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Construct Validity of Scores From the Connor–Davidson Resilience Scale in a Sample of Postsecondary Students With Disabilities

Assessment
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Abstract

Although theory posits a multidimensional structure of resilience, studies have supported a unidimensional solution for data obtained from the commonly used Connor–Davidson Resilience Scale (CD-RISC). This study investigated the latent structure of CD-RISC responses in a sample of postsecondary students with disabilities. Furthermore, the validity of CD-RISC scores was examined with respect to career optimism and well-being. The analyses were conducted using confirmatory factor analysis and exploratory structural equation modeling (ESEM). Results supported a bifactor-ESEM representation of the CD-RISC data that accounts for construct-relevant multidimensionality in scores due to the presence of general and specific factors and the fallibility of indicators as pure reflections of the constructs they measure. Although three specific factors showed meaningful residual specificity over and above the general factor, two specific factors were weakly defined with little meaningful residual specificity. However, these factors may retain some utility in the bifactor-ESEM model insofar as they control for limited levels of residual covariance in items. Evidence was also obtained for relations of the general and substantively interpretable specific factors with career optimism and well-being. The results of the study provide validation data for the CD-RISC and clarify recent research converging on seemingly disparate unidimensional and multidimensional solutions.

Keywords

resilience, CD-RISC, CFA, ESEM, bifactor-ESEM, disability

There has been considerable interest in the construct of resilience over the past two decades. This interest spans major international funders, policy makers, and academic researchers (Windle, Bennett, & Noyes, 2011). Evidence shows that resilience predicts adaptation across a range of adverse events, including combat exposure (Green, Calhoun, & Dennis, & Beckham, 2010), surviving natural disasters (Karaırmak, 2010), and infertility problems (Sexton, Byrd, & von Kluge, 2010). However, concerns have been raised about the construct (Windle et al., 2011), chief among which is the internal structure of data obtained from resilience measures (Green et al., 2014).

Among the most widely used measures of resilience is the Connor–Davidson Resilience Scale (CD-RISC). The CD-RISC is designed to measure individual differences in multiple psychological characteristics (e.g., self-efficacy, control, optimism) believed to promote adaptation under adversity (Connor & Davidson, 2003). The measure was specifically developed for clinical practice and has been used with diverse samples (Fernandez, Fehon, Treloar, Ng, & Sledge, 2015; Green et al., 2014). In addition, the instrument has been shown to produce internally consistent scores, and discriminant and convergent validity evidence has been obtained (Pangallo, Zibarras, Lewis, & Flaxman, 2015; Windle et al., 2011). Notwithstanding the prevalence of the CD-RISC and evidence for its robustness, the latent structure underlying item responses is unclear (Green et al., 2014). Furthermore, correlations among the CD-RISC dimensions have been shown to be near unity (Burns & Anstey, 2010), undermining the multidimensionality perspective underlying the instrument.

In addition to these problems of internal structure and construct discrimination, the CD-RISC has not been systematically investigated in samples of people with disabilities. People with disabilities may be more vulnerable to

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deleterious developmental and social outcomes due to risks associated with impairments (Lucas, 2007; Murray, 2003). Although resilience is often investigated in response to acute trauma, it may also play a role in minimizing adverse outcomes when confronting the daily losses and stigma associated with impairments (Murray, 2003; Sarkar & Fletcher, 2013). Indeed, understanding the protective processes involved in resilience in people with disabilities may guide treatment efforts designed to promote adaptation.

Advances in resilience research, and ultimately the applied utility of the construct, depend on the availability of measures that yield valid scores (Green et al., 2014). Accordingly, the aim of the present study is to further investigate the validity of CD-RISC data. First, the study examines the internal structure of CD-RISC scores in a sample of postsecondary students with disabilities. The espoused correlated five-factor (CFF) structure is tested against plausible unidimensional, higher order (HO), and bifactor (BF) representations. These models are tested using both confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM). We also examine the validity of scores with respect to career optimism (CO) and well-being.

Conceptualization and Theoretical Underpinning

Resilience has been conceptualized as a trait, outcome, or process related to adaptation under adversity (Fletcher & Sarkar, 2015). The trait-based conceptualization holds that resilience is a collection of dispositional characteristics that foster adaptation to adverse circumstances. The outcome-focused conceptualization proposes that resilience reflects adaptive outcomes characterized by the maintenance of effective functioning, or even growth in functioning (i.e., thriving), under adversity. These conceptualizations should be distinguished from the process-based interpretation. From this standpoint, resilience is a dynamic process of adaptation involving multiple psychological systems (e.g., cognitions, emotions, behaviors) and characteristics (e.g., agency, competence, faith) that serve to buffer against the development of psychopathology following exposure to adversity (Sarkar & Fletcher, 2013).

Multiple frameworks have been used to understand resilience. For instance, ecological models have been used to explain resilience, positing that people exist in interconnected environmental systems that influence their adaptation through ongoing person–context transactions (Bronfenbrenner, 1977; Cicchetti & Lynch, 1993). Another perspective is the multilevel triarchic approach, which posits protective processes involved in resilience at individual, family, and community levels (Luthar, Cicchetti, & Becker, 2000). Consistent with these frameworks, Murray (2003) proffers an organizing risk and resilience model for understanding the factors that guard against adverse outcomes and maximize healthy development in people with disabilities, including individual (e.g., internal locus of control), family (e.g., secure attachment to caregiver), school (e.g., positive teacher–student relationships), and community (e.g., access to community mentors) factors. Similarly, Windle (2011) proposes an integrative resilience framework in which resilience is defined as a multifaceted process concerning the capacity for adaptation under adversity, involving individual (e.g., efficacy), social (e.g., family support), and community/societal (e.g., community services) resources.

