational beliefs can certainly be experienced in these areas, REBT theory makes no predictions that rational and irrational beliefs are confined to these contexts or that there is anything unique with respect to the way rational and irrational beliefs operate in theses contexts. The goal of REBT research is to examine the belief processes, rather than the context in which they occur, therefore it may well be necessary to consider, and to control for, this methodological weakness of the ABS-2. In addition, the ABS-2 can be criticized on practical grounds. Comprised of 72 items, the ABS-2 is an extremely long measure that requires a substantial period of time to fully complete, therefore making its use problematic in many research contexts.

In order to address the substantial limitations of the ABS-2, this study was carried out with two main objectives. First, we seek to provide a methodologically rigorous investigation of the construct validity of the ABS-2 (DiGiuseppe et al., 1989) by investigating a series of theoretically plausible models of the underlying structure of the ABS-2, including a novel eight-factor model consistent with current REBT theory which has hitherto not been proposed or empirically investigated. The dimensionality of the ABS-2 will be investigated through the use of conventional CFA techniques, along with the utilization of a bifactor (or hierarchical) modeling approach (Reise, Morizot, & Hays, 2007; Yung, Thissen, & McLeod, 1999). Bifactor modeling provides an empirically and conceptually distinct alternative to traditional higher-order sol-

utions. In traditional higher-order models, observable covariation between latent factors is assumed to be explained in terms of a superordinate latent construct. However, within a bifactor modeling approach, covariation among observable indicators is assumed to be explained by both "general factors" and "nuisance factors" which exist at the same conceptual level. In the present case, the general factors refer to the psychological belief factors assumed to explain the item covariation, while the nuisance factors refer to the three context factors (Comfort, Achievement, and Approval) which also are assumed to contribute to additional item covariation. Both categories of latent factors provide sources of item covariation, therefore inclusion of the nuisance factors within a hierarchical solution should allow for a more accurate determination of the optimal number of psychological factors necessary to explain the dimensionality of the ABS-2 (Reise et al., 2007). Furthermore, while traditional CFA models and bifactor models can produce identical model fit, bifactor models are advantageous in that they provide a useful method of investigating a measures dimensionality in situations such as the ABS-2 where indicators of psychological processes are contaminated by unwanted factors such as contextual presentation.

The second aim of the current study emerges from the practical limitations of the ABS-2, and as such seeks to develop and validate a psychometrically sound abbreviated version of the ABS-2 that will be available for use in future research endeavours.

Methods

Participants and procedures

The sample for the current study consisted of 313 ($N = 313$) emergency service personnel recruited from active duty while in serving in the Republic of Ireland and the Republic of Kosovo over a 12-month period (June 2011–June 2012). The sample consisted of 212 males (67.7%) and 101 females (32.3%). The participants' age ranged from 23 to 65 years with a mean age of the total sample of 38.18 years (SD = 8.70). Participants were informed of the nature of the study being under taken 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. No obligations were placed upon potential respondents nor were any inducements employed to recruit the sample.

Materials

The Attitudes and Belief Scale 2 (ABS-2; DiGiuseppe et al., 1988*)*. The ABS-2 is a 72-item self-report measure of rational and irrational beliefs, as defined by current REBT theory (Ellis 1994). The ABS-2 includes three core components. The first is a measure of cognitive processes that accounts for each of the four irrational belief processes which include *demandingness* (e.g. "I must do well at important things, and I will not accept it if I do not do well."); *catastrophizing* (e.g. "It's awful to have hassles in one's life and it is a catastrophe to be hassled."); *low frustration tolerance* (e.g. "I can't stand being disliked by certain people, and I can't bear the possibility of their disliking me."); and *depreciations* ("If important people dislike me, it is because I am an unlikable bad person."). The ABS-2 also measures the four rational belief processes including *preferences* ("I very much want to be liked by certain people, but I realize I don't have to be liked by them."); *non-catastrophizing* ("It is disappointing if I'm not doing well at tasks that are important to me, but I realize it is not awful or the worst thing in the world if I do not perform well."); *high frustration tolerance* ("If someone important to me disapproves of me or rejects me, I realize I can tolerate and bear his/her disliking me."); and *acceptance* ("When I fail at an important task, I can accept myself with my faults and limitations, and not condemn myself for failing."). The second component of the ABS-2 is a measure of three content/context areas that include rational or irrational beliefs related to areas of comfort, achievement, and affiliations. The third component of the ABS-2 relates to the lexical construction of the individual items; either rationally worded or irrationally worded.

