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Research paper

Assessing Emotion Regulation Ability for Negative and Positive Emotions: Psychometrics of the Perth Emotion Regulation Competency Inventory in United States Adults

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ABSTRACT

People regulate both negative and positive emotions, and their ability to do this successfully is a cornerstone of adaptive psychological functioning. However, few measures have been available to assess emotion regulation ability across both valence domains. The Perth Emotion Regulation Competency Inventory (PERCI) was recently developed for this purpose. Here we present the first psychometric study of the PERCI in the United States (N = 508). Confirmatory factor analyses supported the intended eight-factor structure, which was invariant across age, gender, and education. PERCI scores had high internal consistency, and were associated with measures of psychopathology, emotional reactivity, and emotion regulation strategies in expected ways. These observed relationships between the PERCI and various regulation strategies may serve to establish a profile of what strategy patterns characterize differences in emotion regulation ability. Overall, the PERCI had strong psychometrics. Its capacity to assess both valence domains should enable more comprehensive assessments of emotion regulation ability.

Introduction

Emotions occur across experiential, physiological, and behavioral channels of the emotion system in response to stimuli appraised as meaningful (Mauss et al., 2005). As specified in the process model (Gross, 1998, 2015), emotion regulation is the activation of the goal to modify unfolding emotional responses. People with strong emotion regulation ability are therefore more able to successfully modify these responses, and know when it is appropriate to try to regulate an emotion in the first place (Preece et al., 2018). Typically, emotion regulation attempts are hedonic in nature, focused on down-regulating negative emotions and up-regulating positive emotions, although the opposite pattern also occurs (e.g., to fulfill instrumental motivations; Gross, 1998; Gross and John, 2003). People use a wide variety of strategies to regulate their emotions, and difficulties regulating negative and positive emotions have important implications for well-being, social functioning, and the development or maintenance of a variety of psychopathologies (e.g., Aldao et al., 2010; Conklin et al., 2015; Gross, 2015; Gruber et al., 2011).

Assessing emotion regulation ability is therefore important, but until recently, few measures have comprehensively evaluated this construct in a balanced approach across both negative and positive emotions (with most measures focusing only on negative emotions; John and Eng, 2014). A complete understanding of emotion regulation must assess the regulation of emotion across both negative and positive emotions, given their valence-specific implications in common and costly emotional disorders (e.g., Gross & Jazaieri, 2014; Gruber et al., 2019). The present investigation sought to address these extant gaps and advance the measurement of emotion regulation by broadening its assessment in these ways.

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Emotion regulation assessment: current gaps

Available emotion regulation questionnaires can broadly be categorized into two types, *process measures* and *competence measures*, with both types being useful depending on the research aim (for reviews, see John and Eng, 2014; Preece et al., 2018). Process measures are those designed to provide information about how frequently people use specific emotion regulation strategies (e.g., cognitive reappraisal and expressive suppression in the Emotion Regulation Questionnaire [Gross and John, 2003] or rumination, acceptance, catastrophizing etc. in the Cognitive Emotion Regulation Questionnaire [Garnefski and Kraaij, 2007]), whereas competence measures do not assess specific strategies but instead aim to provide an overall index of emotion regulation ability (i.e., one's perceived ability to successfully influence their emotions). This competence measure approach is useful because process measures alone cannot provide an overall index of emotion regulation ability (because people use a wide variety of regulation strategies and it is difficult to assess all of them, and the effectiveness of specific strategies can vary depending on the context in which they are used; e.g., Aldao et al., 2015).

The majority of past research on emotion regulation has primarily focused on negative emotion regulation, with the most widely used competence measure in the field being the 36-item Difficulties in Emotion Regulation Scale (DERS; Gratz and Roemer, 2004). This has been an extremely important advancement in the field and helpful tool for mapping emotion regulation ability in clinical and research settings (e.g., Becerra et al., 2013). However, the DERS only assesses the regulation of one emotional valence domain (negative emotions).[1] Other earlier competence measures have, similarly, tended to focus only on negative emotions (e.g., Negative Mood Regulation Scale; Catanzaro and Mearns, 1990). This is limiting conceptually, because several psychopathologies are characterized by difficulties with positive emotion regulation (for a review, see Gruber et al., 2019). For example, bipolar disorder—a disorder characterized by expansive and elevated positive mood (mania or hypomania)—is associated with difficulties regulating positive (and negative) emotions in everyday life (e.g., Gruber et al., 2012). Additionally, while it is widely known that enhancing positive emotions is a common motivator for drinking (e.g., Cooper et al., 1995), the role of positive emotion regulation in alcohol use disorder has been largely neglected (Gruber et al., 2019). Perhaps less well-documented is the use of maladaptive behaviors such as over-exercising, laxatives, and restrictive eating to up-regulate positive emotions in the context of anorexia nervosa (e.g., Selby et al., 2014). More broadly, successful up-regulation of positive feelings has also been associated with greater well-being, social support, life satisfaction, and buffers against stress, negative emotions, and onset of depressive episodes (Fredrickson, 1998; Fredrickson et al., 2003, 2008; Livingstone and Srivastava, 2012). The down-regulation of positive emotions has similarly proven to be an important mechanism in supressing inappropriate positive emotions in negative circumstances (e.g., laughing when a friend shares sad news), increasing concentration and focus, and may be an important factor in buffering some severe psychiatric illnesses such as bipolar disorder (e.g., Tamir et al., 2008; Gruber, 2011). Such examples illustrate how a full emotion regulation profile, or a psychometric tool providing an overall index of emotion regulation ability, must ideally include and integrate information about both valence domains.

