Research paper

Self-criticism is a real-time predictor of non-suicidal self-injury and disordered eating: An ecological momentary assessment study among treatment-seeking individuals

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ABSTRACT

Background: Although theory and research implicate self-criticism as a risk factor for non-suicidal self-injury (NSSI), the nature of this association in daily life remains unclear. This study used ecological momentary assessment (EMA) to address whether (1) trait and state self-criticism elevate the risk of NSSI, (2) state self-criticism predicts NSSI behavior in real-time via increased NSSI urge intensity, and (3) the risk pattern extends to disordered eating (DE; binge eating, purging, restrictive eating).

Methods: A total of 125 treatment-seeking individuals who self-injure (87.20% female; M_{age} = 22.98, SD = 5.32) completed measures of trait self-criticism at intake, followed by six daily assessments for 28 days (15,098 assessments; median compliance = 78.6%) measuring self-critical thoughts, NSSI, and DE. Multilevel vector autoregressive models were constructed within a dynamic structural equation modeling framework.

Results: Patients who reported higher mean state self-critical thoughts experienced more intense NSSI urges and an increased risk for NSSI behavior during the 28-day EMA period. Higher-than-usual self-critical thoughts predicted NSSI urge intensity and NSSI behavior within the following 2 h. NSSI urge intensity partially mediated the effect of self-critical thoughts on NSSI behavior. Trait self-criticism did not predict comorbid DE, but mean state self-critical thoughts were associated with binge eating and restrictive eating. The within-person risk pattern of self-criticism generally extended to DE, with full mediation via DE urges for purging and restrictive eating, but not binge eating.

Conclusions: Self-criticism is a real-time predictor of NSSI and comorbid DE. These findings underscore the relevance of monitoring self-criticism outside the therapy room, as it may be an important treatment target.

1. Introduction

Non-suicidal self-injury (NSSI), defined as direct and deliberate damaging of one's body tissue without suicidal intent (International Society for the Study of Self-Injury [ISSS], 2024), is prevalent among treatment-seeking individuals. Approximately 50% of adolescents (Millon et al., 2022) and 10% of adults (Ose et al., 2021) receiving treatment report past-month NSSI. Although NSSI can occur without comorbidities, it is well-known that it frequently co-occurs with *disordered eating* (DE), which encompasses behaviors such as binge eating, purging, and restrictive eating (Cucchi et al., 2016). Individuals with comorbid NSSI-DE experience more severe psychopathological symptoms (Islam et al., 2015) and are more likely to attempt suicide (Brausch and Perkins, 2018) than those who engage in only one of these

behaviors. Accordingly, it is imperative to identify whether risk factors uniquely predict NSSI or transdiagnostically predict NSSI-DE (Kiekens and Claes, 2020), as this can inform prevention and intervention efforts.

One theoretically important risk factor of NSSI is *self-criticism*, a personality style involving overly harsh self-evaluation (Gilbert et al., 2004). According to the *defective self model,* self-critical individuals may engage in NSSI because they believe they are flawed or deserve punishment (Hooley et al., 2010). Similarly, Nock's (2009) *integrated theoretical model* proposes that "high aversive cognitions," such as self-critical thoughts, elevate risk of NSSI. Meta-analytic findings demonstrate a positive association between self-criticism and history of NSSI ($r = 0.38$; Zelkowitz and Cole, 2019), and self-criticism has been shown to predict NSSI behavior over one (Fox et al., 2018) and two (Perkins et al., 2020) months in clinical samples. However, a few studies in community samples have found conflicting findings (Daly and Willoughby, 2019; Zelkowitz and Cole, 2020). Moreover, no studies have investigated the real-time nature of this association in a clinical sample, despite research suggesting that self-critical thoughts fluctuate substantially in daily life (Zuroff et al., 2016; Veilleux et al., 2024).

Three important questions must be addressed to enhance our understanding of the self-criticism-NSSI risk relationship. The first question is whether self-criticism, *both* as a trait and state, elevates risk for NSSI. *Ecological momentary assessment* (EMA), also known as experience sampling methodology, can address this question by having participants report multiple times daily on their self-critical thoughts (Myin-Germeys et al., 2018), with recent work suggesting that young adults who self-injure experience higher levels of both trait and state self-criticism than individuals who do not have a history of NSSI (Kiekens et al., 2024b). Another study found that young people with a history of NSSI retrospectively reported increased self-hatred thoughts when they self-injured (Nock et al., 2009). Likewise, within-person increases in state self-critical thoughts predicted increased NSSI urge intensity concurrently and within the next few hours among university students with a history of NSSI (Burke et al., 2021). However, between-person differences in self-criticism, assessed both as a trait variable at baseline and an aggregated state variable averaged across the 10-day EMA period, did not predict overall NSSI urge intensity (Burke et al., 2021). The low base rate of NSSI in the university sample precluded investigation of NSSI behavior, underscoring the need to complement the present literature with an investigation in a clinical sample.

A second critical question is *how* self-criticism might predict NSSI behavior in real-time. Theoretical models have not yet provided explanations of NSSI urges that meaningfully differ from explanations of NSSI behavior (e.g., Hooley et al., 2010; Nock, 2009). However, ideation-to-action theories of suicide suggest that the factors that lead to suicidal urges are not necessarily the same factors that lead to suicidal behavior (Klonsky and May, 2015; Klonsky et al., 2018). Similarly, it may be valuable to distinguish the processes that contribute to NSSI urges and NSSI behavior. For example, as self-critical thoughts increase, an individual may experience more intense NSSI urges and in turn, a greater risk of NSSI behavior. Therefore, EMA studies are needed to clarify whether NSSI urge intensity mediates the association between self-critical thoughts and NSSI behavior in real-time to identify potential prevention or intervention targets.

