ABSTRACT

Title of Thesis: REAL-WORLD EMOTION DYNAMICS ARE ASSOCIATED WITH CURRENT AND FUTURE INTERNALIZING SYMPTOMS

Paige Ryan Didier, Master of Science, 2024

Thesis Directed By: Professor Alexander Shackman, Departments of Psychology and Neuroscience

Most studies of internalizing disorders have emphasized the role of emotional traits in the development of internalizing disorders, however more proximal pathology-promoting processes like momentary emotional experiences remain underexplored. Given that the current treatments for these debilitating illnesses are far from curative, understanding proximal processes is critical to optimize interventions and alleviate suffering. Here, we utilized smart-phone ecological momentary assessment (EMA) to identify the relevance of real-world emotional dynamics in internalizing symptomatology and change over a 2.5-year follow-up period. Results demonstrate that one's event-independent (tonic) level of affect are predictive of broadband (Dysphoria) and narrow-band (Panic and Well-being) internalizing symptoms, whereas positive and negative event exposure is not. Notably, increased emotional reactivity to negative events predicts greater concurrent and future Dysphoria symptoms but not its trajectory. Whereas tonic levels of negative affect lose predictive value for future Dysphoria when controlling for baseline symptoms, elevated tonic positive affect uniquely predicts healthier Well-being trajectories. These findings advance

our understanding of real-world emotional dynamics in internalizing illnesses and lay the groundwork for improved research paradigms and targeted interventions.

REAL-WORLD EMOTION DYNAMICS ARE ASSOCIATED WITH CURRENT AND FUTURE INTERNALIZING SYMPTOMS

by

Paige Ryan Didier

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Advisory Committee:
Professor Alexander Shackman, Chair
Professor Lea Dougherty
Professor Christopher Conway

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Chapter 1: Introduction

Anxiety, depression, post-traumatic stress, and other internalizing disorders are a leading burden on global public health, drawing the attention of clinicians, scientists, and policymakers (GBD 2021 Disease and Injuries Collaborators, 2024; The White House, 2023; U.S. Surgeon General, 2021; UNICEF, 2021; Watson et al., 2022; WHO, 2022). Existing treatments are far from curative for many, underscoring the urgency of developing a better understanding of the factors that confer risk for these often-debilitating illnesses (Cuijpers et al., 2024; Marx et al., 2023; Singewald et al., 2023). Meta-analyses and prospective-longitudinal studies highlight the importance of emotional traits, showing that individuals with a heightened propensity to experience negative emotions (*high neuroticism/negative emotionality, N/NE)* and those with a diminished propensity to experience positive emotions lower (*low extraversion/positive emotionality, E/PE*) are more likely to experience internalizing symptoms and diagnoses years or even decades in the future (Bucher et al., 2019; Chavanne et al., 2023; Conway et al., 2023; Fullana et al., 2020; Hur et al., 2019; Kostyrka-Allchorne et al., 2020; Lynch et al., 2021; Rimfeld et al., 2021; Schneider et al., 2021; Toenders et al., 2022; Waszczuk et al., 2022). Despite this progress, the momentary emotional experiences that proximally promote illness amidst the flow of daily life remain elusive. Most of what is known is based on either retrospective reports or acute laboratory challenges with uncertain relevance to real-world experience. While a growing number of studies have capitalized on ecological momentary assessment (EMA) techniques, most have focused on aggregate measures of positive and negative affect (PA/NA), muddling variation in

tonic ('baseline') and reactive affect (e.g., Heller et al., 2021; Houben et al., 2015; Shackman et al., 2016).

Momentary Emotional Dynamics

Cross-sectional data underscore the potential relevance of six distinct pathology-promoting processes to the development of internalizing illness: the frequency of encountering negative and positive momentary events (NMEs/PMEs), the intensity of transient reactions to those events, and tonic differences in negative and positive affect (NA/PA) independent of acute emotional challenges (Bolger & Schilling, 1991; Gable et al., 2000; Gross et al., 1998; Mineka et al., 2020; Perkins et al., 2015; Shackman et al., 2016; Suls & Martin, 2005; Thake & Zelenski, 2013; Watson & Clark, 1984; Wichers, Geschwind, et al., 2009).

Frequency of Emotional Events

There is ample evidence that stressors increase the likelihood of developing internalizing illness (e.g., Hengartner et al., 2018; Kendler et al., 2003; Kendler et al., 2004; Mineka et al., 2020; Vinkers et al., 2014; Vrshek-Schallhorn et al., 2015). Daily diary and EMA studies indicate that individuals with internalizing disorders and those with elevated dispositional risk (high N/NE) tend to report more frequent stressors, conflicts, adversities, and other negative events (Barrocas & Hankin, 2011; Boals et al., 2015; Bondy et al., 2021; Borghuis et al., 2020; Bowling et al., 2010; Brock et al., 2016; Crocker & Luhtanen, 2003; Goldstein et al., 2021; Hengartner et al., 2018; Howland et al., 2017; Hutteman et al., 2014; Johnson et al., 2004; Kim et al., 2003;

Metz et al., *in press;* Nielsen & Knardahl, 2015; Sadeh et al., 2015; Shackman et al., 2016; Shapero et al., 2013; Shiner et al., 2017; Wrzus et al., 2021).

Conversely, individuals with internalizing disorders and those at elevated dispositional risk for internalizing disorders tend to experience fewer positive events in their daily lives (Farmer & Kashdan, 2015; Hopko et al., 2003; Kashdan & Steger, 2006; Panaite et al., 2021; Peeters et al., 2003). Research harnessing a variety of real-world measures—including EMA surveys of location (e.g., own vs. friend's home), electronic financial records, and audio clips captured by wearable digital recorders—shows that low levels of E/PE are associated with less frequent exposure to pleasurable places, activities, and people (Gable et al., 2000; Matz & Harari, 2021; Tackman et al., 2020). Interventions that increase the frequency of positive events relieve depression, suggesting a causal role (Craske et al., 2024; Dimidjian et al., 2011; Stein et al., 2021).

Intensity of Emotional Reactions

Individuals with internalizing disorders often show amplified reactions to negative daily events (Farmer & Kashdan, 2015; Tan et al., 2012; van Winkel et al., 2015; Wichers, Barge-Schaapveld, et al., 2009) and this hyper-reactivity is normalized by antidepressants (Wichers, Barge-Schaapveld, et al., 2009). Dispositionally at-risk individuals (high N/NE) report heightened negative affect to intense, real-world challenges (e.g., terrorist attack; Boe et al., 2011; Brosch et al., 2022; Guo et al., 2015; Hengartner et al., 2017; Kandler & Ostendorf, 2016; Kroencke et al., 2020; Libera et al., 2016), uncomfortable medical procedures (Shechner et al., 2013), public-speaking challenges (Bibbey et al., 2013; Penley & Tomaka, 2002; Schneider et al., 2012), and

even frightening virtual-reality games (Lin, 2017). Laboratory, diary, and EMA studies—which control for potential tonic differences in affect—paint a similar picture. At-risk individuals report exaggerated negative affect in response to high-stakes examinations, aversive experimental stimuli, and daily stressors (Bolger, 1990; Borghuis et al., 2020; Grogans et al., 2024; Gunaydin et al., 2016; Hisler et al., 2020; Howland et al., 2017; Hur et al., 2022; Leger et al., 2016; Marco & Suls, 1993; Mroczek & Almeida, 2004; O'Hara et al., 2014; Shackman et al., 2016; Sliwinski et al., 2009; Suls, Green, & Hillis, 1998; Suls, Martin, & David, 1998; Weltz et al., 2016; Wichers, Geschwind, et al., 2009; Wichers et al., 2010; Wrzus et al., 2021; Zautra et al., 2005). Prospective-longitudinal EMA evidence remains sparse and inconsistent. Wichers and colleagues initially reported that heightened reactivity to momentary NEs was associated with the worsening of internalizing symptoms and predicted the future onset of depression in a community sample of 502 women (Wichers, Geschwind, et al., 2009). The same group subsequently reported that higher levels of tonic, but not reactive, NA were associated with a worsening of internalizing symptoms in a mixed-sex community sample of 445 older adolescents (Vaessen et al., 2017).

