



Assessing Emotion Polyregulation in Daily Life: Who Uses It, When Is It Used, and How Effective Is It?

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Abstract

Most research on emotion regulation has focused on understanding individual emotion regulation strategies. Preliminary research, however, suggests that people often use several strategies to regulate their emotions in a given emotional scenario (polyregulation). The present research examined who uses polyregulation, when polyregulation is used, and how effective polyregulation is when it is used. College students ($N = 128$; 65.6% female; 54.7% White) completed an in-person lab visit followed by a 2-week ecological momentary assessment protocol with six randomly timed survey prompts per day for up to 2 weeks. At baseline, participants completed measures assessing past-week depression symptoms, social anxiety-related traits, and trait emotion dysregulation. During each randomly timed prompt, participants reported up to eight strategies used to change their thoughts or feelings, negative and positive affect, motivation to change emotions, their social context, and how well they felt they were managing their emotions. In pre-registered analyses examining the 1,423 survey responses collected, polyregulation was more likely when participants were feeling more intensely negative and when their motivation to change their emotions was stronger. Neither sex, psychopathology-related symptoms and traits, social context, nor subjective effectiveness was associated with polyregulation, and state affect did not moderate these associations. This study helps address a key gap in the literature by assessing emotion polyregulation in daily life.

Keywords Emotion regulation · Ecological momentary assessment · Mood · Affect · Daily life

Sometimes, all it takes to feel better when you are down is a conversation with a friend. Other times, you might vent to a friend while taking an energizing walk—comforting yourself in multiple ways simultaneously. The latter scenario illustrates what emotion regulation (ER) researchers have termed emotion polyregulation or the use of multiple ER

strategies during an emotional episode (Ford et al., 2019). Until recently, the ER literature has typically focused on the incidence and impact of specific individual strategies in isolation of each other (e.g., Aldao et al., 2010). Examining polyregulation, however, is aligned with recent suggestions in the ER field to consider the nuances of how emotions are regulated in daily life. Moreover, evidence suggests that emotion polyregulation is common (Brans et al., 2013; Heiy & Cheavens, 2014), underscoring the need to understand this phenomenon further. The present study leverages ecological momentary assessment (EMA) to examine who uses polyregulation, when polyregulation is used, and how effective polyregulation is when it is used, among a college student sample.

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Defining and Assessing Polyregulation

Polyregulation is defined as an instance of ER consisting of more than one regulatory approach (e.g., strategy) to manage a specific emotional episode (Ford et al., 2019). An

emotional episode begins with a situation, which a person attends to and evaluates in reference to their goals (Moors et al., 2013), setting the stage for an emotional response that prepares the person to act (Barrett, 2012). An emotional episode can be regulated in many ways (Gross, 2015), and polyregulation involves using multiple regulatory approaches during a single episode (vs. using a single approach, termed monoregulation). While it can be challenging to pinpoint exactly when a single emotional episode begins and ends, distinguishing between episodes is useful even when episodes appear close in time given that different episodes often provide distinct contextual affordances (e.g., regulating anxiety from getting stuck in traffic vs. regulating the subsequent embarrassment of being chastised for being late to work after being stuck in traffic).

Polyregulation can take many forms. For example, someone is engaging in polyregulation when they use expressive suppression to mask an emotion's outward expression and reappraisal to reduce an emotion's subjective impact. Indeed, multiple regulatory approaches could be used to act on different channels of the emotion (e.g., behavioral expression, subjective experience), but these approaches may also act on the same channel. In addition, different regulatory approaches could be used for different reasons (e.g., to compensate for a failed initial approach or to complement a successful initial approach) and can occur concurrently or sequentially.

It is also important to distinguish polyregulation from related phenomena. For example, engaging in polyregulation requires people to have several ER approaches in their ER repertoire, but repertoire represents which approaches people could use, not those they actually do use in an emotional episode. Relatedly, polyregulation is distinct from ER flexibility, which we define as using different strategies across different contexts in ways that map onto unique features of those contexts (Aldao et al., 2015; although see Cherry et al., 2021, for a broader definition of flexibility). Unlike ER flexibility, polyregulation strategies need not map onto contextual features. Taken together, polyregulation represents a conceptually distinct phenomenon that can be used for many reasons, in different contexts and configurations, and with diverse outcomes.

Polyregulation: What Is Known

Who Uses Polyregulation?

Some prior research suggests that sociodemographic characteristics may relate to polyregulation. For instance, women report using more ER strategies than men (Garnefski et al., 2004; Nolen-Hoeksema & Aldao, 2011), including in daily life (Heij & Cheavens, 2014; Hiekkaranta et al., 2021).

This might be because women report experiencing more distressing emotions and/or are more aware of their emotions (Nolen-Hoeksema, 2012).

