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Developing a Shortened Measure of Negative Thinking for Use in Patients with Heart Failure

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Synopsis

Background—Negative thinking is a target for treatment of depressive symptoms in patients with heart failure (HF). A brief instrument is needed to measure negative thinking in these patients.

Purpose—Shorten the Crandell Cognitions Index (CCI) for use in patients with HF.

Methods—Baseline data from outpatients with HF ($N=179$, 30% female, 60 ± 13 years) were used to evaluate psychometrics of the CCI. Internal consistency reliability was measured with Cronbach's alpha, construct validity with hypothesis testing. Principal components analysis was used in shortening. A separate sample of hospitalized patients with HF ($N=77$, 49% female, 66 ± 11) was used to validate the shortened CCI (CCI-SF).

Results—The CCI had evidence of reliability and validity but there was item redundancy in outpatients with HF. The 12-item CCI-SF showed good evidence of reliability and validity in inpatients with HF.

Conclusions—Results support reliability and validity of the CCI-SF to measure negative thinking in hospitalized patients with HF.

Introduction

The purpose of this study was to develop a psychometrically sound shortened measure of negative thinking for use in patients with heart failure (HF). Negative thinking—a risk factor for depressive symptoms in the general population^{1, 2}—is a potential target for the treatment of depressive symptoms in patients with HF. The presence of depressive symptoms is a significant clinical problem in patients with HF. In a meta-analysis of data from 23 studies, researchers estimated that the prevalence of depressive symptoms was 30% in both outpatients and inpatients with HF.³

Depressive symptoms have a profound effect on morbidity, mortality, and health-related quality of life among patients with HF.⁴ Patients with HF who have depressive symptoms are twice as likely to die and two and a half times more likely to be re-hospitalized than patients who do not have depressive symptoms.³ Depressive symptoms also have an

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important effect on emotional and physical health-related quality of life in patients with HF.⁴ Cognitive therapy is a psychotherapeutic intervention for depression that focuses on the reduction of negative thinking. Researchers have begun to test cognitive therapy for depressive symptoms in patients with HF,⁵ creating the need for a psychometrically sound measure of negative thinking in patients with HF.

Three of the most commonly used measures of negative thinking are the Automatic Thoughts Questionnaire,⁶ the Cognitive Checklist-Depression subscale,⁷ and the Crandell Cognitions Inventory.⁸ In a critical review of these three instruments, we found that the Crandell Cognitions Inventory—or CCI—has the best potential for measuring negative thinking in patients with HF.⁹ In contrast to the Automatic Thoughts Questionnaire which was developed with undergraduate students, the CCI was developed with a clinical psychiatric population. The CCI is also preferable to the Cognitive Checklist-Depression subscale because it captures a wider range of depressive negative thinking content.⁸

The CCI has been used to measure negative thinking in psychiatric outpatients, healthy adults,⁸ low income single mothers,¹ and college women.¹⁰ However, this instrument has not been tested in patients with HF. Furthermore, although the instrument is written at the Flesch-Kincaid third grade reading level (Microsoft Word, 2007), the length of the instrument (34 negative thinking items and 11 positive thinking, non-scored buffer items) may be burdensome to patients with HF. We have found that among healthy young adults, filling out the CCI takes approximately 3 to 5 minutes. However, for patients hospitalized with HF who routinely experience fatigue and shortness of breath,¹¹ administering the CCI via interview takes 10 to 20 minutes. A shortened version of the CCI would be a valuable tool for researchers and clinicians working with patients who have HF.

The original CCI contains four scales that measure four different types of negative thinking: self-rated inferiority, helplessness, hopelessness, and detachment. These scales are not scored separately. However, the wide range of negative thinking content in the original CCI is a strength of this instrument. Rather than simply selecting one of the scales to use in patients with HF, we chose to shorten the entire instrument. Our goal was to develop a brief instrument that lacks redundancy, but still reflects the wide range of negative thinking content from the original instrument.

Theoretical Framework

The cognitive model of depression, developed by Beck,¹² provides the theoretical framework for this study. Beck defined negative thinking as the cognitive triad: automatic, repetitive, depressive thoughts about the self, world, and future.¹² Beck theorized that negative thoughts influence the emotional, behavioral, and somatic symptoms of depression.¹² Later findings from Crandell and Chambless⁸ suggest a fourth type of negative thinking—negative thoughts about interpersonal relationships or withdrawal from others.

