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A four-wave survey to test the relative importance of schemas and metacognitive beliefs as within-person correlates of depressive symptoms

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ABSTRACT

Understanding theorized psychological mechanisms underlying depressive symptoms at the within-person level can have direct implications for how depression is formulated and targeted in therapy. The cognitive model of depression postulates schemas as central mechanisms in depression, while the metacognitive model challenges this and emphasize dysfunctional metacognitive beliefs. Previous research has investigated the relative importance of these different belief domains in depression but have in large relied on cross-sectional data or focused on between-person prospective relationships. We aimed to evaluate the relative contribution of schemas versus metacognitive beliefs to depressive symptoms at the within-person level over a four-wave survey period (with 4-week intervals) in a sample of 526 individuals. Our results showed that change in positive metacognitive beliefs and negative metacognitive beliefs about the uncontrollability of rumination, but not change in schemas, were the unique factors associated with changes in depressive symptoms over time. Moreover, change in negative metacognitive beliefs about the social consequences of rumination was significantly associated with change in schemas above and beyond the change in depressive symptoms. Our findings suggest a more relevant contribution of metacognitive beliefs than schemas to depressive symptoms at the within-person level. Clinical implications and future directions are discussed, stressing the importance of replicating these findings in clinical samples.

1. Introduction

Depression is a highly prevalent disorder that causes large economic and healthcare costs (Greenberg et al., 2021). Despite significant advances in its understanding and treatment in recent decades, relapse and recurrence rates remain high (Cuijpers, 2015) and there is a substantial proportion of treatment-resistant patients (Herrman et al., 2022). Therefore, efforts to improve our knowledge about the underlying factors in depression are imperative.

One way to better understand why people suffer from depressive symptoms is investigating the main principles of compelling theoretical models through longitudinal studies that use a within-person methodology (Curran and Bauer, 2011; Hamaker et al., 2015). Whereas research has relied mainly on between-person approaches, psychological models of depression postulate mechanisms at the within-person level (e.g., cognitive factors), so within-person statistical approaches may provide better empirical tests of theory-based hypotheses (Curran et al., 2014). In the current paper, we seek to add to previous research by applying a within-person evaluation of the relative importance of two proposed causal factors in depressive symptoms: schemas and metacognitive beliefs.

2. Schemas in depression

The cognitive model of depression (Beck, 1987) proposed a hierarchical model where three layers of cognition –schemas (or core cognitive beliefs), intermediate beliefs, and automatic thoughts– interact with each other to cause depression in a diathesis-stress approach. Schemas are at the deepest level, defined as extensive and penetrating themes of grouped elements of past behaviours that shape a perseverative framework of knowledge. These schemas (e.g., "I am worthless") are triggered by stressful situations that are consistent with them, causing negative

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automatic thoughts, emotions and maladaptive coping strategies that generate and maintain depressive mood. Thus, inflexible schemas are considered central vulnerability elements for depression (Clark and Beck, 2010) and research on Beck's model has found that depression's first-onset, severity, relapse, as well as recurrence are predicted by them (e.g., Alloy et al., 2006; Hankin et al., 2004; Strujis et al., 2013).

Drawing on Beck's cognitive model, Young proposed the term *Early Maladaptive Schemas* (EMS) as an enhanced concept of schema (Young et al., 2003). Like Beck's schemas, EMS refer to pervasive, absolutist, and enduring dysfunctional beliefs about oneself and others. However, there are differences between the two concepts, as EMS emphasize the thematic content and strong evolutionary origins of schemas (see Clarck and Guyitt, 2016). Thus, according to Young, the interplay between the child's biological temperament and acute or chronic thwarted core emotional needs, such as secure attachment, sense of identity, express needs and emotions freely, or self-control, increases individual's vulnerability and the development of EMS that persist into adulthood. Young developed the *Young Schema Questionnaire* (YSQ; Young, 2005), which assesses a large range of EMS organized into four general dimensions, according to unmet core emotional needs: 1) *Disconnection & Rejection*; 2) *Impaired Autonomy & Performance*; 3) *Excessive Responsibility & Standards*; and 4) *Impaired Limits* (Bach et al., 2018). Research using YSQ has shown that depression severity is associated with EMS (Halvorsen et al., 2009, 2010; Harris and Curtin, 2002). Likewise, cross-sectional and longitudinal literature based on non-clinical (Alba and Calvete, 2019; Calvete et al., 2012, 2015; Eberhart et al., 2011; Friedman et al., 2016) and mixed samples (Davoodi et al., 2018; Renner et al., 2012, 2013), points out that EMS are not only related to depressive symptoms but also significantly predict them. Although Young's model does not propose schema-disorder specificity, schemas that fall under the Disconnection & Rejection domain might be more salient in depression (Young and Mattila, 2002), a suggestion supported by two recent meta-analyses (Bishop et al., 2022; Tariq et al., 2021).