Frequency of polyregulation use may also be associated with psychopathology (e.g., depression and anxiety). For example, if people often use polyregulation when struggling to choose an ER strategy that meets the demands of a given situation, we would expect polyregulation to be more common for people high in psychopathology given that ER dysfunction is often implicated in the development and maintenance of psychopathology (Berking & Wupperman, 2012). For this reason, we could also expect polyregulation to be associated with trait-level ER dysfunction. Along these lines, people higher in trait social anxiety (Daros et al., 2019) and trait emotion dysregulation (Daros et al., 2020) were more likely to report using at least one of 8 ER strategies (vs. no ER strategy) at a survey prompt, suggesting they might also report polyregulation more often as well (though polyregulation was not directly assessed in that work). However, other studies have provided inconclusive evidence for a link between using more (vs. fewer) ER strategies during a stressor and psychopathology symptoms (Hiekkaranta et al., 2021) or trait-level ER dysfunction (Daros et al., 2018), consistent with prior theorizing that polyregulation may not be adaptive or maladaptive per se (Ford et al., 2019).

When Is Polyregulation Used?

Both person- and context-level factors may shape when polyregulation is used. For example, it is possible that people will use more ER strategies when they feel more motivated to change their emotions in the moment. This idea is indirectly supported by evidence suggesting that people attempt more strategies in a given emotional episode when they feel greater negative affect (see Ford et al., 2019, for a review). This finding has been observed in EMA/diary studies of daily life (Barrett et al., 2001; Dixon-Gordon et al., 2015) and laboratory studies with standardized emotional stimuli (Aldao & Nolen-Hoeksema, 2013; Wolgast et al., 2011). Some studies have also found that greater positive affect is associated with using more ER strategies, but only when people chose from lists of positively valenced strategies (e.g., savoring; Heij & Cheavens, 2014; Hiekkaranta et al., 2021).

Social context is another factor that might impact when people use polyregulation (English et al., 2017). For example, when asked to imagine hypothetical scenarios (i.e., being alone or being with others) and to select up to 16 ER strategies one would use in each scenario, participants selected more ER strategies when they imagined being alone (Tang & Huang, 2019). Although this study focused only on imagined scenarios, people may indeed have more cognitive resources to engage in polyregulation when they are alone, particularly when using strategies that are inward

and/or require focus (e.g., introspection; Tang & Huang, 2019). In a prior investigation with the current study's dataset, participants were more likely to use at least one ER strategy when alone (vs. with other people), suggesting that they might also report polyregulation more often as well (though, again, polyregulation was not directly assessed in this work; Ladis et al., 2022).

How Effective Is Polyregulation?

Polyregulation's effectiveness refers to how well it helps individuals experience the emotions they want to feel (Ford et al., 2019). This can be contrasted with ER adaptiveness, which typically refers to downstream cumulative consequences of ER (e.g., mental health outcomes; Werner & Gross, 2010). Polyregulation's effectiveness can depend on several factors, including situational context, individual goals, and experiences with particular ER strategies (Ford & Troy, 2019). The few existing empirical studies are inconclusive regarding whether polyregulation is linked with people feeling that they have effectively changed their emotions (e.g., Heij & Cheavens, 2014). This mixed empirical evidence is consistent with divergent theoretical accounts of how polyregulation can unfold (Ford et al., 2019). On one hand, trying more strategies within a short time frame might increase the likelihood of selecting a strategy that is effective, leading people to feel that they are managing their emotions well. On the other hand, trying multiple strategies might reflect that previously chosen strategies have not felt particularly helpful.

The Present Study and Hypotheses

This study helps address unresolved questions related to polyregulation by leveraging an EMA study of college students that assessed ER in daily life (up to six surveys per day) across 2 weeks. The analytic plan, confirmatory hypotheses, and exploratory analyses were pre-registered (see <https://osf.io/u8yd4/>). Descriptive analyses were conducted to characterize polyregulation's prevalence and common ER strategy pairings. We examined who uses polyregulation, and hypothesizing it would be more common among women and people higher in psychopathology-related symptoms and traits¹ (i.e., past-week depression symptoms, social anxiety-related traits, trait emotion dysregulation). We next examined when polyregulation is used, hypothesizing that

polyregulation would be more common than monoregulation when state negative affect is more intense, when motivation to change emotions is stronger, and when people were alone. We also explored whether polyregulation is linked with state positive affect intensity. We then explored the association between polyregulation and perceived ER effectiveness.

Finally, we examined whether these links with polyregulation were heightened by the intensity of one's state affect (except in the model where state affect was the outcome variable). Based on prior research, we hypothesized that the links between polyregulation and psychopathology-related symptoms and traits, motivation to change emotions, and social context would be stronger at higher levels of state negative affect intensity. There is a paucity of research on positive affect and polyregulation, but we also explored whether state positive affect intensity moderated any of the links with polyregulation given that positive and negative affect are distinct constructs (and not merely opposite ends of the same spectrum; Tellegen et al., 1999).

