Cogn Ther Res (2010) 34:92–98
DOI 10.1007/s10608-008-9224-8

BRIEF REPORT

Cognitive Vulnerability to Depressive Symptoms in College Students: A Comparison of Traditional, Weakest-Link, and Flexibility Operationalizations

Gerald J. Haeffel

Published online: 20 December 2008
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Abstract Cognitive vulnerability is a key construct in the hopelessness theory's etiological chain (Abramson, Metalsky, and Alloy, 1989 *Psychological Review, 96,* 358–372). Researchers have proposed three operationalizations of this cognitive vulnerability construct: traditional, weakest-link, and flexibility. A five-week longitudinal study was conducted to test whether the weakest-link and flexibility approaches exhibit incremental validity over the empirically supported traditional approach. Results showed that the weakest-link approach has extensive overlap with the traditional operationalization (correlation was .93), and does not exhibit incremental validity in a college sample. In contrast, the flexibility approach appears to represent a unique vulnerability construct. However, the flexibility construct did not account for unique variance in the prediction of depressive symptoms beyond that explained by the traditional operationalization. The implications of the results for conceptualizing and operationalizing cognitive vulnerability are discussed.

Keywords Cognitive vulnerability · Depression · Hopelessness theory

Introduction

According to the hopelessness theory of depression (Abramson et al. 1989), some individuals have a *cognitive vulnerability* that interacts with negative life events to create depression. Hopelessness theory defines cognitive vulnerability as the tendency of an individual to make particular kinds of inferences about the cause, consequences, and self-worth implications of negative life events. Specifically, when faced with a negative life event, an individual who has a cognitive vulnerability is likely to: (a) attribute the event to stable and global causes; (b) view the event as likely to lead to other negative consequences; and (c) construe the event as implying that he or she is unworthy or deficient. Individuals who generate these three types of negative inferences are hypothesized to be at risk for depression.

The cognitive vulnerability factor featured in the hopelessness theory is measured with the Cognitive Style Questionnaire (CSQ). The CSQ is a self-report questionnaire that measures the three components that compose hopelessness theory's cognitive vulnerability factor (causal attributions, consequences, and self-worth characteristics). This measure has been used in approximately 40 published studies since its inception and has demonstrated strong psychometric and validity properties (see Haeffel et al. 2008 for review). Research using the CSQ has consistently found that individuals with high levels of cognitive vulnerability are at greater risk for depressive symptoms (e.g., Gibb et al. 2006; Haeffel et al. 2007; Hankin 2005) and depressive disorders (e.g., Alloy et al. 2006; Hankin et al. 2004) than those with low levels of cognitive vulnerability when faced with stress. This work supports the cognitive vulnerability hypothesis featured in hopelessness theory, as well as the validity of the CSQ.

Although a growing number of studies support the role of cognitive vulnerability in the development of depression, debate continues on how to best conceptualize this construct (and in turn, how best to score the CSQ). Currently, there are at least three different approaches to conceptualizing the cognitive vulnerability factor featured

G. J. Haeffel (✉)
Department of Psychology, University of Notre Dame,
108 Haggar Hall, Notre Dame, IN 46556, USA
e-mail: ghaeffel@nd.edu

in hopelessness theory. The traditional approach, which is recommended by the creators of the CSQ and has been used in the majority of studies using the CSQ (Haeffel et al. 2008), contends that the three vulnerability components (causal attributions, consequences, and self-worth characteristics) each contribute to a core cognitive vulnerability construct. Thus, this traditional conceptualization is operationalized on the CSQ by creating a composite score for the three vulnerability components—the participants' average score on causal attributions, consequences, and self-worth characteristics. This traditional approach to conceptualizing cognitive vulnerability and scoring the CSQ is supported by a large body of empirical work (e.g., Abramson et al. 1999; Alloy et al. 2006; Gibb et al. 2006; Haeffel et al. 2003; Hankin et al. 2004; Hankin 2005; Metalsky and Joiner 1992).