Negative thinking is a risk factor for depression^{4, 5} and independently predicts the development of depression among women.^{6, 7} Negative thinking originates in childhood and dominates the perceptions of depressed persons.³ Negative thinking worsens and perpetuates depressive symptoms, contributing to a downward spiral of depressive symptoms that may end in major depressive disorder.^{2, 8} Among patients who are being treated for depression, the presence of negative thinking independently predicts a poorer response to treatment for depression.⁹

Cognitive therapy is based on Beck's cognitive model of depression and focuses on the reduction of negative thinking.^{12, 13} This psycho-therapeutic intervention is the predominant non-pharmacological treatment for depression in the general population¹³ and

holds promise as an intervention for patients with HF.¹⁴ Patients with HF who had depressive symptoms described experiencing negative thoughts that worsened their depressed mood.¹⁵ Examples of negative thoughts experienced by patients with HF include, “Useless; I’m just no good,” “I can’t justify my existence,” and “I’m a burden to my family.” By reducing negative thinking, it is theorized that patients will experience improvements in the emotional, somatic, and behavioral symptoms of depression.¹²

Specific Aims

The specific aims of this study were to: 1) examine the dimensionality of the original CCI in outpatients with HF; 2) evaluate the internal consistency reliability of the original CCI; 3) evaluate construct validity of the original CCI via hypothesis testing; 4) shorten the CCI using factor analysis, reliability indicators, and item means and standard deviations; and 5) evaluate the internal consistency reliability and construct validity of the CCI short form (CCI-SF) in an independent sample of hospitalized patients with HF.

Previous investigators have found evidence for construct validity of the CCI by demonstrating that the CCI is strongly and positively related to depressive symptoms.^{1, 8} Therefore, hypotheses used to evaluate construct validity of the original CCI and the CCI-SF in patients with HF were: H₁) patients with depressive symptoms will have higher levels of negative thinking than patients without depressive symptoms; H₂) patients with mild, moderate, and severe depressive symptoms will have progressively higher levels of negative thinking compared to patients with no depressive symptoms; and H₃) the original CCI will be strongly and positively correlated with the CCI-SF.

Researchers frequently publish reports in which they shorten measures; however, to our knowledge, no prominent psychometric reference gives step-by-step recommendations for instrument shortening.^{16–20} In one psychometric text, Zeller and Carmines²¹ make recommendations for theoretical and empirical considerations of instrument shortening. They recommend that prior to using data reduction approaches such as principal components analyses, researchers should first demonstrate that the chosen measure has strong interrelationships among the variables (i.e., internal consistency) and theoretical coherency. Hypotheses are then tested about the relationships of the measure with other theoretically relevant concepts. The results provide evidence upon which to evaluate the validity of the measure. Further recommendations for the shortening of psychometric instruments are made in an article by Coste et al,²² who reviewed the methodology of 42 studies in which investigators shortened psychometric instruments. We chose to also follow Coste et al.’s recommendations which include: 1) examining the psychometric properties of the original instrument, 2) shortening the instrument using statistical techniques and expert analysis, and 3) validating the shortened version in an independent sample.

Methods

Design

Baseline data for this cross-sectional study came from two independent randomized controlled trials. In the first study, investigators tested the effects of biofeedback and cognitive therapy on health outcomes of outpatients with HF (NIH/NINR #R01 NR008567). In the second study, researchers tested a brief cognitive therapy intervention for hospitalized patients with HF.²³ The two data sets were not combined. Rather, data from the first study were used to evaluate the psychometric properties of the original CCI and to shorten it. The second sample of hospitalized patients with HF was used to evaluate the reliability and validity of the CCI-SF.

Sample and settings

In the first study, the sample consisted of outpatients with a diagnosis of preserved or non-preserved systolic function HF. Patients were recruited from June 2004 to May 2009 from the cardiology clinic at an academic medical center as well as a Veteran's Administration cardiology clinic in the South. Patients were eligible for enrollment if they were on stable doses of HF medications for at least three months and not referred for cardiac transplantation. Patients were excluded for: 1) valvular or peripartum HF etiology, 2) myocardial infarction or stroke in the prior three months, 3) major stroke sequelae, or 4) coexisting terminal illness. Only patients who had completed the CCI were included ($N = 179$).