Method

Participants

Data were collected as part of a broader study examining emotion dysregulation in daily life among undergraduate students (Daniel et al., 2019; Daros et al., 2019). Participants were 144 undergraduates who either completed the study for course credit or payment of \$10. Participants were recruited via the University of Virginia's Psychology department participant pool and a university-wide email listserv. Because the present research examined polyregulation versus monoregulation, we excluded surveys where participants reported using no ER strategies. These exclusions resulted in a final sample size of 128 participants and a final data set of 1,423 surveys (see Data Cleaning and Analytic Plan, below. See Table 1 for the full demographic characteristics for these 128 participants).

Procedures

The University of Virginia Institutional Review Board approved all study procedures. Participants attended an in-person lab session where they provided informed consent, demographic information, and completed self-report questionnaires assessing mental health symptoms (see Daros et al., 2019 for more details about study procedures). The Sensus app (Xiong et al., 2016) was downloaded onto participants' smartphones at the first study session. At this first study session, research assistants walked the participants through completing a randomly timed EMA survey. Participants were told to imagine that they got the list of questions

¹ The umbrella term "psychopathology-related symptoms and traits" refers to a combination of traits and symptoms assessed in the present study, some that are specific to a given period of time (e.g., past week), some that are not time bound, and some that are disorder-specific and others that are transdiagnostic (see the "Method" section).

Table 1 Demographic characteristics for $n = 128$ study participants

Demographic characteristic	Mean (<i>SD</i>) or Count
Age	
Mean	19.1 (1.4)
Sex	
Female	84
Male	44
Other	0
Race/ethnicity	
White	70
Asian	38
Black	8
Hispanic/Latinx	3
Multiracial	4
Other	5

Race and ethnicity were not assessed separately in this study

Participants were asked to report their sex but were not separately asked about their gender identity

during an activity they regularly engaged in during the day. They could then ask questions and let the experimenter know if any of the items or answer options were unclear. For 2 weeks, Sensus sent participants six randomly timed survey prompts a day. Surveys were sent randomly within 2-h blocks (i.e., between 9:00–11:00 AM through 7:00–9:00 PM). Participants had up to 30 min to respond to a survey before it disappeared. The survey asked participants how they felt in the moment that they were responding. Participants attended a second study session 2 weeks later where they received monetary compensation or course credit.

With respect to compliance, participants included in analyses completed 29.9% of all randomly timed surveys, which is low compared with compliance rates in other EMA studies (Williams et al., 2021; Wrzus & Neubauer, 2022). On average, participants retained in the analyses completed 1.79 ($SD = 1.23$) surveys per day and 25.1 ($SD = 17.2$) across the full study (range = 1–77 surveys completed out of a total possible 84 surveys). Given that many of our participants were compensated with course credit, they may not have been as adequately incentivized to complete six daily, randomly timed surveys as they would have been if provided with financial incentives (Wrzus & Neubauer, 2022). We elected to retain all participants in analyses irrespective of the number of EMA surveys they completed, in line with recent guidelines that compliance thresholds can bias model estimates (e.g., Jacobson, 2020; Kirtley et al., 2021).

To ensure that compliance rates are not confounded with key sociodemographic factors or other variables of interest, we conducted a series of ANOVAs and t -tests which revealed that age, race/ethnicity, and sex were not predictive of either total number of missing surveys or average number of surveys completed per day ($ps > 0.05$).

Furthermore, linear regressions showed that neither past-week depression symptoms (DASS-D), social anxiety-related traits (SIAS), nor trait emotion dysregulation (DERS) was predictive of number of missing surveys or average number of surveys completed per day ($ps > 0.05$). Thus, though compliance was low, results do not appear to be biased on the basis of sociodemographic factors or on missingness in the key variables of interest.

Measures

Psychopathology-Related Symptoms and Traits

Depression Symptoms Past-week depression symptom severity was assessed via the 7-item depression subscale from the Depression, Anxiety, Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995). Participants rated each statement based on how they have been feeling over the past week, with responses ranging from 0 (“did not apply to me at all”) to 3 (“applied to me very much or most of the time”) and items like “I felt that I had nothing to look forward to.” Subscale scores are multiplied by two to facilitate the comparison of scores to the long-form DASS-42 (e.g., Henry & Crawford, 2005). Internal consistency in this study was good ($\alpha = 0.86$). The mean DASS-21 score in the present study ($M = 7.95$; $SD = 7.15$) was slightly higher than that of a large, non-clinical validation sample in the UK ($M = 5.66$, $SD = 7.74$; Henry & Crawford, 2005). Based on recommended cutoffs, 18.8% of participants included in analyses reported moderate-to-severe depression symptoms (Lovibond & Lovibond, 1996).