Participants are requested to rate their level of agreement or disagreement with each statement along a five-point Likert scale: *strongly disagree (1), somewhat disagree (2), neutral (3), somewhat agree (4),* and *strongly agree (5)*. Scores can be summated to produce a single global score for irrationality; separate scores of rationality or irrationality; or individual scores on each of the four irrational belief processes (demandingness, depreciation, catastrophizing,

and low frustration tolerance) or rational belief processes (preferences, non-catastrophizing, low frustration tolerance, acceptance). High scores in each case indicate higher levels of each variable. Previous research efforts demonstrate that the ABS-2 possesses excellent internal reliability (e.g. David, Schnur, & Belloiu, 2002; DiLorenzo, David, & Montgomery, 2007; DiGiuseppe et al., 1989).

Analysis

Eight alternative confirmatory factor models were developed to explain the latent factor structure of the ABS-2 (DiGiuseppe et al., 1989). The models were specified and estimated using Mplus version 6.0 (Muthen & Muthen, 1998 – 2010) with robust maximum likelihood estimation. The traditional CFA models allowed items to load only onto a single factor, while the bifactor models allowed each item to load onto two factors (the relevant belief factor and the relevant nuisance context factor). In all cases, items measurement error terms were uncorrelated as suggested in previous research (Boduszek, Shevlin, Mallett, Hyland, & O'Kane, 2012).

Model 1 is a one-factor solution in which each of 72 items of the ABS-2 load on a single latent variable of global irrationality. Model 2 is a correlated two-factor model in which the two latent variables are represented by rationality and irrationality and 36 items load on each factor, respectively. Model 3 is an intercorrelated four-factor model in which the four factors reflect the four irrational belief groups; demandingness, catastrophizing, low frustration tolerance, and depreciation. Eighteen items load on the individual factors, respectively. Model 4 is an eight-factor model in which the eight factors are represented by the four irrational belief groups (demandingness, catastrophizing, low frustration tolerance, depreciation) and the four rational belief groups (preferences, non-catastrophizing, high frustration tolerance, acceptance), respectively. Nine items load onto each of the eight factors.

Each of these models was also specified within a bifactor model conceptualization. For these bifactor models, three nuisance factors were specified reflecting the three domains of context: comfort, achievement, and approval. Twenty-four items loaded on each of the three nuisance factors, respectively, and these three nuisance factors were included within each of the four specified models above when estimating the relevant bifactor solutions.

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 χ^2 statistic assessed the sample and implied covariance matrix, and a good fitting model is indicated by a non-significant result. However, χ^2 statistic is strongly associated with sample size, and as such good models tend to be over-rejected. Therefore, Tanaka (1987) suggested that a model should not be rejected simply on the basis of a significant χ^2 result. Accordingly, it is recommended that researchers examine the ratio of the χ^2 value to the degrees of freedom (df), and according to Kline (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 to a baseline model where all variables are uncorrelated. For these indices, values above .90 indicate reasonable fit while values above .95 indicated good model fit (Bentler 1990; Hu & Bentler 1999). In addition, two more absolute indices are presented; the standardized root mean-square residual (SRMR: Joreskog & Sorborn, 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 & Sorborn, 1993). Furthermore, 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

In order to attempt to identify the dimensionality of the ABS-2 (DiGisueppe et al., 1988), we first investigated the four specified alternative models using standard CFA techniques. Table 1 reports the fit indices and comparative fit indices of the four alternative models of the ABS-2 (DiGisueppe et al., 1988). As can be observed, all fit indices showed improvement for the intercorrelated eight-factor solution. All four models produced statistically significant χ^2

Table 1. *Standard CFA and bifactor model fit indices for four alternative models of the ABS-2*

