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Prospective and Concurrent Affective Dynamics in Self-Injurious Thoughts and Behaviors: An Examination in Young Adult Women

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Affective dynamics, assessed using ecological momentary assessment (EMA), provide a nuanced understanding of within-person fluctuations of negative affect (NA) and positive affect (PA) in daily life. NA and PA dynamics have been associated with psychopathology and response to psychological treatments. NA and PA dynamics have been rarely studied concurrently in association with self-injurious thoughts and behaviors (SITB), transdiagnostic difficulties encountered regularly in clinical and community settings. Here we present EMA data from a large, diverse sample of young adult women with high rates of SITB to examine NA and PA dynamics (mean intensity, variability, and inertia). Specifically, we considered the prospective associations between past-year suicidal thoughts and past-year nonsuicidal self-injury and affective dynamics, as well as the concurrent associations between affective dynamics, EMA-reported suicidal thoughts, and EMA-reported urges for nonsuicidal self-injury. Results demonstrate that elevated mean NA and NA variability are robustly associated with all types of SITB assessed prospectively or concurrently. Interestingly, these associations were weakest for past-year nonsuicidal self-injurious behaviors, relative to past-year and concurrent suicidal or nonsuicidal self-injurious thoughts. Past-year suicidal thoughts further predicted increased NA inertia. Decreased PA inertia was associated with past-year nonsuicidal self-injury behavior, as well as concurrent EMA suicidal thoughts. We found no associations (prospective or concurrent) between SITB and mean PA intensity or PA variability. These results highlight the importance of understanding affective processes to develop real-world interventions to prevent nonsuicidal self-injury and suicidal behavior in daily life.

Keywords: self-injurious thoughts and behaviors; suicide; NSSI; affective dynamics; ecological momentary assessment

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SELF-INJURIOUS THOUGHTS AND BEHAVIORS (SITB) include nonsuicidal self-injury (NSSI), suicidal ideation (SI), and suicidal behavior (Nock et al., 2007). SITB are prevalent in community and clinical settings (Bresin & Schoenleber, 2015) and across internalizing and externalizing psychopathology (Franklin et al., 2017). Mood, anxiety, eating, and personality psychopathology confer greatest risk of SITB (Fox et al., 2015; Franklin et al., 2017), and rates of SITB are markedly higher in more intensive psychiatric treatment settings, relative to the general population (Franklin et al., 2017). Women are at greater risk of most SITB relative to men, with the exception of death by suicide (Bresin &

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Schoenleber, 2015; Franklin et al., 2017). Population prevalence studies and meta-analyses suggest that adolescence and young adulthood are particularly high-risk periods for NSSI (Swannell et al., 2014) and suicidal behavior (Nock et al., 2008; Substance Abuse and Mental Health Services Administration, 2014), with some evidence that SITB rates have increased in these groups in recent decades (Twenge et al., 2019). The current study aims to identify factors that may be associated with elevated risk for current and future SITB among high-risk young adultwomen.

Understanding and characterizing the temporal dynamics of affective experiences, i.e., how emotions ebb and flow over time, is crucial to the science and practice of clinical psychology (Trull et al., 2015) and to understanding SITB (Crowe et al., 2019). Individuals vary not only in their "typical" experience of various positive and negative emotions, but also in their emotional intensity (mean), variability (lability), and inertia (stability) over time (Davidson, 2015). Empirical work has demonstrated that these temporal affective patterns differ across the spectra of psychopathology in young adults (Scott et al., 2020), and are associated with important clinical outcomes, such as response to treatment, among adults (Bosley et al., 2019). Further, affective dynamics have served as specific targets in clinical interventions for adults, such as behavioral activation to decrease experiences of negative affect (NA mean; Dimidjian et al., 2011), positive affect treatment to increase experiences of positive affect (PA mean; Craske et al., 2019), dialectical behavior therapy to reduce affective instability (NA/PA variability; Stepp et al., 2008), and exercise to interrupt persistent NA (NA inertia; Bernstein et al., 2019).

Improving our understanding of affective dynamics in relation to SITB may inform theoretical models of SITB initiation and engagement. For instance, the benefits and barriers model (Hooley & Franklin, 2018) posits that NSSI may serve both to downregulate intense NA and/or induce PA, implicating the role of mean NA and PA in NSSI maintenance, consistent with self-reported functions of NSSI (Taylor et al., 2018). Given that NSSI urges are transient, however, it seems possible that NA and PA variability, rather than mean levels, may play a role in why and how NSSI fluctuates over time. With respect to suicide, many theoretical models emphasize the role of intense emotional pain and psychic distress as drivers of suicide (e.g., Klonsky & May, 2015), which may implicate NA intensity as a risk factor for suicidal SITB. Further, most suicide theories consider hopelessness as a component in suicide risk (e.g., Beck et al., 1975; Joiner, 2005; Klonsky & May, 2015; O'Connor, 2011), as well as decreased reasons for living (Ivanoff et al., 1994). To the extent that people view their lives as hopeless and without reasons to stay alive, we might observe elevated NA inertia and decreased PA inertia among suicidal individuals. Finally, recent work with adults has highlighted the marked fluctuations that can occur in suicidal ideation (Kleiman et al., 2017) and risk for suicidal behavior (Bryan & Rudd, 2016) over time, which may suggest that affective variability plays a role in the acute transition from suicidal thoughts to actions.

