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Higher emotion regulation flexibility predicts more stable negative emotions and faster affective recovery in early psychosis: an experience sampling study

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Abstract

Background. While evidence shows that people with early psychosis are flexible in using different emotion regulation (ER) strategies to manage the varying contextual demands, no studies have examined the effectiveness of such regulatory flexibility in this population. We addressed this issue by investigating whether and how ER flexibility relate to different dynamic aspects (variability, instability, inertia, and recovery) of negative affect (NA) in a combined early psychosis sample, consisting of both individuals at high clinical risk for psychosis and those diagnosed with first-episode psychosis.

Methods. Participants were 148 individuals from the INTERACT project, a multi-center randomized controlled trial on the efficacy of acceptance and commitment therapy in early psychosis. We utilized data from the baseline assessment, during which all participants completed six days of experience sampling assessment of momentary NA, as well as end-of-day assessments of ER strategy use.

Results. Multilevel models of within-person associations showed that greater ER flexibility was associated with more stable NA, and quicker recovery of NA from stressors during the day. Linear regression analyses of between-person associations showed that people who had more variable and unstable NA reported greater ER flexibility generally. No evidence was found for associations with NA inertia.

Conclusions. The current study identified unique within-person and between-person links between ER flexibility and dynamics of NA in early psychosis. These findings further provide evidence for ER flexibility in early psychosis, emphasizing the adaptive nature of regulatory flexibility in relation to reduced instability in NA and faster recovery from NA in everyday life.

Original Article

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Emotion dysregulation, which refers to difficulty in regulating emotions, has been identified as a mechanism significantly contributing to the development and maintenance of many psychiatric disorders, including psychosis (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Lincoln, Schulze, & Renneberg, 2022). Problems in emotion regulation (ER) occur across the psychosis continuum, being present both in individuals at clinical high risk as well as in persons with a diagnosis of schizophrenia or schizo-affective disorder (Chapman et al., 2020). ER dysfunctions are linked to more severe positive and negative symptoms in early as well as in chronic psychosis (Lincoln, Sundag, Schlier, & Karow, 2018; Liu, Subramaniam, Chong, & Mahendran, 2020), thus constituting a vital area of study regarding risk for psychosis.

While previous research has largely examined how patients with psychosis differ from healthy participants in using different ER strategies with experimental (Kim et al., 2021; Strauss et al., 2013) and self-report measures (Chapman et al., 2020; Liu et al., 2020), the

emerging dynamic perspective have motivated researchers to move beyond the focus on specific ER strategy use to a more comprehensive conceptualization emphasizing more dynamic features of ER (Murphy & Young, 2018). Specifically, the ER flexibility framework proposed that regulatory flexibility reflecting the extent to which an individual dynamically varies their efforts in the use of different strategies to match the situational demands (Aldao, Sheppes, & Gross, 2015), is linked to more adaptive emotional and behavioral outcomes (Bonanno & Burton, 2013), and as such, central to regulatory success. Indirect evidence supporting the adaptive functioning of ER flexibility comes from work showing that psychological inflexibility, which refers to the lack of psychological flexibility and is defined as the inflexible, rigid responses to internal experiences, relates to many forms of psychopathology (Kashdan & Rottenberg, 2010). For example, lower levels of psychological flexibility were found to be associated with higher stress levels and more severe anxiety and depressive symptoms (Grégoire, Chénier, Doucerain, Lachance, & Shankland, 2020; Hemi et al., 2023). An emerging body of research further suggests that a greater variety in ER strategies, a well-established indicator of ER flexibility, is associated with less negative affect (NA) and less severe psychopathology symptoms in healthy populations (Blanke et al., 2019; Wang, Blain, Meng, Liu, & Qiu, 2021; Wenzel, Blanke, Rowland, & Kubiak, 2021), further supporting the position that ER flexibility represents an adaptive emotional functioning. Importantly, a recent study has reported that people with early psychosis are able to adapt their using of the different ER strategies in response to varying contextual demands (Li et al., 2023), suggesting ER flexibility in early psychosis, yet whether they use these strategies effectively requires further empirical testing.