3. Metacognitive beliefs in depression

Despite evidence of the involvement of schema in depression, the metacognitive model of psychopathology challenges their role as central mechanisms in psychopathology (Wells, 2019; Wells and Matthews, 1994). The metacognitive approach postulates that a particular cognitive style termed the Cognitive Attentional Syndrome (CAS) is the mechanism associated with psychopathology. It involves a repetitive, persistent, and negative style of thinking, threat monitoring, and maladaptive coping strategies. In patients with major depressive disorder, the CAS can be recognized as inflexible rumination and low "meta--awareness", excessive monitoring of internal states, and unhelpful coping such as social withdrawal, resting more, and avoiding planning for the future. The CAS is directed by the *metacognitive control system* (MCS; Wells, 2019) containing knowledge and procedures applied to cognition with an aim to achieving self-regulation. In this perspective, dysfunctional metacognitive beliefs lead individuals to initiate and maintain the CAS, which in turn initiates and prolongs emotional distress (Wells, 2009). Two types of declarative metacognitive beliefs are emphasized: positive metacognitive beliefs regarding the usefulness of the CAS (e.g., "Rumination will help me find the causes of my depression") guiding people to select and continue using the CAS, and negative metacognitive beliefs about the uncontrollability, harmfulness, or social consequences of the CAS (e.g., "Ruminating about my problems is uncontrollable", "Only weak people ruminate"). According to the model, negative metacognitive beliefs are considered of greater relevance as they prohibit disengagement of the CAS which maintains symptoms and hinder individuals from discovering more adaptive ways to self-regulate (Wells, 2019).

The evidence base for a role of metacognitive factors in depressive symptoms is solid. A recent systematic review and meta-analysis (N = 10,607) showed that both positive and negative metacognitive beliefs are associated with depression cross-sectionally and longitudinally (Cano-López et al., 2022). In line with theory, negative metacognitive beliefs showed the strongest association with depressive symptoms. Specifically, negative metacognitive beliefs about the uncontrollability of thinking have received support as important in dysfunctional emotion regulation and clinical symptoms, cross-sectionally and longitudinally (Salguero and Ramos-Cejudo, 2023). Likewise, research using a within-person approach showed that a reduction of metacognitive beliefs and maladaptive coping strategies during the COVID-19 pandemic was associated with greater subsequent improvement in depressive symptoms (Ebrahimi et al., 2022).

4. Schemas versus metacognitive beliefs in depression

While both schemas and metacognitive beliefs have received independent empirical support as mechanisms of depression, only a few studies have examined their relative contribution, yielding mixed results. Furthermore, these previous studies have focused exclusively on schemas as conceptualized in Beck's cognitive model, and there is a lack of evidence from studies assessing EMS.

Two studies that used a nonclinical sample and a cross-sectional design, Yilmaz et al. (2015) and Huntley and Fisher (2016), found that metacognitive beliefs, mainly negative, were the strongest contributors and explained depressive symptoms above and beyond core cognitive beliefs. Also using a nonclinical sample but a longitudinal design, Hjemdal et al. (2013) found that only automatic thoughts contributed independently to future levels of depressive symptoms. The remaining two studies used clinical samples and a longitudinal design. Jelinek et al. (2017) found that only metacognitive beliefs about the need to control thoughts mediated the intervention outcome for participants receiving metacognitive training. Conversely, Faissner et al. (2018) found that both core cognitive and metacognitive beliefs were predictors of depressive symptoms (clinician-rated and self-reported) over a 3.5-year interval.

To our knowledge, only one study has used a within-person approach in a nonclinical sample. Strand and colleagues (2024) found that metacognitive beliefs, mainly negative, were more relevant than core cognitive beliefs in predicting depression over time. They also tested if metacognitive beliefs were predictors of core cognitive beliefs beyond depressive symptoms over time, a hypothesis suggested by the metacognitive model and supported by the data. However, Strand and colleagues measured worry-related and generic metacognitive beliefs rather than rumination-specific, which is more specifically related to depressive symptoms.

5. The present research

Hence, to date, no study has tested the relative importance of schemas measured with the YSQ and metacognitive beliefs associated with rumination in depressive symptoms over time within individuals, which, therefore, was the aim of the present study.

According to Young's model, change in schemas is expected to predict depressive symptoms (Young et al., 2003). Conversely, according to the metacognitive approach, change in metacognitive beliefs is expected to predict depressive symptoms, even after controlling for schemas (Wells, 2019). Based on the metacognitive approach, we hypothesized that metacognitive beliefs would be more reliably associated with depressive symptoms than schemas. Specifically, we expected that negative metacognitive beliefs about uncontrollability will be particularly important, as they enhance general emotional distress by contributing to perseverative thinking and preventing flexible self-regulation (Wells, 2019). Moreover, the metacognitive framework suggests that the activation of schemas may be a by-product of the CAS and biases in the metacognitive control system (Wells, 2019). Subsequently, we explored whether the within-person change over time in schemas could be associated with variations in metacognitive beliefs when controlling for

variance in depressive symptoms.

