Cognitive inflexibility and suicidal ideation: Mediating role of brooding and hopelessness

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ABSTRACT

Previous research suggests that cognitive inflexibility prospectively increases vulnerability to suicidal ideation, but the specific cognitive factors that may explain the relation have not been examined empirically. The present study examined the brooding subtype of rumination and hopelessness as potential mediators of the prospective relation between cognitive inflexibility and suicidal ideation. Fifty-six young adults who completed a measure of cognitive inflexibility and suicidal ideation at baseline were followed up 2–3 years later and completed measures of brooding, hopelessness, and suicidal ideation. Cognitive inflexibility at baseline predicted suicidal ideation at follow up, adjusting for baseline ideation. This relation was mediated by brooding but not by hopelessness. However, there was an indirect relation between perseverative errors and suicidal ideation through brooding, followed by hopelessness, such that brooding was associated with greater hopelessness and hopelessness, in turn, was associated with greater suicidal ideation. Cognitive inflexibility may increase vulnerability to suicidal thinking because it is associated with greater brooding rumination, while brooding, in turn, is associated with hopelessness.

1. Introduction

Emerging adults, or young adults between ages 18 and 29 (Arnett, 2000), have higher rates of suicidal thoughts, suicide planning, and suicide attempts in the United States than older adults (Centers for Disease Control and Prevention, 2011). Accordingly, recent research has focused on determining predictors of suicidal behavior in young adulthood. Various cognitive characteristics, such as ruminative thinking, hopelessness, and poor problem solving, have been identified as risk factors for suicidal ideation and attempts in emerging adults (Smith et al., 2006; Surrence et al., 2009; Sargalska et al., 2011; Linda et al., 2012). However, much of this research is cross-sectional, with few longitudinal studies (e.g., Smith et al., 2006) examining cognitive predictors of suicidal ideation and attempts in emerging adulthood.

Previous evidence suggests that young people may think about and engage in suicidal behavior because they have difficulty generating solutions to problems (Schotte and Clum, 1982; Schotte and Clum, 1982). Cognitive inflexibility is associated with maladaptive cognitions such as rumination (Davis and Nolen-Hoeksema, 2000) and has previously been found to predict increases in suicidal ideation at a 6-month follow up among individuals with a suicide attempt history (Miranda et al., 2012). The present longitudinal study sought to examine the mechanisms by which cognitive inflexibility might predict future suicidal ideation. Specifically, we examined levels of the brooding subtype of rumination and hopelessness as possible mediators of the prospective relation between cognitive inflexibility and suicidal ideation in a sample of emerging adults who were followed up over 2–3 years.

Cognitive inflexibility – defined as the inability to change decision-making in response to feedback from the environment (Lezak et al., 2012) – is associated with suicidal ideation and attempts, although evidence of this relation is mixed (see Jollant et al., 2011, for a review). For instance, one study of 25 depressed patients with current suicidal ideation and 28 depressed patients without suicidal ideation found that the patients with current suicidal ideation performed more poorly on tests of executive functioning, including those measuring cognitive flexibility, compared to the patients without suicidal ideation (Marzuk et al., 2005). Another study found that depressed patients with a history of a high-lethality suicide attempt exhibited more cognitive inflexibility as compared to both healthy controls and depressed patients with a history of a low-lethality attempt (McGirr et al., 2013).
2. Method

