

RESEARCH ARTICLE

Associations between emotion reactivity to daily interpersonal stress and acute social-evaluative stress during late adolescence

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Abstract

Emotion reactivity refers to the intensity of changes in positive and negative emotion following a stimulus, typically studied with respect to daily stressors (e.g., arguments, demands) or laboratory stressors, including the Trier Social Stress Test (TSST). Yet, it is unclear whether emotion reactivity to daily and to laboratory stressors are related. The present study examined whether greater emotion reactivity to daily stressors (i.e., arguments, demands) is associated with greater reactivity to the TSST. Late adolescents ($N = 82$; $M_{\text{age}} = 18.35$, $SD = 0.51$, range 17–19; 56.1% female; 65.9% Latine, 34.2% European American) reported whether they experienced arguments and demands with friends, family, and individuals at school and their negative and positive emotion nightly for 15 days. They also completed the TSST, a validated paradigm for eliciting social-evaluative threat, and reported their emotion at baseline and immediately post-TSST. Multilevel models examined whether daily and laboratory emotion reactivity were related by testing whether the daily associations between arguments and demands with emotion differed by emotion reactivity to the TSST. Individuals with greater positive emotion reactivity (i.e., greater reductions in positive emotion) and greater negative emotion reactivity to the TSST showed greater positive emotion reactivity to daily demands. Emotion reactivity to the TSST was not significantly related to emotion reactivity to arguments. Findings provide preliminary evidence that emotion reactivity to the TSST relates to some aspects of daily emotion reactivity, with relations differing depending on type of daily stressor and valence of emotion. Results contextualise the implications of emotion reactivity to the TSST for daily stress processes.

KEYWORDS

affective reactivity, daily diary, emotion response, emotional reactivity, mood

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1 | ASSOCIATIONS BETWEEN EMOTION REACTIVITY TO DAILY INTERPERSONAL STRESS AND ACUTE SOCIAL-EVALUATIVE STRESS DURING LATE ADOLESCENCE

Emotion reactivity refers to the intensity and duration of changes in emotion, either positive or negative, following a stimulus. Emotion reactivity to stress specifically has been a topic of interest across several subfields of psychology given its relevance to behaviour, cognition, health, and disease. For instance, in health psychology, exaggerated emotion reactivity to stress has been posited as a key mechanism linking stress to disease outcomes (Almeida, 2005). Similarly, in clinical psychology, emotion reactivity has been linked to greater risk for depression and poor health behaviours (e.g., substance use, poor sleep; Alena et al., 2016; Bai et al., 2020; Bylsma et al., 2008), and in educational psychology it is well-established that academic experiences elicit emotion responses from students and that emotion reactivity can influence academic achievement (Heissel et al., 2017; Pekrun et al., 2011). Across studies, emotion reactivity to stress has generally been assessed using daily protocols and lab-based stressors, with the Trier Social Stress Test (TSST) being one of the most widely-used paradigms (Kirschbaum et al., 1993). The underlying assumption is that both daily diary and lab-based experimental approaches provide measures of the same construct (emotion reactivity to stress). However, to our knowledge, no study to date has directly tested this assumption, despite its implications for interpretation and synthesis of results across studies and for designing future studies focused on emotion reactivity to stress. Thus, the goal of the present investigation was to examine whether individuals who show greater emotion reactivity to daily stressors also show greater emotion reactivity to the TSST, a laboratory-based social-evaluative stressor.

Emotion reactivity can be assessed in responses to daily experiences. Daily protocols include assessments at the end of the day or throughout the day regarding whether participants experienced a stressor (e.g., daily arguments, demands) and their emotional states at the moment or throughout the day. By assessing stressors and emotions in daily life, daily measures of emotion reactivity have high ecological validity. They also tend to have high predictive validity, as they have been shown to predict a range of outcomes across multiple domains. For instance, in studies focusing on links between stress and health, individuals who show greater emotion responses to daily stressors (i.e., reductions in positive emotion, increases in negative emotion) tend to have poorer health including greater mortality risk and depressive symptoms (e.g., Chiang et al., 2018; O'Neill et al., 2004), as well as poorer emotion regulation and lower trait resilience (Herres et al., 2016; Vannucci et al., 2019). However, one challenge of utilising daily measures of emotion reactivity to stress is that the content and intensity of these stressors naturally differ across individuals (Bolger et al., 1989). For example, individuals from marginalised backgrounds may experience severe hardships (e.g., financial and identity-based stressors) more frequently than those from non-marginalised groups (e.g., Grzywacz et al., 2004; Potter

et al., 2019). As a result, daily protocols may be measuring emotion responses to different types of daily stressors which can confound estimates of individual differences in emotion reactivity. Another difficulty is that studies are often unable to consistently assess emotion responses immediately after a stressor because daily stressors can be unpredictable and responding immediately after a stressor may be burdensome or infeasible. Emotion is often assessed at either the start or end of the day, making it difficult to link an emotion to a specific discrete event and to determine whether the event elicited the emotion or whether the emotion preceded the event in daily protocols (Shiffman et al., 2008).

Another means of assessing emotion reactivity is measuring emotion responses to laboratory tasks. One systematic, well-established experimental protocol for eliciting social-evaluative stress and prompting psychobiological activation is the TSST (Dickerson & Kemeny, 2004; Kirschbaum et al., 1993), in which individuals are assigned to prepare and deliver an impromptu speech and complete a cognitively demanding arithmetic task while being evaluated by two confederate judges. This protocol allows for precision and standardisation in the content of the stressor and the timing of assessments, and is thought to mirror socially-evaluative stressors commonly experienced in everyday life (e.g., workplace stressors and meetings for adults; classroom presentations for children). Like daily measures of emotion reactivity, responses to the TSST have been related to health-related outcomes including depressive symptoms (Aschbacher et al., 2012), substance use (Rahal et al., 2022), and poorer sleep quality (Leger & Charles, 2020). Furthermore, individuals who show greater emotion responses to the TSST tend to also show greater physiological responses (e.g., changes in cytokine or cortisol levels; Aschbacher et al., 2012; Carroll et al., 2011; Fang et al., 2014; Puterman et al., 2014) implicated in health and disease risk, and populations with clinical disorders (e.g., social phobia, ADHD) tend to show more elevated emotion reactivity to the TSST compared to healthy controls (Krämer et al., 2012; Lackschewitz et al., 2008; Villada et al., 2016). However, relative to common daily stressors, the TSST can be particularly taxing and elicit relatively high levels of negative emotion (Seddon et al., 2020), especially for task variants involving negative as opposed to neutral feedback from the confederate judges. The TSST involves both unexpected speech and math tasks and may be more intense than daily stressors, as individuals can exert more control over situations in their daily lives and may be less likely to experience multiple stressors in such rapid succession.

Although emotion responses to both daily stressors and the laboratory-based TSST presumably assess the same underlying construct (emotion reactivity to stress) and have utility for predicting psychological and health outcomes, few studies have assessed whether estimates of emotion reactivity to the TSST are related to measures of emotion reactivity to daily stressors and thus show ecological validity. A prior study found that people who experience a stressful academic oral exam evaluated by the lecturer show comparable levels of heightened negative emotion and HPA axis activation (i.e., increases in salivary cortisol, indicative of neurobiological arousal

in response to stressor) following the TSST (Henze et al., 2017). In contrast, another study found that salivary cortisol responses to the TSST were not significantly related to salivary cortisol responses to a teaching simulation among student teachers, despite both tasks involving public speaking and participants reporting comparable levels of anticipated mastery, threat, strain, and challenge in response to the TSST and the teaching simulation (Wolfram et al., 2013). These findings suggest that responses to the TSST and ecologically-valid naturalistic stressors may not always align, highlighting the need to assess whether emotion responses to the TSST are related to emotion responses to daily interpersonal stressors.

