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Real-World Emotional Experience Is Associated With Future Internalizing Symptoms

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Abstract

Depression, anxiety, and other internalizing disorders impose a staggering burden on public health. Alterations in emotional experience are central to theory, but prospective-longitudinal studies of real-world affect dynamics are scarce. Leveraging a hierarchical-dimensional approach, we examined associations between momentary emotional experience and broad and narrow internalizing symptoms in a risk-enriched sample of 234 emerging adults followed for 2.5 years. Bayesian models demonstrated that low tonic levels of positive affect (PA) were associated with worsening well-being symptoms, a core feature of depression, social anxiety, and trauma disorders. Baseline differences in tonic negative affect were associated with the severity of future anxious-arousal symptoms but not with longitudinal change. Variation in reactive affect and exposure to everyday positive and negative events was unrelated to symptom trajectories. These observations highlight the centrality of tonic PA to the development of a key transdiagnostic symptom and set the stage for developing more-effective intervention strategies.

Keywords

anxiety, depression, ecological momentary assessment (EMA), emotion, positive affect, open data, preregistered

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Anxiety, depression, and other "internalizing" disorders are a leading cause of human misery, morbidity, and mortality (GBD2023, 2025). Existing treatments are far from curative for many, underscoring the urgency of developing a better understanding of the factors that confer risk (Craske et al., 2017; Harrer et al., 2025; Simon et al., 2024). Meta-analyses and prospective-longitudinal studies have highlighted the importance of emotional traits, showing that individuals with a heightened propensity to negative emotions (high neuroticism/negative emotionality [N/NE]) and individuals with a lower propensity to positive emotions (low extraversion/positive emotionality [E/PE]) are more likely to experience internalizing symptoms and diagnoses years, even decades in the future (Bucher et al., 2019; Chavanne et al., 2023; Conway et al., 2024; Fullana

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et al., 2020; Hur et al., 2019; Khazanov & Ruscio, 2016; Kostyrka-Allchorne et al., 2020; Lynch et al., 2021; Rimfeld et al., 2021; G. Schneider et al., 2021; Toenders et al., 2022; Waszczuk et al., 2022). Despite this important progress, the momentary emotional experiences that proximally promote illness amid 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. A growing number of studies have leveraged [AQ: 4]ecological-momentary-assessment (EMA) techniques to overcome this barrier, yet most have focused on aggregate measures of positive affect (PA) and negative affect (NA) and cross-sectional analyses, precluding inferences about more-granular and context-dependent affect dynamics (Heller et al., 2021; Houben et al., 2015).

Momentary Affect Dynamics

Converging lines of data motivate the hypothesis that three distinct but interrelated facets of momentary emotional experience promote the development of internalizing illness. The first is the frequency of acute emotional events. Individuals who experience more-frequent negative events—hassles, disappointments, conflicts, rejections, and other everyday stressors—are more likely to develop internalizing problems. Conversely, individuals who experience fewer uplifts, daily pleasures, and other positive events are more likely to develop problems. Second is the intensity of transient emotional reactions to acute emotional events ("reactive" affect). Individuals who experience amplified NA to negative events or blunted PA to positive events are more likely to develop internalizing problems. The third is the intensity of emotional feelings in the absence of acute events ("tonic" affect). Individuals prone to heightened NA or diminished PA in emotionally neutral "baseline" settings are more likely to develop internalizing problems. These pervasive affective tendencies have been variously described as "tonic," "basal," "baseline," "endogenous," and "self-generated" affect (Gross et al., 1998; Mineka et al., 2020; Perkins et al., 2015; Shackman et al., 2016; Suls & Martin, 2005; Thake & Zelenski, 2013; Tracy et al., 2014; Watson & Clark, 1984). Tonic affect is distinct from simpler aggregates—for example, the average of all usable EMAs or daily diary entries—that muddle variation in emotional experience because of tonic affect, reactive affect, and the frequency of emotional events (Hisler et al., 2020; Suls & Martin, 2005).

Frequency of Emotional Events

There is ample evidence that stressors tend to elicit NA (e.g., anxiety, grief, humiliation, sadness, and guilt), undermine appetitive motivation and pleasure, and increase the likelihood of developing internalizing psychopathology (Keller et al., 2007; Kendler et al., 2003, 2025; Mineka et al., 2020; Monroe & Harkness, 2022; Toenders et al., 2022; Uliaszek et al., 2010; Yarrington et al., 2023). Interview, questionnaire, diary, and EMA studies have indicated that individuals with internalizing disorders and individuals with elevated dispositional risk (high N/NE) tend to experience more-frequent stressors, conflicts, adversities, and other negative events, as indexed by self-report, other-report, and objective behavioral measures (Barrocas & Hankin, 2011; Bleckmann et al., 2024; Boals et al., 2015; Bondy et al., 2021; Borghuis et al., 2020; Bowling et al., 2010; Brock et al., 2016; Côté & Moskowitz, 1998; Crocker & Luhtanen, 2003; Goldstein et al., 2021; Goodman et al., 2023; Hengartner et al., 2018; Howland et al., 2017; Hutteman et al., 2014; Johnson et al., 2004; Kim et al., 2003; Liu et al., 2024; Luo et al., 2023; McIntosh et al., 2010; Metz et al., 2018; Nielsen & Knardahl, 2015; Sadeh et al., 2015; Santee et al., 2023; Shackman et al., 2016; Shapero et al., 2013; Shiner et al., 2017; Tackman et al., 2020; Thompson et al., 2012; Wenzel et al., 2026; Wrzus et al., 2021). Cognitive-behavioral and pharmacological treatments for depression have been shown to reduce the frequency of daily stressors, at least as indexed by retrospective report, strengthening the possibility of a causal influence (Furman et al., 2024).

In contrast to stressors, positive events tend to promote PA and decrease the likelihood or severity of anxiety and depression (Clark & Watson, 1988; Hovenkamp-Hermelink et al., 2019; Kandler & Ostendorf, 2016; Needles & Abramson, 1990; Spinhoven et al., 2011). Individuals with internalizing disorders and individuals with elevated levels of dispositional risk (high N/NE and/or low E/PE) tend to experience fewer positive events in their daily lives (Farmer & Kashdan, 2015; Heininga et al., 2019; Hopko et al., 2003; Kashdan & Steger, 2006; Panaite et al., 2021; Peeters et al., 2003; Thompson et al., 2012; but cf. H. Wu et al., 2017). Research harnessing a variety of real-world measures—including EMA location surveys (e.g., own vs. friend's home), electronic financial records, and audio clips captured by wearable digital recorders—shows that elevated dispositional risk (i.e., low E/PE) is associated with less-frequent exposure to pleasurable places, people, and activities (Côté & Moskowitz, 1998; Gable et al., 2000; Gladstone et al., 2019; Marengo et al., 2023; Matz & Harari, 2021; Stachl et al., 2020; Tackman et al., 2020). Behavioral activation and other therapeutic interventions that increase the frequency or emotional impact of positive events alleviate depression, suggesting a causal role (Craske et al., 2024; Dimidjian et al., 2011; Furman et al., 2024; Stein et al., 2021).