2.1. Participants

Fifty-six young adults (45 females), aged 18–22 (M = 18.4, S.D. = 0.1) recruited from a public university in the northeastern United States took part in this study for monetary compensation. Participants were recruited from a group of 96 individuals who took part in a study examining cognitive and emotional risk factors for suicidal behavior, including rumination (Surrence et al., 2009), problem-solving (Linda et al., 2012), and emotion dysregulation (see Rajappa et al., 2012). A subsample of these 96 individuals (n = 45) also took part in a 6-month follow-up study that examined cognitive inflexibility as a prospective predictor of suicidal ideation (Miranda et al., 2012). Individuals were selected based on their self-reported history of suicidal ideation and attempts. Efforts were made to recruit an approximately equal number of individuals with and without a suicide attempt history at baseline, and 37 out of the 96 individuals had reported a lifetime history of a suicide attempt (see Rajappa et al., 2012; Surrence et al., 2009, for details). Participants from the original study were contacted 2–3 years after participation for the present study (see Polanco-Roman and Miranda, 2013). The racial/ethnic composition of the present sample was 36% Asian, 23% White, 20% Hispanic, 9% Black, and 13% of other ethnicities. Twenty-five individuals who took part in the follow up had previously endorsed a suicide attempt history, and of these, 22 reported a suicide attempt history at the time of the study. There were no sex or racial/ethnic differences between individuals who did and did not take part in the follow-up study. However, individuals who participated in the follow up were younger, t(42.6) = 2.94, p < 0.01, and had higher levels of hopelessness, t(94) = 2.17, p < 0.05, and suicidal ideation, t(71.7) = 2.68, p < 0.05, than did those who did not take part (see Table 1).

2.2. Measures

2.2.1. Cognitive inflexibility

The computerized version of the Wisconsin Card Sorting Test (WCST; Heaton et al., 1993) was used to assess cognitive inflexibility at baseline. The task is designed to test abstract reasoning and the ability to shift cognitive strategies when presented with changes in sorting rules. Participants are asked to match a target card to one of four key cards by number, shape, or color. However, rather than being provided with the sorting rule, participants must infer the rule based on feedback that they receive (i.e., whether their response was correct or incorrect). After a predetermined number of successful matches, the card sorting rule changes and participants must change their strategy accordingly in order to

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was 0.96 at baseline and 0.98 at follow up. Scores from the 56 participants ranged from 0 to 14 at baseline (in the present sample, the scores ranged from 0 to 14 at baseline (ranging from 0 to 38) are computed by summing items 1–19. In the wish to die, suicidal plans, and access to means during the previous week. Total
scores (ranging from 0 to 38) are computed by summing items 1–19. In the wish to die, suicidal plans, and access to means during the previous week. Total
self-report measure that assesses passive and active suicidal ideation, including

2.2.4. Suicidal ideation

The Beck Scale for Suicide Ideation (BSS; Beck and Steer, 1991) is a 21-item
self-report measure that assesses passive and active suicidal ideation, including
wish to die, suicidal plans, and access to means during the previous week. Total
scores ranging from 0 to 38) are computed by summing items 1–19. In the present
sample, the scores ranged from 0 to 14 at baseline (M = 1.7, S.D. = 3.4) and
0 to 12 at follow up (M = 1.3, S.D. = 3.0). Cronbach’s alpha in the present sample was
0.96 at baseline and 0.98 at follow up.

2.2.5. History of self-harm

History of self-harm, including suicide attempts and non-suicidal self-injury, was
assessed at baseline using the Self-Harm Behavior Questionnaire (SHBQ; Gutierrez
et al., 2001). The SHBQ is designed for use with young adults from a non-clinical
population. It inquires about whether individuals have ever intentionally tried to hurt
themselves (“Have you ever hurt yourself on purpose?”) and whether they have ever
attempted to kill themselves (“Have you ever attempted suicide?”), including number of
previous attempts and the method of their most recent suicide attempt. In the
present sample, 22 individuals reported a suicide attempt history on the SHBQ, and
methods of the most recent attempt included ingestion (n = 9), cutting (n = 6), and
other methods (n = 7), including jumping, suffocation, and strangulation.

2.2.6. Depressive symptoms

Symptoms of depression were examined using the Patient Health Questionnaire-9 (PHQ; Spitzer et al., 1999), a 9-item self-report measure that
assesses symptoms, as experienced in the previous 2 weeks, consistent with a
diagnosis of Major Depressive Disorder, as per the Diagnostic and Statistical Manual
of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association,
1994). Each question is rated on a scale from 0 to 3, and a total score is computed by
summing the items. Item 9, which inquires about thoughts of self-harm, was
excluded from the total score because of its overlap with suicidal ideation. The PHQ-
9 was administered prior to the baseline assessment as part of the initial screening
of the 1011 individuals from which the present sample was selected, and it was
administered again at follow up. Scores on items 1–8 of the PHQ ranged from 0 to
4.9) at the initial assessment and from 0 to 17 (M = 6.8, S.D. = 4.0) at follow up, with Cronbach’s alpha 0.83 at baseline and 0.79 at follow up.

