

## Regular Article

# Childhood temperament as a predictor of adolescent nonsuicidal self-injury

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### Abstract

Previous cross-sectional work has consistently found associations between neuroticism and impulsivity and nonsuicidal self-injury (NSSI). However, there are few longitudinal studies of personality risk factors for NSSI. In this study, we examined associations between individual differences in temperament at age 3 and NSSI from ages 9 to 15. At age 3, 559 preschool-aged children (54% male;  $M_{\text{age}} = 42.2$  months [ $SD = 3.10$ ]) completed laboratory assessments of temperament. Parents also completed questionnaires about their child's temperament. Children completed a diagnostic interview assessing NSSI engagement at ages 9, 12, and 15. By the age 15 assessment, 12.4% of adolescents reported engaging in NSSI. In univariate models, we found that higher levels of observed sadness and maternal-reported sadness and anger were associated with increased risk for NSSI. In multivariate models, female sex and maternal-reported anger were significantly associated with greater likelihood of NSSI. Laboratory observed sadness and impulsivity were associated with a higher likelihood of NSSI. This work extends the literature on personality risk factors associated with NSSI by finding longitudinal associations between early childhood negative affect and later NSSI engagement during adolescence.

**Keywords:** nonsuicidal self-injury; NSSI; risk; temperament

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Nonsuicidal self-injury (NSSI) is a nonfatal act that results in bodily injury where the individual does not intend to die (Klonsky et al., 2014). Prevalence of NSSI is substantial and highly variable across studies, with 2.9%–41.9% of adolescents engaging in the behavior (Meszaros et al., 2017). Some shorter term longitudinal studies suggest that self-injurious behaviors first emerge in early adolescence (age 13); the incidence increases until mid-adolescence (ages 15–17) and then decreases (Plener et al., 2015). There is also evidence that an additional peak in endorsement of NSSI is present in late adolescence/young adulthood (Gandhi et al., 2018; Whitlock et al., 2011). Much of the understanding of psychological processes involved in NSSI comes from cross-sectional studies that compare individuals who do and do not engage in NSSI, with multiple studies reporting on trait individual differences as markers of risk for NSSI. However, longitudinal studies are needed to improve our understanding of risk for engagement in these behaviors. In this study, we examine associations between distal individual difference factors from early childhood, specifically child temperament, and NSSI in late childhood through mid-adolescence.

Studies of associations between NSSI and individual difference characteristics have examined the roles of multiple dimensions from the Big Five and Big Three models of personality (Goddard et al., 2021; MacLaren & Best, 2010; Muris et al.,

2007). Neuroticism (N) and extraversion (E) from the big five model have substantial overlap with negative emotionality (NE) and positive emotionality (PE), respectively, in the big three model of personality. N/NE emphasizes individual differences in reactivity of sadness, anger, and fear. E/PE includes individual differences in positive affect (PA), reward sensitivity, and sociability. Some models of E/PE (e.g., Watson & Clark, 1997) include higher intensity characteristics, such as venture someness and impulsivity within the broader construct. Impulsivity bridges aspects of openness to experience, low conscientiousness, and low agreeableness in the big five model and is located at the low end of the constraint factor in the big three model.

Models of the development and maintenance of NSSI behaviors view negative affective states as playing a critical role (Nock, 2009). Thus, individuals who are predisposed to experiencing negative affect may be more likely to engage in NSSI. Indeed, higher levels of trait negative affectivity (Baetens et al., 2011) and neuroticism (Brown, 2009; Claes et al., 2004, 2010; MacLaren & Best, 2010; Perlman et al., 2018) are significantly associated with engagement in NSSI.

