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Stability of Cognitive Vulnerabilities to Depression: A Short-Term Prospective Multiwave Study

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The stability of 3 cognitive vulnerabilities—a negative cognitive style, dysfunctional attitudes, and rumination—as well as depressive symptoms as a benchmark were examined to investigate whether cognitive vulnerabilities are stable, enduring risks for depression. A sample of adolescents (6th–10th graders) completed measures of these 3 cognitive vulnerabilities and depressive symptoms every 5 weeks for 4 waves of data across 5 months. Mean-level and differential stability were examined for the sample overall and by age subgroups. A negative cognitive style exhibited mean-level stability, whereas rumination and dysfunctional attitudes showed some mean-level change. Absolute magnitudes of test–retest reliabilities were strong for depressive symptoms (mean $r = .70$), moderately high for a negative cognitive style (mean $r = .52$), and more modest for rumination (mean $r = .28$) and dysfunctional attitudes (mean $r = .26$). Structural equation modeling showed that primarily enduring processes, but not contextual forces, contributed to the patterning of these test–retest reliabilities over time for a negative cognitive style and dysfunctional attitudes, whereas both enduring and contextual dynamics appeared to underlie the stability for rumination. Theoretical and clinical implications of these findings are discussed.

Keywords: cognitive vulnerability to depression, stability, change, adolescence

The levels of depressive mood and symptoms as well as prevalence rates of depressive disorder increase from childhood through adolescence (Hankin & Abela, 2005). Adolescent-onset depression is associated strongly with risk for recurrence in adulthood (Rutter, Kim-Cohen, & Maughan, 2006). Studying whether vulnerability factors for depression are enduring risks over time and elucidating the patterning of when depression vulnerabilities stabilize can inform developmental psychopathological models of depression. The primary focus of this study was to examine the stabilization of various cognitive vulnerabilities to depression from early through middle/late adolescence. Rutter et al. (2006) highlighted that cognitive risks may explain the continuity of depression over the life span, but "the degree of stability of cognitive vulnerability from childhood to adulthood is unknown" (p. 283). The present study seeks to fill this important gap.

Cognitive Vulnerability Theories of the Development of Depression: Theory and Evidence

Cognitive theories of depression postulate that the ways in which individuals attend to, interpret, and remember negative life events contribute to the likelihood that they will experience depressive symptoms. The bulk of theory and empirical research has focused on Beck's theory (Beck, 1987), the hopelessness theory of depression (Abramson, Metalsky, & Alloy, 1989), and the response styles theory (Nolen-Hoeksema, 1991). Each of these theories identifies distinct cognitive vulnerabilities (dysfunctional attitudes, negative cognitive style, and a ruminative response style, respectively) that are hypothesized to contribute to the onset and/or maintenance of depression. The dysfunctional attitudes in Beck's theory are rigid and extreme beliefs about the self and the world. Hopelessness theory's negative cognitive style is comprised of (a) the tendency to make negative inferences about the causes of negative events (stable, global attributions), (b) the tendency to catastrophize about the consequences of negative events, and (c) the tendency to infer negative characteristics about the self following negative events. The ruminative response style in response styles theory refers to the process whereby individuals repetitively focus attention on their depressive symptoms and the implications of their symptoms.[1] Considerable empirical support shows that each of these cognitive vulnerabilities, especially in interaction with stressors, predicts prospective depressive symptoms in adults (Abramson et al., 2002; Scher, Ingram, & Segal, 2005) and in children and adolescents (Abela & Hankin, 2008; Lakdawalla, Hankin, & Mermelstein, 2007).

These cognitive vulnerabilities to depression may still be forming and coalescing during childhood and may stabilize into enduring risks for depression during adolescence (Hankin & Abela,

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[1] Although Nolen-Hoeksema (1991) originally proposed that rumination would exacerbate or maintain depression after an individual exhibited initial depressed mood, many other investigators have viewed and examined rumination as a vulnerability to depression (e.g., Abela et al., 2002; Just & Alloy, 1997; Nolen-Hoeksema, 2000). Thus, in this article, rumination is examined as a cognitive vulnerability, which is consistent with the approach of other investigators, although slightly different from response styles theory's original perspective.

2005). In other words, these cognitive risk factors exist and function as predisposing vulnerabilities in childhood, but it is not known when they begin to exhibit enduring properties. Prior to age 7, children do not understand that stable, traitlike causes underlie behavior over time and across situations (Rholes & Ruble, 1984). By age 10, children exhibit understanding that traits can be consistent over time and across situations, and by age 12, an even greater and more mature comprehension of characteristics emerges (Rholes & Ruble, 1984). Longitudinal research on youths' beliefs about their competencies shows that stability estimates become increasingly stronger with increasing age (e.g., Cole et al., 2001; Wigfield, Eccles, Yoon, & Harold, 1997).

Stabilization of Depression Vulnerabilities

Conceptual Models

By definition, a vulnerability to psychopathology is a preexisting, stable characteristic that increases one's risk for disorder (Ingram & Luxton, 2005). Various investigators (e.g., Biesanz, West, & Kwok, 2003; Caspi, Roberts, & Shiner, 2005; Fraley & Roberts, 2005; Watson, 2004) have proposed multiple ways to evaluate continuity over time and the processes underlying such stability. This study focuses on two types of stability. *Mean-level stability* concerns the amount of change in a trait on average over time. If constructs do not change significantly in their average level over time, then this is one indication that they exhibit stability. *Differential stability* (i.e., the correlational pattern) relates to the degree to which individuals maintain their relative ranking and position on the trait over time.