1.1 | Present study

To address this empirical gap and further test the ecological validity of emotion reactivity to the TSST, the present study tested whether individuals who show greater emotion reactivity to the TSST also show greater emotion reactivity to daily interpersonal stress. Participants completed 15 daily checklists in which they reported at the end of each day whether they experienced daily arguments (i.e., verbal, psychological, or physical interpersonal aggression) and daily demands (i.e., imposed activities, responsibilities, and expectations) with friends, family, teachers, and work supervisors as well as their daily positive and negative emotion. Both arguments and demands were assessed, in line with previous research highlighting that these are two unique but taxing daily stressors that elicit emotion responses (Bolger et al., 1989). Participants completed the TSST during a subsequent laboratory visit.

We hypothesised that participants with greater emotion reactivity to the TSST (i.e., changes from baseline to post-task emotion) would also show greater reactivity to daily stressors (i.e., changes in emotion between days when more vs. fewer stressors were experienced than participant's individual average). We were primarily interested in emotion reactivity to daily demands because the TSST is a cognitively demanding task, and prior studies have assessed its validity relative to other academic and professional demands including completing oral presentations (Henze et al., 2017; Wolfram et al., 2013). We also assessed daily reactivity to arguments because the TSST and daily arguments are both interpersonal stressors. Because positive and negative emotions differ in their functional purposes and show unique relations to health (Keltner & Gross, 1999; Pressman & Bowlin, 2014), we tested associations between positive emotion responses to the TSST and to daily stressors, and between negative emotion responses to the TSST and to daily stressors in primary analyses. Additionally, exploratory analyses assessed associations across emotional valence by testing whether positive emotion reactivity to the TSST was related to negative emotion reactivity to daily stressors, and whether negative emotion reactivity to the TSST was related to positive emotion reactivity to daily stressors. These models enabled assessment of whether associations between emotion reactivity to the TSST and daily stress were valence-specific.

2 | METHOD

2.1 | Participants

Participants were 82 late adolescents ($M_{\text{age}} = 18.35$, $SD = 0.51$, range 17–19; 56.1% female; 65.9% Latine, 34.1% European American) drawn from a larger three-wave longitudinal study designed to study psychosocial contributions to health across adolescence. Participants from the parent study included 316 adolescents recruited from 10th and 11th grade classrooms of four high schools in the greater Los Angeles area during the first assessment. Approximately 2 years later, 204 participants completed the second assessment, when they were primarily in the 12th grade or 1-year post-high school. Due to attrition, this sample was replenished with an additional 34 participants, resulting in a total of 238 participants who completed this second assessment.

Participants who completed the second assessment were eligible to complete an experimental laboratory session if they were 18 or older and identified as either Latine or European American. A subsample of 91 participants were recruited, and 82 of these participants completed daily checklists in that wave and were included in the analytic sample. The present analytic sample included the 82 participants (90.1% of subsample, 34.4% of the larger study) who completed both the daily checklist protocol in the larger study and the experimental session. Chi-squared tests (for gender) and *t*-tests (for continuous variables) indicated that these 82 participants did not differ from the participants who completed this second assessment of the larger study but did not complete the laboratory session with respect to gender, age, parents' education, average number of daily arguments and demands, and average daily positive and negative emotion, all *ps* > 0.05. These participants also did not differ from the remaining nine participants who completed the TSST but did not complete the daily checklists with respect to gender, age, parents' education, and emotion reactivity to the TSST, all *ps* > 0.05.

2.2 | Procedure and measures

As part of the larger study, participants completed 15 daily checklists. At the end of each day, participants rated their emotions and whether they experienced various daily stressors, including any arguments and demands. Participants used a pre-programmed electronic stamper to mark when checklists were complete, and most (98%) were completed by 4:00 AM on the assigned night. Participants then completed a laboratory session an average of 5 months (± 2.7) later, during which they completed the TSST. Participants first reported their levels of emotion after a baseline period, and then learnt that they would be preparing and presenting a speech in front of an evaluative panel on why they were qualified for their dream job. They then prepared a speech for 5 min and presented the speech to two confederates who were trained to provide nonverbal negative feedback for 5 min. After the speech task, participants completed a mental arithmetic task in which they subtracted 2935 by 13's as

quickly as possible for 5 min. Confederates instructed participants to start over after each error and to go more quickly after three consecutive correct answers. After the TSST, participants rated their current emotions. Emotion was assessed after the math task but not after the speech task in line with prior studies so as not to interfere with the task (e.g., Aschbacher et al., 2012; Fang et al., 2014; Krämer et al., 2012; Lackschewitz et al., 2008; Puterman et al., 2014; Rahal et al., 2022). Participants received \$75 for completing data collection from the larger study, two movie tickets for completing daily checklists, and \$150 for completing the laboratory visit involving the TSST. All participants provided informed consent, and study procedures were approved by the University of California, Los Angeles Institutional Review Board. Study measures and syntax for analyses in Stata 16.1 can be found in Supplemental Information S1 and at <https://osf.io/6uja5>.

2.2.1 | Daily measures

Daily emotion reactivity was measured by assessing reports of daily stressors (i.e., arguments, demands) and emotion (i.e., positive emotion, negative emotion). Five items assessed arguments and discipline: argued with your mother or father, argued with another family member, argued with a close friend or partner, argued or were punished by an adult at school, and punished or disciplined by parents. All items were dichotomous and a sum was calculated for each day in line with prior studies (e.g., Armstrong-Carter et al., 2021; Bai et al., 2022; Chung et al., 2011; Russell et al., 2012). Items were derived from those used in previous daily assessments (Bolger et al., 1989). Similar items have been related to greater inflammation, life events, and daily distress (Fuligni et al., 2009) and have been used to index emotion reactivity to arguments in married couples (Almeida et al., 2002).

Four items assessed daily demands; participants reported whether they had a lot of demands made by teachers, friends, family, or a work supervisor. Previous studies using these items have found that adolescents experience shorter sleep duration and poorer mood on days when they experience more demands, and adolescents who experience more demands tend to have poorer academic performance and greater low-grade inflammation (Flook & Fuligni, 2008; Fuligni & Hardway, 2006; Levine et al., 2017). Again, the sum number of daily demands was calculated for each day for each participant.

Each day, participants reported their emotion over that day using items from the Profile of Mood States (POMS; McNair et al., 1971) and Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) using a 5-point scale (1 = *not at all*, 5 = *extremely*). Adolescents rated how much they experienced positive emotion (*interested, excited, enthusiastic, cheerful, attentive*) and negative emotion (*sad, hopeless, discouraged, worried, on edge, uneasy, nervous*) that day. Studies previously using these abbreviated scales have found that poorer daily well-being was related to more daily conflict, stressful demands, and peer victimisation (Chung et al., 2009; Espinoza et al., 2013; Kiang et al., 2006). Positive emotion and negative

emotion showed high between-person ($R_{1f} = 0.81, 0.87$) and between-day reliability ($R_C = 0.80, 0.79$) based on data from the sample of 238 participants who completed the second assessment of the larger study.

Preliminary analyses of whether timely completion of daily checklists of study variables (i.e., correlations for continuous variables, *t*-tests for dichotomous variables) indicated that the percentage of days completed on-time was unrelated to participant age, gender, ethnicity, parents' education, emotion reactivity to the TSST, average number of daily arguments, average number of daily demands, positive emotion, and negative emotion (all $ps > 0.05$). However, participants who reported higher positive emotion on average completed more daily checklists, $r(80) = 0.30, p = 0.006$. At the daily level, multilevel logistic models indicated that the odds of completing a checklist on-time were lower on days when participants experienced more daily demands ($B = -1.24, SE = 0.48, p = 0.009, OR = 0.26$). All results were substantively identical (i.e., no change in the pattern of significance) when limiting data to days completed before 4:00 AM on the assigned night. Therefore, subsequent models are presented including data from all checklists.