Social Anxiety-Related Traits The Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) is a 20-item measure of traits considered characteristic of someone with social anxiety. Total possible scores range from 0 to 80, with higher total scores indicating more social anxiety-related traits. The measure assesses social anxiety-related traits in general, not over a particular timeframe. Items include “When mixing socially, I am uncomfortable.” Possible response options for each item range from 0 (“not at all characteristic or true of me”) through 4 (“extremely characteristic or true of me”). Internal consistency in this study was acceptable ($\alpha = 0.73$). The mean SIAS score in the present study ($M = 30.16$; $SD = 9.16$) suggests that our participants were nearly as socially anxious as the 243 individuals diagnosed with social phobia on whom the measure was normed ($M = 34.6$, $SD = 16.4$).

Trait Emotion Dysregulation The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a 36-item measure of the extent to which individuals generally

perceive themselves to struggle when regulating their emotions (e.g., “I have difficulty making sense out of my feelings”). Responses do not specify a particular time frame and options range from 1 (“almost never; 0–10%”) through 5 (“almost always; 91–100%.”) Total scores range from 36 to 180, with higher scores indicating greater emotion dysregulation. Internal consistency in the present study was good ($\alpha = 0.88$). The mean DERS score in the present study (84.22, $SD = 17.18$) is comparable to mean scores for the 357 undergraduate women ($M = 77.99$, $SD = 20.72$) and men ($M = 80.66$, $SD = 18.79$) on whom the measure was normed.

Ecological Momentary Assessment Questionnaires

Emotion Regulation Strategies During each EMA prompt, participants were asked, “Are you doing any of the following (if anything) to change your thoughts or feelings?” They could then endorse any option from the following check-all-that-apply list: “thinking a lot about your thoughts/feelings” (i.e., Introspection), “trying to ignore or push away thoughts/feelings” (i.e., emotional suppression), “coming up with a concrete plan for action” (i.e., problem-solving), “changing your perspective on something” (i.e., reappraisal), “trying to distract yourself from thoughts/feelings” (i.e., distraction), “trying to hide your inner thoughts/feelings” (i.e., expressive suppression), “trying to accept/acknowledge my thoughts/feelings” (i.e., acceptance), and “seeking advice or comfort from others” (i.e., social support). Participants could also endorse that they were not trying to change their thoughts/feelings.

Negative and Positive State Affect Intensity Negative and positive state affect intensity were assessed at each EMA prompt via the questions: “How negative are you feeling?” and “How positive are you feeling?” For both questions, participants responded on a sliding scale ranging from 0 (“not at all”) to 100 (either “very negative” or “very positive”).

Motivation to Change Emotions Motivation to change emotions was assessed at the state level during each EMA prompt via the question, “To what degree are you OK with or wanting to change the emotions you are experiencing?” Participants could respond on a sliding scale ranging from 0 (“very OK”) to 100 (“very much wanting to change”). For additional validation of this item, see the online supplement on OSF (<https://osf.io/kz9x8/>).

Social Context State social context was assessed at each EMA prompt via the question, “Who are you interacting with?” Participants could indicate that they were either alone (“I am alone”) or that they were with others (i.e., “acquaintance/stranger,” “classmate/coworker,” “family member,” or “romantic partner/close friend”).

Subjective Effectiveness State subjective effectiveness of ER strategies used was assessed during each randomly timed EMA prompt via the question, “How much better or worse have efforts to change your thoughts or feelings made you feel?” Possible responses ranged from 0 (“much worse”) to 100 (“much better”). Here, effectiveness specifically refers to the extent to which someone felt better versus worse as a result of their regulatory efforts, as assessed during the survey period. We recognize that this focus on short-term affect optimization is not the only possible valid definition of effectiveness but use it here because it aligns well with people’s common subjective ER goals (see Daniel et al., 2019). For additional validation of this item, see the online supplement on OSF (<https://osf.io/kz9x8/>).

Operationalizing Polyregulation

Given that we examined differences between instances of polyregulation (using more than one ER strategy) compared to monoregulation (using one ER strategy), we limited analyses to surveys where participants reported one or more ER strategy. This is a more stringent approach that allows us to learn about what is unique about polyregulation, even compared to monoregulation. The prior literature has primarily focused on comparing instances of “any” regulation to instances of no regulation, which has conflated polyregulation with monoregulation.

Additionally, polyregulation was operationalized as the endorsement of more than one strategy, as assessed using general strategy categories (e.g., distraction, reappraisal). By focusing on general strategy categories, we adopted a more conservative approach for the assessment of polyregulation, given that there are many specific ways to use any given strategy (different tactics). People may indeed use multiple specific regulation tactics in one emotional episode (e.g., someone can distract themselves by watching a movie and drinking alcohol, etc.), which would also represent an instance of polyregulation (Ford et al., 2019). However, there are possibly limitless tactics for any given general strategy, which makes it a challenge to effectively assess polyregulation at the tactic level in daily life (e.g., the original Ways of Coping checklist included 68 specific regulatory tactics; Folkman & Lazarus, 1980). Thus, we prioritized having conceptual coverage across different families of general ER strategies that have been studied broadly in the ER literature, though we note that this approach could also be underestimating polyregulation instances in daily life.