A third question is whether the risk pattern of self-criticism is unique to NSSI or extends to DE among individuals who self-injure. It is estimated that 54–61% of individuals who engage in NSSI also engage in DE (Cucchi et al., 2016), suggesting that transdiagnostic processes (e.g., self-criticism) underpin these behaviors (Claes and Muehlenkamp, 2014). In parallel to research on NSSI, meta-analytic findings show a positive association between self-criticism and DE ($r = 0.37$–0.40; Paranjothy and Wade, 2024; Zelkowitz and Cole, 2019), whereas results from longitudinal studies are inconsistent (Perkins et al., 2020; Zelkowitz and Cole, 2020). In one EMA study, Mason et al. (2021) found that within-person increases in self-critical thoughts predicted purging and restrictive eating, but not binge eating, within the next few hours among

women with binge eating pathology. Of note is that the *benefits and barriers model* proposes that self-criticism is a unique risk factor for NSSI and should, therefore, be a more robust predictor of NSSI than DE (Hooley and Franklin, 2018). Yet, no EMA study has examined whether self-criticism uniquely predicts NSSI or transdiagnostically predicts comorbid DE, which could inform theoretical models and interventions (Kelly et al., 2024).

1.1. The present study

To address these clinically relevant questions, we present findings from the Detection of Acute Risk of Self-Injury (DAILY) project – an EMA study among treatment-seeking individuals (Kiekens et al., 2023). Based on theory (e.g., Hooley et al., 2010; Nock, 2009) and prior mixed findings (e.g., Burke et al., 2021; Fox et al., 2018), both trait and aggregated state self-criticism were hypothesized to be associated with an increased risk for NSSI urges and behavior during the 28-day EMA period. In addition, within-person increases in self-critical thoughts were anticipated to predict real-time increases in NSSI urge intensity and risk of NSSI behavior within the next 2 h (e.g., Burke et al., 2021). We further hypothesized that the within-person prospective association between self-critical thoughts and subsequent NSSI behavior would (1) no longer be significant when controlling for NSSI urge intensity at the previous time point and (2) be mediated by elevated NSSI urge intensity (Klonsky and May, 2015; Klonsky et al., 2018). Finally, based on earlier findings (e.g., Mason et al., 2021; Perkins et al., 2020) and emerging theoretical perspectives (Kelly et al., 2024), we expected self-criticism to be a real-time transdiagnostic predictor of comorbid DE among patients who self-injure.

2. Methods

2.1. Procedures and participants

The objectives and research plan of this study were preregistered (https://osf.io/8njdb/). Detailed procedures of the DAILY project are outlined in Kiekens et al. (2023), with those relevant to the current study described below. Individuals aged 15–39 years receiving inpatient and/or outpatient mental health services were recruited and had to report past-month NSSI urges and/or behavior. Participants completed a baseline assessment at intake involving self-report surveys and the *Structured Clinical Interview for DSM-5* (SCID-5; Arntz et al., 2018; First et al., 2016). Participants were instructed on completing the EMA protocol using the smartphone app *m-path* (Mestdagh et al., 2023) and completed a 28-day EMA protocol consisting of six daily semi-random surveys administered at roughly two-hour intervals between 10:00 am and 9:30 pm. Additional burst surveys were triggered by intense urges, but these were not included in this study and were solely used to screen for NSSI behavior between regular surveys. Participants needed to initiate the EMA surveys within 15 min of being prompted, and once initiated, responses submitted within 45 min were considered valid. Participants were prompted with one reminder if they did not initiate the EMA survey within 10 min. Participants could also register NSSI behavior via a pushbutton (event sampling). Participants received €20 for compliance ≤33%, €35 for compliance >33%, €70 for compliance >65%, and €100 for compliance >83%. In addition, a personalized feedback report was provided to the clinician so that relevant information could be discussed with the patient. All participants provided informed consent and the authors' institutional review boards approved all procedures.

A total of 132 patients participated between June 2021 and August 2023, with 124 individuals completing the 28-day EMA period. Of the eight participants who did not complete the entire EMA period, two completed >25 regular EMA surveys and met the inclusion threshold for the specification of random effects, and were thus retained in the sample (Muthén and Asparouhov, 2023). One participant who finished the

entire EMA period did not meet this threshold and was excluded, resulting in a final sample of 125 participants (87.20% cisgender women, 6.40% cisgender men, 6.40% gender diverse; M_{age} = 22.98, *SD* = 5.32; 52.80% heterosexual, 12.80% gay or lesbian, 32.00% bisexual, 2.40% asexual). Participants completed 15,123 surveys with a median completion time of 86 s (IQR = 61–127s). This corresponded to a median compliance of 78.57% (IQR = 59.52–88.10%). Twenty-five (0.17%) surveys were not completed within 45 min, resulting in 15,098 valid surveys, averaging 121 assessments (*SD* = 34.53, range = 26–166) per participant across 28 EMA days.

2.2. Baseline measures

2.2.1. Clinical characteristics

Clinical characteristics were measured using Dutch versions of the SCID-5 (Arntz et al., 2018; First et al., 2016), *Eating Disorder Examination Questionnaire* (EDEQ; Aardoom et al., 2017; Fairburn and Beglin, 2008), and *Self-Injurious Thoughts and Behaviors Interview* (SITBI; Kiekens et al., 2018; Nock et al., 2007). We achieved high inter-rater reliability for SCID-5 DSM-5 diagnoses among clinical psychologists (rates of agreement = 92–100%; average kappa = 0.96, range = 0.84–1.00; Landis and Koch, 1977) in a 20% subsample (*n* = 25).

2.2.2. Trait self-criticism

Trait self-criticism was assessed using a Dutch version of *The Forms of Self-Criticizing/Attacking and Self-Reassuring Scale* (FSCRS; Gilbert et al., 2004; Sommers-Spijkerman et al., 2018). We used the hated-self (4 items; e.g., "*I have a sense of disgust with myself*") and inadequate-self (9 items; e.g., "*When things go wrong for me I am easily disappointed with myself*") subscales. Participants rated each item on a five-point Likert scale ranging from 0 (*Not at all like me*) to 4 (*Extremely like me*). To avoid conceptual overlap with the NSSI measures, we excluded the hated-self subscale item, "*I have become so angry with myself that I want to hurt or injure myself*." The FSCRS is reliable in clinical populations (Castilho et al., 2015; Halamová et al., 2019). In our sample, the Cronbach's alphas of the hated-self and inadequate-self subscales were 0.73 and 0.80, respectively.

