Journal of Traumatic Stress, Vol. 20, No. 6, December 2007, pp. 1019–1028 (© 2007)

Psychometric Analysis and Refinement of the Connor–Davidson Resilience Scale (CD-RISC): Validation of a 10-Item Measure of Resilience

Laura Campbell-Sills
Department of Psychiatry, University of California San Diego, La Jolla, CA

Murray B. Stein
Department of Psychiatry, University of California San Diego, La Jolla, CA; Department of Psychology, San Diego State University; and VA San Diego Healthcare System, San Diego, CA

Resilience refers to an individual's ability to thrive despite adversity. The current study examined the psychometric properties of the Connor–Davidson Resilience Scale (CD-RISC). Three undergraduate samples (ns > 500) were used to determine the factor structure of the CD-RISC. The first two samples were used to conduct exploratory factor analysis (EFA), and the third was used for confirmatory factor analysis. The EFA showed that the CD-RISC had an unstable factor structure across two demographically equivalent samples. A series of empirically driven modifications was made, resulting in a 10-item unidimensional scale that demonstrated good internal consistency and construct validity. Overall, the 10-item CD-RISC displays excellent psychometric properties and allows for efficient measurement of resilience.

Resilience refers to positive adaptation in the face of stress or trauma (Luthar, Cicchetti, & Becker, 2000). The ability to maintain good functioning after stress exposure appears more common than previously thought (Bonanno, 2004), and therefore studying resilience is important for achieving a comprehensive understanding of human responses to stress and trauma. Empirical evidence suggests that resilience is grounded in a diverse array of genetic (Caspi et al., 2003; Tannenbaum & Anisman, 2003), biological (Charney, 2004; Morgan et al., 2002), psychological (Campbell-Sills, Cohan, & Stein, 2006; Tugade & Fredrickson, 2004), and environmental (Haskett, Nears, Ward, & McPherson, 2006; King, King, Fairbank, Keane, & Adams, 1998) factors. Continued elucidation of the biopsychosocial underpinnings of resilience may aid in prevention and intervention efforts focused on helping individuals recover from stressful events and stress-related disorders.

One obstacle to an adequate biopsychosocial model of resilience is the lack of well-validated measures of this construct. One exception is the Connor–Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003). The CD-RISC is a self-report scale comprised of 25 items intended to measure resilience. Preliminary analyses of the CD-RISC

This study was supported in part by NIH grants MH64122 (Murray B. Stein) and T32 MH18399-19 (Laura Campbell-Sills). The authors wish to acknowledge Timothy A. Brown for statistical consultation and Jonathan Davidson and Kathryn Connor for comments on a draft of this manuscript. Shadha Hami Cissell, Carla Hitchcock, Teresa Marcotte, and Ryan Pepin coordinated data collection and management for the study.

Correspondence concerning this article should be addressed to: Laura Campbell-Sills, UCSD Department of Psychiatry, 8950 Villa La Jolla Drive, Suite B218, La Jolla, CA 92037. E-mail: campbell-sills@ucsd.edu

 Published online in Wiley InterScience (www.interscience.wiley.com) DOI: 10.1002/jts.20271

in general population, primary care, psychiatric outpatient, and clinical trial samples support its internal consistency, test–retest reliability, and convergent and divergent validity (Connor & Davidson, 2003). The CD-RISC also was shown to moderate the relationship between retrospective reports of childhood maltreatment and current psychiatric symptoms (Campbell-Sills et al., 2006). Finally, CD-RISC scores have been shown to increase with treatments hypothesized to enhance resilience (Davidson et al., 2005).

Given that the CD-RISC is a promising measure of resilience, a more thorough analysis of its psychometric properties is warranted. A major question remaining concerns the factor structure of the CD-RISC. Although the authors used total CD-RISC scores in their psychometric analyses, some evidence suggests the CD-RISC has a multifactorial structure. Connor and Davidson (2003) conducted an exploratory factor analysis (EFA) of the CD-RISC in a general population sample of 577 adults. The EFA yielded a 5-factor solution with factors representing "personal competence, high standards, and tenacity," "trust in one's instincts, tolerance of negative affect, and strengthening effects of stress," "positive acceptance of change and secure relationships," "control," and "spiritual influences" (Connor & Davidson, 2003, p. 80). Although the authors offered these descriptions of the five factors, no discussion of the implications of the factor structure was provided.

Although this EFA provides preliminary evidence of a multifactorial structure of the CD-RISC, several methodological issues suggest that a reanalysis is warranted. First, no clear criteria for factor selection were articulated for the EFA, although it appeared that the eigenvalues >1 rule was the sole basis for retaining factors. The eigenvalues >1 rule can lead to substantial misestimation of factors (Fabrigar, Wegener, MacCallum, & Strahan, 1999). Second, orthogonal rotation was used in the EFA, meaning that the factors were not permitted to intercorrelate. This requirement may be unrealistic for measures of many constructs (e.g., it is feasible that various dimensions of resilience could correlate with one another). Third, the factors that emerged were in several cases difficult to interpret because they contained items with disparate themes. For instance, it is unclear conceptually why the factors of positive acceptance of change and secure relationships would load on a common factor. Finally, the spiritual influences factor was defined by just two items, although methodologists specify that factors should be represented by at least three to five measured variables (MacCallum, Browne, & Sugawara, 1996).