Negative emotional experiences have been identified as critical precipitants to SITB in ecological momentary assessment (EMA) studies. However, most research in this area has focused on either specific types of NA as they relate to SITB (e.g., in young adults; Victor et al., 2019), and/or has been limited to the examination of adults with specific diagnoses, such as BPD (Scala et al., 2018). Although cross-sectional studies have identified low PA as a risk factor for SITB in adolescents (Rojas et al., 2015) and adults (Victor & Klonsky, 2014), research specific to PA in relation to SITB is relatively scarce and limited to primarily cross-sectional examination. Some work has examined the association between affective variability (lability) and SITB (Palmier-Claus et al., 2012), but these studies have primarily used retrospective self-report measures of affective variability. Meanwhile, recent work has demonstrated that adults' NA and PA variability is best observed through repeated measurement of emotional states in real time using intensive longitudinal study designs such as EMA (Solhan et al., 2009). Elucidating the affective signatures most strongly tied to SITB using intensive longitudinal designs may shed light on the processes that initiate and maintain SITB over time among high-risk individuals and help to identify potential treatment targets to prevent SITB.

Although SITB-relevant EMA research is becoming more common, much of this work is focused on examining within-person associations between a specific episode of SITB and prior affective states in adult clinical (Scala et al., 2018) or young adult nonclinical (Victor et al., 2019) samples, rather than on estimation of affective dynamic parameters from EMA data. Two prior studies have examined NA intensity and variability in relation to SITB using EMA. In one case, mean NA intensity (but not variability) was associated with concurrent suicidal ideation and past-year suicide attempts in a sample of adults receiving psychiatric

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treatment for BPD (Links et al., 2007). In the other study, adults with varied psychotic spectrum pathology reported on levels of depression, guilt, anxiety, and hostility, along with urges for NSSI and/or suicide (as a single variable), using EMA (Palmier-Claus et al., 2013). Mean levels of all NA indices were associated with self-harm urges, as was instability of depression (but not other variables) when controlling for mean depression. Thus, the existing literature is limited and inconclusive with regards to the association between NA dynamics and SITB and (to our knowledge) nonexistent in characterizing PA dynamics in relation to SITB, particularly in young adults.

EMA research has examined how specific components of affective dynamics may relate to psychological health and/or pathology beyond SITB, although findings have been mixed across diverse samples and research questions. For instance, elevated mean NA and reduced mean PA has been associated with greater self-reported distress in employed adults (Wang et al., 2020) and community young adults (Spindler et al., 2016). Among adults with mood and/or anxiety disorders, mean NA and PA were associated with current (versus remitted) pathology (Schoevers et al., 2020); other research in this population, however, has found internalizing psychopathology to be uniquely associated with mean NA, but not mean PA (Bosley et al., 2019). In young adult women recruited for recent aggression and/or SITB, mean NA (but not PA) also showed an association with internalizing psychopathology, whereas neither mean NA nor PA related to externalizing pathology (Scott et al., 2020). Given that SITB have been associated with both internalizing and externalizing pathology in meta-analyses (Fox et al., 2015; Franklin et al., 2017; Ribeiro et al., 2016) and with elevated levels of mean NA in limited prior EMA research with adults (Links et al., 2007; Palmier-Claus et al., 2013), mean levels of affective states, particularly NA, may be implicated in understanding risk for SITB broadly.

In addition to examination of mean NA and PA, researchers have begun to examine how affective variability may relate to psychopathological processes. A large meta-analysis (Houben et al., 2015) showed that variability of PA and NA related to poorer psychological well-being, more so for NA than PA. However, subsequent research has failed to link NA variability and well-being (Spindler et al., 2016) when controlling for mean NA in a general population sample of young adults. Greater PA variability has been associated with poorer physical health in older adults (Ong & Steptoe, 2020), but in young adults, PA instability was prospectively associated with *improved* well-being (Spindler et al., 2016), highlighting the importance of examining affective dynamics in the context of unique developmental periods.

NA and PA variability may be more strongly tied to clinical levels of psychopathology, relative to dimensional measures of psychological distress in the community. Several studies have found that NA, but not PA, variability is elevated in adults with depressive disorders (Nelson et al., 2020; Thompson et al., 2012) and young adults with borderline personality disorder (BPD; Houben & Kuppens, 2019); other work has shown that NA variability is transdiagnostic across mood and anxiety pathology in adults, without examining PA variability (Lamers et al., 2018). In a young adult sample selected for recent externalized and self-directed aggression, PA variability showed unique associations across pathology types; externalizing disorders were associated with *increased* PA variability, and internalizing disorders predicted *decreased* PA variability (Scott et al., 2020). To date, only NA variability has been examined in association with SITB, with mixed findings (Links et al., 2007; Palmier-Claus et al., 2013), highlighting the need for examination of both NA *and* PA variability as predictors of SITB.

Relative to NA and PA magnitude and variability, emotional inertia (carry-over or autoregression) has been less frequently studied (Kuppens et al., 2010). Emotional inertia has been described as "resistance to emotional change, formalized as the degree to which a person's current emotional state can be predicted by his or her emotional state at a previous moment" (Kuppens et al., 2010, p. 985). Emotional inertia may be indicative of impaired responsivity to external or internal factors that impact emotional experiences, indicating deficits in the adaptive, regulatory function of affect to motivate changes in behavior. Houben and colleagues (2015) found that greater NA and PA inertia are associated with poorer well-being, with NA inertia exhibiting a stronger association than PA inertia across multiple samples examined using meta-analysis. In clinical samples comprised primarily of adults, findings have been inconclusive, with some evidence of increased PA and NA inertia (Schoevers et al., 2020), greater NA (but not PA) inertia (Houben & Kuppens, 2019; Nelson et al., 2020), or no association with NA inertia (Bosley et al., 2019; Lamers et al., 2018; Thompson et al., 2012). There is also some evidence to suggest that externalizing psychopathology is associated with *decreased* PA inertia (e.g., more fleeting PA) in young adult women, which may be related to sensation-seeking (Scott et al., 2020). Given mixed findings on NA and PA inertia

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in the broader literature and the lack of SITB specific research, research is needed to clarify how NA and PA inertia may relate to SITB.