Data Cleaning and Analytic Plan

The data analyzed for the current study are available on OSF (<https://osf.io/kz9x8/>). One hundred and forty-four participants submitted a total of 4,108 randomly timed

EMA prompts. Given our theoretical interest in comparing instances of polyregulation versus monoregulation, we pre-registered an a priori decision to exclude all randomly timed EMA prompts where no ER strategy was reported. Thus, the results here indicate differences between instances of polyregulation versus monoregulation. Reducing the data to only include EMA prompts where at least one ER strategy was reported yielded 1,423 randomly timed prompts for analysis across 128 unique participants.

Analyses examined individual and contextual correlates of participants' use of polyregulation (compared with monoregulation), measured using multilevel ordinal models. Demographic and trait-level correlates (i.e., level 2 variables) included psychopathology-related symptoms and traits (i.e., past-week depression symptoms, social anxiety-related traits, and trait emotion dysregulation—all continuous variables) and sex (categorical variable). All continuous level 2 variables were standardized to facilitate comparisons of beta estimates across our various measures. Repeatedly assessed EMA correlates that were nested within participants (i.e., level 1 variables) included state negative and state positive affect, motivation to change emotions, perceived effectiveness (all continuous),² and social context (categorical). All continuous level 1 variables were person-mean-centered. Three sets of models were fit for each levels 1 and 2 correlate: one that tested the association between the correlate and the number of strategies endorsed, one that tested state negative affect as a moderator of those associations, and one that tested state positive affect as a moderator of those associations.

The dependent variable was an ordinal variable reflecting the number of ER strategies endorsed during each EMA survey. The dependent variable had three levels: 1 reflecting monoregulation, 2 reflecting simultaneous endorsement of two ER strategies, and 3 reflecting instances in which participants endorsed three or more ER strategies.³ Hypotheses focus on comparing the number of ER strategies used (i.e., one, two, or three or more). We do not have hypotheses related to differences between the two-strategy and three-or-more-strategy polyregulation categories, but setting it up this way allowed us to examine different levels of polyregulation.

All analyses were completed using R version 4.1.1 (R Core Team). Multilevel ordinal models were estimated using

the `clmm` function from the ordinal package (Christensen & Christensen, 2015), which is appropriate for ordered, categorical outcome variables. Random intercepts for participant were included in each model. The `sjstats` package (Lüdtke, 2018) was used to calculate odds ratios, 95% confidence intervals, and marginal (R^2M) and conditional (R^2C) r -squared values. R^2M and R^2C reflect the amount of variance in each model accounted for by the fixed effects and random effects, respectively (Edwards et al., 2008).

Results

How Common Is Polyregulation?

One or more ER strategies were endorsed across 1,423 (34.6%) of the 4,108 randomly timed EMA prompts. Across the 1,423 prompts where at least one ER strategy was endorsed, one strategy was endorsed 62.3% of the time, two strategies were endorsed 25.7% of the time, and three or more strategies were endorsed 12.0% of the time. Thus, our results show that polyregulation was quite common, as it was used approximately 38% of the time any ER was endorsed. The most popular monoregulation strategy (i.e., most frequently endorsed without simultaneous endorsement of another strategy) was problem-solving (endorsed in approximately 25% of monoregulation instances), followed by introspection (23% of monoregulation instances), distraction (14% of monoregulation instances), acceptance (13% of monoregulation instances), thought suppression (12% of monoregulation instances), seeking advice (7% of monoregulation instances), cognitive reappraisal (5% of monoregulation instances), and expressive suppression (1% of monoregulation instances). The most popular polyregulation combinations were thought suppression plus distraction (endorsed approximately 9% of all polyregulation instances) and acceptance plus introspection (7% of all polyregulation instances). In total, we observed over 90 unique ER strategy combinations in the present data, suggesting that there is considerable heterogeneity in how people deploy polyregulation in daily life. See Tables 2 and 3 for the most popular standalone strategies and strategy combinations.

Who Uses Polyregulation?

Sex

We first examined whether sex was associated with the number of emotion regulation strategies used during each instance of emotion regulation (i.e., one, two, or three or more strategies), as outlined in the Analytic Plan above.

² Motivation to change emotions and subjective effectiveness were divided by 10 to facilitate model convergence.

³ We made an a priori choice to use a categorical outcome variable instead of a count variable, even though participants could endorse up to eight strategies during each survey. We chose to do this because only 12% of the responses indicated that people used three or more strategies. All instances in which participants endorsed three or more strategies were binned as a single level.