Recently, Abela and Sarin (2002) provided an alternative approach to operationalizing cognitive vulnerability with the CSQ. According to Abela and Sarin (2002), the traditional composite scoring system is flawed because it masks potentially important information about the three vulnerability components featured in hopelessness theory. The traditional approach creates an average score for the three vulnerability components, and thus, it is unclear what scores contributed to that average. For example, two participants may both have a CSQ average score of 4 (on a scale of 1–7). However, one individual may have scores of 2, 7, and 3 contributing to their average whereas another person may have scores of 4, 4, and 4. According to Abela et al. (2006), the individual who scored a 7 on one of the vulnerability components should be at greater risk for depression than the individual who scored 4 on all the components. To resolve this potential limitation of the traditional scoring system, Abela and Sarin (2002) proposed a "weakest-link" approach to scoring the CSQ. According to this approach, an individual's risk for depression is as great as the most negative of his or her three vulnerability components. In this case, an individual's highest, rather than average, vulnerability score on the CSQ determines his or her level of cognitive vulnerability (the other two vulnerability components are essentially ignored). This scoring approach assumes that the three vulnerability components are relatively independent of one another. The weakest-link approach has received preliminary support in both adult (Abela et al. 2006) and child samples (e.g., Abela and Sarin 2002).

Finally, Fresco et al. (2007) proposed a third conceptualization of cognitive vulnerability called explanatory flexibility. According to these researchers, explanatory flexibility refers, at least in part, to an individual's ability to generate multiple interpretations of negative life events. According to this account, the ability to think about life stress in evenhanded rather than extreme terms may be a more important determinant of future depression than the specific thought content (Peterson et al. 2008). Peterson et al. (2008) contend that the flexibility approach challenges a core assumption of the cognitive theories that cognitive content is a risk factor for depression. Explanatory flexibility is operationalized on the CSQ by calculating an intra–individual standard deviation for all the items on the measure. If an individual's standard deviation is large, then that person is considered flexible; in contrast, if an individual's standard deviation is small, then that person is considered rigid. An alternative strategy for assessing explanatory flexibility (Peterson et al. 2008) is to examine extreme responses on the CSQ (e.g., the number of times a participant endorses the endpoints of the rating scale). Preliminary research (e.g., Fresco et al. 2007) suggests that those with low levels of explanatory flexibility may be at risk for future depressive symptoms.

In summary, researchers have proposed three conceptualizations of cognitive vulnerability: traditional, weakest-link, and flexibility. The traditional conceptualization of cognitive vulnerability has the greatest level of theoretical fidelity to the hopelessness theory as well as the greatest empirical support. However, two alternative conceptualizations (weakest-link and flexibility) have also received preliminary support. The next logical step in this area is to pit these new approaches against the traditional approach. It is critical to determine whether the new operationalizations are scientifically progressive (Lakatos 1970). In other words, do the new operationalizations contribute information beyond that provided by the existing operationalization (e.g., increased predictive power)? Failure to address this issue of incremental validity could result in "…an almost endless proliferation of reconfigured items or variables" (Hunsley and Meyer 2003, p. 449).

The goal of the current investigation was to determine the extent to which two new conceptualizations of cognitive vulnerability (weakest-link and flexibility) demonstrate incremental validity over the traditional approach. To this end, a longitudinal study was conducted to examine the degree to which the three cognitive vulnerability approaches interacted with life stress to predict depressive symptoms over a five-week interval.

Method

Overview

The study used a five-week longitudinal design to test whether cognitive vulnerability would predict increases in depressive symptoms in the presence of stressful life events. At Time 1, participants were administered measures of cognitive vulnerability (CSQ) and depressive

symptoms (BDI). Five weeks later (Time 2) participants completed the BDI and a measure of stressful life events (ALEQ). The five-week time frame was chosen because it is among the most commonly used time frames for short-term longitudinal studies and is a sufficient amount of time to detect changes in depressive symptoms (e.g., Joiner and Schmidt, 1998; Metalsky and Joiner 1992; Pettit et al. 2001; Haeffel et al. 2007).