With regard to positive events, individuals with internalizing disorders often show blunted reactions to positive stimuli in the laboratory and PMEs in daily life, and this appears to be normalized by mood-stabilizing drugs (Bylsma et al., 2008; Rottenberg, 2017; Wichers, Barge-Schaapveld, et al., 2009; Wu et al., 2017). In one of the only studies of its kind, Wichers and colleagues showed that blunted reactivity to momentary PMEs predicts future internalizing symptoms in a sample of 83 women with a history

of major depression (Wichers, Barge-Schaapveld, et al., 2009; Wichers et al., 2010). Whether this association generalizes to other samples and demographic groups remains unknown.

Tonic Differences in Affect

Dispositionally at-risk individuals (high N/NE) are prone to tonically elevated NA in benign settings (Gross et al., 1998; McCrae, 1990; Perkins et al., 2015; Shackman et al., 2016; Watson & Clark, 1984). Diary and EMA studies provide ample evidence that at-risk individuals tend to experience heightened negative affect in the absence of acute stressors (Hur et al., 2022; Shackman et al., 2016; Wrzus et al., 2021). Similarly in laboratory settings, dispositionally negative individuals report elevated negative affect at 'baseline,' while viewing emotionally neutral control stimuli, or simply relaxing (Craske et al., 2009; Glue et al., 1995; Shackman et al., 2016; Verona et al., 2002). As noted earlier, whereas there is some evidence that elevated tonic NA confers risk for future internalizing symptoms (Vaessen et al., 2017), the overall body of evidence remains limited.

Even less is known about tonic PA. In one of the only EMA studies of its kind, Heller and colleagues demonstrated substantial cross-sectional associations between tonic PA and both broadband and narrower internalizing symptoms—including depression, generalized anxiety, and social anxiety—in a risk-enhanced sample of 462 emerging adults (Heller et al., 2021). The degree to which tonically diminished PA forecasts the worsening of internalizing symptoms remains unexplored and unknown

The Present Study

Internalizing disorders are a leading cause of human misery and morbidity. Alterations in emotional reactivity are central to most etiological models, but prospective-longitudinal studies of real-world affect dynamics are scarce (Clark, 2005; Klein et al., 2011; Mineka et al., 2020; Ormel et al., 2013; Sauer-Zavala & Barlow, 2021; Zinbarg et al., 2016). The overarching goal of the present study was to identify the facets of everyday emotional experience most relevant to concurrent and future internalizing symptoms in a racially diverse sample of 225 emerging adults who were repeatedly assessed for 2.5 years, as they negotiated the transition from late adolescence to early adulthood. Smartphone EMA enabled us to intensively sample negative and positive emotional events, reactive changes in affect, and tonic levels of affect across a two-week baseline assessment. Because EMA data are captured in near real time, they circumvent the biases that can distort retrospective reports and provide insights into how emotional experience dynamically responds to everyday challenges (Barrett, 1997; Csikszentmihalyi et al., 2013; Shiffman et al., 2008). To ensure a broad spectrum of internalizing risk, participants were selectively recruited from a pool of 6,594 individuals screened for individual differences in N/NE. We focused on 'emerging adulthood' (~18 to 30 years) because it is a time of profound, often stressful transitions, with many emerging adults experiencing the first onset of clinically significant internalizing symptoms during this often-turbulent developmental chapter (ACHA, 2024; Arnett, 2000; Botha et al., 2023; Healthy Minds Network, 2023; Kieling et al., 2024; SAMHSA, 2024; Saunders et al., 2024; Shackman et al., 2018). We used multilevel structural equation models (MSEM) to test associations between real-world affect dynamics and internalizing symptoms.

Multilevel models naturally handle the nested dependency and variable number of assessments completed by each subject, making them the standard analytic framework for EMA and other kinds of experience-sampling data. MSEM takes this a step further and provides a unified framework for estimating differences in reactive and tonic affect and relating them to internalizing symptoms (Sadikaj et al., 2021). Building on the tripartite model of internalizing illness, we adopted an explicitly hierarchical-dimensional approach and examined relations with broad (general distress) and narrow (anxious arousal and wellbeing/high-PA) internalizing symptoms (Mineka et al., 1998; Watson et al., 2008; Watson et al., 2012). In contrast to traditional diagnosis-centered research, this enabled us to tease apart **(a)** the facets of momentary emotional experience (e.g., tonically elevated NA) that are associated with transdiagnostic distress and dysphoria symptoms **(b)** from those (e.g., reduced PME exposure) associated with the narrow symptoms (e.g., low PA) that differentiate one internalizing disorder from one another. On an exploratory basis, we also examined relations with other narrow-band internalizing symptoms (e.g., social anxiety).

Identifying the momentary emotional experiences most relevant to internalizing illness is important for deepening our understanding of etiology and refining clinical-science theory. The identification of potentially modifiable targets (e.g., exposure to mildly positive everyday activities) would guide the development of improved prevention strategies, including scalable smartphone-delivered mobile health (mHealth) approaches. Determining the *relative* importance of the six pathology-promoting

pathways would provide a data-driven rationale for prioritizing specific kinds of targeted interventions.

Transparency and Openness

Pre-registration, processed data, and code have been or will be made publicly available (https://osf.io/4mksj). We report below how we determined our sample size, all data exclusions, and all measures involved in this study.

Chapter 2: Methods

Study Overview and General Procedures

The present study leverages data collected as part of a larger 2.5-year prospective-longitudinal study focused on the development of internalizing illness in emerging adults. The general study design was inspired by Alloy and Abramson's seminal 30-month Temple-Wisconsin study of depression in university students and reflected a compromise between the scientific goal of tracking the participants for as long as possible—to enable greater opportunity for meaningful change in internalizing symptoms—and practical considerations, including the need to screen, enroll, and perform multiple waves of follow-up assessments within the constraints of a 5-year grant and 4-year baccalaureate degree program (Alloy & Abramson, 1999).

We used well-established measures of N/NE to screen 6,594 young adults (57.1% female, 42.9% male; 59.0% White, 19.0% Asian, 9.9% African American, 6.3% Hispanic, 5.8% Multiracial/Other; *M*=19.2 years, *SD*=1.1 years) (Hur et al., 2022). Screening data were stratified into quartiles (top quartile, middle quartiles, bottom quartile) separately for men and women. Individuals who met preliminary inclusion criteria were independently and randomly recruited from each of the resulting six strata. Given the focus of the larger study, approximately half the participants were recruited from the top quartile, with the remainder split between the middle and bottom quartiles (i.e., 50% high, 25% medium, and 25% low). This enabled us to sample a wide range of dispositional risk for internalizing illness without gaps or discontinuities, while balancing the inclusion of men and women. Simulation work suggests that this

oversampling ('enrichment') approach does not bias statistical tests to a degree that would compromise their validity (Hauner et al., 2014).