A reanalysis of the factor structure of the CD-RISC is important to establish the validity of the measure. First, it must be determined whether the CD-RISC measures resilience as a unitary dimension or multiple latent dimensions. Second, if the CD-RISC has a multifactorial structure, it must be established that this structure is stable across independent samples and that each factor can be reliably and validly measured. Finally, further testing of the ability of the CD-RISC to predict positive functioning following adversity is needed.

The present study sought to apply a systematic approach to establishing the factor structure of the CD-RISC, and to further validate the instrument through an analysis of construct validity. We used a sequential approach with three independent samples that consisted of (a) an initial EFA, (b) replication of EFA findings in an independent sample, and (c) confirmatory factor analysis (CFA). We further used CFA to incorporate an error theory into our model of the latent structure underlying the CD-RISC items. In conducting these analyses, we allowed that the validity of the CD-RISC might be improved by making certain empirically driven modifications to the original scale. Ultimately, we recommend a 10-item version of the CD-RISC.

To evaluate the construct validity of the 10-item CD-RISC, we tested whether scores on this measure moderated the relationship between childhood maltreatment and current psychiatric symptoms. Childhood maltreatment is relatively common and is associated with many negative outcomes for young adults including increased rates of depression and substance use (Hussey, Chang, & Kotch, 2006). However, not all maltreated children go on to manifest such problems and those children have been classified as "resilient" (see Haskett et al., 2006 for a review). If the 10-item CD-RISC is a valid measure of resilience, scores should moderate the relationship between childhood maltreatment and current psychiatric symptoms. We therefore tested whether individuals with high levels of childhood maltreatment and high scores on the 10-item CD-RISC would display significantly lower levels of psychiatric symptoms compared to individuals with high levels of childhood maltreatment and low scores on the 10-item CD-RISC. Such results would suggest that the 10-item CD-RISC indeed captures the achievement of positive functioning in the face of adversity.

METHOD

Participants

Potential participants were 1,743 undergraduates from San Diego State University (SDSU) who completed questionnaires for course credit in 2004–2005. Women comprised the majority of the sample (74.4%) and the mean age was 18.8 years ($SD = 2.2$). Participants self-identified as Caucasian (53.1%), Hispanic (13.4%), Filipino (9.9%), Asian American (7.4%), African American (3.0%), Native American (0.4%), and Mixed Ethnicity/Other (13.0%).

Construct validity analyses were conducted on a subsample of 131 individuals who completed measures of childhood trauma and psychiatric symptoms during a second study. The demographics of this subsample were comparable to those of the factor analytic sample, although a greater percentage was Caucasian (e.g., 72.0% women; mean age = 18.9; 60.6% Caucasian).

Measures

Connor–Davidson Resilience Scale. The Connor–Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003) is a 25-item scale that measures the ability to cope with adversity. Respondents rate items on a scale from 0 (*not true at all*) to 4 (*true nearly all the time*). A preliminary study of the psychometric properties of the CD-RISC in general population and patient samples supported its internal consistency, test–retest reliability, and convergent and divergent validity (Connor & Davidson, 2003).

Brief Symptom Inventory 18. The Brief Symptom Inventory 18 (BSI; Derogatis, 2001) consists of 18 items that measure anxiety, depression, and somatic symptoms that occurred in the past week. Respondents rate each symptom on a scale ranging from 0 (*not at all*) to 4 (*extremely*). The BSI demonstrates good internal consistency, test–retest reliability, and convergent and discriminant validity (Derogatis & Melisaratos, 1983; Morlan & Tan, 1998).

Childhood Trauma Questionnaire Short Form. The Childhood Trauma Questionnaire Short Form (CTQ-SF; Bernstein et al., 2003) is a 28-item questionnaire that assesses emotional abuse, emotional neglect, physical abuse, physical neglect, and sexual abuse. Respondents rate the extent to which each item was true for them on a scale from 1 (*never true*) to 5 (*very often true*). The CTQ-SF demonstrates good internal consistency, test–retest reliability, and concordance with therapists' ratings of child abuse (Bernstein et al., 2003).

Procedure

Participants completed the CD-RISC by computer as part of a testing session at San Diego State University (SDSU). A subset signed up for an experiment in which they completed the BSI and CTQ-SF in addition to other questionnaires and computerized tasks. All procedures were approved by the Institutional Review Boards at SDSU and University of California, San Diego (UCSD).

