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Resilience in organ transplantation: An application of the Connor-Davidson Resilience Scale (CD-RISC) with liver transplant candidates

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Abstract

End-stage liver disease (ESLD) is a chronic and debilitating condition associated with substantial psychological stress, morbidity, and mortality. The Connor Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003) is commonly used resilience measure. The current research examined the validity of the CD-RISC among ESLD patients ($N = 120$) using exploratory factor analysis. Results supported a single-factor solution after removing poorly loading items. The CD-RISC also was correlated with measures of depression, anxiety, quality of life, social support, age, and cognitive ability, thus providing evidence to support its construct validity. Future research should confirm this factor structure and examine its predictive validity prior to wide-spread use among ESLD patients. The current research represents the first step in this process and proposes an alternative version of the CD-RISC for this population.

Resilience has been broadly defined as a multidimensional process that relates to the capacity of an individual to thrive in the face of adversity (Connor & Davidson, 2003). It is the process of negotiating, managing, and adapting to significant sources of stress or trauma that helps people “bounce back” and cope with various challenges, such as ill health (Windle, Bennett, & Noyes, 2011). A review of the resilience literature outlines three necessary components of resilience: (a) a significant adversity/risk, (b) the presence of assets or resources (within the individual) to offset the effects of adversity, and (c) positive adaptation or the avoidance of the negative outcome (Windle, 2010). Resilience is not a fixed characteristic but can vary throughout the lifespan. Some characteristics of resilience include viewing the change of stress as a value or opportunity, recognizing one’s limits of control, possessing close and secure attachments to others, a sense of self-efficacy, an action-oriented problem solving strategy, a sense of humor, optimism, and one’s tolerance of negative affect (Connor & Davidson, 2003).

The study of resilience is consistent with the positive psychology movement, which emphasizes the understanding and promotion of positive human functioning and well-being. Within positive psychology, positive emotion, resilience, and character strength are considered important tools for health promotion (Kobau et al., 2011). Research indicates resilience serves as a protective factor that reduces psychiatric symptoms among adults (Campbell-Sills, Cohan, & Stein, 2006; Wrenn et al., 2011) and is related to enhanced health related quality of life (HRQOL) and coping among medical populations (Viggers & Caltabiano, 2012; Wu, Sheen, Shu, Chang, & Hsiao, 2012).

End stage liver disease (ESLD) is a chronic and progressive disease with a myriad of causes including hepatitis C infection, alcohol use disorders, obesity, and other metabolic disorders, autoimmune causes, and genetic disorders (Lefton, Rosa, & Cohen, 2009; Parry, Patra, & Rehm, 2011; Pol, Vallet-Pichard, Corouge, & Mallet, 2012; Vernon, Baranova, & Younossi, 2011). ESLD is associated with significant medical morbidity and mortality and is characterized by symptoms such as refractory ascites, encephalopathy, variceal bleeding, muscle atrophy, and low platelets. Without a liver transplant, ESLD can lead to liver failure and death. Of the nearly 16,000 Americans currently waitlisted for liver transplantation, approximately 16% will die annually (United Network for Organ Sharing, 2011). Given these uncertainties and challenges, individuals with ESLD face a protracted period of extreme physical and emotional stress—a point that is especially salient given that psychological comorbidities and substance use disorders are common among ESLD patients (DiMartini, Crone, & Dew, 2011; Lopez-Navas et al., 2010; Lopez-Navas et al., 2011; Lopez-Navas et al., 2012).