Taken together, the data reviewed in this section underscore the importance of negative and positive

events to current and future internalizing illness. Yet it remains unclear whether these associations extend to the kinds of mild-but-frequent emotional events routinely encountered in daily life, that is, to negative momentary events (NMEs) and positive momentary events (PMEs).

Intensity of reactive affect

Individuals with internalizing disorders often show amplified reactions to negative daily events (Farmer & Kashdan, 2015; Tan et al., 2012; Thompson et al., 2012; van Winkel et al., 2015; Wichers, Barge-Schaapveld, et al., 2009), and this [AQ: 5]hyperreactivity appears to be normalized by antidepressants (Wichers, Barge-Schaapveld, et al., 2009). Dispositionally at-risk individuals (high N/NE) report heightened NA 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; T. R. Schneider et al., 2012), and even frightening virtual-reality games (Lin, 2017). Laboratory, diary, and EMA studies—which control for variation in baseline or tonic affect—paint a similar picture. At-risk individuals report exaggerated NA 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; Wenzel et al., 2026; Wichers et al., 2010; Wichers, Geschwind, et al., 2009; Wrzus et al., 2021; Zautra et al., 2005). Nevertheless, prospective-longitudinal EMA evidence remains sparse and inconsistent. Wichers, Geschwind, and colleagues (2009) initially reported that heightened reactivity to NMEs was associated with a worsening of internalizing symptoms and predicted the future onset of depression in a community sample of young women followed for 1 year (5 EMA days). The same investigators later 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 emerging adults followed for 1 year (6 EMA days; Vaessen et al., 2017). Negligible associations between reactive NA and the longitudinal course of depression symptoms were also reported in a mixed-sex community sample of middle-aged adults followed for 1.5 years (7 EMA days; Zhaoyang et al., 2020).

Regarding positive events, individuals with internalizing disorders often show blunted reactions to rewards and other pleasant stimuli in the laboratory and to PMEs in daily life, and this appears to be normalized by clinical treatment (Bewernick et al., 2012; Bylsma et al., 2008; Halahakoon et al., 2020; Hanuka et al., 2023; Rottenberg, 2017; Thompson et al., 2012; Trøstheim et al., 2020; Wichers, Barge-Schaapveld, et al., 2009; H. Wu et al., 2017). In one of the only EMA studies of its kind, Wichers and colleagues (2010) showed that blunted reactivity to momentary PMEs predicts future internalizing symptoms in a small sample (N=83) of women with a history of major depression followed for 1 year (5 EMA days). Whether this association generalizes to other samples and demographics remains unknown.

Intensity of tonic affect

Dispositionally at-risk individuals (high N/NE) are prone to elevated NA in benign settings, that is, higher levels of tonic NA (McCrae, 1990; Perkins et al., 2015; Shackman et al., 2016). Diary and EMA studies provide ample evidence that high-N/NE individuals and individuals with internalizing disorders tend to experience heightened NA in the absence of acute stressors (Abitante et al., 2024; Hisler et al., 2020; Hur et al., 2022; Lücke et al., 2024; Mey et al., 2020; Panaite et al., 2020, 2021; Shackman et al., 2016; Thompson et al., 2012; Wrzus et al., 2021). In laboratory settings, dispositionally negative individuals report elevated NA 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). Although there is some evidence that elevated tonic NA confers risk for future internalizing symptoms (Rackoff & Newman, 2020; 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 et al. (2021) documented substantial cross-sectional associations between aggregate PA and internalizing symptoms—including depression, generalized anxiety, and social anxiety—in a risk-enhanced sample of 462 emerging adults. Other groups have reported lower aggregate PA in depressed adolescents and adults (Abitante et al., 2024; Panaite et al., 2020, 2021), and there is evidence that some treatments for depression increase aggregate PA (Geschwind et al., 2011). To date, the degree to which blunted tonic PA forecasts the worsening of internalizing symptoms has received scant empirical attention. In the Midlife in the United States study (N=1,517), daily diary measures of aggregate PA were associated with future depression and anxiety diagnoses (Rackoff & Newman, 2020). Whether these associations generalize to other developmental chapters, whether they hold when controlling for reactive PA and PME exposure, and whether they reflect alterations in broad (e.g., general distress/dysphoria) or narrower (e.g., positive affect/anhedonia) internalizing symptoms remain unknown.

The Present Study

Alterations in emotional reactivity are central to most etiological models of internalizing illness, but prospective-longitudinal studies of real-world affect dynamics are scarce. 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 risk-enriched, racially diverse sample of 225 emerging adults who were repeatedly assessed for 2.5 years, as they navigated 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 (i.e., in the absence of acute emotional challenges) across a 2-week baseline assessment. Because EMA data are captured in 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 such that individuals with high levels of this risk-conferring trait were oversampled. We focused on "emerging adulthood" (≈18–30 years) because it is a time of profound, often stressful transitions, during which many emerging adults experience the first onset of clinically significant internalizing symptoms during this often-turbulent developmental chapter (American College Health Association, 2024; Botha et al., 2023; Healthy Minds Network, 2023; Kieling et al., 2024; Saunders et al., 2024; Substance Abuse and Mental Health Services Administration [SAMHSA], 2024; Turner et al., 2023).

We used multilevel structural equation models (MSEMs) 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. An 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 (Ong & Leger, 2022; 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/dysphoria) and narrow (anxious arousal/panic and high-PA/well-being) internalizing symptoms (Mineka et al., 1998; Watson, 2009; Watson et al., 2008, 2012). In contrast to traditional diagnosis-centered research, this enabled us to tease apart (a) the facets of momentary emotional experience (e.g., elevated tonic NA) that are associated with transdiagnostic general-distress and dysphoria symptoms (b) from those (e.g., reduced PME exposure) associated with the narrow symptoms (e.g., low PA) that differentiate the internalizing disorders from one another. On an exploratory basis, we also examined relations with other narrow internalizing symptoms (e.g., social anxiety).