ER and the adoption of different ER strategies to regulate emotions influences the way emotions fluctuate and change over time (i.e. emotion dynamics) (Kuppens & Verduyn, 2015). Emotional changes that are extreme and/or rigid may reflect failures in ER and are relevant for predicting negative mental health outcomes. For example, higher levels of emotional variability (i.e. the extent of emotional fluctuations), instability (i.e. the magnitude and temporal dependency of emotional fluctuations from moment to moment), and inertia (i.e. the resistance to emotional fluctuations) are found to be associated with more severe psychopathology symptoms (such as anxiety, depression, borderline personality disorder), over and above the mean levels of emotions (Houben, Van Den Noortgate, & Kuppens, 2015; Houben & Kuppens, 2020; Maciejewski et al., 2023). Disruptions in emotional dynamics have been reported with greater variability and instability, and higher inertia in NA in people with psychosis (Myin-Germeys, Delespaul, & deVries, 2000; Nowak, Wood et al., 2022b; Oorschot et al., 2013; Weermeijer et al., 2022). These alterations are already present in the early stages of psychosis (Hermans et al., 2020) and are postulated to contribute to the exacerbation and maintenance of psychotic symptoms (Krkovic, Clamor, Schlier, & Lincoln, 2020). Additionally, affective recovery, which refers to the degree to which affect returns to baseline after stress, also characterizes the temporal dynamics of emotions and is assumed to be dependent on the effectiveness of ER. The inability to regulate emotions can lead to delays in recovery. Notably, delayed recovery of NA from stressors has been uniquely related to early psychosis and not chronic psychosis (Vaessen et al., 2019), suggesting that the early stages of psychosis are particularly marked by slower NA recovery. However, despite the conceptual connections between ER flexibility and emotional dynamics, to date they have only been studied independently.

Our aim in the current study was to investigate the effectiveness of ER strategy use in early psychosis. To this end, we tested whether and how ER flexibility is related to temporal features of NA variability, instability, inertia, and recovery. Importantly, to fully capture ER strategy use and emotion dynamics in context and minimize recall biases, experience sampling methodology (ESM) was used to assess momentary fluctuations in NA, as well as ER strategy use in people with early psychosis. Acceptability and feasibility of ESM has already been demonstrated in clinical samples (Myin-Germeys et al., 2018). Importantly, one particular strength offered by the ESM approach is that it allows characterizing and disaggregating the within-person level associations (i.e. how ER flexibility relates to the different aspects of emotional dynamics within the same individual) from between-person level associations (i.e. are people with psychosis who have higher levels of ER flexibility different from those who have lower levels of ER flexibility in emotional dynamics). We hypothesized that when early psychosis individuals are more flexible in using different ER strategies, they would experience less fluctuations in NA (i.e. less variable, unstable, and inert) and recover quicker from stressors, and tested these hypotheses using both within- and between-person approaches.

Methods

Participants

One hundred and forty-eight individuals in the early stage of psychosis were recruited to participate in the INTERACT study, a multi-center randomized controlled trial investigating the efficacy of acceptance and commitment therapy in daily life (Myin-Germeys et al., 2022). All participants aged between 15 and 65 were at high clinical risk for psychosis or had a first episode of psychosis, assessed with the Comprehensive Assessment of At Risk Mental State (Yung et al., 2005) and Nottingham Onset Schedule (Singh et al., 2005). For the purpose of the current study, we used data from the baseline assessment before intervention. The trial was approved by the 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 beginning of the study. The full study methodology is detailed in the study protocol (Reininghaus et al., 2019).

Data collection

Experience sampling method

All participants participated in a 6-days ESM studies (Myin-Germeys et al., 2018; Myin-Germeys & Kuppens, 2021), in which they were prompted with 10 beeps using the PsyMate™ app (Myin-Germeys, Birchwood, & Kwapil, 2011) between 7:30 am to 10:30 pm in a 90-minute semi-random schedule, to assess momentary NA and stress. Specifically, NA was measured with five items: I feel lonely, anxious, down, guilty, and insecure, on a 1 to 7 Likert scale. The multilevel reliability (Omega coefficient) for these five NA items is 0.725 at the within-person level and 0.924 at the between-person level, indicating good reliability. Scores on these items were averaged to form a composite score representing NA at each beep. Stress was identified by asking participants at each ESM beep 'Think of the most important event for you since the last beep, this event was____',

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rated from −3 (very unpleasant) to 3 (very pleasant). In order to identify stressful events, responses to the item were excluded if they were 1 and higher (which indicated pleasant event). The item was relevant to the calculation of NA recovery only.