2.3. EMA measures

2.3.1. Self-critical thoughts

Self-critical thoughts were measured in each EMA survey using the following item: "*Right now I am disappointed in myself.*" This item was rated on a seven-point Likert scale ranging from 0 (*Not at all*) to 6 (*Very much*). Previous EMA research has used this item to measure self-critical thoughts (Kiekens et al., 2024b; Mason et al., 2021), and it is conceptually similar to items within the inadequate-self subscale (e.g., "*I am easily disappointed with myself*"; Gilbert et al., 2004), which captures cognitions of failure and inadequacy.

2.3.2. NSSI urges and behavior

To measure NSSI urges, each EMA survey asked participants to rate the item, "*Right now, how strong is the urge present to hurt yourself without wanting to die?*" on a seven-point Likert scale ranging from 0 (*Not at all*) to 6 (*Very strong*). To measure NSSI behavior, each EMA survey asked, "*Since the last beep, have you deliberately hurt yourself without wanting to die (for example cut, scratched, or hit yourself)?*", with responses coded as 0 (absent) or 1 (present). NSSI behavior was considered present between consecutive assessments whenever it was retrospectively reported in a survey or had been registered since the last completed survey.

2.3.3. DE urges and behavior

In each EMA survey, participants were given a screening item assessing the presence of thoughts, urges, and engagement in binge eating, purging, and restrictive eating since the previous EMA survey. If participants responded affirmatively, they were given follow-up

questions for each endorsed DE urge or behavior. For binge eating, participants rated the items: "*Right now, how strong is the urge to eat an unusually large amount of food?*" and "*Since the last beep, have you experienced a binge eating episode?*". For purging, participants rated the items: "*Right now, how strong is the urge to vomit deliberately?*" and "*Since the last beep, have you vomited deliberately?*". For restrictive eating, participants rated the items: "*Right now, how strong is the urge to eat less to control your weight?*" and "*Since the last beep, have you eaten less to control your weight?*". DE urge intensity was rated on a seven-point Likert scale ranging from 0 (*Not at all*) to 6 (*Very strong*), with instances when the screening item was not endorsed coded as 0. Due to the extreme right skewness of these items (82.14–94.83% of scores were 0 across DE urges; range skew = 1.97–4.76, range kurtosis = 2.18–16.16), DE urges were dichotomized with 0 as the cut-off value (absent/present). Similarly, DE behaviors were coded as absent (0) or present (1).

2.4. Statistical analyses

Analyses were conducted in R version 4.2.1 or Mplus version 8.3 (Muthén and Muthén, 1998–2017). Initial descriptive analyses provided a descriptive overview of the sample. To address our research objectives, we employed multilevel vector autoregressive (MVAR) models within a dynamic structural equation modeling (DSEM) framework (Asparouhov et al., 2018; McNeish and Hamaker, 2020). To address objective 1, we investigated the role of trait self-criticism and aggregated state self-critical thoughts (i.e., patient-specific aggregated means) as between-person predictors of both the mean intensity of NSSI urges and the propensity for NSSI behavior over 28 days in the entire sample of patients. To address objective 2, a series of MVAR models were employed to evaluate two-hourly within-person associations between self-critical thoughts and NSSI urge intensity (Models 1–2) or NSSI behavior (Models 3–5). Model 1 examined the association between self-critical thoughts$_{T-1}$ and NSSI urge intensity$_T$. Model 2 examined whether self-critical thoughts$_{T-1}$ *incrementally* predicted changes in NSSI urge intensity$_T$ when controlling for NSSI urge intensity$_{T-1}$. Model 3 assessed the association between self-critical thoughts$_{T-1}$ and NSSI behavior$_T$. Model 4 investigated whether self-critical thoughts$_{T-1}$ *incrementally* predicted NSSI behavior$_T$ when controlling for NSSI behavior$_{T-1}$. Finally, Model 5 investigated whether self-critical thoughts$_{T-1}$ not only incrementally but *uniquely* predicted NSSI behavior$_T$ by controlling for both NSSI behavior$_{T-1}$ and the cross-regressive effect of NSSI urge intensity$_{T-1}$. Since within-person associations were modeled, these MVAR models included all participants who experienced NSSI urges and behaviors. Furthermore, to mitigate biases from exogenous covariates, the models included auto-regressive effects of self-critical thoughts (Asparouhov et al., 2018). We then constructed a prospective within-person mediation model assessing if the association between self-critical thoughts$_{T-2}$ and NSSI behavior$_T$ operated via NSSI urge intensity$_{T-1}$, while controlling for the auto-regressive effects of self-critical thoughts, NSSI urge intensity, and NSSI behavior (McNeish and MacKinnon, 2022). Finally, to address objective 3 (i.e., whether the risk pattern of self-criticism extends to DE urges and behavior), we used a similar modeling strategy for DE.

Linear regressions predicted NSSI urge intensity, while probit regressions predicted the presence of NSSI behavior, DE urges, and DE behavior. DSEM relies on Bayesian estimation with non-informative priors based on Markov Chain Monte Carlo using Gibbs sampling. The TINTERVAL statement was specified with two-hour intervals for the EMA surveys, which employs a Kalman filter approach to handle missingness and obtain time-equidistant lagged analyses (Asparouhov et al., 2018; McNeish and Hamaker, 2020). Trait variables assessed at intake were grand-mean centered, while latent person-mean centering was used for state variables to enable interpretation in a relative fashion for each participant at the within-person level while accounting for sampling error.

The statistical significance of effects was evaluated by calculating 95% credibility intervals (CrIs) around each point estimate. We allowed

intercepts to vary between participants, treating the slopes of continuous variables as random and the slopes of categorical variables as fixed. Given that DE models included fewer participants reporting comorbid DE urges and behaviors, the within-person slopes were considered fixed in predicting (categorical) outcomes. We incorporated an unrestricted covariance structure for random effects of intercepts and slopes when possible. Additionally, the residual variance of continuous variables was allowed to be person-specific (McNeish and Hamaker, 2020). Finally, given that all participants were in treatment, we evaluated whether there was a linear effect of time (operationalized in days since starting the EMA period) for within-person associations across all outcome variables. If this effect was significant, it was added as a level-1 covariate in subsequent models evaluating within-person effects (McNeish and Hamaker, 2020). Each model consisted of a minimum of 2500 iterations with thinning set to 20 for robust analysis.