Model	χ^2	*df*	CFI	TLI	RMSEA	SRMR	AIC
CFA models							
One-factor model	7556.795*	2485	0.70	0.70	0.08	0.11	62359.201
Two-factor model	7224.048*	2484	0.72	0.71	0.08	0.10	61958.420
Four-factor model	6621.378*	2478	0.76	0.75	0.07	0.07	61470.374
Eight-factor model	5846.597*	2456	0.80	0.79	0.07	0.07	60600.013
Bifactor models							
One-factor model	6310.949*	2410	0.71	0.76	0.07	0.06	61125.463
Two-factor model	5571.727*	2409	0.81	0.80	0.07	0.09	60343.983
Four-factor model	5659.979*	2404	0.81	0.80	0.07	0.06	60404.801
Eight-factor model	5091.306*	2382	0.84	0.83	0.06	0.06	59778.160

Note. N = *310;* χ^2*, chi square goodness of fit statistic; df, degrees of freedom; 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-square residual. *Indicates* χ^2 *are statistically significant* ($p < .001$).

results, however, rejection of the models on the basis of this fit index is unwarranted given that the sample size utilized in the current study would have increased the power of the test (Tanaka, 1987). Additionally, the eight-factor intercorrelated model produced the lowest χ^2 result, and its χ^2-to-df ratio was less than 3:1, suggesting an acceptable model according to Kline's (1994) indications. The RMSEA and SRMR results also suggest an adequate fit; however, the CFI and TLI values are below the recommended levels for adequate model fit. All models failed to produce satisfactory model fit across all indices but, however, on the basis of the χ^2-to-df ratio, RMSEA, and SRMR results, the intercorrelated eight-factor model could be said to represent an adequate representation of the underlying structure of the ABS-2.

A possible explanation for the less than satisfactory model fit statistics was thought to relate to the presence of three nuisance contextual factors. We therefore included these nuisance latent factors within each of the four theoretical model solutions in order to create four alternative bifactor models which could serve to provide a more satisfactory solution to the underlying structure of the ABS-2. Table 1 also presents the incremental and absolute fit indices for the four alternative bifactor models of the ABS-2. All four models showed marked improvements within the bifactor solutions as compared to the standard CFA solutions supporting the use of bifactor modeling approach for the ABS-2.

The eight-factor solution again provided the best fit of the data across all indices, as well as producing the lowest overall AIC value. A χ^2 difference test revealed that this bifactor model conceptualization was a significantly better model compared with the eight-factor model without the inclusion of the three nuisance factors (χ^2 difference = 755.291, df = 74, $p < .01$). Even with these improved model fit statistics, the eight-factor intercorrelated solution failed to produce satisfactory model fit statistics across all indices with the CFI and TLI values below the required cutoff criteria for acceptable model fit. Overall then, these results fail to support the construct validity of the ABS-2. As such, these results greatly enhanced the importance of the second aim of the current study which sought to develop a psychometrically sound abbreviated version of the ABS-2.

In order to develop an abbreviated version, we followed the guidelines of Bernard (1998) and retained three items with statistically significant factor loadings above .40 from each of the eight belief factors identified from the relevant bifactor model solution. We selected indicators of each belief factor from the bifactor solution, as item factor loadings in the bifactor model provided a clearer indication of which items most accurately measured each belief process, given that item covariation due to the nuisance contextual factors had been removed. Twenty-four items were thus retained for the abbreviated version and five models were compared within a standard alternative models framework using CFA techniques.

These five models included a one-factor solution in which all 24 items loaded on a single latent construct; an intercorrelated two-factor solution of rationality and irrationality; an intercorrelated four-factor solution representing the four irrational belief processes (demandingness, catastrophizing, low frustration tolerance, and depreciation); an intercorrelated eight-factor solution representing the four irrational belief processes and the four rational belief processes (preferences, non-catastrophizing, high frustration tolerance, and acceptance); and finally a higher-order model in which the four rational belief factors are subsumed under a Rationality factor and the four irrational belief factors are subsumed under an irrationality factor.