6. Methods

6.1. Participants and procedure

A total of 526 individuals consented to and participated at time 1 (79.3 % female and 20.2 % male and .6 % missing value), ranging from 18 to 78 years old ($M = 29.03$, $SD = 11.44$). Regarding civil status, 205 (39 %) reported to be single, 191 (36.3 %) in a stable romantic relationship, 45 (8.6 %) in a romantic relationship for less than one year, 67 (12.7 %) were married, 14 (2.7 %) reported to be divorced, 1 (.2 %) widowed, and 4 (.8 %) missing value. In terms of occupational status, 267 (50.8 %) reported they were students, 124 (23.6 %) were working, 38 (7.2 %) were self-employed, 30 (5.7 %) were part-time workers, 24 (4.6 %) were unemployed, 17 (3.2 %) were part-time students, 10 (1.9 %) were retired, and 16 (3.0 %) missing value. In total, 188 (35.8 %) had high-school or below as their highest completed education, 150 (28.5 %) reported having a university degree, 118 (22.4 %) had a master's degree, 64 (12.2 %) had a Certificate of Higher Education, and 6 (1.1 %) gave no information. At time 2, 324 individuals participated, 277 at time 3, and 211 at time 4.

Participants were gathered at convenience to participate in an online survey administered four times with a 4-week interval between each assessment. Participants had to be 18 years old or above and be able to read Spanish. The study was advertised through several social media platforms as Facebook, Instagram, or Twitter. University lessons were also used to gather participants, undergraduate students were asked to take part in a study aiming to examine the relationships between cognitive and emotional variables over time. They were verbally informed about the study, which was voluntary, anonymous, and confidential, there was no compensation for participating. All participants provided informed consent electronically and the survey were then administered and completed individually through the online platform SurveyMonkey. It should be considered that the time-limit for the first round of data-collection was set to two-weeks, and the same time-window was set for the subsequent time-point assessments. The ethical committee of the Málaga University approved the study (Ref. 15-2023-H).

6.2. Instruments

Patient-Reported Outcomes Measurement Information System; Depression domain (PROMIS; Cella et al., 2007). The PROMIS is an 8-item self-report measure that appraises the severity of depressive symptoms (e.g. "I felt worthless"). Responses range from 1 = "Never" to 5 = "Always". The total score varies from 8 to 40 and was used as the primary outcome in the present study. Findings showed good psychometric properties and validity in both the original and the Spanish version of PROMIS (Cella et al., 2007; Vilagut et al., 2019). The internal consistency coefficients in the present study ranged from Cronbach's α .93 to .95 and McDonald's ω .93 to .95 between the four time points.

Positive Beliefs about Rumination Scale (PBRS; Papageorgiou and Wells, 2001b). The PBRS is composed of 9 items that measure positive metacognitive beliefs about rumination (e.g., "Rumination about the past helps me work out how things could have been done better"). Respondents indicate the extent to which they agree with each item on a scale ranging from 1 = "Do not agree" to 4 = "Agree very much". Total score ranges from 9 to 36, higher scores indicate greater endorsement of positive metacognitive beliefs. Internal consistency and test-retest reliability coefficients were good in both the original (Papageorgiou and Wells, 2001b) and the Spanish version (Cano-López et al., 2021). In the current study the internal consistency ranged from Cronbach's α .93 to .96 and McDonald's ω .93 to .96 between the four time points.

Negative Beliefs about Rumination Scale (NBRS; Papageorgiou and Wells, 2001a). The NBRS is composed of 13 items that evaluate negative metacognitive beliefs about ruminative thinking. In the present study we used the three-factor structure found in recent studies (Cano-López et al., 2021; Zhou et al., 2023): The subscale of uncontrollability contains 3 items that assess the uncontrollability of rumination (e.g., "I cannot stop myself from ruminating"); the harm subscale is composed of 5 items that assess its harmfulness (e.g., "Ruminating can make me harm myself"); and the social consequences subscale, contains 5 items that assess metacognitive beliefs about its interpersonal consequences (e.g., "People will reject me if I ruminate). Using a 4-point scale, 1 = "Do not agree" to 4 = "Agree very much", participants state the extent to which they agree on each item, higher scores indicate higher levels of metacognitive beliefs. The validity and reliability of the NBRS was good in the original (Luminet, 2004; Papageorgiou and Wells, 2001a) and the Spanish version (Cano-López et al., 2021). In the current study the internal consistency between the four time points ranged from Cronbach's α .83 to .88 and McDonald's ω .83 to .88 for uncontrollability, from Cronbach's α .80 to .84 and McDonald's ω .80 to .83 for harm, and from Cronbach's α .79 to .85 and McDonald's ω .81 to .85 for social consequences.

Young Schema Questionnaire-Short Form (YSQ-SF; Young and Brown, 1994). The YSQ-SF is composed of 75 items (e.g., "I worry that people I feel close to will leave me or abandon me", "I'm unworthy of the love, attention, and respect of others"), which assess 15 early maladaptive schemas using a 6-point scale, 1 = "Completely untrue for me" to 6 = "Describes me perfectly". In the present study, we used shortened version where eight early maladaptive schemas (two items for each schema), belonging to the dimensions of Disconnection & Rejection (*Emotional deprivation, Mistrust/Abuse, Emotional inhibition, Defectiveness/Shame, Social isolation*) and Impaired Autonomy & Performance (*Dependence/Incompetence, Failure,* and *Abandonment/Instability*), were assessed. The original and the Spanish version of the YSQ-SF have shown good internal consistency, test-retest reliability, and convergent and discriminant validity (Cid and Torrubia, 2002; Schmidt et al., 1995). In the current study, between the four time points, the internal consistency ranged from Cronbach's α .90 to .92 and McDonald's ω .90 to .92 for Disconnection & Rejection, and from Cronbach's α .84 to .87 and McDonald's ω .83 to .86 for Impaired Autonomy & Performance.

