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Emotion regulation in daily life in early psychosis: The role of contextual appraisals

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ABSTRACT

Background: Little is known about whether and how contextual appraisals relate to emotion regulation (ER) strategy use across the ultra-high risk and first episode stages of psychosis. The present study extends previous research by investigating the extent to which different appraisal dimensions of the most negative and positive events of the day are associated with ER strategy use in individuals with ultra-high risk (UHR) and first-episode psychosis (FEP).

Method: Sixty-eight UHR individuals and fifty-five FEP individuals filled out an experience sampling evening questionnaire for six consecutive days, in which their appraisal of intensity, importance and perceived control concerning the most negative or positive event of the day, and the ER strategies they deploy in response to these events were measured.

Results: Multilevel mixed effect models showed that intensity appraisal was most closely associated with ER strategy use, as opposed to importance and controllability appraisals. Higher intense negative events were associated with more rumination and social sharing, while less intense negative events were associated with more reappraisal. Higher intense positive events were associated with a greater number of deployed strategies and more efforts in using savoring, expression and social sharing. The UHR and FEP individuals did not significantly differ regarding effects of above-mentioned appraisal dimensions on ER.

Conclusions: These results provide evidence supporting ER flexibility in early psychosis, and event intensity emerged as the dimension most strongly associated with ER. Future research should better account for other situational factors (such as social context) that might affect ER use in psychosis.

1. Introduction

Difficulties in emotion regulation (ER) are associated with many mental health problems, including psychosis (Gross et al., 2019). Compared with healthy controls, patients with psychosis have

difficulties in down-regulating negative emotions (Strauss et al., 2013), and show a preference for ER strategies that are related to poor outcomes (Chapman et al., 2020). Moreover, patients with psychosis tend to employ a greater number of and expend more effort in response to negative events compared to healthy controls, as evidenced by two

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recent studies (Rough and Strauss, 2021; Visser et al., 2018), pointing toward contextually inappropriate regulatory effort contributing to the aberrant patterns of ER use in individuals with chronic psychosis.

There is evidence suggesting that individuals at the early stages of psychosis also experience ER difficulties (Chapman et al., 2020; Kim et al., 2021). For example, a recent laboratory-based study in patients with first-episode psychosis (FEP) and in individuals at ultra-high risk (UHR) for psychosis revealed that both FEP and UHR individuals have difficulties in down-regulating negative emotions with cognitive reappraisal, although no difference between FEP and UHR groups were observed (Kim et al., 2021). A study using self-report questionnaires further showed that problems in ER predict more severe positive and depressive symptoms in patients with FEP (Liu et al., 2019). However, few studies have examined real-life ER strategy use in early psychosis (Bahlinger et al., 2020; Bahlinger et al., 2021) and to our knowledge, no studies have examined the effect of contextual appraisals on ER strategy use in early psychosis. Exploring the factors that influence the use of ER strategies in the initial stages of psychosis may offer valuable insights into the nature of emotion dysregulation in psychosis.

Experience sampling methodology (ESM) is a structured diary technique that enables real-time and repeated sampling, which could yield accurate estimates of emotional experience and event context (Csikszentmihalyi and Larson, 1987; Myin-Germeys et al., 2018). ESM studies in psychosis revealed that patients with psychosis reported higher efforts in regulating emotions and tended to use more strategies than healthy controls in the flow of daily life (Ludwig et al., 2020a; Rough and Strauss, 2021; Visser et al., 2018). In early psychosis, increased use of acceptance and reappraisal predicted lower negative affect at the following time point, while increased use of rumination and suppression was associated with higher negative affect (Bahlinger et al., 2021). ESM thus makes it possible to examine which ER strategies are used in daily life. Interestingly, recent work in this area has moved beyond the singular focus on specific strategy use and efforts are made to identify factors that might influence ER strategy use. The ER choice framework proposed that flexibly choosing ER strategies to match the varying contextual demands is adaptive and crucial for maintaining well-being. Additionally, this theoretical approach highlights the significance of the intensity of emotional events and stimuli as a core contextual appraisal dimension that might affect ER strategy use (Sheppes et al., 2014; Sheppes, 2020). In fact, a large body of research in healthy populations has provided evidence for the critical role of event intensity in shaping ER decisions. The higher the intensity of the event, the more ER strategies are deployed in adolescents (Hiekkaranta et al., 2021; Lennarz et al., 2019) and healthy adults (Dixon-Gordon et al., 2015; Troy et al., 2019). However, mixed findings were found regarding the associations between event intensity and specific ER strategies. For example, whereas some studies found reappraisal to be more often used in response to events with lower intensity or stressors that elicited lower negative affect (Blanke et al., 2021; Hiekkaranta et al., 2021; Sheppes et al., 2014; Troy et al., 2019), another study found no associations between event intensity and reappraisal use (Lennarz et al., 2019).