Identifying the momentary emotional experiences most relevant to internalizing illness is important for understanding etiology and refining clinical-science theory. The identification of potentially modifiable real-world targets has the potential to guide the development of improved prevention strategies, including scalable smartphone-delivered mobile-health approaches (Ong et al., 2025). Determining the relative importance of the six pathology-promoting pathways would provide a data-driven rationale for prioritizing specific kinds of targeted interventions (Ong et al., 2025).

Transparency and Openness

Preregistration

Our general approach and specific hypotheses were preregistered (https://osf.io/4mksj).

Data, materials, code, and online resources

Raw data and select materials are publicly available (https://nda.nih.gov/edit_collection.html?id=2447). Deidentified processed data and annotated statistical code are publicly available (https://osf.io/4mksj).

Reporting

We report below how we determined our sample size, all data exclusions, and all measures involved in this study. Other measures and procedures conducted as part of the larger parent grants will be presented in separate reports.

Ethical approval

The protocol was approved by the University of Maryland Institutional Review Board (Protocol No. 659385-28).

Method

Study overview and general procedures

In the present study, we capitalized on 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 (1999) 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 research grant and 4-year baccalaureate degree program.

As detailed in prior work (Grogans et al., 2024), we used a composite measure of N/NE that encompassed measures of neuroticism (John et al., 2008) and trait anxiety (Goldberg, 1999; Goldberg et al., 2006) to screen 6,594 emerging adults (57.1% female, 42.9% male; 59.0% White, 19.0% Asian, 9.9% African American, 6.3% Hispanic, 5.8% multiracial/other; age: $M = 19.2$ years, $SD = 1.1$). At screening, the neuroticism and anxiety scales were strongly correlated (rs > .85) and internally consistent (αs > .85). Screening data were stratified into three bands (top quartile, middle two 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, and the remainder were split between the middle two and bottom quartiles (≈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 in good self-reported physical health with normal or corrected-to-normal color vision and routine 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 mood, anxiety, or trauma disorder (past 2 months) based on the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*; American Psychiatric Association [APA], 2013); severe substance abuse (i.e., associated with physical disability, hospitalization, or inpatient treatment); active suicidality; and ongoing psychiatric treatment (pharmacological and/or psychosocial) as determined by an experienced master's-level diagnostician using the Structured Clinical Interview for DSM-5 (First et al., 2015). To maximize the range of risk, participants with other-specified internalizing diagnoses and/or a lifetime history of internalizing illness 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 eight EMA surveys per day for 1 week. Momentary affect dynamics were **[AQ: 6]**reassessed 6 months after the initial visit using the identical 1-week EMA protocol. Internalizing symptoms were reassessed 6, 24, and 30 months later. Follow-up assessments were conducted in the laboratory or online according to 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; DeYoung et al., 2025; Gell et al., 2024; Kang et al., 2024; Makowski et al., 2024; Nikolaidis et al., 2022; Schoeler et al., 2025; Tiego et al., 2023). 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). Shorter-term fluctuations in risk were not central to our aims. With an eye to enhancing reliability and statistical power and ensuring adequate sampling of momentary events, it was appealing to aggregate the two natural pairs of internalizing assessments, as in prior work by our group (Conway et al., 2024; Grogans et al., 2025). Along similar lines, EMA data aggregated across the 0- and 6-month assessments served as the primary predictor of concurrent and future internalizing symptoms. For a sensitivity analysis separately considering 0- and 6-month data, the supplementary results in the Supplemental Material available online.

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., 2026; Cornwell et al., 2025; Didier et al., 2025; Grogans et al., 2024, 2025; Hur et al., 2022; Hur, Smith, et al., 2020; Shackman et al., 2024), personality (Conway et al., 2024), and social anxiety (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 baseline assessment—including a diagnostic interview, self-report

Table 1. Descriptive Statistics for the Final Sample ($N = 225$)

Sample characteristics	*n*	%	Age: *M*	*SD*
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

measures, and MRI assessment—and were 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; age: $M = 18.8$ years, $SD = 0.4$). The remaining 24 were excluded based on the baseline diagnostic interview (e.g., current or recent internalizing illness), inadequate EMA completion (<50%) at the 0-month assessment, or study withdrawal. Of the 234 participants eligible for follow-up, nine were censored from analyses because of inadequate EMA completion at the 6-month assessment ($n = 5$), failure to complete either the 24- or 30-month internalizing assessments ($n = 1$), or loss to follow-up ($n = 3$). EMA adherence 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%). For demographic information, see Table 1. All participants were first-year undergraduate students at the University of Maryland at the time of study enrollment. Other demographic information was either not assessed or deemed insufficiently valid (e.g., familial income).

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 ($r = .30$) with up to 20% planned attrition ($n = 192$ usable data sets) using two-tailed $\alpha = .05$. To enable readers to better interpret our results, we performed a post hoc power analysis (exact test; bivariate normal model), which indicated that the final sample of 225 usable data sets provides 75% power to detect a focal association as small as $r = .17$.

EMA protocol, measures, and data reduction

Protocol. *SurveySignal* was used to automatically deliver eight text messages a day to each subject's smartphone. EMA data were collected for 7 days (eight texts/day) at 0 and 6 months, resulting in 14 days of data collection or up to 112 assessments per participant at baseline. Messages were delivered between 8:30 a.m. and 11:00 p.m. on weekdays and between 11:00 a.m. and 11:00 p.m. on weekends with 1.5 hr to 3 hr between successive messages ($M = 120$ min, $SD = 0.43$). During weekdays, messages were specifically delivered during the "passing periods" between scheduled university courses to reduce burden and maximize adherence. Messages were delivered according to a fixed schedule that varied across days (e.g., the third message was delivered at 12:52 p.m. on Mondays and 2:10 p.m. on Sundays). Messages contained a link to a secure [AQ: 7]online survey. Participants were instructed to respond within 30 min ($Mdn = 5.4$ min, $SD = 1.91$) and to refrain from responding at unsafe or inconvenient moments. During the introductory laboratory session, several procedures were used to promote adherence, including (a) delivering a test message to the participant's phone and confirming that the participant was able to successfully complete the online survey, (b) providing participants with a 24/7 technical support number, and (c) providing graduated monetary bonuses for adherence.