Organ transplant centers rely on extensive pre-transplant candidate selection procedures that are intended to minimize participant risk and maximize positive outcome. Pre- and post-transplant psychological functioning, coping, and social support are robust predictors of post-transplant morbidity and mortality (Corruble et al., 2011; Stilley et al., 2010). For example, depressive symptomology is associated with increased risk of post-transplant mortality (Corruble et al., 2011). A study of 152 transplant recipients found that avoidant coping, emotional dysregulation, and behavior dysregulation (e.g. impulsivity and problem solving difficulties) were predictive of higher liver enzyme levels (i.e., bilirubin and aspartate aminotransferase), lower quality of life, and higher levels of emotional distress post-transplant. Thus, increased attention to a participant's ability to cope and regulate his/her emotional experiences may be important for predicting, and potentially improving, physical and mental health before and after transplant. While research is limited, resilience is one protective factor that may enhance physical health indirectly through emotional coping (Davidson et al., 2012; Erim et al., 2010). For example, resilience may indirectly promote health by helping patients manage their liver disease (e.g., diet, medication management, and abstinence from drugs/alcohol) while coping with a chronic, progressive, and life threatening illness.

The current study evaluates resilience among participants with ESLD using the Connor-Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003). The CD-RISC is a measure of psychological resilience that is widely cited in the literature (Connor & Davidson, 2003). The CD-RISC has five factors. Factor 1 assesses personal competence,

high standards, and tenacity (i.e., “when things look hopeless, I don’t give up”). Factor 2 assesses trust in one’s instincts, tolerance of negative affect, and strengthening effects of stress (i.e., “coping with stress strengthens me”). Factor 3 measures positive acceptance of change and secure relationships (i.e., “I am able to adapt to change”). Factor 4 measures control (i.e., “I am in control of my life”); and factor 5 assesses spirituality (i.e., “sometimes fate or God can help”). A full listing of items for each factor can be found in Connor and Davidson (2003). While the CD-RISC is the most widely cited resilience measures in the literature, it has been criticized for its atheoretical factor structure, which combines conceptually dissimilar items within the same subscale (Windle et al., 2011). Three of the five factors lack theoretical coherence given that they include a range of potential resilience-related constructs that seem to represent distinct constructs (e.g. factor 1 includes items related to ‘personal competence,’ ‘high standards,’ and ‘tenacity’). Factor 5, Spirituality, has only two items, which is also problematic from a measurement standpoint (reliability for two items is likely to be low), and these two items are often removed in subsequent studies to improve model fit (Burns & Anstey, 2012; Campbell-Sills & Stein, 2007; Karairmak, 2010). In addition, the original exploratory factor analysis (EFA) applied orthogonal rotation, which did not permit potentially related factors to correlate in the model, and was not followed by confirmatory factor analysis. Finally, the fit of the original model was difficult to determine in the original paper because the reliability of each factor was not reported, nor were fit indices or scree plot results.

Due to these issues, and possibly others, the original factor structure of the CD-RISC has never been replicated in subsequent research (Burns & Anstey, 2012; Sexton, Byrd, & von Kluge, 2010). Numerous alternative versions of the CD-RISC, using fewer items, have been proposed in the literature. These include, but are not limited to, a three-factor solution among South African adolescents (Jorgensen & Sabaat, 2008), a two-factor solution among U.S. veterans (Green et al 2014), a four-factor solution among adult women over age 60 (Lamond et al, 2008), a three-factor Chinese version (Yu et al., 2007), and a three-factor Turkish version (Karairmak, 2010). Several studies have compared the five-factor measure with unidimensional versions of the CD-RISC with favorable results, including a 22-item unidimensional version of the CD-RISC validated among young adults in Australia (Burns & Anstey, 2010), and a unidimensional 10-item measure validated among American undergraduates (Campbell-Sills & Stein, 2007). Several studies have found support for the 10-item CD-RISC among American Indian (Goines et al, 2012) and African American men (Coates, 2013). Therefore, an abbreviated, single factor version of the CD-RISC may offer a valid and parsimonious solution in subsequent research.