Apart from event intensity, the role of other contextual appraisal dimensions, such as event importance and perceived control on influencing ER use, has received considerably less attention and investigation. The higher the importance of the event, the longer the emotion experience lasts (Verduyn et al., 2009; Verduyn and Lavrijsen, 2015), which might implicate the use of certain ER strategies, such as rumination and reflection. Similarly, the relevance of controllability to ER strategy use has been scarcely investigated. However, studies on stress response have highlighted the role of controllability in determining the using of different coping strategies (Lazarus and Folkman, 1987). Indeed, when stressors are perceived as low in controllability, people tend to use cognitive reappraisal rather than situation change (Troy et al., 2013), while a stronger belief in controllability is positively associated with the use of problem-solving (Ortner and Pennekamp, 2020). Finally, whereas most studies focus on the intensity of negative

emotions or negative events (i.e., stressor), there is some evidence that intensity of positive emotions might also affect ER strategy use (Hiekkaranta et al., 2021).

Taken together, previous studies provided important evidence regarding contextual appraisal and its associations with ER strategy use in healthy populations. The very few studies that investigated ER usage in psychosis (but see Bahlinger et al., 2021; Visser et al., 2018) did not take context into account. Investigating whether and how individuals with early psychosis flexibly adapt regulatory strategies to manage the demand of varying situations is crucial. Such an examination could provide insights into key contextual dimensions that influence the use of ER strategies and inform the development of optimized therapy and prevention programs.

The aim of the present study is thus to examine the associations between ER strategy use and contextual appraisals in relation to negative and positive events in a combined early psychosis sample, comprising both UHR and FEP individuals. There is evidence indicating a lack of group differences in ER between the UHR and FEP groups (Kim et al., 2021). Furthermore, it has been suggested that the distinction between the UHR and FEP phase is arbitrary (Yung et al., 2010) and there is temporal and phenomenological continuity of psychotic symptoms between UHR and FEP, both representing the early phase of psychotic illness (Fusar-poli et al., 2015). Note that the present study did not include a healthy volunteer group, as we focused on whether and how contextual appraisals impacted ER strategy use across risk and first episode stages of psychosis. Because both theoretical and empirical accounts point toward event intensity playing a crucial role in shaping ER strategy use in healthy population (Blanke et al., 2021; Sheppes, 2020), the primary aim of this study was to examine the associations between intensity appraisal and ER strategy use in the whole sample. We estimated ER strategy use with total ER efforts, efforts per strategy, and the number of deployed strategies. It is hypothesized that higher intensity of the daily most negative (or positive) event is associated with greater ER efforts in total, efforts per strategy and a greater number of strategies.

Furthermore, exploratory analyses were conducted. First, although we did not expect to observe differences between groups on the effects across risk and first-episode stages, this issue has not been explored in previous studies. Therefore, we conducted an exploratory analysis to test whether associations between intensity appraisal and ER strategy use differed between UHR and FEP. In addition, to more comprehensively account for the varied contextual appraisal dimensions, we additionally incorporated ratings of the importance and controllability of the events. We explored their associations with ER strategy use by including the three appraisal dimensions independently and simultaneously (i.e., the additive effects of different appraisal dimensions). Furthermore, we examined whether there are interaction effects between these appraisal dimensions in predicting ER strategy use by including intensity, importance and controllability as predictors, together with all the two-way and three-way interactions between these predictors (i.e., the interaction effects of different appraisal dimensions). Finally, we examined whether UHR and FEP individuals differed regarding the predicting effect of these three contextual appraisal dimensions and their interactions on ER.

2. Methods

2.1. Sample

The sample was collected as part of the INTERACT study (Dutch Trial Register, ID: NTR4252), a multi-center randomized controlled trial aiming at investigating the efficacy of Acceptance and Commitment Therapy in Daily Life with a combination of face-to-face therapy with an ecological momentary intervention (Myin-Germeys et al., 2022). The full study methodology is detailed in the study protocol (Reininghaus et al., 2019).

Individuals within the early stages of psychosis, aged between 15 and

65, were recruited from five regions in the Netherlands and Belgium. The UHR and FEP status were assessed with the Comprehensive Assessment of At Risk Mental State (Yung et al., 2005) and Nottingham Onset Schedule (Singh et al., 2005). UHR individuals had no history of antipsychotic medication for psychotic symptoms, and FEP individuals had a duration of psychosis within 3 years of illness onset. Symptom severity was assessed with total score of the Brief Psychiatric Rating Scale (BPRS, Ventura et al., 1993). One hundred and forty-eight participants were recruited. For the purpose of the current study, we used data from the baseline assessment before intervention. The trial received ethical approval from the Medical Ethics Review Committees (MERC) at Maastricht University Medical Centre (MUMC), the Netherlands (reference: NL46439.068.13) and the University Clinic Leuven, Belgium (reference: B322201629214). Written informed consents were obtained from participants at the starting of the baseline assessment.