Perth emotion regulation competency inventory

To try to integrate the assessment of both valence domains within a single tool, the Perth Emotion Regulation Competency Inventory (PERCI; Preece et al., 2018) was developed as a new competence questionnaire. The PERCI is a 32-item self-report questionnaire designed to align with Gross's (2015) theoretical model of emotion regulation. It assesses an individual's ability to regulate their negative and positive emotions in terms of the experiential and behavioral channels of the emotion system, as well as people's ability to know when it is appropriate to activate a goal to regulate emotions in the first place (i.e., being able to sit with or tolerate emotions when appropriate). Eight subscales of the PERCI can be derived to assess different aspects of emotion regulation ability, with half corresponding to each valence domain (all items in these subscales are listed in Table 1). One set of subscales assesses difficulties regulating the experiential channel of the emotion system, in terms of difficulties down-regulating negative feelings or up-regulating positive feelings (*Negative-Controlling Experience, Positive-Controlling Experience*); another set of subscales assesses difficulties regulating the behavioral channel of the emotion system, either in terms of difficulties inhibiting dominant behavioral response tendencies (*Negative-Inhibiting Behavior, Positive-Inhibiting Behavior*) or difficulties activating non-dominant behavioral response tendencies (*Negative-Activating Behavior, Positive-Activating Behavior*); and a final set of subscales assesses difficulties knowing when it is appropriate to activate a goal to regulate an emotion in the first place, that is, difficulties being able to tolerate emotions when appropriate (*Negative-Tolerating emotions, Positive-Tolerating Emotions*). Combinations of the eight subscales are also typically summed into theoretically meaningful composites, such as valence-specific *Negative-Emotion regulation* or *Positive-Emotion regulation* scores, and a *General-Emotion regulation* (total scale) score from all 32 items as an overall index of emotion regulation ability (Preece et al., 2018).

There is presently only one published study on the psychometrics of the PERCI, which is Preece et al.'s (2018) original development study. That study, across two Australian adult samples (*N*s=231, 1175), found the factor structure of the PERCI was best represented by eight positively correlated factors (corresponding to the eight intended subscales). All PERCI subscale and composite scores had high internal consistency (Cronbach's α = 0.84–0.95) and correlated as expected with other constructs. Specifically, poor emotion regulation abilities (as assessed by the PERCI) were associated with higher usage of expressive suppression, less usage of cognitive reappraisal, higher alexithymia (emotion processing deficits), more severe psychopathology symptoms, and more insecure attachment styles in close relationships. Although these findings are promising, more research is needed to determine the utility of the PERCI across different population types. For example, to date, no published data are available on the performance of the PERCI in the United States (US). The measurement invariance of the PERCI across different demographic categories has also not yet been examined, which is key to determining its applicability across different groups (e.g., different gender, age, and education categories).

The present study

The present study sought to address these gaps by examining the psychometric properties of the PERCI in a general community adult sample from the US. We examined its factor structure, measurement invariance, internal consistency, and concurrent validity. In our concurrent validity analysis, we used a more comprehensive battery than that used in the original PERCI development study (Preece et al., 2018). We compared PERCI scores with established measures of psychopathology symptoms (depression and anxiety), emotional reactivity, and

[1] There is a separate positive emotion version of the DERS that was recently introduced, the 15-item DERS-P (Weiss et al., 2015). However, the DERS-P does not have the same number of items or subscales as the 36-item original (negative) DERS, and unlike the negative DERS, it has no subscale assessing people's ability to regulate the experiential channel of the emotion system. In this sense, the DERS total scale score and the DERS-P total scale score are not comparable. Because these two measures were developed as separate instruments with different structures, the DERS and DERS-P items were also not designed to be scored together, so they cannot be combined/integrated to provide an overall index of emotion regulation ability.

Table 1
A List of All PERCI Items and Subscales, with Standardised Factor Loadings from Confirmatory Factor Analysis (Eight-Factor Model).

Item/factor	Factor loadings
F1. Negative-Controlling Experience	
1-When I'm feeling bad (feeling an unpleasant emotion), I don't know what to do to feel better.	.80
5-When I'm feeling bad, I'm powerless to change how I'm feeling.	.77
9-When I'm feeling bad, I don't have many strategies (e.g., activities or techniques) to help get rid of that feeling.	.75
13-When I'm feeling bad, I have no control over the strength and duration of that feeling.	.81
F2. Negative-Inhibiting Behavior	
3-When I'm feeling bad, I do stupid things.	.79
7-When I'm feeling bad, my behavior becomes out of control.	.85
11-When I'm feeling bad, I have trouble controlling my actions.	.88
15-When I'm feeling bad, I have strong urges to do risky things.	.78
F3. Negative-Activating Behavior	
2-When I'm feeling bad, those feelings stop me from getting work done.	.81
6-When I'm feeling bad, I can't complete tasks that I'm meant to be doing.	.85
10-When I'm feeling bad, I can't get motivated to do important things (work, chores, school etc.).	.85
14-When I'm feeling bad, I have trouble getting anything done.	.92
F4. Negative-Tolerating Emotions	
4-When I'm feeling bad, I believe I need to get rid of those feelings at all costs.	.74
8-When I'm feeling bad, I can't allow those feelings to be there.	.73
12-When I'm feeling bad, I must try to totally eliminate those feelings.	.83
16-When I'm feeling bad, I believe those feelings are unacceptable.	.64
F5. Positive-Controlling Experience	
18-When I'm feeling good, I don't have many strategies (e.g., activities or techniques) to increase the strength of that feeling.	.60
22-I don't know what to do to create pleasant feelings in myself.	.77
26-When I'm feeling good, I have no control over whether that feeling stays or goes.	.76
30-When I'm feeling good, I don't have any useful ways to help myself keep feeling that way.	.74
F6. Positive-Inhibiting Behavior	
17-When I'm feeling good (feeling a pleasant emotion), I do stupid things.	.70
21-When I'm feeling good, my behavior becomes out of control.	.78
25-When I'm feeling good, I have strong urges to do risky things.	.70
29-When I'm feeling good, I can't keep control over myself (in terms of my behaviors).	.82
F7. Positive-Activating Behavior	
19-When I'm feeling good, I have trouble completing tasks that I'm meant to be doing.	.66
23-When I'm feeling good, I end up neglecting my responsibilities (work, chores, school etc.).	.79
27-When I'm feeling good, I have difficulty staying focused during important stuff (at work or school, etc.).	.80
31-When I'm feeling good, I have trouble getting anything done.	.81
F8. Positive-Tolerating Emotions	
20-When I'm feeling good, part of me hates those feelings.	.77
24-When I'm feeling good, I can't allow those feelings to be there.	.80
28-When I'm feeling good, I believe those feelings are unacceptable.	.78
32-When I'm feeling good, I must try to eliminate those feelings.	.82

Note. All loadings were statistically significant, $p<.001$.

emotion regulation strategy usage. In so doing, a secondary aim of this study was also to help establish what profile of emotion regulation strategy usage characterizes poor or strong emotion regulation ability.