At enrollment, all participants were first-year university students in good physical health with normal or corrected-to-normal color vision and access to a smartphone. All reported the absence of lifetime neurological or pervasive developmental disorders, MRI contraindications, or prior experience with aversive electrical stimulation. All were free from lifetime psychotic and bipolar disorders; a current DSM-5 mood, anxiety, or trauma disorder (past 2 months); severe substance abuse (i.e., associated with physical disability, hospitalization, or inpatient treatment); active suicidality; and ongoing psychiatric treatment as determined by an experienced masters-level diagnostician using the Structured Clinical Interview for DSM-5 (First et al., 2015). To maximize the range of risk, participants with a current Other-Specified internalizing diagnosis and/or a lifetime history of internalizing disorders were not excluded, consistent with prior work (Alloy & Abramson, 1999). At the baseline laboratory session, participants provided informed written consent, were familiarized with the EMA protocol, and completed the first assessment of internalizing symptoms. Beginning the next day, they completed up to 8 EMA surveys per day for 1 week. Internalizing symptoms were re-assessed 6, 24, and 30 months later. Momentary emotion dynamics were re-assessed 6 months after the initial visit, using the identical one-week EMA protocol. Follow-up assessments were conducted in the laboratory or online based on participant preference.

To minimize error and occasion-specific fluctuations in responding, we aggregated across adjacent assessments to create 'baseline' (0 and 6 months) and 'follow-up' (24 and 30 months) internalizing composites (Chmielewski & Watson, 2009; Gell et al., 2023; Nikolaidis et al., 2022; Roemer et al., *in press*). This decision was motivated by a combination of conceptual and methodological considerations. Conceptually, we aimed to understand the prospective relevance of momentary emotional experience to changes in internalizing symptoms across the transition from late adolescence to early adulthood, a transition that spans years, not weeks or months (Arnett, 2000). Short-term fluctuations in risk were not central to our aims. In light of this, it was appealing to aggregate the two natural pairs of internalizing assessments, with an eye to enhancing reliability and statistical power (Tiego et al., 2023). Along similar lines, EMA data aggregated across the 0- and 6-month assessments served as the primary predictor of concurrent and future internalizing symptoms.

All procedures were approved by the University of Maryland Institutional Review Board (protocol 659385-28). The present sample overlaps with that featured in prior work focused on neuroimaging measures (Bas-Hoogendam et al., 2022; Cornwell et al., 2024; Grogans et al., 2024; Hur et al., 2022; Hur, Smith, et al., 2020; Shackman et al., 2024), personality and internalizing symptoms (Conway et al., 2024), and social anxiety and negative affect (Hur, DeYoung, et al., 2020), but has never been used to address the present aims.

Participants

A total of 258 participants met preliminary inclusion criteria and provided informed written consent. Of these, 234 successfully completed all aspects of the month 0 assessment—including a diagnostic interview, self-report measures, and MRI assessment—and were deemed eligible for longitudinal follow-up (50.0% female; 61.1% White, 17.9% Asian, 9.0% African American, 4.7% Hispanic, 0.4% Native Hawaiian or Other Pacific Islander, 6.8% Multiracial/Other; M = 18.8 years, SD = 0.4 years). The remaining 24 were excluded based on the baseline diagnostic interview (e.g., current or recent internalizing illness), inadequate EMA completion at the 0-month assessment (<50%), or study withdrawal. Of the 234 participants eligible for follow-up, 9 were censored from analyses due to inadequate EMA completion at the 6-month assessment (<50%; n=5), failure to complete either the 24- or 30-month internalizing assessments (n=1), or loss to follow-up (n=3). EMA compliance was acceptable in the final sample of 225 participants (M=86.3%; SD=6.8%; *Range*=61.6%-98.2%; Total EMAs=21,750). Most participants completed both baseline internalizing assessments (99.6%) and both follow-up assessments (98.6%). Demographic information is presented in **Table 1**.

Power Analysis

Sample size was determined *a priori* as part of the award that supported data collection (R01-MH107444). The target sample size (n=240) was chosen to afford acceptable power and precision given available resources (Schönbrodt & Perugini, 2013). At the time of study design, G-power 3.1.9.2 (Faul et al., 2007) indicated >99% power to

detect a benchmark (i.e., analysis-independent) medium-sized effect (r=0.30) with up to 20% planned attrition (n=192 usable datasets) using two-tailed α=0.05. To enable readers to better interpret in our results, we performed a post-hoc power analysis, which indicated that the final sample of 225 usable datasets provides 80% power to detect a focal association as small as r=0.18.

EMA Protocol, Measures, and Data Reduction

Protocol

SurveySignal was used to automatically deliver 8 text messages/day to each subject's smartphone. Messages were delivered between 8:30 AM and 11:00 PM, with 1.5-3 hours between successive messages (*M*=120 min, *SD*=0.43). During weekdays, messages were delivered during the 'passing periods' between scheduled university courses to reduce burden and maximize compliance. Messages were delivered according to a fixed schedule that varied across days (e.g., the third message was delivered at 12:52 PM on Mondays and 12:16 PM on Tuesdays). Messages contained a link to a secure on-line survey. Subjects were instructed to respond within 30 minutes (*Median*=2 min, *SD*=7.16) and to refrain from responding at unsafe or inconvenient moments. During the baseline laboratory session, several procedures were used to promote compliance including: (a) delivering a test message to the subject's phone and confirming that they were able to successfully complete the on-line survey, (b) providing subjects with a 24/7 technical support number, and (c) providing graduated monetary bonuses for compliance.

EMA Survey and Data Reduction

Negative affect (*afraid, nervous, worried, hopeless, sad*) and positive affect (*cheerful, content, enthusiastic, joy, relaxed, calm*) at the moment of the survey prompt was rated using a 0 (*not at all*) to 4 (*extremely*) scale. NME exposure was assessed using a binary item (*Did you experience one or more negative events in the past hour?)*. A parallel item was used to assess PMEs. We previously reported that a factor analysis (principal components extraction; oblimin rotation) of the negative and positive affect items yielded a two-factor solution, with robust loadings on the target scales (λ=0.64-0.88) and negligible cross-loadings (λ<|.19|) (Hur et al., 2022). Both scales demonstrated adequate internal-consistency reliability at both the between- ($\alpha_{Between}$=0.94-0.95) and within-participants levels (α_{Within}=0.72-0.81). Between-participant reliability was evaluated using group-averaged scores, whereas within-participant reliability was evaluated using person-centered scores to capture item variability across repeated measurements (Kaurin et al., 2021). The reliability of the Level-1 intercept represents McDonald's *w* adjusted for differences between participants (Nezlek, 2007; Raudenbush & Bryk, 2002). To better understand the nature of significant associations, follow-up tests employed composite anxiety (*afraid, nervous, worried*) and depression (*hopeless, sad*) facet scales ($\alpha_{Between}$=0.90-0.93; α_{Within}=0.56-0.72). See **Supplementary Table S2** for detailed reliability estimates.