In the second study, patients hospitalized with HF were enrolled from March 2009 to December 2009 at two regional hospitals in the Southern U.S. Patients were eligible if they had a confirmed diagnosis of preserved or non-preserved systolic function HF. Patients were excluded for: 1) co-existing terminal illness, 2) end-stage HF (defined as mechanical pump support, continuous at home inotropic infusions, referral for heart transplant, or hospice care), 3) cognitive impairment (determined via chart review or nursing report of cognitive status), and 4) self-reported severe depression or suicidal ideation. Only patients with complete data on the CCI were included ($N = 77$).

Measures

Negative thinking—Negative thinking was measured using the Crandell Cognitions Inventory (CCI).⁸ The CCI is a 45-item scale that contains 34 negative items and 11 positive, non-scored buffer items. Patients are asked to endorse how frequently they experience a thought on a scale from 1 to 5 (*almost never*, *seldom*, *sometimes*, *frequently*, and *almost always*). Total scores are calculated by summing the item responses to the 34 negative items. Scores range from 34–170; higher scores indicate a greater frequency of negative thinking.

Crandell and Chambless developed the CCI with a sample of depressed psychiatric patients, non-depressed psychiatric patients, and healthy persons without psychiatric illness.⁸ Only the psychometric properties of the 34 negative items have been reported; the 11 positive, non-scored items are used for buffer purposes only. Evidence of internal consistency is excellent in psychiatric patients,⁸ healthy adults,⁸ college women,¹⁰ and single mothers.¹ However, the strong Cronbach's alphas (.95–.97) suggest item redundancy.

With regard to dimensionality, Crandell and Chambless⁸ hypothesized that the CCI would have three dimensions based on Beck's cognitive triad: negative thoughts about the self, world, and future. However, with factor analysis, they found four dimensions: self-rated inferiority (negative view of the self), helplessness (negative view of personal control of the world), hopelessness (negative view of the future), and detachment (negative view about withdrawal from others). These results led Crandell and Chambless to propose a fourth dimension of negative thinking—negative thoughts about withdrawal from others.

Crandell and Chambless found good evidence for criterion-related and construct validity of the CCI.⁸ The CCI correctly predicted the classification of 93% of depressed psychiatric patients, non-depressed psychiatric patients, and healthy persons without a psychiatric illness. Evidence supporting construct validity was demonstrated by strong correlations of the CCI with the Beck Depression Inventory.^{1, 8} Crandell and Chambless⁸ also found evidence for divergent validity of the CCI when it was compared with IQ.⁸

Depressive symptoms—Depressive symptoms were defined as clinically significant symptoms of depression that exist with or without the presence of major depressive disorder.²⁴ The Beck Depression Inventory II (BDI-II) measures the presence and severity of depressive symptoms.²⁵ The BDI-II has a total of 21 items rated on a scale from 0 to 3. Each item is a list of at least 4 statements arranged in order of increasing severity about a particular symptom. Patients are asked to pick the one statement that best describes the way they have been feeling for the past two weeks. Total scores can range from 0 to 63. Patients who score greater than 13 are considered to have clinically significant depressive symptoms. BDI-II scores can also be used to categorize people into 4 groups: those with none to minimal depressive symptoms (0–13), mild depressive symptoms (14–19), moderate depressive symptoms (20–28), and severe depressive symptoms (29–63).²⁵ The BDI-II has strong evidence for internal consistency reliability and validity in both medical²⁶ and non-medical populations.²⁷ In our study, Cronbach's alpha for the BDI-II was .88 in the sample of outpatients with HF and .86 for the sample of hospitalized patients with HF, providing evidence of adequate reliability.

Procedure

Institutional Review Board approval was obtained for both studies. In the first study, informed consent was obtained and patients completed questionnaires at a General Clinical Research Center. In the second study, patients completed the process of informed consent and questionnaires while hospitalized. Research associates were present at all times to answer questions and verify that no items were inadvertently skipped. After completion of each study, data were de-identified and became part of a HF registry, approved as an exempt protocol by our Institutional Review Board.