Table 2 Frequencies with which each emotion regulation strategy was endorsed on its own and with one or more other strategies across all participants

Individual ER strategy	Monoregulation: number of times used alone (% of total monoregulation instances)	Polyregulation: number of times used with 1 or more additional strategy (% of total polyregulation instances)	Top strategy pairing
Problem-solving	221 (25%)	43 (8%)	Cognitive Reappraisal ($n=26$); Introspection ($n=26$) (tie)
Introspection	205 (23%)	43 (8%)	Acceptance ($n=35$)
Distraction	121 (14%)	48 (9%)	Thought suppression ($n=46$)
Acceptance	115 (13%)	43 (8%)	Introspection ($n=35$)
Thought suppression	104 (12%)	33 (6%)	Distraction ($n=46$)
Seeking advice	61 (7%)	38 (7%)	Problem-solving ($n=24$)
Cognitive reappraisal	48 (5%)	39 (7%)	Problem-solving ($n=26$)
Expressive suppression	12 (1%)	21 (4%)	Distraction ($n=11$)

Percentages are rounded to the nearest whole number

Table 3 Frequencies of individual emotion regulation strategies as well as the top strategy combinations endorsed across all participants

Individual strategy or combination	Count	% of all instances where any ER was reported	% of all instances where polyregulation was reported
Individual strategy			
Problem-solving	221	16%	–
Introspection	205	14%	–
Distraction	121	9%	–
Acceptance	115	8%	–
Thought suppression	104	7%	–
Seeking advice	61	4%	–
Cognitive reappraisal	48	3%	–
Strategy combinations*			
Thought suppression and distraction	46	3%	9%
Acceptance and introspection	35	2%	7%
Problem-solving and cognitive reappraisal	26	2%	5%
Problem-solving and introspection	26	2%	5%
Problem-solving and seeking advice	24	2%	4%
Seeking advice and introspection	23	2%	4%
Cognitive reappraisal and introspection	22	2%	4%
Acceptance and problem-solving	18	1%	3%
Introspection and distraction	18	1%	3%
Introspection, acceptance, and seeking advice	17	1%	3%
Problem-solving and thought suppression	15	1%	3%
Acceptance and distraction	15	1%	3%
Problem-solving and distraction	15	1%	3%

Counts for individual strategies reflect the total number of times that the strategy was selected throughout the study, regardless of whether multiple strategies were simultaneously endorsed

*There were 81 other unique combinations of strategy endorsements that were endorsed 1–12 times Percentages are rounded to the nearest whole number

Contrary to hypotheses, sex (coded as female, male, or “other”) was not significantly associated with using more or less ER strategies ($b=0.06$, $SE=0.26$, $z=0.24$, $p=0.813$, $R^2M=0.00$, $R^2C=0.25$).

Table 4 Associations between contextual variables and number of emotion regulation strategies endorsed

Variable name	β (<i>SE</i>)	95% C.I	<i>OR</i>	R^2M	R^2C
Sex*Negative affect	.00 (0.01)	[0.99, 1.02]	1.00	.02	.27
Sex*Positive affect	.00 (0.01)	[0.99, 1.02]	1.00	.01	.27
DERS*Negative affect	-.00 (0.00)	[0.99, 1.00]	1.00	.02	.28
DERS*Positive affect	.00 (0.00)	[1.00, 1.01]	1.00	.02	.27
SIAS*Negative affect	-.01 (0.00)	[0.99, 1.00]	0.99	.03	.28
SIAS*Positive affect	.00 (0.00)	[1.00, 1.01]	1.00	.02	.27
DASS-D*Negative affect	-.00 (0.00)	[0.99, 1.00]	1.00	.02	.28
DASS-D*Positive affect	.00 (0.00)	[1.00, 1.01]	1.00	.02	.27
Motivation to change*Negative affect	-.00 (0.00)	[1.00, 1.00]	1.00	.02	.28
Motivation to change*Positive affect	-.00 (0.00)	[1.00, 1.00]	1.00	.02	.27
Social context*Negative affect	.01 (0.01)	[1.00, 1.02]	1.01	.02	.28
Social context*Positive affect	-.01 (.01)	[0.98, 1.00]	0.99	.02	.27
Effectiveness*Negative affect	-.00 (.00)	[1.00, 1.00]	1.00	.02	.28
Effectiveness*Positive affect	.00 (.00)	[1.00, 1.01]	1.00	.02	.27

SE, standard error; 95% *CI*, 95% confidence interval; *OR*, odds ratio; R^2M , marginal R-squared (variance due to fixed effects); R^2C , conditional R-squared (variance due to random effects)

DERS, Difficulties in Emotion Regulation Scale; *SIAS*, Social Interaction Anxiety Scale; *DASS-D*, Depression, Anxiety, Stress Scales–Depression Subscale; Motivation to change, motivation to change emotions; Effectiveness, subjective effectiveness

Social context (whether someone was alone or not)