It has been noted that the CD-RISC has little theoretical grounding that complicates its measurement of resilience (Windle et al., 2011). The development of the CD-RISC content domain was based on a synthesis of concepts drawn from prior work on hardiness, adaptability, and positive adjustment following trauma (Connor & Davidson, 2003). Although plausible conceptual underpinnings, it is not clear why this work was considered while other literature omitted (Windle et al., 2011). Furthermore, the validity of CD-RISC data is seemingly undermined by the inclusion of content related to spirituality based on the memoirs of Shackleton's expedition to the Antarctic (Sarkar & Fletcher, 2013).

Despite this conceptual ambiguity, the CD-RISC may be reconciled with existing accounts of resilience. For instance, consistent with Windle's (2011) and Murray's (2003) accounts, the measure aims to operationalize resilience as a multidimensional process relating to an individual's ability to negotiate, manage, and adapt to adversity, implicating beliefs, relationships, and competences. The CD-RISC aims to capture this multidimensionality by measuring five distinct, though related, dimensions as follows: (a) personal competence, high standards, and tenacity (competence); (b) trust, tolerance of unpleasant affect, and adaptive value of stress (tolerance and trust); (c) acceptance of change and secure relationships (acceptance); (d) control; and (e) spirituality (Connor & Davidson, 2003). However, this multidimensionality has not been adequately reflected in the literature, especially in practices such as computing global resilience scores and creating short-form measures that are unlikely to provide sufficient coverage of the construct's expansive content domain (Campbell-Sills & Stein, 2007).

Dimensional Structure of Resilience

Although the CD-RISC is intended to be multidimensional, evidence is unclear about the internal structure of data. Initial validation work found support for a five-factor model (Connor & Davidson, 2003). However, subsequent studies have largely failed to support this structure (Fernandez et al., 2015; Green et al, 2014). Indeed, even where a five-factor structure has been supported (Baek, Lee, Joo, Lee, & Choi, 2010; Connor & Davidson, 2003; Yu, Lau, Mak, Zhang, & Lui, 2011), factor content seems to differ considerably across solutions (Baek et al., 2010; cf. Connor & Davidson, 2003).

Absent of consistent evidence for replicability, alternative models have been proposed. Despite retaining a multidimensional solution in initial validation work (Connor & Davidson, 2003), the current scoring key for the CD-RISC, in which item scores are summed to form a composite resilience score, implies a strictly unidimensional structure. Although there is some evidence for unidimensionality, this is typically only obtained after item deletion and correlating residual variances (Burns & Anstey, 2010; Campbell-Sills & Stein, 2007; Fernandez et al., 2015). Furthermore, theoretically, support for a unidimensional model is inconsistent with the view of resilience as a multidimensional construct. Thus, it would seem that comparing the unidimensional structure with a competing CFF model is important to clarifying the internal structure.

Another model that may be an appropriate representation is the HO model (Lee, Sudom, & McCreary, 2011). The rationale for this specification is that the firstorder resilience dimensions are sufficiently related to assume the existence of an underlying common factor. This is consistent with not only the theoretical view of resilience as a multidimensional construct (Richardson, 2002) but also emerging evidence suggesting the presence of a global construct underlying data (Burns & Anstey, 2010). There is tentative evidence for this hierarchical representation. For instance, Yu et al. (2011) obtained tentative support for a HO structure with scores on the five resilience dimensions indexing a global reliance factor. However, a notable limitation of this solution is that a HO structure was not directly tested; insetad, observed composite scores on the five resilience dimensions were used as indicators of global resilience. In addition, Goins, Gregg, and Fiske (2012) obtained uniformly strong loadings of the five resilience dimensions on the global factor, though model data fit was suboptimal. However, given the sizeable HO loadings in this study, it is unlikely that misfit could be attributed to the second-order portion of the model.

A final alternative structure that may be relevant is a BF model. To the authors' knowledge, a BF representation has not been considered with respect to the CD-RISC data. This is somewhat surprising as a BF structure may adequately reflect the multidimensionality perspective espoused by most theoretical views on resilience but still retain the notion of a general resilience resource that has been supported in recent empirical studies (e.g., Burns & Anstey, 2010; Fernandez et al., 2015). It is conceivable that individuals possess an integrated resilience resource in addition to more differentiated behavioral and cognitive responses in the adaptation process when confronting adversity. Insofar as both the general and specific resilience components are of substantive interest, the BF model is the only straightforward framework for analyzing relevant covariate-based differences on the general and specific components and effects of these dimensions on theoretically-relevant criteria.

Psychometric Multidimensionality

Although the failure of several CFA studies to support the CFF structure has been attributed to differing ways in which people respond to adversity across different cultures or age groups (Yu et al., 2011), at least another reason for this dearth of support may be that the appropriate analytic model has not been used. For multidimensional data drawn from instruments designed to measure conceptually overlapping dimensions, the typical independent clusters model (ICM) of CFA may be too restrictive as items often index more than one dimension (Perera, 2015a, 2015b). Although the BF-CFA model can account for multidimensionality due to the coexistence of general and specific factors, psychometric multidimensionality may also be due to item fallibility (Perera, McIlveen, Burton, & Corser, 2015). Accordingly, these imperfect items are likely to show some systematic association with nontarget constructs, manifested as small-to-moderate cross-loadings in a factor analytic framework (Hopwood & Donnellan, 2010). This source of construct-relevant item psychometric multidimensionality tends to be magnified in measures of theoretically complex constructs, such as resilience, with multiple conceptually overlapping domains (Morin, Arens, & Marsh, 2015).

As the CD-RISC is a multidimensional measure of factorially complex items (Connor & Davidson, 2003), the ICM-CFA may not be an appropriate model for investigating data dimensionality. In the ICM-CFA, the constraint of true non-zero cross-loadings to zero may be a source of model misspecification that results in model–data misfit. This misspecification may explain, at least in part, findings of misfit for the CFF-CFA in previous studies. Moreover, the restriction of cross-loadings to zero may lead to inflated factor correlations in correlated-factor models and inflated general factor loadings in (orthogonal) BF models. This is because any true relation between an item and nontarget factor that should be accounted for via a cross-loading can only be expressed through (inflated) factor correlations in correlated-factors CFA models and general factor loadings in orthogonal BF-CFA models (Morin, Arens, & Marsh, 2015). Indeed, previous applications of the CFF-CFA to the CD-RISC data have resulted in substantial factor correlations (e.g., Burns & Anstey, 2010). As the CD-RISC has been shown to have factorially complex items (Connor & Davidson, 2003), ESEM may be a more appropriate tool for investigating the internal structure of data. However, a formal test of this proposition is required (Morin, Arens, & Marsh, 2015).