Data analysis

To test the psychometric properties of the original CCI and shorten the instrument, we used data from outpatients with HF enrolled in the first study. To provide evidence for reliability and validity of the shortened measure, we used data from the separate sample of hospitalized patients with HF enrolled in the second study. Regarding sample size, our subject per item ratios fell within the recommended guidelines of using at least 5 subjects per item in factor analysis (i.e., 179 patients for the 34 items of the original version of the CCI and 77 patients for the 12-item short form of the CCI).^{16, 28} Data analysis was conducted using SPSS v. 18 (SPSS Inc, Chicago).

Step 1: Psychometric testing of the original CCI—Dimensionality of the 34 negative items was evaluated using principal components analysis with direct oblimin rotation because correlations among the factors were expected. To assess the suitability of data for factor analysis, we used Bartlett's test for sphericity and the Kaiser Meyer-Olkin (KMO) statistic. The 11 positive buffer items were not included in this principal components analysis. Factors were retained for rotation if they had an eigenvalue greater than one and if the factors were located above the elbow on the scree plot. Internal consistency reliability was evaluated using Cronbach's alpha. Alpha coefficients greater than .70 were considered to indicate adequate internal consistency, while coefficients greater than .90 were considered to indicate item redundancy. Corrected item-total correlations were also used to evaluate the internal consistency of the CCI. An acceptable coefficient for item-total correlations was greater than .20.²⁰

To evaluate construct validity of the original CCI, the independent t-test was used to determine whether patients with depressive symptoms had higher levels of negative thinking than patients without depressive symptoms. One-way analysis of variance with post-hoc comparisons using the Tukey HSD test was used to evaluate whether patients with mild,

moderate, and severe depressive symptoms had progressively higher levels of negative thinking.

Step 2: Shortening of the CCI—First, we eliminated the 11 positive buffer items, as these are non-scored and were not needed in the shortened scale. Next, the factor analysis from Step 1 was examined—items were eliminated if they had double or triple loadings (defined as a minimum loading of .32).²⁹ After deleting these items, a second principal components analysis was run; additional items with double or triple loadings were deleted.

Next, item means and standard deviations, item-total correlations, and inter-item correlations were examined. Items with means of 1.2 or less were deleted to increase variability. Items with item-total correlations less than .60 were deleted to improve overall item fit with the construct of negative thinking. Items with 10 or more inter-item correlations below .40 or any inter-item correlations greater than .70 were deleted to eliminate non-contributory and redundant items.³⁰

A final principal components analysis was run to confirm that the short form of the CCI consisted of only one dimension with no double or triple loadings. To evaluate the content validity of the shortened scale, three experts reviewed it for theoretical soundness, lack of item redundancy, and appropriateness for patients with HF.

Step 3: Psychometric testing of the CCI-SF—We followed the same data analysis procedures listed in Step 1 to test the dimensionality, internal consistency reliability, and construct validity of the CCI-SF in an independent sample. To provide further evidence of construct validity, we used Pearson correlation coefficients to determine the strength of the relationship between the original CCI and the CCI-SF.

Results

Sample Characteristics

Characteristics of the two samples are summarized in Table 1. Of the patients from the first study (outpatient setting), 33% were female, 53% were married, and 47% had New York Heart Association (NYHA) functional class III or IV. Of the sample from the second study (acute care setting), 49% were female, 53% were married, and 72% had NYHA functional class III or IV HF. Approximately 24% of the patients from the first study and 35% of the patients from the second study reported clinically significant depressive symptoms.

Demographic and clinical characteristics from the two samples are also compared in Table 1. Patients from the acute care setting had a higher mean age and a higher mean score on the BDI-II. There were a higher percentage of patients recruited from the acute care setting who were female, NYHA functional class III/IV, and had a comorbidity of chronic obstructive pulmonary disease. Compared to patients from the outpatient setting, there were also a lower percentage of patients from the acute care setting who were taking ACE inhibitors and beta blockers. No other demographic and clinical characteristic differed between the two groups.

Psychometric Testing of the Original CCI

Dimensionality—The 34 negative items were subjected to principal components analysis. The significant Bartlett's test ($p < .001$) and the high KMO index (.94) indicate that the sample was appropriate for this analysis. Based on the scree plot, one primary component emerged that explained 46% of the variance. Three other components had eigenvalues greater than 1. These components explained an additional 5%, 4%, and 3% of the variance. When the component matrix was examined, all items loaded strongly on the first

component. A few items loaded on components two through four but these loadings were weaker than the loadings for the first component. Thus the CCI exhibited only one component in this sample.