Investigations have also examined other domains of personality in relation to NSSI. Cross-sectional and short-term longitudinal associations have been found between NSSI engagement and lower levels of positive emotionality (Hankin & Abela, 2011), extraversion (Hankin & Abela, 2011; Perlman et al., 2018), and conscientiousness (Claes et al., 2004, 2010; Hasking et al., 2010; Perlman et al., 2018). Additionally, Gromatsky et al. (2020) found that low conscientiousness and high avoidance were associated with first-onset of NSSI over a 3-year follow-up period. Studies have also

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found cross-sectional associations between NSSI engagement and self-reported impulsivity (Deng Bao-ping, 2013; Hamza et al., 2015). Specific dimensions of impulsivity such as effortful control were also found to be associated with NSSI (Baetens et al., 2011). Additionally, in studies of individuals with borderline personality disorder, specific dimensions of impulsivity, such as impulsive aggression and behavioral disinhibition, have been found to be associated with adolescent and adult engagement in NSSI (Crowell et al., 2012).

The majority of studies have examined cross-sectional associations between personality dimensions and NSSI (Baetens et al., 2011; Brown, 2009; Claes et al., 2004, 2010; MacLaren & Best, 2010; Nock, 2009; Perlman et al., 2018). There are surprisingly few studies that longitudinally examine personality trait predictors of NSSI (Gromatsky et al., 2020; Hankin & Abela, 2011). Some studies examine proximal risk factors to explain engagement in the behavior over narrow windows of times using ambulatory assessment methods (e.g., Ammerman et al., 2017; Vansteelandt et al., 2017). These shorter-term studies assess fairly low base-rate behaviors daily and/or multiple times per day among individuals already engaging in the behaviors. Other studies have relied on longitudinal assessments over the course of months or a few years (e.g., Steinhoff et al., 2021). However, these studies have frequently focused on assessing both risk factors and NSSI engagement contemporaneously, making it unclear if the trait preceded the onset of NSSI. Additionally, as demonstrated in a recent meta-analysis (Fox et al., 2015), existing longitudinal work largely focuses on samples with previous engagement in NSSI that prevents identifying predictors of first engagement. Thus, it is important to assess traits early on, prior to the onset of NSSI behaviors. Studies with a longer temporal separation between the assessment of individual difference risk factors and the assessment of NSSI may provide greater leverage for identifying factors that precede the onset of NSSI. In addition, when risk factors are identified during a much earlier period of development, it provides a greater window of opportunity for prevention. Here, our focus is on assessment of individual differences in temperament traits during the preschool period and NSSI during adolescence.

Predominant models of child temperament focus on the dimensions of surgency, negative affectivity, and effortful control that parallel the big three model of adult personality with E/PE, N/NE, and Constraint (Caspi et al., 2005; De Pauw & Mervielde, 2010; Rothbart & Bates, 2006; Zentner & Bates, 2008). In contrast to studies of older children and adults that frequently rely on self-report assessments of personality, early childhood temperament is frequently assessed via caregiver report and/or observational methods. Although there are frequently modest associations across caregiver report and observations of youth temperament (Durbin et al., 2007, 2012), it is important to examine the prognostic value of dimensions of temperament assessed across multiple methods to better inform long-term predictions. Moreover, as findings from studies examining behavioral measures of impulsivity have failed to show associations with NSSI (Glenn & Klonsky, 2010; Hamza et al., 2015; Janis & Nock, 2009), further examination of the predictive utility of behavioral assessments is critical.

This study builds on previous cross-sectional studies by examining associations between individual differences in temperament at age 3 and NSSI through age 15. Identification of predictors of NSSI in early childhood potentially allows a large window of time and greater opportunity for prevention and early intervention. Moreover, much of the existing literature has relied solely on parent and/or child reports for both NSSI and associated

predictors. In this study, we use both observational and parent-report measures in early childhood as a means of investigating differences in predictive validity across methods. In addition, our assessment of NSSI is based on information obtained from both a parent and the child. Based on cross-sectional findings, we hypothesize that early childhood temperament traits related to both negative emotionality and impulsivity will be associated with NSSI during adolescence.