3. Results

3.1. Sample description

Table 1 provides a clinical description of the sample. Most patients had engaged in NSSI >100 times in their lifetime (57.60%), >20 times in the past year (70.40%), and at least once within the past month (85.60%). Of the sample, 72.00% met the diagnostic criteria for an NSSI disorder, and 38.40% met the criteria for an eating disorder. The average EDEQ score was 70.61 ($SD = 31.67$). Patients reported a mean of 6.51 on the trait hated-self ($SD = 3.68$) and 18.35 on the inadequate-self ($SD = 5.45$) subscales. During the 28-day EMA period, the average intensity of self-critical thoughts was 2.92 ($SD = 1.45$). All but one patient (99.20%) reported NSSI urges, with an average urge intensity of 1.53 ($SD = 1.13$). There were 105 patients (84.00%) who reported engaging in NSSI behavior (median = 4). Additionally, 56.80% of patients reported binge eating urges (median = 5, $n = 71$) and 43.20% reported binge eating behavior (median = 4, $n = 54$). Purging urges (median = 7, $n = 54$) and behavior (median = 3, $n = 38$) were reported by 43.20% and 30.40% of patients, respectively. Restrictive eating urges and behavior were reported by 72.00% and 59.20% of patients for a median of 17.5 ($n = 90$) and 9 ($n = 74$) times, respectively.

3.2. What is the association between trait and state self-criticism with NSSI urges and behavior?

We first investigated the between-person associations between trait and aggregated state self-criticism and NSSI over 28 days. This revealed that trait inadequate-self did not significantly predict either NSSI urges ($B = 0.02$, 95% CrI = -0.014, 0.059) or behavior ($B = 0.02$, 95% CrI = -0.009, 0.050). However, patients with higher trait hated-self scores upon intake exhibited a significantly higher mean intensity of NSSI urges ($B = 0.07$, 95% CrI = 0.010, 0.117), although this did not extend to NSSI behavior ($B = 0.04$, 95% CrI = -0.002, 0.083). In contrast, higher aggregated state self-critical thoughts were associated with higher mean levels of NSSI urge intensity ($B = 0.484$, 95% CrI = 0.368, 0.595) and a greater propensity to engage in NSSI behavior during the EMA period ($B = 0.15$, 95% CrI = 0.043, 0.258). When both trait hated-self ($B = 0.02$, 95% CrI = -0.022, 0.065) and aggregated state self-critical thoughts ($B = 0.48$, 95% CrI = 0.355, 0.592) were considered, only the latter remained a predictor of higher NSSI urge intensity between patients.

Next, we investigated the two-hour within-person associations between self-critical thoughts and NSSI urges and behavior (Table 2), which revealed a positive prospective association between self-critical thoughts$_{T-1}$ and NSSI urge intensity$_T$ ($B = 0.20$, 95% CrI = 0.160, 0.232; Model 1). This effect remained significant when controlling for NSSI urge intensity$_{T-1}$ ($B = 0.09$, 95% CrI = 0.063, 0.111; Model 2). Furthermore, self-critical thoughts$_{T-1}$ predicted NSSI behavior$_T$ ($B = 0.23$, 95% CrI = 0.169, 0.309; Model 3), even when controlling for NSSI

behavior$_{T-1}$ ($B = 0.20$, 95% CrI = 0.134, 0.258; Model 4). Self-critical thoughts$_{T-1}$ remained a significant predictor of NSSI behavior$_T$ when additionally controlling for NSSI urge intensity$_{T-1}$ ($B = 0.08$, 95% CrI = 0.010, 0.152; Model 5).

3.3. Does state self-criticism predict NSSI behavior via NSSI urge intensity?

Within-person mediation analyses revealed that greater self-critical thoughts$_{T-2}$ predicted increased NSSI urge intensity$_{T-1}$ ($B = 0.11$, 95% CrI = 0.068, 0.147), which, in turn, predicted elevated risk of NSSI behavior$_T$ ($B = 0.32$, 95% CrI = 0.247, 0.391). The direct effect of self-critical thoughts$_{T-2}$ on NSSI behavior$_T$ was significant ($B = 0.10$, 95% CrI = 0.026, 0.178), indicating partial mediation via NSSI urge intensity$_{T-1}$ (Fig. 1A).

Table 1

Clinical description of patients ($n = 125$) and EMA sample ($i = 15,098$ intensive longitudinal assessments).

	% (n)		% (n)
Current Mode of Care		**DSM-5 NSSI Disorder**	72.00 (90)
Inpatient Treatment	36.00 (45)	**Comorbid DSM-5 Mental Disorders**	
Outpatient Treatment	36.00 (45)	Major Depressive Disorder (past month)	68.80 (86)
Hybrid Inpatient and Outpatient Treatment	28.00 (35)	Generalized Anxiety Disorder (past 6 months)	66.40 (83)
NSSI Age of Onset		Panic Disorder (past month)	40.80 (51)
Childhood (11 years or younger)	12.80 (16)	Alcohol Use Disorder (past 12 months)	26.40 (33)
Adolescence (12–18 years)	77.60 (97)	Any Other Substance Use Disorder (past 12 months)	40.00 (50)
Emerging Adulthood (19–29 years)	9.60 (12[a])	Posttraumatic Stress Disorder (past month)	56.80 (71)
Lifetime NSSI Frequency		Anorexia Nervosa (past 3 months)	20.00 (25)
5–20 times	3.20 (4)	Bulimia Nervosa (past 3 months)	8.00 (10)
21–50 times	19.20 (24)	Binge Eating Disorder (past 3 months)	10.40 (13)
51–100 times	20.00 (25)		
100+ times	57.60 (72)	**Presence of NSSI During EMA Surveys**	
Past-Year NSSI Frequency		NSSI Urge (score >0)	57.09 (8619)
<5 times	5.60 (7[b])	NSSI Behavior	6.41 (968)
5–20 times	24.00 (30)	**Presence of Binge Eating During EMA Surveys**	
21–50 times	30.40 (38)	Binge Eating Urge (score >0)	6.82 (1030)
51–100 times	22.40 (28)	Binge Eating Behavior	2.34 (353)
100+ times	17.60 (22)	**Presence of Purging During EMA Surveys**	
Top Three NSSI Methods		Purge Urge (score >0)	5.17 (780)
Cut or carved skin	93.60 (117)	Purging Behavior	1.28 (193)
Scratched skin	75.20 (94)	**Presence of Restrictive Eating During EMA Surveys**	
Smashed hand or foot against wall or other objects	71.20 (89)	Restrictive Eating Urge (score >0)	17.86 (2696)
Presence of Past-Month NSSI	85.60 (107)	Restrictive Eating Behavior	8.92 (1347)