EMA survey and data reduction. The intensity of NA (afraid, nervous, worried, hopeless, sad) and PA (cheerful, content, enthusiastic, joy, relaxed, calm) at the

moment of the survey prompt was rated using a scale from 0 (*not at all*) to 4 (*extremely*). 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 PME exposure. Participants were free to interpret the NME/PME prompts as they saw fit; no specific instructions or guidance were provided during the training session. The past-hour [AQ: 8]time frame was explicitly chosen to focus on immediate emotional triggers and experiences while avoiding the inclusion of comparatively distal events (e.g., prior evening) captured by "since the last assessment" instructions (Conner & Barrett, 2012; Fritz et al., 2024; Kuppens et al., 2022). We (Hur et al., 2022) previously reported that a factor analysis (principal components extraction; oblimin rotation) of the NA and PA items yielded a two-factor solution that had robust loadings on the target scales (λs = .64–.88) and negligible cross-loadings ($\lambda < |.19|$). Both scales demonstrated adequate internal-consistency reliability at both the between- (αs = .94–.95) and within-participants levels (αs = .72–.81). [AQ: 9]Between-participants reliability was evaluated using group-averaged scores, whereas within-participants reliability was evaluated using person-centered scores to capture item variability across repeated measurements (Kaurin et al., 2021). To clarify the nature of significant associations, follow-up tests employed composite anxiety (afraid, nervous, worried) and depression (hopeless, sad) facet scales (between-participants: αs = .90–.93; within-participants: αs = .56–.72). For detailed reliability estimates, see Table S1 in the Supplemental Material.

Internalizing symptoms

Internalizing symptoms were assessed using the Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007; Watson & O'Hara, 2017), 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). Panic indexes somatic symptoms (e.g., dizziness, dry mouth, trembling, racing heart), whereas Well-Being captures symptoms of positive, energized engagement (e.g., interest, optimism, pleasure, and pride). The IDAS also includes two broader scales: General Depression (which contains items drawn from several specific symptom scales) and Dysphoria (which does not). To maximize independence of measures, we used the latter scale to index broad internalizing symptoms (Conway et al., 2024; Watson et al., 2007, 2012). The Dysphoria scale captures "a large, nonspecific factor representing the core affective and cognitive symptoms of depression and anxiety" (Watson et al., 2012, p. 399), making it a reasonable marker of the tripartite model's general-distress construct. Specific items probe concentration difficulties, depression, disinterest, inadequacy, restlessness, self-blame, and worry. Variation in Dysphoria is a sensitive and specific marker of *DSM* internalizing diagnoses (Stasik-O'Brien et al., 2019). Higher levels of Dysphoria and Panic and lower levels of Well-Being are associated with greater impairment (Cervin et al., 2024; Sanchez-Garcia et al., 2025; Vittengl et al., 2024). Participants used a scale from 1 (*not at all*) to 5 (*extremely*) to rate themselves on a total of 64 items; item responses were averaged to compute mean scale scores. Here, the IDAS was modified to probe 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 (between-participants: αs = .80–.97; Table S1 in the Supplemental Material).

Analytic strategy

Overview. The overarching goal of the present study was to determine whether variation in specific facets of momentary emotional experience is associated with concurrent (baseline) and future (follow-up) internalizing symptoms. Emotional experience was assessed via smartphone EMA at baseline and included exposure to NMEs and PMEs, reactive changes in NA and PA, and tonic levels of NA and PA. Building on the tripartite model of internalizing illness, we focused our hypothesis testing on associations with broad (general distress/Dysphoria) and narrow (anxious arousal/Panic and high-PA/Well-Being) internalizing symptom dimensions (Conway et al., 2024; Mineka et al., 1998; Watson et al., 2008, 2012). Exploratory analyses enabled us to examine associations with other narrow internalizing symptoms (e.g., social anxiety). Hypothesis testing leveraged an MSEM framework (Sadikaj et al., 2021) and latent mean partitioning, as shown in Figure 1 and detailed below. MSEM analyses were performed using MplusAutomation (Hallquist & Wiley, 2018) and Mplus (Version 8.10; Muthén & Muthén, 2017). Analyses employed Bayesian estimators (which allow for efficient handling of a complex multilevel structure; Sadikaj et al., 2021) with uninformed priors. 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

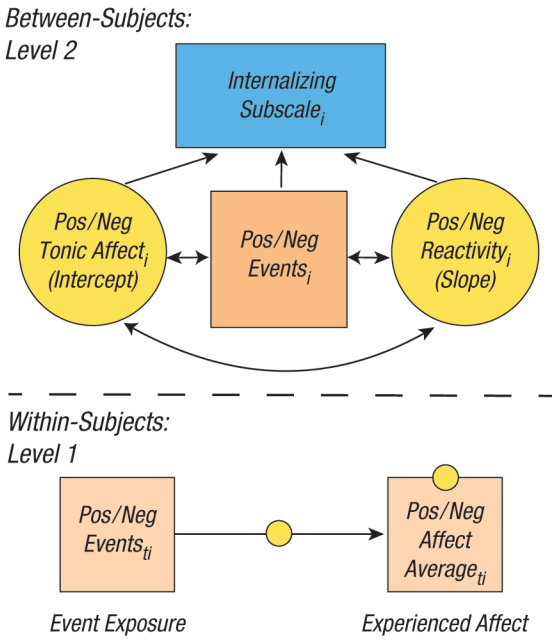


Fig. 1. MSEM path model. Model depicts the decomposition of key EMA (yellow/peach) and symptom (blue) variables into between- ($_i$) and within-participants ($_t$) variance. Single-headed arrows indicate regression paths, and double-headed arrows indicate correlations. Dots (yellow) indicate random effects. The random slopes and intercepts from the Level 1 regression become the latent tonic and reactive affect predictors at Level 2. These predictors, in conjunction with observed event exposure, were used to predict the severity of internalizing symptoms both concurrently (cross-sectional) and prospectively (longitudinal). In prospective-longitudinal change models, baseline internalizing symptoms were included as an additional Level 2 predictor. MSEM = multilevel structural equation model; EMA = ecological momentary assessment.