Participants

Participants were 251 unselected undergraduates (167 women, 84 men) from the University of Wisconsin-Madison (see Haeffel et al. 2007 for additional information about the sample and study design). Participants were recruited through a volunteer folder sign-up procedure and were given extra credit points for their participation.

Measures

Acute Life Events Questionnaire (ALEQ)

A modified Life Events Questionnaire (Needles and Abramson, 1990) was used to assess naturally occurring *acute* stressful life events important to college students. Items assessed a broad range of life events from achievement to interpersonal. Participants were instructed to indicate which of the negative life events had occurred to them over the previous 5 weeks. Scores can range from 0 to 30 with higher scores indicating the occurrence of more negative events. Internal consistency in the current sample was fair; $\alpha = .70$.

Beck Depression Inventory (BDI; Beck et al. 1988)

The BDI is a 21-item self-report inventory that assesses depressive symptoms. Total scores on the BDI can range from 0 to 63, with higher scores indicating greater levels of depressive symptoms. The BDI has high internal consistency, test-retest reliability, and validity with both psychiatric and normal samples. Internal consistency in the current sample was good; α at T1 = .85; α at T2 = .90.

Cognitive Style Questionnaire (CSQ; Haeffel et al. 2008)

The CSQ is a self-report questionnaire that measures the three components that compose hopelessness theory's cognitive vulnerability factor. It assesses participants' causal attributions for 12 hypothetical negative events on dimensions of stability and globality; in addition, participants rate the probable consequences of each event and the self-worth implications of each event. Internal consistency in the current sample was good; $\alpha = .90$.

Using the traditional scoring system, an individual's CSQ score is their average rating across the three vulnerability components (stable global causal attributions, consequences, and self-worth characteristics) for the 12 hypothetical negative life events. This composite score (total score divided by the number of items) can range from 1 to 7, with higher scores reflecting greater levels of cognitive vulnerability to depression. In contrast, an individual's weakest-link score is their highest vulnerability component score (as opposed to the average score). Consistent with prior research, CSQ scores were standardized prior to selecting the highest vulnerability component score. Finally, explanatory flexibility is operationalized as the standard deviation of an individual's responses on the CSQ to the three vulnerability components (Fresco et al. 2007). It also can be operationalized as extreme responding on the CSQ (Peterson et al. 2008). That is, the number of times a participant endorsed either a 1 (low end of scale) or a 7 (high end of scale), respectively.

Results

Means, standard deviations, and inter-correlations of relevant study measures are summarized in Table 1. Data analyses focused on testing the hypothesis that cognitive vulnerability would interact with stressful life events to predict depressive symptoms over a five-week prospective interval. Three hierarchical multiple regression (Cohen et al. 2003) equations were used to test the predictive power of each cognitive vulnerability operationalization, respectively. In all analyses, the Time 1 depression measure (T1 BDI) was entered in the first step of the regression equation to create a residual change score for the same Time 2 measure (T2 BDI). In the second step, the main effects of cognitive vulnerability (CSQ traditional, weakest-link, or flexibility) and stressful life events (ALEQ) were entered. Last, the appropriate Vulnerability × Stress interaction term was entered (e.g., CSQ × ALEQ).

Traditional

Consistent with prior research, there was a significant traditional CSQ × ALEQ interaction, $B = 0.56$, $t = 3.14$, $pr = .20$, $p = .002$ (see Table 2). Participants with high traditional CSQ scores and high stress exhibited the greatest level of depressive symptoms at T2, even after controlling for T1 BDI scores.