Notes. [a]One patient reported an age of onset at age 30, [b]two patients reported no NSSI behavior in the past year. NSSI = Non-Suicidal Self-Injury; EMA = Ecological Momentary Assessment.

Table 2

Self-critical thoughts as a real-time predictor of non-suicidal self-injury (NSSI) urges and behavior among patients with NSSI urges and behavior.

Within-Person Effects	NSSI Urge Prediction ($n = 124$, $i = 14{,}947$ assessments)		NSSI Behavior Prediction ($n = 105$, $i = 12{,}771$ assessments)		
	Model 1: Urge Intensity$_T$	Model 2: Urge Intensity$_T$ (Controlling for Urge Intensity$_{T-1}$)	Model 3: Behavior$_T$	Model 4: Behavior$_T$ (Controlling for Behavior$_{T-1}$)	Model 5: Behavior$_T$ (Controlling for Behavior$_{T-1}$ and Urge Intensity$_{T-1}$)
	B (95% CrI)	B (95% CrI)	B (95% CrI)	B (95% CrI)	B (95% CrI)
Self-Critical Thoughts$_{T-1}$	**0.20 (0.160, 0.232)**	**0.09 (0.063, 0.111)**	**0.23 (0.169, 0.309)**	**0.20 (0.134, 0.258)**	**0.08 (0.010, 0.152)**
NSSI Urge Intensity$_{T-1}$	-	**0.37 (0.324, 0.409)**	-	-	**0.30 (0.231, 0.376)**
NSSI Behavior $_{T-1}$	-	-	-	**0.32 (0.256, 0.391)**	**0.19 (0.116, 0.255)**
Time (Days)	0.00 (-0.001, 0.001)	-	**-0.01 (-0.019, -0.008)**	**-0.01 (-0.014, -0.006)**	**-0.01 (-0.017, -0.008)**

Notes. Each column represents the results of an individual multilevel vector autoregressive model. These models include the specific variable(s) mentioned in the rows as a predictor of NSSI urge intensity and behavior. Boldface indicates a 95% probability that the true value of the effect is not null (i.e., the credibility interval does not include zero). B = Median Point Estimate, 95% CrI = 95% Credibility Interval, NSSI = Non-Suicidal Self-Injury.
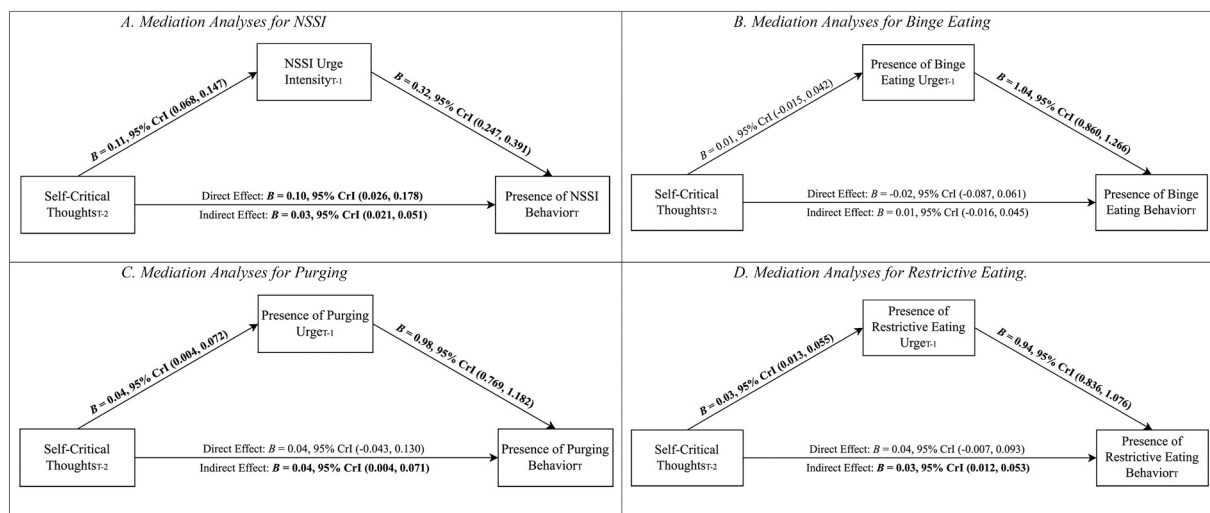

Fig. 1. Mediation analyses of the within-person risk associations between self-critical thoughts and non-suicidal self-injury and disordered eating behavior via urge intensity.

Notes. Autoregressive effects of behavior were included in each mediation model but are not presented for simplicity purposes. Boldface for within-person effects indicates a 95 % probability that the true value of the effect is not null (i.e., the credibility interval does not include zero). B = Median Point Estimate, 95%CrI = 95% Credibility Interval, NSSI = Non-Suicidal Self-Injury.

3.4. Does the risk pattern of self-criticism extend to DE urges and behavior?

Inadequate-self and hated-self did not predict DE urges or behavior during the EMA period (Table 3). However, patients with a higher mean intensity of self-critical thoughts exhibited a higher mean intensity of restrictive eating urges ($B = 0.24$, 95% CrI = 0.011, 0.484) and propensity for engaging in restrictive eating behavior ($B = 0.25$, 95% CrI = 0.029, 0.484). Similarly, aggregated state self-critical thoughts were positively associated with binge eating urges across the EMA period ($B = 0.24$, 95% CrI = 0.046, 0.421), although this association did not extend to binge eating behavior (Table 3).