Internal consistency reliability—The mean level of negative thinking using the original CCI was 59 ± 25 , with a range of 34 to 158 (possible range of 34 to 170). Cronbach's alpha was .96, indicating excellent internal consistency but item redundancy. The Cronbach's alpha would not increase if any of the items were deleted. The corrected item-total correlations were all greater than .40, indicating that each of the items contributed to the scale (Table 2).

Construct validity—The level of negative thinking among patients with depressive symptoms was higher than that of patients without depressive symptoms (87 ± 25 vs. 50 ± 26 , $p < .001$). As seen in Figure 1, patients with mild, moderate, and severe depressive symptoms had progressively higher levels of negative thinking when compared to patients with no depressive symptoms, providing evidence for convergent validity ($p < .001$). Post-hoc tests revealed significant differences in levels of negative thinking across the four groups (Fig. 1).

Shortening the CCI

Table 2 is a summary of the statistics used for the CCI item reduction. First, two principal components analyses were run. In the first principal components analysis with the 34 original negative items, 11 items had double or triple loadings. These 11 items were deleted, and a second principal components analysis was run with the remaining 23 items. Six items with double or triple loadings were deleted.

The remaining 17 items were compared to the additional criteria for item deletion (Table 2). Three items were deleted because of a large number of low inter-item correlations. Three items had inter-item correlations greater than .70. Item 13 ("It all seems so useless") had greater than .70 inter-item correlations with both item 12 ("Why can't I be happy?") and item 37 ("I feel trapped"). After expert review, we chose to retain item 13 and delete the other two items (item 12 and 37). We considered item 12 ("Why can't I be happy?") to be redundant with item 20 ("I'll never be happy with myself").

In the final principal components analysis, none of the 12 items had double or triple loadings. The single factor explained 58% of the variance. In the component matrix, the loadings for component one were all strong and ranged from .71 to .85 (Table 3).

Three experts reviewed the remaining 12 items to evaluate theoretical soundness, lack of redundancy, and appropriateness for use in patients with HF. We found that although there was only one dimension in principal components analysis, the 12 items represented all four dimensions of negative thinking as described by Crandell and Chambless.⁸ Six items came from their original scale of self-rated inferiority, and two items each represented the original scales of helplessness, hopelessness, and detachment (Table 3). Thus, we determined that the shortened version was theoretically sound. We reviewed the content of the 12 items and determined that there was no redundancy.

Finally, we found that the remaining items appeared appropriate for use in patients with HF. Several items on the original CCI that were problematic for use in patients with HF had already been eliminated during the statistical shortening process. For example, a person with HF might choose item 3, "I'll never feel good again," because of the chronic nature of physical HF symptoms. Item 23, "I don't seem to have the energy to get through the day," could be chosen by persons with HF who are experiencing HF-related fatigue and low

energy. Similarly, item 29, “I don’t even feel like going out of the house,” could be selected by persons with HF who have high levels of fatigue or dyspnea and are not physically able to engage in outings from the house.

Psychometric Testing of the CCI-Short Form in an Independent Sample

Dimensionality—The appropriateness of the data for principal components analysis of the CCI-SF was evidenced by a significant Bartlett’s test ($p < .001$) and an adequate KMO index (.62). In the principal components analysis, four components had eigenvalues greater than 1. The first component had an eigenvalue of 4.4 and explained 37% of the variance. The other factors had eigenvalues of 1.5, 1.1, and 1.2; these variables explained 13, 10, and 9% of the variance, respectively. However, the elbow on the scree plot indicated only one dimension. Further evidence of only one dimension was provided by the component matrix. The loadings on the first component ranged from .47 to .88, and all but two loadings were greater than .55. To further evaluate dimensionality, we performed oblimin rotations with forced 2- and 3-factor solutions. Both rotations indicated that the CCI-SF was one-dimensional.

Internal consistency reliability—The mean score of the CCI-SF was 17 ± 7 with a range of 12 to 43 (possible range of 12 to 60). The CCI-SF showed evidence of adequate internal consistency reliability without redundancy. Cronbach’s alpha was .84. The corrected item-total correlations ranged from .37 to .81; 10 of the 12 items had corrected item-total correlations of .40 to .65.