2.2.7. Mood or anxiety diagnosis

The presence of a mood or anxiety diagnosis was assessed using the young
adult version of the Computerized Diagnostic Interview Schedule for Children (C-
DISC; Shaffer et al., 2000). This structured interview is designed to be adminis-
tered by lay interviewers and uses a computer algorithm to yield diagnoses
consistent with the DSM-IV. In the present study, trained post-baccalaureate and
Masters-level interviewers administered the C-DISC, and the following diagnoses
were assessed with respect to the previous year: Major Depressive Disorder, Dysthymic Disorder, Mania, Hypomania, Social Phobia, and Generalized Anxiety
Disorder.

2.3. Procedure

Participants completed two assessments 2–3 years apart. Ninety-six indivi-
duals who had participated in an initial screening of 1011 college undergraduates
from an introductory psychology course took part in the present study 3–4 weeks after the initial screening, based on their endorsement of suicidal ideation, a suicide attempt history, or neither ideation nor an attempt. Participants completed the BHS, BSQ, and a computerized version of the WCST at baseline. Approximately 2–3 years later, the 96 participants were invited to participate in the present follow-up study. Fifty-six individuals were successfully recruited and completed self-report questionnaires assessing hopelessness, depressive symptoms, rumination, and suicidal ideation. After each session, research assistants completed a risk assessment procedure before debriefing participants. Individuals who reported a recent suicide attempt or current suicidal ideation were interviewed by a licensed clinical psychologist and referred for further assessment, if necessary. All participants were provided with a list of local treatment referrals at the conclusion of each session. Participants received $50 or research credit in their psychology class for taking part in the baseline study session and $25 for taking part in the follow-up study session. All procedures were given full board approval by an Institutional Review Board.

3. Results

3.1. Relation between Wisconsin card Sorting test scores and self-report measures

Zero-order correlations between subsccales of the WCST and primary study measures are shown in Table 2a. None of the WCST subscals was significantly associated with suicidal ideation. However, both number of categories completed (out of a possible total of six) and conceptual level responses at baseline were negatively correlated with brooding and hopelessness at follow up. We also computed partial correlations between WCST scales and brooding, hopelessness, and suicidal ideation at follow up, adjusting for baseline levels of each respective variable. As shown in Table 2b, number of perseverative errors on the WCST was significantly and positively associated with suicidal ideation, while categories completed and conceptual responses were significantly and negatively associated with brooding, hopelessness, and suicidal ideation. We should note that when examining whether there were differences on WCST scales between participants with versus without a history of a suicide attempt, there was only a difference on the WCST Learning to Learn score, which was significantly higher among individuals without a suicide attempt history (M = 1.3, S.D. = 4.3), compared to individuals with a suicide attempt history (M = 0.9, S.D. = 2.3), t(48) = 2.04, p < 0.05.

3.2. Examining brooding rumination and hopelessness as mediators

We hypothesized that cognitive inflexibility, measured at baseline, would predict suicidal ideation at follow up, and that both brooding rumination and hopelessness (also measured at follow up) would mediate this prospective relation. Examination of scatterplots did not suggest a curvilinear relation between the predictors of interest and suicidal ideation. When there is an approximately linear relation between variables, an ordinary least squares regression coefficient will yield an unbiased estimate of the population value (Fox, 1997). However, to address potential bias in our significance testing due to non-normality of the distribution of suicidal ideation scores, we used bootstrapping to construct confidence intervals around regression coefficients, given that the assumption of normality is not necessary for bootstrapping (see Zhu, 1997).