Method

Participants, materials, and procedure

Our sample ($N = 508$) was recruited by Qualtrics panels (an online survey recruitment company) to be representative of the general community of the US in terms of gender (49.6% female, 49% male, 1.4% non-binary), age ($M = 46.65$, $SD = 17.43$, range = 18–88), and US geographic region (38.8% South, 21.9% Midwest, 20.1% Northeast, 19.3% West).[2] In terms of race, 79.9% reported being White/Caucasian, 7.5% Black/African American, 3.9% Asian American, 0.8% American Indian or Alaska Native, 0.2% Native Hawaiian or Pacific Islander, 3.9% selected 'other', 0.6% preferred not to answer, and the remainder selected multiple categories. 8.7% reported being of Hispanic or Latino origin. Just under half (43.7%) had completed a college degree (i.e., associate, bachelor, or post-graduate degree) and 7.9% were college students at the time of the study. All participants completed an online survey as part of a large battery of questionnaires (taking about 30 min to complete) that included the PERCI as well as measures of psychopathology, emotional reactivity, and emotion regulation strategy as concurrent validity markers.[3]

Perth emotion regulation competency inventory (PERCI)

The PERCI (Preece et al., 2018) is a 32-item measure of emotion regulation ability. Eight subscale scores and five composite scores can be derived to assess different aspects of emotion regulation ability (for a list of these scores, see Table 2). Items are answered on a 7-point Likert scale (1 strongly disagree to 7 strongly agree), with higher scores indicating more emotion regulation difficulties or poorer emotion regulation ability across negative and positive emotions. Subscale and composite scores can be compared to population norms with the number of standard deviations from the mean indicating the severity of a respondents emotion regulation difficulties in that domain. The PERCI is freely available for use, and a copy with scoring instructions is provided in the supplementary materials.

Emotion regulation questionnaire (ERQ)

The ERQ (Gross and John, 2003) is a 10-item measure of two emotion regulation strategies. Separate scale scores are derived for *cognitive reappraisal* (e.g., "When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm") and *expressive suppression* (e.g., "I control my emotions by not expressing them"). Items are answered on a 7-point Likert scale, with higher scores indicating higher usage of that strategy. It has demonstrated good validity and reliability (e.g., Gross and John, 2003) and had good internal consistency in our sample (α=0.75–0.88, ω=0.75–0.88).

Cognitive emotion regulation questionnaire (CERQ)

The CERQ (Garnefski and Kraaij, 2007) is a 36-item measure of nine cognitive-based emotion regulation strategies. Separate scale scores are derived for *self-blame* (e.g., "I feel that I am the one to blame for it"), *acceptance* (e.g., "I think that I have to accept that this has happened"), *rumination* (e.g., "I often think about how I feel about what I have experienced"), *positive refocusing* (e.g., "I think of nicer things than what I have experienced"), *refocus on planning* (e.g., "I think of what I can do best"), *positive reappraisal* (e.g., "I think I can learn something from the situation"), *putting into perspective* (e.g., "I think that it all could have been much worse"), *catastrophizing* (e.g., "I often think that what I have

[2] Some additional participants beyond these 508 also attempted the survey, but their data were excluded from the final data-set because they failed validity checks indicating inattentive responding. Specifically, they failed an attention check question that asked them to select a specific scale point and/or they answered one or more questionnaires in the battery impossibly quickly (at a rate of less than 2 seconds per question).

[3] Data from other measures from this data-set have been used in three published papers (Preece et al., 2020a, Preece et al., 2020b, Preece et al., 2021). Those three studies do not overlap with the current study: they used different measures (e.g., did not examine the PERCI), different analyses, and focused on a different research question (focused on alexithymia or loneliness).

experienced is much worse than what others have experienced"), and *blaming others* (e.g., "I feel that others are to blame for it"). Items are answered on a 5-point Likert scale, and higher scores indicate higher usage of that strategy in response to unpleasant events. It has demonstrated good validity and reliability (e.g., Garnefski and Kraaij, 2007) and had good internal consistency in our sample (α=0.72–0.85, ω=0.74–0.85).

Behavioral emotion regulation questionnaire (BERQ)

The BERQ (Kraaij and Garnefski, 2019) is a 20-item measure of five behavioral-based emotion regulation strategies. Separate scale scores are derived for *seeking distraction* (e.g., "I engage in other, unrelated activities"), *withdrawal* (e.g., "I avoid other people"), *actively approaching* (e.g., "I try to do something about it"), *seeking social support* (e.g., "I look for someone to comfort me"), and *ignoring* (e.g., "I move on and pretend that nothing happened"). Items are answered on a 5-point Likert scale, and higher scores indicate higher usage of that strategy in response to unpleasant events. It has demonstrated good validity and reliability (e.g., Kraaij and Garnefski, 2019) and had good internal consistency in our sample (α=0.77–0.90, ω=0.78–0.90).

Perth emotional reactivity scale-short form (PERS-S)

The PERS-S (Preece et al., 2019) is an 18-item measure of emotional reactivity (i.e., the typical *ease of activation, intensity*, and *duration of emotions*). Separate scores are derived for negative and positive emotions. Items are answered on a 5-point Likert scale, with higher scores indicating higher levels of reactivity. It has demonstrated good validity and reliability (e.g., Preece et al., 2019) and had good internal consistency in our sample (α=0.77–0.92, ω=0.78–0.93).

Depression anxiety stress scales-21 (DASS-21)

The DASS-21 (Lovibond and Lovibond, 1995) is a 21-item measure of *depression, anxiety*, and *stress* symptoms. Separate scale scores can be derived for the three symptom categories. Items are answered on a 4-point Likert scale, with higher scores indicating more severe symptoms. It has demonstrated good validity and reliability (e.g., Antony et al., 1998) and had good internal consistency in our sample (α=0.88–0.93, ω=0.89–0.93).