Within differential stability, one can distinguish between two processes that give rise to rank-order stability over time. First, according to trait models, the pattern of test–retest correlations over time will be invariant regardless of the length of test–retest intervals because a stable psychological variable is postulated to organize manifestations of the construct across time. Second and in contrast to trait processes, contextual models predict that the magnitude of the test–retest correlations will diminish as the size of the follow-up interval increases (i.e., a simplex pattern to the correlations; Kenny & Zautra, 2001). This autoregressive pattern occurs because there is not an enduring psychological variable that organizes stability over time. To investigate rigorously these models underlying the pattern of test–retest correlations over time, multiple waves of data are required because it is the pattern of correlations over time, not the simple magnitude of the test–retest correlation, that enables one to distinguish between trait and contextual processes (Fraley & Roberts, 2005).

Empirical Evidence for Stability of Cognitive Vulnerabilities

For personality traits in general, few studies have assessed a comprehensive set of personality constructs and tracked continuities and discontinuities over time (Caspi et al., 2005). No study has used multiple waves of data among youths to investigate all three cognitive vulnerabilities. Various studies have reported high test–retest stability correlations in measures of cognitive vulnerabilities completed at two times by adults(e.g., Alloy et al., 2000; Burns & Seligman, 1989) and by youths (Voelz, Walker, Petit, Joiner, & Wagner, 2003). Yet, as noted earlier, this design in which measures are completed at two times is inadequate for accurately evaluating the processes (trait or contextual) contributing to differential stability, regardless of the time interval (Fraley & Roberts, 2005). Only two studies (Hankin, Fraley, & Abela, 2005; Zuroff, Blatt, Sanislow, Bondi, & Pilkonis, 1999) have examined mean-level and rank-order stability of cognitive vulnerabilities among any age group with multiple waves of data. Zuroff et al. (1999) analyzed data on dysfunctional attitudes before and immediately after treatment as well as 18 months later. Dysfunctional attitudes maintained mean-level and rank-order stability. Hankin et al. (2005) examined data from a 35-day diary study and found that daily negative inferences to stressors exhibited both mean-level and rank-order stability. Further, these negative cognitions were structured in a traitlike, not a contextual, manner.

Clearly, there remains much to be learned about the stability and processes underlying the potential enduring nature of cognitive vulnerabilities. No study has examined any form of stability for rumination. Moreover, the participants in past research were adults, so it is unknown whether cognitive vulnerabilities function as stable, enduring risks for depression among youths and, if so, whether age/development affects the degree of stability over time.

Overview of Current Research

The present research examined the degree of stability of cognitive vulnerabilities to depression by investigating mean-level and rank-order stability. I hypothesized that cognitive vulnerabilities would exhibit mean-level stability (i.e., no significant average changes in levels over time) and at least moderate test–retest stability estimates over time. Moreover, I hypothesized that enduring, traitlike processes, not contextual dynamics, would organize these moderate rank-order test–retest correlations best. Finally, I hypothesized that some age-related differences in stability would be observed, such that mean-level and rank-order stability would be stronger in middle compared with early adolescents. These novel questions were addressed in a four-wave, relatively short-term prospective study in which early and middle adolescents (6th–10th grades) completed measures of cognitive vulnerabilities to depression and depressive symptoms at each data wave. Depressive symptoms were included in the study as a *benchmark* (Watson, 2004) against which the stability of cognitive vulnerabilities to depression could be compared.

Method

Participants

Participants were youths who were recruited from five Chicago area schools. Briefly, 390 youths provided active parental consent and were willing to participate, and 356 completed the baseline questionnaire. The 34 students who were willing to participate but did not complete the baseline visit were sick or absent from school and were unable to reschedule. We examined data from 350 youths who provided complete data (depressive symptoms and cognitive vulnerabilities) at baseline. Rates of participation in the study decreased slightly at each wave of follow-up: Wave 2 (N = 303, 86%), Wave 3 (N = 308, 88%), and Wave 4 (N = 345, 98%). Participants' age range was 11–17 years (M = 14.5, SD = 1.4), and 57% were female. Of the participants, 13% were Latino, 6% were Asian or Pacific Islander, 21% were African American, 53% were White, and 7% were bi- or multiracial.

The rationale for studying a sample of 6th–10th graders is that this is a likely developmental period (early to middle adolescence) when cognitive vulnerabilities to depression may show increasing stability. Developmental research has indicated that numerous cognitive developmental changes (e.g., concrete to abstract thinking) theorized to be important for contributing to stabilization (cf. Gibb & Coles, 2005)occur prior to 6th grade. Moreover, past longitudinal research examining stability of competence, a conceptually related construct, has revealed increasing stability estimates during 6th–10th grades (cf. Cole et al., 2001). Thus, it was reasoned that early and middle adolescence would provide an optimal but initial examination of the study of stability of vulnerabilities among youths.

Procedures

Students participated in this study with active parental informed consent. Permission to conduct this investigation was provided by the school districts and their institutional review boards, the school principals, the individual classroom teachers, and the university institutional review board. Trained research personnel visited classrooms in the schools and briefly described the study to youths, and letters describing the study were sent home to parents. Specifically, students and parents were told that this study was about adolescent mood and experiences and that participation would require completion of questionnaires at four different times. Students who agreed to participate and returned active parental consent forms read and signed their own assent form after having the opportunity to ask any questions they had about the study. Youths completed a battery of questionnaires during class time and were debriefed at the end of the study. Participants completed questionnaires four times over a 5-month period, with approximately 5 weeks between each assessment. The study took place during a single academic year, and there was no obvious developmental transition (e.g., change of grade) for most youths. Youths were compensated $10 for their participation at each wave in the study, for a possible total of $40 for completing all four assessments.