Existing literature has highlighted the importance of NA and PA dynamics in relation to psychopathology, including SITB, but prior work has often been limited by a failure to examine NA and PA dynamics concurrently, while also modeling multiple components of affective dynamic processes (e.g., mean, variability, and inertia) in relation to each other. These limitations may partially explain conflicting findings in prior work. Further, lack of clarity regarding outcomes of interest (e.g., through the use of single items to assess both urges for NSSI and SI) may obscure unique associations to specific types of SITB. Thus, a conjoint model of affective dynamics across both NA and PA examined using EMA in a clinically diverse sample may be fruitful in understanding SITB, given their transdiagnostic nature (Fox et al., 2015; Franklin et al., 2017) and strong association with affective states (May et al., 2020; Victor et al., 2019).

The current study aims to address limitations in extant literature to identify affective dynamics, which may serve to refine and test theories of the development of suicidal and nonsuicidal SITB and identify promising treatment targets to guide clinical interventions for SITB. Consistent with elevated SITB risk during the transition from adolescence to adulthood, participants were young adult women recruited from the community for recent aggressive behaviors and/or SITB who reported a range of clinical and personality disorders at study intake, including mood, anxiety, psychotic, substance use, and personality disorders. Specifically, we examined prospective and concurrent associations between past-year and concurrent SITB and affective dynamics assessed during a 3-week EMA protocol. First, we examined whether past-year NSSI behavior and SI predicted NA and PA dynamics (intensity, variability, and inertia) assessed during EMA. Second, we examined the concurrent associations between NA and PA dynamics and extent of self-injurious thoughts (NSSI urges, SI) experienced during EMA. We examined NSSI and SI separately based on prior work demonstrating that nonsuicidal and suicidal SITB differ in their phenomenology and correlates (Glenn et al., 2017; Muehlenkamp, 2005), as well as their proximal antecedents (Nock et al., 2009; Victor et al., 2019) and prospective associations with future suicide risk (Ribiero et al., 2016).

Based on the literature described above, we developed two hypotheses and two exploratory aims. First, we expected that all SITB types would be associated with elevated mean NA and NA variability, consistent with limited prior EMA SITB research in adult clinical samples (Links et al., 2007; Palmier-Claus et al., 2013) and evidence that NA intensity and variability are associated with poorer psychological well-being and psychopathology in young adult (Houben & Kuppens, 2019; Scott et al., 2020; Spindler et al., 2016) and adult samples (Nelson et al., 2020; Thompson et al., 2012). Second, we hypothesized that these associations would be stronger when examining concurrent (versus lagged) relationships. This hypothesis is based on evidence that mean NA and NA variability are elevated among adults experiencing current, relative to remitted, psychopathology (Schoevers et al., 2020), and prior work indicating a more robust association between NA intensity and variability with concurrent SI (relative to past-year suicidal behavior) in adults with BPD (Links et al., 2007). As prior work has not directly compared nonsuicidal and suicidal SITB with respect to affective dynamics, we examined potential differences between the nonsuicidal and suicidal SITB models in an exploratory manner. Finally, we aim to test how all types of SITB may relate to NA inertia and PA dynamics broadly; however, given the limited and mixed literature on affective inertia and PA dynamics in relation to psychopathology, these analyses were also treated as exploratory.

Methods

PARTICIPANT RECRUITMENT AND STUDY PROCEDURES

We conducted a secondary analysis of data from a substudy of a larger, longitudinal, community cohort study following girls (now women) yearly from early childhood. The characteristics and sampling structure for the larger study (Keenan et al., 2010), as well as for this substudy (Scott et al., 2017), have been described thoroughly elsewhere. Briefly, prospective participants for the substudy, which focused on aggressive and self-harming behavior in young women, were identified through regular follow-up assessments within the larger longitudinal study followed by telephone screening to assess recent SITB and aggressive behavior. Participants who reported SITB and/or aggressive behaviors in the past month were eligible for the substudy. These recruitment criteria resulted in a transdiagnostic sample of young women exhibiting clinically significant impairment and elevated risk for suicide. The substudy included a baseline clinical interview assessment, a 3-week EMA protocol, and additional laboratory assessments (data

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not presented here). The EMA protocol involved seven prompts (surveys) per day, scheduled between participants' self-reported wake and bedtimes. Participants reported state NA and PA at each prompt, as well as SITB since the last survey at all but the first prompt each day.

All participants provided written and oral informed consent, and study procedures were conducted in accordance with the responsible Institutional Review Board. EMA data from this substudy have been previously reported elsewhere in papers examining: (1) within-person associations between interpersonal stressors, NA type, and aggression, and the moderating roles of borderline and antisocial personality disorder symptoms in those associations (Scott et al., 2017), (2) within-person associations of interpersonal stressors, NA type, and SITB (Victor et al., 2019), and (3) affective dynamic constructs as they relate to general internalizing and externalizing psychopathology dimensions based on diagnoses from clinical interviews (Scott et al., 2020).