For factor analysis, we combined data from three semesters and then randomly assigned cases to one of three subsamples. Cases were included in the factor analyses if they had no missing data for the items submitted to the analyses. Sample 1 was used to conduct an exploratory factor analysis (EFA) of the 25-item CD-RISC. Sample 2 was used to conduct an independent EFA to determine if the factor structure found in the first EFA was stable. Based on the results of these initial EFAs, modifications to the scale were made and Samples 1 and 2 were used again to conduct independent EFAs of the modified CD-RISC. Sample 3 was used for a confirmatory factor analysis (CFA) of the factor structure that was hypothesized based on the EFA results.

Data Analysis

For factor analysis, the sample variance–covariance matrices were analyzed using a latent variable software program and maximum-likelihood minimization functions (Mplus 2.12; Muthén & Muthén, 1998). Goodness of fit was evaluated using the root mean square error of approximation (RMSEA; Steiger, 1990) and its 90% confidence interval (CI), p value for test of close fit (Cfit; estimates the probability that RMSEA <.05), standardized root mean square residual (SRMR; Jöreskog & Sörbom, 1986), and comparative fit index (CFI; Bentler, 1990). The chi-square test is reported, but not relied upon to evaluate model fit due to its oversensitivity to sample size and the fact that it tests for perfect fit. These fit indices provide different types of information (i.e., absolute fit, fit adjusting for model parsimony, fit relative to a null model), and when combined they provide a reliable and conservative evaluation of model fit (Jaccard & Wan, 1996). For EFA and CFA, final acceptance or rejection of models was based on (a) conventional criteria for good model fit (RMSEA <.08, Cfit, 90% CI <.08; SRMR <.05; CFI >.90), (b) the strength of the parameter estimates (i.e., primary factor loadings >.35, absence of salient cross-loadings), and (c) the interpretability of the solution (i.e., the comprehensibility of the factors on a conceptual level). When competing models were tested, nested χ^2 tests were used.

To assess construct validity, we tested whether CD-RISC scores moderated the relationship between childhood maltreatment and current psychiatric symptoms. We conducted a hierarchical regression with CTQ-SF and CD-RISC scores on the first step and an interaction term (CTQ-SF × CD-RISC) on the second step. A significant interaction term would support the moderation hypothesis as well as the construct validity of the CD-RISC. Prior to the regression analysis, CTQ-SF scores were log-transformed to address skew and kurtosis in this variable's distribution (due to many individuals reporting low maltreatment). In addition, CTQ and CD-RISC scores were mean-centered to address multicollinearity between the main effect and interaction terms.

RESULTS

Exploratory Factor Analysis of the Original CD-RISC

Using Sample 1 ($n = 511$), we submitted the CD-RISC items to an EFA with maximum-likelihood estimation and promax rotation. We specified that solutions with one to six factors should be evaluated. The 5- and 6-factor solutions provided good fit according to statistical criteria but we rejected them because each had factors that were defined by single items. The 4-factor solution provided the best fit according to the criteria outlined in the Data Analysis section. It met statistical criteria for good model fit, $\chi^2(206) = 424.09$, $p < .001$; RMSEA = .046, 90% CI = .039–.052, CFit = .88. Eigenvalues >1 for the unreduced correlation matrix were 8.25, 1.72, 1.41, 1.24, and 1.13. The four factors were reasonably coherent; however, one factor was defined by just two items and one factor contained items with two disparate themes (ability to engage social support in times of stress and sense of purpose in life). We labeled the factors *hardiness* (10 items), *social support/purpose* (4 items), *faith* (2 items), and *persistence* (7 items). No items had salient cross-loadings; however, two items (18 and 20) did not load on any factor (see Table 1).

A second EFA was conducted with Sample 2 ($n = 512$). The 5- and 6-factor solutions did not converge for these data. A 4-factor solution provided the best fit, $\chi^2(206) = 453.36$, $p < .001$; RMSEA = .048, 90% CI = .042–.054, CFit = .66. Eigenvalues >1 for the unreduced correlation matrix were 8.40, 1.59, 1.40, 1.18, and 1.06. The first factor shared 9 of its 12 items with the hardiness factor, and the second factor shared 4 of its 5 items with the social support/purpose factor from the Sample 1 EFA. The third factor was identical to the faith factor, and the four items that defined the fourth factor had loaded on the persistence factor in the previous EFA. Items 5 and 20 had no salient loadings, and no items cross-loaded (see Table 1).