There were two major theoretical reasons for choosing 5 weeks as the interval between follow-ups. First, most past prospective cognitive vulnerability–stress studies of depression among youths (e.g., Abela, 2001; Gibb & Alloy, 2006; Hankin, Abramson, & Siler, 2001, 2001) used a relatively short-term follow-up around 5 weeks. Thus, to evaluate predictive validity of cognitive vulnerabilities, 5-week follow-up intervals were chosen to be consistent with past research. Second, the use of 5-week intervals over multiple assessments enabled discrimination between dependability versus stability in traits over time (Cattell, Eber, & Tatsuoka, 1970; see Watson, 2004, for discussion). Specifically, Cattell et al. (1970) defined dependability of a construct as the test–retest correlation of the same measure in a relatively short time frame (less than 2 months), such that this short time lapse is likely to be insufficient for actual change to occur, whereas stability is a test–retest period longer than 2 months that enables a reasonable test of the amount of change possible in the underlying trait as opposed to the measure assessing the construct. Following this logic, any adjacent 5-week interval (e.g., from Time 1 to Time 2) qualifies as dependability and assesses test–retest of the vulnerability measure, whereas the longer interval (e.g., 5 months from Time 1 to Time 4) allows for evaluation of stability of the construct.

Measures

The three cognitive vulnerabilities were assessed with the following measures.

Adolescent Cognitive Style Questionnaire (ACSQ; Hankin & Abramson, 2002). The ACSQ measures inferences about cause, consequence, and self, as featured in hopelessness theory. The ACSQ presents the adolescent with negative hypothetical events in achievement and interpersonal domains and asks the youth to make inferences about the causes (internal–external, stable–unstable, and global–specific) and consequences of the event and the characteristics about the self based on the hypothetical event. Each item dimension is rated from 1 to 7. Average item scores on the ACSQ range from 1 to 7, with higher scores indicating a more negative cognitive style. The ACSQ has demonstrated excellent internal consistency reliability, good test–retest reliability, and a factor structure consistent with hopelessness theory, as a measure of hopelessness theory's cognitive vulnerability to depression among adolescents (Hankin & Abramson, 2002). Internal reliability in this sample was $\alpha = .95$ at Time 1.

Children's Dysfunctional Attitudes Scale (CDAS; Lewinsohn, Joiner, & Rohde, 2001). The CDAS is a nine-item scale adapted from the adult version of the Dysfunctional Attitudes Scale (Weissman & Beck, 1978). The CDAS assesses adolescents' propensity to endorse dysfunctional attitudes, the cognitive vulnerability emphasized in Beck's theory. Andrews, Lewinsohn, Hops, and Roberts (1993) reported that the nine items in the CDAS loaded most highly onto a general dysfunctional attitudes factor, and these nine items correlated highly with a full version of the Dysfunctional Attitudes Scale. Moderate test–retest reliability and good validity were reported (Lewinsohn et al., 2001). Adolescents rated the items on a 5-point Likert scale, with higher scores indicating greater levels of dysfunctional attitudes. Internal reliability in this sample was $\alpha = .70$ at Time 1.

Children's Response Styles Questionnaire (CRSQ; Abela, Vanderbilt, & Rochon, 2004). The Ruminative Response subscale from the overall CRSQ was used in this study to assess rumination. It includes 10 items describing responses to depressed mood that are self-focused (e.g., "Think about how alone you feel"). For each item, adolescents use a 1–5 Likert scale to rate how often they respond in this way when they are feeling sad. Higher scores indicate a greater tendency for youths to focus on negative self-meaning and implications as a response tendency when feeling sad or depressed. Past research with the CRSQ indicated good validity and moderate internal consistency (Abela et al., 2004). Internal reliability for the Ruminative Response subscale in this sample was $\alpha = .80$ at Time 1.

Children's Depression Inventory (CDI; Kovacs, 1985). The CDI is a 27-item self-report measure that assesses depression in children and adolescents. Each item is rated on a scale from 0 to 2. Reported scores are means of all items. Higher scores indicate more depression. The CDI has been shown to have good validity as a measure of depression in youths (Klein, Dougherty, & Olino, 2005). Internal reliability for this sample was $\alpha = .90$ at Time 1.

The CDI was also included as a benchmark (Watson, 2004) against which continuity for cognitive vulnerabilities could be compared. The stability of the CDI has been demonstrated (e.g., Tram & Cole, 2006), such that mean test–retest correlations among youths are strong (r = .70). Given known stability estimates, the stability of the CDI in this sample can be compared to the stability estimates observed in cognitive vulnerabilities to inform the interpretation of results.

Results

Preliminary Analyses

Table 1 shows the descriptive statistics and the intercorrelations (with pairwise deletion used to include all available data for individuals for each variable) among the three cognitive vulnerabilities and the depressive symptoms for the four assessment times. As seen in Table 1, depressive symptoms were associated with the cognitive vulnerabilities within and across each of the four waves of data, although the magnitude of these correlations varied depending on the vulnerability examined. The average correlations between depressive symptoms and cognitive vulnerabilities across all occasions were .50, .27, and .43 for a negative cognitive style, dysfunctional attitudes, and rumination, respectively. These are consistent with previously published findings.

Also, structural stability analyses (Biesanz et al., 2003) were conducted to evaluate whether the structures of cognitive vulnerabilities and depressive symptoms were relatively equivalent in early compared with middle adolescents, as an initial examination of whether developmental influences contributed to any instability in cognitive vulnerabilities or depression over time. Structural equation modeling (AMOS 6.0; Arbuckle, 2006) was used to compare the fit of two models. Full information maximum likelihood (Arbuckle, 2006) was used to handle the missing data in all structural equation modeling analyses. In the first model, the correlations among the different assessments of each construct were freely estimated in each age group (early adolescents = ages 11–14, n = 126; middle adolescents = ages 15–17, n = 224), and the second model constrained these covariances at different measurement waves to be equivalent across age groups. Chi-square difference tests revealed no significant differences between the two models for any of the cognitive vulnerabilities and CDI, thus providing initial support for invariance across age groups, although caution is needed in interpreting these results given the relatively small sample sizes for subgroups.