The Current Study

In order to extrapolate meaningful clinical information from the CD-RISC and use the measure to draw conclusions about resiliency within an ESLD population, evidence to support a factor structure for use in this population is needed. The psychometric properties of any measure should be examined prior to application in a new population (Loewenthal, 2001), and this is of particular importance for the CD-RISC in light of past research (Windle et al., 2011). Given that this is the first study to test the CD-RISC in an ESLD population, exploratory factor analysis (EFA) was used to identify a best-fitting model. This study also

evaluated construct validity by examining the associations of the CD-RISC with validated psychosocial measures of depression, anxiety, quality of life, social support, age, and cognitive ability. Based on prior research and theory, we hypothesized that resilience would be positively correlated with quality of life and social support, negatively correlated with depression and anxiety, and unrelated to age and cognitive ability. Finally, we evaluated the extent to which resilience was related to the severity of liver disease in the present sample as measured by the Model for End Stage Liver Disease (MELD).

Method

Participants

All English speaking participants who were 18 years or older and currently on the United Network for Organ Sharing (UNOS) wait-list for liver transplantation at a single transplant center ($n = 270$) were invited to participate (See Figure 1). Of patients screened, 223 were eligible. All eligible participants were informed of this study during routine clinic appointments and/or by telephone and were given the option of participation. A total of 125 ESLD patients agreed to participate and consented to the study. The sample was 39.2% ($n = 47$) female with a mean age of 56.1 years ($SD = 8.64$) (See Table 1). More than half (50.8%; $n = 61$) were married. The sample was predominantly White/non-Hispanic (75.8%; $n = 91$). The majority (51.7%; $n = 62$) had ESLD due to Hepatitis C. The mean MELD score in the sample was 12.5 ($SD = 4.47$).

Procedure

Participants were administered a battery of brief psychological assessment instruments to assess emotional resilience, quality of life, and psychosocial functioning at a single assessment time point. Medical information was recorded through the medical records system. All assessment and medical record information was collected by trained and experienced research assistants from the Department of Psychiatry, Yale University School of Medicine, and verified by the lead author (ACF). This study was approved by the Yale University School of Medicine's Human Investigation's Committee, and all participants were required to provide written informed consent prior to their participation in this study.

Measures

Demographic and medical variables—Demographic information including gender, race/ethnicity, and age were collected through self-report and verified through the patient's medical record. Medical information including liver disease etiology and Model for End Stage Liver Disease (MELD; Kamath & Kim, 2007) score were obtained from patient's medical record. MELD score is used to assess the severity of liver disease based on a patient's serum bilirubin, serum creatinine, and the international normalized ratio for prothrombin time (INR).

The *Connor Davidson Resilience Scale* (CD-RISC; Connor & Davidson, 2003). The CD-RISC is a 25-item, 5-factor measure assessing psychological resilience. Items are scored on Likert-type scale using a 5-point scale ranging from 0 (*Not true at all*) to 4 (*True nearly all the time*). A sum score was calculated. The overall mean total score for this sample was

72.79 (SD = 15.97). The scale was developed using an EFA conducted among a general population sample recruited via a random-digit dial ($n = 577$). In the original study, test-retest reliability and convergent validity were examined in clinical samples which included primary care outpatients ($n = 139$), psychiatric outpatients in private practice ($n = 43$), individuals participating in a study generalized anxiety disorder ($n = 25$), and participants in two clinical trials of PTSD ($n = 22$). Test-retest reliability was 0.87, represented by an intraclass correlation coefficient. Resilience was higher among the general population sample relative to the clinical samples. Factor loadings for the original EFA ranged from .40 to .78. Eigenvalues for the five factors were all above 1, but no fit indices were reported. The authors concluded that the CD-RISC had a five-factor structure and indicated that factor 1 (8 items) assesses the notion of personal competence, high standards, and tenacity. Factor 2 (7 items) assesses trust in one's instincts, tolerance of negative affect, and strengthening effects of stress. Factor 3 (5 items) assesses positive acceptance of change and secure relationships. Factor 4 (3 items) assesses control; and factor 5 (2 items) assesses spirituality. Cronbach's alpha for each of the five factors in this sample was .90, .86, .82, .63, and .11, respectively. The low reliability of several factors underscores the limitations of the original factor structure in this sample.