2.2.2 | TSST measures

Participants reported their emotion at baseline and immediately after the TSST using 5-point scales (1 = Not at all, 5 = Extremely). Participants reported positive emotion using five items from the daily measure of positive emotion (e.g., Telzer & Fuligni, 2009). A full subscale of positive emotion items was not administered due to time constraints related to the task paradigm, in line with prior studies of emotion reactivity to the TSST (e.g., Rahal et al., 2022). Analyses of positive emotion reactivity were limited to 69 participants because positive emotion items were added to the study protocol after data collection began. The 13 participants who did not rate positive emotion reactivity to the TSST did not differ from other participants with respect to gender, ethnicity, age, daily emotion or stressors, or negative emotion reactivity to the TSST, $ps > 0.05$. Participants completed eight items of the negative emotion subscale (e.g., afraid, nervous, upset) of the PANAS-X (Watson & Clark, 1999). Means were calculated across the items for each measure, with higher values indicating higher positive emotion and negative emotion. Because items assessing positive emotion were taken from the daily protocol, we similarly computed a measure of negative emotion using the six items (i.e., discouraged, hopeless, nervous, on edge, sad, uneasy) that were administered in both the TSST and the daily protocol. Results were consistent when testing analyses using negative emotion as measured by the PANAS-X subscale and when limiting items to those used in the daily protocol. As such, we present results using the PANAS-X subscale below. Participants also completed the fear and guilt subscales of the PANAS-X, which each included five items (e.g., scared, shaky for fear; guilty, ashamed, dissatisfied with self for guilt), and the depression (seven items; e.g., miserable, unhappy), tension/anxiety (five items; e.g., anxious, uneasy), and anger (five items; e.g.,

furious, angry) subscales of the Profile of Mood States (POMS; McNair et al., 1971), which were assessed in supplemental analyses. Alpha inter-item reliabilities were consistently high across items across administrations before and after the task (α s = [0.85–0.88] for positive emotion, [0.71–0.85] for negative emotion). Emotion reactivity was quantified as a change score (Emotion Post-TSST–Emotion at Baseline), with separate measures of positive and negative emotion reactivity. More positive values indicated greater negative emotion reactivity (increases in negative emotion), whereas more negative values indicated greater positive emotion reactivity (decreases in positive emotion).

3 | RESULTS

3.1 | Descriptive statistics

Descriptive statistics for study variables are provided in Table 1. Preliminary correlations between emotion variables across days, before the TSST, and following the TSST were examined (Supplemental Table S1). Average levels of positive emotion across days were positively correlated with positive emotion prior to the TSST

($r[67] = 0.32, p = 0.007$) but not after ($r[67] = 0.24, p = 0.050$). Average levels of negative emotion across days were positively correlated with negative emotion both before ($r[80] = 0.40, p < 0.001$) and after the TSST ($r[80] = 0.32, p = 0.004$). Average levels of positive and negative emotion across days were not related to emotion reactivity to the TSST (all p s > 0.05). Positive and negative emotion across days were unrelated to one another ($r[80] = -0.09, p = 0.42$). Similarly, positive and negative emotion assessed before the TSST were unrelated ($r[67] = -0.21, p = 0.090$). However, post-TSST assessments of positive and negative emotion were significantly related to one another, such that individuals with lower positive emotion also tended to have higher negative emotion ($r[67] = -0.30, p = 0.012$).

In order to examine individuals' emotion reactivity in everyday life, multilevel models with days (Level 1) nested within participants (Level 2) were used to predict emotion from daily arguments and demands, with random slopes for arguments and demands. Separate models were estimated for positive and negative emotions, and for arguments and demands. Results indicated that participants reported less positive emotion on days when they experienced relatively more arguments, $B = -0.10, SE = 0.04, p = 0.022$, 95% Confidence Interval (CI) $(-0.18, -0.01)$, but not when they experienced more demands, $B = -0.08, SE = 0.05, p = 0.064$, 95% CI $(-0.17, 0.01)$. They also

TABLE 1 Descriptive statistics for study variables.

Variable	N	M	SD	Min	Max
Total number of arguments over study period ^a	82	3.39	3.87	0.00	25.00
Average number of arguments per day	82	0.23	0.26	0.00	1.67
Total number of demands over study period	82	2.71	3.71	0.00	19.00
Average number of demands per day	82	0.19	0.26	0.00	1.27
Average daily positive emotion	82	2.95	0.70	1.34	4.54
Average daily negative emotion	82	1.42	0.42	1.00	2.90
Pre-TSST positive emotion	69	2.85	0.87	1.00	4.60
Post-TSST positive emotion	69	2.14	1.00	1.00	4.60
Positive emotion reactivity to the TSST	69	-0.71	0.81	-2.60	1.00
Pre-TSST negative emotion	82	1.21	0.30	1.00	2.38
Post-TSST negative emotion	82	1.63	0.70	1.00	4.75
Negative emotion reactivity to the TSST	82	0.42	0.62	-0.88	3.50
Parents' education ^b	82	7.30	1.86	2.00	11.00
Age at daily protocol	82	18.31	0.61	17.08	19.83
Months between daily protocol and TSST	82	5.16	2.76	1.00	12.00

Abbreviations: M, Mean; SD, standard deviation.

^aThere was one outlier on total number of arguments (5.58 SD above the mean, over double the next highest value of 11 total arguments across the study period). In an abundance of caution, analyses regarding daily emotion reactivity to arguments were repeated omitting this participant, and there was no change in the pattern of results.

^bPrimary caregivers reported the education achieved by each of the adolescent's parents, and values were averaged across both parents when possible (1 = some elementary school; 2 = completed elementary school; 3 = some junior high school; 4 = completed junior high school; 5 = some high school; 6 = graduated from high school; 7 = trade or vocational school; 8 = some college; 9 = graduated from college; 10 = some medical, law, or graduate school; 11 = graduated from medical, law, or graduate school).

reported more negative emotion on days when they experienced relatively more arguments, $B = 0.18$, $SE = 0.05$, $p < 0.001$, 95% CI (0.08, 0.28), and more demands, $B = 0.13$, $SE = 0.04$, $p < 0.001$, 95% CI (0.06, 0.20), than their personal mean (Figure 1; Table S1). Similarly, with respect to emotion during the laboratory visit, participants generally reported moderate levels of positive emotion ($M = 2.85$, $SD = 0.87$) and low levels of negative emotion ($M = 1.21$, $SD = 0.28$) at baseline prior to the TSST, and significantly lower positive emotion and greater negative emotion in response to the TSST, $t_s > 6.55$, $p_s < 0.001$ (Figure 1).