We then investigated the two-hour within-person associations between self-critical thoughts and the occurrence of DE urges and behavior (Table 4). Self-critical thoughts$_{T-1}$ predicted binge eating urges$_T$ ($B = 0.06$, 95% CrI = 0.024, 0.090), purging urges$_T$ ($B = 0.09$, 95% CrI = 0.053, 0.117), and restrictive eating urges$_T$ ($B = 0.08$, 95% CrI = 0.050, 0.099; Models 1). These effects remained significant for purging and restrictive eating urges, but not binge eating urges, when controlling for the respective DE urge$_{T-1}$ (Models 2). Greater self-critical thoughts$_{T-1}$ predicted binge eating behavior$_T$ ($B = 0.06$, 95% CrI = 0.018, 0.103),

purging behavior$_T$ ($B = 0.16$, 95% CrI = 0.102, 0.219), and restrictive eating behavior$_T$ ($B = 0.10$, 95% CrI = 0.069, 0.126; Models 3). These effects remained significant when controlling for the respective DE behavior$_{T-1}$ (Models 4). However, when also controlling for the presence of the respective DE urge$_{T-1}$ (Models 5), self-critical thoughts$_{T-1}$ no longer predicted binge eating behavior$_T$ or restrictive eating behavior$_T$ but still predicted purging behavior$_T$ ($B = 0.09$, 95% CrI = 0.040, 0.147).

Within-person mediation analyses (Fig. 1B-D) revealed that self-critical thoughts$_{T-2}$ predicted increased risk of purging urges$_{T-1}$ ($B = 0.04$, 95% CrI = 0.004, 0.072) and restrictive eating urges$_{T-1}$ ($B = 0.03$, 95% CrI = 0.013, 0.055), which, in turn, predicted heightened risk of purging behavior$_T$ ($B = 0.98$, 95% CrI = 0.768, 1.182) and restrictive eating behavior$_T$ ($B = 0.94$, 95% CrI = 0.836, 1.076). The direct effects of self-critical thoughts$_{T-2}$ on restrictive eating behavior$_T$ ($B = 0.04$, 95% CrI = −0.007, 0.093) and purging behavior$_T$ ($B = 0.04$, 95% CrI = −0.043, 0.130) were not significant, indicating full mediation via DE urges$_{T-1}$. We observed no mediation for binge eating.

Table 3

Self-criticism as a between-person predictor of disordered eating (DE) urges and behavior ($n = 125$, $i = 15,098$ intensive longitudinal assessments).

Between-Person Effects	Binge Eating Urges and Behavior	
	Mean Propensity Urges	Mean Propensity Behavior
	B (95% CrI)	B (95% CrI)
Trait Inadequate-Self	0.04 (−0.010, 0.101)	0.01 (−0.026, 0.058)
Trait Hated-Self	0.03 (−0.049, 0.113)	0.01 (−0.054, 0.072)
Aggregated State Self-Critical Thoughts	**0.24 (0.046, 0.421)**	0.12 (−0.039, 0.284)

	Purge Urges and Behavior	
	Mean Propensity Urges	Mean Propensity Behavior
	B (95% CrI)	B (95% CrI)
Trait Inadequate-Self	0.03 (−0.031, 0.092)	0.01 (−0.036, 0.060)
Trait Hated-Self	0.06 (−0.022, 0.165)	0.06 (−0.008, 0.139)
Aggregated State Self-Critical Thoughts	0.10 (−0.114, 0.331)	0.08 (−0.107, 0.273)

	Restrictive Eating Urges and Behavior	
	Mean Propensity Urges	Mean Propensity Behavior
	B (95% CrI)	B (95% CrI)
Trait Inadequate-Self	0.02 (−0.047, 0.080)	0.01 (−0.052, 0.069)
Trait Hated-Self	0.03 (−0.060, 0.131)	0.05 (−0.043, 0.141)
Aggregated State Self-Critical Thoughts	**0.24 (0.011, 0.484)**	**0.25 (0.029, 0.484)**

Notes. Each cell displays the result of a separate vector autoregressive model within a dynamic structural equation model with the independent variable(s) specified in the row as a between-person predictor and the disordered eating variable in the columns as the outcome. Boldface indicates a 95 % probability that the true value of the effect is not null (i.e., the credibility interval does not include zero). B = Median Point Estimate, 95% CrI = 95% Credibility Interval, NSSI = Non-Suicidal Self-Injury.

4. Discussion

This study used the highest-resolution EMA data currently available among treatment-seeking individuals who self-injure to investigate whether (1) trait and state self-criticism elevate risk of NSSI urges and behavior, (2) self-critical thoughts predict NSSI behavior via NSSI urge intensity in daily life, and (3) this risk pattern extends to DE. Overall, findings implicate self-criticism as a real-time, transdiagnostic risk factor of NSSI and comorbid DE. Three specific findings warrant further discussion.

First, we found evidence that higher trait levels of self-criticism, particularly involving self-hatred, indicated which patients were most at risk of experiencing more intense NSSI urges but not NSSI behavior. This observation is partly consistent with prior longitudinal studies (Fox et al., 2018; Perkins et al., 2020; Zelkowitz and Cole, 2020) and highlights the clinical relevance of distinguishing between NSSI urges and NSSI behaviors. However, the absence of an association between trait self-criticism and NSSI behavior was somewhat unexpected. One explanation might be that trait self-criticism differentiates individuals with and without a history of NSSI rather than accounting for variations among those who self-injure, as was the case in our clinical sample. Trait self-criticism might be a specific risk factor for the onset of NSSI (Hooley and Franklin, 2018), suggesting that individuals may need to reach a certain threshold of self-criticism to begin engaging in NSSI, rather than influencing the persistence or severity of the behavior once it has

started. Notably, aggregated state self-critical thoughts were positively associated with NSSI, with patients who experienced more intense self-critical thoughts in their daily lives reporting stronger NSSI urges and more frequent NSSI behavior. As a result, differences in the frequency of NSSI behavior might be more robustly associated with higher levels of moment-to-moment self-critical thoughts, emotional states, or external triggers rather than retrospectively reported stable traits like self-criticism. Although trait self-criticism also did not predict which patients engaged in comorbid DE, those with higher state self-critical thoughts were more vulnerable to reporting binge eating urges and restrictive eating urges and behaviors. This provides ecologically valid support for NSSI models (Hooley et al., 2010; Hooley and Franklin, 2018; Nock, 2009) and indicates the relevance of incorporating self-criticism into theoretical models of DE (Kelly et al., 2024).