Based on the results of the two EFAs, we could not confidently specify a model for CFA that contained the full 25 items. Problems with the 25-item CD-RISC included (a) several items that displayed inconsistent loadings across the two EFAs (items 5, 15, 18, 23, and 25), (b) an item that

Table 1. Exploratory Factor Analysis of the 25-item Connor-Davidson Resilience Scale in Sample 1 (n = 511) and Sample 2 (n = 512)

	Hardiness		SS/Purpose		Faith		Persistence	
Item	S1	S2	S1	S2	S1	S2	S1	S2
1	*.40*	*.43*	.04	−.02	.02	.01	.05	.09
4	*.64*	*.65*	.10	−.01	−.01	−.08	.08	.16
6	*.64*	*.46*	−.06	−.15	.01	.07	−.11	.15
7	*.58*	*.55*	−.05	.03	.21	.11	.04	−.01
8	*.64*	*.58*	−.07	−.19	.01	.15	.09	.08
14	*.50*	*.41*	.32	.18	−.09	−.08	.04	.13
16	*.39*	*.49*	.16	.27	−.09	−.13	.24	.03
17	*.38*	*.64*	.26	.19	−.06	−.01	.29	.04
19	*.50*	*.53*	.12	.11	−.06	.12	.02	−.17
2	.11	.04	*.45*	*.42*	.16	.09	−.16	−.07
13	.18	.10	*.56*	*.50*	.24	.11	−.05	−.05
21	−.10	−.01	*.47*	*.59*	.28	.04	.34	.19
22	−.06	.12	*.55*	*.54*	−.09	−.14	.31	.19
3	−.10	−.05	.12	.25	*.59*	*.46*	.10	−.04
9	.12	−.03	.03	−.02	*.60*	*.88*	.05	.00
10	.14	−.01	−.07	.12	.14	.02	*.53*	*.63*
11	.17	.10	−.05	.09	.09	−.01	*.66*	*.70*
12	.25	.25	.03	−.04	.12	.00	*.49*	*.61*
24	.08	.11	.00	.15	.07	−.02	*.71*	*.64*
5	*.41*	.24	.03	.22	.10	.03	.34	.29
15	.19	*.43*	.15	.27	−.19	−.10	*.36*	−.02
18	.15	*.54*	.20	.16	−.20	−.12	.21	−.14
20	.26	.21	−.04	.00	.10	.23	.08	.05
23	.19	*.36*	.01	.08	−.14	.04	*.42*	.27
25	−.13	−.05	.07	*.36*	.09	.11	*.61*	.33

Note. Exploratory factor analysis was conducted with maximum-likelihood estimation and promax rotation. Salient (>.35) factor loadings are in italics. Items presented in the lower portion of the table had inconsistent or nonsalient loadings in the two analyses. S1 = Sample 1; S2 = Sample 2.

had no salient loading in either EFA (item 20), (c) a factor that was consistently defined by too few items (faith), and (d) a factor that was consistently defined by four items but was difficult to interpret because it contained two disparate themes (social support/purpose). These problems with the original scale led us to propose a shorter version of the CD-RISC. We dropped all items that had either inconsistent or nonsalient loadings (5, 15, 18, 20, 23, 25), as well as items corresponding to factors that were poorly defined (2, 3, 9, 13, 21, 22). The abridged CD-RISC therefore contained only items that had consistent, salient loadings on the hardiness and persistence factors in the Sample 1 and Sample 2 EFAs. We repeated EFA in Samples 1 and 2 using this shorter version of the CD-RISC before conducting CFA.

Exploratory Factor Analysis of the Abridged CD-RISC

We subjected the following CD-RISC items to EFA in Sample 1 (n = 532 had complete data for this subset of items): 1, 4, 6–8, 10–12, 14, 16, 17, 19, and 24. We specified that solutions containing one to three factors should be tested. The 3-factor solution provided a good statistical fit for the data, but it was rejected because it had a factor that contained three seemingly unrelated items. The 2-factor solution was the best-fitting model that also had conceptual coherence, $\chi^2(53) = 101.60$, $p < .001$; RMSEA = .042, 90% CI = .029–.054, CFit = .87. Eigenvalues >1 for the unreduced correlation matrix were 5.52 and 1.18. All items had salient loadings on one of the factors (.40 to .74) and no items had salient cross-loadings. The hardiness factor was defined by items 1, 4, 6–8, 14, 16, 17, and 19. The persistence factor was defined by items 10–12 and 24. The correlation of the hardiness and persistence factors was .63.

We repeated the EFA procedure with Sample 2 (n = 539 had complete data for the subset of CD-RISC items). The 3-factor solution did not converge in Sample 2 and the 2-factor solution provided the best fit for the data, $\chi^2(53) = 74.42$, $p < .001$; RMSEA = .027, 90% CI = .009–.041, CFit = 1.00. Eigenvalues >1 for the unreduced correlation matrix were 5.35 and 1.21. All items had salient loadings on one of the factors (.40 to .75) and no items had salient cross-loadings. The hardiness and persistence factors were identical in item content to those factors identified in the Sample 1 EFA, and their correlation coefficient was again .63.

Confirmatory Factor Analysis of and Further Revision of the CD-RISC

The results of the two EFAs of the abridged CD-RISC were highly consistent, and allowed for confident specification of a CFA model. The factor that we labeled *hardiness* contained items referring to ability to cope with change (a), unexpected events (4), stress (7), illness/hardship (8), pressure (14), negative outcomes (16), and unpleasant feelings (19); in addition to items referring to general personal toughness (17) and ability to use humor when faced with problems (6). The factor that we labeled *persistence* contained items referring to giving one's best effort no matter what (10), belief in one's ability to achieve goals despite obstacles (11), not giving up (12), and working to attain goals despite roadblocks (24). For the CFA, we hypothesized paths from each item to its corresponding factor and set all cross-loading paths to zero. The two factors were permitted to correlate.