2.2. Procedure

Before being allocated to the intervention or control group, all participants underwent a baseline assessment that included a six-day ESM assessment. As part of this, participants were asked to fill out a questionnaire in the evening reflecting on the past day. In the current paper, the data of the evening questionnaire that consisting items of contextual appraisal and ER strategy were used.

2.2.1. Contextual appraisal items

Appraisal of the most negative (or positive) event of the day was assessed from three dimensions: event intensity, event importance and perceived controllability, with the following ESM items on 7-point Likert scale: Think about the most negative (or positive) event of the day, “This event was (–3 = ‘very unpleasant’, 3 = ‘very pleasant’)”, “This was important to me (–3 = ‘very unimportant’, 3 = ‘very important’)”, “I was in control of this event (1 = ‘not at all’, 7 = ‘very much’)”. Rating on event importance appraisal was converted into a scale ranging from 1 to 7.

2.2.2. ER items

ER strategies in response to the most negative event of the day were assessed with seven items: “I talked about it with somebody” (social sharing), “I have thought about it a lot” (rumination), “I reappraised it” (reappraisal), “I just let it happen” (acceptance), “I expressed my emotions” (expression), “I tried to forget about it quickly” (avoidance), “I tried to change the situation” (situation change). ER strategies in response to the most positive event of the day were assessed with three ER items: “I talked about it with somebody” (social sharing), “I have thought about it a lot” (savoring), “I expressed my emotions” (expression). Social sharing was binary rated (1 = “yes”, 0 = “no”), other items were rated with a 7-point Likert scale (1 = “not”, 7 = “very much”).

A sum of responses to all ER items (except of social sharing due to its binary scoring) was calculated to represent total ER efforts per daily most negative event. As only three positive ER strategies were included, we did not estimate total ER efforts per daily most positive event. ER efforts per strategy were raw scores on each ER item or “yes” in the case of social sharing. The number of deployed strategies in response to the daily most negative (or positive) event was calculated as the number of strategies where participants responded with 2 or higher, or “yes” in the case of social sharing.

2.3. Statistical analyses

Responses to intensity appraisal of the most negative event >1 and of the most positive event <-1 were excluded, as they were considered counterintuitive responses. All hypotheses were tested with multi-level modeling (MLM) with random slope and random intercept using R software and R studio version 4.1.2 (R Core Team, 2021), the lme4 (Bates et al., 2015) and the lmerTest (Kuznetsova et al., 2017) packages.

To address the predictive effect of event intensity (level-1 predictor) of the daily most negative (or positive) event on ER outcomes, separate MLM models, with event appraisal and ER strategies (level-1) nested within persons, were conducted with event intensity as predictor and total ER efforts, efforts per strategy, and the number of strategies as level-1 outcomes respectively. Second, a series of exploratory analyses were conducted with ER strategy use (total ER efforts, efforts per strategy, and the number of strategies) as level-1 outcomes and (1) with intensity appraisal as level-1 predictor, and diagnostic status (1 = UHR, 2 = FEP) as level-2 predictor; (2) with intensity, importance and controllability appraisals as level-1 predictors; (3) with intensity, importance and controllability appraisals, as well as their two- and three-way interactions as level-1 predictors; (4) with intensity, importance and controllability appraisals as level-1 predictors, and diagnostic status (1 = UHR, 2 = FEP) as level-2 predictor, as well as their two-, three- and four-way interactions. Level-1 predictors were person-mean centered before model construction. Multiple imputation was used to deal with missing values for continuous variables at level-1. Age and gender were considered potential confounding variables, because age and gender differences in ER strategy use have been frequently observed (Nolen-Hoeksema and Aldao, 2011), thus both were entered into the models as covariates. Bonferroni multiple comparison correction was used for controlling for type-I error.

Analysis plans of the current study were registered on the Open Science Framework (OSF) using the template for registration of ESM studies (Kirtley et al., 2021). All relevant code and materials are available (<https://osf.io/yjkb4/>). Deviations from the registration are described in the Supplemental material.