Construct validity—Patients with depressive symptoms had higher levels of negative thinking compared to patients without depressive symptoms (20 ± 6 vs. 15 ± 6 , $p = .003$). There were significant differences in CCI-SF scores among patients with no, mild, moderate, and severe depressive symptoms ($p < .001$). Patients with moderate and severe depressive symptoms had similar levels of negative thinking; these two groups had significantly higher levels of negative thinking compared to patients with no and mild symptoms (Figure 2). There was a strong, positive correlation between scores on the CCI-SF and scores on the original CCI ($r = .92$, $p < .001$).

Discussion

In this study, we tested the psychometric properties of the original CCI⁸ and developed a shortened version for use in patients with HF. Negative thinking is a modifiable target of depressive symptoms in patients with HF; however, prior to this study, researchers have not tested the psychometric properties of a negative thinking instrument in this population. Our results demonstrate that among patients with HF, the original CCI had excellent internal consistency reliability and validity but also item redundancy. The original CCI contains 45 items and is longer than other measures of negative thinking, such as the Cognitions Checklist-Depression scale (14 items)⁷ and the Automatic Thoughts Questionnaire (30 items).⁶ By developing and testing the CCI-SF, we have improved the research and clinical practicality for use in patients with HF while also reducing patient burden. We also removed several items that could be problematic when used with patients with HF, such as “I don’t seem to have enough energy to get through the day.”

In our principal components analyses, only one dimension emerged from both the original and the short-form versions of the CCI. The single factor explained 46% of the variance in the original CCI and 37% of the variance in the short form. Our findings differ from Crandell and Chambless,⁸ who found a 4-factor structure using principal components analysis with data from clinically depressed adult in-patients and outpatients. The four

components explained [ENREF 8](#) 45% of the variance in the CCI and the variance explained was divided almost equally across the four factors.

The differences between our findings and those of Crandell and Chambless⁸ could be due to several factors. Crandell and Chambless did not report all factor loadings across the four factors and did not address whether there were any double or triple loadings. They also did not describe the criterion used for identification of the number of meaningful factors—i.e., the eigenvalue greater than one rule or the scree plot. The sample size used for the factor analysis was small—81 people with depression—and with 34 items in the scale, the minimum requirement of five subjects per item for principal components analysis was not met. In contrast, in our study we included all patients in the principal components analyses, regardless of depressive symptom status ($N=177$ and 77). Our target population consisted of people with HF, while Crandell and Chambless included persons who were receiving inpatient or outpatient treatment for major depressive disorder. It is possible that negative thinking may manifest itself differently in patients who are acutely or chronically ill with HF, compared to adults receiving psychiatric treatment for depression. Regardless of the possible reasons for our finding of a unidimensional factor structure for both the original and shortened versions of the CCI, our shortened version of the CCI still contained items reflecting all four of the original authors' scales, providing support for construct validity of the shortened version.

In psychometric testing of the original CCI and the CCI-SF, we found that patients with clinically significant depressive symptoms had higher levels of negative thinking compared to patients without depressive symptoms. We also observed that as the severity of depressive symptoms increased, the original CCI scores increased accordingly—a finding that provides strong support for validity of the original CCI among patients with HF. However, when examining the relationship between the CCI-SF and the severity of depressive symptoms, we found that patients with moderate and severe depressive symptoms had higher levels of negative thinking than patients with no and mild symptoms, but we did not observe a progressive relationship between the CCI-SF and depressive symptoms. This finding may be due to a smaller sample size and the exclusion of patients with self-reported severe depression in the second sample that we used to evaluate the psychometric properties of the CCI-SF. However, scores on the CCI-SF were strongly and positively correlated with scores on the original CCI. Overall, we demonstrated strong evidence of internal consistency reliability and construct validity of the CCI-SF as a measure of negative thinking in hospitalized patients with HF.

Two limitations should be noted. We did not use a diagnostic interview to categorize patients as depressed or non-depressed. Therefore, we could not evaluate the concurrent validity of the CCI by testing the ability to distinguish levels of negative thinking between clinically depressed and non-depressed patients with HF. The inclusion of a diagnostic interview for major depressive disorder would be beneficial in future psychometric analyses of a shortened version of the CCI-SF. We also used two different HF populations—outpatient and acute care—for psychometric testing of the original CCI and the CCI-SF. Furthermore, the data were collected during two different time periods (2002–2006 and 2009), and treatment of patients with HF has changed during that time period. However, our use of two different HF populations could also be considered strength because we have now provided evidence of reliability and validity for the original CCI in the outpatient setting and the CCI-SF in the acute care setting.