SAMPLE CHARACTERISTICS

A total of 166 women were enrolled in the study. Five participants were excluded due to dropout from the EMA portion of the study ($n = 4$, completed less than five all scheduled surveys in week one and no completed surveys in weeks two or three) or extreme values on all EMA indices of interest ($n = 1$, values >3 SDs above sample means). Thus, results presented here were based on a sample of 161 young women between the ages of 18 and 24 ($M = 21.52$, $SD = 1.56$). The demographic characteristics of the substudy were similar to those of the larger longitudinal study (Keenan et al., 2010) from which participants were recruited (see Table 1 for additional information). Participants were primarily African-American or non-Hispanic White, and more than half were receiving public assistance tied to low income (50.93%).

Table 1
Descriptive Demographic and Clinical Characteristics ($N = 161$)

Demographics	*n* (%)
Race	
White	45 (27.95)
African-American/Black	113 (70.19)
Multiracial	3 (1.86)
Hispanic Ethnicity	4 (2.48)
Education	
Less than HS/GED	16 (9.94)
HS/GED	65 (40.37)
Some College	67 (41.61)
College Degree or Higher	13 (8.07)
Employment	
None	59 (36.65)
Part-time	59 (36.65)
Full-time	43 (26.71)
Low Income (Public Assistance)	82 (50.93)
Self-Injurious Thoughts and Behaviors	***n* (%)**
Suicidal Ideation: Lifetime	97 (61.78)
Suicidal Ideation: Past Year	58 (36.94)
Suicide Plan: Lifetime	30 (19.11)
Suicide Plan: Past Year	12 (7.64)
Suicide Gesture: Lifetime	29 (18.59)
Suicide Gesture: Past Year	7 (4.49)
Suicide Attempt: Lifetime	35 (22.29)
Suicide Attempt: Past Year	14 (8.92)
NSSI Ideation: Lifetime	55 (35.03)
NSSI Ideation: Past Year	29 (18.47)
NSSI Behavior: Lifetime	52 (33.12)
NSSI Behavior: Past Year	16 (10.19)

Note. Self-injurious thoughts and behaviors data were missing for $n = 4$ participants for all variables except suicide gestures (missing data for $n = 5$). Data for these participants were included in all models. Acronyms above include HS (high school), GED (General Education Development diploma), and NSSI (non-suicidal self-injury).

MEASURES

Diagnostic Interviews

Participants' histories of SITB were assessed with the Self-Injurious Thoughts and Behaviors Interview (Nock et al., 2007), a validated, structured assessment of suicidal thoughts, plans, gestures, and attempts, as well as NSSI urges and behaviors. Over two-thirds (68.15%) of participants reported some lifetime SITB, and 40.13% reported past-year SITB. The most common past-year SITB were SI (36.94%), NSSI urges (18.47%), and NSSI behaviors (10.19%). Almost one-tenth (8.92%) reported at least one suicide attempt in the past year.

To appropriately characterize the psychopathology observed in this sample, clinical and personality disorders were assessed using the Structured Clinical Interview for DSM-IV-TR Disorders (First et al., 2002) and the Structured Interview for DSM-IV Personality (Pfohl et al., 1997), respectively. All interviews were administered by research staff with a bachelor's degree or higher who were trained to reliability by a doctoral-level clinical psychologist. Interrater reliability was calculated using the kappa (κ) statistic for all diagnoses that occurred in at least 5% of the sample, and the average κ was .81 (range = .62 to 1.0). Further details regarding interview reliability and validity are available elsewhere (Scott et al., 2017; Scott et al., 2020; Victor et al., 2019).

Over two-thirds of participants met diagnostic criteria for at least one clinical diagnosis

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(n = 110, 70.06%), and almost half had a current clinical diagnosis at the time of intake (n = 75, 47.77%; see Table 2 for additional clinical characteristics). Among those with at least one clinical diagnosis, the number of lifetime diagnoses ranged from one to seven (M = 2.75, SD = 1.63), and current diagnoses ranged from zero to six (M = 1.35, SD = 1.45). The most common lifetime clinical diagnoses were major depressive disorder (40.13%), substance use disorder (38.85%), and posttraumatic stress disorder (23.57%). Dimensional scores for personality disorders were greatest for borderline personality disorder (excluding SITB item; M = 6.13, SD = 4.19) and antisocial personality disorder (M = 4.04, SD = 3.86). Participants endorsed a mean of 7.82 personality disorder symptoms above diagnostic threshold (SD = 6.04, range = 0-30), and almost one-third met diagnostic threshold for at least one personality disorder (n = 46, 29.11%).

EMA Assessments

Participants rated several emotions from the Positive and Negative Affect Schedule (Watson & Clark, 1994) on a 5-point Likert scale (1 = "not at all", 5 = "extremely") at each prompt regarding how they felt "in the past 15 minutes." Composite NA (ashamed, sad, guilty, hostile, irritable, scared, lonely) and PA (excited, proud, happy, cheerful, joyful, delighted) scales were created using person-mean scores for NA and PA items at each prompt. Thus, each participant's reported NA and PA at each prompt was modeled at the within-person level, centered at that participant's mean level across the entire EMA; participants' overall endorsement levels of NA and PA were