In addition, participants were also instructed to complete an evening questionnaire assessing ER strategy use, which was prompted between 8:00 PM and 11:00 PM throughout the ESM period. Specifically, each evening, participants reported on their use of six ER strategies (rumination, reappraisal, acceptance, expression, avoidance, situation modification), they were firstly asked to think about the most negative event of the day, then they rated each ER item on a 1–7 Likert scale (1 = 'not', 7 = "very much). Participants also indicated their experience of emotional intensity of the event: "This event was" (−3 = "very unpleasant", 3 = "very pleasant"). Days where the most negative event of the day was rated 1 or higher (which indicated positive event) were excluded from further analysis.

Statistical analyses

Measures

ER flexibility and ER effort In accordance with the framework proposed by Aldao et al. (2015) and previous evidence (Blanke *et al.* 2019; Wenzel *et al.* 2021), we operationalized ER flexibility as levels of variations in using different strategies. Both within-person and between-person parameters of ER flexibility and ER effort were calculated. Specifically, for each participant, daily ER flexibility was calculated as the average amount of variability on the use of different ER strategies on each day, i.e. the standard deviation (S.D.) of scores across the six ER items indicated in the evening assessment. Daily mean ER effort was calculated as the average scores on the six ER items in the evening assessment. Then, to get the between-person parameters, daily ER flexibility (or daily mean ER effort) over the ESM period were averaged to obtain the person-level ER flexibility (or person-level ER effort).

NA dynamics Dynamics in NA were conceptualized as variability, instability, inertia, and recovery. Specifically, we firstly calculated emotional dynamics per day, which were used to estimate within-person effects. Daily NA variability was calculated as the S.D. of NA across the ten beeps on each day (Hermans et al., 2020). Daily NA instability was calculated as root mean square of successive differences (RMSSD) between consecutive beeps, within days; daily NA inertia was calculated as the auto-regressive effect within days, i.e. NA at beep t was regressed onto NA at beep t-1. Difference scores between two observations overnight were excluded. Recovery was defined as the median time took for NA to be equal to or lower than the mean NA following the first stressor of the day. Additionally, daily mean NA was calculated as the average score across the 10 beeps of the day. Then, for each measure, scores were averaged over the ESM period, yielding a stable measure of the person-level mean of the individual, which allowed estimation of between-person effects.

Statistical models

Statistical analyses were performed using R software and R studio version 4.1.2 (R Core Team, 2021). Multilevel modeling was conducted with the lme4 (Bates, Mächler, Bolker, & Walker, 2015) and the lmerTest (Kuznetsova, Brockhoff, & Christensen, 2017) packages, each model was fitted with restricted maximum likelihood estimation. The *lm* function in R was used to fit linear regression models. To estimate the median recovery time per individual, survival analyses were conducted with the R *survival* package (Therneau, Crowson, & Atkinson, 2020), and we used the Weibull regression model to estimate the median survival time, indicative of the time till recovery (De Calheiros Velozo et al., 2023) (details see the Supplementary Material).

We used multilevel modeling (MLM) to account for the hierarchical structure of the ESM data in studying the within-person associations between ER flexibility and NA dynamics, with daily NA variability, daily NA instability, daily NA inertia, and daily NA recovery as the outcome respectively, and daily ER flexibility as the primary predictor. Additionally, daily mean ER effort and daily mean NA were entered into the models as level 1 covariates because research indicated that dynamic measures could be significantly impacted by the average levels of the same variable (Dejonckheere et al., 2019). Level 1 predictors were person-mean centered before being included to models, thus removing between-person differences. Next, linear regression models were conducted to examine between-person associations between ER flexibility and NA dynamics, with person-level NA variability, NA instability, NA inertia and NA recovery as the outcome respectively, and person-level of ER flexibility as the primary predictor. Similarly, person-level ER effort and NA were entered as covariates. Age and sex were also included in all MLM and regression models as covariates.

The study and analyses plan were preregistered after data collection, at the open science framework (https://osf.io/xjsp7/). More details of statistical analyses and deviations from the registration were described in the Supplementary Material.