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 participants (Level 1). The slopes (reactive NA) and intercepts (tonic NA, the predicted NA when NME=0) resulting from the regression of momentary affect on event exposure were modeled as random effects. Latent mean partitioning was used to parse within-participants (Level 1) from between-participants (Level 2) variability. Level 1 variables were person-mean centered according to the Mplus default settings. The same approach was used to quantify individual differences in reactive and tonic PA. As a check on data integrity and general analytic validity, we also used this approach to confirm that past-hour exposure to NMEs and PMEs credibly increased momentary NA and PA, respectively. Emotional "reactivity" can be fractionated into more specific facets (e.g., threshold to respond, peak response, persistence of response; Davidson, 1998; Rothbart & Derryberry, 1981; Tracy et al., 2014). We acknowledge that our approach, which relies on real-world observational data and self-reported NME/PME exposure, muddles the distinction between these facets.

Between-participants (Level 2) modeling. Three families of MSEMs were implemented: (a) cross-sectional, which used baseline EMA metrics to predict concurrent symptom severity at baseline; (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 and positive) and symptom (general distress/Dysphoria, anxious arousal/Panic, high PA/Well-Being). 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. Within-persons centering of NME and PME was automatically handled as part of the latent decomposition, and grand-mean centering was applied at the between-subjects level. 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 [AQ: 10]bivariate model that pruned the other two EMA predictors. Second, in cases in which 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, providing a gauge on their incremental validity (Kendall et al., 2015; Waszczuk et al., 2022). Third, to further clarify significant associations, we performed follow-up tests that separately examined the anxious and depressive facets of momentary NA (Hur et al., 2022).

Results

Descriptive statistics

For means, standard deviations, and bivariate correlations for the three primary internalizing outcomes, see Table S2 in the Supplemental Material. Although individual differences in Dysphoria, Panic, and Well-Being were fairly stable from baseline to follow-up ($r > .62$, $p < .001$)—consistent with prior work in emerging adults (Birg et al., 2025; Conway et al., 2024; Peng et al., 2023; Zinbarg et al., 2023)—there was marked variation in the magnitude and sign of longitudinal change (Fig. 2). Between one-third and one-half of participants showed numeric worsening of symptoms from baseline to follow-up (Dysphoria: 45.8%; Panic: 34.7%; Well-Being: 51.1%), providing sufficient variation for meaningful individual-differences analyses.

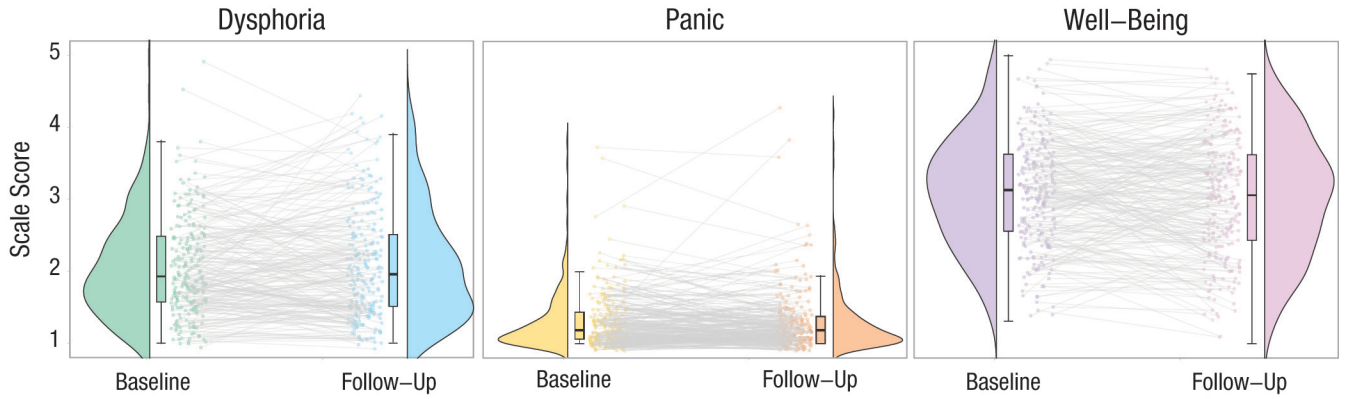


Fig. 2. Marked individual differences in the longitudinal course of internalizing symptoms. Only a small minority of the sample showed no numeric change in symptoms from baseline to follow-up (Dysphoria: 5.3%; Panic: 20.9%; Well-Being: 4.5%). Conversely, 45.8% of the sample showed a numeric increase in Dysphoria (d = 0.06), 34.7% showed a decrease in Panic (d = −0.05), and 51.1% showed a decrease in Well-Being (d = −0.11). Dots depict individuals. Gray lines indicate the sign and magnitude of intraindividual change. Box plots indicate the median and interquartile range. Half-violin plots show the smoothed distributions.

All analyses leveraged Bayesian MSEM estimation and 95% CIs. Standardized estimates (STDYX) of beta are reported throughout. Latent correlations among predictors are model-dependent, and their exact magnitudes vary across specifications (for detailed results, see Table S3 in the Supplemental Material). EMA predictors showed acceptable collinearity (pairwise r < .33; Mumford et al., 2015).

Within participants (Level 1): momentary emotional events have predictable consequences for reactive NA and PA

On average, participants reported past-hour NMEs on 8.4% of completed EMAs (SD = 6.0%) and past-hour PMEs on 19.7% (SD = 16%). The frequency of NMEs is broadly consistent with prior EMA research (Haehner et al., 2026; Suls, Green, & Hillis, 1998; Wrzus et al., 2021). We confirmed that NMEs and PMEs increased NA (β = 0.24, 95% CI = [0.19, 0.26]) and PA (β = 0.28, 95% CI = [0.25, 0.30]), respectively (Fig. 3).

Between participants (Level 2)

Pairwise associations between the EMA metrics and internalizing symptoms are shown in Table 2. Because the three EMA metrics (e.g., NME exposure, reactive NA, and tonic NA) were included as simultaneous predictors, the reported associations represent the unique explanatory value of each metric over and beyond the other two. In all cases, credible EMA-internalizing associations remained significant in simpler follow-up models that pruned the other two EMA predictors (Table S4 in the Supplemental Material).

Tonic negative affect is consistently associated with the severity of current and future symptoms

At baseline, tonic NA was credibly associated with more severe Dysphoria (β = 0.39, 95% CI = [0.26, 0.50]), more severe Panic (β = 0.47, 95% CI = [0.35, 0.59]), and diminished Well-Being (β = −0.24, 95% CI = [−0.37, −0.10]). In contrast, reactive NA was credibly associated only with Dysphoria, a broad index of general distress (β = 0.33, 95% CI = [0.19, 0.47]). Variation in NME exposure was unrelated to concurrent internalizing symptoms (Table 2).