Second, when a given patient experienced higher-than-usual self-critical thoughts, they subsequently experienced increased NSSI urge intensity and risk of NSSI behavior within the next 2 h. These results extend past EMA research in university students (Burke et al., 2021) and underscore the value of investigating both trait and state self-criticism in daily life (Zuroff et al., 2016). Moreover, these results suggest that ideation-to-action frameworks of NSSI should highlight self-criticism as a proximal risk factor of *both* NSSI urges and behavior. Finally, increased NSSI urge intensity was one mechanism by which self-critical thoughts predicted subsequent NSSI behavior. The fact that only partial mediation was found raises questions about what other mechanisms (e.g., rumination, low self-efficacy to resist NSSI urges; Hughes et al., 2019; Kiekens et al., 2020) might account for the link between self-critical thoughts and NSSI in daily life, which is an important avenue for future research.

Third, the within-person risk pattern identified between self-criticism and NSSI extended to purging and restrictive eating, but not binge eating. These findings align with past EMA research in women with binge eating pathology (Mason et al., 2021). There are two potential explanations for these findings. One explanation is that self-criticism is a stronger real-time predictor of purging and restrictive eating than binge eating. Individuals who are highly self-critical are thought to have a strong desire for self-punishment (Hooley et al., 2010), and purging and restrictive eating are more strongly motivated by self-punishment than binge eating (Robillard et al., 2022). A second explanation is that self-critical thoughts predict binge eating, but over a shorter timescale (Kockler et al., 2018). Additional EMA research with denser sampling schemes should investigate these explanations. Collectively, our results challenge the notion of self-criticism as a unique within-person risk factor for NSSI (Hooley and Franklin, 2018) and suggest it should be viewed as a transdiagnostic predictor of NSSI and comorbid purging and restrictive eating (Claes and Muehlenkamp, 2014; Kelly et al., 2024). Future research should identify risk factors that differentiate NSSI and DE (e.g., pain tolerance, body image concerns, behavior-specific expectancies, self-efficacy to resist urges), as these variables may help explain why individuals choose one behavior over another (Kiekens and Claes, 2020). By clarifying both transdiagnostic and behavior-specific predictors, we can better understand the mechanisms that increase risk for NSSI, DE, and other self-damaging behaviors (e.g., substance use) in daily life.

Our results have several important clinical implications. For instance, it may be valuable for clinicians to assess self-hatred at the outset of treatment among patients who self-injure, as this can identify which patients are at the highest risk of experiencing NSSI urges. Furthermore, our findings elucidate *when* a patient is at imminent risk of NSSI, purging, and restrictive eating (i.e., when self-critical thoughts are higher than the person's mean level). Thus, it may be beneficial to assess urges and self-critical thoughts outside the therapy room using EMA, especially during evening hours (Kiekens et al., 2024a; Lavender et al., 2016), which could enhance intervention timing. For example, it may be beneficial to develop *just-in-time adaptive interventions* (JITAIs) for NSSI and DE that prompt patients to engage in self-compassion techniques

Table 4

Self-critical thoughts as a real-time predictor of disordered eating (DE) urges and behavior among patients with DE urges and behavior.

	Binge Eating Urge Prediction ($n = 71$, $i = 8{,}543$ Assessments)		Binge Eating Behavior Prediction ($n = 54$, $i = 6{,}602$ Assessments)		
	Model 1: Urge Presence$_T$	Model 2: Urge Presence$_T$ (Controlling for Urge Presence$_{T-1}$)	Model 3: Behavior$_T$	Model 4: Behavior$_T$ (Controlling for Behavior$_{T-1}$)	Model 5: Behavior$_T$ (Controlling for Behavior$_{T-1}$ and Urge Presence$_{T-1}$)
Within-Person Effects	B (95% CrI)	B (95% CrI)	B (95% CrI)	B (95% CrI)	B (95% CrI)
Self-Critical Thoughts$_{T-1}$	**0.06 (0.024, 0.090)**	0.03 (-0.001, 0.059)	**0.06 (0.018, 0.103)**	**0.04 (0.004, 0.079)**	0.03 (-0.040, 0.091)
Binge Eating Urge$_{T-1}$	-	**0.39 (0.316, 0.460)**	-	-	**1.05 (0.849, 1.238)**
Binge Eating Behavior$_{T-1}$	-	-	-	**0.44 (0.340, 0.545)**	**-0.24 (-0.341, -0.121)**
Time (Days)	**-0.01 (-0.017, -0.007)**	**-0.01 (-0.013, -0.005)**	-0.01 (-0.011, 0.002)	-	-

	Purge Urge Prediction ($n = 54$, $i = 6{,}613$ Assessments)		Purge Behavior Prediction ($n = 38$, $i = 4{,}604$ Assessments)		
	Model 1: Urge Presence$_T$	Model 2: Urge Presence$_T$ (Controlling for Urge Presence$_{T-1}$)	Model 3: Behavior$_T$	Model 4: Behavior$_T$ (Controlling for Behavior$_{T-1}$)	Model 5: Behavior$_T$ (Controlling for Behavior$_{T-1}$ and Urge Presence$_{T-1}$)
Within-Person Effects	B (95% CrI)	B (95% CrI)	B (95% CrI)	B (95% CrI)	B (95% CrI)
Self-Critical Thoughts$_{T-1}$	**0.09 (0.053, 0.117)**	**0.07 (0.037, 0.101)**	**0.16 (0.102, 0.219)**	**0.12 (0.071, 0.179)**	**0.09 (0.040, 0.147)**
Purge Urge$_{T-1}$	-	**0.23 (0.140, 0.306)**	-	-	**0.52 (0.395, 0.657)**
Purge Behavior$_{T-1}$	-	-	-	**0.28 (0.100, 0.452)**	-0.08 (-0.202, 0.053)
Time (Days)	**-0.02 (-0.022, -0.011)**	**-0.01 (-0.018, -0.008)**	**-0.01 (-0.016, -0.000)**	-0.01 (-0.013, 0.000)	-