As detailed in Table 2, the eight-factor solution of the 24-item abbreviated version of the ABS-2 was the only model to exhibit satisfactory model fit. The χ^2-to-df ratio was approximately 2:1 and the SRMR value was .05 indicating good model fit. The CFI, TLI, and RMSEA values, respectively, indicated an adequate fit of the data. The adequacy of this model can also be observed in relation to the parameter estimates. Table 3 reports the standardized and unstandardized factor loadings (along with standard errors) for each observed variable on its respective latent variable. All factor loadings were positive and statistically significant, and all items possessed factor loadings greater than .40 with the majority of indicators exhibiting factor loadings above .60, thus generally satisfying the strict recommendations of Hair, Anderson, Tatham, and Black (1998) for factor loading requirements.

The factor correlations for the abbreviated version were predominately within expected and acceptable levels with the majority of variables moderate-to-moderately strongly correlated (see Table 4). However, there was one notable exception in the case of the factor correlation between Acceptance and Depreciation beliefs ($r = -.948$). These observed factor correlations suggested the possible presence of two higher order latent constructs. We therefore tested a two-factor higher-order model in which the four rational belief factors loaded on a Rationality factor, and the four irrational belief factors loaded on an irrationality factor. However, as detailed in Table 2, this solution was rejected as a poor fitting model.

Discussion

The current study set out to assess the dimensionality of the ABS-2 (DiGiuseppe et al., 1988), a frequently used measure of rational and irrational beliefs in REBT research contexts, which has not been subjected to rigorous psychometric investigation. In order to ascertain the appropriate factor structure of the ABS-2, a series of alternative factor solutions were devised including a novel and original eight-factor solution that is congruent with contemporary REBT theory (David et al., 2010). Furthermore, given a methodological limitation associated with the ABS-2, namely that the individual items fail to discriminate between the process of belief and the context of belief, we concurrently applied a bifactor modeling approach that served to control for the presence of these nuisance contextual factors which could lead to mis-

Table 2. *Fit Indices for the alternative factor models of the abbreviated version of the ABS-2*

Model	χ^2	*df*	CFI	TLI	RMSEA	SRMR	AIC
CFA models							
One-factor model	1334.263*	252	0.74	0.71	0.12	0.10	21905.520
Two-factor model	1263.337*	251	0.76	0.73	0.11	0.10	21805.427
Four-factor model	844.996*	246	0.86	0.84	0.08	0.09	21337.153
Eight-factor model	488.908*	224	0.94	0.92	0.06	0.05	20955.071
Second-order model	733.998*	243	0.88	0.87	0.08	0.08	21201.614

Note. N = *310; χ^2, chi square goodness of fit statistic; df, degrees of freedom; 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-square residual. *Indicates χ^2 are statistically significant ($p < .001$).*

Table 3. *Standardized and unstandardized factor loadings (and standard errors) for the four-factor model of the abbreviated version of the ABS-2*