Psychopathology-Related Symptoms and Traits

Contrary to hypotheses, psychopathology-related symptoms and traits were not significantly associated with using more or less ER strategies, including past-week depression symptoms ($b = 0.12$, $SE = 0.12$, $z = 0.99$, $p = 0.322$, $R^2M = 0.00$, $R^2C = 0.25$), social anxiety-related traits ($b = -0.20$, $SE = 0.12$, $z = -1.65$, $p = 0.098$, $R^2M = 0.01$, $R^2C = 0.26$), and trait emotion dysregulation ($b = -0.17$, $SE = 0.11$, $z = -1.51$, $p = 0.132$, $R^2M = 0.01$, $R^2C = 0.25$).

this relationship also held while controlling for negative affect ($b = 0.08$, $SE = 0.03$, $z = 2.24$, $p = 0.025$, $R^2M = 0.02$, $R^2C = 0.28$).

Social Context

Contrary to hypotheses, social context was not significantly associated with using more or less ER strategies ($b = -0.20$, $SE = 0.12$, $z = -1.64$, $p = 0.100$, $R^2M = 0.00$, $R^2C = 0.25$).

When Is Polyregulation Used?

Negative and Positive State Affect Intensity

As hypothesized, greater state negative affect intensity was associated with using more ER strategies ($b = 0.01$, $SE = 0.00$, $z = 4.90$, $p < 0.001$, $R^2M = 0.02$, $R^2C = 0.27$). Also, greater state positive affect intensity was associated with using fewer ER strategies ($b = -0.01$, $SE = 0.00$, $z = -3.86$, $p < 0.001$, $R^2M = 0.01$, $R^2C = 0.27$).

Motivation to Change Emotions

As hypothesized, greater motivation to change emotions was associated with using more ER strategies ($b = 0.13$, $SE = 0.03$, $z = 4.83$, $p < 0.001$, $R^2M = 0.02$, $R^2C = 0.27$), and

Is Polyregulation Effective?

Subjective Effectiveness

Subjective effectiveness was not associated with using more or fewer ER strategies ($b = 0.00$, $SE = 0.04$, $z = 0.06$, $p = 0.952$, $R^2M = 0.00$, $R^2C = 0.25$).

Does State Affect Intensity Moderate These Links?

To understand whether state affect intensity influences *who*, *when*, or *how effectively* polyregulation is used, we also tested whether any of the associations reported above are moderated by state negative affect intensity (and in exploratory analyses, also examined moderation by state positive affect intensity). Contrary to hypotheses, these analyses indicated that state negative affect

intensity did not moderate any of these relationships. Exploratory analyses also indicated that state positive affect intensity also did not moderate any of these relationships (see Table 4).

Discussion

The present study systematically investigated emotion polyregulation in daily life. Participants engaged in polyregulation in 38% of ER episodes, supporting earlier findings that polyregulation is common (Brans et al., 2013; Heij & Cheavens, 2014). There were no predominant ER strategy combinations; for example, the most common combination was only observed in 9% of all polyregulation episodes. Instead, over 90 unique combinations of ER strategies were observed, suggesting that polyregulation is characterized by considerable heterogeneity.

We next examined who uses polyregulation. Unexpectedly, no trait-level correlates of polyregulation (i.e., sex; psychopathology-related symptoms and traits) were identified. This may reflect that polyregulation is more dependent on within-person differences than between-person factors. The non-significant relationship between polyregulation and psychopathology-related symptoms and traits also underscores the idea that polyregulation is neither inherently healthy nor unhealthy, but rather, its longer-term outcomes likely depend on why polyregulation is occurring (e.g., due to low distress tolerance vs. flexibly responding to situational demands) and/or which combinations of ER strategies are used (Southward & Cheavens, 2020). For example, using expressive suppression in conjunction with substance use in response to negative emotions may bolster emotional distress, whereas using acceptance and reappraisal together may support healthier long-term functioning.

We then examined when polyregulation is used. Replicating prior literature, we found that people are more likely to engage in polyregulation when they feel worse (Dixon-Gordon et al., 2015; Opitz et al., 2015). Also in line with the hypotheses, people reported using more ER strategies when they were more motivated to change their emotions. This relationship held while controlling for negative affect, suggesting that motivation to change emotions provides a unique contribution to ER above and beyond state affect. Because it can be taxing to regulate, using more strategies might be more likely when people are feeling a greater urge to change their emotions, compared with situations where a single strategy is sufficient (Tamir, 2021). Contrary to hypotheses, social context (i.e., being alone versus with others) did not predict whether individuals engaged in polyregulation. However, collapsing social context into instances of

“alone” and “with others” may have been too crude a distinction to discern meaningful social context effects, given that regulation in social contexts often depends on the nature of the social partner (English et al., 2017).