Results

Participant characteristics

A total of 119 participants (67 individuals at high clinical risk, 52 individuals with a first episode of psychosis) had data in the ESM and evening questionnaire and were included in the analysis (64 female, with a median age of 24). Among participants of the final sample, the average response rate to ESM beeps was 42%, and the average response rate to the evening questionnaire was 56% (see Table 1).

The mean, standard deviations, the intraclass correlation coefficient (*ICCs*), and the within-person and between-person correlation coefficients for the variables are presented in Table 2.

Table 1. Demographic and clinical characteristics of participants

Demographic	*Mean* (S.D.)	Range
Number of participants	119	
Age (years)	24.76 (5.91)	15–46
Sex: N female (% female)	64 (54%)	
Symptom severity[a]	41.33 (8.22)	25–68
Number of beep responses[b]	25.48 (12.92)	2–55
Number of responses to the evening questionnaire[c]	3.37(1.69)	1-6

Note. [a]The severity of psychotic symptoms was measured with the 24-item Brief Psychiatric Rating Scale (BPRS, Overall and Gorham1962); [b]The number of beep responses was calculated based on responses to negative affect items; [c]The number of responses to the evening questionnaire was calculated based on responses to emotion regulation items.

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Table 2. Descriptive statistics and correlations among study variables

	Between-persons			Within-person		Correlations, *r* (within-persons above the diagonal)					
	Mean	S.D.	Range	S.D.	*ICC*	1	2	3	4	5	6
1. Mean ER effort	4.10	0.76	2.25–6	0.41	0.57	1	−0.122***	0.076***	0.081***	0.037*	−0.04*
2. ER flexibility	1.62	0.63	0–2.95	0.35	0.55	−0.02	1	0.075***	−0.07***	−0.095***	−0.01
3. Mean NA	2.69	1.08	1–5.74	0.50	0.77	0.15	−0.08	1	0.24	0.28	−0.09
4. NA variability	0.63	0.36	0–1.92	0.28	0.47	0.16	0.258**	0.504***	1	0.74	0.13
5. NA instability	0.75	0.52	0–3.2	0.36	0.52	0.16	0.329***	0.364***	0.895***	1	−0.31
6. NA inertia	−0.13	0.19	−0.6 to 0.22	0.27	0.22	0.06	0.03	−0.03	0.02	−0.188*	1

Note. ER, emotion regulation; NA, negative affect; S.D., standard deviation; ICC, intraclass correlation coefficient. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

ER flexibility and emotion dynamics

Within-person associations

For daily variability in NA, no significant associations were found with daily ER flexibility, or daily mean ER effort. Higher levels of daily mean NA were related to greater variability in NA (Table 3), suggesting that diversity in ER strategy use did not account for any significant additional variance in variability in NA than the mean level of NA or mean ER effort during the day. Age was found to be associated with lower daily variability in NA, while being female was found to be associated with higher daily variability in NA.

As predicted, lower daily instability in NA was associated with higher daily ER flexibility (Fig. 1). No significant associations between daily instability in NA and daily mean ER effort were found. Greater daily instability in NA was associated with higher levels of daily mean NA. The association between age or sex and daily instability in NA was not significant.

For daily inertia in NA, no significant within-person associations were found for daily ER flexibility, or daily mean ER effort, or daily mean NA. The association between age or sex and daily inertia in NA was not significant.

For recovery speed in NA, results from the survival analyses showed that overall, after 103 min (ranging from 101 to 204 min, S.D. = 50.15) there was a 50% chance that the participant had not yet recovered, the effect of age or sex was not significant. Cumulative stress was associated with delayed recovery in NA, beta = 0.68, $z = 3.44$, $p < 0.001$. The MLM analysis showed that higher daily ER flexibility was associated with quicker NA recovery during the day, while greater daily mean ER effort was associated with slower NA recovery. Therefore, higher flexibility rather than greater efforts in ER strategy use are related to faster recovery of NA in everyday life in people with early psychosis.

Between-person associations

Greater variability in NA was associated with higher flexibility in ER strategy use in people with early psychosis, which indicated that individuals with early psychosis who reported greater use of different ER strategies, also demonstrated higher levels of variability in NA. No significant between-person association between NA variability and ER efforts was found. The greater NA variability in early psychosis were associated with higher levels of NA in general. The association between age or sex and NA variability was not significant.