Next, we used a series of prospective-longitudinal MSEMs to determine whether these associations remained evident at the follow-up assessment, approximately 2 years later. In fact, elevated tonic NA at baseline was credibly associated with more-severe Dysphoria (β = 0.28, 95% CI = [0.14, 0.41]) and Panic (β = 0.30, 95% CI = [0.15, 0.42]) at follow-up. In contrast to the cross-sectional analyses, variation in tonic NA was unrelated to Well-Being at follow-up (β = −0.12, 95% CI = [−0.27, 0.01]). Elevated levels of reactive NA were associated with more severe Dysphoria at follow-up (β = 0.20, 95% CI = [0.04, 0.35]), and more frequent NME exposure was associated with modestly elevated Well-Being at follow-up (β = 0.16, 95% CI = [0.004, 0.32]; Table 2).

Analyses focused on the anxious and depressive facets of NA largely mirrored our primary results (Table S5 in the Supplemental Material), with two exceptions. A modest but credible association between reactive NA and future Dysphoria was evident only for the anxious facet (Anxiety: β = 0.20, 95% CI = [0.04, 0.36]; Depression: β = 0.10, 95% CI = [−0.06, 0.26]). Conversely, a weak but credible association between future Well-Being and NME exposure was evident only for the depressive facet

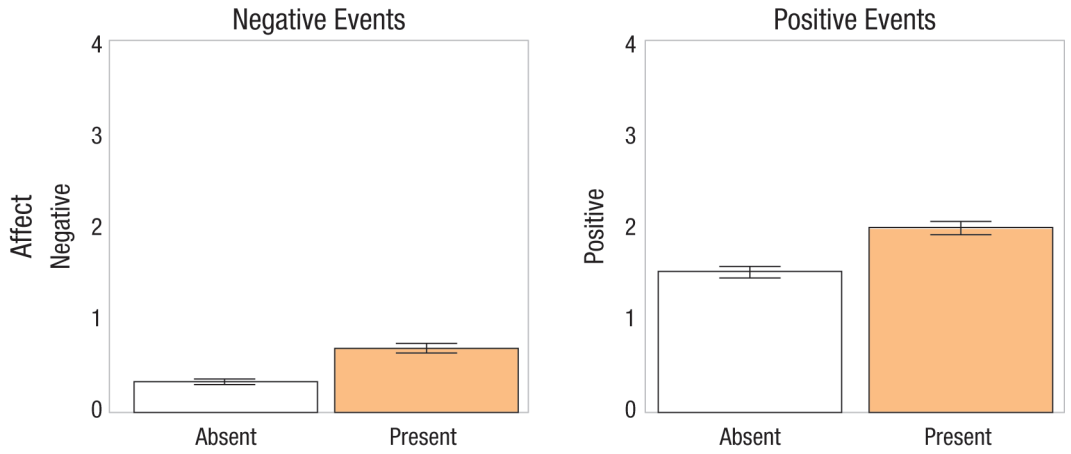


Fig. 3. Momentary emotional events are associated with credible increases in valence-congruent momentary affect. To illustrate the typical scale of momentary response, the bars depict unstandardized predicted affect levels (i.e., the original scale from 0 to 4 used in the EMA survey), generated from the unstandardized intercept and slope estimates of the MSEM. As noted, standardized within-persons MSEM analyses showed credible increases in NA following NMEs (β = 0.24, 95% CI = [0.22, 0.26]) and credible increases in PA following PME exposure (β = 0.28, 95% CI = [0.27, 0.30]). Error bars indicate Bayesian 95% CIs. EMA = ecological momentary assessment; MSEM = multilevel structural equation model; NA = negative affect; PA = positive affect; NME = negative momentary event; PME = positive momentary event; CI = credible interval.

(Anxiety: β = 0.14, 95% CI = [–0.01, 0.30]); Depression: β = 0.17, 95% CI = [0.03, 0.33]).

Taken together, these observations show that among the analyses considered so far, tonic NA shows the most robust and analytically stable associations with current and future Dysphoria and Panic symptoms. Nearly all prospective associations remained credible in follow-up analyses that accounted for the facets of positive emotional experience that showed credible associations with internalizing symptoms (with the exception of NME and future Well-Being; Table S6 in the Supplemental Material). Furthermore, none of the negative EMA metrics—tonic NA, reactive NA, and the frequency of NME exposure—was credibly associated with the slope of longitudinal changes in any of the focal internalizing symptoms (Table 2).

Table 2. Standardized Coefficients From Between-Participants (Level 2) Multilevel-Structural-Equation-Model Analyses

		Negative affect					Positive affect			
Internalizing outcome	R^2	Tonic β	Reactivity β	Momentary events β	Baseline internalizing β	R^2	Tonic β	Reactivity β	Momentary events β	Baseline internalizing β
Cross-sectional										
Dysphoria	**.355**	**0.387**	**0.334**	0.033	—	**.118**	**–0.340**	–0.021	0.047	—
Panic	**.242**	**0.474**	0.043	–0.040	—	**.047**	**–0.193**	–0.049	0.003	—
Well-Being	**.082**	**0.239**	–0.046	0.149	—	**.477**	**0.651**	0.024	0.100	—
Prospective longitudinal										
Dysphoria	**.162**	**0.283**	**0.199**[a]	–0.026	—	**.112**	**–0.308**	0.058	0.035	—
Panic	**.119**	**0.299**	0.061	0.005	—	**.025**	–0.080	0.046	–0.026	—
Well-Being	**.041**	–0.122	0.045	**0.155**[a,b,c]	—	**.315**	**0.533**	0.071	0.076	—
Prospective longitudinal change										
Dysphoria	**.241**	0.035	0.034	–0.043	**0.475**	**.251**	–0.117	0.078	0.009	**0.460**
Panic	**.274**	–0.015	0.053	0.034	**0.507**	**.283**	0.053	0.092	–0.032	**0.512**
Well-Being	**.292**	0.032	0.105	0.069	**0.511**	**.244**	**0.239**	0.073	0.028	**0.041**

Note: Variability in between-persons variance (R^2) in Inventory of Depression and Anxiety Symptoms outcome is presented. Credible associations are shown in bold (for additional details, see Tables S5 and S6 in the Supplemental Material).
[a]Nonsignificant for depressive and/or anxious facets of negative affect.
[b]Nonsignificant when all credible negative and positive predictors are included in the model.
[c]Nonsignificant in bivariate model.