Item	β	B	SE
Factor 1 (demandingness)			
I must do well at important things, and I will not accept it if I do not do well.	0.775	1.000	–
It's essential to do well at important jobs; so I must do well at these things.	0.777	0.971	0.070
I must be successful at things that I believe are important, and I will not accept anything less than success.	0.759	1.031	0.074
Factor 2 (catastrophizing)			
It's awful to be disliked by people who are important to me, and it is a catastrophe if they don't like me.	0.783	1.000	–
Sometimes I think the hassles and frustrations of everyday life are awful and the worst part of my life.	0.763	0.984	0.062
If loved ones or friends reject me, it is not only bad, but the worst possible thing that could happen to me.	0.742	0.911	0.062
Factor 3 (low frustration tolerance)			
It's unbearable being uncomfortable, tense or nervous and I can't stand it when I am.	0.761	1.000	–
It's unbearable to fail at important things, and I can't stand not succeeding at them.	0.621	0.855	0.089
I can't stand being tense or nervous and I think tension is unbearable.	0.830	1.104	0.069
Factor 4 (depreciation)			
If important people dislike me, it is because I am an unlikable bad person.	0.920	1.000	–
If I do not perform well at tasks that are very important to me, it is because I am a worthless bad person.	0.908	1.035	0.034
When people I like reject me or dislike me, it is because I am a bad or worthless person.	0.961	1.110	0.034
Factor 5 (preferences)			
I do not want to fail at important tasks but I realize that I do not have to perform well just because I want to.	0.682	1.000	–
I want to perform well at some things, but I do not have to do well just because I want to.	0.680	0.930	0.092
I want to do well at important tasks, but I realize that I don't have to do well at these important tasks just because I want to.	0.694	1.044	0.127
Factor 6 (non-catastrophizing)			
It is unfortunate when I am frustrated by hassles in my life, but I realize it's only disappointing and not awful to experience hassles.	0.604	1.000	–
When life is hard and I feel uncomfortable, I realize it is not awful to feel uncomfortable or tense, only unfortunate and I can keep going.	0.560	0.989	0.205
It's bad to be disliked by certain people, but I realize it is only unfortunate to be disliked by them.	0.594	1.053	0.168
Factor 7 (high frustration tolerance)			
I do not like to be uncomfortable, tense or nervous, but I can tolerate being tense.	0.571	1.000	–
I get distressed if I'm not doing well at important tasks, but I can stand the distress of failing at important tasks.	0.454	0.743	0.148
It's only frustrating not doing well at some tasks, but I know I can stand the frustration of performing less than well.	0.787	1.221	0.138
Factor 8 (acceptance)			
When people whom I want to like me disapprove of me, I know I am still a worthwhile person.	0.915	1.000	–
Even when my life is tough and difficult, I realize that I am a person who is just as good as anyone else even though I have hassles.	0.977	1.117	0.031
When my life becomes uncomfortable, I realize that I am still a good person even though I am uncomfortable.	0.909	0.993	0.032

Notes. *All Factor loadings are statistically significant ($p < .001$). B stands for Beta (unstanbdardized factor loading).*

Table 4. *Correlations for the eight-factor model of the abbreviated version of the ABS-2*

Item	DEM	CAT	LFT	DEP	PREF	NCAT	HFT	ACC
Demandingness (DEM)	–							
Catastrophizing (CAT)	0.788	–						
Low frustration tolerance (LFT)	0.798	0.780	–					
Depreciation (DEP)	0.569	0.748	0.730	–				
Preferences (PREF)	−0.634	−0.480	−0.670	−0.477	–			
Non-catastrophizing (NCAT)	−0.444	−0.349	−0.465	−0.486	0.401	–		
High frustration tolerance (HFT)	−0.612	−0.538	−0.681	−0.624	0.859	0.670	–	
Acceptance (ACC)	−0.597	−0.713	−0.754	−0.948	0.565	0.579	0.698	–

Note. *All Factor correlations are statistically significant* ($p < .001$).

identification of the appropriate factor structure. Bifactor modeling has predominately been applied within intelligence testing paradigms (e.g. Carroll 1993; Gustafsson & Balke 1993) or in situations where researchers are interested in identifying a unidimensional structure for a given measure (Reise et al., 2007). However, bifactor modeling approaches offer many advantages that make their use desirable when assessing the dimensionality of measures of various psychological constructs, and such approaches are beginning to be adopted by researchers interested is psychological constructs other than intelligence (e.g. Patrick, Hicks, Nichol, & Kruger, 2007).

Our initial results based on standard CFA model specifications indicated that none of the four tested models of the factor structure of the ABS-2 satisfied the required model fit statistics. The results did suggest that our proposed eight-factor model was the best approximation of the population covariance matrix of the models tested. We therefore hypothesized that the presence of three contextual "nuisance" factors may have been contributing additional, and unwanted, item covariation which was contributing to the poor model fit results. A bifactor modeling approach was thus adopted and the same four solutions were specified, but in each case three nuisance factors were also included within a hierarchical model.

Inclusion of these nuisance factors improved the model fit of all four models across all fit indices indicating that consideration of these nuisance context factors is worthwhile when assessing the factor structure of the ABS-2 (DiGiuseppe et al., 1989). This intercorrelated eight-factor solution again provided the most impressive factor solution; however, despite the improvements in model fit obtained by utilizing a bifactor solution, the model fit statistics failed to satisfy acceptable fit criteria across all indices. Ultimately, although the addition of the nuisance contextual factors improved the model fit of the eight-factor conceptualization, these analyses failed to provide strong empirical support for the construct validity of the ABS-2.