This 2-factor model provided a good fit for the Sample 3 ($n = 537$) data, $\chi^2(64) = 167.30$, $p < .001$; RMSEA = .055, 90% CI = .045–.065, CFit = 0.21; SRMR = .037; CFI = .96. All items had salient loadings on their latent constructs, ranging from .39 to .80 (all ps < .001). Although the fit indices and factor loadings pointed toward an adequate model, the factor intercorrelation was very high ($r = .81$), suggesting poor discriminant validity of the two factors.

Given the high level of overlap between the two latent factors, we considered the possibility that the CD-RISC items were not in fact measuring independent constructs of hardiness and persistence. It was possible that all of the items were measuring a unitary construct, but systematic error variance was causing some items to cluster together as a separate factor. One advantage of CFA is that it allows for specification of an error theory. We examined the CD-RISC items and found that the four items comprising the persistence scale possessed a high degree of redundancy in content (e.g., "I believe I can achieve my goals, even if there are obstacles" versus "I work to attain my goals, no matter what roadblocks I encounter along the way"). This contrasted with the items comprising the hardiness factor, each of which had unique wording and content.

We therefore hypothesized that the 13 items of the abridged CD-RISC loaded on a single factor, and that additional relationships among the persistence items could be explained by correlated error. Prior to testing this more complex model, we fit a 1-factor model with no error theory to (a) serve as a baseline model, and (b) see if modification indices suggested freeing paths among the residuals of the persistence items. As expected, this 1-factor model provided a suboptimal fit for the data, $\chi^2(65) = 317.27$, $p < .001$; RMSEA = .085, 90% CI = .076–.094, CFit = 0.00; SRMR = .053; CFI = .90. When compared to the previously specified 2-factor model, it significantly degraded model fit, $\chi^2_{\text{diff}}(1) = 149.97$, $p < .001$, presumably because the 2-factor model better accounted for the covariance of the persistence items. The highest modification indices were associated with paths among the residuals of the persistence items, lending preliminary support to our error theory. The error theory for our single-factor model specified that the residuals of items 10, 11, 12, and 24 should be permitted to correlate to account for their high degree of content overlap. This model provided a good fit for the data, $\chi^2(59) = 138.69$, $p < .001$; RMSEA = .050, 90% CI = .039–.061, CFit = 0.47; SRMR = .033; CFI = .97. Moreover, it provided a superior fit to the 2-factor model we had specified based on our EFA results, $\chi^2_{\text{diff}}(5) = 28.61$, $p < .001$. All items had salient loadings (.39–.74) on the latent factor, which we labeled *resilience*. In addition, all of the paths between residuals that we specified were statistically significant (zs = 5.27–7.59). Standardized residuals and modification indices did not suggest any points of strain in the model. The determinacy estimate (i.e., validity coefficient) for the resilience factor was very favorable at .94.

Taken together, these results suggested that the single-factor model specifying correlated error among items 10, 11, 12, and 24 was superior to the 2-factor model that we hypothesized based on the EFA results. However, the need to correlate residuals among these four items to attain a good-fitting model begged the question of why four items with highly overlapping content were needed. As a final modification, we selected one of the four redundant items to retain and dropped the other three items. We chose item 11 ("I believe I can achieve my goals, even if there are obstacles") because it loaded most strongly on the resilience factor. This resulted in a 10-item scale that fit the Sample 3 data well, $\chi^2(35) = 93.77$, $p < .001$; RMSEA = .056, 90% CI = .042–.069, CFit = 0.23; SRMR = .034; CFI = .96. All items had salient loadings (.39–.74), and no points of strain were apparent from the standardized residuals or modification indices. The determinacy value was .93 for the resilience factor. These results were replicated after combining Samples 1–3 (n = 1,622) to obtain the most accurate parameter estimates (see Table 2). Results in the total sample were consistent with those obtained using the Sample 3 data, $\chi^2(35) = 176.10$, $p < .001$, RMSEA = .050, 90% CI = .043–.057, CFit = 0.50, SRMR = .028, CFI = .97, determinacy = .93.

Reliability and Construct Validity of the 10-Item CD-RISC

Internal consistency of the 10-item CD-RISC was evaluated by calculating Cronbach's alpha. The alpha value of .85 indicated good reliability (see Table 2).