Weakest-Link

Consistent with prior research, there was a significant weakest-link CSQ × ALEQ interaction, $B = 0.45$, $t = 3.02$,

Table 1 Means, standard deviations, and correlations between measures

	1	2	3	4	5	6	7	8
1 Traditional	–							
2 Weakest	**.93**	–						
3 Flexibility	**−.16**	−.08	–					
4 Extreme low	**−.57**	**−.48**	**.69**	–				
5 Extreme high	**.49**	**.52**	**.51**	**.15**	–			
6 ALEQ	**.23**	**.23**	−.05	**−.17**	.07	–		
7 BDI T1	**.40**	**.37**	**−.12**	**−.22**	**.24**	**.29**	–	
8 BDI T2	**.26**	**.24**	−.03	−.09	**.21**	**.40**	**.63**	–
M	4.09	.50	1.58	4.65	4.03	2.86	6.20	5.66
SD	.73	.92	.38	5.37	5.16	2.45	5.57	6.33

Note: $N = 251$; Traditional, CSQ traditional scoring; Weakest, CSQ weakest-link scoring; Flexibility, CSQ flexibility scoring (standard deviation); Extreme low, CSQ extreme responding (endorsing "1"s); Extreme high, CSQ extreme responding (endorsing "7"s); ALEQ, Acute Life Events Questionnaire; BDI T1, BDI at Time 1; BDI T2, BDI at Time 2; Correlations in bold are significant to the .05 level

Table 2 Cognitive vulnerability-stress interactions predicting T2 depressive symptoms

Predictor	*B*	*β*	*pr*	*t*	Step R^2 Change
Traditional					
Step 1					.40
T1 BDI covariate	.72	.63	.63	12.77***	
Step 2					.05
ALEQ	.63	.24	.30	4.91***	
Traditional	−.18	−.02	−.03	−.40	
Step 3					.02
Traditional × ALEQ	.56	.15	.20	3.14**	
Model $R^2 = .47$, $F(4, 246) = 54.72$, $p < .001$					
Flexibility					
Step 1					.40
T1 BDI covariate	.72	.63	.63	12.77***	
Step 2					.06
ALEQ	.63	.24	.30	4.92***	
Extreme High	.08	.07	.09	1.36	
Step 3					.02
Extreme High × ALEQ	.06	.13	.16	2.59**	
Model $R^2 = .47$, $F(4, 246) = 54.07$, $p < .001$					
Comparison					
Step 1					.40
T1 BDI covariate	.72	.63	.63	12.77***	
Step 2					.06
ALEQ	.65	.25	.31	5.03***	
Traditional	−.56	−.06	−.07	−1.12	
Extreme High	.11	.09	.11	1.71	
Step 3					.02
Traditional × ALEQ	.39	.11	.12	1.94*	
Extreme High × ALEQ	.04	.08	.08	1.39	
Model $R^2 = .47$, $F(6, 246) = 37.23$, $p < .001$					

Note: BDI, T1 Beck Depression Inventory; ALEQ, Acute Life Events Questionnaire; Traditional, CSQ traditional scoring; Extreme High, CSQ extreme responding (endorsing "7"s)

*$p < 05$. **$p < 01$. ***$p < 001$

$pr = .19$, $p = .003$. Participants with high weakest-link CSQ scores and high stress exhibited the greatest level of depressive symptoms at T2, even after controlling for T1 BDI scores.

Flexibility CSQ

Contrary to hypotheses, when flexibility was operationalized as the standard deviation of a participant's responses on the CSQ, it did not interact with the ALEQ to predict depressive symptoms at T2, $B = 0.003$, $t = .01$, $pr = .001$, $p = .99$. Similarly, when flexibility was operationalized as extreme low responding (number of "1" responses), the CSQ score did not interact with the ALEQ to predict depressive symptoms at T2, $B = -0.03$, $t = -1.19$, $pr = -.08$, $p = .24$. However, when the CSQ was operationalized as extreme high responding (number of "7" responses), it did interact with the ALEQ to predict depressive symptoms at T2, $B = 0.06$, $t = 2.59$, $pr = .16$, $p = .01$ (see Table 2). Participants with a high number of extreme CSQ responses ("7"s) and high stress exhibited the greatest level of depressive symptoms at T2, even after controlling for T1 BDI scores.