Table 2
Descriptive Diagnostic Characteristics

Clinical Disorders (n = 157)	*Lifetime n* (%)	*Current n* (%)
Bipolar	3 (1.91)	2 (1.27)
Major Depressive	63 (40.13)	25 (15.92)
Dysthymic	9 (5.73)	–
Psychotic Spectrum	4 (2.55)	2 (1.27)
Alcohol Use	45 (28.66)	9 (5.73)
Substance Use	61 (3.89)	32 (20.38)
Panic	14 (8.92)	8 (5.10)
Agoraphobia	4 (2.55)	4 (2.55)
Social Anxiety	15 (9.55)	10 (6.37)
Specific Phobia	13 (8.28)	10 (6.37)
Obsessive Compulsive	10 (6.37)	7 (4.46)
Post-Traumatic Stress	37 (23.57)	21 (13.38)
Generalized Anxiety*	–	12 (7.64)
Anorexia Nervosa	0 (0)	0 (0)
Bulimia Nervosa	3 (1.91)	0 (0)
Binge Eating	6 (3.82)	3 (1.91)
Pain*	–	1 (0.64)
Hypochondriasis*	–	1 (0.64)
Body Dysmorphic*	–	1 (0.64)
Somatization*	–	0 (0)
Undifferentiated Somatoform*	–	0 (0)
Personality Disorders (n = 158)	***M* (*SD*)**	**Threshold *n* (%)**
Antisocial	4.04 (3.86)	14 (8.86)
Avoidant	1.70 (2.78)	7 (4.43)
Borderline	6.13 (4.19)	24 (15.19)
Dependent	1.14 (1.80)	0 (0)
Histrionic	2.37 (2.80)	3 (1.90)
Narcissistic	2.01 (3.19)	3 (1.90)
Obsessive Compulsive	2.81 (2.35)	4 (2.53)
Paranoid	2.32 (2.70)	3 (1.90)
Schizoid	1.40 (1.96)	2 (1.27)
Schizotypal	1.41 (2.07)	0 (0)

Note. Disorders marked by an * indicate those assessed only for current, not lifetime, prevalence. Dysthymic disorder is assessed only for lifetime prevalence. Personality disorder data includes the dimensional sum scores (*M, SD*) as well as the proportion of participants who met or exceeded recommended diagnostic thresholds for each disorder. Diagnostic data were missing for n = 4 participants for clinical disorders and n = 3 participants for personality disorders.

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also grand-mean-centered around the entire sample's means at the between-persons level. Between- and within-person reliability was high for both NA (.98 and .74) and PA (.99 and .90), respectively. Further, intraclass correlation coefficients, representing the proportion of variance attributable to between-person differences, were low for NA (.38) and PA (.42), indicating that over half of the NA and PA variance was attributable to within-person variability (see above references for detailed psychometrics).

Participants were also asked two items to indicate if they "felt the urge or wanted to": (1) engage in NSSI, or (2) make a suicide attempt, since their last prompt. Each of these items were rated on the 5-point Likert scale above at each pseudo-random prompt, but not the morning (wake-up) prompt. Due to the zero-inflated and skewed nature of these variables, NSSI urges and SI responses were dichotomized into "yes" or "no" at each beep, where any response other than 1 ("not at all") was coded "yes." As relatively few participants reported self-injurious *behaviors* during the EMA ($n = 4$), our analyses focus on EMA NSSI urges and SI. A total of 39 participants (24.22%) reported 148 instances of non-zero NSSI urges during the EMA, while 25 participants (15.53%) reported 65 non-zero episodes of SI during EMA.

DATA ANALYSES

We modeled temporal dynamics of NA and PA in relation to SITB using Bayesian multilevel time-series (dynamic) structural equation modeling (DSEM) in MPlus version 8.4 (Muthén & Muthén, 2017), which has several advantages for analysis of EMA data (Hamaker et al., 2018). As we were primarily interested in examination of affective dynamic features as they relate to *between-persons* differences in SITB, we used two-level random effects models to create person-specific estimates of each participant's overall NA and PA intensity (means), variances (variability) and auto-regression (inertia) reported during EMA. These latent variables were then allowed to predict, or covary with, other between-persons variables, such as SITB. To examine EMA-reported SITB in association with affective dynamics, person-mean levels of SI and NSSI urges reported during the EMA were estimated concurrently with NA/PA dynamics as random effects in two-level models. This approach utilizes all available data (e.g., every rating of NA, PA, and report of SITB across all EMA observations) to estimate random effects for each participant, grand-mean-centered relative to the entire sample's means for each parameter.

For models using past-year SI and NSSI behavior as SITB indicators, NA and PA dynamics parameters were simultaneously regressed on the past-year SITB indicator, given the temporal precedence of the past-year SITB relative to the EMA-assessed affective dynamics. Thus, we were able to examine whether prior NSSI and/or SI, reported before the EMA began, predicted EMA-reported NA and PA dynamics. For models examining EMA-assessed (concurrent) SITB and NA/PA dynamics, a specific direction of effect was less clear; thus, person-mean levels of SI and NSSI urges reported during the EMA were allowed to covary with NA and PA dynamics, rather than being regressed on these dynamics (or vice versa).

All models were estimated with a minimum of 10,000 iterations and non-informative (default) priors, and convergence was checked using proportional scale reduction (PSR) values. PSR values close to one suggest model convergence, and all models were re-run with double the original number of iterations following first convergence to ensure model stability. Statistical significance was determined by estimating a 95% credibility interval (CI) for each parameter; 95% CIs that do not include 0 indicate statistical significance for $\alpha = .05$. In each model, we specified an interval of 1 hour across which to examine lagged within-person parameters. We also included the effect of time enrolled in the EMA protocol as a covariate for NA and PA, as earlier work demonstrated NA and PA decreases over the course of the EMA (Scott et al., 2020).