Validity analyses were conducted with the subsample ($n = 131$) that completed the CTQ-SF and BSI. Reported levels of childhood maltreatment ($M = 34.4$, $SD = 11.3$, range = 25–79) and psychiatric symptoms ($M = 14.8$, $SD = 11.9$, range = 0–53) were low on average, but there was a wide range on both variables. We predicted that scores on the 10-item CD-RISC would moderate the relationship between childhood maltreatment and current psychiatric symptoms. A hierarchical regression was conducted that included CTQ-SF and CD-RISC scores as predictors on the first step and the CTQ-SF x CD-RISC interaction on the second step. The main effects model was significant, $R = .51$, $R^2 = .26$, $F\ (2, 127) = 22.76$, $p < .001$; however, the regression model that also included the interaction term was superior, $R = .56$, $R^2 = .31$, $F\ (3, 126) = 19.00$, $p < .001$. It explained significantly more variance than the first model, $F\ (1, 126) = 8.71$, $p < .01$, R^2 change = .05. There were significant main effects of trauma, $\beta = .18$, $p < .05$, and resilience, $\beta = -.39$, $p < .001$; however, these were qualified by the significant CTQ-SF × CD-RISC interaction effect, $\beta = -.22$, $p < .01$.

To understand the nature of the interaction effect, high and low values of trauma and resilience were entered into the regression equation. High values were defined as one standard deviation above the mean; low values were defined as one standard deviation below the mean (Holmbeck, 1998). Figure 1 shows the predicted BSI scores for hypothetical individuals classified as low trauma/low resilience, low trauma/high resilience, high trauma/high resilience, and high trauma/low resilience. The figure illustrates that resilience moderates the impact of childhood maltreatment on current psychiatric symptoms. Individuals who report significant trauma and low resilience are highly symptomatic, whereas individuals who report significant trauma and high resilience have low levels of symptoms. Resilient maltreated individuals were indistinguishable from resilient individuals with low levels of maltreatment with respect to BSI scores.

Table 2. Confirmatory Factor Analysis of the 10-item Connor–Davidson Resilience Scale

Item	Description	Factor loading
1	Able to adapt to change	.44
4	Can deal with whatever comes	.72
6	Tries to see humorous side of problems	.46
7	Coping with stress can strengthen me	.58
8	Tend to bounce back after illness or hardship	.61
11	Can achieve goals despite obstacles	.63
14	Can stay focused under pressure	.62
16	Not easily discouraged by failure	.63
17	Thinks of self as strong person	.74
19	Can handle unpleasant feelings	.57
Determinacy		.93
Reliability		.85
M		27.21
SD		5.84

DISCUSSION

The current study applied exploratory and confirmatory factor analytic methods to the CD-RISC, a measure of resilience. Initial EFAs showed that the factor structure of the 25-item CD-RISC was not stable across two demographically equivalent subsamples. However, two

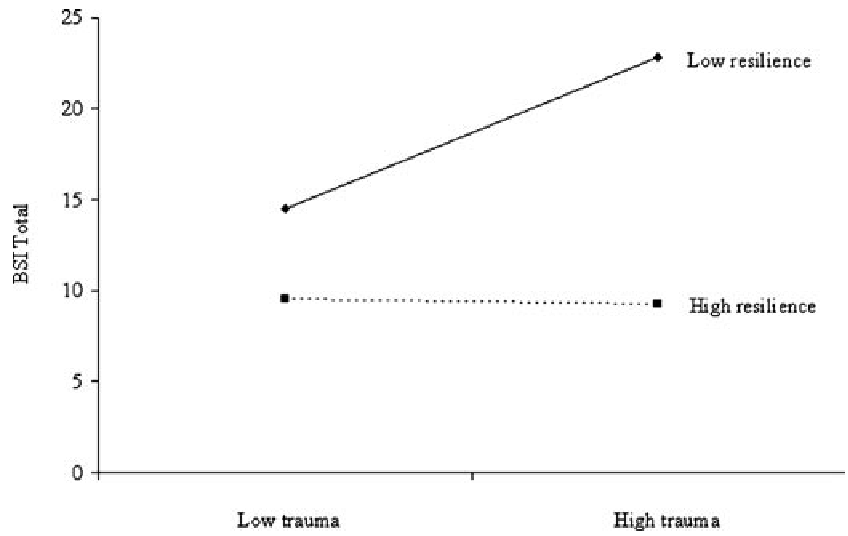

Figure 1. Levels of psychiatric symptoms on the BSI for individuals scoring low and high on the CTQ-SF and the 10-item CD-RISC. BSI = Brief Symptom Inventory; CTQ-SF = Childhood Trauma Questionnaire-Short Form; CD-RISC = Connor–Davidson Resilience Scale.

factors that emerged in these EFAs appeared relatively stable, well defined, and conceptually coherent. We labeled these two factors *hardiness* and *persistence*, and created an abridged version of the CD-RISC that contained only items that loaded on these factors.