Contrary to the results of within-person associations, greater instability in NA was associated with greater flexibility in ER strategy use. No significant association between ER efforts and instability in NA was found. In addition, as predicted, the greater instability in NA in early psychosis was associated higher levels of NA. The association between age or sex and NA instability was not significant.

No significant between-person associations were found for NA inertia, with ER flexibility, or ER efforts, or NA. The association between age or sex and NA inertia was not significant.

The linear regression analysis showed no significant between-person associations between NA recovery with ER flexibility or ER effort. Thus, recovery speed of NA in early psychosis did not differ by levels of variability or average efforts in ER strategy use.

Discussion

The current study examined the within and between-person associations between ER flexibility and dynamics in NA in early

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Table 3. Results of multilevel models and linear regression models estimating associations between ER flexibility, emotional dynamic measures and affective recovery

	NA variability			NA instability			NA inertia			NA recovery[a]		
Predictors	*Estimate* (S.E.)	*t*	*p*	*Estimate* (S.E.)	*t*	*p*	*Estimate* (S.E.)	*t*	*p*	*Estimate* (S.E.)	*t*	*p*
Within-person effects												
Intercept	0.51(0.05)	11.01	<0.001	0.64(0.07)	9.26	<0.001	−0.08(0.03)	−2.74	0.006	146.74(4.07)	36.02	<0.001
ER flexibility	−0.05(0.04)	−1.28	0.203	−0.11(0.06)	−1.98	0.049	−0.01(0.04	−0.15	0.883	−17.37(6.79)	−2.56	0.012
Mean ER effort	0.03(0.03)	0.91	0.365	0.003(0.05)	0.05	0.958	−0.01(0.04)	−0.39	0.697	17.21(6.01)	2.86	0.005
Mean NA	0.12(0.04)	3.00	0.003	0.17(0.06)	2.91	0.004	−0.01(0.04)	−0.26	0.794	-	-	-
Age	−0.08(0.03)	−2.41	0.018	−0.09(0.05)	−1.74	0.086	−0.01(0.02)	−0.36	0.718	-	-	-
Sex	0.18(0.06)	2.92	0.004	0.15(0.09)	1.60	0.112	0.05(0.04)	1.33	0.183	-	-	-
Between-person effects												
Intercept	−0.21(0.18)	−1.59	0.114	−0.5(0.28)	−1.79	0.077	−0.21(0.12)	−1.77	0.08	155.72(25.24)	6.17	<0.001
ER flexibility	0.16(0.04)	3.62	<0.001	0.29(0.07)	4.05	<0.001	0.01(0.03)	0.41	0.681	0.21 (5.86)	0.04	0.971
Mean ER effort	0.042(0.04)	1.15	0.252	1.00(0.06)	1.61	0.11	0.01(0.03)	0.31	0.761	−2.84(5.70)	−0.50	0.619
Mean NA	0.17(0.03)	6.5	<0.001	0.19(0.04)	4.66	<0.001	−0.01(0.02)	−0.72	0.474	-	-	-
Age	−0.02(0.03)	−0.73	0.467	−0.05(0.05)	−1.13	0.261	0.01(0.02)	0.48	0.631	-	-	-
Sex	0.02(0.06)	0.33	0.739	−0.08(0.09)	−0.82	0.415	0.05(0.04)	1.14	0.257	-	-	-

Note. [a]In the analsysis of NA recovery, mean NA was used as the indicator of baseline level of NA, and we have already controlled for age and gender in the survival regression. ER, emotion regulation; NA, negative affect; S.E., standard errors.

psychosis. The results showed different and even opposite patterns of associations. At the within-person level, higher flexibility in ER, but not more effort, was associated with more stable NA and a quicker recovery from stressors during the day. In contrast, at the between-person level, higher flexibility in ER strategy use related to higher variability and instability in NA in early psychosis. The results provide evidence for the effectiveness of ER strategy use by showing within-person links between ER flexibility and NA instability and recovery in the early stages of psychosis. The findings also highlight the necessity of considering ER flexibility in everyday life and incorporating various emotional dynamic dimensions in evaluating regulatory effectiveness in psychosis.