As outlined by Mackinnon et al. (2002), mediation may be tested when the predictor (cognitive inflexibility) relates to both the mediator (brooding, hopelessness) and outcome variable (suicidal ideation). A relation between the predictor (cognitive inflexibility) and outcome (suicidal ideation) may or may not be present. Note that because a mediator should follow the predictor (Baron and Kenny, 1986), rumination at follow up, rather than at baseline, was included in these analyses (given that the initial assessment of brooding rumination was made during the initial screening from which the baseline sample was selected, and this initial assessment session occurred up to 1 month before the baseline administration of the WCST). Bias-corrected confidence intervals around the indirect relations between cognitive inflexibility and suicidal ideation through brooding and hopelessness were calculated using a bootstrapping procedure with n = 1000 resamples (Hayes, 2012).

Three linear regression analyses were performed to assess whether cognitive inflexibility (predictor) at baseline predicted

| Table 2b |
|-----------------|-----------------|-----------------|
|               | Brooding | Hopelessness | Suicidal ideation |
| Perseverative errors | 0.19     | 0.26       | 0.29**           |
| Conceptual level responses | −0.33*   | −0.28*    | −0.28*           |
| Categories completed | −0.28*   | −0.34*    | −0.33*           |
| Failure to maintain set | −0.07   | −0.05     | 0.04             |

* p < 0.01.
Note: Total errors, perseverative responses, and non-perseverative errors had correlations of 0.87, 0.99, and 0.75, respectively, with perseverative errors, and thus were excluded from correlation tables to reduce redundancy.

Table 2a
Zero-order correlations between scores on the Wisconsin Card Sorting Test and brooding, hopelessness, and suicidal ideation at follow up, adjusting for baseline levels.

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<td>2. Conceptual resp. (1)</td>
<td>−0.50**</td>
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<td>3. Categories completed (1)</td>
<td>−0.71**</td>
<td>0.89**</td>
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<td>4. Maint. set (1)</td>
<td>0.16</td>
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<td>5. Learning to learn (1)</td>
<td>0.07</td>
<td>0.30*</td>
<td>0.45**</td>
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<td>6. Suicide attempt (1)</td>
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<td>7. Brooding (−)</td>
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<td>8. Brooding (2)</td>
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<td>9. Hopeless (1)</td>
<td>0.06</td>
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<td></td>
<td></td>
<td>0.03</td>
<td>0.24</td>
<td>0.38**</td>
<td>0.27**</td>
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<td>10. Hopeless (2)</td>
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<td>11. Ideation (1)</td>
<td>−0.20</td>
<td>0.05</td>
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<td>12. Ideation (2)</td>
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</table>

(−) Measured prior to baseline.
(1) Measured at baseline.
(2) Measured at follow up.
* p = 0.05.
** p < 0.05.
*** p < 0.01.

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brooding (mediator), hopelessness (mediator), and suicidal ideation (outcome variable) at follow up, respectively, adjusting for suicidal ideation at baseline, suicide attempt history at baseline, and depressive symptoms at baseline. Cognitive inflexibility was a statistically significant predictor of brooding \( (b=0.17, \text{S.E.}=0.07, \beta=0.32, p<0.05) \), hopelessness \( (b=0.22, \text{S.E.}=0.10, \beta=0.29, p<0.05) \), and suicidal ideation \( (b=0.13, \text{S.E.}=0.06, \beta=0.27, p<0.05) \) at follow up.

A hierarchical linear regression was then conducted in which cognitive inflexibility (first step), brooding at follow up (second step), and hopelessness at follow up (third step) were examined as predictors of suicidal ideation, adjusting for baseline suicidal ideation, baseline suicide attempt history, and baseline depressive symptoms. As noted above, cognitive inflexibility significantly predicted suicidal ideation at follow up. Brooding significantly predicted ideation in the second step, but cognitive inflexibility no longer predicted idea tion after adjusting for brooding. Hopelessness significantly predicted ideation in the third step, with brooding no longer a significant predictor of ideation after adjusting for hopelessness (see Table 3). Standardized regression coefficients for these effects are summarized in Fig. 1. These relations held even when depressive symptoms at follow up were added to the analysis (see Tables 2a and b).