The second objective of the current study was to develop a psychometrically sound abbreviated version of the ABS-2 for use in many research contexts where the application of a 72-item measure is impractical. Given that current findings failed to provide the desired

level of empirical support for the construct validity of the ABS-2 (DiGiuseppe et al., 1989), the development of an abbreviated version of the ABS-2 with sound psychometric properties was of the utmost importance. In order to select the relevant items for the abbreviated version of the ABS-2, we inspected the items factor loadings for each of the eight belief factors as revealed in the relevant bifactor model solution. Since this model allowed items to load on both the nuisance context factor and the appropriate psychological factor, we were able to retain items that were the best indicators of the relevant rational and irrational belief processes. All items selected possessed statistically significant factor loadings above a value of .40.

Given that indicators were selected after the effects of the nuisance factors were controlled, it was necessary to only compare the four alternative model solutions using standard CFA techniques. Of the five alternative specified models, the intercorrelated eight-factor solution for the abbreviated version of the ABS-2 was the only model to obtain satisfactory model fit. The χ^2-to-df ratio result indicated a good model, as did the SRMR result, while the RMSEA, CFI, and TLI values all indicated adequate model fit. It should also be noted that despite being less parsimonious that many of the other tested models, the AIC, CFI, and RMSEA indices, all include explicit penalties for model complexity and this eight-factor solution still exhibited the most impressive values across all three indices, therefore strongly suggesting that it is the most accurate conceptualization of the underlying factor structure of the measure. Furthermore, this factor solution derived additional support on the basis of the observed standardized factor loadings. The majority of the indicators exceeded Hair et al.'s (1998) strict cutoff criteria of 0.60, and those few indicators that did not still exhibited statistically significant factor loadings above 0.40.

As would be expected based on theoretical understandings, the eight latent factors all showed statistically significant associations, and these associations were predominately moderate to strong. The correlation between acceptance and depreciation beliefs ($r = .95$) was very high. Given that these beliefs are the rational and irrational counterparts of each other, it suggests that they are either bipolar constructs, or the indicators of each factor are failing to appropriately measure the distinctive constructs. Future research endeavours with the abbreviated version of the ABS-2 will be necessary to ascertain which of these possible explanations is correct. All four irrational latent factors and all four rational latent factors were positively and statistically significantly related to one another. These correlations suggested the possible presence of two second-order latent factors, rationality and irrationality, which could serve to explain the observed factor correlation, however, this second-order model was a poor representation of the data.

As is the case with any research project, there are limitations that need to be indicated. The current analysis was conducted within a sample of 313 participants drawn from a unique and specialized strata of the population (emergency service personnel), and therefore these results are not widely generalizable. Future studies should preferably retest the factor structure of both the 72-item ABS-2 (DiGiuseppe et al., 1988) and the 24-item abbreviated version presented herein among more diverse population groups in order to develop a more robust picture of the factor structure of these measures. Future analyses should ideally utilize a bifactor modeling approach to control for the effects of context factors, as present results indicate that such bifactor models improve model fit. In addition, construct validation studies are preferably conducted on larger sample sizes which can additionally facilitate investigation of the factorial invariance of the measure between the sexes. However, given the extremely specialized nature of the current sample, this limitation was impossible to overcome.

In conclusion, this study has provided the most comprehensive and methodologically rigorous investigation of the psychometric properties of a widely used measure of rational and irrational beliefs within the REBT field to date. In doing so, this paper has provided empirical support for the value of utilizing a bifactor modeling approach when assessing the dimensionality of this psychological measure. Our results failed to provide acceptable evidence of the dimensionality of the ABS-2 (DiGiuseppe et al., 1988) within this particular population, in spite of attempts to overcome a number of methodological limitations associ-

ated with the measure. In order to surmount the identified methodological and practical difficulties associated with the full version of the ABS-2, a 24-item abbreviated version was developed and psychometrically validated. An original and previously un-suggested eight-factor intercorrelated solution, fully consistent with contemporary REBT theory, was demonstrated to provide satisfactory fit of the obtained data. The abbreviated version of the ABS-2 therefore provides a practical, theoretically consistent, and psychometrically validated measure of rational and irrational beliefs.

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