Conclusion

The findings from our study provide strong support for the reliability and validity of the original CCI and the CCI-SF as measures of negative thinking in patients with HF. Depressive symptoms remain a significant clinical problem in patients with HF, and negative thinking is a potential target for the treatment of depressive symptoms in this population. The CCI-SF has greater clinical utility than the original CCI for use in hospitalized patients with HF. Further research is needed to test the psychometric properties of the CCI-SF in outpatients with HF. We recommend that the CCI-SF be used in research studies measuring negative thinking in hospitalized patients with HF.

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Figure 1.
Relationship between severity of depressive symptoms and the original Crandell Cognitions Inventory in outpatients with heart failure* ($N = 179$)

*One-way analysis of variance; $F = 62$, $p < .001$

Figure 2.
Relationship between severity of depressive symptoms and the Crandell Cognitions Inventory-Short Form in hospitalized patients with heart failure* ($N = 77$)
*One-way analysis of variance; $F = 8.3$, $p < .001$

Table 1

Sample characteristics for the first study (outpatients with HF) and second study (hospitalized patients with HF)*

	Outpatient setting <i>N</i> = 179	Acute care setting <i>N</i> = 77
Characteristic	Frequency (%) or mean $\pm$ standard deviation	
Female [†]	59 (33%)	38 (49%)
Age [‡]	60 $\pm$ 13	66 $\pm$ 11
Married	94 (53%)	41 (53%)
Minority	35 (20%)	13 (17%)
Education level [†]		
<i>Less than high school</i>	34 (19%)	26 (34%)
<i>High school graduate</i>	44 (25%)	24 (31%)
<i>Some college or greater</i>	103 (57%)	27 (35%)
Employment status		
<i>Employed</i>	47 (26%)	5 (7%)
<i>Disability</i>	36 (20%)	25 (33%)
<i>Retired</i>	84 (47%)	42 (55%)
Body Mass Index	33 $\pm$ 8	32 $\pm$ 9
NYHA functional class [§]		
<i>Class I</i>	15 (8%)	1 (1%)
<i>Class II</i>	75 (42%)	21 (27%)
<i>Class III</i>	71 (40%)	46 (60%)
<i>Class IV</i>	13 (7%)	9 (12%)
Left ventricular ejection fraction	37 $\pm$ 15	40 $\pm$ 36
Ischemic HF etiology	79 (44%)	42 (55%)
Months diagnosed with HF	77 $\pm$ 84	71 $\pm$ 94
Comorbidities		
<i>Myocardial infarction</i>	88 (49%)	30 (39%)
<i>Atrial fibrillation</i>	78 (44%)	38 (50%)
<i>Implanted defibrillator</i>	63 (35%)	34 (44%)
<i>Stroke</i>	38 (21%)	19 (25%)
<i>COPD</i> [§]	32 (18%)	28 (36%)
<i>Diabetes</i>	79 (44%)	42 (55%)
Medications		
<i>ACE inhibitor</i> [‡]	127 (71%)	34 (44%)
<i>Beta blocker</i> [‡]	157 (88%)	56 (73%)
<i>Antidepressant</i>	42 (24%)	23 (30%)
Crandell Cognitions Inventory	59 $\pm$ 25	55 $\pm$ 20
Beck Depression Inventory-II [†]	10 $\pm$ 8	13 $\pm$ 9

HF = Heart failure, NYHA = New York Heart Association, COPD = Chronic obstructive pulmonary disease, ACE = Angiotensin-converting enzyme

* Differences between groups were assessed using the independent t-test or Pearson chi-square, as appropriate to the level of measurement:

[†] $p < .05$

[‡] $p < .001$

[§] $p \leq .005$

Table 2

Grandell Cognitions Inventory: Item statistics and scale reduction process in outpatients with heart failure ($N = 179$)*