The combination of ESEM with BF modeling reflects an integrative analytic framework for accounting for construct-relevant item multidimensionality due to indicator fallibility and the presence of general and specific constructs (Morin, Arens, & Marsh, 2015). Central to this framework is an initial comparison of the first-order ICM-CFA and ESEM models to assess the presence of psychometric

multidimensionality due to indicator fallibility. The next step in this framework involves a comparison of the first-order structure versus structures specifying the presence of global and specific constructs to examine construct-relevant multidimensionality due to the coexistence of general and specific factors. Depending on the results of the initial step, CFA or ESEM structures may be examined. For the CD-RISC data, which may be expected to (a) have more than one source of true-score variance due to the conceptual relatedness of its dimensions (i.e., indicator fallibility) and (b) assess a general construct in addition to content specificities shared by item subsets, these analytic procedures provide an integrative framework for the examination of both sources of construct-relevant multidimensionality.

Relations With External Constructs

Relations of resilience with CO and well-being would yield convergent and criterion-related evidence, respectively, supporting the validity of the CD-RISC scores. CO, reflecting favorable success expectancies for career-related development, represents a higher level of specificity than general dispositional optimism but has greater generality than situation-specific optimism (Rottinghaus, Day, & Borgen, 2005). Although no studies have examined the resilience–CO association, conceptually, a link should be expected because a disposition for favorable expectancies reflected in CO also constitutes an aspect of the resilience content domain (Connor & Davidson, 2003). This shared conceptual content should be empirically manifested as sizeable relations of resilience with CO. For well-being, reflecting affective–emotional and cognitive–evaluative wellness as well as positive psychological functioning (Keyes, Shmotkin, & Ryff, 2002), most resilience theories hold that resilience serves as a protective factor that buffers the deleterious effects of adversity (Richardson, 2002; Windle, 2011). Consistent with this view, there is considerable evidence that dimensions of resilience are associated with higher well-being (Burns, Anstey, & Windsor, 2011; Fernandez et al., 2015), including in people with disabilities (Terrill et al., 2014). We expect moderate to strong positive associations of resilience with well-being.

Method

Participants and Procedure

Participants were 274 students enrolled in a regional university in South East Queensland, Australia. All participants were registered with the University's Disability Services Division, indicating the presence of at least one disabling condition. The mean age of participants was 38.788 (SD = 12.696), and 64.6% (n = 177) of the sample was female. One student (0.4%) did not report their age or gender. Of the 274 participants, 5.5% (n = 15) reported autism spectrum disorders, 3.6% (n = 10) reported deafness or other hearing impairments, 33.6% (n = 92) reported psychological difficulties (e.g., depression, anxiety, bipolar disorder), 5.5% (n = 15) reported physical disabilities (e.g., paraplegia, quadriplegia, orthopedic impairments), 2.6% (n = 7) reported attention disorders (e.g., attention deficit disorder, attention deficit hyperactivity disorder), 1.5% (n = 4) reported learning disabilities, 0.7% (n = 2) reported speech or language impairments, 2.9% (n = 8) reported acquired traumatic brain injury, 21.9% (n = 60) reported medical disabilities (e.g., diabetes, fibromyalgia, arthritis), 2.9% (n = 8) reported visual impairments, 6.6% (n = 18) reported "other" disabilities (e.g., narcolepsy, postconcussion syndrome), and 12.8% (n = 35) reported multiple disabilities (i.e., more than one diagnosed disabling condition).

Participants were recruited by the Disability Services Division in the spring of 2014. Students were advised that they would be contributing to a study on "resilience and thriving in postsecondary students with disabilities." Participation involved the completion of an online battery of demographic items and psychological instruments, including measures of resilience, CO, and well-being. Participants provided informed consent prior to their participation in the study, and all participants were compensated for their contribution by way of noncash vouchers worth $20.00 AUD. The study was approved by the institution's human research ethics review board.

Measures

Resilience. Resilience was measured using the CD-RISC (Connor & Davidson, 2003). This measure is a 25-item self-report inventory, rated on a 5-point Likert-type scale, ranging from 0 (*not true at all*) to 4 (*true nearly all the time*). A sample item from the scale is "I tend to bounce back after illness, injury, or other hardships." The CD-RISC is designed to yield subscale scores on the five dimensions of resilience identified by Connor and Davidson as well as a global psychological resilience score. In the present sample, the coefficient alpha reliabilities for the subscale scores were .865 for perceived competence, .792 for tolerance and trust, .828 for acceptance, .784 for control, and .596 for spirituality.

Career Optimism. CO was measured by items from the CO subscale of the Career Futures Inventory (CO-CFI; Rottinghaus et al., 2005). The CO-CFI comprises 11 items, rated on a 5-point Likert-type scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A sample item from the subscale is "I am eager to pursue my career dreams." The scale is designed to index favorable expectations with regard to future career development. Responses to the CO-CFI have demonstrable internal consistency and temporal stability,

and the validity of scores has been found via theoretically consistent concurrent and criterion-related relations (Rottinghaus et al., 2005). In the present sample, the coefficient alpha reliability for the total score was .881.

Well-Being. Well-being was measured using items from the World Health Organization Well-being Index–Five (WHO-5; WHO, 1998). The WHO-5 is a five-item self-report inventory measuring affective–emotional and optimal functioning aspects of well-being. Respondents rate the extent of their functioning over the previous fortnight using a 6-point Likert-type scale ranging from 0 (*at no time*) to 5 (*all of the time*). A sample item from the scale is "I have felt calm and relaxed." Data from the WHO-5 have been shown to be internally consistent, conform to a unidimensional structure, and possess criterion-related validity (Henkel et al., 2003; Heun, Bonsignore, Barkow, & Jessen, 2001). In the present sample, the coefficient alpha reliability for the scale score was .894.