Overview of Analyses

The main question addressed in this study includes evaluating the degree of stability in cognitive vulnerabilities across time among youths. Two types of stability, mean-level and differential stability, were evaluated. Mean-level stability shows whether there are changes in cognitive vulnerabilities on average across time. Hierarchical linear modeling (HLM) was used to address this aspect of stability. Differential stability shows the test–retest correlational pattern in cognitive vulnerabilities across time and the underlying processes (i.e., enduring, traitlike forces or autoregressive/contextual dynamics) that organize the pattern of correlations over time. Structural equation modeling was used to examine differential stability. Finally, these types of stability (mean level examined with HLM and differential examined with structural equation modeling) were evaluated for the sample as a whole (6th–10th graders) and for different age groups (early and middle adolescents).

Mean-Level Stability

HLM (Bryk & Raudenbush, 1992; Raudenbush, 2000) was used to investigate mean-level stability in cognitive vulnerabilities and

Table 1
Descriptive Statistics and Intercorrelations Among Cognitive Vulnerabilities and Depressive Symptoms Over Time

Scale and wave	ACSQ1	ACSQ2	ACSQ3	ACSQ4	CDAS1	CDAS2	CDAS3	CDAS4	CRSQ1	CRSQ2	CRSQ3	CRSQ4	CDI1	CDI2	CDI3	CDI4
ACSQ1	—															
ACSQ2	.53	—														
ACSQ3	.57	.61	—													
ACSQ4	.41	.43	.57	—												
CDAS1	.23	.17	.16	.11	—											
CDAS2	.16	.28	.11	.13	.32	—										
CDAS3	.23	.20	.23	.30	.16	.35	—									
CDAS4	.34	.36	.39	.52	.22	.32	.20	—								
CRSQ1	.11	.12	.07	.12	.22	.23	.12	.16	—							
CRSQ2	.26	.34	.24	.19	.36	.46	.32	.21	.33	—						
CRSQ3	.28	.32	.44	.30	.16	.35	.35	.27	.20	.32	—					
CRSQ4	.42	.47	.52	.56	.09	.16	.17	.44	.16	.28	.42	—				
CDI1	.42	.49	.49	.64	.26	.35	.11	.42	.28	.39	.38	.60	—			
CDI2	.42	.64	.50	.52	.23	.42	.10	.42	.22	.46	.46	.64	.73	—		
CDI3	.40	.45	.68	.51	.19	.26	.11	.40	.17	.33	.63	.63	.69	.69	—	
CDI4	.33	.40	.46	.64	.17	.23	.10	.48	.23	.27	.43	.77	.68	.68	.70	—
M	3.17	3.04	2.96	3.22	24.40	22.41	25.64	24.79	14.00	14.40	15.42	11.00	13.07	12.05	12.26	15.17
SD	1.12	0.83	0.86	0.80	5.79	4.98	5.15	4.46	5.88	5.15	5.18	5.37	8.69	9.18	9.27	12.94

Note. rs > .11, p < .05; rs > .15, p < .01; rs > .18, p < .001. Pairwise deletion was used to vary Ns at different waves (N = 350 at Wave 1, N = 303 at Wave 2, N = 308 at Wave 3, N = 345 at Wave 4). ACSQ = Adolescent Cognitive Style Questionnaire; CDAS = Children's Dysfunctional Attitudes Scale; CRSQ = Children's Response Styles Questionnaire; CDI = Children's Depression Inventory; 1–4 = Waves 1–4.

depressive symptoms over time for the sample in general. At Level 1, a regression equation was constructed to model separately the variation in the repeated measure (e.g., cognitive vulnerabilities) as a function of time (i.e., the four waves of data). Age was included at Level 2 to provide accurate estimates for the growth model parameters given heterogeneity in ages at baseline, because simply using measurement wave, without including age as a predictor in the growth models, provides incorrect parameter estimates (Mehta & West, 2000). The program used for the present analyses, HLM 5.04 (Raudenbush, Bryk, Cheong, & Congdon, 2001), assumes that a youth's completed reporting of levels of vulnerabilities are representative of the particular participant's modal trajectory. As such, participants with missing data were not eliminated from the data set because their available data points were used to estimate the individual-level parameters at Level 1 (i.e., intercepts and slopes).

Results from these HLM analyses (intercept and linear slope plus random error) for the whole sample for cognitive vulnerabilities show that youths did not significantly change in their average levels for negative cognitive style, although there was mean-level change for dysfunctional attitudes and rumination over time. Specifically, for negative cognitive style, youths' average level (intercept) was −0.57, with a variance of 0.027 ($p < .001$). Slope was 0.001 (SE = 0.005), $t(348) = 0.36$, *ns*, with a variance of 0.02 ($p < .001$). Age significantly affected intercept ($b = 0.09$, SE = 0.006), $t(348) = 15.23$, $p < .001$, but did not affect slope (b = −0.05), $t(348) = -0.68$. For dysfunctional attitudes, intercept was 24.35, with a variance of 9.36 ($p < .001$). Slope was −16.07 (SE = 3.36), $t(348) = -4.77$, $p < .001$, with a variance of 3.77, *ns*. Age significantly affected slope ($b = 1.2$, SE = 0.23), $t(348)$ = 5.26, $p < .001$, but did not affect intercept ($b = -0.05$), $t(348)$ = −0.25. For rumination, intercept was 25.23, with a variance of 10.77 ($p < .001$). Slope was −35.22 (SE = 3.46), $t(348)$ = −10.16, $p < .001$, with a variance of 1.49, *ns*. Age significantly affected intercept ($b = -0.71$, SE = 0.19), $t(348) = -3.65$, $p <$ .001, and affected slope ($b = 2.26$, SE = 0.23), $t(348) = 9.69$. As shown in Table 1, the means for rumination were generally stable from Times 1 through 3, but Time 4 appears to have driven the significant mean decline, whereas the change in increasing mean levels of dysfunctional attitudes seems to have been largely confined to Times 2 and 3. Thus, on average, over time, and after including age effects, youths' dysfunctional attitudes scores became more elevated, rumination scores decreased, and no change was observed for negative cognitive style.