Analytic strategy

Factor structure. Confirmatory factor analyses (CFA; maximum likelihood estimation with the Satorra-Bentler [SB] scaled χ^2 statistic and robust standard errors) were conducted in *R* using the lavaan package (version 0.6–5; Rosseel, 2012).

We examined the *eight-factor model* endorsed by Preece et al. (2018), with factors representing the intended eight valence-specific subscales (see Fig. 1). Additionally, we examined some simpler models as comparative baselines, to test whether there was statistical value in separating between the different valence domains and subscale categories within the latent structure of emotion regulation ability. These simpler models were a *one-factor model* comprised of a general factor; a *two-factor model* that distinguished items based on negative and positive valence, but did not distinguish between the different subscale components of emotion regulation; and a *four-factor model* that distinguished items based on their subscale components, but did not distinguish between valences.

Model goodness-of-fit was judged based on the comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardised root mean square residual (SRMR) fit index values with robust standard errors. CFI values ≥.90 were judged acceptable and ≥.95 excellent. RMSEA and SRMR values ≤.08 were judged acceptable and ≤.06 excellent (Marsh et al., 2004). We also directly compared the models using AIC values (which penalises for model complexity, and lower values indicate a better fitting model) and SBχ^2 difference tests ($p<.05$; Byrne, 2016).

Measurement invariance. We then assessed the invariance of the best fitting factor model across different *gender* (female [$n = 252$], male [$n = 249$]), *age* (44 years or younger [$n = 238$], 45+ years [$n = 270$]),[4] and *education* (no college degree [$n = 286$], college degree [$n = 222$]) categories. Beginning with the basic *configural invariance* model (equal form), we progressively added more equality constraints: constraining factor loadings (*metric invariance*), intercepts (*scalar invariance*), and residuals (*strict invariance*). Full invariance was supported if the CFI value difference between the configural and strict models was less than 0.01 (Cheung and Rensvold, 2002).

Internal consistency. McDonald's omega (ω) and Cronbach's alpha (α) reliability coefficients were calculated for all PERCI subscale and composite scores. Values ≥.70 were judged acceptable, ≥.80 good, and ≥.90 excellent (Groth-Marnat and Wright, 2016).

Relationships with other constructs/measures. Pearson correlations were calculated between PERCI scores and DASS-21, PERS-S, ERQ, CERQ, and BERQ scores. Because emotion regulation difficulties are conceptually a key risk factor for affective disorders (Campbell-Sills et al., 2014; Joormann and Siemer, 2014), we expected that high PERCI scores (i.e., indicating emotion regulation difficulties for negative and positive emotions) would be associated with higher levels of depression, anxiety, and stress symptoms. Also, because emotion regulation attempts are usually focused on achieving hedonic goals (i.e., down-regulating negative emotions and up-regulating positive emotions; Gross, 2015), we expected people with high PERCI scores would be less effective at achieving this, so high PERCI scores would be associated with higher levels of negative reactivity and lower levels of positive reactivity (Becerra et al., 2019). With respect to the profile of emotion regulation strategies associated with poor emotion regulation ability, we expected high PERCI scores would be associated with more use of those strategies usually linked to poorer mental health and social outcomes (e.g., expressive suppression, rumination, self-blame, catastrophizing, withdrawal, ignoring) and less use of strategies usually linked to good mental health and social outcomes (e.g., cognitive reappraisal, actively approaching) (Aldao et al., 2010).

Additionally, to further explore the mental health relevance of the PERCI, we conducted a series of multiple regression analyses examining how much variance PERCI scores could account for in depression, anxiety, and stress symptoms. The eight PERCI subscale scores were entered as predictor variables and DASS-21 depression, anxiety, or stress scores were used as the dependent variables.

Results

Descriptive statistics and reliability coefficients

Descriptive statistics and reliability coefficients for all PERCI subscale and composite scores are displayed in Table 2 (and supplementary Table S1 for the other measures). All PERCI subscales had good or excellent omega and alpha reliabilities (>0.80), and all composite scores had excellent omega and alpha reliabilities (>0.90).

Factor structure and measurement invariance

Fit indices for all CFA models are displayed in Table 3. The intended eight-factor model was the best fitting model, and an excellent fit to the data according to all fit indices. All items loaded well on their intended subscale factor (i.e., >0.40; see Table 1), and all factors were

[4] 45 years old is frequently used as a cut-off point categorising between young and middle-aged adults (e.g., Howden & Meyer, 2011), and allowed the separation of two reasonably even samples sufficient in size for factor analysis.