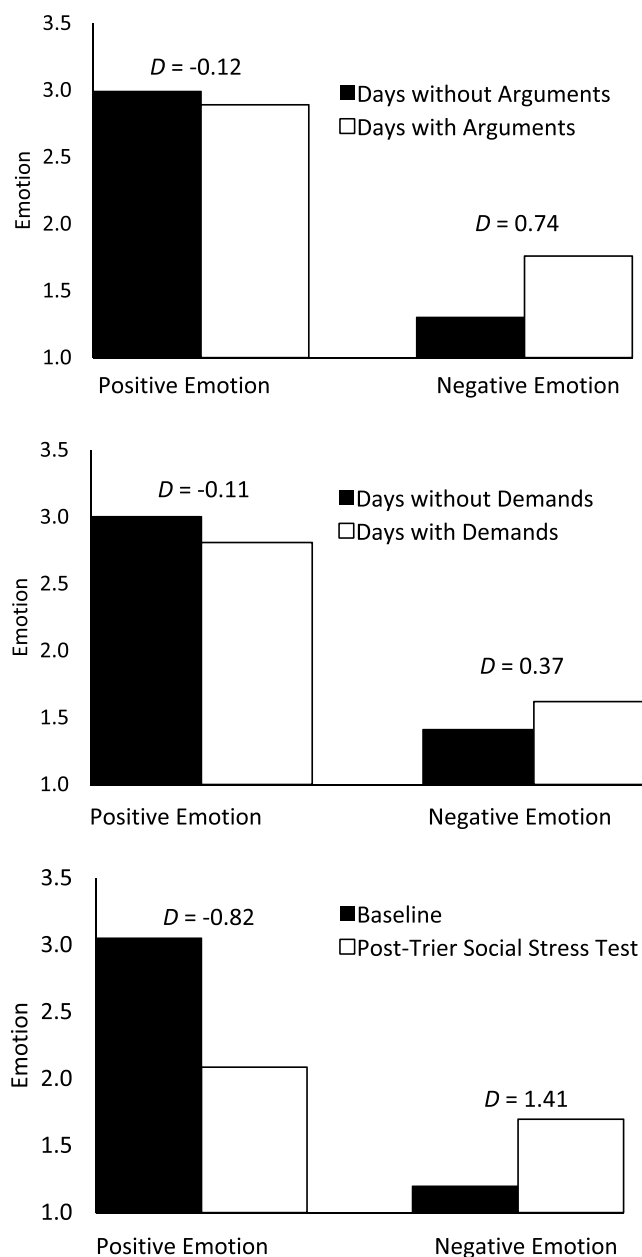


FIGURE 1 Changes in each emotion between days when arguments (top) and demands (middle) were and were not experienced, and between before and after the Trier Social Stress Test (bottom). D refers to Cohen's D for a dependent, within-subjects t -test.

3.2 | Associations between TSST and daily emotion reactivity

Multilevel models tested whether emotion reactivity to the TSST modulated associations between daily stressors and emotions. More specifically, positive emotion reactivity to the TSST and negative emotion reactivity to the TSST were tested as moderators of the daily association between number of daily stressors (i.e., arguments and demands) and positive and negative emotion. Parallel analyses were tested for daily arguments and daily demands. Daily arguments and demands were person-centred, and simple slopes probed associations between daily stressors and emotion (i.e., daily emotion reactivity) for individuals who displayed more negative (i.e., one standard deviation below the sample's average; values of -1.52 for positive emotion reactivity to the TSST and -0.20 for negative emotion reactivity to the TSST), average, and more positive (i.e., one standard deviation above the sample's average; values of 0.10 for positive emotion reactivity to the TSST and 1.04 for negative emotion reactivity to the TSST) values of changes in emotion following the TSST. Emotion reactivity to the TSST was a person-level variable centred at the sample mean. Covariates included gender ($0 = \text{female}$, $1 = \text{male}$), ethnicity ($0 = \text{Latine}$, $1 = \text{European American}$), age, parents' education (rated by parents on an 11-point scale, averaged across both parents when possible), number of months between the daily checklist protocol and the TSST, mean number of daily arguments or demands across days (all measured at the level of participants and centred at the grand mean), and the previous day's emotion (centred at the participant's mean). Unstandardised coefficients are reported for all study variables. Full tabulated results are available in Supplemental Information S1.

With respect to daily arguments, positive emotion reactivity to the TSST was not related to positive emotion reactivity to arguments, $B = 0.05$, $SE = 0.06$, $p = 0.402$, 95% CI (-0.06 , 0.16) (Table S2, column 1). Negative emotion reactivity to the TSST was also not significantly related to negative emotion reactivity to arguments, $B = 0.13$, $SE = 0.07$, $p = 0.067$, 95% CI (-0.009 , 0.27) (Table S2, column 4). Although this association was non-significant, we probed the interaction given the preliminary nature of this work. Simple slopes indicated that only participants with greater negative emotion reactivity to the TSST (i.e., average and high increases in negative emotion following the TSST) reported significantly more negative emotion on days when they experienced more arguments (Figure 2).

Regarding daily demands, greater positive emotion reactivity to the TSST (i.e., greater decreases in positive emotion) was related to greater positive emotion reactivity to daily demands (i.e., greater reductions in positive emotion on days when they experienced more demands than their personal average), $B = 0.18$, $SE = 0.06$, $p = 0.004$, 95% CI (0.06 , 0.30) (Table S3, column 1). Simple slopes indicated that only individuals with greater positive emotion reactivity to the TSST (i.e., those who reported an average or high decline in positive emotion following the TSST) also reported lower positive emotion on days when they experienced more daily demands (Figure 3). By contrast, negative emotion reactivity to the TSST was not related to

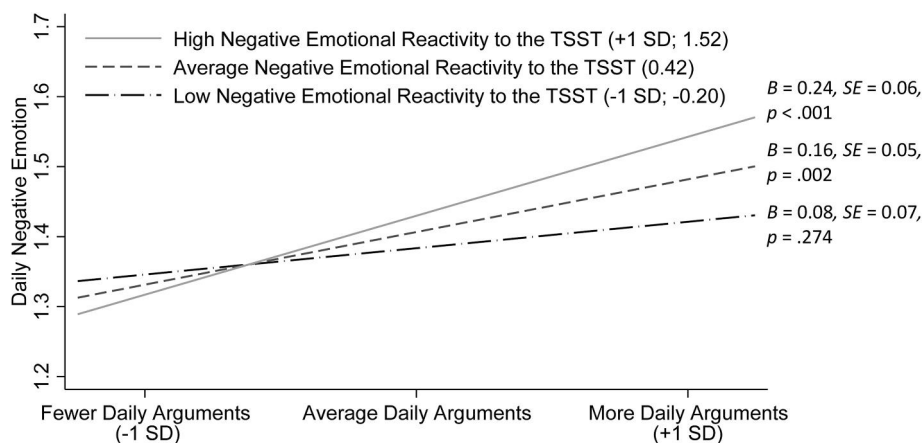


FIGURE 2 Daily negative emotion as a function of daily arguments and negative emotion reactivity to the Trier Social Stress Test (TSST). Daily arguments were centred at the person mean and negative emotion reactivity to the TSST was centred at the sample mean. Models controlled for gender (0 = female, 1 = male), ethnicity (0 = Latine, 1 = European American), age (grand mean-centred), parents' education (grand mean-centred), number of months between daily checklist protocol and the TSST (grand mean-centred), mean number of daily arguments (grand mean-centred), and previous day's emotion (person-mean centred). Negative emotion reactivity to the TSST refers to increases in negative emotion between before and after the TSST, and therefore more negative values indicate lower reactivity and more positive values indicate greater reactivity.