In addition, these HLM analyses were reconducted among the subsamples of early adolescents and middle adolescents for dysfunctional attitudes and rumination to further explore the significant age effects. Age group (early = 1, middle = 2) was included as a Level 2 effect in HLM with these cognitive vulnerabilities at Level 1. For rumination, results showed that early adolescents' rumination levels decreased significantly over time (slope = −2.25, SE = 0.22), $t(124) = -10.27$, $p < .001$, whereas middle adolescents' levels were stable (slope = 0.02), $t(222) = 0.15$, *ns*. For dysfunctional attitudes, early adolescents' dysfunctional attitude levels did not change over time (slope = −0.29, SE = 0.22), $t(124) = -1.32$, *ns*, whereas middle adolescents' levels became more elevated over time (slope = 0.85, SE = 0.12), $t(222) = 6.68$, $p < .001$.[2] Thus, on average, early adolescents showed decreases in rumination, whereas middle adolescents exhibited increases in dysfunctional attitudes over time.

Finally, to provide a benchmark with which to interpret these mean-level changes, HLM analyses were conducted for CDI. Youths' overall depressive symptoms did not exhibit significant mean-level change over time: The intercept was −0.24 (SE = 0.12, $p = .05$), with a variance of 0.054 ($p < .001$); the slope was −0.06 (SE = 0.16), $t(348) = -0.39$, with a variance of 0.032 ($p <$ .001). Age significantly affected average intercept for CDI (b = 0.047, SE = 0.009, $p < .001$) but not slope ($b = 0.009$), such that older youths exhibited higher CDI scores compared with younger youths at baseline as expected.

Differential (Rank-Order) Stability

To assess the structure and organization of these cognitive vulnerabilities, as well as depressive symptoms as benchmarks, the pattern of empirical test–retest correlations, as shown in Table 1, was compared against those predicted by both trait and contextual models of personality structure (Fraley & Roberts, 2005; Hankin et al., 2005, with young adults). Overall, the test–retest correlations were relatively small to moderate for all cognitive vulnerabilities and were strong for CDI. Specifically, for negative cognitive style, correlations ranged from .61 to .41 (mean test–retest r = .52), for dysfunctional attitudes the correlations ranged from .35 to .16 (mean test–retest r = .26), and for rumination the correlations ranged from .42 to .16 (mean test–retest r = .28). The correlations ranged from.68 to .73 (mean test–retest r = .70) for CDI.

To evaluate formally the process contributing to these test–retest correlations, the fit of a model incorporating both trait and contextual components was compared with the empirical data. The aspect of the overall model with respect to trait paths assumes that the pattern of correlations among cognitive vulnerabilities can be explained by a latent variable (i.e., a common factor) that contributes to variation in cognitive vulnerabilities across time and circumstance. The trait component of the model predicts that the correlation between measures of the same construct should be relatively invariant across time. For example, the correlation for a negative cognitive style between Time 1 and Time 2 should be nearly identical to the correlation between Time 1 and Time 4, ignoring stochastic processes. In contrast, the component of the contextual model assumes that various statistical factors operate to influence or reorganize the nature of these cognitive vulnerabilities over time. As such, the test–retest stability observed from one assessment time to the next reflects an autoregressive process, such that the test–retest correlation between any two assessment times will become smaller as the temporal interval between those time periods becomes larger.

Structural equation modeling was used to capture these casual mechanisms (i.e., trait and contextual processes). The paths leading from the latent trait to the manifest cognitive vulnerabilities were freely estimated but constrained to be identical across the four assessment times, whereas autoregressive paths (the variable at Time k has a direct effect on the variable at Time $k + 1$) were used to capture the dynamics assumed by the contextual component. The autoregressive paths were also constrained to be equal

[2] For the average scores for each age subgroup at each assessment time, please contact Benjamin L. Hankin for details.

across time. Finally, restricted versions (i.e., trait and contextual models only) of this overall model were fitted and compared against the full model to examine whether both trait and contextual processes were required to capture the dynamics underlying the pattern of test–retest correlations over time.

First, as shown in Table 2, several of the full models fit the data relatively well. Comparative fit index values above .90 and root mean square error of approximation values less than .05 represent an excellent fit, whereas root mean square error of approximation values between .05 and .08 suggest an adequate fit to data (Browne & Cudeck, 1993). Hu and Bentler (1999) suggested that comparative fit index and normed fit index values above .95 as well as standardized root mean square residual values less than .08 indicate excellent fit, and combining the fit statistics of comparative fit index values greater than .95 and standardized root mean square residual values less than .09 indicates excellent fit when evaluating model fit. With these various suggested criteria for model fit, all fit indices were above conventional criteria for a negative cognitive style and rumination, whereas dysfunctional attitudes and CDI models had reasonably adequate but somewhat less acceptable fits because not all fit indices were within accepted standard criteria for good fit. Table 2 also shows the standardized coefficients for the trait and contextual paths for the sample overall. The trait paths were all significant and estimated to be .81 for ACSQ, .42 for CDAS, .41 for CRSQ, and .74 for CDI, whereas the contextual paths were not significant and were much smaller: .03 for ACSQ, .04 for CDAS, .17 for CRSQ, and .11 for CDI.[3] Asterisks in Table 2 indicate that the paths (trait or contextual) were significantly different from 0. Second, Table 2 also shows fit statistics and estimates for restricted models for trait-only and contextual-only influences. Chi-square difference tests indicated that the trait-only models fit as well as the full models for the ACSQ, CDAS, and CDI, whereas the restricted trait model for the CRSQ fit significantly worse, $\Delta\chi^2(1, N = 350) = 13.1, p < .001$. The contextual-only path models for all cognitive vulnerabilities fit significantly worse than the full models for these constructs: ACSQ, $\Delta\chi^2(1, N = 350) = 33.13, p < .001$; CDAS, $\Delta\chi^2(1, N = 350) = 25.4, p < .001$; CRSQ, $\Delta\chi^2(1, N = 350) = 15.9, p < .001$; and CDI, $\Delta\chi^2(1, N = 350) = 103.6, p < .001$.