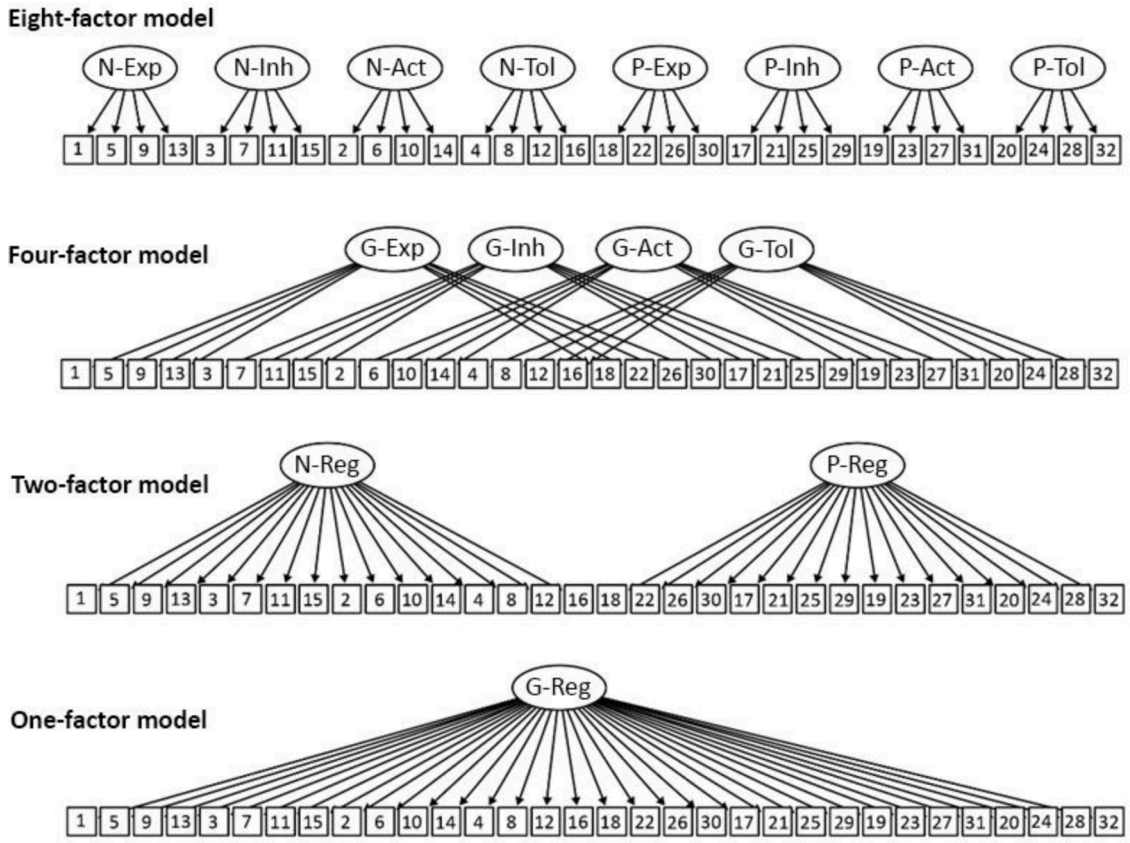

Fig. 1. The examined confirmatory factor analysis models of the PERCI. Ellipses are latent factors, squares are item numbers. All items had an associated error term. All factors were allowed to correlate. N-Exp = Negative-Controlling Experience; N-Inh = Negative-Inhibiting Behavior; N-Act = Negative-Activating Behavior; N-Tol = Negative-Tolerating Emotions; P-Exp = Positive-Controlling experience; P-Inh = Positive-Inhibiting Behavior; P-Act = Positive-Activating Behavior; P-Tol = Positive-Tolerating emotions; G-Exp = General-Controlling Experience; G-Inh = General-Inhibiting Behavior; G-Act = General-Activating Behavior; G-Tol; General-Tolerating Emotions; N-Reg = Negative-Emotion Regulation; P-Reg = Positive-Emotion Regulation; G-Reg = General-Emotion Regulation.

Table 2
escriptive Statistics and McDonald's Omega (ω) and Cronbach's Alpha (α) Reliability Coefficients for PERCI Subscale and Composite Scores.

	Total Sample (N = 508)					Males (n = 249)		Females (n = 252)	
	M	*SD*	Range	ω	α	*M*	*SD*	*M*	*SD*
Subscales									
Negative-Controlling Experience	13.08	6.34	4–28	.87	.86	13.17	6.43	12.91	6.27
Negative-Inhibiting Behavior	11.38	6.71	4–28	.90	.90	11.99	7.10	10.73	6.20
Negative-Activating Behavior	15.36	7.15	4–28	.92	.92	14.39	7.29	16.21	6.89
Negative-Tolerating Emotions	15.30	5.95	4–28	.82	.82	16.06	5.95	14.64	5.86
Positive-Controlling Experience	11.49	5.70	4–28	.81	.81	11.80	5.94	11.09	5.44
Positive-Inhibiting Behavior	7.77	4.79	4–28	.84	.84	8.49	5.05	6.97	4.37
Positive-Activating Behavior	8.03	4.50	4–28	.85	.85	8.40	4.77	7.68	4.23
Positive-Tolerating Emotions	6.71	4.29	4–28	.87	.87	7.20	4.39	6.22	4.13
Composites									
Negative-Emotion Regulation	55.12	21.11	16–110	.93	.93	55.61	22.17	54.48	20.04
Positive-Emotion Regulation	34.00	15.76	16–112	.92	.92	35.89	16.49	31.96	14.87
General-Facilitating Hedonic Goals[a]	66.61	24.77	20–137	.93	.93	67.40	25.87	65.57	23.64
Positive-Containing Emotions[a]	22.51	12.03	12–84	.93	.92	24.10	12.66	20.87	11.26
General-Emotion Regulation (total score)	89.12	32.66	32–218	.94	.94	91.50	34.26	86.44	30.84

Note. [a]The *General-Facilitating Hedonic Goals* and *Positive-Containing Emotions* scores are additional/alternate conceptually meaningful composite scores suggested by Preece et al. (2018). The General-Facilitating Hedonic Goals composite is comprised of all four negative subscales as well as the Positive-Controlling Experience subscale; it measures difficulties down-regulating negative emotions and up-regulating positive emotions. The Positive-Containing Emotions composite is comprised of all the positive subscales except for Positive-Controlling Experience; it measures difficulties down-regulating or containing positive emotions. These alternate composite score combinations therefore reflect a conceptual difference between the Positive-Controlling Experience subscale and the other three positive subscales, in terms of whether the subscales assess difficulties up-regulating or down-regulating positive emotions.

significantly positively correlated (estimated *r*s=0.22–0.84, *p*s<0.001; see Table 4). This model was substantially better fitting than the one-, two-, and four-factor models, thus highlighting the statistical value of distinguishing between the different valence categories and subscale components. This eight-factor structure was also invariant across the different gender, age, and education categories. As displayed in Table 3, CFI values did not differ substantially (i.e., <0.01) across the configural, metric, scalar, and strict models.

Table 3
Goodness-of-fit index values from Confirmatory Factor Analyses of the PERCI and Measurement Invariance for the Eight-Factor Model across Gender, Age, and Education Categories.