When the hardiness and persistence items were submitted to EFA, a stable 2-factor structure emerged that allowed for specification of a CFA model. Although the fit indices pertaining to the 2-factor CFA model were favorable, the very high correlation (>.80) between the two factors raised concerns about their discriminant validity. We hypothesized that the hardiness and persistence items actually were measuring the same latent construct, but that similar wording of the persistence items was causing them to cluster together and appear as a distinct factor. Further CFA evaluations showed that a single-factor model that incorporated this error theory was superior to the 2-factor model that had been specified based on the EFA results. Therefore, it appeared that all 13 items were indicators of a common factor, and that four of the items had significantly correlated error due to redundancy in their content.

Our final revision to the CD-RISC involved choosing one of the four items with overlapping content to retain, while discarding the three others. This resulted in a 10-item version of the CD-RISC that fit the data well and contained items with minimal redundancy. The retained items reflect the ability to tolerate experiences such as change, personal problems, illness, pressure, failure, and painful feelings. Endorsement of these items reflects an ability to bounce back from the variety of challenges that can arise in life.

Additional analyses offered preliminary support for the construct validity of the 10-item scale. Scores on the 10-item CD-RISC moderated the relationship between retrospective reports of childhood maltreatment and current psychiatric symptoms. Overall, individuals reporting childhood maltreatment reported higher levels of psychiatric symptoms; however, this was not the case for individuals who characterized themselves as resilient on the 10-item CD-RISC. Those individuals manifested symptom levels that were as low as those reported by individuals reporting low levels of childhood maltreatment and high levels of resilience. The results of these analyses suggest that the 10-item CD-RISC measures a characteristic that differentiates individuals who are functioning well after adversity from those who are not. It important to note, however, that these analyses were cross-sectional in nature and that other causal relationships could explain the observed pattern of results. For example, participants' current symptoms might impact their responses on the resilience measure (e.g., participants who are feeling depressed might view themselves in a more negative light). Further tests of the validity of the 10-item CD-RISC are needed, and longitudinal tests of the ability of the 10-item CD-RISC to predict positive and negative reactions to stress would be particularly useful.

We believe that the 10-item CD-RISC captures the core features of resilience; in fact, scores on this short unidimensional measure are very highly correlated with scores on the original instrument ($r = .92$), which assessed many different domains. However, it might be argued that our elimination of items resulted in important features of resilience being left out of the measure. Indeed, reasonable theoretical and/or empirical bases exist for including items measuring faith, social support, and self-efficacy in a resilience measure (Connor, Davidson, & Lee, 2003; King et al., 1998, 1999; Rutter, 1985). The reasons for excluding them from the CD-RISC in the current study were primarily statistical in nature. It is possible that if each of these domains was represented by a sufficient number of items, they would emerge as reliable and valid dimensions of resilience.

One limitation of the current study is that the samples were homogeneous in terms of age and educational level. Although our samples were reasonably ethnically diverse, African American students were underrepresented. In addition, some potentially important demographic features (e.g., income level) were not assessed. The reliability, factor structure, and construct validity of the 10-item CD-RISC for older adults, individuals from certain ethnic minority groups, and individuals with different levels of education and income cannot be determined based on this study. Although our participants were predominantly Caucasian women, multiple-groups CFA analyses of the current dataset showed that the psychometric properties of the 10-item CD-RISC were essentially equivalent for men compared to women, and for Caucasian compared to ethnic minority participants. Results of these analyses are available from the corresponding author upon request.

Based on this study, we cannot draw conclusions about the psychometric properties of the 10-item CD-RISC in clinical samples or in samples of individuals with high trauma exposure. An argument could be made that the concept of resilience is only meaningful in relation to trauma exposure. The perspective that guides this study is that the ability to bounce back from more moderate levels of stress also is meaningful and therefore the concept of resilience can be applied to the general population rather than just individuals exposed to trauma. However, evaluating the properties of the 10-item CD-RISC in samples selected based on trauma exposure is an important topic for future studies.

Finally, our assessment of trauma history was limited in a number of ways. First, we only assessed childhood maltreatment and do not know if participants had a history of other types of trauma. Second, some individuals may have underreported childhood maltreatment because they were uncomfortable disclosing such personal information in a research context. Finally, adults' retrospective reports of adverse childhood experiences might be influenced by current mood state, although a recent review concluded that such biases are likely to be minor (Hardt & Rutter, 2004). Nonetheless, our estimates of relationships between childhood maltreatment, psychiatric symptoms, and resilience could be influenced by mood-congruent memory biases.

In summary, the current investigation found that the factor structure of the original CD-RISC was unstable, but an abridged version of the instrument had excellent psychometric properties. Analyses supported the reliability and construct validity of the 10-item measure. Rather than reflect negatively on the CD-RISC, the results of this investigation are positive in demonstrating that resilience can be reliably assessed with a subset of the CD-RISC items. Investigations of resilience will further benefit from the development and validation of resilience measures that do not rely on self-report. Future directions for improving the assessment of resilience may include the development and validation of informant, clinician-rated, behavioral, and/or biological measures of this construct.