3. Results

3.1. Sample and descriptive statistics

Of the 148 participants, twenty-five did not complete any evening-questionnaire and were removed, resulting in a final sample of 123 participants (58 male), with a mean age of 24.63 ($SD = 6.07$, range 15 to 46). Among participants of the final sample, the compliance rate ranges from 63.67 % to 100 % on item level. The UHR ($n = 68$) and FEP ($n = 55$) individuals were comparable for age ($p = .179$) and sex ratio ($p = .265$), UHR individuals scored higher on BPRS than FEP individuals (UHR: $M = 42.52$, $SD = 7.38$; FEP: $M = 39.29$, $SD = 8.67$), $t = 2.14$, $p = .035$ (Supplementary Table S1).

Descriptive statistics for appraisal of event intensity, importance and perceived control are presented in Table 1, based on the non-imputed dataset (see Supplementary Table S2 for imputed values).

For descriptive purposes, we nonetheless present the frequency for each ER strategy in Table 1. Regarding ER strategy use, acceptance was the most often used strategy in response to the most negative event of the day (95 %), whereas savoring was the most used strategy for positive events (86 %). Social sharing was least frequently used, either in response to the most negative or positive event (42 %, 51 %). In response to the daily most negative event, in 1.3 % of events, no strategy was used, one strategy was used in 0.7 % events, two were used in 2 % of events, three were used in 7 % of events, four were used in 11 % of events, five were used in 18 % of events, six were used in 38 % of events, and seven were used in 23 % of events. Therefore, in 78 % of the instances, five or more strategies were used. In response to daily most positive event, in 7 % of events, no strategy was used, one strategy was used in 12 % of events, two were used in 33.11 % of events, and three were used in 48 % of events. Therefore, in almost half of the most positive events, all of three strategies were used.

UHR and FEP individuals differed from each other in intensity ratings on the daily most negative event, with UHR individuals reporting the daily most negative event as more intense compared to FEP individuals. No significant differences between UHR and FEP individuals were found on appraisal of event importance or controllability, or on

Table 1
Descriptive statistics on contextual appraisals and ER strategy use.

Outcome variable	All participants		UHR individuals	FEP individuals	Group comparison	
	M (SD)	% of use	M (SD)	M (SD)	t	p
<i>Daily most negative event</i>						
Event intensity	-1.59 (1.02)	-	-1.76 (1)	-1.35 (1.01)	2.53	.013
Event importance	4.33 (1.66)	-	4.37 (1.72)	4.27 (1.56)	-0.49	.625
Perceived controllability	3.4 (1.77)	-	3.37 (1.8)	3.43 (1.73)	-0.29	.77
Rumination	3.82 (1.99)	83 %	4.09 (1.99)	3.5 (1.93)	-1.2	.233
Expression	3.53 (1.93)	78 %	3.48 (2)	3.6 (1.82)	0.97	.336
Social sharing (% of yes)	42 %	42 %	43 %	40 %	-0.25	.805
Reappraisal	4.01 (1.55)	89 %	4.09 (1.48)	3.89 (1.64)	-0.5	.619
Situation change	3.58 (1.92)	77 %	3.65 (2.05)	3.47 (1.72)	-0.56	.575
Avoidance	4.37 (1.84)	89 %	4.37 (1.93)	4.37 (1.7)	-0.06	.949
Acceptance	4.68 (1.62)	95 %	4.64 (1.71)	4.73 (1.5)	1.09	.28
Total ER efforts	23.78 (5.13)	-	24.1 (5.02)	23.4 (5.25)	0.11	.911
Number of strategies	5.46 (1.36)	-	5.41 (1.32)	5.52 (1.41)	0.62	.541
<i>Daily most positive event</i>						
Event intensity	1.92 (0.96)	-	1.92 (0.91)	1.92 (1.02)	0.18	.854
Event importance	5.44 (1.41)	-	5.43(1.38)	5.46 (1.46)	-0.1	.923
Perceived Controllability	5.28 (1.54)	-	5.23 (1.58)	5.35 (1.5)	0.47	.639
Savoring	4.17 (1.93)	86 %	4.04 (1.9)	4.32 (1.96)	0.81	.422
Expression	4.1 (1.87)	84 %	3.94 (1.92)	4.27 (1.82)	1.35	.181
Social sharing (% of Yes)	51 %	51 %	50 %	52 %	-0.16	.876
Number of strategies	2.23 (0.91)	-	2.16 (0.95)	2.3 (0.86)	0.58	.562

Note: ER: emotion regulation; “-” represents not applicable; UHR: ultra-high risk for psychosis; FEP: first-episode psychosis. % of use referred to the proportion of surveys where ER was attempted that the particular strategy was chosen. Comparisons between UHR and FEP individuals were conducted with MLMs, with diagnostic status (1 = UHR, 2 = FEP) as the level-2 predictor, age and sex were included as covariates.

any ER outcomes.