We examined several demographic and clinical characteristics as potential covariates for our analyses, in addition to time. Race (non-Hispanic white versus all other racial/ethnic categories), age, and number of completed EMA surveys were not associated with any of our affective dynamic parameters. We also examined whether dimensional BPD symptoms (minus the SITB item) were associated with affective dynamics; consistent with prior literature, BPD symptoms were associated with elevated NA variability ($B = 0.21$) and mean NA ($B = 0.18$). However, given the strong association between other BPD symptoms (such as affective instability and anger) and affective dynamics, we felt that including BPD as a covariate would unnecessarily reduce the amount of variance in NA/PA to be explained in our models, leaving us underpowered to detect affective dynamic effects associated with SITB. These concerns, combined with conceptual and clinical limitations of covarying related psychiatric phenomena in the study of SITB (Rogers et al., 2018), led us to the decision not to include BPD as a covariate in the main por-

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tion of the manuscript; however, these results are included in an Appendix (see Table S1). Finally, although we considered the reason for participant referral (e.g., recent aggressive behaviors and/or SITB) as a potential covariate, aggression and SITB were highly comorbid. Although the study did not initially include secondary screening after referral, additional screening was implemented partway through the study and completed for 141 of the 161 participants whose data are included here. Of these individuals, all reported past-month SITB, and 128 (90.78%) also reported past-month aggressive behaviors. Thus, we chose not to include recent aggression as a covariate, to avoid problems with multicollinearity in model estimation. We also elected not to conduct multigroup analyses, as the sample of individuals with SITB *without* aggressive behaviors would be too small for comparison.

Although we considered modeling SITB predictors concurrently (e.g., one model with both past-year SI and past-year NSSI behaviors as covarying predictors, one model with both EMA NSSI urges and EMA SI covarying with EMA NA and PA dynamics), nonsuicidal and suicidal SITB are phenomenologically distinct (see above), and these models also presented concerns regarding multicollinearity. Thus, we present the separate models here, although we have included the combined models in a supplemental appendix (see Table S2).

Results

PAST-YEAR SITB AND AFFECTIVE DYNAMICS

Compared to participants with no past-year SI, participants with past-year SI exhibited elevated mean NA ($B = 0.30$), NA variability ($B = 0.31$), and NA inertia ($B = 0.21$). There was no effect of past-year SI on PA dynamics, including mean PA ($B = -0.10$), PA variability ($B = -0.09$), and PA inertia ($B = -0.04$). Thus, past-year SI predicted more intense, variable, and persistent NA in daily life, but did not evidence associations with PA dynamics. Full results from this model, and models described below, are shown in Table 3.

These results were distinct from those found when examining past-year NSSI behavior predicting EMA affective dynamics. Past-year NSSI behavior significantly predicted elevated mean NA ($B = 0.18$) and NA variability ($B = 0.17$), but these effects were smaller than those for past-year SI; there was no significant association between past-year NSSI behavior and NA inertia ($B = 0.06$). Past-year NSSI behavior did predict reduced PA inertia ($B = -0.19$), meaning past-year NSSI behavior related to more fleeting, or shorter duration, reports of PA. Past-year NSSI behavior did not predict reduced mean PA ($B = -0.03$) or PA variability ($B = 0.09$).

CONCURRENT SITB AND AFFECTIVE DYNAMICS

The estimated between-person (latent) mean of EMA SI was positively associated with mean NA ($B = 0.34$) and NA variability ($B = 0.51$), but not NA inertia ($B = 0.16$). Further, mean EMA SI was associated with reduced PA inertia ($B = -0.28$), but not with PA variability ($B = 0.22$) or mean PA ($B = -0.14$). Thus, greater concurrent SI was associated with more intense and variable NA, as well as more transient PA during the EMA. Mean EMA NSSI urges was associated with elevated mean NA ($B = 0.46$), NA variability ($B = 0.63$), and NA inertia ($B = 0.25$). However, mean EMA NSSI urges were not associated with mean PA ($B = -0.14$), PA variability ($B = 0.12$), or PA inertia ($B = -0.20$). This pattern is similar to what was found for EMA SI, except that increased NA stability, rather than decreased PA stability, was found.

Discussion

In this sample of young adult women, we examined multiple types of SITB (past-year SI, past-year NSSI behavior, concurrent SI, concurrent NSSI urges) as they relate to EMA-derived indicators of NA and PA dynamics. Consistent with our first hypothesis, all SITB parameters were positively associated with mean NA and NA variability, suggesting these may be shared correlates of both nonsuicidal and suicidal SITB. Our results replicate prior findings implicating NA and its fluctuations as key SITB correlates (Links et al., 2007; Palmier-Claus et al., 2013), while extending earlier work by demonstrating a prospective association between historical SITB and subsequently assessed NA in a transdiagnostic sample. NA intensity and variability may be risk factors for, and/or downstream consequences of, SITB, perhaps due to negative affective states that follow SITB (Chapman & Dixon-Gordon, 2007). Our findings are consistent with extant SITB theories, which emphasize not only intense NA, such as psychache (Klonsky & May, 2015), but also fluctuations in NA (e.g., Bryan & Rudd, 2016), as SITB risk factors.