Comparison

Traditional, weakest-link, and flexibility (extreme high responding) operationalizations all interacted with stress to predict changes in depressive symptoms. Thus, the next step was to determine whether the weakest-link and flexibility (extreme high responding) operationalizations account for unique variance in depressive symptoms beyond that predicted by the traditional conceptualization. To this end, a fourth regression equation was used in which each of the significant Cognitive Vulnerability × Stressful Life Event interaction terms were entered together. However, further analysis revealed that it was not appropriate to compare the traditional and weakest-link conceptualizations due to the problem of multicollinearity (Tolerance = .13; Cohen et al. 2003). As can be seen in Table 1, the weakest-link operationalization was nearly identical to the traditional operationalization ($r = .93$). Thus, only the traditional CSQ and flexibility CSQ interaction terms were entered into a regression equation (see Table 2). When both previously significant vulnerability × stress interaction terms were in the equation, only the traditional CSQ × ALEQ interaction term remained a unique predictor of depressive symptoms at T2, $B = 0.39$, $t = 1.94$, $pr = .12$, $p = .05$. The flexibility CSQ × ALEQ interaction term was no longer significant, $p = .17$ (see Table 2).

Discussion

A five-week longitudinal study was conducted to determine the incremental validity of two alternative operationalizations of cognitive vulnerability—weakest-link and flexibility. Results indicate that the weakest-link operationalization is not a unique cognitive vulnerability construct as it almost completely overlaps with the traditional operationalization. In contrast, the explanatory flexibility operationalization (both standard deviation and extreme responding operationalizations) appears to be distinct from the traditional operationalization. The correlations between the traditional CSQ score and flexibility CSQ scores were low to moderate. Flexibility, as operationalized by extreme high responding, also predicted changes in depressive outcomes. However, the flexibility construct did not account for unique variance in the prediction of depressive outcomes when statistically controlling for the traditional operationalization.

Consistent with prior research, the traditional operationalization predicted depressive symptoms. The weakest-link approach was also supported. However, it failed to exhibit incremental validity. Indeed, the weakest-link approach was virtually indistinguishable from the traditional scoring approach. The correlation between the two operationalizations was .93. This extensive overlap indicates that the weakest-link conceptualization is not distinct from the traditional conceptualization. It appears that an individual's weakest-link score is strongly representative of their more general cognitive style as measured by all three vulnerability components. In other words, if an individual exhibits a high level of cognitive vulnerability on one component (e.g., causal attributions) then he or she will likely exhibit a similar level of cognitive vulnerability on the other two components (e.g., consequences and self-worth characteristics). These findings contradict the assumption of weakest-link approach that the three vulnerability components are independent and do not tap a common core vulnerability factor.

If the traditional and weakest-link scoring approaches are indistinguishable, then the question becomes which operationalization should be used. According to the reasoning of Clark and Watson (1995), the traditional approach should be used. They argue that construct validity is compromised if a scale's content becomes narrower than the target construct. Clark and Watson (1995)provide the following example to illustrate this point. Assume that two researchers were each trying to create a measure of negative affect. One researcher includes items that assess a wide variety of negative moods (e.g., angry, blue, frightened, upset) whereas the other researcher includes items that are specific to anxiety and fear (scared, frightened, anxious,

worried). According to Clark and Watson (1995), the latter scale may have a strong level of internal consistency, but it will not adequately measure the broad construct of negative affect. This same type of case can be applied to measuring cognitive vulnerability. According to the hopelessness theory, cognitive vulnerability is the tendency to make three types of negative inferences—causal attributions, negative consequences, and negative self-worth characteristics. This means that examining only one of the three vulnerability components (e.g., the weakest-link component) leads to a scale in which its content is narrower than the cognitive vulnerability construct as conceptualized by the theory. Thus, it is critical to include all three components of hopelessness theory's cognitive vulnerability construct to ensure the theoretical fidelity of the measure. Moreover, using a composite scoring system that includes all three vulnerability components tends to enhance the internal consistency of the CSQ (Haeffel et al. 2008).