ER flexibility and emotion dynamics

The results showed that greater flexibility in ER strategies was associated with lower instability of NA during the day, while no such associations were found for variability or inertia of NA. Although measures of emotional variability, instability, and inertia are mathematically and conceptually related, they capture distinct facets of emotional dynamics, with instability capturing the frequent and extreme emotional changes from one moment to the next (Jahng, Wood, & Trull, 2008). These findings also corroborate the concern regarding the relevance of emotional inertia or variability for psychosis compared to emotional instability (Nowak, Krkovic, Kammerer, & Lincoln, 2022a), as people with psychosis and healthy volunteers were differentiated on levels of emotional instability only. In addition, previous ESM studies demonstrated that more pronounced instability in NA was associated with more frequent and severe paranoia in healthy participants (Nittel et al., 2019; Nowak & Lincoln, 2021), while a longitudinal study found higher mood instability concurrently and prospectively predicted more severe psychotic experiences (Marwaha, Broome, Bebbington, Kuipers, & Freeman, 2014), further underscoring the relevance of NA instability in psychosis.

The negative within-person associations between ER flexibility and instability in NA are consistent with our hypothesis. When people in the early stages of psychosis flexibly adapt the use of different strategies to fit with the situational demands, they experience less extreme and less frequent changes in NA, suggesting regulatory effectiveness. Similarly, there is evidence supporting regulatory effectiveness in chronic psychosis, showing that the use of certain strategies was associated with subsequent reductions in NA and delusional intensity among patients with schizophrenia (Ludwig, Mehl, Krkovic, & Lincoln, 2020; Raugh, Bartolomeo, Zhang, James, & Strauss, 2023). This finding is also in line with studies in healthy populations, which show that high ER flexibility is related with a variety of desirable outcomes such as lower NA and less severe depressive symptoms (Blanke et al., 2019; Wang et al., 2021).