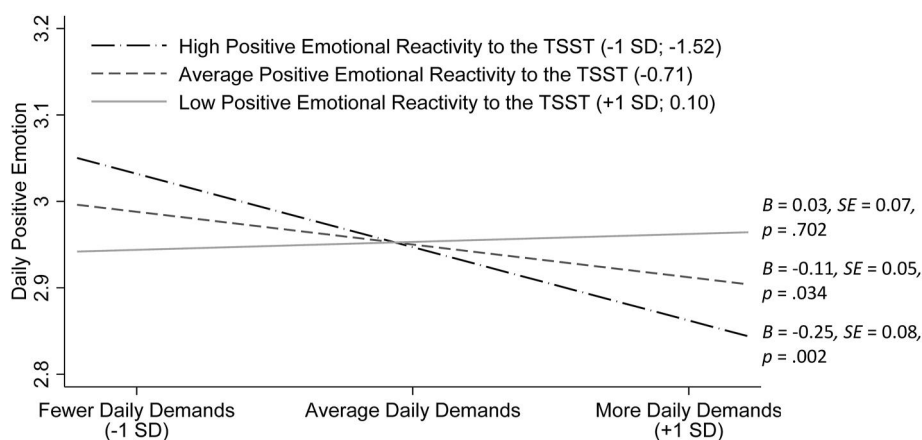


FIGURE 3 Daily positive emotion as a function of daily demands and positive emotion reactivity to the Trier Social Stress Test (TSST). Daily demands were centred at the person mean and positive emotion reactivity to the TSST was centred at the sample mean. Models controlled for gender (0 = female, 1 = male), ethnicity (0 = Latine, 1 = European American), age (grand mean-centred), parents' education (grand mean-centred), number of months between daily checklist protocol and the TSST (grand mean-centred), mean number of daily demands (grand mean-centred), and previous day's emotion (person-mean centred). Positive emotion reactivity to the TSST refers to declines in positive emotion between before and after the TSST, and therefore more positive values indicate lower reactivity and more negative values indicate greater reactivity.

negative emotion reactivity to daily demands, $B = 0.00$, $SE = 0.07$, $p = 0.955$, 95% CI $(-0.13, 0.14)$ (Table S3, column 4).

Supplemental follow-up analyses tested discrete negative emotion responses to the TSST (i.e., fear and guilt subscales of the PANAS-X; depression, tension/anxiety, and anger subscales of the POMS) to determine whether associations between negative emotion reactivity to the TSST and daily reactivity were driven by specific dimensions of negative emotion, given research regarding the functional importance of discrete emotions (Keltner & Gross, 1999). In line with results for negative emotion reactivity to the TSST, greater fear, depressive, and anger reactivity to the TSST were each

related to greater positive emotion reactivity to daily demands, and associations did not emerge with negative emotion reactivity to daily demands or with emotion reactivity to daily argument (see Supplemental Information S1 for full results).

3.3 | Exploratory analyses

Finally, exploratory models tested whether positive emotion reactivity to the TSST was related to negative emotion reactivity to daily stressors, and whether negative emotion reactivity to the TSST was

related to positive emotion reactivity to daily stressors. Positive emotion reactivity to the TSST was related to neither negative emotion reactivity to daily arguments ($B = -0.04$, $SE = 0.07$, $p = 0.568$, 95% CI $[-0.18, 0.10]$; Table S2, column 3) nor negative emotion reactivity to daily demands ($B = -0.09$, $SE = 0.06$, $p = 0.175$, 95% CI $[-0.21, 0.04]$; Table S3, column 3). Negative emotion reactivity to the TSST was also not significantly related to positive emotion reactivity to daily arguments, $B = -0.02$, $SE = 0.05$, $p = 0.720$, 95% CI $(-0.12, 0.08)$ (Table S2, column 2).

However, just as greater positive emotion reactivity to the TSST was related to greater positive emotion reactivity to daily demands, negative emotion reactivity to the TSST was also significantly related to positive emotion reactivity to daily demands, $B = -0.19$, $SE = 0.07$, $p = 0.007$, 95% CI $(-0.32, -0.05)$ (Table S3, column 2). Again, simple slopes indicated that only individuals with greater negative emotion reactivity to the TSST (i.e., those who showed average and high changes in negative emotion following the TSST) also reported lower positive emotion on days when they experienced more daily demands (Supplemental Figure S1).

4 | DISCUSSION

The present study tested whether emotion reactivity to the TSST was related to emotion reactivity to daily stressors, as measured by daily checklists. Greater emotion reactivity measured by daily checklists and emotion reactivity to the TSST constitute two different approaches to assessing emotion reactivity to stress, and there is evidence to suggest that each approach has predictive value, although it remains unclear whether estimates of emotion reactivity from these two approaches are related. Our results suggest that both greater positive and negative emotion reactivity to the TSST were related to greater positive emotion reactivity to daily demands. Negative emotion reactivity to the TSST was not significantly related to negative emotion reactivity to daily arguments, although probing of simple slopes indicated that individuals with greater negative emotion reactivity to the TSST tended to show greater negative emotion on days when they experienced relatively more daily arguments, whereas individuals who did not show an increase in negative emotion following the TSST also did not show a significant increase in negative emotion on days when they experienced relatively more daily arguments. Overall, these findings provide preliminary support for the ecological validity of emotion reactivity to the TSST, in line with prior findings that psychobiological responses to academic exams were related to responses to the TSST (Henze et al., 2017). Our findings extend beyond the context of academic-related, performance-based stressors by comparing emotion reactivity to the TSST with emotion responses to daily interpersonal stressors, which can accumulate over time to negatively impact health (Almeida, 2005). These results further contextualise the specific daily stress processes (i.e., emotion reactivity to daily demands) that this measure of emotion reactivity may be more closely assessing.

Although both daily arguments and demands have been shown to elicit robust changes in emotion (e.g., Bolger et al., 1989), emotion reactivity to the TSST was significantly related to positive emotion reactivity to daily demands but not related to emotion reactivity to daily arguments. It may be that the TSST is more similar to daily interpersonal demands than to daily arguments. During the TSST, participants must present to and be judged by other people. The TSST may be effortful and taxing in ways comparable to daily demands, which are often made by friends, family, and either teachers at school or supervisors at work. By contrast, interpersonal conflict typically involves more actively responding to other people's emotions, behaviours, and verbal expressions, often about a disagreement. Given these differences, the emotion regulation strategies used by participants in each situation may differ (e.g., Blanke et al., 2020). As such, although arguments and demands tend to elicit high levels of negative emotion, individuals who tend to be more reactive to one situation may not necessarily be equally reactive to the other. From this perspective, our results may suggest that emotion responses to the TSST may not correspond to emotion reactivity to all forms of daily stress and that emotion reactivity to the TSST may more closely index daily emotion reactivity to demands rather than to arguments. If so, emotion reactivity to other paradigms (e.g., prompts for an argument among dyads) may be more related to daily emotion and stress processes involving interpersonal conflict.

Another plausible explanation for the differential findings for emotion reactivity to arguments and to demands is that estimates of emotion reactivity to arguments may be biased relative to emotion reactivity to demands. Negative emotion can cause people to be less agreeable and to engage in frictional behaviour (Hine et al., 2009; Sears et al., 2016). Conflicts are inherently dyadic, and individuals may respond negatively to behaviours related to negative emotion (e.g., frictional or avoidant behaviour), thereby increasing risk for conflict (Lobraico et al., 2020; Morelen & Suveg, 2012). Thus, estimates of daily emotion reactivity to arguments may be confounded by emotion dynamics preceding arguments. Although demands vary day-to-day, demands address the circumstances of that day and are relatively less likely to arise in response to a person's emotion. Therefore, the daily paradigm may provide better estimates of emotion reactivity to demands relative to arguments, and more frequent assessments throughout the day may be needed to disaggregate emotion reactivity to arguments from sequelae of negative emotion. The TSST was systematically administered to all participants regardless of baseline emotion such that emotion responses to acute social-evaluative stress were measured without this potential confounding in directionality of stressors and emotion.