6.3. Statistical analyses

Prior to the main analyses, we investigated whether constructs retain the same meaning across measurement points. Therefore, we test configural invariance to confirm that the overall factor structure is consistent, and metric invariance to ensure that the relationships between items and the underlying construct remain stable, and that the meaning of the constructs have not changed across time. A two-level multilevel model (MLM) for longitudinal data (Heck and Thomas, 2015; Raudenbush and Bryk, 2002; Singer et al., 2003) was used to analyse change in the outcome variables over time in Mplus software. Full-information Maximum Likelihood (FIML) method with robust estimator (MLR) was used for all available data. The MLM accounts for correlations among repeated measurements nested within individuals when examining within-person changes and between-person differences and the relationship with other variables. For all outcome variables, we estimated two unconditional models: 1) *the unconditional means model* with no predictors at either level, and 2) the *unconditional growth model* with time as the only level-1 predictor and no substantive predictors at level-2 to examine whether there is systematic variation in the outcome variable over time and how much variation there is both within- and between-persons, respectively. Thus, providing a baseline model for evaluating the success of subsequent model building and the inclusion of predictors (Singer et al., 2003). Next, we estimated a model including the time-varying effects of covariates. The effects of time-varying covariates were fixed across people for model parsimony and person-mean-centering was used to capture the within-person part of their effects in all models.

Change in depression symptoms was the outcome variable in the first set of analyses, while i) *metacognitive beliefs* (i.e., positive beliefs, and subdomains of negative beliefs – uncontrollability, harm and social consequences) and ii) *schemas* (i.e., Disconnection & Rejection and Impaired Autonomy & Performance domains) were included as within-person time-varying predictors. Disconnection & Rejection was the outcome variable in the second set of analyses while, i) *metacognitive beliefs* (i.e., positive beliefs, uncontrollability, social consequences, and harm), ii) *depression symptoms,* and iii) Impaired Autonomy & Performance were included as within-person time-varying predictors. Finally, Impaired Autonomy & Performance was the outcome variable in the third set of analyses while, i) *metacognitive beliefs* (i.e., positive beliefs, uncontrollability, social consequences, and harm) and ii) *depression symptoms,* and iii) Disconnection & Rejection were included as within-person time-varying predictors. We evaluated the predictive strengths of each time-varying predictor against the others to determine the most important predictors of within-person changes in the outcome variables over time.

7. Results

7.1. Missing data analysis

The completeness of data for each covariance of scores between two variables indicates the proportion of available data. At any given point, the maximum coverage reached 100 % of participants, while the minimum was 31 %. Table S1 in the Supplementary Material provides an overview of the covariance coverage pattern. Further analyses of missing data revealed no significant differences in T1 scores between participants who completed the study and those who dropped out at T2–T4 (Supplementary Material, Table S2). Additionally, logistic regression was used to assess the extent to which earlier variables (T1–T3) predicted attrition at later time points (T2–T4). If variables included in the analysis were linked to attrition, it would suggest that dropout did not occur completely at random (i.e., missing completely at random, MCAR). However, results indicated that logistic regression models were largely non-significant in predicting attrition at subsequent time points (Supplementary Material, Table S3). These systematic evaluations of missing data suggest that data were missing at random, supporting the use of Full-Information Maximum Likelihood (FIML). FIML is widely regarded as an advanced missing data handling technique that enhances both accuracy and statistical power in analyses (Schafer and Graham, 2002).

7.2. Descriptive preliminary findings

Table 1 summarizes the means, standard deviations, and Pearson correlations across time for outcome variables. Fig. S1 in the Supplementary Material illustrates observed individual trajectories for a randomly selected subset of completers ($n = 45$) for outcome measures. For depressive symptoms, the means and standard deviations followed a simple trend, showing a decline in symptom levels alongside increased variation across individuals. However, the means and standard deviations for Disconnection & Rejection and Impaired Autonomy & Performance did not exhibit a consistent pattern. Despite this, individual trajectory plots revealed a general similarity in variability around the intercepts and the rate of change.