Statistical Analyses

Analyses were conducted in two phases. First, CFA and ESEM analyses of the CD-RISC data were conducted to test the fit of the CFF, unidimensional, HO, and BF models. For the unidimensional model, all items were specified to load onto a single resilience factor. For the CFF-CFA model, each item was specified to load onto only the factor it was designed to measure, with factor correlations freely estimated. In the HO-CFA, the five first-order factors were specified to index a second-order resilience factor. For the BF-CFA, all CD-RISC items were specified to load onto a general resilience factor as well as one of the five specific factors. Null relations among the general and specific factors were specified.

For the CFF-ESEM, HO-ESEM, and BF-ESEM models, the same pattern of target item–factor loadings and factor relations was specified as per their CFA analogues. However, CFF-ESEM and BF-ESEM solutions were rotated using the target and bifactor target rotations, respectively, with all cross-loadings "targeted" to be approximately zero but not constrained to zero (Asparouhov & Muthén, 2009). Target rotation is particularly advantageous for the CD-RISC data as there is partial knowledge of the espoused factor structure. This rotational procedure allows for the prespecification of target and secondary loadings in a somewhat confirmatory fashion (Morin, Arens, & Marsh, 2015). Nontarget loadings that are targeted to be zero but deviate substantially from zero can then be the focus of investigation and theoretical justification (Perera, 2015b). For the HO-ESEM, as operationalizations of ESEM in software do not allow for the specification of HO models, the ESEM-within-CFA (EwC) approach was used to test this model.

The second phase of analyses involved an examination of the relations of the CD-RISC scores, based on the retained measurement solution, with CO in one model, and with well-being in a second model. For the first model, a general latent variable model (LVM) was specified, including the retained CD-RISC structure and a unidimensional CO factor indicated by CO-CFI items. For these indicators of CO, we specified three correlated uniquenesses to account for potential method artifacts generated by highly similar item wordings (e.g., "It is difficult for me to set career goals," "It is difficult to relate my abilities to a specific career plan"; see McIlveen & Perera, 2015). Correlations of resilience with CO were freely estimated. For the second model, another LVM was specified, including the retained CD-RISC measurement structure and a unidimensional well-being factor indicated by WHO-5 items. In this model, well-being was regressed on the resilience dimensions.

Statistical analyses were conducted using M*plus* 7.3 (Muthén & Muthén, 1998-2014). All solutions were estimated using robust diagonal weighted least squares with a mean-and-variance adjusted test statistic, operationalized as the WLSMVestimator, in M*plus*. Model fit assessment involved an evaluation of fit indices, parameters estimates, and alternative models. As the χ^2 can be oversensitive to even minor model misspecifications given moderately large samples and contains a restrictive hypothesis test (i.e., exact fit), three approximate fit indices were considered: Comparative fit index (CFI) and Tucker–Lewis index (TLI), >.900 and .950 for acceptable and excellent fit, respectively; and root mean square error of approximation (RMSEA), <.050 and .080 for close and reasonable fit, respectively (Marsh, Hau, & Wen, 2004). For nested model comparisons, because the adjusted χ^2 difference (MD χ^2) test appropriate for the WLSMVestimator also tends to be sensitive to even trivial differences, changes in the CFI (ΔCFI) and RMSEA (ΔRMSEA) were primarily used. A decrease in the CFI and increase in the RMSEA of less than .01 and .015, respectively, are suggestive of support for a more restrictive model (Chen, 2007; Cheung & Rensvold, 2002).

Results

Descriptive Statistics

Univariate proportions for the CD-RISC, CO-CFI, and WHO-5 items and sample estimates of polychoric correlations among these items can be found in Supplemental Appendix A (all supplementary appendices are available online at http://asm.sagepub.com/content/by/supplemental-data).

Latent Structure

Results of the fit of the models are shown in Table 1. Fit indices for the unidimensional model that is common to

Table 1. Model Fit Statistics for the ICM-CFA and ESEM Measurement Structures.

Model	χ^2	*df*	CFI	TLI	RMSEA	RMSEA 90% CI	MD χ^2(*df*)
Independence model	8663.202	300					
M1: Unidimensional	800.183	275	.937	.931	.083	[.077, .090]	
M2: Five-factor CFA	633.136	265	.956	.950	.071	[.064, .078]	165.756[a] (10)***
M3: Higher order CFA	638.346	270	.956	.951	.071	[.064, .078]	11.811[b] (5)*
M4: Five-factor ESEM	304.815	185	.986	.977	.049	[.039, .058]	317.925[c] (80)***
M5: Higher order ESEM[d]	300.361	190	.987	.979	.046	[.036, .056]	2.907[e] (5)
M6: Bifactor-ESEM	249.622	165	.990	.982	.043	[.032, .054]	60.654[f] (20)***

Note. M = model; ICM-CFA = independent clusters model of confirmatory factor analysis; ESEM = exploratory structural equation modeling; *df* = degrees of freedom; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval for the RMSEA; MD χ^2 = chi-square difference test computed via the DIFFTEST utility in M*plus*. *N* = 274. The test of the bifactor-CFA model did not converge to an admissible solution.
[a]This nested model comparison is between M1 and M2. [b]This nested model comparison is between M3 and M2. [c]This nested model comparison is between M2 and M4. [d]The higher order ESEM specification was conducted in an EwC framework. [e]This nested model comparison is between M5 and M4. [f]This nested model comparison is between M4 and M6.