The *Beck Depression Inventory* (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) is a 21-item measure. Each item is scored on a scale that ranges from 0 to 3, with item content assessing symptoms of clinical depression. Scores represent a continuous measure of depression severity, with higher scores indicating higher levels of depression. The BDI has demonstrated reliability and validity among psychiatric and non-psychiatric populations and has a high correlation with other measures of depression (Beck, Steer, & Carbin, 1988). Cronbach's alpha in this sample was .91.

The *Beck Anxiety Inventory* (BAI; Beck, Epstein, Brown, & Steer, 1988) is a 21-item measure of anxiety (Beck, Epstein, Brown, & Steer, 1988) which has been validated among psychiatric and medical populations (Steer, Ranieri, Beck, & Clark, 1993; Wetherell & Areán, 1997). Each item is scored on a 4-point scale ranging from 0 (*Not at all*) to 3 (*I could barely stand it*). The BAI scoring criteria represent a continuous measure representing anxiety severity, with higher scores indicating higher levels of anxiety. Each item assesses the individual's of common anxiety symptoms. Cronbach's alpha in this sample was .94.

The *Medical Outcome Study Social Support Survey* (SSS; Sherbourne & Stewart, 1991) is a 20-item, self-report Likert-type scale measuring perceived social support. For each item, patients are asked to indicate how often each kind of support was available to them if they needed it. Scores ranged from 0 (*None of the time*) to 4 (*All of the time*). Higher scores on the SSS reflect higher levels of perceived social support. The SSS is a widely used, brief measure of perceived social support that assesses the contributions of network size and four major categories of support (instrumental, emotional, informational, and companionship). Cronbach's alpha in this sample was .95.

The *Medical Outcome Study Short-Form 36 Health Survey* (SF-36; Ware & Sherbourne, 1992) is a well-known and widely used self-report measure of health-related quality of life (HRQOL). The SF-36 includes 8 multi-item scales that create two overall physical and

mental health component scores (PCS and MCS) using a standardized transformation and scoring procedure. The SF-36 has shown evidence of validity across diverse participant groups (McHorney, War, Lu, & Sherbourne, 1994). Higher scores of the SF-36 indicate higher HRQOL. Cronbach's alpha in this sample was .92 for the PCS and .78 for the MCS.

The *World Health Organization (Five) Wellbeing Index* (WHO-5; World Health Organization, 1998) is a 5-item, self-report measure that assesses positive and negative well-being (World Health Organization, 1998). Each item assesses how an individual has felt in the last 2 weeks and is scored on a 6-point scale ranging from 0 (*At no time*) to 5 (*All of the time*). Higher scores on the WHO-5 indicate higher levels of wellbeing. Cronbach's alpha in this sample was .92.

The *Wechsler Abbreviated Scale of Intelligence* (WASI; Wechsler, 1999) Matrix Reasoning subtest acts as a measure of nonverbal abstract problem solving, often used to approximate cognitive abilities and intelligence (Wechsler, 1999). The WASI Matrix Reasoning subtest contains 35 items, is untimed, and uses standardized instructions and scoring, where raw scores are converted into T-score equivalents. The scale's correlation with the Matrix Reasoning subtest of the Wechsler Adult Intelligence Scale is .66, and its correlation with the WASI Full Scale IQ is .89 (Wechsler, 1999). The present study used the WASI Matrix Reasoning subtest as a marker of discriminant validity. Independent ratings of WASI Matrix Reasoning scores for this sample demonstrated a high level of agreement, with an intraclass correlation coefficient of .98.