The within- and between-person correlation matrixes between contextual appraisals and ER have been added to the Supplementary materials (for negative events see Table S3; for positive events see Table S4).

3.2. Effects of event intensity on ER strategy use

Intensity of the daily most negative event was significantly associated with the use of rumination, social sharing and reappraisal (Table 2). That is, individuals with early psychosis exerted more efforts in using rumination and social sharing when the event was more intense, while

Table 2
Effects of intensity appraisal on ER strategy use in early psychosis.

	Total ER efforts	Number of strategies	Rumination/Savoring	Expression	Social sharing	Reappraisal	Situation change	Avoidance	Acceptance
<i>Daily most negative event</i>									
Intercept	β 23.36 (SE) (0.55) p <.001	5.48 (0.13)	3.88 (0.21)	3.23 (0.18)	-0.72 (0.24)	3.86 (0.15)	3.5 (0.19)	4.29 (0.18)	4.63 (0.16)
Age	β 0.02 (0.06) (SE) p .804	<.001 0.04 (0.01)	<.001 0.02 (0.02)	<.001 0.02 (0.02)	.003 0.04 (0.03)	<.001 0.002 (0.02)	<.001 0.03 (0.02)	<.001 -0.004 (0.02)	<.001 -0.05 (0.02)
Sex ^a	β 1.59 (0.75) (SE) p .034	0.19 (0.18)	0.23 (0.27)	0.58 (0.25)	0.54 (0.33)	0.23 (0.2)	0.33 (0.26)	0.21 (0.25)	-0.07 (0.22)
Event intensity ^b	β -0.65 (SE) (0.31) p .041	-0.14 (0.09)	-0.6 (0.13)	-0.32 (0.15)	-0.53 (0.17)	0.39 (0.11)	-0.24 (0.11)	0.01 (0.12)	0.1 (0.09)
<i>Daily most positive event</i>									
Intercept	β 2.3 (0.08) (SE) p <.001	4.33 (0.2)	4.05 (0.19)	0.13 (0.28)	.643				
Age	β 0.01 (0.01) (SE) p .414	<.001 0.02 (0.02)	<.001 0.01 (0.02)	<.001 0.01 (0.02)	.67 0.02 (0.03)	.655 (0.39)			
Sex ^a	β -0.05 (0.11) (SE) p .637	-0.08 (0.25)	0.13 (0.25)	-0.15 (0.39)	.695				
Event intensity ^c	β 0.25 (0.06) (SE) p <.001	0.78 (0.15)	0.51 (0.15)	0.68 (0.18)	.001				

Note: ER: emotion regulation; uncorrected p values were reported; p values in bold: significant after Bonferroni correction (p < .01).

^a Betas represent the effect of being female.

^b Responses to intensity appraisal of the most negative event were excluded if they were 1 or higher (indicating a positive event).

^c Responses to intensity appraisal of the most positive event were excluded if they were -1 or lower (indicating a negative event).

they made more efforts in using reappraisal when the event was rated as less intense. In addition, higher intensity of the daily most negative event was associated with greater total ER efforts in regulating emotions, more efforts in using emotion expression, and situation change strategies. However, these associations were not significant after Bonferroni correction. No significant association was found between intensity appraisal and efforts in using acceptance or avoidance strategy, or the number of deployed strategies. Age was found to be negatively associated with efforts in using acceptance, and no significant effect of gender was found.

Intensity of the daily most positive event was positively associated with more efforts in using savoring, social sharing, emotion expression, and a greater number of deployed strategies, such that more intense positive events were associated with a greater use of all strategies. No significant effect of age or gender on positive ER strategy use was found.

No significant effect of diagnostic status (UHR vs FEP), or interaction effect between diagnostic status and event intensity on total efforts in ER, efforts per strategy, or the number of strategies in response to the daily most negative (or positive) event was found (Supplementary Table S5).

3.3. Effects of intensity, importance and controllability appraisals on ER strategy use

When importance and controllability were added to the model of negative events, event intensity remained significantly associated with the use of rumination, social sharing, and reappraisal (Table 3). In addition, importance appraisal was associated with more efforts in using rumination. No other significant associations between importance or controllability appraisal and ER strategy use outcomes were found. Age was associated with less effort in using acceptance, and no significant effect of gender was found. Adding the two-way and three-way interaction effects between event intensity, importance and controllability did not change the results, except for the association between event intensity and efforts in using social sharing, which no longer held with Bonferroni correction (Supplementary Table S6). None of the two- or three-way interactions reached significance.