Model	SBχ^2 (df)	CFI	RMSEA	SRMR	AIC
Total sample					
One-factor model	3604.165 (464)	.586	.115 (0.112–0.118)	.130	57,023.275
Two-factor model	2246.596 (463)	.765	.087 (0.084–0.090)	.101	55,195.397
Four-factor model	2640.101 (458)	.712	.097 (0.094–0.100)	.145	55,704.845
Eight-factor model	722.302 (436)	.962	.036 (0.032–0.040)	.044	53,084.323
Gender invariance					
Configural	1194.894 (872)	.956	.038 (0.034–0.043)	.052	52,339.851
Metric	1215.631 (896)	.956	.038 (0.033–0.042)	.054	52,313.137
Scalar	1271.780 (920)	.952	.039 (0.035–0.043)	.055	52,319.190
Strict	1292.635 (952)	.954	.038 (0.033–0.042)	.055	52,344.328
Age invariance					
Configural	1199.318 (872)	.957	.038 (0.034–0.043)	.054	52,926.545
Metric	1239.103 (896)	.955	.039 (0.034–0.043)	.058	52,925.321
Scalar	1292.324 (920)	.951	.040 (0.035–0.044)	.058	52,926.162
Strict	1333.252 (952)	.950	.040 (0.035–0.044)	.061	53,007.770
Education invariance					
Configural	1102.259 (872)	.969	.032 (0.027–0.037)	.051	53,105.083
Metric	1129.146 (896)	.969	.032 (0.027–0.037)	.054	53,085.235
Scalar	1159.882 (920)	.968	.032 (0.027–0.037)	.054	53,062.693
Strict	1223.727 (952)	.964	.034 (0.029–0.038)	.055	53,108.383

Table 4
Estimated Factor Intercorrelations from Confirmatory Factor Analyses of the PERCI.

Factor	F1	F2	F3	F4	F5	F6	F7
Two-Factor Model							
F1. Negative-Emotion Regulation	–	–	–	–	–	–	–
F2. Positive-Emotion Regulation	.531	–	–	–	–	–	–
Four-Factor Model							
F1. General-Controlling Experience	–	–	–	–	–	–	–
F2. General-Inhibiting Behavior	.720	–	–	–	–	–	–
F3. General-Activating Behavior	.832	.719	–	–	–	–	–
F4. General-Tolerating Emotions	.451	.642	.341	–	–	–	–
Eight-Factor Model							
F1. Negative-Controlling Experience	–	–	–	–	–	–	–
F2. Negative-Inhibiting Behavior	.765	–	–	–	–	–	–
F3. Negative-Activating Behavior	.828	.725	–	–	–	–	–
F4. Negative-Tolerating Emotions	.372	.458	.391	–	–	–	–
F5. Positive-Controlling Experience	.764	.531	.601	.225	–	–	–
F6. Positive-Inhibiting Behavior	.411	.632	.344	.305	.544	–	–
F7. Positive-Activating Behavior	.457	.482	.369	.223	.659	.835	–
F8. Positive-Tolerating Emotions	.353	.440	.222	.252	.485	.828	.739

Note. All correlations were statistically significant, $p<.001$.

Relationships with other constructs/measures

Pearson correlations with psychopathology, emotional reactivity, and emotion regulation strategy use. Correlations between all measures' subscale and composite scores are displayed in Table 5. Poor overall emotion regulation ability (as assessed by the PERCI total scale score), was significantly associated with more severe depression (r = 0.65, $p<.001$), anxiety (r = 0.54, $p<.001$), and stress symptoms (r = 0.60, $p<.001$), as well as more easily activated (r = 0.57, $p<.001$), more intense (r = 0.56, $p<.001$), and more prolonged (r = 0.62, $p<.001$) negative emotions, and less easily activated (r= −0.34, $p<.001$), less intense (r= −0.16, $p<.001$), and less prolonged (r= −0.39, $p<.001$) positive emotions. In terms of correlations with different emotion regulation strategies, PERCI total scores were significantly positively correlated with habitual use of self-blame (r = 0.39, $p<.001$), acceptance (r = 0.28, $p<.001$), rumination (r = 0.43, $p<.001$), catastrophizing (r = 0.46, $p<.001$), other-blame (r = 0.27, $p<.001$), expressive suppression (r = 0.26, $p<.001$), withdrawal (r = 0.52, $p<.001$), and ignoring (r = 0.30, $p<.001$) strategies; and significantly negatively correlated with habitual usage of cognitive reappraisal type strategies (i.e., positive refocusing [r = −0.13, p = .003], refocus on planning [r= −0.25, $p<.001$], positive reappraisal [r= −0.29, $p<$ .001], putting into perspective [r= −0.16, $p<.001$], cognitive reappraisal [r= −0.29, $p<.001$]) and actively approaching (r= −0.30, $p<.001$) strategies. Similar correlation patterns were generally present at the PERCI subscale level, with the exception of the *Negative-Tolerating Emotions* subscale which was positively correlated with increased usage of both typically helpful and unhelpful regulation strategies (see Table 5).

Regression analysis predicting psychopathology symptoms. Our multiple regression analyses indicated that the eight PERCI subscales, together, predicted a significant 51.8%, 34.1%, or 46.1% of the variance in depression (F[8, 499]=66.996, $p<.001$), anxiety (F[8, 499]=32.303, $p<.001$), and stress symptoms (F[8, 499] = 53.343, $p<.001$), respectively. The Negative-Controlling Experience (β=0.17–0.30), Negative-Inhibiting Behavior (β=0.16–0.31), and Negative-Activating Behavior (β=0.17–0.22) subscales were significant unique predictors for all three symptom categories, and the Positive-Controlling Experience subscale was a significant unique predictor specifically for depression symptoms (β=0.20) (for all coefficients, see supplementary Table S2).

Discussion

Our main aim in this study was to examine the validity and reliability of the PERCI, conducting the first psychometric study of it in a United States sample. Overall, consistent with the original development study in Australian adults (Preece et al., 2018), we found it to perform strongly. All subscale and composite scores displayed high internal consistency. The factor structure of the PERCI was well represented by the theory-driven eight-factor model, with all factors correlating well and items loading strongly on their intended subscale factor. The superiority of this eight-factor model over the simpler one-, two-, and four-factor solutions supports the importance of accounting for the different emotional valences and regulation components to more fully capture the latent structure of the multidimensional emotion regulation ability construct. Our study was also the first to examine the invariance of this PERCI structure across different demographic categories, and full invariance was supported across gender, age, and education categories. This indicates that the latent structure of the emotion regulation ability construct manifests similarly across these groups, supporting confident

Table 5
Pearson Correlations between Subscale and Composite Scores of the PERCI, DASS-21, PERS-S, ERQ, CERQ, and BERQ.