REFERENCES

Bentler, P. M. (1990). Comparative fit indices in structural models. Psychological Bulletin, 107, 238–246.

Bernstein, D. P., Stein, J. A., Newcomb, M. D., Walker, E., Pogge, D., Ahluvalia, T., Stokes, J., et al. (2003). Development and validation of a brief screening version of the Childhood Trauma Questionnaire. Child Abuse & Neglect, 27, 169–190.

Bonanno, G. A. (2004). Loss, trauma, and human resilience. American Psychologist, 59, 20–28.

Campbell-Sills, L., Cohan, S. L., & Stein, M. B. (2006). Relationship of resilience to personality, coping, and psychiatric symptoms in young adults. Behaviour Research and Therapy, 44, 585–599.

Caspi, A., Sugden, K., Moffitt, T. E., Taylor, A., Craig, I. W., Harrington, H., et al. (2003). Influence of life stress on depression: Moderation by a polymorphism in the 5-HTT gene. Science, 301, 386–389.

Charney, D. S. (2004). Psychobiological mechanisms of resilience and vulnerability: Implications for adaptation to extreme stress. American Journal of Psychiatry, 161, 195–216.

Connor, K. M., & Davidson, J. R. T. (2003). Development of a new resilience scale: The Connor–Davidson Resilience Scale (CD-RISC). Depression and Anxiety, 18, 76–82.

Connor, K. M., Davidson, J. R. T., & Lee, L-C. (2003). Spirituality, resilience, and anger in survivors of violent trauma: A community survey. Journal of Traumatic Stress, 16, 487–494.

Davidson, J. R., Payne, V. M., Connor, K. M., Foa, E. B., Rothbaum, B. O., Hertzberg, M. A., et al. (2005). Trauma, resilience, and saliostatis: Effects of treatment on posttraumatic stress disorder. International Clinical Psychopharmacology, 20, 43–48.

Derogatis, L. R. (2001). Brief Symptom Inventory 18: Administration, scoring, and procedures manual. Minneapolis, MN: NCS Pearson, Inc.

Derogatis, L. R., & Melisaratos, N. (1983). The Brief Symptom Inventory: An introductory report. Psychological Medicine, 13, 595–605.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. Psychological Methods, 4, 272–299.

Hardt, J., & Rutter, M. (2004). Validity of adult retrospective reports of adverse childhood experiences: Review of the evidence. Journal of Child Psychology and Psychiatry, 45, 260–273.

Haskett, M. E., Nears, K., Ward, C. S., & McPherson, A. V. (2006). Diversity in adjustment of maltreated children: Factors associated with resilient functioning. Clinical Psychology Review, 26, 796–812.

Holmbeck, G. N. (1998). Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: Examples from the child-clinical and pediatric psychology literatures. In A. E. Kazdin (Ed.), Methodological issues and strategies in clinical research (2nd ed., pp. 83–112). Washington, DC: American Psychological Association.

Hussey, J. M., Chang, J. J., & Kotch, J.B. (2006). Child maltreatment in the United States: Prevalence, risk factors, and adolescent health consequences. Pediatrics, 118, 933–942.

Jaccard, J., & Wan, C. K. (1996). LISREL approaches to interaction effects in multiple regression. Thousand Oaks, CA: Sage.

Jöreskog, K. G., & Sörbom, D. (1986). LISREL IV: Analysis of linear structural relationships by maximum likelihood and least square methods. Mooresville, IN: Scientific Software.

King, L. A., King, D. W., Fairbank, J. A., Keane, T. M., & Adams, G. A. (1998). Resilience-recovery factors in posttraumatic stress disorder among female and male Vietnam veterans: Hardiness, postwar social support, and additional stressful life events. Journal of Personality and Social Psychology, 74, 420–434.

Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. Child Development, 71, 543–562.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. Psychological Methods, 1, 130–149.

Morgan, C. A., Rasmusson, A. M., Wang, S., Hoyt, G., Hauger, R. L., & Hazlett, G. (2002). Neuropeptide-Y, cortisol, and subjective distress in humans exposed to acute stress: Replication and extension of previous report. Biological Psychiatry, 52, 136–142.

Morlan, K. K., & Tan, S-Y. (1998). Comparison of the Brief Psychiatric Rating Scale and the Brief Symptom Inventory. Journal of Clinical Psychology, 54, 885–894.

Muthén, L. K., & Muthén, B. O. (1998–2004). Mplus 3.0 [Computer software]. Los Angeles: Author.

Rutter, M. (1985). Resilience in the face of adversity: Protective factors and resistance to psychiatric disorders. British Journal of Psychiatry, 147, 598–611.

Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. Multivariate Behavioral Research, 25, 173–180.

Tannenbaum, B., & Anisman, H. (2003). Impact of chronic intermittent challenges in stressor-susceptible and resilient strains of mice. Biological Psychiatry, 53, 292–303.

Tugade, M. M., & Fredrickson, B. L. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. Journal of Personality and Social Psychology, 86, 320–333.