Our second hypothesis posited that concurrent associations between mean NA, NA variability, and SITB would be stronger than lagged (past-year) relationships. This was true for NSSI; mean NA and NA variability were more strongly tied to concurrent NSSI urges than past-year NSSI behaviors. However, these differences may be

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Table 3
Full Model Results ($N = 161$)

	Past-Year SI	Past-Year NSSI Behavior
Within-Person Level	***B* [95% CI]**	***B* [95% CI]**
NA on time	−0.02 [−0.03, −0.02]*	−0.02 [−0.03, −0.02]*
PA on time	−0.02 [−0.03, −0.02]*	−0.02 [−0.03, −0.02]*
Between-Person Level	***B* [95% CI]**	***B* [95% CI]**
NA Mean on SITB	0.30 [0.15, 0.44]*	0.18 [0.01, 0.33]*
NA Variability on SITB	0.31 [0.16, 0.45]*	0.17 [0.01, 0.32]*
NA Inertia on SITB	0.21 [0.04, 0.37]*	0.06 [−0.11, 0.23]
PA Mean on SITB	−0.10 [−0.26, 0.06]	−0.03 [−0.18, 0.13]
PA Variability on SITB	−0.09 [−0.24, 0.07]	0.09 [−0.07, 0.24]
PA Inertia on SITB	−0.04 [−0.21, 0.13]	−0.19 [−0.35, 0.01]*
	Concurrent EMA SI	**Concurrent EMA NSSI Urge**
Within-Person Level	***B* [95% CI]**	***B* [95% CI]**
NA on time	−0.02 [−0.03, −0.02]*	−0.02 [−0.03, −0.02]*
PA on time	−0.02 [−0.03, −0.02]*	−0.02 [−0.03, −0.02]*
Between-Person Level	***B* [95% CI]**	***B* [95% CI]**
NA Mean with EMA SITB	0.34 [0.12, 0.52]*	0.46 [0.29, 0.60]*
NA Variability with EMA SITB	0.51 [0.26, 0.70]*	0.63 [0.44, 0.76]*
NA Inertia with EMA SITB	0.16 [−0.08, 0.39]	0.25 [0.03, 0.44]*
PA Mean with EMA SITB	−0.14 [−0.40, 0.12]	−0.14 [−0.36, 0.09]
PA Variability with EMA SITB	0.22 [−0.03, 0.45]	0.12 [−0.09, 0.32]
PA Inertia with EMA SITB	−0.28 [−0.48, −0.04]*	−0.20 [−0.40, 0.01]

Note. * indicates a credibility interval that does not include zero, indicating statistical significance at $p < 0.05$. Acronyms above include NA (negative affect), PA (positive affect), SI (suicidal ideation), NSSI (non-suicidal self-injury), SITB (self-injurious thoughts and behaviors), EMA (ecological momentary assessment, *B* (standardized beta), CI (credibility interval).

attributed to examining past-year NSSI behaviors relative to concurrent EMA NSSI urges, as most EMA-assessed NSSI urges did not result in NSSI. These results may be due to distinct risk factors for NSSI *ideation or urges* relative to NSSI *behaviors*, consistent with ideation-to-action suicide models (Klonsky et al., 2018). The benefits and barriers model (Hooley & Franklin, 2018) argues that NSSI may be motivated by a desire to reduce NA, but that nonaffective barriers (pain tolerance, aversion to NSSI stimuli) explain who actually engages in NSSI. Thus, NA may be more closely tied to the desire for NSSI, regardless of outcome, with other factors influencing NSSI engagement.

Our suicidal SITB results are more comparable across time, as both past-year and EMA-assessed variables captured SI, rather than suicidal behavior. Results were partially consistent with our hypothesis; mean NA showed similar associations with concurrent and prospective SI, whereas NA variability was more strongly associated with concurrent EMA SI than past-year SI. It is possible that NA variability *itself* fluctuates over time, and that the stronger association with concurrent EMA-assessed SI is due to extraneous variables (e.g. stressors) that temporally contribute to increased NA variability and EMA SI. Thus, mean NA may be a more consistent risk factor for SI across time, whereas NA variability differentiates past versus concurrent SI.

We also examined whether the associations between mean NA and NA variability varied in association with suicidal versus nonsuicidal SITB. For NSSI urges and SI reported during the EMA, however, results were comparable, with somewhat stronger effects for NSSI urges than SI. It is unclear whether this is a true differential pattern of associations across SITB types, or attributable to a lower endorsement rate of SI (relative to NSSI urges) during the EMA, which may have decreased statistical power for that model. Future research should examine this question in more clinically severe samples endorsing high rates of both NSSI urges and SI, which may elucidate shared versus distinct risk factors for each type of SITB.

Our NA inertia findings were mixed. Past-year SI predicted increased NA inertia, but mean EMA SI was not. This could suggest that SI occurs in the context of pathology defined by consistently elevated NA (e.g., depression) but that the stability of NA is not a more proximal correlate of daily SI. It is also possible that SI itself contributes to NA inertia, for instance, by contributing to "emotional cascades" in which a person ruminates on and

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extends their negative emotional state (Selby et al., 2008). In contrast, NA inertia was positively associated with EMA-assessed NSSI urges. NSSI urges may be perceived as more distressing than SI, perpetuating antecedent NA. Given low endorsement of NSSI behaviors during EMA, this may reflect participants' tolerance of distress (e.g., NA) associated with the decision *not* to engage in NSSI.

Finally, we considered associations of past and concurrent SITB with PA dynamics, which (to our knowledge) has not been examined in prior work. Although not commonly noted in SITB theories, PA dynamics predict treatment outcomes among adults (Bosley et al., 2019), suggesting that relationships between PA and SITB may be important for developing effective SITB treatments. In these data, SITB was not related to mean PA or PA variability, but reduced PA inertia (more fleeting PA) related to past-year NSSI behaviors and EMA-assessed SI. To our knowledge, only one study (Scott et al., 2020) has shown reduced PA inertia in (externalizing) psychopathology, which may be related to sensation-seeking. Sensation-seeking has been implicated as a cross-sectional correlate of NSSI history (Knorr et al., 2013) and suicidality in adolescents (Ortin et al., 2012). It is possible that some people may engage in NSSI in order to generate or maintain PA in the face of decreased stability of PA states, and that reduced PA inertia could be indicative of decreased enjoyment of daily experiences, consistent with the association between reduced reasons for living and SI (Ivanoff et al., 1994).