In summary, the trait paths from the full model were significant and moderate to large in size, whereas the contextual paths were not significant and were small. Also, the restricted trait models fit as well the full models for all cognitive vulnerabilities except rumination, whereas the restricted contextual models did not. Taken together, this evidence suggests that enduring forces organize the pattern of test–retest correlations over time for most of the cognitive vulnerabilities as well as depressive symptoms.

In addition to examining the sample as a whole, the full models were fit to the early adolescent and middle adolescent subsamples to examine potential age effects for trait and contextual influences. As seen in Table 2, the full models fit well for all cognitive vulnerabilities in early adolescents (but not for depressive symptoms), and fit statistics in middle adolescent models were good for negative cognitive style, acceptable for rumination and depressive symptoms (except for root mean square error of approximation), and poor for dysfunctional attitudes. Finally, only trait influences were significant in any of the cognitive vulnerabilities and depressive symptoms among middle adolescents, and only trait influences were significant for negative cognitive style and depressive symptoms among early adolescents. For rumination and dysfunctional attitudes, neither trait nor contextual forces were significant among early adolescents.

Discussion

Interest in the developmental origins of depression vulnerabilities has increased in recent years (e.g., Abela & Hankin, 2008; Ingram, 2003). To understand how potential developmental antecedents (e.g., genetics, adverse childhood events, parental modeling, attachment, learning, emotion regulation, etc.) influence formation of depression vulnerabilities, it is important first to elucidate the patterning of different depression vulnerabilities and whether they have stabilized into enduring factors. Along these lines, the present study examined the degree of continuity and change in measures of cognitive vulnerabilities to depression among early and middle adolescents in a relatively short-term four-wave longitudinal study. Overall, the findings suggest that these cognitive vulnerabilities mostly exhibited enduring properties in that they appear to have largely stabilized in the age range of this investigation (6th–10th grade). However, there was clearly change alongside continuity, which depended on the type of stability metric used and the form of cognitive vulnerability examined. Developmentally oriented social/personality psychologists have noted that stability and change coexist (Caspi et al., 2005), and the present findings are consistent with this perspective. The degree of stability and change for each form of cognitive vulnerability is discussed first, and then broader issues and implications are considered.

Degree of Stability for Cognitive Vulnerabilities

Of the three cognitive vulnerabilities examined, a negative cognitive style exhibited the greatest degree of stability across the different ways of examining stability over time. First, mean-level stability was observed for the sample overall and for the early and middle adolescent groups. The absolute magnitude of test–retest correlations was moderately high. Finally, enduring processes in the trait model fit the data best for the sample overall and for both the early and middle adolescent groups; the autoregressive components of the overall model were not significant, and the restricted contextual model did not fit well.

Dysfunctional attitudes exhibited mean-level stability for the early adolescent group only, whereas the overall sample and the middle adolescent group revealed significant mean-level change in the form of increasingly more dysfunctional attitudes over time. Moreover, a closer inspection of the mean scores at each time reveals some mean-level instability, such that scores decreased from Time 1 to Time 2, then increased from Time 2 to Time 3, and then slightly dropped from Time 3 to Time 4. Potential reasons for this unexpected up-and-down pattern are discussed later. The average absolute magnitude of test–retest correlations was fairly small. Finally, traitlike component processes were significant in

[3] Similar structural equation modeling was conducted for the negative inferences for the Cause, Self, and Consequences subscales of the ACSQ. Consistent with results for the overall ACSQ, the overall models fit well, and only trait influences, but not contextual processes, were significant for the subscales. Contact Benjamin L. Hankin for additional details.

Table 2
Structural Equation Modeling Results Examining Trait and Contextual Processes Underlying the Test–Retest Pattern of Correlations for Cognitive Vulnerabilities to Depression and Depressive Symptoms Over Time