## Method

### Participants

Data come from the Stony Brook Temperament Study (Olino et al., 2010). Participants were recruited through commercial mailing lists, and children with any significant medical conditions or developmental disabilities were excluded. The sample included 559 children at baseline assessment (54% male;  $M_{\text{age}} = 42.2$  months [ $SD = 3.10$ ]) from Long Island, New York and their biological parent (mothers). On average mothers were 36.0 years old ( $SD = 4.5$ ). Most participants (86.9%) were White and middle class, as measured by Hollingshead's Four Factor Index of Social Status ( $M = 45.1$  [ $SD = 10.9$ ]). Approximately half the mothers (54.7%) had at least a 4-year college degree. Most children (95.0%) lived with both biological parents, and 51.9% of the mothers worked outside the home part time or full time. Participants were assessed again at age 12 ( $M_{\text{age}} = 12.66$  years,  $SD = 0.46$ ) and age 15 ( $M_{\text{age}} = 15.25$  years,  $SD = 0.41$ ). Of the 559 original participants, 437 children completed diagnostic interviews at the age 12 follow-up, and 458 children completed these study procedures at the age 15 follow-up.

### Observational measures

At age 3, children were assessed in an observational laboratory setting with sessions lasting approximately 2 hr. The assessment included a set of 11 episodes (risk room, tower of patience, arc of toys, stranger, car go, transparent box, pop-up snakes, impossibly perfect green circles, popping bubbles, and box empty) adopted from the Laboratory Temperament Assessment Battery (Lab TAB; Goldsmith, 1996) and one additional episode (exploring new objects) that was designed specifically for this study (Dyson et al., 2012). The additional task, "Exploring New Objects," was designed to be thematically consistent with the "Risk Room" episode but involved different stimuli. We found that the behaviors elicited in the task showed consistency with behaviors in the other tasks that were used to derive our observed temperament ratings. Children were given a short play break between episodes, providing the children time to return to a neutral affective state.

#### Risk room

This episode involved leaving the child alone in a room to explore novel objects. Objects included a large black box with eyes, a cloth tunnel, a balance beam, a Halloween mask, and a miniature staircase. After 5 min, the experimenter returned to the room and asked the child to play with each of the objects.

#### Tower of patience

The child and the experimenter took turns building a tower with blocks. For each turn, the experimenter increasingly delayed the amount of time it took them to place a block during their turn, making the child wait.

### *Arc of toys*

After allowing the child to play by themselves with a variety of toys, the experimenter returned and asked the child to clean up.

### *Stranger*

After being left alone in the assessment room, a male research assistant entered the room and began speaking to the child while gradually moving closer.

### *Car go*

The child and the researcher race remote controlled cars together.

### *Exploring new objects*

The child was left alone to explore novel objects including pretend mice, sticky gel balls filled with water, a mechanical bird and spider, and a pretend skull under a blanket. After 5 min alone, the experimenter returned and asked the child to play with each of the objects.

### *Transparent box*

The child selected a toy, which was then locked inside of a transparent box. The child was then left with the box and an incorrect set of keys to open the box.

### *Pop-up snakes*

The child was shown a fake can of potato chips, which actually contained “snakes” that pop out. The child was then encouraged by the experimenter to surprise their parents with the pop-up snakes.

### *Impossibly perfect green circles*

The experimenter instructed the child to repeatedly draw a circle on a piece of paper. The circles were mildly criticized following each drawing.

### *Popping bubbles*

The child and the experimenter played with a bubble-shooting toy.

### *Snack delay*

The child was instructed to wait for the experimenter to ring a bell before eating the snack. The ringing of the bell was delayed each time by the experimenter.

### *Box empty*

The child was given an empty box to unwrap. After a delay, the experimenter provided presents for the child.

### *Laboratory coding*

The emphasis of the study is on temperament dimensions that are conceptualized as being general patterns of behavior that are reasonably consistent across contexts. Our observational coding system implemented this by making global ratings, attending to relevant behaviors across the entire episode, of the same dimensions of child behavior across all laboratory tasks. LAB-TAB episodes were coded by undergraduate research assistants, study staff, and graduate students who completed extensive training prior to coding. Each coder was assigned to specific episodes. Coders had to reach at least 80% agreement on all specific codes within the episode with a “master” rater before coding independently. Videotapes of 35 children were re-coded by an independent coder to examine inter-rater reliability. Internal consistency of each scale

was also examined using coefficient alpha based on the whole sample ( $n = 559$ ).