Analytic Strategy

We screened the data for missing values on 125 responses. One case had not completed greater than 90% of the questions and was excluded from analysis. Four additional cases were missing key demographic information, such as gender. The final sample of 120 participants were included in all analyses. With regard to missing data, 3.02% of the data points were missing ($n = 123$ of 4080 data points), corresponding to missing data points on 58.82% of variables ($n = 20$) and 67.5% of cases ($n = 81$). Review of missing data frequencies suggested that the majority of missing data were found in the WASI Matrix Reasoning subtest (77 values missing; 64.2%). Removal of this variable resulted in missing data values dropping to 1.16% of the total data ($n = 46$ of 3960 data points), corresponding to 19 variables (57.58%) and 22 cases (18.33%). The WHO-5 and SSS variables also had > 5% missing data (WHO-5: $n = 12$, 10.0%; SSS: $n = 10$, 8.3%). Visual inspection of missing data was not suggestive of systematic missing data patterns or monotonicity. In addition, Little's test was nonsignificant, $\chi^2 = 2269.92$, $df = 2438$, $p = .993$, suggesting that the data were missing completely at random.

An exploratory factor analytic approach was used to identify the best fitting measurement model for the CD-RISC in the present ESLD population. All structural equation models (SEMs) were fit in MPlus© 6.12 (Muthén & Muthén, 2011) with weighted least squares with mean and variance adjustment (WLSMV) estimation appropriate for categorical data and the default geomin rotation method. Model fit was evaluated using fit indices and cutoff criteria recommended by Hu and Bentler (1999). Fit indices included the standardized root mean square residual (SRMR), the Tucker-Lewis Index (TLI), Comparative Fit Index (CFI),

and root mean squared error of approximation (RMSEA). Cutoffs representing good fit between the model and the data were represented by and SRMR close to .08, an RMSEA close to .06, and a CFI and TLI close to .95. We also report χ^2 goodness-of-fit tests. This test is a standard in the field but is not recommended as an isolated guide to model adequacy because it is sensitive to sample size, data non-normality, and is likely to capture small and inconsequential differences between a model and the data (Li-Tze & Bentler, 1995). Bivariate correlations were examined to test predicted relationships between the CD-RISC and conceptually similar and dissimilar constructs. All variables were examined for violations of normality. Statistical significance was determined using $p < .05$ (two-tailed).

Results

Exploratory Factor Analysis (EFA)

A series of categorical EFAs were conducted to evaluate the factor structure of the CD-RISC scores in an ESLD population. Eigenvalues for the 6 factors were as follows: 13.40, 1.68, 1.33, 1.15, 0.88, and 0.79. Based on fit statistics and eigenvalues, the 4-factor solution was one plausible solution for our data. As such, the factor loadings from rotated solutions, factor correlations, and factor structure of the 4-factor solution were examined further. However, several problems emerged. One of the four factors was not significantly correlated with the others, and no single item correlated most strongly with this factor. Another factor in the 4-factor solution included only two items (based on factor-item correlations and factor loadings), and the two remaining factors were highly correlated, ($r = .782, p < .001$). Subsequent iterative trials of multi-factor solutions, removing items and conducting EFAs, suggested that cross-loadings were high in a 2-factor solution, and factor interpretability was extremely limited for solutions with more than two factors.

A single factor solution was another plausible solution for our data. Visual inspection of the scree plot and the results of parallel analysis¹ suggested a one-factor solution. The 25-item, one-factor solution failed a test of exact fit, $\chi^2 = 467.01, df = 275, p < .001$, but exceeded most (CFI = .97, TLI = .96, SRMR = .073) albeit not all (RMSEA = .076) of the general guidelines of Hu and Bentler (1999). Evaluation of the factor loadings for the one-factor solution revealed five items for which loadings were less than .60 -- item 2 (loading = .579), item 3 (loading = .231), item 9 (loading = .417), item 13 (loading = .572), and item 20 (loading = .328). Removal of these five items resulted in an improvement in model fit, $\chi^2 = 298.55, df = 170, p < .001$; RMSEA = .079, 90% CI = [.064, .094]; CFI = .98; TLI = .97; SRMR = .059, and all remaining item loadings were greater than .60.