In contrast to the weakest-link conceptualization, explanatory flexibility (both standard deviation and extreme responding operationalizations) appears to be distinct from the traditional cognitive vulnerability conceptualization. In the current study, the correlations between the traditional and flexibility operationalizations were low to moderate. This weak association suggests that explanatory flexibility taps a construct that does not overlap with the traditional conceptualization. However, only one of the three flexibility operationalizations (extreme high responding) interacted with life stress to predict depressive symptoms, and even this result did not hold when controlling for the traditional cognitive vulnerability conceptualization (note that null results were also found if the extreme high and extreme low scores were combined into an overall index of extreme responding). These findings contradict a recent study by Fresco et al. (2007), which showed that standard deviation operationalization of explanatory flexibility interacted with negative life events to predict depressive symptoms over an eight-week interval. One explanation for the different findings is that Fresco et al. (2007) used the ASQ whereas the current study used the CSQ to measure cognitive vulnerability. The ASQ is the same as the CSQ with one exception—it only assesses the causal attribution component of cognitive vulnerability (it does not measure consequences or self-worth characteristics for the 12 negative hypothetical scenarios). However, post hoc analyses reveal that this difference in measurement is not a likely explanation for the discrepant findings. The results of the current study remain the same even if only the causal attribution component of the CSQ (i.e., an ASQ proxy) is used. Thus, taken together, the largely null results of current study indicate that flexibility (particularly the standard deviation operationalization) may not account for unique variation in depressive outcomes. The results also indicate that the CSQ may not be the ideal instrument for assessing explanatory flexibility. Indeed, the CSQ was not designed with the flexibility conceptualization in mind. Thus, it may be fruitful to examine alternative strategies for measuring the explanatory flexibility construct.

Clearly, it is important to replicate the current findings before making any definitive conclusions. To this end, we compared the three conceptualizations in two additional independent samples (details available upon request). Findings from these studies (n's = 887 and 48, respectively) fully corroborated the current results. Results showed that the traditional operationalization was the only unique predictor of depressive outcomes (past major depression and depressive reactions to a naturalistic stressor). Neither the weakest-link nor the flexibility approaches exhibited predictive power beyond that accounted for by the traditional account. Further, the weakest-link approach was again indistinguishable from the traditional approach (correlations of .93 and .97).

It is important to note limitations to the current study. For example, the study used a college sample so it is possible that the results may not generalize to community and clinical samples. However, it is important to note that the "college sophomore problem" is often overstated. The results of studies using college samples often do generalize to community and clinical samples, particularly when basic processes (e.g., cognition) are being studied (e.g., Anderson et al. 1999). Another potential limitation of the current study is that it examined depressive symptoms, but not clinical diagnoses. Thus, we cannot make conclusions about clinically significant forms of depression. However, given research suggesting that depressive symptoms and depressive syndromes lie on a continuum, we expect that future research will provide evidence that our pattern of results also extends to depressive disorders. Finally, it is also necessary to examine whether the results hold in samples of children and adolescents. There is evidence that the weakest-link conceptualization could exhibit incremental validity in younger populations (e.g., Abela and Sarin 2002).

In summary, the results of the current study suggest that two recent conceptualizations of cognitive vulnerability (weakest-link and explanatory flexibility) do not account for unique variance in the prediction of depressive symptoms in college students. On a specific level, these findings suggest that the original conceptualization and operationalization of hopelessness theory's cognitive vulnerability factor, as measured by the CSQ, is still valid and scientifically progressive. On a general level, these findings underscore the importance of comparing competing theories and conceptualizations. Such comparisons can help constrain the production of constructs and theories that overlap with existing constructs and theories.

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