both the CFA and ESEM specifications were at odds. The CFI and TLI were indicative of acceptable fit, whereas the RMSEA exceeded the .080 cutoff for reasonable fit. The CFF-CFA model provided a reasonable fit to the data. In comparative terms, the unidimensional model provided an inferior fit to the data relative to the CFF-CFA solution. As per the general framework for testing responses for construct-relevant multidimensionality, an initial comparison is between the CFA and ESEM representations of the CFF structure. The CFF-ESEM solution fitted the data well in absolute terms, and, in relative terms, fitted appreciably better than its CFA analogue (e.g., ΔCFI = .030). In terms of parameter estimates, the CFF-CFA loading estimates (|λ| = .464-.871, *M* = .712) were systematically stronger than corresponding ESEM target loadings (|λ| = .151-.897, *M* = .511). As for factor correlations, CFA estimates were generally large (|*r*| = .354-.938, *M* = .698) and suggestive of some dimensional redundancy. The magnitude of these estimates undermines the discriminant validity of the CD-RISC factors and the multidimensionality perspective espoused by most theoretical accounts of resilience. Contrariwise, ESEM estimates of factor correlations were uniformly weaker (|*r*| = .062-.599, *M* = .367) and much more consistent with the dominant multidimensionality perspective underlying the CD-RISC. Taken with superior fit, the finding of appreciably lower factor correlations in the ESEM structure provides support for the presence of psychometric multidimensionality due to item fallibility and thus the retention of ESEM models.

We compared the CFF, HO, and BF ESEM models to determine the most appropriate solution. The three models provided excellent fits to the data and could not be distinguished based on changes in approximate fit indices (see Table 1). Thus, we considered the theoretical consistency of parameter estimates. Notwithstanding the plausibility of factor correlations obtained in the CFF-ESEM solution, across four of the five factors, there were 11 instances of cross-loadings exceeding the magnitude of target loadings, with 8 cross-loadings exceeding .300 (see Supplemental Appendix B). This pattern of inflated cross-loadings may emerge where some general construct underlying all items is unmodeled in a first-order structure. Although the HO-ESEM model posits a hierarchically superior global resilience factor, from a substantive standpoint, this solution is unappealing. The second-order loading of spirituality on global resilience was near zero and nonsignificant (λ = −.046, $p > .05$). Furthermore, the higher order loading of acceptance on global resilience was weak and nonsignificant (λ = .225, $p > .05$) with a large standard error (*SE* = .290), indicating the instability of the solution. This low loading and excessively large standard error may be attributed to complex and large between-construct item–factor relations involving the acceptance items at the first-order level. The BF-ESEM structure may better accommodate this complex pattern of item–factor relations.

The BF-ESEM model provided an excellent fit. The factor loading estimates from this solution are shown in Table 2. The G-factor was well-defined in the solution with generally moderate to large loadings (|λ| = .246-.884, *M* = .635; ω = .962[1]). The items designed to specifically tap acceptance showed especially strong loadings on the general factor (|λ| = .579-.884, *M* = .749). Indicators of control (|λ| = .670-.708, *M* = .689), competence (|λ| = .446-.826, *M* = .653), and tolerance and trust (|λ| = .429-.748, *M* = .606) also showed fairly sizeable G-factor loadings. The items designed to assess spirituality had relatively weaker loadings on the G-factor (|λ| = .246-.359, *M* = .303).

Beyond the G-factor, target loadings (|λ| = .030-.667, *M* = .305) on the S-factors were systematically larger than nontarget loadings (|λ| = .001-.329, *M* = .074). Spirituality was well-defined, with uniformly strong target factor loadings (|λ| = .619-.667, *M* = .643; ω = .638). The competence (|λ| = .054-.557, *M* = .321; ω = .680) and control (|λ| = .151-.445, *M* = .348; ω = .530) S-factors were also relatively

Table 2. Standardized Factor Loadings for the BF-ESEM Solution of the CD-RISC.

Item	G-factor	PC	TT	ACC	CTRL	SPR
24	**.662**	***.557***	.015	−.052	−.001	.077
12	**.761**	***.318***	−.114	−.120	.020	−.009
11	**.696**	***.390***	−.049	−.050	−.009	.033
25	**.525**	***.409***	.070	.147	.227	.046
10	**.446**	***.528***	−.036	.072	−.113	.074
23	**.557**	*.245*	.093	−.112	.117	−.192
17	**.826**	*.067*	.121	−.006	.018	−.078
16	**.749**	*.054*	.103	−.115	.035	−.072
20	**.441**	−.108	***.377***	−.048	−.054	.294
18	**.429**	.095	***.599***	−.010	−.068	−.092
15	**.554**	.068	*.167*	−.032	.082	−.090
6	**.609**	−.057	*−.032*	.003	−.025	−.077
7	**.748**	−.137	*−.079*	−.067	−.036	.016
19	**.734**	−.113	***.368***	.089	.054	−.067
14	**.724**	−.014	*−.030*	−.065	.113	−.190
1	**.732**	.048	.012	*.066*	−.207	.020
4	**.819**	.073	−.045	*.151*	−.146	.012
5	**.730**	.134	−.074	*.125*	.013	.055
2	**.579**	−.091	.036	***.653***	.128	.117
8	**.884**	−.070	−.028	*−.085*	−.108	−.019
22	**.708**	.027	−.075	.029	***.455***	.002
13	**.689**	−.032	−.046	**.329**	*.151*	.122
21	**.670**	.137	.032	−.009	***.439***	.121
3	.246	−.025	.013	.123	.130	***.619***
9	**.359**	.105	.022	.018	−.012	***.667***

Note. CD-RISC = Connor–Davidson Resilience Scale; BF-ESEM = bifactor–exploratory structural equation modeling; G-factor = general resilience; PC = perceived competence; TT = trust and tolerance; ACC = acceptance; CTRL = control; SPR = spirituality. $N = 274$. All factor loading estimates are standardized. Loadings ≥ .30 are bolded, and target loadings on S-factors appear in italics.

well-defined with more than half the specific target loadings nontrivial and statistically significant. The tolerance and trust ($|\lambda| = .030$-$.559$, $M = .236$; $\omega = .450$) and acceptance ($|\lambda| = .066$-$.653$, $M = .216$; $\omega = .435$) S-factors were weakly defined with little meaningful content specificity. However, the presence of nonzero loadings for both S-factors, including at least one loading for each factor exceeding .500, suggests a minimum level of residual specificity that necessitates statistical control to adequately partition item variance. Thus, even though we do not attach substantive meaning to these S-factors, they are included in the final model to account for limited levels of residual covariance among item subsets over and above the G-factor. A key observation in the BF-ESEM solution is that nontarget loadings ($|\lambda| = .001$-$.329$, $M = .074$) were systematically weaker than cross-loadings in the CFF-ESEM solution ($|\lambda| = .001$-$.511$, $M = .140$). This indicates that construct-relevant multidimensionality due to the coexistence of general and specific constructs, which was expressed via inflated cross-loadings in the CFF-ESEM, is reexpressed via the G-factor in the BF-ESEM. We retained the BF-ESEM model for further analyses.