	Restrictive Eating Urge Prediction ($n = 90$, $i = 11{,}098$ Assessments)		Restrictive Eating Behavior Prediction ($n = 74$, $i = 9{,}107$ Assessments)		
	Model 1: Urge Presence$_T$	Model 2: Urge Presence$_T$ (Controlling for Urge Presence$_{T-1}$)	Model 3: Behavior$_T$	Model 4: Behavior$_T$ (Controlling for Behavior$_{T-1}$)	Model 5: Behavior$_T$ (Controlling for Behavior$_{T-1}$ and Urge Presence$_{T-1}$)
Within-Person Effects	B (95% CrI)	B (95% CrI)	B (95% CrI)	B (95% CrI)	B (95% CrI)
Self-Critical Thoughts$_{T-1}$	**0.08 (0.050, 0.099)**	**0.04 (0.024, 0.066)**	**0.10 (0.069, 0.126)**	**0.07 (0.045, 0.095)**	0.04 (-0.004, 0.085)
Restrictive Eating Urge$_{T-1}$	-	**0.52 (0.473, 0.567)**	-	-	**0.96 (0.849, 1.080)**
Restrictive Eating Behavior$_{T-1}$	-	-	-	**0.64 (0.590, 0.688)**	**-0.19 (-0.268, -0.109)**
Time (Days)	**-0.02 (-0.023, -0.015)**	**-0.01 (-0.013, -0.007)**	**-0.01 (-0.014, -0.005)**	**-0.00 (-0.007, -0.002)**	0.00 (-0.005, 0.012)

Notes. Each column of disordered eating (DE) outcomes represents the results of an individual multilevel vector autoregressive model. These models include the specific variable(s) mentioned in the rows as a predictor of DE urges and behavior. Boldface for within-person effects indicates a 95% probability that the true value of the effect is not null (i.e., the credibility interval does not include zero). B = Median Point Estimate, 95% CrI = 95% Credibility Interval.

(Wakelin et al., 2022) when increases in self-critical thoughts are detected. A future research endeavor will be to evaluate patients' and clinicians' perspectives on the use of such JITAIs (Kiekens et al., 2023). From a transdiagnostic perspective, these clinical strategies may be particularly worthwhile because they target not only the form of self-damaging behavior (e.g., NSSI, DE) but also the common processes that contribute to these behaviors (e.g., self-critical thoughts). This approach might enhance the efficiency of interventions by targeting multiple self-damaging behaviors simultaneously.

5. Limitations and future directions

Our study has several important limitations to consider when interpreting the findings. First, although NSSI was assessed in each EMA survey, DE was only assessed if patients responded affirmatively to a screening item. This assessment strategy may have reduced variability in the DE analyses. Second, although our study focused on NSSI and DE, self-criticism is a transdiagnostic risk factor for a variety of mental health concerns, including depression and anxiety (Werner et al., 2019). Based on our findings and theoretical models (e.g., Hooley and Franklin,

2018), it is possible that self-directed behaviors, such as NSSI and specific forms of DE (e.g., purging, restricting), are more strongly influenced by self-criticism than other mental health concerns. These behaviors could represent a more immediate and overt way of acting on self-critical thoughts through self-punishment. Future EMA research could test this possibility by comparing the distinct role of self-criticism in predicting a broader range of mental health symptoms and self-damaging behaviors. Third, we only used one item to measure self-critical thoughts, which overlapped conceptually with cognitions of failure and inadequacy (Gilbert et al., 2004). These methodological decisions were made to reduce participant burden (Eisele et al., 2022). Building on the present findings, future EMA research could examine prospective associations of a multi-item measure of state self-criticism also involving cognitions of self-hatred and contemptuous feelings. Fourth, this study examined self-criticism as a sole predictor of NSSI and DE. Although self-criticism is an important factor, other state variables, such as affect and interpersonal stress, have also been shown to predict these behaviors (e.g., Berg et al., 2013; Kranzler et al., 2018; Mason et al., 2021; Victor et al., 2019). Future EMA research could explore how these factors interact with self-criticism to increase momentary risk

levels. Finally, it would be valuable to investigate whether the short-term predictive ability of self-criticism we observed depends on the context (Kelly et al., 2024) and function(s) of the behaviors, as some individuals engage in NSSI/DE for intrapersonal motives (e.g., to regulate emotions or punish themselves) and others for interpersonal motives (e.g., to seek support; Muehlenkamp et al., 2019; Robillard et al., 2022). This approach could provide a more comprehensive understanding of the immediate precursors to NSSI and DE, as well as enhance real-time predictive models for NSSI in future research.

6. Conclusion

This study presents findings from the highest-resolution EMA data currently available among treatment-seeking individuals, with 125 patients who self-injure responding to 15,098 assessments of self-critical thoughts, NSSI, and DE across 28 days. The key finding is that state self-criticism emerged as a transdiagnostic, real-time predictor of NSSI and comorbid DE. This emphasizes the importance of acknowledging self-criticism within theoretical models of NSSI and DE and highlights the potential value of assessing and targeting self-critical thoughts in future interventions.

CRediT authorship contribution statement

Christina L. Robillard: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Laurence Claes:** Writing – review & editing, Supervision, Methodology, Investigation, Data curation, Conceptualization. **Sarah E. Victor:** Writing – review & editing, Methodology, Formal analysis. **Inez Myin-Germeys:** Writing – review & editing, Investigation, Data curation. **Glenn Kiekens:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Declaration of competing interest

The authors have no competing interests to declare.

Data availability

The datasets generated for this study are available upon reasonable request to the corresponding author and after signing a data-sharing agreement. The registration of the research plan, code, and output files of analyses are available on the Open Science Framework page of the study: https://osf.io/8njdb/

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