Regarding the daily most positive event, associations between positive intensity and efforts in using savoring, efforts in using emotion expression and the number of deployed strategies remained significant when importance and controllability were added to the model (Table 3). Furthermore, a significant association between importance appraisal and efforts in using savoring was found, indicating that when individuals with early psychosis rated their daily most positive event as

Table 3
Effects of event intensity, event importance and perceived controllability appraisals on ER strategy use in early psychosis.

		Total ER efforts	Number of strategies	Rumination/ Savoring	Expression	Social sharing	Reappraisal	Situation change	Avoidance	Acceptance
<i>Daily most negative event</i>										
Intercept	β	23.38	5.5 (0.13)	3.86 (0.21)	3.22 (0.18)	−0.73	3.88 (0.15)	3.5 (0.19)	4.28 (0.18)	4.63 (0.16)
	(SE)	(0.55)				(0.25)				
	<i>p</i>	<.001	<.001	<.001	<.001	.003	<.001	<.001	<.001	<.001
Age	β	0.02 (0.06)	0.04 (0.02)	0.02 (0.02)	0.02 (0.02)	0.04	0.003 (0.02)	0.03 (0.02)	−0.01	−0.05
	(SE)					(0.03)			(0.02)	(0.02)
	<i>p</i>	.771	.016	.429	.445	.188	.865	.122	.822	.008
Sex ^a	β	1.55 (0.75)	0.15 (0.18)	0.26 (0.27)	0.58 (0.25)	0.54	0.21 (0.2)	0.33 (0.26)	0.21 (0.25)	−0.07
	(SE)					(0.34)			(0.23)	(0.23)
	<i>p</i>	.037	.411	.331	.02	.105	.301	.2	.384	.771
Event intensity ^b	β	−0.55	−0.13 (0.07)	−0.53(0.14)	−0.27	−0.49	0.31 (0.11)	−0.22 (0.12)	0.03 (0.11)	0.12 (0.1)
	(SE)	(0.32)			(0.12)	(0.18)				
	<i>p</i>	.088	.085	.001	.027	.006	.007	.067	.779	.202
Event importance	β	0.43 (0.17)	0.05 (0.05)	0.21 (0.07)	0.07 (0.07)	0.18	−0.06	0.1 (0.08)	0.02 (0.07)	0.08 (0.06)
	(SE)					(0.12)	(0.06)			
	<i>p</i>	.015	.315	.002	.342	.129	.299	.2	.763	.151
Perceived controllability	β	0.22 (0.15)	0.06 (0.04)	0.02 (0.07)	0.09 (0.06)	0.07	0.12 (0.05)	0.03 (0.06)	−0.05	0.01 (0.05)
	(SE)					(0.09)			(0.05)	
	<i>p</i>	.145	.088	.814	.129	.439	.032	.55	.37	.843
<i>Daily most positive event</i>										
Intercept	β		2.31 (0.08)	4.31 (0.2)	4.05 (0.19)	0.12				
	(SE)					(0.28)				
	<i>p</i>		<.001	<.001	<.001	.664				
Age	β		0.01 (0.01)	0.01 (0.02)	0.01 (0.02)	0.01				
	(SE)					(0.03)				
	<i>p</i>		.306	.505	.671	.678				
Sex ^a	β		−0.09 (0.12)	−0.07 (0.25)	0.13 (0.25)	−0.15				
	(SE)					(0.39)				
	<i>p</i>		.463	.797	.598	.71				
Event intensity ^c	β		0.24 (0.06)	0.57 (0.15)	0.42 (0.16)	0.51				
	(SE)					(0.21)				
	<i>p</i>		<.001	.001	.01	.015				
Event importance	β		0.05 (0.04)	0.25 (0.08)	0.08 (0.08)	0.22				
	(SE)					(0.13)				
	<i>p</i>		.219	.002	.321	.081				
Perceived controllability	β		0.01 (0.03)	0.1 (0.07)	0.08 (0.07)	0.001				
	(SE)					(0.11)				
	<i>p</i>		.712	.146	.242	.995				

Note: ER: emotion regulation; uncorrected *p* values were reported; *p* values in bold: significant after Bonferroni correction (*p* < .01).

^a Betas represent the effect of being female.

^b Responses to intensity appraisal of the most negative event were excluded if they were 1 or higher (indicating a positive event).

^c Responses to intensity appraisal of the most positive event were excluded if they were −1 or lower (indicating a negative event).

more important, they are more likely to savor their positive experience. No other significant effects of event importance or perceived controllability on efforts in using either ER strategy or the number of deployed ER strategies were found. The effect of age or gender on positive ER strategy use was not significant. Similar to the models of negative events, adding the two-way and three-way interaction effects between event intensity, importance and controllability to the models of positive events did not change the results, except for the association between event intensity and efforts in using expression, which no longer survived Bonferroni correction (Supplementary Table S6). None of the two- or three-way interactions reached significance.