Model tested	Negative cognitive style	Dysfunctional attitudes	Rumination	CDI
Full model				
RMSEA	.04	.08	.01	.18
CFI	.99	.90	.99	.95
NFI	.99	.89	.94	.98
SRMR	.01	.03	.01	.05
χ^2 (*df*)	5.96 (3)	10.99 (3)	3.1 (3)	42 (3)
β for trait process	$.81^{***}$	$.42^{***}$	$.41^{***}$	$.74^{***}$
β for contextual process	.03	.04	.17	.11
Trait process restricted model				
RMSEA	.03	.07	.09	.16
CFI	.99	.93	.92	.95
NFI	.96	.86	.88	.96
SRMR	.03	.04	.03	.10
χ^2 (*df*)	6.0 (4)	12.1 (4)	16.2 (4)	44.9 (4)
β	$.82^{***}$	$.45^{***}$	$.54^{***}$	$.82^{***}$
Contextual process restricted model				
RMSEA	.12	.13	.09	.27
CFI	.85	.57	.91	.84
NFI	.77	.10	.44	.84
SRMR	.14	.10	.10	.15
χ^2 (*df*)	39.3 (5)	36.4 (5)	19.0 (5)	145.6 (5)
β	$.67^{***}$	.20	$.35^{**}$	$.71^{***}$
Early adolescent—full model				
RMSEA	.06	.00	.00	.21
CFI	.99	1.00	1.00	.94
NFI	.98	.92	.99	.90
SRMR	.07	.05	.01	.20
χ^2 (*df*)	4.7 (3)	1.4 (3)	2.3 (3)	20.9 (3)
β for trait process	$.71^{***}$	.37	.29	$.85^{***}$
β for contextual process	.02	.15	.30	.01
Middle adolescent—full model				
RMSEA	.04	.22	.09	.18
CFI	.99	.86	.95	.96
NFI	.98	.86	.96	.98
SRMR	.01	.04	.07	.05
χ^2 (*df*)	3.9 (3)	36.8 (3)	9.3 (3)	26.1 (3)
β for trait process	$.61^{***}$	$.48^{***}$	$.55^{***}$	$.71^{***}$
β for contextual process	.15	.06	.04	.14

Note. *N* for the overall sample was 350; *N* for the early adolescent subsample was 126; *N* for the middle adolescent subsample was 224. A CFI value greater than .90 and an RMSEA value less than .05 indicate excellent fit, whereas RMSEA values between .05 and .08 indicate adequate fit (Browne & Cudeck, 1993). Hu and Bentler (1999) suggested a CFI value and an NFI value greater than .95 and an SRMR value less than .08 for good fit. Combining a CFI value greater than .95 and an SRMR value less than .09 indicates excellent fit when evaluating models (Hu & Bentler, 1999). RMSEA = root mean square error of approximation; CFI = comparative fit index; NFI = normed fit index; SRMR = standardized root mean square residual; CDI = Children's Depression Inventory.
$^{**}p < .01$. $^{***}p < .001$.

the full model for the sample overall and for the middle adolescent group (but not for early adolescents), and the fit for the full model was acceptable, whereas the middle adolescent model had poor fit. The autoregressive components of the overall model were not significant, and the restricted contextual model did not fit well.

A ruminative response style exhibited mean-level stability for the middle adolescent group only, whereas the overall sample and the early adolescent group revealed significant mean-level change in the form of decreasing rumination over time. The decreasing average level of rumination over time seems to be driven largely by a large drop in Time 4 scores compared with those at Times 1–3. The absolute magnitude of test–retest correlations was also fairly small. Finally, the full model fit the data well, and only enduring processes, not contextual influences, were significant in the full model for the sample overall and for the middle adolescent group (but not for early adolescents). However, the restricted trait-process-only model exhibited only acceptable fit, and this model fit significantly worse than the full model with both trait and autoregressive processes. The autoregressive components of the overall model were not significant, and the restricted contextual model did not fit well. This suggests that considering only traitlike processes does not capture the dynamics that structure the test–retest correlations in rumination over time. Indeed, the autoregressive processes in the contextual-only restricted model were significant, although this restricted contextual model did not fit the data well. Thus, some combination of enduring and contextual processes, as well as the potential unreliability of the measure (see later discussion), may best explain the dynamics underlying the test–retest correlations.

The unexpected set of mean-level stability results for dysfunctional attitudes and rumination, especially when compared with the substantially higher stability estimates for a negative cognitive style and depressive symptoms, are difficult to explain from a straightforward developmental theoretical perspective. There is little developmental rationale to expect that rumination levels would significantly decrease at one assessment time or that dysfunctional attitudes would exhibit an up-and-down pattern over time without meaningful developmental transitions (e.g., school change), and there was no obvious developmental transition for youths in this 5-month prospective study during the school year. It is unclear whether these results for rumination and dysfunctional attitudes reflect lack of mean-level stability, measurement problems for the questionnaires, or some combination. The measures (CDAS and CRSQ) used in this study have been used in prior research and have demonstrated reasonable reliability and validity (Abela et al., 2002; Lewinsohn et al., 2001). Still, continued future psychometric research is needed to examine the structure, reliability, and validity of various methods for assessing rumination and dysfunctional attitudes among youths (Abela & Hankin, 2008). Replication with psychometrically sound assessments of dysfunctional attitudes and rumination will be important for understanding the degree of stability in cognitive vulnerabilities to depression, because a negative cognitive style, along with depressive symptoms as a benchmark, exhibited enhanced stability relative to dysfunctional attitudes and rumination. The measure of a negative cognitive style used in this study (the ACSQ) has demonstrated excellent reliability, factor structure consistent with theory, and good validity (Hankin & Abramson, 2002). Thus, from the present study, it is unclear whether the findings showing good stability for negative cognitive style and inconsistent stability for dysfunctional attitudes and rumination reflects measurement issues, the actual degree of continuity in these constructs, or both.

Additionally, the degree of stability seen in depressive symptoms over time provides a benchmark against which the differential continuity in cognitive vulnerabilities to depression can be interpreted and compared (Watson, 2004). The magnitude of the average test–retest correlations across time was reasonably large for a negative cognitive style ($r = .52$) and was fairly small for dysfunctional attitudes ($r = .26$) and rumination ($r = .28$), but it was much higher for depressive symptoms ($r = .70$; see also Tram & Cole, 2006). Despite the small-to-moderate absolute magnitude of the correlations, the structural equation modeling results also demonstrated an enduring organization to the pattern of correlations that is consistent with a stable, traitlike structure. The absolute magnitude of correlations (either high or low) cannot be used to demonstrate the processes (trait or contextual) that contribute to the pattern of test–retest correlations across time (cf. Fraley & Roberts, 2005). As a result, the relatively small-to-moderate correlations, by themselves, cannot determine which processes organize these dynamics over time.