Our results have several clinical implications for young adult women experiencing SITB. A variety of treatments target mean NA and NA variability, such as behavioral activation (Dimidjian et al., 2011) and dialectical behavior therapy (Stepp et al., 2008). Evidence suggests that exercise can interrupt persistent (inert) NA (Bernstein et al., 2019), which may be a feasible approach to coping with stable NA as it relates to concurrent NSSI urges, consistent with self-report research indicating that physical exercise may be helpful in resisting NSSI urges (Klonsky & Glenn, 2008). There is also evidence that interventions designed to increase PA stability, such as mindfulness (Yen et al., 2019), may be useful for women struggling with SITB. Further, SITB and externalizing psychopathology may be linked to reduced PA inertia due to shared relations with negative urgency (Zapolski et al., 2010), a subtype of impulsivity that has been effectively targeted using dialectical behavior therapy (Stepp et al., 2008). Further work is needed to identify both existing and novel treatments that can impact affective dynamic processes that may contribute to SITB risk by assessing affective dynamics before, during, and after psychological and psychiatric interventions.

Taken together, these results clarify the importance of examining SITB in transdiagnostic samples, rather than attempting to make inferences about SITB based on related types of psychopathology. For example, both depression and BPD have been associated with NA, but not PA, inertia (Houben & Kuppens, 2019; Nelson et al., 2020), whereas we found some evidence of decreased PA inertia associated with SITB. Thus, using depression and/or BPD as proxies for SITB risk, in lieu of examining SITB itself, not only ignores the transdiagnostic nature of SITB, but also obscures an important potential SITB risk factor (low PA inertia) identified in our analyses. These results also highlight the importance of modeling and examining NA and PA dynamics concurrently, not only because of the unique (and understudied) role of PA in SITB, but also because modeling the full range of affective states as they covary with each other provides more accurate estimations of affective dynamics. Further, the unique patterns of findings relevant to suicidal versus nonsuicidal SITB, and those indexing thoughts versus behaviors, demonstrate the utility of examining specific SITB types to identify shared and unique correlates of these comorbid, but phenomenologically distinct, difficulties (Glenn et al., 2017; Klonsky & May, 2015; Muehlenkamp, 2005).

As with all empirical research, interpretation of our findings should consider relevant characteristics of our sample and methodology that may have impacted our results. First, our sample was comprised entirely of young adult women, thus requiring further extension and replication in samples with greater diversity of gender identity and age. As affective dynamics are known to vary across the lifespan (Le Vigouroux et al., 2020), it is possible that their associations with SITB may also differ depending on developmental context. There is some meta-analytic evidence that the association between affective variability and psychological well-being is weaker in samples that include more men (Houben et al., 2015), but this has not yet been extended to gender invariance of relationships between affective dynamics and SITB.

Second, our sample was predominantly comprised of African-Americans and individuals with low income, groups historically underrepresented in suicide and self-injury research. Thus, although our findings extend existing literature in novel ways, we cannot determine whether these novel results are broadly relevant to SITB or more specif-

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ically applicable to the phenomenology of SITB in this population. Given the association between affective dynamics and stress (Wang et al., 2020), and the increased experiences of stress associated with racism and low socioeconomic status (Turner & Avison, 2003), it is certainly possible that our participants' affective dynamics, and experience of SITB, may be impacted in ways unique to their sociocultural contexts and identities.

Third, the way that SITB were measured in this study makes interpretation of our findings slightly less clear with respect to self-injurious urges, thoughts, and/or desires. For instance, historical SI was assessed using the item, "Have you ever had thoughts of killing yourself?" from the SITBI, whereas EMA SI was assessed using the item, "Since the last prompt have you felt the urge or wanted to make a suicide attempt?" It is possible that some discrepancies between our past-year SI and EMA SI findings may be due to different interpretations of these questions, with the former assessing all levels of SI, including passive ideation, and the latter capturing more acute desire to engage in a suicide attempt. However, given that both suicidal thinking and higher severity markers of suicidal desire (e.g., suicide planning) are risk factors for death by suicide (Ribeiro et al., 2016), both sets of results improve our understanding of the affective dynamics associated with SITB. Future research may benefit from examining SITB using a dimensional approach to examine unique versus shared affective correlates associated with aspects of SITB across a spectrum of risk.

Finally, our sample was recruited on the basis of recent SITB or aggressive behaviors, which were highly correlated across individuals. This may have resulted in a somewhat unique sample relative to the broader population of young adult women experiencing SITB. Consistent with this possibility, our participants exhibited significant symptoms of both BPD and antisocial personality disorder. Although controlling for BPD symptoms did not markedly change our results (see Table S1), it is possible that personality disorder symptoms may be a third variable influencing both SITB and affective dynamic processes. Future research in populations with more varied histories of aggressive behaviors will inform our understanding of unique affective dynamics in relation to self- versus other-directed aggressive behaviors.

Taken together, our findings clarify the prospective and concurrent associations between several SITB indicators and affective dynamics assessed using real-world EMA data collection methods. Future research should extend this work to other at-risk groups, such as individuals receiving intensive psychiatric treatment (who are at increased odds of suicidal behavior; Franklin et al., 2017), and to studies examining mobile interventions to address NA and PA dynamics as they occur in real-world settings. These results have implications both for our theoretical understanding of the mechanisms that prompt and maintain SITB, as well as for the development and testing of just-in-time interventions to prevent NSSI and suicide attempts.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

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