### *Affect*

Each time stamp recorded instance of facial, bodily, and vocal affect during all 12 laboratory episodes were rated on a three-point intensity scale (low, moderate, and high intensity) for positive affect, anger, sadness, and fear. Intensity ratings within each laboratory episode were summed within each channel of affect (facial, bodily, and vocal). These ratings were then averaged across channels, resulting in scores for each of the 12 episodes for each of the four affective traits. These variables were then standardized, and the standardized scores were averaged across episodes for each affect trait. Inter-rater reliability for these dimensions was good ( $ICC_{PA} = .933$ ;  $ICC_{anger} = .695$ ;  $ICC_{sad} = .933$ ;  $ICC_{fear} = .933$ ).

### *Behavior*

All relevant behaviors in each episode were used to derive global ratings, which were then averaged across episodes. For this study, we focused on the behavioral rating for impulsivity. Impulsivity was based on the child’s tendency to respond without reflection or hesitation and was rated on a single four-point Likert scale (0 = *low*, 1 = *moderate*, 2 = *moderate to high*, and 3 = *high*). The inter-rater reliability for impulsivity was very good ( $ICC = .852$ ).

### *Questionnaire measures*

#### *Child temperament*

Parent-reported child temperament was assessed at age 3 via the Child Behavior Questionnaire (CBQ). The CBQ is an assessment of temperament in early childhood and assesses 15 temperament traits on a 7-point Likert Scale ranging from 1 (*extremely untrue of your child*) to 7 (*extremely true of your child*). The present study used 5 of these subscales (sadness, anger, fear, smiling/laughter, and impulsivity). Internal consistency was estimated for the 5 subscales; sadness ( $\alpha = .63$ ; 12 items), anger ( $\alpha = .79$ ; 13 items), fear ( $\alpha = .74$ ; 12 items), smiling/laughter ( $\alpha = .73$ ; 13 items), and impulsivity ( $\alpha = .75$ ; 12 items). For this report, we relied on maternal reports of youth temperament.

#### *Interview assessment*

##### *Nonsuicidal self-injury*

NSSI was assessed at age 12 and age 15 using an expanded version of the Schedule for Affective Disorders and Schizophrenia for School-Age Children Present and Lifetime version (K-SADS-PL; Kaufman et al., 1997). Adolescents and a parent were interviewed separately, with the parent interviewed first. At the conclusion of the two interviews, the interviewer integrated this information in a final rating using clinical judgment. NSSI engagement was defined in the K-SADS as self-mutilation, or other acts done *without intent* of killing oneself, and was determined based on responses to whether or not participants had engaged in the following self-harming behaviors without the intent to die between age 9 and the age 12 interview and between the age 12 and age 15 interviews: cutting, biting, burning, carving, pinching, pulling hair, severe scratching, banging or hitting, interfering with wound healing, rubbing skin against rough surface, sticking self with needle, or swallowing dangerous substances. Participants were also permitted to endorse additional forms of self-harm that were not listed during the interview. Because the interview was semi-structured, interviewers inquired about ambiguous responses to ascertain whether the behavior was NSSI or the participant had an intent to die. Our

NSSI engagement variable represented the presence or absence of any of these behaviors at either or both assessments. Following K-SADS conventions, the interviewer used clinical judgment to try to understand and evaluate any discrepancies between parent and child reports.

### Data analysis

All analyses were estimated in Mplus 8.1. As there were participants lost to follow-up at ages 12 and 15, we relied on full information maximum likelihood to include all observations in the analyses. Thus, for all analyses, models included all 559 participants from the baseline assessment. First, we examined bivariate logistic regression models examining associations between individual predictor variables and NSSI. We also examined associations with sex. Second, we examined a final model including all predictors simultaneously in a single model.