Indirect effects were tested using bias-corrected 95% confidence intervals, calculated using a bootstrapping procedure (with \( n=1000 \) resamples), as bootstrapping does not assume normality of a distribution (Preacher and Hayes, 2008). Effects were estimated using the PROCESS procedure (Hayes, 2012). Indirect effects were considered statistically significant when their confidence intervals did not include zero. The following indirect effects were tested: (1) the indirect effect of cognitive inflexibility on suicidal ideation through brooding; (2) the indirect effect of cognitive inflexibility on suicidal ideation through hopelessness; and (3) the indirect effect of cognitive inflexibility on suicidal ideation through brooding and hopelessness (see Table 4). There was an indirect effect of cognitive inflexibility on suicidal ideation through brooding \( (95\% \text{ CI}=0.0004–0.11, \text{p}<0.01) \), but not through hopelessness \( (95\% \text{ CI}=-0.02–0.10) \), in models that also adjusted for baseline suicidal ideation, baseline suicide attempt history, and for depressive symptoms at both baseline and follow up. There was an indirect effect of cognitive inflexibility on suicidal ideation through brooding and hopelessness (i.e., a path from cognitive inflexibility to brooding, from brooding to hopelessness, and from hopelessness to suicidal ideation \( (95\% \text{ CI}=0.002–0.07) \).

### Table 3

Hierarchical linear regression predicting suicidal ideation at follow up.

<table>
<thead>
<tr>
<th>Block</th>
<th>Predictor</th>
<th>( b )</th>
<th>S.E.</th>
<th>( \beta )</th>
<th>( p )</th>
<th>Adjusted ( R^2 )</th>
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<td>1</td>
<td>Suicidal ideation (1)**</td>
<td>0.35</td>
<td>0.12</td>
<td>0.40</td>
<td>&lt;0.01</td>
<td>0.27**</td>
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<td>Suicide attempt history (1)</td>
<td>1.50</td>
<td>0.81</td>
<td>0.24</td>
<td>0.07</td>
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<td>-0.01</td>
<td>0.97</td>
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<td>0.27</td>
<td>0.03</td>
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<td>2</td>
<td>Suicidal ideation (1)</td>
<td>0.23</td>
<td>0.12</td>
<td>0.26</td>
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<td>0.35**</td>
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<td>0.11</td>
<td>0.29</td>
<td>0.03</td>
<td>0.45**</td>
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<td>0.17</td>
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<td>Hopelessness (2)**</td>
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<td>0.08</td>
<td>0.39</td>
<td>&lt;0.01</td>
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<td>Suicidal ideation (1)</td>
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<td>0.09</td>
<td>-0.44</td>
<td>&lt;0.01</td>
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</table>

(1) Baseline.
(2) Follow up.
\( b \)=Unstandardized regression coefficient.
\( \beta \)=Standardized regression coefficient.
* \( p<0.05 \).
** \( p<0.01 \).

4. Discussion

Previous research has shown that cognitive inflexibility is associated with both suicidal ideation and attempts (Marzuk et al., 2005; McGirr et al., 2012), and prospectively predicts suicidal ideation at 6-month follow up (Miranda et al., 2012). The present study sought to extend these findings by examining the longitudinal relation between cognitive inflexibility and ideation over a longer follow-up period, and by exploring whether brooding rumination and hopelessness would mediate this relation. Our results partially supported our hypotheses: cognitive inflexibility predicted suicidal ideation at 2–3 year follow up, and brooding mediated the relation between cognitive inflexibility and suicidal ideation. While there was no statistically significant path from cognitive inflexibility to suicidal ideation through hopelessness, there was an indirect path that went from cognitive inflexibility to suicidal ideation, from brooding to hopelessness, and from hopelessness to suicidal ideation.

In addition to underscoring the longitudinal association between cognitive inflexibility and suicidal ideation, the present findings also lend support to the diathesis-stress-hopelessness model of suicidality (Schotte and Clum, 1982). This model suggests that mental inflexibility may be a cognitive vulnerability during times of stress that leads to increased hopelessness and suicidal ideation. In the original model, impaired problem solving was suggested as a mechanism through which cognitive inflexibility impacts hopelessness and ideation. Although the present study did not include a measure of stress, its findings implicate another possible mechanism from cognitive inflexibility to hopelessness and ideation: brooding rumination. That is, our results suggest that cognitive inflexibility may lead to higher levels of future suicidal ideation through its effect on brooding rumination, a finding that is consistent with previous research demonstrating an association between brooding and suicidal ideation (e.g., Miranda and Nolen-Hoeksema, 2007; O’Connor and Noyce, 2008). Brooding rumination, in turn, may impact future suicidal ideation by increasing an individual’s hopelessness.

