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Non-suicidal self-injury as a risk factor for purging onset: Negatively reinforced
behaviors that reduce emotional distress

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Abstract

Both non-suicidal self-injury (NSSI) and purging behavior are thought to involve harm to the self. The acquired capability for self-harm model holds that engaging in one self-harming behavior increases the capability to tolerate harm to the self, thus increasing risk for engaging on other such behaviors. In addition, both behaviors are thought to serve the similar function of relief from distress. We thus tested whether engagement in one of these behaviors predicts the subsequent onset of the other. In a longitudinal design, 1158 first year college women were assessed for purging and NSSI at two time points. Engagement in NSSI at Time 1 predicted the college onset of purging behavior 9 months later (OR = 2.20, $p < .04$, CI=1.07-4.19) beyond prediction from Time 1 binge behavior, and purging behavior at Time 1 predicted the subsequent onset of NSSI (OR = 6.54, $p < .01$, CI=1.71-25.04). These findings are consistent with the acquired capability for harm model and with the possibility that the two behaviors serve a similar function.

Key words: purging, NSSI, longitudinal, risk factors, onset

Non-suicidal self-injury as a risk factor for purging onset: Negatively reinforced behaviors that reduce emotional distress

Purging behavior (the deliberate expulsion of unwanted or excessive food intake through the use of behaviors such as self-induced vomiting in order to avoid weight gain or lose weight; American Psychiatric Association, 2013) and non-suicidal self-injury (NSSI: the direct, deliberate destruction of bodily tissue without any suicidal intent; American Psychiatric Association, 2013) appear to share important features. First, both types of behavior cause harm to the self. Purging behavior results in hypokalemia, abnormal levels of liver enzymes, and dental erosion (Greenfeld, Mickley, Quinlan, & Roloff, 1995; Keel, Haedt, & Edler, 2005; Little, 2002; Mickley, Greenfeld, Quinlan, Roloff, & Zwas, 1996). NSSI causes harm by definition, because it involves destruction of bodily tissue. Second, both purging behavior (Haedt-Matt & Keel, 2011; Pearson, Wonderlich, & Smith, 2015) and NSSI (Klonsky, 2011; Riley, Combs, Jordan, & Smith, in press) are thought to provide negative reinforcement in the form of relief from, or distraction from, subjective distress.

Co-occurrence of Purging and NSSI

Exact rates of co-occurrence of purging behavior and NSSI are unknown, but among individuals with eating disorders, 12.5-72% report engaging in NSSI and among those individuals who self-harm, between 24-61% report eating pathology (Jacobson & Luik, 2014), and there is some evidence that this relationship is not restricted to one type of eating disorder pathology (Islam et al., 2015). Jacobson and Luik (2014) discuss a specific link between NSSI and purging behavior such that the likelihood of engaging in NSSI behavior is greater among those individuals whose eating disorder symptomatology is characterized by purging behavior.

Harm to the Self from Purging and NSSI

One contributor to risk for engaging in any specific self-harming behavior is thought to be engagement in other self-harming behaviors previously. The underlying theory for this risk conceptualization is that engaging in a self-harming behavior increases one's ability to tolerate pain, thus leading to an acquired capability for harm (Selby et al., 2010; Van Orden et al., 2005). The ability to tolerate pain is thought to develop from repeated exposure to physically painful and fear-inducing experiences such as childhood maltreatment, combat exposure, suicide attempts, and engagement in self-harming behaviors (Selby et al., 2010; Van Orden et al., 2005). The experience of painful events concurrently predicts NSSI frequency (Selby et al., 2010), and pain tolerance appears to mediate the relationship between painful experiences and the acquired capability for suicide (Franklin, Hessel, & Prinstein, 2011).

Some researchers have argued that disordered eating behaviors constitute painful events and exist on the continuum of harmful acts along with self-injurious behavior (Claes & Muehlenkamp, 2014; Farber, 2008). One such disordered eating behavior is purging by way of self-induced vomiting, a particularly intense and unpleasant act. To the extent that purging constitutes a harmful act, it is expected that an individual would need to have developed a heightened capacity for harm in order to engage in the painful act of purging. In this context, it is noteworthy that purging appears to be associated with suicidality; in a sample of Swedish adults, the odds of suicide were highest in women with eating disorders that included purging behavior (Pisetsky, Thornton, Lichtenstein, Pedersen, & Bulik, 2013).