## Results

### Sample characteristics

Bivariate associations between all predictor variables measured at age 3 are provided in Table 1. Notably, there were low associations between laboratory observation ratings and parent-report measures of temperament. Cumulatively across the age 12 and 15 assessments, 12.4% ( $n = 50$ ) of participants endorsed NSSI. Across the age 12 and age 15 assessments, 32% ( $n = 16$ ) of participants reported engaging in NSSI once, 8% ( $n = 4$ ) reported engaging twice, and 60% ( $n = 30$ ) reported engaging in NSSI 3 or more times. The primary method of NSSI reported by participants was cutting (50%), followed by banging or hitting (28%), and severe scratching (18%). A majority of participants (74%,  $n = 33$ ) reported only one method of NSSI across the age 12 and age 15 assessments.

### Regression models

In bivariate logistic regression models (Table 2), we found that higher levels of observed sadness, maternal-reported sadness and anger, and female sex were associated with increased risk for NSSI. In multivariate models (Table 2), including all predictors simultaneously, female sex and maternal-reported anger were uniquely associated with greater likelihood of NSSI. Laboratory observed sadness and impulsivity were associated with higher, and maternal-reported impulsivity was associated with lower, likelihood of NSSI at the level of a trend. We explored interactions between dimension of temperament and child sex. None were statistically significant (all  $p > .46$ ) and are not reported further.

## Discussion

Previous studies report that approximately 17% of adolescents engage in nonsuicidal self-injury (NSSI), with rates ranging from 4.1% to 39.3% (Gillies et al., 2018). Importantly, NSSI is associated with multiple adverse outcomes (Adrian et al., 2011; Heath et al., 2008). Thus, identifying early risk factors to inform prevention and early intervention for NSSI is critical. However, much of the work examining associations between markers of risk for NSSI based on psychological constructs is limited by relying on cross-sectional (Claes et al., 2004, 2010; Cyders et al., 2007; Klonsky et al., 2003; MacLaren & Best, 2010) or short-term longitudinal studies (Ammerman et al., 2017; Plener et al., 2015; Vansteelandt et al., 2017). Although these studies provide evidence in support of the

idea that heightened negative affect precedes NSSI engagement, this heightened negative affect may be within the boundaries of developmentally normative reactions to specific stressors. For example, while Ammerman et al. (2017) found that some daily experiences of negative affect predicted NSSI engagement, low levels of overall distress tolerance was a stronger predictor. This study builds on previous work by examining longitudinal associations between temperament assessed using multiple methods in early childhood and NSSI during adolescence, up to age 15. We found general support for temperamental negative affectivity during the preschool years to predict later NSSI. Additionally, by examining temperament in early childhood, we have greater confidence that temperament precedes the development of NSSI.

Previous studies have reported associations between dimensions from the Big Five and Big Three models of personality, such as neuroticism or negative emotionality and NSSI (Baetens et al., 2011; Brown, 2009; Claes et al., 2004, 2010; MacLaren & Best, 2010; Nock, 2009; Perlman et al., 2018). This work has generally examined neuroticism at the broad, or higher order level, potentially obscuring the critical facet(s) reflecting risk and relied on self-report or parent-report measures. Here, we used observational as well as parent-report measures to examine specific dimensions of negative affectivity and found that negative temperament traits, mainly anger and sadness, were associated with higher likelihood of engaging in NSSI over a 12-year follow-up period. Moreover, maternal report of child anger during the preschool years was associated with later NSSI in both univariate and multivariate models. Thus, the strongest evidence for predictive validity is for this domain of affect.