We investigated the consistency of measurement models across time using longitudinal measurement invariance. For depression symptoms, model fit across time was acceptable for the unconstrained configural ($\chi^2 = 653.04$, $df = 80$, $p < .001$; RMSEA = .15; CFI = .93) and the constrained metric ($\chi^2 = 668.69$, $df = 101$, $p < .001$; RMSEA = .14; CFI = .93) models, although the RMSEA was above acceptable threshold. Change in model fit was not significant ($\Delta\chi^2 = 15.65$, $df = 12$, $p = .79$). Model fit for Disconnection & Rejection were acceptable for configural ($\chi^2 = 93.86$, $df = 20$, $p < .001$; RMSEA = .11; CFI = .98) and the constrained metric ($\chi^2 = 110.09$, $df = 32$, $p < .001$; RMSEA = .09; CFI = .98). Change in model fit was not significant ($\Delta\chi^2 = 16.23$, $df = 12$, $p = .18$). Impaired Autonomy & Performance were measured by three items resulting in a just identified configural model. The constrained metric model ($\chi^2 = 13.44$, $df = 6$, $p < .05$; RMSEA = .06; CFI = .99) resulted in marginal deterioration ($\Delta\chi^2 = 13.44$, $df = 6$, $p = .04$) of model fit.

7.3. Results for depressive symptoms

Model A in Table 2 presents the results of the unconditional means model for depressive symptoms, indicating notable variability both within and between individuals, with an intra-class correlation (ICC) of .67. The estimated within- and between-person reliability using multilevel omega (ωwithin = .87 and ωbetween = .98) as recommended for time-varying constructs (Geldhof et al., 2014) were good. Model B, representing the unconditional growth model, showed significant within-person variance as well as variance in the intercept, but not in the slope at the between-person level. Model C introduced time-varying predictors, resulting in a significantly improved model over Model B, -2ΔLL (6) = 182.52, $p < .001$. To interpret the variability in random intercepts and slopes, 95 % confidence intervals for random effects were computed as *CI = fixed effect ± 1.96*SQRT [random effect variance]*. The model estimated that 95 % of individuals would have depressive symptom intercepts between 6.45 and 30.03 and linear changes between −1.57 and .97. This suggests that while some individuals experienced an increase in symptoms, others showed a decline, and some remained stable over time. Furthermore, only the within-person effects of positive metacognitive beliefs and negative metacognitive beliefs regarding uncontrollability were significantly associated with depressive symptoms over time, with no significant difference in their relative predictive strength ($\beta = .23$, $p = .134$).

7.4. Results for Disconnection & Rejection

Model A in Table 3 presents the unconditional means model for Disconnection & Rejection, showing significant within-person and between-person variability, with an ICC of .85. The estimated within- and between-person reliability were .65 and .92, respectively. Model B, representing the unconditional growth model, indicated significant variability at both levels, including the intercept and slope. Model C, incorporating time-varying predictors, showed a significant improvement over Model B, -2ΔLL (6) = 178.17, $p < .001$. The model predicted that 95 % of individuals would have Disconnection & Rejection intercepts between 1.77 and 38.97 and linear changes between −1.28 and 1.34, meaning some individuals experienced increases in Disconnection & Rejection, others saw decreases, and some remained stable. Additionally, negative metacognitive beliefs regarding social consequences and the Impaired Autonomy & Performance dimension were both significantly associated with Disconnection & Rejection over time, with no significant difference in their relative predictive power ($\beta = .19$, $p = .203$).

7.5. Results for Impaired Autonomy & Performance

Model A in Table 4 presents the unconditional means model for Impaired Autonomy & Performance, revealing substantial within-person and between-person variability, with an ICC of .79. The estimated within- and between-person reliability were .51 and .79, respectively. Model B, which tested the unconditional growth model, showed significant variability at the within-person level and in the intercept at the between-person level, but not for the slope. Model C, which incorporated time-varying predictors, represented a significant improvement over Model B, -2ΔLL (6) = 202.67, $p < .001$. The model estimated that 95 % of individuals would have Impaired Autonomy & Performance intercepts ranging from 1.75 to 24.95 and linear changes between −1.07 and 1.31. This suggests that some individuals exhibited a