Cognitive inflexibility may lead to brooding in response to a negative mood, because individuals with decreased mental flexibility may have difficulty disengaging from thoughts about the causes and consequences of their negative mood. Furthermore, previous research suggests that people who tend to ruminate in response to their negative moods often attribute their rumination to the process of trying to understand and solve their problems (e.g., Papageorgiou and Wells, 2003). This attribution, along with the inability to shift cognitive set in response to changing environmental feedback (e.g., a cognitive strategy, such as brooding, which does not lead to resolution of a problem), may lead individuals to continue to engage in an ineffective cognitive response such as brooding.

Contrary to prediction, we found that hopelessness did not mediate the prospective relation between cognitive inflexibility
Cognitive inflexibility significantly predicts brooding rumination, hopelessness, and suicidal ideation at follow up, adjusting for baseline suicidal ideation. Brooding mediates the relation between cognitive inflexibility and hopelessness and between cognitive inflexibility and suicidal ideation. Hopelessness mediates the relation between brooding and suicidal ideation. Values shown are standardized regression coefficients.

Table 4
Indirect effects of cognitive inflexibility at baseline on suicidal ideation at follow up through brooding and hopelessness at follow up.

<table>
<thead>
<tr>
<th>Path</th>
<th>Indirect effect</th>
<th>95% CI</th>
<th>Effect</th>
<th>S.E.*</th>
<th>(Lower, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cog. inflex. (1)→ Brooding (2)→ Suicidal ideation (2)</td>
<td>0.04</td>
<td>0.03</td>
<td>(0.0004, 0.11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cog. inflex. (1)→ Hopelessness (2)→ Suicidal ideation (2)</td>
<td>0.03</td>
<td>0.03</td>
<td>(−0.02, 0.10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cog. inflex. (1)→ Brooding (2)→ Hopelessness (2)→ Suicidal ideation (2)</td>
<td>0.02</td>
<td>0.02</td>
<td>(0.0002, 0.07)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Baseline.  
(2) Follow up.  
* Estimated using bootstrapping with n=1000 samples. Covariates include baseline suicidal ideation, suicide attempt history, baseline depressive symptoms, and depressive symptoms at follow up.

and suicidal ideation, although it was part of the path from brooding rumination to ideation. The latter finding is consistent with prior research suggesting that brooding rumination is related to suicidal ideation over time (Miranda and Nolen-Hoeksema, 2007), and that hopelessness may help to explain the link between rumination and suicidal ideation (Smith et al., 2006). Continued rumination in response to a negative mood may decrease an individual’s capacity to generate alternative solutions or take action to relieve the distress. This lack of problem resolution may, in turn, provide individuals with evidence that their situation is hopeless, as has previously been suggested (Nolen-Hoeksema et al., 2008). These feelings of hopelessness may then increase vulnerability to suicidal ideation. Future research is needed to further examine the inter-relations between rumination, impaired problem solving, hopelessness, and suicidal ideation.

Our findings also lend support to models of suicide that suggest a role for cognitive constriction in the emergence of suicidal thoughts and behaviors (Wenzel and Beck, 2008). Much as individuals who are cognitively inflexible may have difficulty disengaging from rumination about the causes of their negative mood, these individuals may also have difficulty disengaging from their thoughts about suicide. Wenzel and Beck (2008) suggest a cognitive model of suicidality in which suicidal individuals exhibit a narrowing of attentional focus, such that suicide is perceived as the only solution to their distress. It is possible that cognitive inflexibility and associated brooding may facilitate this type of cognitive constriction. A perceived lack of alternate solutions to their distress may then lead individuals to feelings of hopelessness and an eventual focus on suicide as a solution.