The 20-item, single-factor solution provided the best balance of fit and parsimony. Internal consistency of the 20-item scale was high (Cronbach's alpha = .96). Item loadings are presented in Table 2. In a final EFA of only these 20 items, sample eigenvalues > 1 were 11.00 and 1.16. Visual inspection of the scree plot and parallel analysis supported a single-factor solution. This 20-item, single-factor version of the CD-RISC was used for the remaining analyses.

¹Parallel analysis was conducted using Maximum Likelihood Robust (MLR) estimation.

Construct Validity

To evaluate the validity of the resilience construct as measured by the CD-RISC in the present ESLD sample, we tested the *a priori* hypotheses that CD-RISC scores would be negatively correlated with depression and anxiety, positively correlated with social support and HRQOL, and unrelated to age and matrix reasoning. All correlation coefficients are presented in Table 3. As can be seen, the hypothesized relationships were supported. The CD-RISC was negatively associated with depression and anxiety, positively associated with social support and HRQOL, and unrelated to age and matrix reasoning, respectively. CD-RISC scores were not found to be related to the severity of liver disease as assessed by participant MELD scores.

Discussion

This study is the first to examine psychometric properties of the CD-RISC among ESLD patients. Results of our EFA supported a 20-item single factor solution as the best fitting model for the data based on fit indices and parsimony. All fit indices reached the pre-determined cutoffs for good model fit established by Hu and Bentler (1999) after removing several poorly loading items. Tests of construct validity further supported the 20-item CD-RISC. The measure was negatively correlated with theoretically dissimilar constructs (anxiety and depression), and positively correlated with theoretically similar constructs (social support and HRQOL). These correlations ranged from moderate to strong in magnitude (Cohen, 1988). Discriminant validity was demonstrated through the non-significant association between the CD-RISC 20 and cognitive ability and age. Collectively, these results support the use of a unidimensional 20-item CD-RISC scale among ESLD patients and are consistent with a growing body of research supporting a unidimensional CD-RISC measure (Burns & Anstey, 2010; Campbell-Sills & Stein, 2007).

Our research found that five items from the original CD-RISC reduced model fit for the single factor version, yet did not represent a separate related factor. The 5 items removed from our final model were; *Close and secure relationships* (item 2: loading = .573), *Sometimes fate or God can help* (item 3: loading = .230), *Things happen for a reason* (item 9: loading = .416), *Know where to turn for help* (item 13: loading = .564) and *Have to act on a hunch* (item 20: loading = .304). At the level of face validity, several of these low-loading items seem to be sampled from a potentially related, but distinct content domain from resilience, such as “meaning in life” (see Heintzelman & King, 2014). Prior analysis of the CD-RISC by Burns and Anstey (2010) indicated removal of the same items 2, 3, and 9 improved model fit as well. In the original CD-RISC, items 3 and 9 made up a 2-item factor called ‘spirituality.’ Spirituality was not a distinct factor in our study, and 2-item factors are problematic from a psychometric perspective (Kline, 2005). Future researchers interested in assessing spirituality in ESLD patients, should consider using an alternative spirituality measure with stronger psychometric support such as the spiritual transcendence index (Seidlitz et al., 2002).

In our research, MELD score was not significantly correlated with resilience. The mean MELD score in our population was relatively low. It would be interesting to evaluate the relationship between resilience, MELD score, and other health outcomes in a larger

longitudinal study with a wider range of MELD scores represented, particularly in light of existing research linking coping style and healthier liver enzyme levels (Stilley et al., 2010) in transplant recipients.

Limitations and Future Directions

Limitations of the current research include recruitment of an ESLD patient sample from a single transplant center, reliance on self-report data, and lack of social desirability assessment. Our sample size limited our ability to split the sample and conduct both EFA and a subsequent confirmatory analysis of our proposed factor structure. This is the first analysis of the CD-RISC among ESLD patients; thus additional confirmatory research should test the psychometric validity of the proposed 20-item CD-RISC scales among this population as well as explore the suitability of other factor structures. Future research should also test predictive validity, to determine whether the measure predicts psychological or health outcomes throughout the transplant process. This may include depression, anxiety, relapse to drugs/alcohol, health-related quality of life, transplant outcome, MELD score, and mortality. Such research would benefit from a large longitudinal sample and clear health indicators to draw conclusions about the impact of resilience or other psychosocial variables on health outcomes in an ESLD patient population. Strengths of this study include the recruitment of an ESLD sample with diverse liver disease etiologies, the application of EFA, and tests of construct validity using reliable psychosocial measures.