Table 1
Table of means, standard deviations, skewness, kurtosis and Pearson correlations across time for key variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
DEP_T1																												
DEP_T2	.73**																											
DEP_T3	.71**	.74**																										
DEP_T4	.64**	.62**	.64**																									
PBRS_T1	.34**	.27**	.37**	.38**																								
PBRS_T2	.36**	.33**	.33**	.36**	.67**																							
PBRS_T3	.41**	.34**	.42**	.40**	.70**	.76**																						
PBRS_T4	.34**	.38**	.37**	.48**	.75**	.76**	.82**																					
NBRS_1_T1	.51**	.50**	.51**	.38**	.39**	.45**	.44**	.43**																				
NBRS_1_T2	.49**	.51**	.49**	.31**	.37**	.45**	.39**	.36**	.75**																			
NBRS_1_T3	.60**	.61**	.63**	.45**	.47**	.51**	.55**	.48**	.77**	.80**																		
NBRS_1_T4	.45**	.47**	.51**	.48**	.45**	.46**	.53**	.55**	.68**	.68**	.76**																	
NBRS_2_T1	.36**	.40**	.34**	.34**	.07	.15*	.14*	.14	.55**	.46**	.41**	.38**																
NBRS_2_T2	.43**	.45**	.41**	.30**	.11	.13*	.11	.14	.54**	.57**	.47**	.40**	.72**															
NBRS_2_T3	.44**	.49**	.50**	.38**	.18**	.18**	.18**	.25**	.52**	.53**	.55**	.46**	.63**	.71**														
NBRS_2_T4	.47**	.52**	.52**	.46**	.18*	.17*	.19*	.21**	.53**	.53**	.56**	.57**	.63**	.76**	.77**													
NBRS_3_T1	.44**	.47**	.47**	.50**	.20**	.33**	.32**	.30**	.50**	.49**	.50**	.46**	.60**	.52**	.53**	.58**												
NBRS_3_T2	.51**	.51**	.50**	.45**	.26**	.29**	.26**	.28**	.56**	.58**	.54**	.54**	.52**	.60**	.51**	.64**	.75**											
NBRS_3_T3	.48**	.52**	.54**	.50**	.26**	.25**	.30**	.27**	.53**	.52**	.60**	.49**	.46**	.49**	.62**	.62**	.72**	.75**										
NBRS_3_T4	.50**	.51**	.56**	.56**	.27**	.19*	.30**	.28**	.51**	.45**	.55**	.61**	.42**	.42**	.52**	.63**	.66**	.72**	.79**									
DR_T1	.53**	.48**	.51**	.46**	.28**	.39**	.38**	.42**	.45**	.45**	.53**	.45**	.35**	.37**	.36**	.38**	.52**	.53**	.47**	.37**								
DR_T2	.54**	.55**	.53**	.50**	.29**	.42**	.41**	.44**	.53**	.51**	.60**	.49**	.35**	.38**	.38**	.44**	.57**	.57**	.57**	.49**	.86**							
DR T3	.57**	.55**	.56**	.53**	.33**	.44**	.40**	.45**	.55**	.56**	.56**	.49**	.38**	.44**	.42**	.44**	.58**	.63**	.59**	.50**	.87**	.92**						
DR T4	.55**	.56**	.54**	.57**	.31**	.36**	.38**	.47**	.43**	.43**	.51**	.55**	.32**	.34**	.34**	.47**	.53**	.57**	.55**	.55**	.82**	.83**	.84**					
IAP_T1	.53**	.50**	.54**	.43**	.28**	.31**	.32**	.25**	.51**	.50**	.52**	.48**	.45**	.50**	.48**	.56**	.53**	.57**	.55**	.48**	.66**	.58**	.61**	.57**				
IAP_T2	.57**	.59**	.61**	.56**	.28**	.36**	.36**	.37**	.61**	.60**	.61**	.54**	.47**	.52**	.49**	.58**	.58**	.63**	.57**	.53**	.63**	.66**	.69**	.59**	.82**			
IAP_T3	.54**	.53**	.62**	.48**	.29**	.36**	.40**	.37**	.53**	.57**	.59**	.55**	.40**	.49**	.52**	.55**	.54**	.56**	.59**	.53**	.61**	.64**	.71**	.59**	.77**	.88**		
IAP_T4	.49**	.55**	.54**	.54**	.30**	.33**	.39**	.41**	.49**	.46**	.50**	.60**	.37**	.43**	.43**	.55**	.54**	.56**	.58**	.60**	.50**	.54**	.57**	.68**	.73**	.77**	.77**	
Mean	18.41	17.83	17.8	17.15	20.93	18.7	18.71	18.75	6.07	5.91	6.14	5.76	9.91	9.67	9.74	9.42	6.85	6.87	6.93	6.87	20.57	20.31	20.64	21.54	13.51	13.27	13.51	13.9
SD	7.07	7.25	7.39	7.39	7.31	7.05	7.25	7.62	2.49	2.52	2.65	2.51	3.65	3.61	3.66	3.55	2.68	2.63	2.81	2.75	10.19	10.11	10.21	10.95	6.54	6.34	6.82	7.04
Skewness	.53	.63	.79	.66	.01	.23	.23	.34	.74	.68	.61	.75	.54	.60	.62	.75	1.89	1.74	1.83	1.87	1.12	1.12	1.11	.9	1.14	1.12	1.16	1.01
Kurtosis	-.38	-.42	.13	-.34	-.95	-.93	-.97	-.86	-.19	-.46	-.59	-.26	-.49	-.49	-.34	.01	3.72	2.78	3.48	3.92	.63	.65	.52	-.06	.91	.80	.94	.33

Note: *$p < .05$, **$p < .01$; DEP = Depressive symptoms; PBRS = Positive Beliefs about Rumination Scale; NBRS_1= Uncontrollability; NBRS_2 = Harm; NBRS_3 Social Consequences; DR = Disconnection & Rejection; IAP = Impaired Autonomy & Performance.

decline in Impaired Autonomy & Performance, while others experienced increases or remained stable over time. Within-person effects of positive metacognitive beliefs, negative metacognitive beliefs about the uncontrollability of rumination and social consequences, depressive symptoms, and Disconnection & Rejection all were significantly associated with Impaired Autonomy & Performance over time. Notably, negative metacognitive beliefs about social consequences were stronger predictors than both positive metacognitive beliefs ($\beta = .19$, $p < .05$) and depressive symptoms ($\beta = .20$, $p < .05$). Similarly, Disconnection & Rejection had a greater predictive effect than positive metacognitive beliefs ($\beta = .23$, $p < .001$) and depressive symptoms ($\beta = .25$, $p < .001$).