Internalizing Symptoms

Internalizing symptoms were assessed using the Inventory of Depression and Anxiety Symptoms (IDAS) (Watson et al., 2007), which includes 11 specific symptom scales:

Appetite Gain, Appetite Loss, Dysphoria, Ill Temper, Insomnia, Lassitude, Panic, Social Anxiety, Suicidality, Traumatic Intrusions, and Well-Being). The Panic and Well-being scales map onto the narrow tripartite dimensions of anxious arousal and high-PA, respectively (Watson et al., 2007). The IDAS also includes two broader scales: General Depression (which contains items drawn from several specific IDAS scales) and Dysphoria (which does not). To maximize independence of measures, we used the latter scale to index broadband internalizing symptoms (Watson et al., 2012; Watson et al., 2007). The Dysphoria scale captures "a large, nonspecific factor representing the core affective and cognitive symptoms of depression and anxiety" (Watson et al., 2007) (Watson et al., 2012, p. 399), making it a reasonable marker of the tripartite model's general distress construct. Variation in Dysphoria is a sensitive and specific marker of DSM internalizing diagnoses (Stasik-O'Brien et al., 2019) Participants used a 1 (*not at all*) to 5 (*extremely*) scale to rate themselves on a total of 64 items; item responses were averaged to compute mean scale scores. For the present study, the IDAS timeframe was modified to cover past-month symptoms. To minimize error and occasion-specific fluctuations in responding, we aggregated across adjacent assessments to create 'baseline' (0 and 6 months) and 'follow-up' (24 and 30 months) internalizing composites (α=0.80-0.97; **Supplementary Table S2**).

Analytic Strategy

Overview

The overarching goal of the present study was to determine whether variation in specific aspects of momentary emotional experience are associated with concurrent

(*baseline:* 0 and 6 months) and future (*follow-up:* 24 and 30 months) internalizing symptoms. Emotional experience was assessed via smartphone EMA at baseline (i.e., for up to 14 days) and included exposure to negative and positive momentary events (NME/PMEs), reactive changes in affect, and tonic affect. Building on the tripartite model of internalizing illness, hypothesis testing focused on associations with broad (general distress/dysphoria) and narrow (anxious arousal/panic and wellbeing/high-PA) internalizing symptom dimensions (Mineka et al., 1998; Watson et al., 2008; Watson et al., 2012). Exploratory analyses enabled us to examine associations with other narrow-band internalizing symptoms (e.g., social anxiety). Hypothesis testing leveraged a MSEM framework (Sadikaj et al., 2021) and latent mean partitioning, as described in more detail below and in **Figure 1**. MSEM analyses were performed using *Mplus* (version 8.10) (Muthén & Muthén, 2017) and employed Bayesian estimators, which allow for efficient handling of complex multilevel structure (Sadikaj et al., 2021); uninformed priors; 100 iterations; and the default covariance structure. Statistical significance was determined using Bayesian 95% Credibility Intervals (CIs). CIs that did not contain 0 were deemed credible or 'significant' (McElreath, 2020). Descriptive analyses were performed using *R* (version 4.4.1), *Rstudio* (version 2024.09.0+375), *psych* (version 2.4.6.26) (R Core Team, 2022; Revelle, 2022; RStudio Team, 2022). Diagnostic procedures and data visualizations were used to confirm that test assumptions were satisfied (Tukey, 1977). Some figures were created using *ggplot2* (version 3.5.1) (Wickham, 2016).

Within-participants (Level-1) modeling

Consider negative aspects of momentary emotional experience. In this framework, the EMA-derived *NA* (continuous) and *NME* (binary) 'time-series' were nested within subjects (Level-1). Slopes (reactive NA) and intercepts (tonic NA) were modeled as random effects. Latent mean partitioning was used to parse within-participant (Level-1) from between-participant (Level-2) variability. Level-1 variables were person-mean centered according to the *Mplus* default settings. The same approach was used to model positive affect of momentary emotional experience and quantify individual differences in reactive and tonic PA. As a check on data integrity and general analytic validity, we used this approach to confirm that exposure to NMEs and PMEs credibly increased momentary NA and PA, respectively.

Between-participants (Level-2) modeling

Three families of MSEMs were implemented: **(a)** cross-sectional, which used baseline EMA metrics to predict baseline symptom severity; (b) prospective-longitudinal, which used baseline EMA to predict symptom severity at follow-up (~2 years later); and **(c)** prospective-longitudinal symptom change, which used baseline EMA to predict follow-up symptom severity while controlling for grand-mean centered baseline symptoms. Models were computed separately for each combination of emotional valence (negative/positive) and internalizing symptom (general distress/dysphoria, anxious arousal/panic, wellbeing/high-PA). In all cases, the three EMA metrics were included as simultaneous predictors, which enabled us to estimate their unique

predictive value, over-and-above the other two. NME/PME frequency was grand-mean centered. To clarify interpretation, three kinds of follow-up analyses were performed for credible EMA predictors. First, we determined whether the association remained credible in a simpler bi-variate model (i.e., pruning the other two EMA predictors). Second, in cases where one or more negative EMA metrics (e.g., tonic NA) *and* one or more positive metrics (e.g., reactive PA) showed credible associations, we computed a new model that contained all of the credible predictors, enabling us to gauge their incremental predictive validity. Lastly, to better understand the nature of significant associations, follow-up tests for credible negative affect EMA predictors employed the composite anxiety (*afraid, nervous, worried*) and depression (*hopeless, sad*) facet scales of negative momentary affect.

Chapter 3: Results

Descriptive statistics

Outcome measure means, standard deviations and correlations between primary IDAS internalizing outcomes are provided in **Supplementary Table S1**. Although participants did not meet criteria for DSM-5 (American Psychiatric Association, 2013) anxiety disorders at time of enrollment, a relatively high prevalence of subclinical internalizing symptoms were endorsed (Conway et al., 2023). Although Dysphoria, Well-being, and Panic scores were relatively stable from Baseline to Follow-up (r's ≥ 0.63, p's<0.001), differing magnitude and direction of subject-level internalizing symptomatology change was present in our sample (**Figure 2**), providing ample variation to explain in MSEM analyses.

Bayesian estimation with 95% credibility intervals was used to obtain standardized values in MSEM analyses. Analyses focused on the theory-based outcomes of broadband Dysphoria as well as the narrow-band internalizing facets of Panic and Well-being.

Within-Participants (Level-1): Negative and positive events have predictable consequences for momentary affect

As a precursor to hypotheses testing, we confirmed that NMEs and PMEs increased momentary NA ($\beta = 0.24$ [0.21, 0.25]) and PA ($\beta = 0.28$ [0.26, 0.29]), respectively. As illustrated in **Figure 3**, both effects were credible (see figure caption for estimates and CIs), underscoring the separability of tonic and reactive affect, and reinforcing the general validity of our approach.

Between-Participants (Level-2)

Associations between the EMA metrics and internalizing symptoms are detailed in **Table 2**. Because the three EMA metrics (e.g., tonic NA, NME, and reactive NA) were included as simultaneous predictors, the reported associations represent the unique predictive merits of each EMA metric, over and beyond the other two. In all cases, credible EMA-internalizing associations remained significant in simpler bi-variate models. In cases where one or more negative EMA metrics (e.g., tonic NA) *and* one or more positive metrics (e.g., tonic PA) were credible, we computed a follow-up model that contained all the credible predictors, enabling us to gauge their incremental predictive validity. Again, all credible associations remained credible when considered simultaneously. All follow-up analyses of composite anxiety and depression replicated patterns of primary analyses except where highlighted below.