Construct Relations

An LVM was specified to examine the relations between the resilience dimensions, as per the retained BF-ESEM structure, and CO. Correlations of the G-factor and specific competence, control, and spirituality factors with CO were freely estimated, whereas correlations of the nonsubstantive tolerance and trust and acceptance S-factors were constrained to zero. As current software implementations of ESEM do not permit the specification of differential associations of single-set ESEM factors with external variables, we operationalized the BF-ESEM via EwC. The test of this model resulted in an acceptable fit to the data, $\chi^2(477) = 906.931$, $p < .001$, CFI = .958, TLI = .924, RMSEA = .057, 95% CI [.052, .063]. The G-factor ($r = .566$, $p < .001$) and specific competence ($r = .477$, $p < .001$) and control ($r = .637$, $p < .001$) factors were strongly and significantly related to CO. Contrariwise, the spirituality S-factor was not significantly related to CO ($r = .124$, $p > .05$).

To examine the test–criterion relationships of the resilience dimensions with well-being, we specified an LVM comprising an EwC operationalization of the retained BF-ESEM structure. Structural paths from the G-factor and

perceived competence, control, and spirituality S-factors to well-being were freely estimated. The paths from the specific tolerance and trust and acceptance specific factors to the criterion were fixed to zero. This model provided an acceptable-to-excellent fit to the data, $\chi^2(291) = 487.238$, $p < .001$, CFI = .980, TLI = .971, RMSEA = .050, 95% CI [.042, .057]. Expressed as completely standardized estimates, the G-factor ($\gamma = .423$, $p < .001$) and control S-factor ($\gamma = .527$, $p < .001$) were strong positive predictors of well-being, whereas specific competence ($\gamma = -.215$, $p < .05$) was a relatively weaker and negative predictor. Spirituality was unrelated to well-being, after partialling out the influence of the other substantive factors ($\gamma = -.015$, $p > .05$). In totality, the substantive resilience dimensions explained 55.1% of the variance in well-being.

Discussion

This study represents the first systematic attempt to evaluate the validity of CD-RISC scores in a sample of people with disabilities using both CFA and ESEM methods. We examined the latent structure of CD-RISC data and associations of the resilience dimensions with CO and well-being. The results of the investigation show that the best representation of CD-RISC scores is a BF-ESEM structure with substantively meaningful general resilience and specific competence, control, and spirituality factors. In addition, two further S-factors were retained in the model to control for a limited amount of residual covariance in the items measuring tolerance and trust and acceptance, accounting for the G-factor. Data were also acquired supporting the validity of CD-RISC scores with respect to relations with CO and well-being. Taken together, this research makes important contributions to not only understanding resilience in samples of people with disabilities specifically but also the measurement and theory of resilience more generally. On a methodological level, the study illustrates a novel analytic framework that accounts for construct-relevant psychometric multidimensionality in data due to indicator fallibility and the coexistence of general and specific factors.

As with prior work reporting tests of multidimensional data (see Marsh et al., 2014, for a review), in this study, ESEM models provided a better fit than CFA solutions and yielded advantages in parameter estimation. The better fit of the ESEM solutions can be attributed to freely estimating nonzero secondary loadings (Perera, 2015b). As Morin, Arens, and Marsh (2015, p. 20) note, the expectation for indicators that are perfect reflections of only the single constructs they are purported to measure is often a "convenient fiction" and will be rejected by statistical criteria in realistic modeling scenarios. ESEM provides a superior analytic approximation to real-world data that are seldom ever truly unidimensional, and, if allowed to do so, will load on more than one construct. In addition to superior model fit, ESEM has advantages over the CFA in parameter estimation. For instance, in the CFF-ESEM model, factor correlation estimates were appreciably lower than those obtained in the CFA analogue and much more consistent with the multidimensionality perspective on resilience espoused by most resilience theories (Richardson, 2002; Windle, 2011).

Although the CFF-ESEM model provided a good fit to the data and yielded theoretically consistent factor correlation estimates, the results from this model were suggestive of the presence of a second source of construct-relevant multidimensionality. Across the competence, tolerance and trust, acceptance, and control factors, there were several instances of sizeable cross-loadings, indicating that some overarching construct may underlie the data in addition to residual content specificities represented by item subsets. While the CFF-ESEM model can control for multidimensionality due to indicator fallibility, the structure cannot adequately account for construct-relevant multidimensionality due to the presence of general and specific factors (Morin, Arens, & Marsh, 2015).