Thus, some individuals are thought to acquire a capability to tolerate harm to the self, and this capability is a risk factor for continued engagement in self-harming behaviors. If purging behavior can be understood, in part, to represent a self-harming or painful event, then one risk factor for purging behavior may be engagement in other self-harming acts, presumably through

the development of the increased capability for harm. Engagement in NSSI may thus increase risk for the subsequent onset of purging behavior. Similarly, engagement in purging behavior may, itself, increase the capability for harm and thus increase risk for other self-harming behaviors. Purging behavior may increase risk for the subsequent onset of NSSI.

Negative Reinforcement in Purging and NSSI

Several bodies of research support the idea of purging behavior as having a negative reinforcement function and this claim is supported empirically. In a meta-analysis of studies using ecological momentary assessment examining trends in affect during a binge-purge cycle, Haedt-Matt and Keel (2011) found that negative affect decreases following compensatory behaviors such as purging. In a recent examination of the functional role of purging behavior, Wedig and Nock (2010) identified negative reinforcement, in the form of relief of anxiety, avoidance of bad feelings, and coping with distress, as one important functional dimension to purging behavior. Current theories of bulimia nervosa identify a negative reinforcement function of purging behavior (Pearson et al., 2015).

Self-harm behavior may serve multiple functions (Nock & Prinstein, 2004), but a central function appears to be negative reinforcement, as NSSI serves to provide relief from emotional distress and help regulate negative affect (Bresin, Gordon, Bender, Gordon & Joiner, 2010; Klonsky, 2011; Nock & Prinstein, 2004) or stabilize affect (Vansteelandt et al., 2013). This negative reinforcement function is clearly quite similar to what has been described for purging behavior. Just as is true for purging behavior, individuals experience increases in distress immediately preceding an episode of NSSI, and negative affect decreases following engagement in this behavior (Armey et al., 2011).

Previous findings on NSSI and purging

There have been at least two longitudinal studies that suggest engaging in either purging or NSSI behavior increases the risk for engaging in the other. First, in college students, Peterson and Fischer (2012) found that NSSI at baseline predicted NSSI and purging behavior at 8-month follow-up, and that purging behavior at baseline predicted NSSI and purging behavior at eight month follow-up. Second, in a sample of NSSI-active individuals (Turner, Yiu, Layden, Claes, Zaitsoff, & Chapman, 2014), NSSI at baseline predicted increased frequency of fasting, excessive exercise, self-induced vomiting, and laxative/diuretic use at 3-month follow-up. However, eating disorder behavior did not predict subsequent NSSI. Neither of these studies conducted the more rigorous test of predicting the onset of one behavior from engagement in the other.

The present study: A test of two hypothesized pathways

To date, little research has examined predictive relationships between the onset of purging behavior and NSSI. The current longitudinal study did so. We tested the hypothesis that engagement in one of these behaviors predicted the subsequent onset of the other. The bases for this hypothesis are (a) the theory that engaging in one form of self-harming act leads to an acquired capability for harm that makes other such acts more likely (Selby, Connell, & Joiner, 2010; Van Orden, Merrill, & Joiner, 2005), and (b) the observation that the two behaviors serve the same function of negative reinforcement and do so in a similar way (reducing emotional distress through harmful bodily acts).

The current study is, we believe, the first to test two predictive pathways using a prospective design; specifically, that engagement in NSSI would predict the college onset of purging and purging would predict the onset of NSSI. To conduct this test, we studied women over a 9-month period from prior to college entry to near the end of their first year of college.

We included binge eating behavior with loss of control in the design as well, because it was important to test whether NSSI, a marker of capacity for self-harm, predicted the subsequent onset of purging behavior beyond prediction from prior binge eating. Similarly, we tested whether initial purging behavior predicted subsequent engagement in NSSI, beyond prediction from initial binge eating. This last step was to determine whether, among behaviors that define bulimia nervosa, purging uniquely predicted subsequent self-harm.