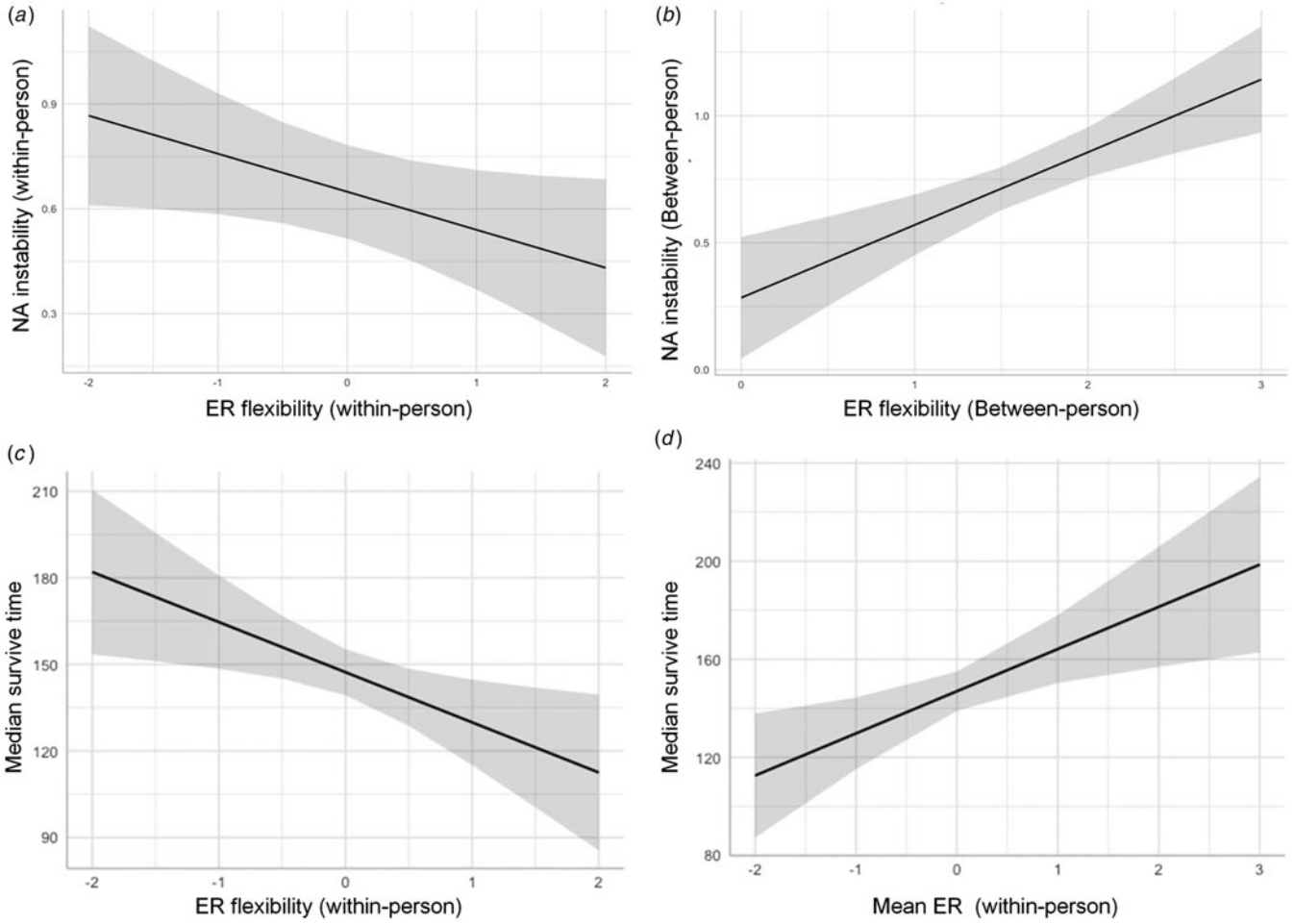

Figure 1. (a) Within-person associations between ER flexibility and instability in NA; (b) between-person associations between ER flexibility and instability in NA; (c) within-person associations between ER flexibility and NA recovery; (d) within-person associations between mean ER efforts and NA recovery.

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In support of our hypothesis, results showed that when people with early psychosis were relatively more flexible in managing their emotions elicited by the most negative event of that day, they recovered faster from stressors during the day, indicating that the more flexible ER strategy use fosters a swifter return of NA to baseline. Although previous research linked impaired recovery to early psychosis (Vaessen et al., 2019; Weintraub et al., 2019), the results suggest that this association is moderated by level of regulatory flexibility. The finding that higher regulatory flexibility relates to faster affective recovery is consistent with assumptions of the flexibility model of ER, which emphasized the value of such flexibility and links it to positive adaption (Aldao et al., 2015). Likewise, a body of work has related other forms of flexibility to adaptive outcomes, for example, experimental studies showed that people with greater expressive flexibility showed a more rapid recovery from acute pain (Feldner et al., 2006) as well as a better adjustment at a 3-year follow-up among individuals experiencing high level of cumulative life stress (Westphal, Seivert, & Bonanno, 2010). These findings are further supplemented by longitudinal studies showing that lower levels of cognitive and coping flexibility predicted more severe mental health problems during the COVID-19 pandemic (Chen & Bonanno, 2021; Hemi et al., 2023).

When people with early psychosis engaged in greater regulatory efforts, it is associated with a slower recovery during the day. That is, greater endorsement of ER strategies, did not hasten but prolong the recovery process in early psychosis. This is not surprising because a study in a healthy population has suggested that greater ER effort is an indicator of regulatory failure, revealing positive associations between ER efforts and higher levels of NA (Blanke et al., 2019). Previous work in schizophrenia suggests that the ER effort made by people with psychosis, while adequate, but might not be contextually appropriate. For example, it has been shown that relative to controls, individuals with schizophrenia reported more frequent regulatory attempts (Raugh & Strauss, 2022; Visser, Esfahlani, Sayama, & Strauss, 2018), such that they fail to select the most appropriate strategies that meet the situational demands (Raugh et al., 2023; Strauss et al., 2019). Moreover, individuals with schizophrenia have been found to switch too much and terminate too late in the regulatory process (Bartolomeo, Raugh, & Strauss, 2022). However, how people at the early stages of psychosis vary their ER efforts across the four stages of the emotion generation process and whether they differ from the healthy population warrants further investigation. Furthermore, the role of potential moderators, such as the severity of psychotic experience, in shaping ER efforts in early psychosis also requires clarification, because patients with schizophrenia have been found to report higher levels but less effective ER efforts during psychotic experiences (Kimhy et al., 2020; Strauss et al., 2019). In addition, no between-person associations were found for ER flexibility and affective recovery, thus again, ER flexibility seems to have a unique role in influencing affective recovery in everyday life, at the within-person level. These results add evidence to the emerging literature examining the different facets of ER and support that effort and flexibility capture two related but distinct dimensions.