Tonic PA is associated with the severity and longitudinal course of symptoms

Turning to positive facets of momentary experience, tonic PA was credibly associated with lower concurrent levels of Dysphoria (β = −0.34, 95% CI = [−0.47, −0.21]) and Panic (β = −0.19, 95% CI = [−0.33, −0.05]) and higher levels of Well-Being (β = 0.65, 95% CI = [0.55, 0.73]) at baseline, mirroring tonic NA's concurrent associations. All of these associations remained credible in follow-up analyses that controlled for the negative facets of momentary experience that showed credible associations (e.g., tonic NA; Table S6 in the Supplemental Material). At baseline, differences in the magnitude of reactive PA and frequency of PME exposure were unrelated to concurrent internalizing symptoms (Table 2).

In prospective-longitudinal models, higher levels of tonic PA at baseline were associated with lower levels of Dysphoria (β = −0.31, 95% CI = [−0.45, −0.17]) and higher levels of Well-Being at the follow-up assessment (β = 0.53, 95% CI = [0.41, 0.63]). Both associations remained credible in follow-up analyses that included negative facets of momentary emotional experience (e.g., reactive NA; Table S6 in the Supplemental Material). Differences in reactive PA and PME exposure were both unrelated to future symptoms (Table 2).

In prospective-longitudinal models of symptom change—the most stringent test—baseline differences in tonic PA were credibly associated with the slope of Well-Being symptoms across the 2-year follow-up (β = 0.24, 95% CI = [0.06, 0.40]). As shown in Figure 4, individuals with lower tonic PA at baseline were more likely to report diminished levels of Well-Being at follow-up while controlling for baseline Well-Being, that is, they evinced a less-favorable 2-year symptom trajectory.

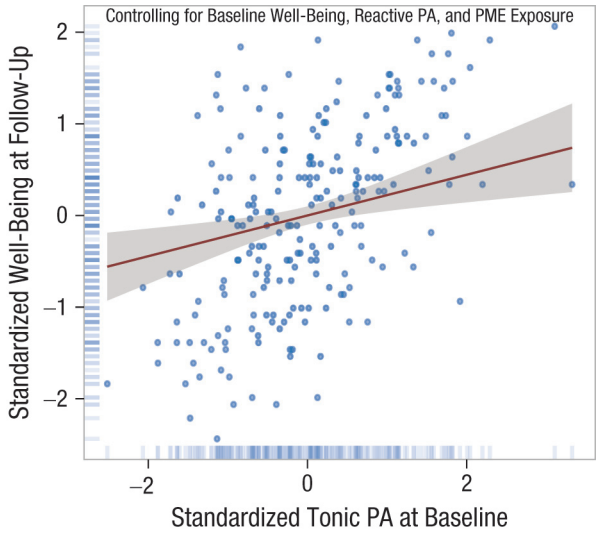


Fig. 4. Baseline levels of tonic PA are associated with the longitudinal course of Well-Being symptoms. MSEM results indicate that individuals evincing higher tonic levels of PA at baseline showed steeper increases in Well-Being across the approximately 2-year longitudinal follow-up period (cf. Figure 2). From a symptom-severity perspective, individuals who were 1 *SD* below the average level of tonic PA at baseline showed a 0.22 *SD* decrease in Well-Being at follow-up (β = 0.22, 95% CI = [0.08, 0.36]). The red line depicts the marginal association while controlling for variation in baseline symptoms, reactive PA, and exposure to positive momentary events. Gray envelope depicts the Bayesian 95% CI. Blue dots and ticks indicate individuals. PA = positive affect; MSEM = multilevel structural equation model; CI = credible interval.

Exploratory analyses

Exploratory analyses enabled us to examine associations with other narrow internalizing symptoms captured by the IDAS (Table S7 in the Supplemental Material). Four sets of results merit comment. First, variation in tonic NA at baseline was associated with heighted concurrent and future levels of all internalizing symptoms—with the lone exception of future insomnia—and a credible longitudinal worsening of Social-Anxiety symptoms across the 2-year follow-up (β = 0.19, 95% CI = [0.05, 0.33]). Second, reactive NA inconsistently predicted concurrent symptoms and was unrelated to future symptoms. Third, tonic PA was credibly associated with lower concurrent levels of every internalizing symptom except appetite loss/gain, less consistently associated with follow-up symptoms, and not at all associated with longitudinal changes in symptom severity. Fourth, individual differences in the frequency of NME/PME exposure and the magnitude of reactive PA at baseline were unrelated to symptom severity.

Discussion

Internalizing disorders are common and challenging to treat, pointing to the need to clarify the factors that promote symptom development and maintenance of symptoms. Here, we leveraged Bayesian MSEMs and 21,750 momentary assessments acquired from a risk-enriched sample of 234 emerging adults followed for 2.5 years to demonstrate that individuals marked by low levels of tonic PA at baseline showed a worsening course of Well-Being symptoms across a 2-year follow-up. Among our primary tests, variation in tonic PA was the only credible predictor of longitudinal change in the severity of internalizing symptoms (Table 2). This association was also evident for concurrent and future Well-Being symptoms, and it remained credible when controlling for variation in the frequency of PME exposure, magnitude of reactive PA, and negative facets of momentary emotional experience (e.g., tonic NA; Table S6 in the Supplemental Material). Although individuals with higher tonic NA at

baseline tended to experience more-severe general-distress (Dysphoria) and anxious-arousal (Panic) symptoms at follow-up, only the latter association was consistently evident across follow-up tests (Table 2). Exploratory analyses of other narrow internalizing symptoms revealed that tonic NA was associated with a worsening longitudinal course of Social-Anxiety symptoms (Table S7 in the Supplemental Material). At baseline, tonic PA and tonic NA both showed robust associations with the severity of a wide variety of concurrent internalizing symptoms (Table 2 and Table S7 in the Supplemental Material), consistent with prior EMA and diary research (Heller et al., 2021; Rackoff & Newman, 2020). Associations with the intensity of reactive affect (NA/PA) and the frequency of event exposure (NMEs/PMEs) were less consistent across assessments and less stable across analytic models (Table 2; Tables S6 and S7 in the Supplemental Material). Collectively, these observations underscore the centrality of tonic affect to the longitudinal development of internalizing symptoms.