To find that both prospective pathways are present would be to advance understanding of risk factors for maladaptive behavior that are used to regulate affect. Positive findings would suggest that early engagement in a harmful behavior that serves to reduce negative affect, such as NSSI, may increase risk for the onset of other harmful acts that operate along a similar negative reinforcement pathway, such as purging. Such findings would be consistent with the acquired capability of harm model.

Method

Participants

Participants were incoming freshman women at a large Southern-Midwest university; they were recruited the summer before their freshman year of college to participate in a 9-month long longitudinal study. They were deemed eligible if they were women, if their enrollment was traditional (i.e., within three years of graduating high school), if they were 18 years of age or older, and if they spoke English. A total of 1158 women participated at two time points: the month before the school year began (July) and near the end of the freshman year (April). 84.5% of the participants were of European American descent, 9.3% were of African American descent, and 2.1% were of Asian American descent; other participants reported other backgrounds in

small numbers or did not report an racial background. The mean age of participants at the initiation of the study was 18.04; 95% of participants were 18 years old at Time 1).

The retention rate was 75% from Time 1 to Time 2; of the 92% of students who stayed in school for the full year (Sugarman, 2012), we retained 82%. Retained and lost participants did not vary on any study variables, suggesting that data were missing at random. As a result, expectation maximization procedures were used to impute missing data. This procedure produces more reliable estimates of population parameters than traditional methods, such as mean substitution or case deletion (Enders, 2006).

Measures

Deliberate Self-Harm Inventory (DSHI; Gratz, 2001). The DSHI is a self-report questionnaire that assesses the presence and nature of deliberate self-harm with good reliability and validity. We measured engagement in NSSI dichotomously. The endorsement of any type of self-harming behavior earned a score of 1; endorsing no such behavior earned a score of 0. Onset of NSSI was defined as reporting no engagement in any type of NSSI behavior at or prior to Time 1 (i.e. no lifetime prevalence of NSSI), but reporting engagement in NSSI at Time 2.

Eating Disorder Examination (EDE-Q; Luce & Crowther, 1999). The EDE-Q is adapted from the Eating Disorder Examination, which assesses the key behavioral features of eating disorders in reliable and valid ways. We measured purging behavior dichotomously. A positive answer to the question “Over the past four weeks, have you made yourself sick (vomit) as a means of controlling your weight, or to counteract the effects of eating?” earned a score of 1 and a negative answer earned a score of 0. Onset of purging behavior was defined as receiving a score of 0 at Time 1 and a score of 1 at Time 2.

We also measured binge eating behavior with loss of control, again dichotomously, using two EDE-Q questions: “Have there been times when you have eaten what most people would regard as an unusually large amount of food?” and “During how many of these episodes of overeating did you have a sense of having lost control?” If the participant answered “yes” to the first question and then indicated that at least one of these binge episodes was characterized by a loss of control, this dual endorsement earned a score of 1 for binge eating with loss of control; endorsing no such behavior earned a score of 0.

Procedure

The study was online and accessible through the university’s Qualtrics survey system. The Time 1 assessment took place in July prior to the participants’ first day of move-in. The Time 2 assessment took place in late April of the participants’ freshman year. The study was approved by the University of Kentucky Institutional Review Board.

Results

Correlations among key study variables are presented in Table 1. Reported engagement in each behavior (purging, binge eating, and NSSI) at Time 1 was associated with engagement in the same behavior at Time 2. Behaviors were generally correlated with each other both cross-sectionally and longitudinally. To provide information on the frequency of co-occurrence of the two behaviors, Table 2 presents Chi-Square analyses relating purging (4-week prevalence) and NSSI (lifetime prevalence) at both Time 1 and Time 2.

At baseline, a small number of women endorsed purging behavior within the past 4 weeks ($n = 30$, or 2.6% of the sample). An additional number of women ($n = 34$, or 2.9% of the sample) endorsed purging behavior within the past 4 weeks of Time 2 assessment, indicating that they began purging during the first year of college and were active for that behavior in April, 9

months after baseline assessment; this group represents the positive for onset purging group. A relatively large number of women endorsed lifetime NSSI at baseline ($n = 237$, or 20.5% of the sample). An additional 27 women began engaging in NSSI during the first year of college (2.3% of the sample); this group constitutes the positive for NSSI onset group.