Conclusions

This study adds to a growing body of literature that supports the use of a unidimensional CD-RISC measure and provides additional evidence that the original five factor-structure of the CD-RISC does not generalize well across samples. Past research has shown that resilience can moderate the relationship between negative life events and psychiatric symptoms (Campbell-Sills et al., 2006) and may do so in ESLD populations as well. In the future, the CD-RISC may be used to assess and understand the role of resilience in ESLD patients and possibly aid in clinical decision making. In addition, the CD-RISC can potentially be used to gain a better understanding of factors that enhance psychological functioning and coping during the pre-transplant period. Given that healthy psychological functioning is integral to matching organs with emotionally stable recipients, understanding protective factors such as resilience is imperative.

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Figure 1.
Flowchart of Participant Recruitment and Outcome

Table 1

Demographic and Medical Characteristics of Sample (N = 120).

Patient Characteristic	N	%
Gender		
Male	73	60.8
Female	47	39.2
Race/Ethnicity		
White	91	75.8
Black	12	10.0
Hispanic	11	9.2
Other	3	2.5
Missing	2	21.7
Marital Status		
Single	19	15.8
Married	61	50.8
Separated	4	3.3
Divorced	29	24.2
Widowed	5	4.2
Missing	2	1.7
Liver Disease Etiology		
HCV	62	51.7
ALD	18	15.0
HCC alone	2	1.7
NASH	11	9.2
Other Diagnoses	26	21.7
Missing	1	0.8
HCC status		
Yes	30	74.2
No	90	25.0
Missing	1	0.8

Note. ALD = Alcoholic Liver Disease; HCC = Hepatocellular Carcinoma; HCV = Hepatitis C Virus (HCV); NASH = Nonalcoholic Steatohepatitis; 'Other Diagnoses' includes genetic, metabolic, autoimmune and other unknown etiologies of liver disease

Table 2

Item Loadings on the 20-item CD-RISC

Item	Loading
1	.777
4	.793
5	.741
6	.627
7	.703
8	.862
10	.678
11	.801
12	.807
14	.806
15	.816
16	.703
17	.867
18	.875
19	.834
21	.819
22	.682
23	.823
24	.839
25	.786

Table 3

Correlations of the CD-RISC 20 and measures of mental and physical health

	CD-RISC 20	BDI	BAI	SSS	WHO-5	SF-36 MCS	SF-36 PCS	Matrix Reasoning	Age	MELD
CD-RISC 20	1.00									
BDI	-.58***	1.00								
BAI	-.32***	.54***	1.00							
SSS	.29**	-.17	-.08	1.00						
WHO-5	.62***	-.74***	-.52***	.24*	1.00					
MCS	.46***	-.59***	-.52***	.13	.58***	1.00				
PCS	.27**	-.35***	-.34***	.20*	.49***	-.01	1.00			
Matrix Reasoning	.10	.10	.00	.16	-.14	-.05	.00	1.00		
Age	.00	-.03	-.03	.08	-.03	-.05	.02	.14	1.00	
MELD	.12	-.18	-.32**	.15	.21*	.18*	.08	.21	.03	1.00

Note. BAI = Beck Anxiety Inventory, BDI = Beck Depression Inventory, CD-RISC = Connor Davidson Resilience Scale, SSS = Social Support Survey, WHO = World Health Organization, SF-36 MCS = Medical Outcome Study Short-form 36 Health Survey Mental Component Score, SF-36 PCS = Medical Outcome Study Short-form 36 Health Survey Physical Component Score, MELD = Model for End Stage Liver Disease.

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$