Item	Double or triple loading on first (1) or second (2) PCA	M (SD)	Corrected item-total correlation	Number of inter-item correlations	
				<.40	>.70
1. I'm just a nobody [†]	1	1.4 (0.9)	.56	19	
3. I'll never feel good again [§]	1	2.2 (1.2)	.57	18	
4. I sure have wasted the opportunities in my life [†]		2.1 (1.3)	.72	5	
5. I don't know what I should do [‡]	2	2.0 (1.2)	.66	8	
6. I'm always letting myself down [†]		1.8 (1.2)	.77	4	
8. I've made such a mess of my life [†]		1.7 (1.1)	.70	8	
10. Nothing ever works out for me anymore [‡]	2	1.8 (1.1)	.70	6	
11. Things really look hopeless [‡]		1.5 (0.9)	.68	9	
12. Why can't I be happy? [†]		1.7 (1.2)	.78	3	1
13. It all seems so useless [‡]		1.5 (0.9)	.77	3	1
15. I just don't cut it ^{II}		1.7 (1.1)	.74	3	
16. I sure am bored [‡]	1	2.0 (1.2)	.48	32	
17. My life is so confused, I'll never straighten it out [§]		1.5 (1.0)	.79	2	
18. I'm a burden to my family [†]	2	1.6 (1.0)	.61	15	
20. I'll never be happy with myself [§]		1.6 (1.1)	.70	5	
22. There's no way out of this mess [§]	1	1.7 (1.2)	.63	14	
23. I don't seem to have the energy to get through the day ^{II}	1	2.4 (1.3)	.64	11	
24. I really can't do what's expected of me ^{II}	1	2.0 (1.2)	.68	7	
26. No one can know how alone I feel [‡]	2	1.9 (1.2)	.66	8	
27. I'll never do as well as others [§]	2	1.8 (1.1)	.62	14	
28. Everything I do is a failure [†]		1.4 (0.8)	.70	6	
29. I don't even feel like going out of the house ^{II}	1	1.9 (1.2)	.53	26	
30. I'm a real disappointment to my family [†]		1.5 (1.0)	.69	9	

Item	Double or triple loading on first (1) or second (2) PCA	M (SD)	Corrected item-total correlation	Number of inter-item correlations
32. I feel so detached; I just can't communicate ^{II}		1.4 (0.8)	.66	7
33. I mess everything up [†]		1.4 (0.8)	.73	7
35. I know what I should do but I just can't do it [‡]	1	2.4 (1.3)	.55	20
36. Nothing's ever going to work out for me [§]	1	1.6 (1.1)	.72	5
37. I feel trapped [‡]		1.5 (1.0)	.74	3
38. Daytimes are bad but nightmares are terrible [§]		1.5 (1.0)	.62	15
39. I just wish it would be all over [‡]	2	1.3 (0.9)	.60	13
41. Nothing seems exciting anymore ^{II}	1	2.0 (1.2)	.60	16
43. I wish people would just leave me alone ^{II}	1	1.6 (1.0)	.54	20
44. Nobody cares about me [‡]		1.5 (1.0)	.60	14
45. I feel so helpless ^{II}		1.5 (1.0)	.65	10

PCA = Principal components analysis

* Items in boldface represent item statistic that met deletion criteria; asterisks indicate which scale the item previously belonged to on the original Crandell Cognitions Inventory as reported by Crandell and Chambliss:

[†] Self-rated inferiority

[‡] Helplessness

[§] Hopelessness

^{II} Detachment

Table 3

Final principal components analysis of the Crandell Cognitions Inventory-Short Form in outpatients with HF (Study 1) and hospitalized patients with HF (Study 2)*

Item	Study 1 (N = 179) Loadings	Study 2 (N = 77) Loadings
4: I sure have wasted the opportunities in my life [†]	.73	.48
6: I'm always letting myself down [†]	.84	.56
8: I've made such a mess of my life [†]	.77	.67
11: Things really look hopeless [‡]	.72	.58
13: It all seems so useless [‡]	.79	.57
15: I just don't cut it ^{II}	.75	.60
17: My life is so confused, I'll never straighten it out [§]	.84	.64
20: I'll never be happy with myself [§]	.71	.70
28: Everything I do is a failure [†]	.76	.62
30: I'm a real disappointment to my family [†]	.75	.47
32: I feel so detached; I just can't communicate ^{II}	.72	.74
33: I mess everything up [†]	.78	.88

* Asterisks indicate which scale the item previously belonged to on the original Crandell Cognitions Inventory as reported by Crandell and Chambless:

[†] Self-rated inferiority

[‡] Helplessness

[§] Hopelessness

^{II} Detachment