Estimates of emotion reactivity to arguments may also be biased relative to emotion reactivity to demands due to differences in recovery processes. Daily emotion was assessed at the end of the day before participants went to bed. Because daily stressors could have occurred earlier in the day, it has been argued that daily measures of emotion reactivity (with emotion assessed at the end of the day) capture aspects of both reactivity and recovery, and that daily paradigms may measure longer lasting negative emotion responses

(Scott et al., 2017). Although both arguments and demands elicit changes in emotion, arguments tend to elicit greater distress than demands (Bolger et al., 1989). It is possible that individuals are less likely to sustain consistently high levels of negative emotion, in line with evidence from studies using ecological momentary assessment that people show emotion recovery across the day (Ha et al., 2019). Reconciliation with other people may facilitate emotion recovery from arguments within the day, whereas continued friction may further elevate negative emotion. In contrast, emotion recovery from demands may begin upon completion of one's responsibilities. Differences in how emotion recovery processes unfold within the day may have differentially biased estimates of reactivity to arguments versus demands and contributed to the observed pattern of findings. Intensive longitudinal designs including ecological momentary assessment and burst designs could allow for finer-grained assessment of acute emotion responses in the moments following stressor onset, and could be better positioned to identify associations between distinct aspects of daily emotion reactivity and emotion reactivity to the TSST.

Interestingly, both positive and negative emotion responses to the TSST were significantly related to positive emotion reactivity but not to negative emotion reactivity to daily demands. This pattern of results may have occurred for two reasons. First, although positive and negative emotions are fundamentally distinct, they are often inversely related (higher negative emotion, lower positive emotion) and this association is particularly strong in the context of intense experiences such as stress (Diener & Iran-Nejad, 1986). An intense stressor such as the TSST may simultaneously elicit increased negative and decreased positive emotion, such that positive and negative emotion reactivity to the TSST may be highly related to each other. Indeed, our results indicated that average levels of positive and negative emotion across days were unrelated to each other. Likewise, positive and negative emotion assessed prior to TSST onset were not associated with each other. By contrast, positive and negative emotion following the TSST were negatively correlated. As a result, changes in both positive and negative emotion to the TSST may be related to changes in a single dimension of emotion (i.e., positive but not negative emotion) to daily demands in similar ways.

Second, the degree to which positive emotion changes in response to daily demands may vary in meaningful ways across individuals that are distinct from variations in the degree to which negative emotion changes in response to daily demands. For instance, individuals may show smaller declines or even increases in positive emotion on days when they experience more demands if they are passionate about their work or if they appreciate and find meaning in completing tasks for other people (Telzer & Fuligni, 2009). Research has highlighted fragile positive emotion, or the notion that negative experiences can worsen positive emotion for certain individuals, as a risk factor for poor well-being (Ong & Ram, 2017). These potentially meaningful individual differences in the degree to which one's positive emotion is shaped by daily demands could be tied to one's capacity for acutely responding to stress, irrespective of valence, in line with evidence that positive

emotion in daily life can impact how individuals respond to stress and regulate emotion (e.g., Aspinwall, 1998; Fredrickson, 2004). Future research should consider the implications of emotion reactivity to the TSST for daily positive emotional processes.

4.1 | Limitations

Data were limited by aspects of the sample and study design. Participants were late adolescents, who tend to show heightened emotion reactivity relative to adults, particularly in socially-evaluative contexts (Bailen et al., 2019; Spear, 2009), and whose interpersonal stressors may differ from those of adults (e.g., school vs. workplace demands). Given that associations in the present study differed between daily arguments and demands, differences in aspects of these daily experiences may influence the observed associations. However, it is important to note that participants in the present study reported levels of daily arguments and demands that were comparable to those reported in previous studies of adolescents and adults (Almeida & Kessler, 1998; Bolger et al., 1989; Vannucci et al., 2019). Levels of emotion reactivity to demands and arguments were also in line with previous research in adults (Bolger et al., 1989). Still, further research is needed to investigate these associations among adults and young populations.

There were also limitations to the measures. Following prior research (e.g., Armstrong-Carter et al., 2021; Bai et al., 2022; Chung et al., 2011; Russell et al., 2012), each item was dichotomous, precluding participants from reporting if they had multiple arguments or demands within a specific domain (e.g., having a single argument with a certain friend and having multiple arguments with that same friend or different friends could not be distinguished). Although this approach may not reflect the precise sum number of arguments that participants experienced, it minimises inaccuracies that may arise from the subjectivity of counting distinct arguments and demands (such as arguing about the same topic throughout the day with the same person or with multiple people). Furthermore, in light of the low frequency of arguments reported more generally in the present study and other studies of children and adolescents (Armstrong-Carter et al., 2021; Bai et al., 2022; Chung et al., 2011), we believe that it is unlikely that participants had multiple arguments with or demands from a particular individual in a given day. Nonetheless, future methodological studies will be needed to assess the implications of checklist versus short-answer items for frequencies of arguments.

There was a temporal lag between the administration of daily checklists and the TSST, which may have weakened the strength of associations. In addition, only one aspect of positive emotion reactivity to the TSST was assessed, and more fine-grained assessment of different types of positive emotion (e.g., calmness vs. excitement) could inform associations of daily and TSST-based positive emotion reactivity (Acevedo et al., 2022). Analyses for positive emotion were further limited because 13 participants were not administered items regarding positive emotion during the laboratory visit (i.e., 69

participants in analyses). Thus, future studies should replicate the present study's findings using larger and more diverse samples. Finally, the daily protocol only assessed emotion at the end of the day, such that emotion responses may have been several hours after stressor onset, and associations between emotion reactivity to daily stressors and to the TSST may have been stronger if emotions were rated immediately after experiencing daily stressors, as described above. Future studies should incorporate multiple emotion ratings into both the daily and laboratory protocol, potentially using ecological momentary assessment, to measure the timing of emotion responses.

5 | CONCLUSIONS

Taken together, results suggest that emotion reactivity to the TSST is related to aspects of emotion reactivity to daily stressors, particularly positive emotion responses to daily demands. Given the importance of daily emotion reactivity for health (e.g., Chiang et al., 2018), further research is needed to assess the potential utility of assessment of emotion reactivity to the TSST as a contributor to health. Our findings provide preliminary evidence that individual differences in emotion reactivity to the TSST may relate to positive emotion reactivity to daily demands, and further research can test these associations in larger samples and with respect to varied aspects of stress and emotion. Studies that administer both intensive longitudinal protocols and the TSST should measure similar associations to better understand when and for whom emotion reactivity to daily stressors may relate to emotion reactivity to the TSST.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

This study followed the ethical standards of the Declaration of Helsinki and was approved by the University of California, Los Angeles Institutional Review Board.