In univariate analyses, both laboratory observed and maternal reports of sadness at age 3 were associated with NSSI through age 15. However, in the multivariate model, these associations were no longer statistically significant. Notably, sadness and anger significantly covary in preschoolers (Dyson et al., 2012, 2015); thus, the association between sadness and NSSI may be better accounted for by anger. We did not find any significant associations between fearfulness, regardless of assessment methods, and NSSI. Previous studies of older adolescents have relied on dimensions of neuroticism in the aggregate, inclusive of sadness, anger, and fear (Bresin et al., 2013; Selby et al., 2013). Individual differences in temperament have also been associated with increased risk for NSSI in the developmental literature, where many authors aim to determine what specifically leads adolescents to engage in NSSI compared with other maladaptive behaviors. Negative affect is associated with multiple adverse outcomes, including broad internalizing (Kranzler et al., 2016; Nock et al., 2006) and externalizing (Meszaros et al., 2017; Nock et al., 2006) problems, as well as poor emotion regulation (Kranzler et al., 2016). Our finding that dimensions of negative emotionality are associated with NSSI is consistent with Cummings et al.'s (2021) theoretical framework that emphasizes the impact of distal risk factors, including temperament, on NSSI engagement. This model suggests that distal vulnerabilities may lead to other risk processes, including the benefits to barriers pathway (Hooley & Franklin, 2018; Nock, 2009) and the social contagion pathway (Barrocas et al., 2011). The benefits-to-barriers pathway proposes that individuals begin to engage in NSSI when the perceived "benefits" of engaging in NSSI (e.g., self-punishment, affect regulation, and peer affiliation) are greater than the "barriers" to NSSI (e.g., high self-esteem, social norms against NSSI, the fear of pain, lack of awareness of NSSI). The social contagion pathway (Barrocas et al., 2011) proposes that individuals initiate NSSI because of the desire to affiliate with peer groups that

**Table 1.** Bivariate associations among focal predictor variables

	Laboratory observation					CBQ			
	Sad	Fear	Anger	PA	Imp	Fear	Sad	Anger	Imp
Obs. PA									
Obs. Sad	-.08								
Obs. Fear	.03	.13**							
Obs. Anger	.03	.42***	.07						
Obs. Imp	.33***	.14***	.01	.32***					
CBQ PA	.11*	-.02	-.02	-.01	.07				
CBQ Sad	.06	.18***	.06	.08	-.04	-.05			
CBQ Fear	.06	.11*	.21***	.01	-.04	-.16**	.31***		
CBQ Anger	.06	.14**	.08	.12*	.07	-.11*	.50***	.29***	
CBQ Imp	.08	-.01	-.04	.11*	.34***	.31***	-.06	-.28***	.17***

Note. CBQ = child behavior questionnaire; Obs. PA = behaviorally observed positive affect; Obs. Sad = behaviorally observed sadness; Obs. Fear = behaviorally observed fear; Obs. Anger = behaviorally observed anger; Obs. Imp = behaviorally observed impulsivity; CBQ PA = parent-reported positive affect; CBQ Sad = parent-reported sadness; CBQ Fear = parent-reported fear; CBQ Anger = parent-reported anger; CBQ Imp = parent-reported impulsivity.

\* $p < .05$ .

\*\* $p < .01$ .

\*\*\* $p < .001$ .

**Table 2.** Univariate and multivariate models examining early predictors of NSSI through age 15

Method	Predictor	Univariate model	Multivariate model
		OR [95% CI]	OR [95% CI]
Observed	Positive affect	0.90 [0.57, 1.43]	0.76 [0.47, 1.24]
	Sadness	1.63 [1.17, 2.28]**	1.54 [1.00, 2.38]
	Fear	1.14 [0.82, 1.59]	0.99 [0.67, 1.45]
	Anger	1.06 [0.75, 1.50]	0.79 [0.50, 1.26]
	Impulsivity	1.23 [0.51, 2.95]	3.70 [1.00, 13.70]
Parent report	Positive affect	0.64 [0.38, 1.07]	0.73 [0.42, 1.30]
	Sadness	1.90 [1.22, 2.97]**	1.23 [0.72, 2.09]
	Fear	1.20 [0.86, 1.69]	0.90 [0.60, 1.34]
	Anger	1.77 [1.16, 2.71]**	1.83 [1.02, 3.29]*
	Impulsivity	0.71 [0.48, 1.03]	0.61 [0.37, 1.02]
Female sex		2.65 [1.41, 4.99]**	3.50 [1.67, 7.32]**

Note. OR = odds ratio; 95% CI = 95% confidence interval.