8. Discussion

The current study aimed to examine the relative importance of schemas and metacognitive beliefs on depressive symptoms over time, as well as to test whether metacognitive beliefs were associated with schemas beyond depressive symptoms by disaggregating within-person variance from between-person variance. Our multilevel model includes time-varying covariates, which allow us to examine whether within-person changes are associated across the four waves, but does not determine temporal ordering or causality.

Regarding our first aim, changes in metacognitive beliefs, but not in schemas, were associated with changes in depressive symptoms over time after controlling for the overlap between variables. Specifically, only positive metacognitive beliefs and negative beliefs about the uncontrollability of rumination were significantly associated, with the effect of uncontrollability being of greater magnitude. This finding is in line with a previous study that highlighted the importance of metacognitive beliefs, especially about the uncontrollability and danger of worry, as a stronger within-person factor associated with depressive symptoms (Strand et al., 2024). While previous studies have relied on measurements based on Beck's formulation of schemas, we found these results assessing schemas with the YSQ. Together, these findings suggest a distinct contribution of metacognitive beliefs over different conceptualizations of schemas. Furthermore, using the three factors of NBRS allowed us to examine the unique effect of uncontrollability beliefs separated from other negative metacognitive beliefs about rumination. As expected, this was the metacognitive belief domain that was significantly associated to depressive symptoms.

Schemas were not significantly associated with depressive symptoms beyond metacognitive beliefs. This finding contrast with previous research that found that core cognitive beliefs have a specific contribution to depression longitudinally (Faissner et al., 2018) and at the within-person level (Strand et al., 2024). Some features of our study may help explain these discrepancies. First, unlike previous between-person research, the longitudinal within-person methodology used does not necessarily mirror mechanisms at the between-person level but rather address information about how individuals change relative to themselves, which is the most relevant level of specificity to psychotherapy models. Second, in contrast to the within-person study by Strand et al. (2024), we used the PBRS/NBRS rumination-specific measures to assess metacognitive beliefs, which are more specifically linked to depression compared to the metacognition's questionnaire (MCQ-30; Wells and Cartwright-Hatton, 2004). Thus, specificity in metacognitive belief domains is likely relevant to formulate different symptom types (e.g., anxiety versus depression). Finally, unlike previous studies, we assessed schemas using YSQ, and these might be less relevant maintenance factors of depressive symptoms, at least in comparison to dysfunctional metacognitive beliefs about rumination.

This finding is in line with the metacognitive framework, since it considers biases in the metacognitive system as the main factor in emotional distress and disorders (Wells, 2019). Moreover, the metacognitive model emphasizes the relevance of metacognitive beliefs about uncontrollability as predictors of general emotional distress by perpetuating the CAS, which is in consonance with our results and previous research (Salguero and Ramos-Cejudo, 2023).

Furthermore, we found that changes in metacognitive beliefs were significantly associated with the changes in schemas at the within-person level over time. Specifically, metacognitive beliefs about the social consequences of rumination were associated to the dimension of Disconnection & Rejection, while both positive and negative

Table 2
Results of Fitting a Taxonomy of Multilevel Models for Change in Depressive symptoms.

		Parameter	Model A	Model B	Model C
Fixed effects					
Initial status		γ_{00}	18.03***	18.42***	18.24***
Rate of change		γ_{10}		−.48***	−.30*
PBRS		γ_{20}			.08*
NBRS_Uncontrollability		γ_{30}			.31*
NBRS_Harm		γ_{40}			.13
NBRS_Social consequences		γ_{50}			.22
Disconnection & Rejection		γ_{60}			.10
Impaired Autonomy & Performance		γ_{70}			.14
Variance components					
Level 1	Within-person	σ_ε^2	16.92***	15.49***	14.39***
Level 2	Initial status	σ_0^2	34.41***	36.04***	36.16***
	Rate of change	σ_1^2		.64	.42
	Covariance	σ_{01}		−.86	−.81
Goodness fit					
	LL		−3947.115	−3937.843	−3810.672
	AIC		7900.230	7887.686	7645.344
	BIC		7915.599	7918.424	7706.534

Note: PBRS Positive Beliefs about Rumination Scale, NBRS Negative Beliefs about Rumination Scale. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 3
Results of fitting a taxonomy of multilevel models for change in Disconnection & Rejection.