REFERENCES

- Acevedo, A. M., Leger, K. A., Jenkins, B. N., & Pressman, S. D. (2022). Keep calm or get excited? Examining the effects of different types of positive affect on responses to acute pain. *The Journal of Positive Psychology*, 17(3), 409–418. <https://doi.org/10.1080/17439760.2020.1858338>
- Almeida, D. M. (2005). Resilience and vulnerability to daily stressors assessed via diary methods. *Current Directions in Psychological Science*, 14(2), 64–68. <https://doi.org/10.1111/j.0963-7214.2005.00336.x>
- Almeida, D. M., & Kessler, R. C. (1998). Everyday stressors and gender differences in daily distress. *Journal of Personality and Social Psychology*, 75(3), 670–680. <https://doi.org/10.1037/0022-3514.75.3.670>
- Almeida, D. M., McGonagle, K. A., Cate, R. C., Kessler, R. C., & Wethington, E. (2002). Psychosocial moderators of emotional reactivity to marital arguments: Results from a daily diary study. *Marriage and Family Review*, 34(1–2), 89–113. https://doi.org/10.1300/J002v34n01_05
- Altena, E., Micoulaud-Franchi, J. A., Geoffroy, P. A., Sanz-Arigita, E., Bio-ulac, S., & Philip, P. (2016). The bidirectional relation between emotional reactivity and sleep: From disruption to recovery. *Behavioral Neuroscience*, 130(3), 336–350. <https://doi.org/10.1037/bne0000128>
- Armstrong-Carter, E., Nelson, B. W., & Telzer, E. H. (2021). Prior night sleep moderates the daily spillover between conflict with peers and family and diurnal cortisol. *Developmental Psychobiology*, 63(8), e22209. <https://doi.org/10.1002/dev.22209>
- Aschbacher, K., Epel, E., Wolkowitz, O. M., Prather, A. A., Puterman, E., & Dhabhar, F. S. (2012). Maintenance of a positive outlook during acute stress protects against pro-inflammatory reactivity and future depressive symptoms. *Brain, Behavior, and Immunity*, 26(2), 346–352. <https://doi.org/10.1016/j.bbi.2011.10.010>
- Aspinwall, L. G. (1998). Rethinking the role of positive affect in self-regulation. *Motivation and Emotion*, 22, 1–32. <https://doi.org/10.1023/A:1023080224401>
- Bai, S., Buxton, O. M., Master, L., & Hale, L. (2022). Daily associations between family interaction quality, stress, and objective sleep in adolescents. *Sleep Health*, 8(1), 69–72. <https://doi.org/10.1016/j.sleh.2021.11.006>
- Bai, S., Robles, T. F., Reynolds, B. M., & Repetti, R. L. (2020). Daily mood reactivity to stress during childhood predicts internalizing problems three years later. *Journal of Abnormal Child Psychology*, 48(8), 1063–1075. <https://doi.org/10.1007/s10802-020-00650-7>
- Bailen, N. H., Green, L. M., & Thompson, R. J. (2019). Understanding emotion in adolescents: A review of emotional frequency, intensity, instability, and clarity. *Emotion Review*, 11(1), 63–73. <https://doi.org/10.1177/1754073918768878>
- Blanke, E. S., Brose, A., Kalokerinos, E. K., Erbas, Y., Riediger, M., & Kuppens, P. (2020). Mix it to fix it: Emotion regulation variability in daily life. *Emotion*, 20(3), 473–485. <https://doi.org/10.1037/emo0000566>
- Bolger, N., DeLongis, A., Kessler, R. C., & Schilling, E. A. (1989). Effects of daily stress on negative mood. *Journal of Personality and Social*

- Psychology*, 57(5), 808–818. <https://doi.org/10.1037/0022-3514.57.5.808>
- Bylsma, L. M., Morris, B. H., & Rottenberg, J. (2008). A meta-analysis of emotional reactivity in major depressive disorder. *Clinical Psychology Review*, 28(4), 676–691. <https://doi.org/10.1016/j.cpr.2007.10.001>
- Carroll, J. E., Low, C. A., Prather, A. A., Cohen, S., Fury, J. M., Ross, D. C., & Marsland, A. L. (2011). Negative affective responses to a speech task predict changes in interleukin (IL)-6. *Brain, Behavior, and Immunity*, 25(2), 232–238. <https://doi.org/10.1016/j.bbi.2010.09.024>
- Chiang, J. J., Turiano, N. A., Mroczek, D. K., & Miller, G. E. (2018). Affective reactivity to daily stress and 20-year mortality risk in adults with chronic illness: Findings from the National Study of Daily Experiences. *Health Psychology*, 37(2), 170–178. <https://doi.org/10.1037/hea0000567>
- Chung, G. H., Flook, L., & Fuligni, A. J. (2009). Daily family conflict and emotional distress among adolescents from Latin American, Asian, and European backgrounds. *Developmental Psychology*, 45(5), 1406–1415. <https://doi.org/10.1037/a0014163>
- Chung, G. H., Flook, L., & Fuligni, A. J. (2011). Reciprocal associations between family and peer conflict in adolescents' daily lives. *Child Development*, 82(5), 1390–1396. <https://doi.org/10.1111/j.1467-8624.2011.01625.x>
- Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, 130(3), 355–391. <https://doi.org/10.1037/0033-2909.130.3.355>
- Diener, E., & Iran-Nejad, A. (1986). The relationship in experience between various types of affect. *Journal of Personality and Social Psychology*, 50(5), 1031–1038. <https://doi.org/10.1037/0022-3514.50.5.1031>
- Espinoza, G., Gonzales, N. A., & Fuligni, A. J. (2013). Daily school peer victimization experiences among Mexican-American adolescents: Associations with psychosocial, physical and school adjustment. *Journal of Youth and Adolescence*, 42(12), 1775–1788. <https://doi.org/10.1007/s10964-012-9874-4>
- Fang, C. Y., Egleston, B. L., Manzur, A. M., Townsend, R. R., Stanczyk, F. Z., Spiegel, D., & Dorgan, J. F. (2014). Psychological reactivity to laboratory stress is associated with hormonal responses in postmenopausal women. *Journal of International Medical Research*, 42(2), 444–456. <https://doi.org/10.1177/0300060513504696>
- Flook, L., & Fuligni, A. J. (2008). Family and school spillover in adolescents' daily lives. *Child Development*, 79(3), 776–787. <https://doi.org/10.1111/j.1467-8624.2008.01157.x>
- Fredrickson, B. L. (2004). The broaden-and-build theory of positive emotions. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, 359(1449), 1367–1377. <https://doi.org/10.1098/rstb.2004.1512>
- Fuligni, A. J., & Hardway, C. (2006). Daily variation in adolescents' sleep, activities, and psychological well-being. *Journal of Research on Adolescence*, 16(3), 353–378. <https://doi.org/10.1111/j.1532-7795.2006.00498.x>
- Fuligni, A. J., Telzer, E. H., Bower, J., Cole, S. W., Kiang, L., & Irwin, M. R. (2009). A preliminary study of daily interpersonal stress and C-reactive protein levels among adolescents from Latin American and European backgrounds. *Psychosomatic Medicine*, 71(3), 329–333. <https://doi.org/10.1097/PSY.0b013e3181921b1f>
- Grzywacz, J. G., Almeida, D. M., Neupert, S. D., & Ettner, S. L. (2004). Socioeconomic status and health: A micro-level analysis of exposure and vulnerability to daily stressors. *Journal of Health and Social Behavior*, 45(1), 1–16. <https://doi.org/10.1177/002214650404500101>
- Ha, T., Van Roekel, E., Iida, M., Kornienko, O., Engels, R. C., & Kuntsche, E. (2019). Depressive symptoms amplify emotional reactivity to daily perceptions of peer rejection in adolescence. *Journal of Youth and Adolescence*, 48(11), 2152–2164. <https://doi.org/10.1007/s10964-019-01146-4>
- Heissel, J. A., Levy, D. J., & Adam, E. K. (2017). Stress, sleep, and performance on standardized tests: Understudied pathways to the achievement gap. *AERA Open*, 3(3), 2332858417713488. <https://doi.org/10.1177/2332858417713488>
- Henze, G. I., Zänkert, S., Urschler, D. F., Hiltl, T. J., Kudielka, B. M., Pruessner, J. C., & Wüst, S. (2017). Testing the ecological validity of the Trier Social Stress Test: Association with real-life exam stress. *Psychoneuroendocrinology*, 75, 52–55. <https://doi.org/10.1016/j.psyneuen.2016.10.002>
- Herres, J., Ewing, E. S. K., & Kobak, R. (2016). Emotional reactivity to negative adult and peer events and the maintenance of adolescent depressive symptoms: A daily diary design. *Journal of Abnormal Child Psychology*, 44(3), 471–481. <https://doi.org/10.1007/s10802-015-0043-6>
- Hine, M. J., Murphy, S. A., Weber, M., & Kersten, G. (2009). The role of emotion and language in dyadic e-negotiations. *Group Decision and Negotiation*, 18(3), 193–211. <https://doi.org/10.1007/s10726-008-9151-9>
- Keltner, D., & Gross, J. J. (1999). Functional accounts of emotions. *Cognition and Emotion*, 13(5), 467–480. <https://doi.org/10.1080/026999399379140>
- Kiang, L., Yip, T., Gonzales-Backen, M., Witkow, M., & Fuligni, A. J. (2006). Ethnic identity and the daily psychological well-being of adolescents from Mexican and Chinese backgrounds. *Child Development*, 77(5), 1338–1350. <https://doi.org/10.1111/j.1467-8624.2006.00938.x>
- Kirschbaum, C., Pirke, K. M., & Hellhammer, D. H. (1993). The 'Trier Social Stress Test'—a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology*, 28(1–2), 76–81. <https://doi.org/10.1159/000119004>
- Krämer, M., Seefeldt, W. L., Heinrichs, N., Tuschen-Caffier, B., Schmitz, J., Wolf, O. T., & Blechert, J. (2012). Subjective, autonomic, and endocrine reactivity during social stress in children with social phobia. *Journal of Abnormal Child Psychology*, 40(1), 95–104. <https://doi.org/10.1007/s10802-011-9548-9>
- Lackschewitz, H., Hüther, G., & Kröner-Herwig, B. (2008). Physiological and psychological stress responses in adults with attention-deficit/hyperactivity disorder (ADHD). *Psychoneuroendocrinology*, 33(5), 612–624. <https://doi.org/10.1016/j.psyneuen.2008.01.016>
- Leger, K. A., & Charles, S. T. (2020). Affective recovery from stress and its associations with sleep. *Stress and Health*, 36(5), 693–699. <https://doi.org/10.1002/smi.2966>
- Levine, C. S., Hoffer, L. C., & Chen, E. (2017). Moderators of the relationship between frequent family demands and inflammation among adolescents. *Health Psychology*, 36(5), 493–501. <https://doi.org/10.1037/hea0000469>
- LoBraico, E. J., Brinberg, M., Ram, N., & Fosco, G. M. (2020). Exploring processes in day-to-day parent-adolescent conflict and angry mood: Evidence for circular causality. *Family Process*, 59(4), 1706–1721. <https://doi.org/10.1111/famp.12506>
- McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). *Manual for the profile of mood states*. Educational and Industrial Testing Services.
- Morelen, D., & Suveg, C. (2012). A real-time analysis of parent-child emotion discussions: The interaction is reciprocal. *Journal of Family Psychology*, 26(6), 998–1003. <https://doi.org/10.1037/a0030148>
- O'Neill, S. C., Cohen, L. H., Tolpin, L. H., & Gunthert, K. C. (2004). Affective reactivity to daily interpersonal stressors as a prospective predictor of depressive symptoms. *Journal of Social and Clinical Psychology*, 23(2), 172–194. <https://doi.org/10.1521/jscp.23.2.172.31015>
- Ong, A. D., & Ram, N. (2017). Fragile and enduring positive affect: Implications for adaptive aging. *Gerontology*, 63(3), 263–269. <https://doi.org/10.1159/000453357>
- Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary*