Both the HO and BF models can accommodate the presence of global and specific dimensions underlying data. Although the HO-ESEM fitted the data well, substantively, the model is unappealing because both the spirituality and acceptance first-order factors failed to load appreciably and significantly on the second-order resilience factor. Additionally, the standard error associated with the higher order loading of acceptance on global resilience was large, indicating a potentially unstable solution. On the contrary, the BF-ESEM model yielded uniformly admissible and theoretically meaningful parameter estimates; the model also provided a very good fit to the data. In this solution, the G-factor was well-defined with all 25 standardized G-factor loadings exceeding .246, and 23 of the 25 loadings exceeding .429. The cohesiveness of the G-factor is noteworthy considering that the CD-RISC dimensions were designed to reflect distinct components of resilience (Connor & Davidson, 2003). Beyond the G-factor, the competence, control, and spirituality S-factors were sufficiently defined with some meaningful content specificity. However, the tolerance and trust and acceptance S-factors were weakly defined, with no apparent meaningful specificity over and above the G-factor, which precludes their substantive interpretation. Nonetheless, the presence of nonzero target loadings, including at least one loading for each of these S-factors exceeding .500, indicates that the factors may retain some utility in the BF-ESEM structure, serving primarily to control for the limited amount of residual covariance present in item subsets, after accounting for the G-factor, which results in a more accurate partitioning of item response variance (Morin, Arens, Tran, & Caci, 2015).

Notwithstanding the apparent advantage of including the less well-defined S-factors in the BF-ESEM structure in

terms of variance decomposition, the retention of S-factors for the purpose of statistical control is controversial. As noted by Reise, Morizot, and Hays (2007), true BF models should not be used to account for residual (co)variance alone but applied when there are meaningful content specificities constituting well-defined specific factors. Yet it is possible that residual specificities are construct relevant but not necessarily well-defined. The present residual specificities shared by the tolerance and trust and acceptance item subsets, although insufficient to form well-defined content factors, are construct relevant. Indeed, they do not appear to reflect some item wording idiosyncrasy or other method artifact that is construct irrelevant. The BF-ESEM model provides a rather natural and efficient way of accounting for residual specificities in subsets of items that are construct relevant but too limited to be meaningfully interpreted. In the final solution, these factors do not need to be interpreted as having substantive meaning, but rather simply serve to account for residual specificities shared among indicator subsets. This raises an important question about minimal conditions for inferring a well-structured S-factor and substantively interpreting that factor quite apart from statistically controlling for limited residual content specificities. We suggest that this judgment should include a close inspection of the size and substantive meaning of the S-factor loadings, an evaluation of factor composite reliability, and, conditional on the adequacy of the former criteria, an examination of the S-factor in context with a nomological network.

The final BF-ESEM solution converges with not only the multidimensionality perspective espoused by resilience theories but also the notion of a general resilience resource that has been supported in several recent empirical studies (Burns & Anstey, 2010; Fernandez et al., 2015). Indeed, the retained BF model may reflect the view that people possess an integrative resilience resource that remains relatively undifferentiated when confronting adversity in addition to more distinct cognitive, behavioral, and social responses that may promote adaptation. Interestingly, the 10 items of the short-form version of the CD-RISC (Campbell-Sills & Stein, 2007), reflecting adaptability, had uniformly strong loadings on the G-factor in the present study. This suggests that the G-factor may reflect, to a considerable extent, the ability to adapt in the face of adversity, which is viewed as the core of resilience (Green et al., 2014).

Beyond the G-factor, the competence S-factor was largely defined by items measuring perseverance and beliefs in the ability to achieve goals and future success. This finding aligns with Green et al. (2014) who obtained support for a persistent effort and self-efficacy factor in their two-factor solution for the CD-RISC responses in a sample of veterans. Notably, these authors also found that several items from this factor had cross-loadings on a more general resilience factor reflecting adaptability, suggesting the plausibility, as argued in the present study, of an underlying G-factor. In the current study, the S-factor control was primarily indexed by items measuring feelings of control and purpose, whereas the spirituality S-factor was indicated by items reflecting religious coping and a teleological tendency, with the underlying commonality of less controlled cognition in response to events.

An important observation regarding the substantive S-factors is that, even after accounting for the G-factor in the BF-ESEM, there were still S-factor cross-loadings. However, in general, these secondary loadings ($|\lambda|$ = .001-.329, M = .074) were weaker than those obtained in the CFF-ESEM ($|\lambda|$ = .001-.511, M = .140). This should be expected as any G-factor presumed to underlie an item set will be expressed through (inflated) cross-loadings in measurement structures, such as the CFF model, which do not explicitly model the overarching dimension (Morin, Arens, and Marsh, 2015; Perera, 2015a). Notwithstanding this observation, in the BF-ESEM, some S-factor cross-loadings were theoretically meaningful. For instance, Item 20 ("In dealing with life's problems, sometimes you have to act on a hunch without knowing why") cross-loaded nontrivially on Spirituality, which may reflect the transcendent spiritual influences that inform people's instincts in the face of adversity. Likewise, the cross-loading of Item 5 ("Past successes give me confidence in dealing with new challenges and difficulties") on the competence S-factor may reflect the efficacy beliefs central to this perceived competence. The cross-loading of Item 25 ("I take pride in my achievements") on the control S-factor is also theoretically plausible and may reflect a shared motivational pathway of goal regulation (Carver, Sinclair, & Johnson, 2010). Although these secondary loadings were generally small, they serve to enhance construct estimation using all available indicator-level information (Morin, Arens, Tran, & Caci, 2015).

Evidence from the tests of the relations of the resilience dimensions with CO also support the validity of CD-RISC responses. The G-factor was found to be a strong and positive correlate of CO. This finding is consistent with theoretical views on resilience positing that favorable expectations are a component of the resilience content domain (Connor & Davidson, 2003). Moreover, the results show that the competence and control S-factors, beyond the G-factor, were also strongly associated with higher CO, whereas the Spirituality S-factor was unrelated to CO. The relation of competence with CO is largely attributable to shared conceptual content reflecting an optimistic outlook and action orientation (Rottinghaus et al., 2005). The association between control and CO may reflect overlapping content related to purpose in life and a capacity to be in control of, and plan for, the future. Importantly, these findings of convergent evidence demonstrate that the competence and control S-factors have validity with respect to CO, over and above the G-factor.