To test our core hypotheses, we conducted two binomial logistic regression analyses (see Table 3). In the first, we tested whether engagement in NSSI at Time 1 predicted the onset of purging behavior over the course of the first year of college. In this analysis, we selected only those participants who were not active for purging behavior at Time 1 ($n = 1128$). We then predicted Time 2 purging behavior from Time 1 NSSI behavior and Time 1 binge eating behavior with loss of control, thus predicting the first year college onset of purging behavior. NSSI behavior at Time 1 predicted the subsequent college onset of purging behavior ($OR = 2.20$, $p < .04$, 95% $CI = [1.07, 4.19]$) beyond prediction from Time 1 binge eating behavior with loss of control. Thus, controlling for binge eating, women who had engaged in some form of lifetime NSSI but had not purged the July before college entry were 2.2 times as likely to report engaging in purging behavior 9 months later than were women not engaging in NSSI.

Second, we tested whether engagement in purging behavior at Time 1 predicted the onset of NSSI over the course of the first year of college. We began by selecting only those participants who had not engaged in lifetime NSSI prior to Time 1 ($n = 921$). We predicted Time 2 NSSI from Time 1 purging behavior and Time 1 binge eating behavior. This test was also statistically significant. Purging behavior at Time 1 predicted the subsequent onset of NSSI ($OR = 6.54$, $p < .01$, 95% $CI = [1.71, 25.04]$) above and beyond prediction from Time 1 binge eating behavior. Thus, controlling for binge eating, women who were engaging in purging behavior in the month prior to college entry were between 6 and 7 times as likely to begin engaging in NSSI

during their first year of college than were the women who were not engaging in purging behavior at Time 1.

Discussion

Among young adult women assessed from the month prior to college entry and again near the end of their first year of college, those who were purging at the start of college were more likely to begin engaging in NSSI over the first year of college than were other women. In addition, women who had engaged in NSSI before beginning college and were not purging, were more likely to have engaged in purging behavior 9 months later. Engaging in one of these harmful bodily acts (NSSI or purging) increased the likelihood of engaging in the other.

The results of this study are consistent with past theoretical and empirical work that highlights the link between NSSI and purging behavior (Claes & Muehlenkamp, 2014; Peterson & Fischer, 2012; Wedig & Nock, 2010). The current findings extend that work by demonstrating that engaging in one of these maladaptive, harmful behaviors puts women at risk to begin engaging in the other. The findings of this study are consistent with the acquired capability for harm model. It is possible that engaging in one form of self-harming behavior leads to a capability to tolerate harm to the self, and thus increases risk for engaging in other forms of self-harming behavior.

With respect to theory, it may be important to add consideration of the acquired capability for harm to existing models of purging behavior risk. Current risk models include the negative reinforcement function of the behavior and many additional factors such as anxiety proneness, comorbid mood, anxiety, and substance disorders, perfectionism, female sex, parent-perceived child overweight, and college peers' dieting behavior (Brown, Haedt-Matt, & Keel, 2011; Forbush, Heatherton, & Keel, 2007; Keel, Forney, Brown, & Heatherton, 2013; Pearson et

al., 2015). The acquired capability for harm, and the exposure to painful events that develop it, may represent another dimension of risk for purging behavior.

A developing acquired capability for harm increases the risk for a multitude of harmful acts (Selby et al., 2010); the mechanism by which it would lead to purging specifically requires further inquiry. Among the possible mechanisms are, for example, the self-punishment hypothesis, self-determination theory (Vansteenkiste, Claes, Soenens, & Verstuyf, 2013), and the co-occurrence of other purging risk factors, such as those described above and learned expectancies for overgeneralized life improvement from thinness and restricting food intake (Hohlstain, Smith, & Atlas, 1998; Stice & Whitenton, 2002).