- Educational Psychology*, 36(1), 36–48. <https://doi.org/10.1016/j.cedpsych.2010.10.002>
- Potter, L. N., Brondolo, E., & Smyth, J. M. (2019). Biopsychosocial correlates of discrimination in daily life: A review. *Stigma & Health*, 4(1), 38–61. <https://doi.org/10.1037/sah0000120>
- Pressman, S. D., & Bowlin, S. L. (2014). Positive affect: A pathway to better physical health. In J. Gruber & J. T. Moskowitz (Eds.), *Positive emotion: Integrating the light sides and dark sides* (pp. 183–205). Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199926725.003.0011>
- Puterman, E., Epel, E. S., O'Donovan, A., Prather, A. A., Aschbacher, K., & Dhabhar, F. S. (2014). Anger is associated with increased IL-6 stress reactivity in women, but only among those low in social support. *International Journal of Behavioral Medicine*, 21(6), 936–945. <https://doi.org/10.1007/s12529-013-9368-0>
- Rahal, D., Shirtcliff, E. A., Fuligni, A., Kogut, K., Gonzales, N., Johnson, M., & Deardorff, J. (2022). Dampened psychobiological responses to stress and substance use in adolescence. *Development and Psychopathology*, 35(3), 1–18. <https://doi.org/10.1017/s0954579422000244>
- Russell, A., Bergeman, C. S., & Scott, S. B. (2012). Daily social exchanges and affect in middle and later adulthood: The impact of loneliness and age. *The International Journal of Aging and Human Development*, 74(4), 299–329. <https://doi.org/10.2190/AG.74.4.c>
- Scott, S. B., Ram, N., Smyth, J. M., Almeida, D. M., & Sliwinski, M. J. (2017). Age differences in negative emotional responses to daily stressors depend on time since event. *Developmental Psychology*, 53(1), 177–190. <https://doi.org/10.1037/dev0000257>
- Sears, M. S., Repetti, R. L., Reynolds, B. M., Robles, T. F., & Krull, J. L. (2016). Spillover in the home: The effects of family conflict on parents' behavior. *Journal of Marriage and Family*, 78(1), 127–141. <https://doi.org/10.1111/jomf.12265>
- Seddon, J. A., Rodriguez, V. J., Provencher, Y., Raftery-Helmer, J., Hersh, J., Labelle, P. R., & Thomassin, K. (2020). Meta-analysis of the effectiveness of the Trier Social Stress Test in eliciting physiological stress responses in children and adolescents. *Psychoneuroendocrinology*, 116, 104582. <https://doi.org/10.1016/j.psyneuen.2020.104582>
- Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annual Review of Clinical Psychology*, 4, 1–32. <https://doi.org/10.1146/annurev.clinpsy.3.022806.091415>
- Spear, L. P. (2009). Heightened stress responsivity and emotional reactivity during pubertal maturation: Implications for psychopathology. *Development and Psychopathology*, 21(1), 87–97. <https://doi.org/10.1017/S0954579409000066>
- Telzer, E. H., & Fuligni, A. J. (2009). Daily family assistance and the psychological well-being of adolescents from Latin American, Asian, and European backgrounds. *Developmental Psychology*, 45(4), 1177–1189. <https://doi.org/10.1037/a0014728>
- Vannucci, A., Finan, L., Ohannessian, C. M., Tennen, H., De Los Reyes, A., & Liu, S. (2019). Protective factors associated with daily affective reactivity and instability during adolescence. *Journal of Youth and Adolescence*, 48(4), 771–787. <https://doi.org/10.1007/s10964-018-0943-1>
- Villada, C., Hidalgo, V., Almela, M., & Salvador, A. (2016). Individual differences in the psychobiological response to psychosocial stress (Trier Social Stress Test): The relevance of trait anxiety and coping styles. *Stress and Health*, 32(2), 90–99. <https://doi.org/10.1002/smi.2582>
- Watson, D., & Clark, L. A. (1999). The PANAS-X: Manual for the positive and negative affect schedule-expanded form.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070. <https://doi.org/10.1037/0022-3514.54.6.1063>
- Wolfram, M., Bellingrath, S., Feuerhahn, N., & Kudielka, B. M. (2013). Cortisol responses to naturalistic and laboratory stress in student teachers: Comparison with a non-stress control day. *Stress and Health*, 29(2), 143–149. <https://doi.org/10.1002/smi.2439>

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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