Tonic and Reactive Negative Affect are Associated with the Severity of Internalizing Symptoms

Cross-sectional MSEM models demonstrated that tonic NA was credibly associated with heighted levels of Dysphoria (β = 0.42 [0.29, 0.55]) and Panic (β = 0.48 [0.33, 0.59]) and diminished levels of Well-being (β = -0.23[-0.36, -0.12]). In contrast, reactive NA was only credibly associated with broadband Dysphoria symptoms (β = 0.41 [0.26, 0.56]). Variation in NME exposure was unrelated to the severity of concurrent internalizing symptoms (**Table 2**).

Prospective-longitudinal MSEMs enabled us to determine whether these associations remained evident at the follow-up assessments conducted approximately two years later. Indeed, tonic NA was credibly associated with more severe Dysphoria (β = 0.29 [0.14, 0.42]) and Panic symptoms (β = 0.31 [0.14, 0.43]) at follow-up, but not Well-being (β = -0.10 [-0.27, 0.02]). Echoing the cross-sectional results, elevated levels of reactive NA at baseline were associated with more severe Dysphoria at follow-up (β =0.27, 95% CI = 0.12, 0.41). NME was unrelated to future internalizing symptoms (**Table 2**).

To determine whether EMA indices of momentary emotional experience predict changes in symptom severity across the ~2-year follow-up, we recomputed the prospective-longitudinal MSEMs with baseline symptom severity included as a predictor. Results indicated that none of the negative EMA metrics—tonic NA, NMEs, reactive NA—was credibly associated with the slope of symptom trajectories (**Table 2**). Follow-up analyses of the depression and anxiety facets of NA largely mirrored primary results, except that increased endorsement of anxiety (*afraid, nervous, worried*) after NMEs was associated with increased prospective panic symptoms (β = 0.16 [0.029, 0.31]) but not trajectory (β = 0.085 [-0.04, 0.23]).

Tonic Positive Affect is Associated with the Severity and Longitudinal Course of Well-being Symptoms

In cross-sectional MSEMs, tonic PA was credibly associated with diminished levels of Dysphoria (β = -0.33 [-0.43, -0.21]) and Panic (β = -0.19 [-0.30, -0.06]) and heightened

levels of Well-being (β = 0.66 [0.56, 0.74]). Neither reactive PA nor PME exposure was only credibly associated with the severity of concurrent internalizing symptoms (**Table 2**).

In prospective-longitudinal MSEMs, tonic PA at baseline was associated with less severe Dysphoria symptoms (β = -0.31 [-0.40, -0.17]) and higher levels of Well-being (β = 0.53 [0.41, 0.64]). Reactive PA and PME exposure were unrelated to future internalizing symptoms (**Table 2**).

In prospective-longitudinal models of symptom change, differences in tonic PA at baseline were credibly associated with the slope of Well-being symptoms across the two-year follow-up (β = 0.24 [0.08, 0.40]). As shown in **Figure 4**, individuals with low levels of tonic PA at baseline were more likely to report diminished levels of Wellbeing at follow-up while controlling for baseline Wellbeing, that is, a less favorable symptom trajectory.

Exploratory analyses

Results of exploratory analyses of the other narrowband IDAS facets display largely similar patterns to the primary analyses, wherein tonic NA was credibly associated with heighted concurrent levels of all exploratory internalizing symptoms. In predicting follow-up broadband internalizing facets, tonic NA was less consistently predictive. In prospective-longitudinal models of symptom change, differences in tonic NA at baseline were credibly associated with the slope of Social Anxiety symptoms over

follow-up (β = 0.21 [0.08, 0.33]). Regarding positive affect, tonic PA was credibly associated with lower concurrent levels of many exploratory internalizing symptoms and less consistently with follow-up symptoms. See **Supplementary Table S3** for more details.

Chapter 4: Discussion

Internalizing disorders can be intensely debilitating and are a leading global public health burden (GBD 2021 Disease and Injuries Collaborators, 2024; The White House, 2023; U.S. Surgeon General, 2021; UNICEF, 2021; Watson et al., 2022; WHO, 2022). Not only is there a vast accessibility gap for mental health treatments, but even for those with access, the existing treatments can be far from curative. Thus, to alleviate suffering, it is imperative to better understand the factors that confer risk for and maintain internalizing disorders. Whereas great strides have been made to understand how personality traits such as N/NE relate to internalizing risk, there is a dearth of understanding of more proximal pathology promoting processes like momentary emotional experiences. Prospective longitudinal studies have the potential to illuminate these processes, but inconsistent findings about the predictive validity of reactive and tonic NA preclude decisive conclusions (Vaessen et al., 2017; Wichers, Geschwind, et al., 2009). Understanding of the relevance of positive affective dynamics is even less explored. The present study capitalizes on an intensive experience-sampling method to address this gap by disentangling how differences in real-world emotional dynamics underlie broadband (Dysphoria) and narrow-band (Panic and Well-being) internalizing symptoms and trajectory (**Figure 1**). Confirming that individuals' emotional experiences ebb and flow in relation to affective events encountered in daily living, individuals indeed endorsed greater NA following NMEs and greater PA following PMEs (**Figure 3**). On a between-subject level, however, affective event exposure was not predictive of concurrent or future internalizing symptoms or trajectory. We found that tonic dynamics –or the event-independent tendency toward negative or positive

emotions—were more predictive of concurrent and future internalizing symptoms than event—related (or reactive) dynamics. The predictive utility of tonic dynamics was particularly robust with respect to the broader Dysphoria outcome versus narrower internalizing facets. While these results underscore the importance of tonic emotional dynamics irrespective of emotional valence, notable valence-specific results emerged. Specifically, more reactivity to negative events was predictive of increased concurrent and future Dysphoria, but this effect did not extend to reactive PA, which showed no predictive relationship across any primary internalizing outcome. Extending key cross-sectional results from Heller and colleagues (Heller et al., 2021), our results highlighted a unique protective role of tonic PA in the trajectory of Well-being over the 2.5-year follow-up (see **Table 2**). These results add to the growing literature on pathology-promoting processes by providing insight into the relative importance of real-world emotional dynamics and their connection to internalizing symptoms. Moving forward it will be useful to determine whether CBT for emotional illness normalizes or rescues aberrant or risk conferring real-world emotional dynamics.

By examining real-world emotional dynamics and prospective longitudinal internalizing symptom change, we extend the, albeit small, literature highlighting the importance of positive affect in internalizing illness. Blunted reactivity to positive laboratory and real world stimuli is well documented (Bylsma et al., 2008; Rottenberg, 2017; Wichers, Barge-Schaapveld, et al., 2009; Wu et al., 2017), but few have investigated the importance of tonic PA in internalizing pathology. Not only does tonic PA appear to predict concurrent internalizing symptoms in cross-sectional studies

(Heller et al., 2021), but our results highlight that it may play a more causal role in longer term internalizing trajectories. We identify lower tonic PA, rather than reactive processes, as a promoter of a maladaptive Well-being trajectory (**Figure 4**). This indicates that individuals with higher tonic PA not only report better Well-being at a given point in time but also show an *improvement* in Well-being over a 2.5-year period. The protective role of tonic PA in Well-being trajectory highlights its potential as both a potential treatment marker and target for promoting better mental health outcomes. Interventions such as behavioral activation therapy (BAT), have successfully treated depression by encouraging engagement in pleasurable activities. This study's findings bring into question the potential mechanisms through which therapies such as BAT may act. Although BAT targets increased engagement in PMEs, research should investigate whether and how these interventions impact the generalization of positive affect throughout daily life (i.e. tonic PA). Moreover, studies tracking emotional dynamics throughout intervention are needed to help clarify and potentially optimize treatment mechanisms.