It appears useful to understand both purging behavior and NSSI as serving the negative reinforcement function of regulating or reducing negative affect, and this conceptualization rests on strong empirical grounds (Bresin et al., 2010; Haedt-Matt & Keel, 2011; Klonsky, 2011). Appreciating that harmful behaviors such as these also have a functional value for individuals is important both clinically and theoretically. With respect to treatment, this perspective suggests that interventions that provide skills for managing negative affect and affect-based urges, such as Dialectical Behavior Therapy (DBT; Linehan, 1993) and Integrated Cognitive Affective Therapy for Bulimia Nervosa (ICAT-BN: Wonderlich et al., 2014), may prove useful in relation to purging behavior. Hill, Craighead, and Shafer (2011) applied DBT to purging behavior with promising results, and early tests of ICAT-BN are promising as well (Wonderlich et al., 2014). Certainly, it will be important to continue to explore the different roles that negative affect regulation and, alternatively, affect stabilization play in the risk process for both purging and NSSI.

The current findings should be considered in the context of the study's limitations. Data were collected by self-report questionnaire using a web-based format, so we did not have the opportunity to clarify questions or responses, particularly concerning the wording of the self-harm measure. The rate of retention was not optimal, although missing participants did not vary from retained participants on study variables. Only vomiting was examined as a purging behavior in this study, which limits the generalizability of our results to other purging behaviors such as laxative use or excessive exercise. In addition, there was a discrepant timeframe in our measurement of NSSI (measured as lifetime prevalence) and purging behavior (measured as 4-week prevalence), which has two important implications: (1) because purging was only measured over a 4-week timeframe at Time 1 and Time 2, it is possible that some of the participants had purged prior to college and what we classified as college onset might actually have been relapse, and (2) we may have underestimated the true prevalence of purging, given the short timeframe. Finally, the sample is made up of predominantly white college women, which limits the generalizability of the findings.

Despite these limitations, the finding that engagement in purging behavior predicts the subsequent onset of NSSI, and engagement in NSSI predicts the subsequent onset of purging behavior, provides an important advance to understanding risk for purging specifically and self-harming behavior generally. Future work may focus on integrating the current findings into existing risk models and testing interventions based on the functional negative reinforcement perspective and acquired capability for harm theory.

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Table 1. Correlations among key study variables

	T1 Purging	T1 NSSI	T1 Binge with LOC	T2 Purging
T1 Purging				
T1 NSSI	.07*			
T1 Binge with LOC	.16**	.09**		
T2 Purging	.46**	.07*	.12**	
T2 NSSI	.10**	.66**	.08**	.08**

Note. N = 1158; Binge with LOC = binge eating with loss of control. All variables indicate the presence of behaviors measured at T1 (Time 1) or T2 (Time 2). All variables were measured dichotomously, so the correlations are phi coefficients. ** $p < .01$. * $p < .05$

Table 2.

Crosstabulation of purging behavior and NSSI at Time 1

	NSSI non-active	NSSI active	χ^2
Purging non-active	902	226	4.97*
Purging active	19	11	

Note. Purging behavior was assessed as purging within the past 4-weeks, NSSI was assessed as lifetime prevalence. *= p < .05.

Crosstabulation of purging behavior and NSSI at Time 2

	NSSI non-active	NSSI active	χ^2
Purging non-active	949	156	8.08**
Purging active	38	15	

Note. Purging behavior was assessed as purging within the past 4-weeks, NSSI was assessed as prevalence of NSSI from July – April. *= p < .05, ** = p < .01.

Table 3. Regression analyses for binary logistic regressions predicting Onset of Time 2 purging or NSSI

Prediction of Time 2 Purging Onset

Variable	B	SE B	OR	χ^2
Step One				4.82*
T1 Binge with LOC	.34	.55	1.43	
T1 NSSI	.79	.37	2.20*	

n = 1128; LOC = loss of control; * *p* < 0.05

Prediction of Time 2 NSSI Onset

Variable	B	SE B	OR	χ^2
Step One				5.87*
T1 Binge with LOC	.19	.66	1.20	
T1 Purging	1.88	.67	6.54**	

n = 921; LOC = loss of control; * *p* < 0.05; ** *p* < 0.01