Finally, level-2 predictor of diagnostic status (UHR vs. FEP), as well as its two-, three- and four-way interactions with these three appraisal dimensions were added to predict ER strategy use, none of the interactions were significant, in the model of negative or positive events (Supplementary Table S7).

4. Discussion

The current study used ESM to investigate how perceived intensity, importance and controllability over the daily most negative and positive event shaped ER strategy use in early psychosis. Event intensity emerged as the factor most consistently associated with ER. More intense negative events were associated with more efforts in using rumination and social sharing, while less intense negative events were associated with more efforts in using reappraisal. More intense positive events were associated with higher efforts per strategy and a higher number of deployed strategies. In addition, negative or positive events of higher importance were associated with greater use of rumination or savoring respectively. Perceived controllability over the event, however, did not explicitly relate to ER strategy use. No significant differences were found between UHR and FEP individuals.

4.1. Intensity appraisal and ER

Event intensity emerged as the factor most strongly associated with ER. This is consistent with findings in healthy populations (Hiekkaranta et al., 2021; Lennarz et al., 2019), as well as in samples of people with depression (van der Stouwe et al., 2019) or with social anxiety (Goodman et al., 2021a), demonstrating the important role of intensity appraisal in influencing ER use. These findings are in line with predictions from the ER choice framework (Sheppes, 2020), the varying use of different ER strategies as a function of event intensity provides preliminary evidence supporting the retained capacity of ER flexibility in early psychosis.

Empirical evidence from self-report questionnaire studies suggests a higher use of putatively maladaptive strategies (e.g., rumination) and a lower use of putatively adaptive strategies (e.g., reappraisal) in individuals with psychosis (Chapman et al., 2020; Liu et al., 2020). The impact of perceived contextual demands, however, was rarely considered. The present study extends these findings by showing that the use of rumination, social sharing and reappraisal in early psychosis is modulated by the intensity of negative events. Similar to what has been found in the general population (Hiekkaranta et al., 2021; Lennarz et al., 2019), more intense negative events were associated with higher efforts in using rumination and social sharing in people in the early stages of psychosis. People with psychosis were found to use rumination more often than healthy controls (Ludwig et al., 2020a), and they showed heightened affective reactivity to stress (Myin-Germeys et al., 2001), thus rumination might be one mechanism driving the increase of affective reactivity in psychosis. Similarly, reappraisal was found to be more often used in response to less intense negative events in early psychosis, which is also in line with findings from the general population (Hiekkaranta et al., 2021; Socastro et al., 2022). Reappraisal involves reframing the meaning of an emotional situation to change its impact, requiring a higher degree of cognitive effort and resources (Bartolomeo

et al., 2020; Sullivan and Strauss, 2017). The emotion-eliciting event competes with the cognitive appraisal process for the limited cognitive resources, which makes high intense negative events hard to reappraise (Ford and Troy, 2019; Sheppes and Gross, 2011). This may be even more pronounced in individuals with early psychosis. Indeed, experimental studies reported difficulties in using reappraisal to down-regulate negative emotions in early psychosis, when highly arousing emotional material were used as stimuli (Kim et al., 2021). The current study thus shows that individuals in the early stages of psychosis report a flexible ER use, which is adapted to the intensity of the events, similar to what has been found in healthy populations. However, it remains to be investigated whether they use these strategies equally effective.

4.2. Acceptance strategy use in early psychosis

Acceptance was most frequently used in response to daily negative events in early psychosis, although its use was not affected by contextual demands. This finding appears to be consistent with results from studies in the general population suggesting that acceptance is the most frequently used strategy and it is perceived to be an “easy” strategy to use (Dixon-Gordon et al., 2015; Lennarz et al., 2019; Troy et al., 2018). For example, although effort requirements of acceptance and cognitive appraisal are similar, people reported less difficulty in using acceptance than reappraisal and rated themselves as more successful in using acceptance than reappraisal (Troy et al., 2018). As such, it is plausible that acceptance is habitually used in individuals with psychosis as is in healthy volunteers due to its availability and perceived success. In addition, age was found to be negatively associated with efforts in using acceptance in early psychosis. The findings that younger individuals with early psychosis tend to rely more on acceptance as a coping strategy are in contrast to the positive correlation between age and acceptance observed in healthy individuals (Shallcross et al., 2013). This inconsistency may be attributed to variations in symptom severity, as greater use of acceptance was linked to more severe psychotic symptoms in early psychosis patients (Farhall and Gehrke, 1997; So and Wong, 2008). Further investigation is required to ascertain whether symptom severity is responsible for the negative correlation between age and acceptance in early psychosis.