Differences in negative affect have been consistently associated with internalizing illness and risk in the literature. Replicating findings by Wichers and colleagues which link concurrent internalizing symptoms to heightened reactivity to negative events (Wichers, Barge-Schaapveld, et al., 2009), we similarly found increased reactive NA and tonic NA to be associated with more maladaptive internalizing symptomatology, particularly with respect to broadband Dysphoria. However, our findings diverge from the albeit inconsistent conclusions about the predictive benefit of these negative

emotional dynamics (Wichers, Geschwind, et al., 2009), as tonic and reactive NA did not credibly predict internalizing trajectory. One interpretation of these findings is that these negative emotional dynamics are scars or concomitants of internalizing symptoms, particularly broadband Dysphoria. For example, broad contextual stressors or neurobiological factors could simultaneously promote internalizing symptoms and these negative emotional dynamics. Another more prosaic possibility draws up Borsboom's network model perspective that complex and bidirectional pathways reinforce symptomatology (Borsboom & Cramer, 2013). In accordance with this perspective, tonic and reactive NA may play a causal role in internalizing illness but do not exert their influence consistently over a two-year period. A key challenge to distinguishing between these possibilities will be to assess the predictive validity of these emotional dynamics at shorter follow-up intervals.

Momentary events, while sufficient to transiently alter negative and positive affect (**Figure 3**) are not major determinants of internalizing symptoms after accounting for tonic and reactive fluctuations in affect. Prior studies typically have focused on cataloging events and retrospective assessments of distress and severity yet rarely, if ever, simultaneously consider multiple markers of emotional dynamics. Does this mean that negative and positive life events are unimportant? Certainly not—the well-documented link between life events and internalizing disorders presented in the introduction underscores their significance. However, moving forward, employing the complementary strengths of daily diary and EMA methods may better capture the relative importance of infrequent but consequential life events on internalizing

outcomes. Particularly, studies with better representation of significant major life stressors (e.g. divorce or losing a job) or achievements (e.g. getting a promotion) as well as momentary affective events will be critical to disentangle the relevance of intensity and chronicity of affective events on internalizing illness.

Despite numerous strengths, the limitations of our results provide a roadmap for future inquiry to further understand the relevance of real-world emotional dynamics to internalizing illness. A key avenue for future research is to expand prospective longitudinal work to include samples that better represent the full demographic diversity of the population. Whereas our ethnoracially diverse sample was enriched for higher risk of developing internalizing illness (high N/NE) and were followed throughout the transition from late adolescence to early adulthood, inquiry into the generalizability of results to other developmental periods, populations in treatment, and those with co-occurring serious mental illness is needed. It is possible that our findings are attenuated estimates compared with that of a general or more symptomatic sample. Our exploratory results, also provide for promising avenues of future prospective longitudinal research. As seen in **Supplementary Table S3**, individuals with greater tonic NA displayed a worse trajectory of social anxiety symptoms. Given the lack of specific hypothesis related to this exploratory and preliminary discovery, replication is particularly important.

This study represents a step forward in understanding the role of real-world emotional dynamics in internalizing illnesses by leveraging the rigor of multi-wave data collection and advanced MSEM methodologies. By integrating EMA's ecologically valid and retrospective-bias-reducing assessments with a MSEM-aided focus on both tonic and reactive affective processes, our findings extend the field's understanding of pathology and resilience-promoting mechanisms. This work contributes to the growing body of literature in affective science by demonstrating the value of EMA for understanding emotional dynamics and internalizing symptoms. Unlike most studies that rely heavily on laboratory-based paradigms focused primarily on inducing acute (i.e., reactive) emotional responses, EMA can provide real-time, naturalistic assessment of both reactive and tonic emotional processes, offering a more comprehensive picture of context-independent and context-dependent tendencies toward positive or negative affect. Importantly, our prospective longitudinal design allowed for the identification of tonic PA as a critical factor in Well-being trajectories. This finding not only suggests that laboratory paradigms should be designed to better capture tonic dynamics, but it also provides translational insight into potential mechanisms for optimizing mental health interventions. By refining our understanding of the factors that promote resilience and exacerbate suffering, this work not only underscores the importance of investigating both transient emotional responses and typical emotional tendencies but also provides a foundation for optimizing interventions for individuals suffering from internalizing disorders.

Tables and Captions

Sample Characteristics		n	%	Mean (Age)	SD (Age)
Sex					
	Female	113	50.2%	18.7	0.34
	Male	112	49.8%	18.7	0.36
Race/Ethnicity					
	Asian	41	18.2%	18.7	0.35
	Biracial/Multiracial or Other	14	6.2%	18.6	0.30
	Black or African-American	20	8.9%	18.6	0.37
	Hispanic/Latina/Latino	11	4.9%	18.8	0.29
	Native Hawaiian or Other Pacific Islander	1	0.4%	18.5	
	White/Caucasian	138	61.3%	18.8	0.35
Age					
	Total Sample	225		18.71	0.35

Table 1. Descriptive statistics for the final sample (n=225).

		Negative Affect				Positive Affect			
	Internalizing Outcome	Tonic β	Reactivity β	Momentary Events β	Baseline Internalizing β	Tonic β	Reactivity β	Momentary Events β	Baseline Internalizing β
Cross-Sectional									
	Dysphoria	**0.417**	**0.405**	0.027	-	**-0.332**	0.005	0.047	-
	Panic	**0.475**	0.137	-0.035	-	**-0.186**	-0.026	0.009	-
	Well-being	**-0.228**	-0.084	0.142	-	**0.660**	-0.013	0.103	-
Prospective Longitudinal									
	Dysphoria	**0.285**	**0.273**	-0.012	-	**-0.305**	0.092	0.036	-
	Panic	**0.308**	0.135	0.020	-	-0.088	0.078	-0.015	-
	Well-being	-0.102	0.029	0.153	-	**0.532**	0.049	0.087	-
Prospective Longitudinal Change									
	Dysphoria	0.063	0.031	-0.054	**0.462**	-0.107	0.079	0.001	**0.463**
	Panic	0.010	0.030	0.034	**0.497**	0.054	0.070	-0.030	**0.512**
	Well-being	0.055	0.091	0.056	**0.506**	**0.242**	0.054	0.021	**0.403**

Table 2. Standardized coefficients from between-participant (Level-2) MSEM analyses.

Credible associations are shown in **bold**.