\* $p < .05$ .

\*\* $p < .01$ .

The multivariate model includes all variables listed.

promote NSSI. Our results show that these associations may be driven specifically by feelings of anger, rather than broad negative affect. Thus, future studies of later personality and NSSI may increase in the specificity of prediction by focusing on individual facets of neuroticism.

Impulsivity has been identified as a risk factor for NSSI (Herpertz et al., 1995; Simeon et al., 1992). However, we did not find significant associations between impulsivity and NSSI using either observational or maternal-report assessments in univariate or multivariate models. In the multivariate model, the associations for impulsivity were not conventionally significant, but were in opposite directions. Higher laboratory observed impulsivity was positively, and maternal-reported impulsivity was negatively,

associated with NSSI. It is possible that impulsivity manifests differently across the methods. Other studies also have considered affective valence in the relationship between impulsivity and NSSI (Bresin et al., 2013). Negative urgency is a construct that focuses on impulsivity accompanied by negative affect (Cyders et al., 2007; Cyders & Smith, 2008). Some theories of NSSI and impulsivity suggest that individuals high in negative urgency are most at risk for engagement in NSSI (Deng Bao-ping, 2013; Hamza et al., 2015). The opposing associations between impulsivity and NSSI across assessment methods could be related to the context in which impulsivity is assessed. We speculate that maternal reports of impulsivity may primarily reflect impulsivity in positive affective or neutral contexts. For example, many CBQ items such as “When eager to go outside, sometimes rushes out without putting on the right clothes” and “Sometimes interrupts others when they are speaking” focus on impulsivity in the absence of affect, whereas the laboratory assessment was explicitly designed to elicit emotion, so impulsivity may have generally occurred in negative affective contexts.

Previous work (Claes et al., 2004, 2010; MacLaren & Best, 2010) has found negative associations between extraversion, in which positive emotionality plays a prominent role, and NSSI. However, our results failed to replicate associations between positive affectivity and NSSI. One interpretation of our null findings is that positive affect may play a stronger protective role against NSSI over shorter (e.g., Hasking et al., 2017), but not longer, periods of time, with the long period of time between assessments resulting in diminished associations between low positive affect and NSSI engagement.

As parent reports are, at best, modestly associated with lab- and home-based observations of child temperament (Durbin et al., 2007) we examined temperament constructs using multiple assessment methods. Our multimethod approach showed that maternal-reported anger was associated with a greater likelihood of engagement in NSSI. This suggests that for prediction of NSSI, maternal reports may be the more useful method for NSSI, but this may not generalize to other behavior problems or forms of psychopathology.

We found that the proportion of adolescents who engaged in NSSI (12%) is somewhat lower than that reported in other community samples (Baetens et al., 2011; Hilt et al., 2008). Prior research has used relatively wide age ranges (e.g., all adolescents ages 7–16; Barrocas et al., 2012), whereas we sampled across more narrow, salient developmental periods. Previous studies show that the peak prevalence of NSSI is in mid-adolescence (Plener et al., 2015). However, onset of NSSI continues throughout adolescence; thus, continued assessments through late adolescence would yield higher cumulative lifetime rates of NSSI (Barrocas et al., 2012). Consistent with previous studies (Plener et al., 2009; Ross & Heath, 2002; Sornberger et al., 2012; Yates et al., 2008), we also found that girls showed higher likelihood of engagement with NSSI than boys. We also examined whether child sex moderated the associations between temperament dimensions and NSSI, but no significant associations were found.