The present findings show that lower levels of tonic PA are associated with a worsening 2-year trajectory of Well-Being symptoms. The IDAS Well-Being scale is an index of positive engagement with the past, present, and future, encompassing variation in interest, optimism, pleasure, and pride. Diminished well-being ("anhedonia") is a cardinal symptom of major depression, but it is also common among individuals with social anxiety and trauma disorders (APA, 2022; Craske et al., 2024; Kashdan, 2007; Kashdan et al., 2013; World Health Organization, 2019). Our results also inform work focused on trait-like individual differences in E/PE. Although E/PE has been shown to predict global measures of current and future anxiety and depression, associations with longitudinal change are modest in size and inconsistent across studies (Conway et al., 2024; Khazanov & Ruscio, 2016). Our observations suggest that these associations are likely to be most robust for the affective facet of E/PE and for comparatively narrow Well-Being and related anhedonia symptoms. Indeed, prior work shows that among the major facets of E/PE—Ascendance, Excitement Seeking, PE, and Sociability—only PE is associated with longitudinal changes in depression (Naragon-Gainey & Watson, 2014). In cross-sectional research, PE shows especially robust associations with depressed mood and motivation-and-pleasure deficits (Watson et al., 2015). Our results suggest that these trait-illness associations emerge from tonic differences in the intensity of momentary PA states. This view stands in contrast to dominant models of temperament and personality, which often conceptualize E/PE in terms of amplified reactivity to rewards, incentives, and related kinds of acute "trait-relevant" challenges (Allport, 1966; Eysenck, 1967).

A key unresolved question concerns causation. It will be important to determine whether existing internalizing interventions "rescue" tonic PA, whether these effects are more pronounced for interventions that specifically target PA, and whether they are equally evident for psychological and biological interventions (Catalano et al., 2026; Craske et al., 2019, 2024; Taylor et al., 2024), including emerging treatments focused on physical exercise (Caplin et al., 2021; Henriksson et al., 2022; Noetel et al., 2024; Ruissen et al., 2022). Recent ambulatory studies demonstrate that bouts of physical activity and exercise are associated with persistently elevated levels of tonic PA (and decreased levels of tonic NA), and these salubrious associations are most pronounced among individuals with internalizing disorders or individuals at risk for developing them (Difrancesco et al., 2022; Li et al., 2022; Ruissen et al., 2022; Shankman et al., 2025). It will also be useful to identify the specific psychological processes—for example, the capacity to anticipate, enjoy, prolong ("savor"), and internalize positive experiences—that promote pervasive PA in otherwise neutral settings (Daros et al., 2021; Heller et al., 2009, 2015; Taylor et al., 2017; H. Wu et al., 2017). From a clinical perspective, addressing these challenges has the potential to inform the development of improved strategies for preventing and treating a key transdiagnostic internalizing symptom (Ong et al., 2025).

Clearly, a number of challenges remain for future research. First, it will be important to determine whether our conclusions generalize to more-severe but infrequent emotional events (e.g., trauma, high-stakes examinations) and more-demographically and -clinically representative samples (Bolger & Schilling, 1991; Kendler et al., 2025; Mineka et al., 2020; Monroe & Harkness, 2022; Villano et al., 2024; Villano & Heller, 2024). Moving forward, it may be useful to combine EMA with methods (e.g., daily diary, brief videoconference interviews) better suited to capturing comparatively rare positive and negative life events (e.g., promotion, romantic breakup). Because the present sample was collected as part of a parent study focused on risk for the development or recurrence of internalizing illness, individuals with a current diagnosis were excluded. This necessarily restricted the range of internalizing symptoms at baseline and may have attenuated estimates of longitudinal change relative to either general-population or clinically ascertained samples (Wichers, Barge-Schaapveld, et al., 2009; Wichers et al., 2010). Second, our prospective-longitudinal analyses relied on self-report questionnaires collected years following the baseline assessment of real-world emotional experience. In the future, it will be useful to extend this work to include other informants (e.g., clinician or partner ratings; Stasik-O'Brien et al., 2019; Zinbarg et al., 2025) and more-frequent symptom assessments. It may be that longitudinal associations with event exposure and reactivity are evident only at intervals of weeks or months.

Third, our exploratory analyses revealed a credible association between baseline variation in tonic NA and a worsening trajectory of Social-Anxiety symptoms. It will be important to determine whether this novel discovery is reproducible.

Internalizing disorders afflict approximately 690 million individuals worldwide each year (GBD2021, 2024; Institute for Health Metrics and Evaluation, 2025). In the United States, nearly one in three individuals will experience a lifetime anxiety disorder (NCS-R, 2007), and one in five will experience a depression disorder (Hasin et al., 2018). Direct [AQ: 11]health-care costs exceed $75 billion annually, and diagnoses and service utilization are surging (Brody & Hughes, 2025; Cummings et al., 2025; Dieleman et al., 2025; Forrest et al., 2025; Gkitakou et al., 2026; Keyes et al., 2024; Momen et al., 2025; Olfson et al., 2025a, 2025b; SAMHSA, 2024; Y. Wu et al., 2025; Yang et al., 2024). Existing first-line treatments are only moderately effective and remain inaccessible, unacceptable, or intolerable for many (Brenan, 2024; Craske et al., 2017; Cuijpers et al., 2020, 2024; Davenport et al., 2023; Harrer et al., 2025; Marx et al., 2023; National Alliance on Mental Illness, 2021, 2023; Patient Access Network Foundation, 2023; Psychological Health Center of Excellence, 2021; Pollitz et al., 2023; Reinert et al., 2024; Rural Health Information Hub, 2024; Simon et al., 2024; Walker et al., 2015). The present results highlight the centrality of tonic affect to the longitudinal development of internalizing symptoms, showing that low levels of tonic PA are associated with a worsening 2-year trajectory of Well-Being, a key transdiagnostic symptom dimension. Exploratory analyses provided preliminary evidence that high levels of tonic NA are associated with credible increases in the severity of Social-Anxiety symptoms. In contrast, variation in the intensity of reactive affect (NA/PA) and frequency of exposure to emotional events (NMEs/PMEs) was unrelated to the longitudinal course of internalizing symptoms. These observations provide new clues about the pathways linking dispositional risk (low E/PE) to internalizing symptoms, showcase the enhanced precision afforded by hierarchical-dimensional models of psychopathology, and lay the groundwork for developing more-effective intervention strategies. A comparatively large, racially diverse, and risk-enriched sample and [AQ: 12]preregistered approach enhance confidence in the robustness and translational relevance of these results.

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Declaration of Conflicting Interests

The authors declare no conflicts of interest with respect to the authorship or the publication of this article. [AQ: 13]

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Supplemental Material

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