Figures and Captions

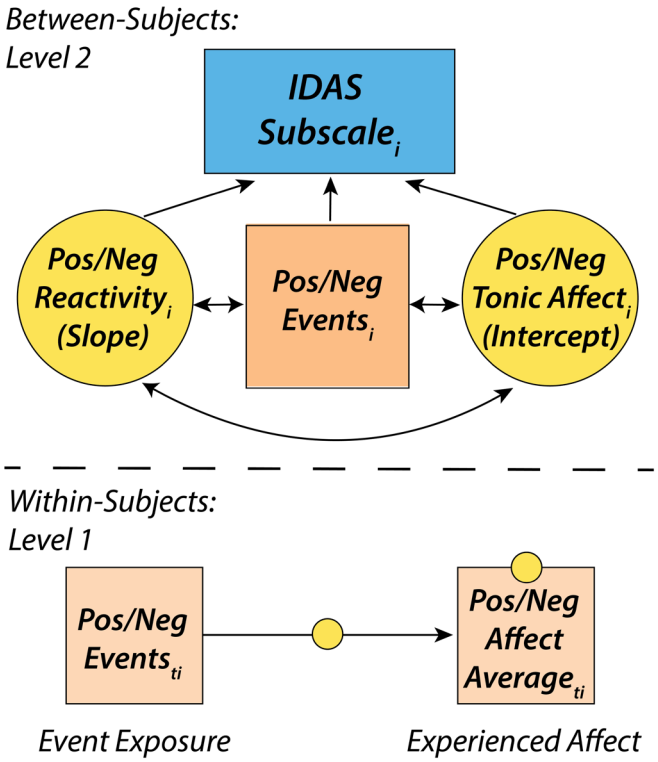

Figure 1. Path model used in MSEM analyses including decomposition of the key variables related to emotional and internalizing dynamics into between (subscript i) and within-subject (subscript t) variance.

Positive and negative events are operationalized as endorsements experiencing one or more affective events (e.g. Did you experience one or more negative events in the past hour?). Negative and positive affect averages are computed from 0-to-4-scale responses to affect items: negative (afraid, nervous, worried, hopeless, sad) or positive (cheerful, content, enthusiastic, joy relaxed, calm). Single headed arrows indicate regression paths and double-headed arrows indicate correlations. The yellow-filled dots represent random effects. The random slopes and intercepts from the Level 1 regression become the latent reactivity and tonic affect predictors at Level 2. These predictors, in conjunction with observed event exposure predict internalizing scores (either concurrently in cross-sectional analyses or prospectively in longitudinal analyses). In prospective longitudinal change models, IDAS at baseline is also included as a Level 2 predictor.

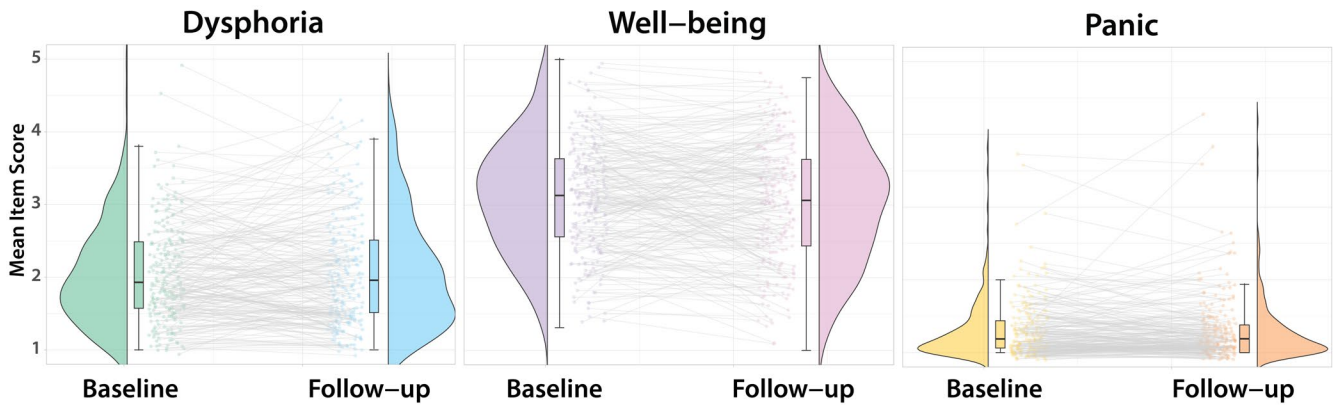

Figure 2. Changes in observed internalizing symptoms across the transition from late adolescence to early adulthood.

Individual differences in internalizing symptoms were rated on a 1-5-point scale. Dots represent each individual's score at baseline or follow-up. Gray lines represent the sign and magnitude of intraindividual change in the given internalizing domain. Box plots indicate the median in interquartile range, whereas the half-violin plots show the smoothed distributions. Baseline measures are a composite of assessments at months 0 and 6, whereas follow-up measures average assessments from months 24 and 30.

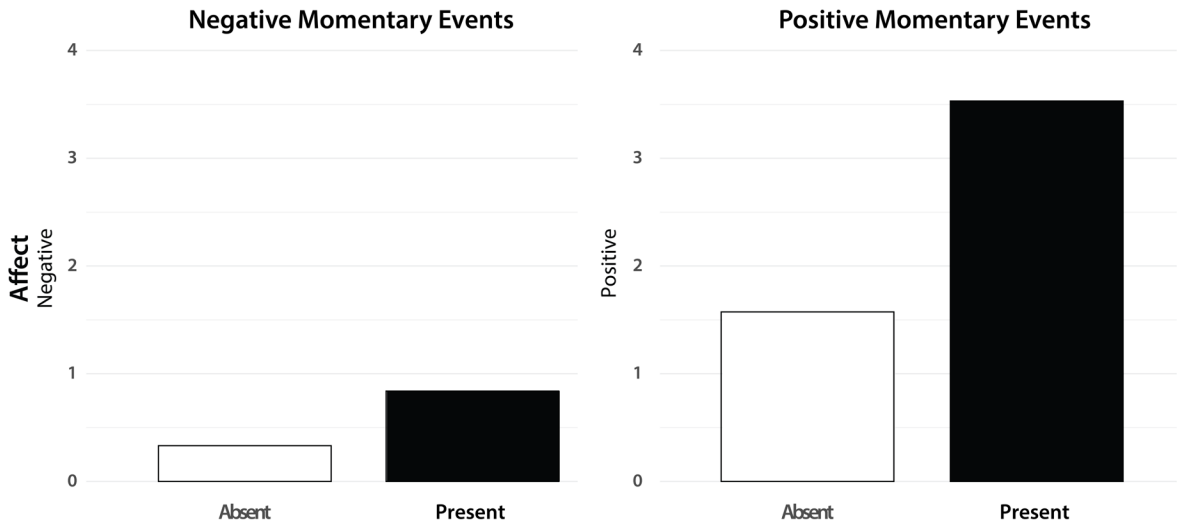

Figure 3. Ecological Momentary Assessment (EMA) demonstrates that affective events are associated with an increase in valence-congruent affect.

White bars represent subjects' average reported affect when affective events are absent (tonic affect) and black bars represent reported affect after event exposure (tonic affect + reactive affect). Values from the bar chart were derived from the standardized individual estimates of the latent tonic and reactive factors from the Mplus SAVEDATA command and converted to original scale units for illustrative purposes in R. In MSEM analyses NMEs reliability were associated with increased NA ($\beta = 0.24$ [0.21, 0.25]) and PMEs were reliably associated with increased PA ($\beta = 0.28$ [0.26, 0.29]). Correspondingly, across individuals, the mean negative affect endorsed attributable to tonic affect was 0.33 [0.32, 0.34] and the mean negative affect endorsed when NMEs were endorsed was 0.84 [0.82, 0.86]. For positive affect, the mean positive affect attributable to tonic PA was 1.57 [1.54, 1.6], with an average score of 3.53 [3.47, 3.59] being endorsed after PMEs.