Measure	PERCI Subscales								PERCI Composites				
	Negative-Controlling Experience	Negative-Inhibiting Behavior	Negative-Activating Behavior	Negative-Tolerating Emotions	Positive-Controlling Experience	Positive-Inhibiting Behavior	Positive-Activating Behavior	Positive-Tolerating Emotions	Negative-Emotion Regulation	Positive-Emotion Regulation	General-Facilitating Hedonic Goals	Positive-Containing Emotions	General-Emotion Regulation (Total score)
DASS-21													
Depression	.67***	.56***	.63***	.24***	.55***	.30***	.33***	.26***	.66***	.45***	.69***	.34***	.65***
Anxiety	.50***	.54***	.50***	.29***	.32***	.32***	.27***	.24***	.57***	.36***	.56***	.31***	.54***
Stress	.60***	.61***	.60***	.31***	.40***	.29***	.27***	.20***	.66***	.36***	.66***	.29***	.60***
PERS-S													
Subscales													
Negative-Activation	.60***	.53***	.56***	.18***	.43***	.29***	.34***	.24***	.59***	.40***	.60***	.32***	.57***
Negative-Intensity	.58***	.58***	.58***	.16***	.39***	.27***	.28***	.18***	.60***	.35***	.60***	.28***	.56***
Negative-Duration	.66***	.57***	.61***	.17***	.50***	.29***	.36***	.26***	.63***	.44***	.66***	.34***	.62***
Positive-Activation	−0.37***	−0.21***	−0.32***	.03	−0.41***	−0.13**	−0.24***	−0.23***	−0.28***	−0.32***	−0.33***	−0.22***	−0.34***
Positive-Intensity	−0.27***	−0.04	−0.16***	.14**	−0.31***	.01	−0.12**	−0.14**	−0.11*	−0.18***	−0.16***	−0.09*	−0.16***
Positive-Duration	−0.49***	−0.28***	−0.36***	.04	−0.47***	−0.14**	−0.24***	−0.20***	−0.35***	−0.34***	−0.41***	−0.22***	−0.39***
Composites													
Overall Neg. Reactivity	.67***	.61***	.61***	.18***	.48***	.31***	.35***	.25***	.67***	.44***	.68***	.34***	.64***
Overall Pos. Reactivity	−0.42***	−0.20***	−0.32***	.08	−0.45***	−0.10*	−0.22***	−0.21***	−0.28***	−0.31***	−0.34***	−0.20***	−0.33***
ERQ													
Cognitive reappraisal	−0.40***	−0.25***	−0.22***	.12**	−0.35***	−0.16***	−0.20***	−0.21***	−0.24***	−0.29***	−0.28***	−0.22***	−0.29***
Expressive Suppression	.23***	.20***	.09	.22***	.19***	.16***	.20***	.24***	.22***	.24***	.24***	.22***	.26***
CERQ													
Self-blame	.39***	.40***	.37***	.19***	.27***	.17***	.18***	.15***	.42***	.24***	.42***	.19***	.39***
Acceptance	.24***	.24***	.28***	.21***	.21***	.13**	.12**	.06	.30***	.17***	.31***	.12**	.28***
Rumination	.43***	.45***	.46***	.21***	.20***	.24***	.20***	.12**	.49***	.24***	.46***	.21***	.43***
Positive refocusing	−0.21***	−0.06	−0.13**	.13**	−0.24***	−0.01	−0.10*	−0.12**	−0.09	−0.15***	−0.13**	−0.09	−0.13**
Refocus on planning	−0.34***	−0.14**	−0.21***	.08	−0.36***	−0.12**	−0.20***	−0.17***	−0.19***	−0.27***	−0.25***	−0.18***	−0.25***
Positive reappraisal	−0.41***	−0.17***	−0.26***	.08	−0.42***	−0.09	−0.20***	−0.14**	−0.24***	−0.27***	−0.30***	−0.16***	−0.29***
Putting into perspective	−0.26***	−0.14**	−0.13**	.09*	−0.25***	−0.03	−0.10*	−0.07	−0.14**	−0.15***	−0.18***	−0.08	−0.16***
Catastrophizing	.44***	.44***	.37***	.27***	.22***	.28***	.25***	.25***	.48***	.31***	.46***	.30***	.46***
Blaming others	.22***	.25***	.22***	.12**	.18***	.22***	.16***	.13**	.25***	.21***	.26***	.19***	.27***
BERQ													
Seeking distraction	−0.13**	.07	−0.01	.15***	−0.15***	.08	.01	−0.09	.02	−0.05	−0.02	.00	−0.01
Withdrawal	.50***	.51***	.51***	.21***	.36***	.27***	.30***	.19***	.54***	.35***	.55***	.29***	.52***
Actively approaching	−0.42***	−0.23***	−0.30***	.02	−0.33***	−0.09*	−0.17***	−0.14**	−0.29***	−0.24***	−0.33***	−0.15	−0.30***
Seeking social support	−0.04	0.06	.02	.10*	−0.15***	.08	.03	−0.01	.04	−0.03	.00	.04	.02
Ignoring	.24***	.28***	.25***	.29***	.16***	.15***	.17***	.13**	.33***	.19***	.32***	.17***	.30***

Note. ***$p<.001$, **$p<.01$, *$p<.05$.

use of (and comparisons between) PERCI scores across people of different demographic backgrounds (Cheung and Rensvold, 2002).

The validity of the PERCI was further supported by its relations with other constructs/measures. Specifically, as was expected, people reporting poor emotion regulation abilities on the PERCI also tended to report more severe levels of depression, anxiety, and stress symptoms, as well as higher negative reactivity and lower positive reactivity. Generally speaking, the negatively valenced subscales of the PERCI were the strongest predictors of depression, anxiety, and stress, but in the case of depression the Positive-Controlling Experience subscale also accounted for substantial variance.