These findings are also compatible with research suggesting a link between suicidal behavior and impulsivity (e.g., Nock et al., 2008; Wu et al., 2009). Joiner (2005) suggests that individuals acquire the ability to engage in lethal self-harm through painful and provocative life experiences. A recent study found that the experience of painful and provocative life events statistically mediated the relation between impulsivity and the acquired ability for suicide (Bender et al., 2011). An inability to disengage from a negative mood may lead individuals to engage in such provocative behaviors (e.g., aggressive behaviors, non-suicidal self-injury), thus increasing risk for suicidality. Future research should examine whether cognitive inflexibility and brooding affect the tendency to respond impulsively.

Some study limitations should be noted. Despite the longitudinal nature of the study, the sample size was small, primarily female, and was not a clinical sample. Thus, these findings might not be generalizable to a general community or to a clinical sample of emerging adults. Secondly, the racial/ethnic composition of the sample, although fairly representative of the college setting from which it was drawn, may not be representative of the overall population of emerging adults with suicidal ideation. At the same time, the racial/ethnic diversity of the sample is a strength. A third limitation was the modest rate of participation in the follow up, as only 56 (58%) of the original 96 individuals who took part in the baseline assessment were followed up 2–3-years later. We were thus unable to examine whether a suicide attempt history moderated the mediated relations in this study. Other limitations included the use of a self-report measure to assess suicidal ideation, rather than a clinical interview, and the fact that the study did not test for the possible influence of other variables thought to explain the relation between cognitive inflexibility and ideation, such as problem-solving (Schotte and Clum, 1982, 1987) or impulsivity (Wu et al., 2009). In addition, we used number of perseverative errors on the WCST to quantify cognitive inflexibility. Previous research examining the relation between suicidal ideation/attempts and performance on the WCST has yielded mixed findings (see Jollant et al., 2011, for a review; Keilp et al., 2013). We also did not include measures of lower-order cognitive processes, such as attention and working.
memory, which have been shown to be affected among suicide attempters (Keipel et al., 2013). Future studies should include such measures, along with other measures of cognitive inflexibility, in conjunction with the WCST, to more conclusively establish a relation between cognitive inflexibility and suicidal ideation and behavior. Finally, the present study suggested associations between other WCST scales (e.g., conceptual level responses) and measures of brooding rumination and hopelessness (specifically, negative associations), and these relations may warrant future research.

The fact that the present study assessed self-focused rumination (i.e., brooding) in relation to a negative mood is another study limitation. Future research may benefit from examining ruminative thinking that occurs independently of a negative mood. In addition, future research should consider other types of rumination to which these findings may generalize. For instance, previous research suggests that hopelessness-related cognitions may arise through rumination about the future (see Andersen and Limpert, 2001). Perhaps cognitive inflexibility is part of a path from other such types of rumination to hopelessness and suicidal ideation. Finally, because the first brooding rumination assessment was completed in the initial screening session up to a month before the baseline assessment of cognitive inflexibility, we were limited to examining brooding and hopelessness at follow up as mediators of the relation between cognitive inflexibility and suicidal ideation and were thus unable to draw conclusions about the direction of the relation between these mediators and suicidal ideation. Future research should examine cognitive inflexibility, rumination, and hopelessness at multiple time points.

The present study has implications for clinical intervention. Our findings suggest that brooding rumination may arise from cognitive inflexibility and may explain why cognitive inflexibility increases risk for future suicidal ideation. Furthermore, brooding may increase vulnerability to suicidal ideation through increased hopelessness, which has previously been implicated in risk for suicidal ideation and attempts. Deficiencies in the ability to develop alternative solutions to problems may play a role in this process, arising from cognitive inflexibility and its effect on rumination. Clinicians can benefit from this knowledge by focusing on therapeutic interventions that decrease brooding rumination (e.g., Watkins, 2009) and increase problem-solving skills in cognitively inflexible patients. Decreased brooding and more effective problem-solving skills may then lead to lower levels of hopelessness, as individuals learn to develop alternative coping strategies.

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