Comparing the within- and between-person effects

When examining between-person effects, we found that people with early psychosis who reported greater variability and instability in NA showed higher flexibility in ER strategy use generally. That is, people with early psychosis who experienced highly variable and unstable NA have a tendency to search for and apply different strategies in an attempt to regulate emotions, compared to those with lower NA fluctuations. The results are corroborated by a recent study, showing that the higher levels of NA in daily life were associated with a greater desire and more attempts to regulate emotions in the healthy population (Daros et al., 2020). On the other hand, results of the within-person associations have shown that when an individual is able to flexibly apply different ERs, they seem to experience reduced daily fluctuation in NA around his/her mean. These findings support that the more diverse ER use in managing negative emotions is effective, in changing certain dynamics patterns of NA (i.e. instability and recovery) within the daily context in early psychosis.

It is noteworthy that when comparing within-person and between person effects, opposite relationships were found. For example, while higher levels of ER flexibility were positively related to instability in NA at the between-person level, negative associations were found at the within-person level. The reversed relationship, although contrary to our hypothesis, is not surprising and has been observed in other research areas (Snippe et al., 2016; Thorvaldsson et al., 2012). For example, although the between-person associations between exercise and heart rate are generally negative, within-person there is a positive association, heart rates increase during exercise (Arai et al., 1989; Fletcher et al., 1996). Therefore, these findings corroborate the view that drawing inferences about within-person effects based on between-person observations can be dangerous (Kievit, Frankenhuis, Waldorp, & Borsboom, 2013), highlighting the necessity of separating and disentangling effects that operate at different levels.

Strengths and limitations

This study has several notable methodological strengths, including different measures of emotional dynamics, adjusting for the confounding effect of mean levels of ER and emotional intensity, examining the associations at between-person level, as well as within-person level at a more micro timescale. Yet, there are also several limitations to be mentioned. First, we assessed ER strategy use at the end of the day, but NA over the entire day. The mismatch in timescales of measures of ER and affect means that this association is not temporally linked. Thus, it is possible that other factors than the way people with early psychosis respond to the most intense negative events may have influenced daily fluctuations and recovery in NA during the day. Future work might benefit by measuring ER strategy use within the same time window of NA to better account for their temporal and reciprocal relations (Blanke, Neubauer, Houben, Erbas, & Brose, 2022). Furthermore, we operationalized ER flexibility as variety in ER strategy use in a given situation. As a result, we may not have captured the full complexity of ER flexibility. The effects of other components of ER flexibility, such as context sensitivity (Battaglini et al., 2022; Li et al., 2023) in relation to psychosis requires further validation. In addition, our operationalization of recovery of NA relied on emotional responses to the first stressful event to avoid spill-over effects from previous stressors. Thus, the way how people response to other stressors later in the day was not examined. A major challenge for future studies is to account for this temporal complexity by further considering contextual demands of stressors. Also, we focused on dynamic patterns of NA only, temporal dynamic and the recovery process of positive affect might also be informative in understanding risk

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factors related to psychosis (Ader et al., 2022). Finally, one noteworthy limitation of this study is the absence of a healthy control group, which precludes the examination of whether individuals with early psychosis are as flexible and effective as a healthy population comparison population in their regulatory process.

Conclusion

In order to understand whether and how ER flexibility is associated with emotional dynamics in early psychosis, we investigated the association of ER flexibility with three commonly used dynamics measures of NA and recovery speed in NA in people with early psychosis, from a within-person and between-person perspective. Results of the within-person effects demonstrated that when people with early psychosis are more flexible in regulating emotions, they experience less abrupt changes in NA and their NA recover faster from negative events. Results of the between-person effects showed that people with early psychosis who had more variable and unstable in NA are more diverse in ER strategy use. These results add empirical evidence to the theoretical reasoning regarding adaptiveness of ER flexibility and support effectiveness of such regulatory flexibility in reducing instability in NA and foster NA recovery in early psychosis. Such findings further confirm the importance of disaggregating within-person from between-person effects, which may provide a more nuanced understanding regarding the core affective correlates of ER flexibility in early psychosis.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0033291724000151.

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Ethical standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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