These symptom-specific findings are consistent with contemporary models of emotion regulation difficulties with depression and anxiety disorders (e.g., Campbell-Sills et al., 2014; Hofmann, 2014; Joormann and Siemer, 2014; Rottenberg and Gross, 2007), which highlight difficulties down-regulating negative emotions across both disorder categories, but which prominently emphasize difficulties up-regulating positive feelings in depressive presentations (e.g., anhedonia; Carl et al., 2013). Our findings therefore further highlight the potential clinical utility of assessing both valence domains when measuring emotion regulation ability. Those PERCI subscales that assess difficulties containing or down-regulating positive emotions (Positive-Inhibiting Behavior, Positive-Activating Behavior, Positive-Tolerating Emotions) did not account for unique variance in the DASS-21 symptoms assessed here, but we anticipate that these PERCI subscales might be particularly useful in explaining variance in manic symptoms or bipolar presentations (see Gruber et al., 2012). No marker of manic symptoms was administered in this study, so this will be an important area for future research.

In terms of the relationships between PERCI scores and the use of various emotion regulation strategies (as assessed by the ERQ, CERQ, and BERQ process measures), the overall pattern of findings similarly conformed to our expectations. People reporting poor overall emotion regulation ability on the PERCI tended to report a regulation strategy profile characterised by increased behavioural avoidance (e.g., expressive suppression, withdrawal, ignoring) and more unhelpful cognitive patterns (e.g., focused on rumination, blame-attribution, and catastrophising), combined with decreased use of active problem solving (e.g., actively approaching) and fewer change-oriented cognitive patterns (e.g., focused on cognitive reappraisal). Although it is difficult to categorize regulation strategies as globally unhelpful or helpful (because the adaptiveness of a strategy can vary substantially depending on the goal and context in which it is used; Aldao et al., 2015), prior research has highlighted that certain strategies, when used habitually, are often associated with either good or poor social and mental health outcomes (e.g., Gross and John, 2003; Conklin et al., 2015). As such, our findings are broadly consistent with these prior patterns across the 16 subscales of the ERQ, CERQ, and BERQ, in indicating that people with poor emotion regulation ability (as assessed by the PERCI) tend to habitually use the 'unhelpful' strategies more and the 'helpful' strategies less.[5]

One potential exception to this general pattern of findings was our observation that poor emotion regulation ability was correlated with greater use of acceptance-based strategies. Acceptance features prominently in some psychotherapies and so is often regarded as an adaptive regulation strategy (e.g., Acceptance and Commitment Therapy; Hayes et al., 2006). However, it is possible that the association observed might be explained by the importance of considering context when evaluating the adaptiveness of a strategy. Specifically, reacting to an unpleasant situation with acceptance (e.g., CERQ item 11 "I think that I have to accept the situation") may be helpful if the situation cannot be changed or controlled, but may instead be unhelpful if it represents avoidance of a situation that can be solved, or other factors such as an external locus of control, resignation, helplessness, or hopelessness (e.g., Aldao and Nolen-Hoeksema, 2012). In this sample, it may be that endorsement of the administered acceptance items fits within an inflexible regulation profile of habitual cognitive and behavioural avoidance. Another exception was specific to the PERCI *Negative-Tolerating Emotions* subscale, with lower tolerance linked to increased usage of nearly all tested regulation strategies, including strategies usually categorised as helpful. Intolerance of emotions, in particular, may lead to excessive or indiscriminate usage of a range of regulation strategies in attempts to avoid distressing affect, but such strategies might consequently not be used in the right contexts (or on the right targets) to successfully obtain good long-term outcomes (e.g., Jefferies et al., 2016; Sheppes et al., 2011).

Transdiagnostic approaches to treating mental disorders often target emotion regulation difficulties, and these approaches are becoming increasingly popular (e.g., Barlow et al., 2017; Mennin and Fresco, 2014; Sauer-Zavala et al., 2020). In this context, our findings mapping the habitual strategy profile of poor emotion regulation ability could be useful, suggesting that people's emotion regulation ability in these programs might be most effectively improved by targeting a combination of cognitive and behavioural regulation strategies, specifically: reductions in usage of avoidant cognitive and behavioural regulation strategies (e.g., expressive suppression, withdrawal, ignoring), reductions in rumination, blame-attribution, and catastrophising, as well as increases in cognitive reappraisal and active problem solving (e.g., Bullis et al., 2015). Our psychometric findings also suggest that the PERCI might be a useful pre- and post-treatment measure in these contexts, identifying people who might particularly benefit from such programs, as well as assessing the impact of emotion regulation focused interventions on emotion regulation ability. Relatedly, future use of the PERCI with different diagnostic groups may be fruitful in terms of mapping what profiles of negative and positive emotion regulation abilities characterize specific diagnoses (e.g., Becerra et al., 2013).

Limitations and future directions

The present investigation can be interpreted within the confines of three main limitations. First, we did not include a clinical sample in our analyses; hence, although we have discussed some potential clinical applications, future studies with the PERCI in clinical samples would be beneficial to more clearly confirm this utility, as well as to test the invariance of the emotion regulation ability construct across non-clinical and clinical samples. Second, our concurrent validity markers were all self-report measures. Future studies could further examine the validity of the PERCI by looking at how scores relate to behavioural or laboratory-based markers of emotion regulation and related constructs (e.g., Mauss et al., 2005; Wolgast et al., 2011). Third, most of our US sample was White/Caucasian and all were adults. Some work has highlighted that emotion regulation processes (such as the extent to which a regulation strategy is adaptive) can differ between cultures (e.g., Soto et al., 2011), and the development of emotion regulation skills throughout childhood is a topic of substantial interest (e.g., Gullone et al., 2010). As such, studies with different cultural groups and adolescents would be useful to more widely determine the utility of the PERCI and help map potential differences in emotion regulation between such groups (e.g., Soto et al., 2011). The PERCI may be of particular interest to researchers examining positive emotion and reward sensitivity from a lifespan developmental perspective, as different patterns and trajectories of positive emotion across the lifespan may indicate health or risk for psychopathology (Villanueva et al., press).

In sum, our findings indicate that the PERCI has strong psychometric properties as a measure of emotion regulation ability for negative and positive emotions. Given that previous measures of this type have tended to focus only on negative emotions, future use of the PERCI in research and clinical settings may therefore help to develop a more

[5] 'Helpful' or 'unhelpful' in terms of whether habitual use of these strategies is usually associated with good or poor long-term outcomes (e.g., well-being, psychopathology symptoms, interpersonal functioning).

comprehensive understanding of the multidimensional emotion regulation ability construct and its relationships with other variables.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2021.07.055.

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