4.3. Importance and controllability appraisal and ER

When the three contextual appraisal dimensions were all considered, appraising the event as more important was associated with higher efforts in using rumination in response to the daily most negative event, and higher efforts in using savoring in response to the daily most positive event. This result might explain why events of high importance elicited long lasting negative emotions as was found in previous study (Verduyn and Lavrijsen, 2015). By keeping the events and its related emotional experience “alive”, repeated engagement of ruminative thinking prolongs the duration of affective experience and exacerbates thoughts and feelings related to the emotional event (Shaw et al., 2019). Noteworthy, no significant associations between perceived controllability and efforts in regulating negative emotions in early psychosis were found. This is in line with a recent study, showing a limited contribution of stressor controllability appraisal to the prediction of emotional reactivity (van der Stouwe et al., 2019). General beliefs about controllability may be a more relevant predictor of ER decisions compared to moment-to-moment perceived controllability (Goodman et al., 2021b). Taken together, the addition of importance and controllability appraisal did not significantly change the regulatory pattern in early psychosis.

4.4. Contextual appraisal and the regulation of positive emotions

Similar to findings in healthy adolescents (Hiekkaranta et al., 2021) and adults (Vanderlind et al., 2021), more intense positive events were associated with greater efforts in using sharing, savoring, expression and

the deployment of more strategies. These strategies help with maintaining and extending positive emotional experiences (Hovasapian and Levine, 2018; Tugade and Fredrickson, 2006), and thus strongly relate to well-being. Moreover, importance appraisal was found to be associated with the use of savoring. Savoring of positive emotional experiences has been suggested to be associated with positive outcomes in daily life in psychosis, such as increased positive emotion, more social interaction, and greater social interest (Moran et al., 2018). This finding suggests that individuals with early psychosis are capable of up-regulating positive emotional feelings in daily life.

4.5. Limitations

The current study has some limitations. First, we deal with a large dataset with missing data, of which we assumed that data were missing at random. Participants were allowed to skip questions and we noticed that compliance rates varied across items. Further investigations of why and when the missing happens might have great implications for fully understanding regulatory patterns in psychosis (McLean et al., 2017). Second, one important step to achieve a more contextualized understanding of ER choice in psychosis is to examine how and when ER strategy use is related to psychotic symptoms. The selection and regulatory success of specific strategies might differ across contexts in which psychosis was present versus absent (Strauss et al., 2019). For example, difficulties in ER were identified as risk factors that exacerbated the impact of negative emotions on the experience of and recovery from psychotic symptoms in psychosis (Lawlor et al., 2020; Ludwig et al., 2020b). Third, a key limitation is the lack of demographically matched healthy volunteers for the UHR and FEP samples, thus we are unable to make claims about differences in whether and how appraisals of the context associate to ER in healthy population as they do in psychosis. Finally, caution should be taken to interpret the findings given the small sample size. Future studies are needed to investigate the replicability and generalizability of the findings in a more comprehensive and representative sample of early psychosis, with a more intensive sampling strategy.

5. Conclusions

The current study found that individuals with early psychosis showed regulatory flexibility in changing efforts in using rumination, social sharing, reappraisal and emotional expression to match the situation demands of daily life, in response to both negative and positive events, which was comparable to findings in the general population. Event intensity was the strongest predictor of efforts in regulating negative and positive emotions above and beyond other contextual dimensions. Future research should better account for other situational factors (such as social context) that might affect ER use in psychosis, and to which extent the use of various ER strategies across situations is effective at reducing negative emotions of early psychosis needs further validation.

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The funders of the study had no role in the design and conduct of the study, nor the decision to prepare and submit the manuscript for publication.

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CRedit authorship contribution statement

XL: Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Writing – Original draft, Writing – Review & editing, Visualization, Funding acquisition. **LG:** Software, Formal analysis, Writing – Review & editing. **EvA:** Conceptualization, Investigation, Data curation, Writing – Review & editing. **TV:** Conceptualization, Writing – Review & editing. **APH:** Conceptualization, Writing – Review & editing. **MH:** Conceptualization, Writing – Review & editing. **ABK:** Investigation, Writing – Review & editing. **LdH:** Resources, Writing – Review & editing. **FS:** Investigation, Writing – Review & editing. **UR:** Conceptualization, Writing – Review & editing, Supervision, Project administration. **IMG:** Conceptualization, Writing – Review & editing, Supervision, Project administration, Funding acquisition. All authors contributed to writing and editing of the manuscript and approved its final version.

Declaration of competing interest

All authors declare that they have no competing interests.

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Appendix A. Supplementary data

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