It is instructive to compare the present study's results to other multiwave research of cognitive vulnerability to depression among adults (theoretically, these vulnerabilities are expected to have stabilized in adults). For example, the average test–retest correlation for negative inferences made to daily stressors over 35 days was relatively modest ($r = .38$), and structural equation modeling revealed that a trait model with enduring processes best organized the pattern of correlations over time (Hankin et al., 2005). The available research from adults (Hankin et al., 2005; Zuroff et al., 1999) and the present study with youths suggest that there is an enduring, within-person structure that organizes the pattern of correlations over time, yet the absolute magnitude of these correlations is relatively modest and not as strong as those seen in depressive symptoms or temperamental traits (DeFruyt et al., 2006). The relatively modest test–retest correlations suggest that there are other forces, likely dynamic and transactional, in addition to the enduring, relatively traitlike processes that contribute to the test–retest correlational pattern in cognitive vulnerabilities to depression over time.

Theoretical and Clinical Implications

On a theoretical level, there has been substantial interest among developmental psychopathologists seeking to understand when cognitive vulnerabilities to depression emerge and stabilize. *Emergence* refers to when a vulnerability begins to predict later increases in depression, whereas *stabilization* refers to the structure and organization of the vulnerability over time. Cognitive vulnerabilities to depression can emerge and stabilize at different developmental periods. Most research examining development of cognitive vulnerabilities to depression has focused on when these risks emerge, not when they stabilize. The present study extends knowledge by demonstrating the degree of stability and change in cognitive vulnerabilities and showing that an enduring structure organizes the pattern for different vulnerabilities.

Still, it is important to emphasize that stability coexists alongside change. Vital to advancing knowledge is examining mechanisms that contribute both to stability and to change over time. Various processes have been suggested and empirically supported, including genetic influences (Lau, Rijsdijk, & Eley, 2006), temperament (Hankin & Abramson, 2001), negative life events (Gibb & Alloy, 2006), and depressive symptoms (Gibb & Alloy, 2006; Hankin, Wetter, Cheely, & Oppenheimer, in press). Indeed, there are likely gene–environment correlations, including active and evocative processes, that transact over time (Hankin & Abramson, 2001) to contribute to the pattern of test–retest correlations observed in cognitive vulnerabilities. For example, a negative attributional style (Gibb & Alloy, 2006) and dysfunctional attitudes (Hankin et al., in press) both interact with stressors to predict later depressive symptoms, and changes in these cognitive vulnerabilities were predicted by initial depressive symptoms and stressors.

Of interest, the magnitude of test–retest correlations was higher for depressive symptoms (average $r = .70$) than for any of the cognitive vulnerability stability estimates. This raises the interesting questions of why the average test–retest stability estimates would be higher for depressive symptoms than for cognitive vulnerabilities, and how cognitive vulnerabilities (e.g., rumination with mean test–retest $r = .26$) might function as a traitlike vulnerability factor for later depressive symptoms, which exhibited greater differential stability. Clearly, additional research and theory are needed to address the implications of these findings. It may be that there is an enduring structure that organizes the low-to-moderate test–retest reliabilities in cognitive vulnerabilities and that depressive symptoms can influence change in level of cognitive vulnerabilities over time (cf. Gibb & Alloy, 2006; Hankin et al., in press), while cognitive vulnerabilities also interact with stressors to predict prospective elevations in depressive symptoms. Taken together, a dynamic, transactional, developmental psychopathological model may best account for the emergence and stabilization of cognitive vulnerabilities of depression as well as the stability and prediction of depressive symptoms across time.

Studying the emergence and stabilization of cognitive vulnerabilities can inform translational research to treat and prevent depression. An interesting question that arises is, When is an optimal time for clinical interventions? Given the recurrence of depression (Rutter et al., 2006), preventing depression prior to first onset is a priority. Still, it is unclear when preventive interventions should be initiated. There are at least two optimal times. First, preventions could be started before the surge in depression rates during middle adolescence (ages 15–18; Hankin et al., 1998), but as the present results suggest, some cognitive vulnerabilities may have already stabilized into enduring risks to depression by this time, so it may be more difficult to prevent depression at this developmental period. Second, preventions could be initiated before the vulnerabilities begin to stabilize into enduring factors, yet prevention efforts would have to be started in late childhood, and this is many years before the rates of depression rise. The persistence of depression preventions is not well known, so implementing interventions at this developmental period may be too early.

Strengths, Limitations, and Future Directions

Strengths of the present work include the following: (a) a multiwave, prospective design that enabled a rigorous examination of the processes and various types of stability among cognitive vulnerabilities; (b) examination of various prominent cognitive vulnerabilities; (c) use of depressive symptoms as a benchmark to interpret stability of cognitive vulnerabilities; and (d) investigation of stability among different age groups to explore potential developmental effects at a time when vulnerabilities to depression have been hypothesized to emerge and stabilize and when the rates of depression are rising. A primary limitation includes the use of only youths' self-report measures of cognitive vulnerabilities and depressive symptoms. Future research should replicate and extend these findings with parent and child reports of depressive symptoms and other methods to assess cognitive vulnerabilities (e.g., information-processing tasks).

Given that the present work suggests that cognitive vulnerabilities have stabilized to some extent by early adolescence, future research can examine stability with earlier ages to pinpoint more precisely the age when these vulnerabilities begin to stabilize. Such research can use a multiwave design with longer time intervals between follow-ups and can plan to cover developmental transitions (e.g., change of schools, puberty) to examine continuity and change at different developmental periods. Finally, it will be interesting to explore developmental antecedents and processes that may contribute to the stabilization of these cognitive vulnerabilities (Abela & Hankin, 2008).

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