We then examined how effective polyregulation is when it is used. Results from this exploratory analysis showed that polyregulation was unrelated to how effective participants believed they were at changing their thoughts or feelings. In some instances, people might feel less efficacious if using multiple strategies indicates they are unable to find a strategy that works, thus prompting them to employ more strategies. In other cases, people might feel more efficacious if they are able to strategically combine multiple strategies to address the situation at hand.

Finally, we found that negative and positive state affect intensity did not moderate who, when, or how effectively polyregulation was used. These findings suggest, for example, that when people are more motivated to change their emotions, they are more likely to engage in polyregulation even if their current affect intensity is relatively low. Such findings indicate that polyregulation may be independently (and non-interactively) driven by both how much someone wants to change their emotion and how badly or well someone feels in the moment.

Limitations and Future Directions

These results add to the nascent literature on polyregulation and point to interesting future directions. First, it was not possible to tell whether a report of polyregulation indicated two or more strategies used in rapid succession, or simultaneous implementation of multiple strategies. Relatedly, though we assessed state negative affect as a correlate of polyregulation, we could not infer whether polyregulation was preceded by specific emotional events or triggers. Future research could assess polyregulation’s emotional antecedents through event-contingent EMA or burst designs, which can capture emotion dynamics on a more granular time scale.

Second, we did not assess specific tactics falling under broad ER strategy categories, despite certain tactics within the same strategy family being differentially adaptive (e.g., drinking alcohol and exercise). It is also possible that a single multidimensional regulatory action serves multiple regulatory categories—for example, talking to a friend during an emotional episode can provide simultaneous distraction, social support, and problem-solving. Future work could expand these ideas by collecting more information about specific regulatory efforts (including rich qualitative data).

Third, there were limitations related to how some contextual correlates of polyregulation were operationalized. The social context variable was limited to “alone” and “with others,” limiting understanding of polyregulation across more varied

social contexts. Participants also chose from a list of mostly “covert” ER strategies (i.e., those that tend to be done inwardly and privately; Aldao & Dixon-Gordon, 2014), which may have underestimated polyregulation in more social settings. Furthermore, because this was a secondary data analysis, we were limited in how many correlates of polyregulation we could feasibly test. Examining associations between polyregulation and other contextual factors would be a useful future direction.

Fourth, there was a high rate of missingness in this dataset, and low compliance may have led to some analyses being underpowered and reduced the interpretability of null effects. Improved compliance (e.g., by providing greater financial incentives; Wrzus & Neubauer, 2022) would likely increase power to detect modest effects.

Finally, given that participants were predominantly White college students in the USA, results may not generalize to more diverse samples. For example, non-White marginalized individuals often encounter pressures to regulate that are not shared by White individuals, including experiences with systematic discrimination and racism (Wilson & Gentzler, 2021). Such stressors often require individuals to orchestrate a complex response, drawing from a wide variety of coping strategies in a given emotional episode (Brondolo et al., 2009), which may also promote the use of polyregulation. Research with more diverse samples that accounts for culture-specific stressors is necessary to learn about how polyregulation manifests across cultures and when it is effective and adaptive.

Conclusion

The present research examined who uses polyregulation, when polyregulation is used, and how effective polyregulation is when it is used. Our results indicate that polyregulation is highly common among instances of regulation and is used more when people are feeling greater state negative affect and greater motivation to change their emotions. This study also underscores the importance of future research to determine who uses polyregulation and when it is effective. Understanding polyregulation holds promise to ultimately help clinicians and their clients determine when trying multiple strategies reflects resourcefulness and flexibility, when it signifies desperation and wasted effort, and how to better optimize emotion regulation to promote better mental health and well-being.

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Data Availability The dataset is available on Open Science Framework: <https://osf.io/kz9x8/>.

Code Availability R code used for analyses is available on Open Science Framework: <https://osf.io/kz9x8/>.

Authors' Contributions Ilana Ladis: conceptualization (lead), formal analysis (lead), methodology (lead), writing—original draft (lead), and writing—review and editing (lead). Emma R. Toner: conceptualization (supporting), writing—original draft (supporting), and writing—review and editing (supporting). Alexander R. Daros: conceptualization (supporting), writing—original draft (supporting), and writing—review and editing (supporting). Katharine E. Daniel: conceptualization (supporting), writing—original draft (supporting), and writing—review and editing (supporting). Mehdi Boukhechba: investigation (lead) and data curation (lead). Philip I. Chow: investigation (lead) and data curation (lead). Laura E. Barnes: funding acquisition (lead) and supervision (supporting). Bethany A. Teachman: conceptualization (supporting), methodology (supporting), writing—original draft (supporting), writing—review and editing (supporting), funding acquisition (lead), and supervision (lead). Brett Q. Ford: conceptualization (supporting), methodology (supporting), writing—original draft (supporting), and writing—review and editing (supporting).

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Institutional Review Board at the University of Virginia.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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