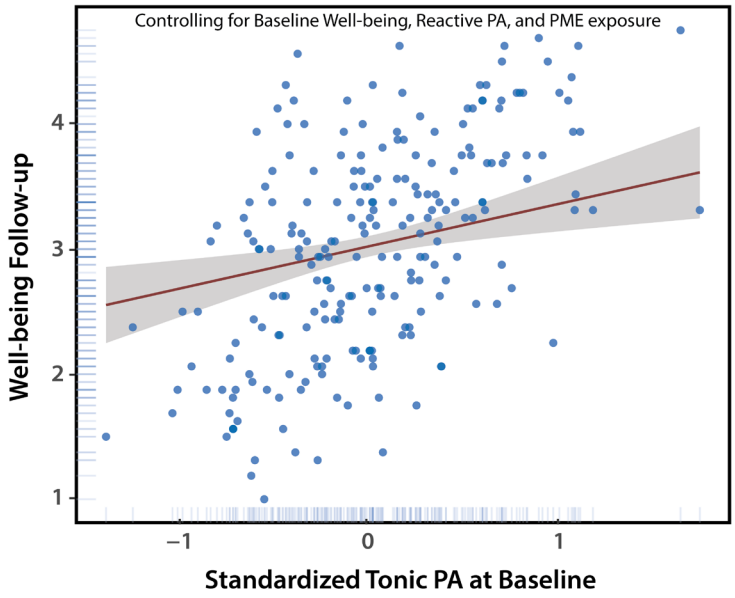

Figure 4. Marginal effects plot illustrating the association between standardized tonic PA and Well-being at follow-up, controlling for baseline Well-being, reactive PA, and PME exposure.

The line (and 95% CI band) illustrates the significant relationship between standardized tonic PA and Well-being at follow-up, holding baseline Well-being, reactive PA, and positive momentary event (PME) exposure at their mean values. Results from MSEM prospective longitudinal change analyses were used for hypothesis testing, demonstrating that tonic PA is associated with an adaptive Well-being trajectory over the 2.5-year follow-up period even when Well-being, reactive PA, and PME exposure, tonic PA are included in the model (β =0.24, 95% CI = 0.08, 0.40). This marginal effects plot is presented for illustrative purposes only and was creating using the predict and ggplot R functions.

Supplementary Tables

		1	2	3	4	5	M (SD)
1	Dysphoria, baseline						2.04 (0.68)
2	Dysphoria, follow-up	0.63					2.07 (0.77)
3	Well-being, baseline	-0.47	-0.40				3.10 (0.76)
4	Well-being, follow-up	-0.30	-0.55	0.64			3.03 (0.83)
5	Panic, baseline	0.70	0.47	-0.25	-0.14		1.31 (0.41)
6	Panic, follow-up	0.54	0.64	-0.20	-0.17	0.65	1.29 (0.44)

Supplementary Table S1. Descriptive statistics for primary internalizing outcomes, including mean, standard deviation and correlations between IDAS internalizing subscales and baseline and follow-up.

Baseline measures are a composite of assessments at months 0 and 6, whereas follow-up measures average assessments from months 24 and 30. All correlations are significant ($p<0.05$).

		Baseline		Follow-up	
		Within-Subjects Alpha	Between-Subjects Alpha	Within-Subjects Alpha	Between-Subjects Alpha
EMA					
	Negative Affect Average	0.72	0.94	-	-
	Positive Affect Average	0.81	0.95	-	-
	Anxiety Average	0.72	0.93	-	-
	Depression Average	0.56	0.9	-	-
IDAS					
	Dysphoria	0.91	0.94	0.90	0.93
	Well-being	0.94	0.96	0.92	0.95
	Panic	0.87	0.91	0.86	0.90
	Lassitude	0.82	0.87	0.80	0.85
	Insomnia	0.78	0.85	0.79	0.86
	Suicidality	0.84	0.87	0.83	0.85
	Appetite Loss	0.95	0.97	0.95	0.96
	Appetite Gain	0.79	0.82	0.77	0.82
	Ill temper	0.79	0.85	0.81	0.86
	Social Anxiety	0.86	0.86	0.80	0.80
	Traumatic Intrusions	0.81	0.87	0.80	0.86

Supplementary Table S2. Reliability estimates of EMA and IDAS measures.

For EMA analyses, the omega function in R was used and within-subjects reliability was evaluated using person-centered scores to capture item variability across repeated measurements. For IDAS analyses, items were averaged across adjacent waves for each participant and the alpha function in R was used.

		Negative Affect				Positive Affect			
	Internalizing Outcome	Tonic β	Reactivity β	Momentary Events β	Baseline Internalizing β	Tonic β	Reactivity β	Momentary Events β	Baseline Internalizing β
Cross-Sectional									
	Lassitude	**0.375**	**0.180**	0.079	-	**-0.281**	0.085	0.013	-
	Insomnia	**0.314**	**0.264**	-0.036	-	**-0.196**	0.110	0.004	-
	Suicidality	**0.433**	**0.128**	0.056	-	**-0.196**	-0.012	0.108	-
	Appetite Loss	**0.272**	**0.141**	-0.004	-	-0.134	0.066	-0.016	-
	Appetite Gain	**0.306**	0.015	-0.015	-	-0.013	0.039	0.050	-
	Ill-temper	**0.323**	**0.308**	0.045	-	**-0.219**	0.063	0.032	-
	Social Anxiety	**0.385**	**0.224**	0.036	-	**-0.299**	-0.024	0.049	-
	Traumatic Intrusion	**0.364**	**0.303**	0.055	-	**-0.199**	0.037	0.071	-
Prospective Longitudinal									
	Lassitude	**0.242**	**0.147**	0.095	-	**-0.251**	0.112	0.032	-
	Insomnia	0.104	**0.182**	0.032	-	**-0.189**	**0.192**	0.023	-
	Suicidality	**0.293**	0.073	-0.101	-	-0.125	0.026	-0.031	-
	Appetite Loss	0.139	0.042	-0.060	-	-	-	-	-
	Appetite Gain	**0.209**	0.017	0.028	-	-	-	-	-
	Ill-temper	**0.232**	0.137	0.024	-	-0.119	0.120	-0.009	-
	Social Anxiety	**0.384**	0.153	0.001	-	**-0.247**	0.019	0.122	-
	Traumatic Intrusion	**0.269**	**0.159**	0.022	-	-0.104	0.116	0.054	-
Longitudinal Change									
	Lassitude	0.010	0.024	0.033	**0.518**	-0.065	0.051	0.015	**0.515**
	Insomnia	-0.050	0.052	0.039	**0.380**	-0.080	**0.132**	0.009	**0.363**
	Suicidality	0.110	-0.030	**-0.150**	**0.370**	-	-	-	-
	Appetite Loss	-	-	-	-	-	-	-	-
	Appetite Gain	0.085	0.001	0.033	**0.383**	-	-	-	-
	Ill-temper	0.092	-0.021	-0.009	**0.342**	-	-	-	-
	Social Anxiety	**0.206**	0.023	0.014	**0.438**	-0.060	0.017	**0.097**	**0.474**
	Traumatic Intrusion	0.127	0.008	-0.022	**0.349**	-	-	-	-

Supplementary Table S3. Standardized coefficients from exploratory Level 2 (Between-subject) MSEM analyses, resulting from regressing internalizing symptoms on individual differences in affective parameters.

Significant estimates (95% CI excludes 0) are bolded. Parameters are presented for all families of analyses.

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