Associations of the resilience dimensions with well-being were also obtained. The G-factor was found to be a strong positive predictor of well-being. This finding is consistent with the theoretical view that resilience serves as a protective factor in the stress–distress relationship (Green et al., 2014), though not a direct test of this buffering hypothesis. Furthermore, the result replicates previous data showing positive associations of resilience factors with well-being (e.g., Burns et al., 2011), including in samples of people with disabilities (Terrill et al., 2014). The present findings also extend previous work by demonstrating, for the first time, that the control and competence S-factors have validity for predicting well-being over and above the G-factor. Specifically, control was a strong and positive predictor of well-being. This finding suggests that maintaining control and purpose in life, as distinct from general resilience resources, may be integral to well-being for those with disabilities participating in postsecondary studies. On the contrary, competence was found to exert a negative and relatively weak effect on well-being. Absent of the general resilience resources required to successfully adapt in the face of adversity, high efficacy for managing problems, as reflected in the perceived competence S-factor, may reflect an inflated assessment of capabilities. Inflated self-assessments can lead to setting risky goals that exceed capabilities and resources, leading to deleterious outcomes (Baumeister, Heatherton, & Tice, 1993). Furthermore, it is conceivable that persistent effort, reflected in the competence S-factor, may be deleterious to well-being, particularly in the absence of other adaptive resources, as the individual struggles to disengage from an unattainable goal (Wrosch, Scheier, Carver, & Schulz, 2003).

Although the relations of the S-factors with CO and well-being provide some insights into the meaning of these factors, which can be challenging to interpret in BF models, an unresolved question remains to what extent these S-factors are a part of the resilience domain. It would seem that competence is inconsistent with the protective function of resilience to the extent that it exerts a negative effect on well-being, accounting for the influence of the G-factor. In addition, given the dubious theoretical basis for the inclusion of spirituality content in the CD-RISC content domain (Sarkar & Fletcher, 2013), the finding of relatively low loadings of spirituality items on the resilience G-factor, taken with extant evidence of marginal relations of spirituality with other dimensions of resilience (Gucciardi, Jackson, Coulter, & Mallett, 2011), raise the possibility that spirituality may not be a dimension of the multidimensional conceptualization of resilience. Future research would do well to further examine the theoretical underpinnings of spirituality as a component of resilience.

Limitations, Directions for Future Research, and Implications

There are limitations to the present study. First, although a strength of this study is the recruitment of a sample of people with disabilities, the relatively small size of the sample and recruitment from a single university, limiting representativeness, constitute important limitations. These sample characteristics raise the possibility that some of the results obtained may be idiosyncratic to the particular sample. Future researchers are strongly encouraged to examine the replicability of the retained factor structure in a larger and more representative sample of people with disabilities and those without disabilities. Second, though support was found for the validity of CD-RISC scores, this constitutes only limited evidence for validity. Future researchers are encouraged to harness these findings, especially those concerning the retained BF-ESEM structure, to further explore validity. One possibility is to examine convergent and divergent evidence for validity based on the BF-ESEM structure within a multitrait–multimethod framework. A second possibility, as noted above, is a direct test of moderation hypotheses reflecting the buffering role of the substantive resilience dimensions in the stress–distress relationship. Yet another line of inquiry may be an examination of the temporal stability of the general and specific factors. It may be that the G-factor reflects a cohesive constellation of relatively stable psychological resources available to people when confronting adversity (Vaishnavi, Connor, & Davidson, 2007), whereas the specific factors may represent more situation-specific behavioral and cognitive responses to manage a particular event. Indeed, this is consistent with current theoretical views that conceptualize resilience as a process-oriented construct reflecting people's dispositions and situation-specific cognitions and behaviors, in combination, when confronting adversity (Murray, 2003). What is clear is that future research along these suggested lines is required to affirm the validity of the CD-RISC scores and better understand the general and specific resilience dimensions.

The issue of the substantive meaningfulness of the general and specific resilience factors raises important questions about scoring the CD-RISC in line with the retained BF structure. Support for the BF-ESEM model complicates the scoring of the CD-RISC because prevailing approaches to computing observed scores cannot straightforwardly decompose item variance into G- and S-factor components implied by the BF model (Chen, Carver, Laurenceau, & Zhang, 2012). Given the generally weaker loadings on the S-factors, relative to the well-defined G-factor, investigators may justify computing a total resilience score. However, this total score approach assumes that the CD-RISC item responses are strictly unidimensional, which is not supported in the present study. Where the assumption of strict unidimensionality is violated, the total score approach will confound the variance associated with general and specific factors. Likewise, the computation of subscale scores will obfuscate the unique contribution of specific subscales and the contribution of the common components shared by all items. Although no definitive guidelines for scoring the

CD-RISC can be provided until the present factor structure is replicated, tentatively, one approach for researchers to manage this construct-relevant psychometric multidimensionality is to work within a latent variable modeling framework where the BF structure can be explicitly modeled. An alternative approach, particularly for researchers who work with manifest variable methods for examining structural relationships, is to generate factor scores based on a preliminary BF model and use these as input data. For clinicians who use the CD-RISC for identifying those with low resilience, we urge caution in changing approaches to scoring the instrument until further data potentially replicating these results are available to guide practice. However, in the interim, it may be prudent for clinicians to qualify results by acknowledging the multidimensionality of the CD-RISC.

In sum, this study has been concerned with examining the dimensional structure of the CD-RISC data and investigating relations of the concomitant resilience dimensions with CO and well-being. The study has demonstrated that CD-RISC responses are best represented by a BF-ESEM structure that accounts for psychometric multidimensionality due to (a) the coexistence of general and specific constructs underlying the data and (b) the fallibility of items as purely unidimensional indicators of the constructs they are designed to measure. Although three S-factors showed meaningful content specificity over and above the G-factor, two S-factors were weakly defined and retained in the final model only to serve to control for limited residual specificity. In addition, evidence was obtained for meaningful relations of the general and substantively interpretable specific factors with CO and well-being. Beyond these substantive contributions, the study illustrates the utility of BF-ESEM as an integrative analytic framework that can account for two distinct sources of construct-relevant psychometric multidimensionality that may characterize data derived from multifactorial measures.

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Note

1. This coefficient is McDonald's (1970) composite reliability index.

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