The present study adds to the growing body of literature on risk for NSSI by examining early childhood factors as predictors of adolescent NSSI. Our work provides better temporal separation between risk and engagement in NSSI. Results support assertions that regulation of negative emotions, particularly anger, may be a fruitful focus for preventing initial engagement with NSSI. We also utilized both self-report and laboratory observational measures of temperament as convergence across methods allows for more confidence in findings. Despite these strengths, the work should be evaluated in light of several limitations. First, our sample consisted of primarily White, intact families, limiting the generalizability of our findings to families similar on these demographic characteristics. Second, our measures of impulsivity provided little context for those behaviors. Given previous literature highlighting the associations between impulsivity during negative emotional experiences (i.e., negative urgency; Cyders et al., 2007; Cyders & Smith, 2008) and NSSI (Crowell et al., 2009; Deng Bao-ping, 2013), it is possible that finer-grained assessment of these behaviors may show different patterns of associations with NSSI. Third, we relied on maternal reports for assessing parental perspectives on child temperament. Further work including fathers is needed to evaluate the utility of parent report in predicting NSSI risk. Relatedly, across more extreme and normative levels of parent-child relationship problems, studies (Bureau et al., 2010; Hesse & Main, 2006; Lyons-Ruth & Jacobvitz, 1999; Muehlenkamp et al., 2008) have found that dimensions of parenting characterized by high negative affect are associated with higher risk for NSSI, and dimensions of parenting characterized by high positive affect are associated with lower risk for NSSI. Thus, parental socialization of emotion regulation may also play a role in the emergence of NSSI and should be examined in future studies. Fourth, we focused on temperamental risk. However, other factors including biological vulnerabilities (e.g., Westlund Schreiner et al., 2015; Hankin et al., 2015) or environmental/caregiving factors (e.g., Baetens et al., 2014; Victor et al., 2019) may also play a role in risk for NSSI. Additionally, nonspecific distal risk factors, such as temperament, may lead to NSSI but also to a range of other negative mental health outcomes. However, the goal of this study was to test whether NSSI was one of the broader set of negative outcomes of temperamental risk. Future research should analyze additional negative outcomes to better capture the multifinality of distal risk factors such as sadness and anger. Fifth, our operationalization of NSSI focused solely on lifetime prevalence of NSSI and did not account for severity of NSSI. Therefore, our sample likely comprised a heterogeneous group of youth who had engaged in single and repeated episodes of NSSI. Associations with temperament may differ for youth

engaging in NSSI more regularly or habitually, and those engaging in NSSI more rarely or experimentally. Finally, we assessed NSSI between ages 9 and 15. Thus, we did not capture these behaviors before age 9. While some studies have found that initial engagement in NSSI can begin before age 9 (Barrocas et al., 2012; Luby et al., 2019), the average onset appears to be around mid-adolescence (Nock & Prinstein, 2004). Thus, although we may have not assessed some cases that started and stopped engagement before age 9, it is likely that this is only a modest number.

NSSI is a prominent mental health outcome for youth. Understanding the clinical significance of NSSI is relevant to treatment planning across domains. For adolescents engaging in NSSI without significant psychiatric comorbidity, brief treatments focused on the relieving of negative affect may be considered. At present, there are no empirically supported prevention programs for preadolescents (Klonsky & Muehlenkamp, 2007; Nock et al., 2007; O'Connor & Nock, 2014), as interventions for NSSI are typically implemented in adolescence. The present study provides evidence for risk of adolescent NSSI engagement indexed by temperament in children as young as 3. We found evidence in our univariate analyses that laboratory-observed sadness and mother-reported anger and sadness at age three predicted NSSI engagement through age 15. Mother-reported anger remained significantly associated with engagement in NSSI in multivariate analysis, and laboratory-observed sadness and impulsivity were associated with NSSI engagement through age 15 at the level of a trend. Although there were some differences in statistically significant associations across models and assessment methods, we found consistent evidence that early childhood negative emotionality, particularly sadness and anger were associated with later engagement in NSSI. NSSI has become a common youth behavior in both community and clinical samples, and research identifying factors associated with its onset is necessary to further prevention and intervention efforts.

We shed light on correlates of risk beginning at age 3 that may inform prevention of NSSI. Thus, efforts to enhance regulation of these domains of affect early in development may have important impacts on shaping preventative and intervention models.

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