		Parameter	Model A	Model B	Model C
Fixed effects					
Initial status		γ_{00}	20.40***	20.51***	20.37***
Rate of change		γ_{10}		−.14	.03
PBRS		γ_{20}			.04
NBRS_Uncontrollability		γ_{30}			.14
NBRS_Harm		γ_{40}			.11
NBRS_Social consequences		γ_{50}			.36**
Depressive symptoms		γ_{60}			.07
Impaired Autonomy & Performance		γ_{70}			.55***
Variance components					
Level 1	Within-person	σ_ε^2	15.48***	13.49***	10.11***
Level 2	Initial status	σ_0^2	85.82***	89.96***	90.06***
	Rate of change	σ_1^2		1.19*	.45
	Covariance	σ_{01}			
Goodness fit					
	LL		−4021.163	−4015.412	−3894.329
	AIC		8048.326	8042.824	7812.658
	BIC		8063.623	8073.419	7873.848

Note: PBRS Positive Beliefs about Rumination Scale, NBRS Negative Beliefs about Rumination Scale. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 4
Results of fitting a taxonomy of multilevel models for change in impaired Autonomy & Performance.

		Parameter	Model A	Model B	Model C
Fixed effects					
Initial status		γ_{00}	13.45***	13.51***	13.35***
Rate of change		γ_{10}		−.09	.12
PBRS		γ_{20}			.09**
NBRS_Uncontrollability		γ_{30}			.19*
NBRS_Harm		γ_{40}			.04
NBRS_ Social consequences		γ_{50}			.26**
Depressive symptoms		γ_{60}			.06*
Disconnection & Rejection		γ_{70}			.31***
Variance components					
Level 1	Within-person	σ_ε^2	9.13***	7.49***	5.68***
Level 2	Initial status	σ_0^2	33.57***	35.12***	35.03***
	Rate of change	σ_1^2		−1.14	.37
	Covariance	σ_{01}			−.12
Goodness fit					
	LL		−3607.674	−3598.406	−3471.382
	AIC		7221.347	7208.812	6966.764
	BIC		7236.645	7239.408	7027.954

Note: PBRS Positive Beliefs about Rumination Scale, NBRS Negative Beliefs about Rumination Scale. *$p < .05$, **$p < .01$, ***$p < .001$.

metacognitive beliefs –the subscales about uncontrollability and social consequences of rumination– and depressive symptoms were associated to the dimension of Impaired Autonomy & Performance. These results are in line with previous studies that found that worry-related metacognitive beliefs predicted dysfunctional attitudes (after controlling depressive symptoms) (Strand et al., 2024) and social self-beliefs at the between-person level (after controlling for social anxiety) (Nordahl et al., 2022). Similarly, a randomized clinical trial comparing metacognitive therapy (MCT) and Cognitive-behavioural therapy (CBT) for major depressive disorder found that, even without addressing them directly, MCT was superior to CBT in changing core cognitive beliefs (Callesen et al., 2020).

These findings are consistent with the hypothesis that metacognitive factors are relevant to the endorsement of schemas. The metacognitive model (Wells, 2019) suggests that the CAS directed by underlying metacognitive beliefs will influence and bias the content of thoughts. The endorsement of maladaptive schemas and frequency of negative thoughts can in this perspective be understood as a by-product of the CAS. For instance, it is possible that people holding the belief that rumination has negative social or interpersonal consequences (which was the most relevant predictor of cognitive beliefs in our study) will engage in self-regulatory strategies such as rumination that is ineffective and back-fire, which further will strengthen negative cognitive beliefs about the self and influence how the individual acts in social settings or relate to interpersonal stressors. However, future studies should also consider the possibility of criterion contamination between the schemas assessed in our study and metacognitive beliefs about social consequences, as the wording of some items is similar. Nonetheless, our finding that changes in metacognitive beliefs were associated with changes in schemas beyond depression symptoms is in line with the first reported by Strand et al. (2024) suggesting that the relevance of metacognition to understanding individual differences in self-beliefs warrants further investigation.

Finally, in our secondary analysis we found that depressive symptoms were uniquely associated with Impaired Autonomy & Performance over time. This result is in line with previous longitudinal studies that have found a unidirectional link from depressive symptoms to cognitive beliefs (Wang et al., 2023) or negative automatic thoughts (LaGrange et al., 2011). Further, a recent systematic review found evidence of bidirectional relationships between mental health and core cognitive beliefs (assessed with the YSQ), suggesting that experiencing symptoms (e.g., of depression) might reinforce schemas and consolidate them as psychopathological markers in youth (Nicol et al., 2020).

Clinical implications could be derived from the study, as a within-person approach may provide relevant information to clinicians when treating individuals (Curran et al., 2014; Hamaker and Wichers, 2017). The cognitive and metacognitive approach has developed different treatment approaches focused on different levels, content-level versus metacognitive-level, respectively. Thus, whereas CBT is focused on the modification of the *content* of schemas through cognitive restructuring and behavioural strategies (Beck and Dozois, 2011), MCT is focused on creating change in the higher-order system of metacognitions, changing top-down influences on cognitive *processes* and strategies with an aim to improve mental regulation (Wells, 2009). Both approaches have proven to be effective for depression (Andersson et al., 2024; Basile et al., 2018; Cuijpers et al., 2023a, 2023b; Normann and Morina, 2018). However, our findings and other studies (e.g., Strand et al., 2024) point to metacognitive beliefs as the more central mechanisms underlying depression, which are in line with results from Callesen et al.'s (2020) RCT study were MCT was superior to CBT for individuals with major depressive disorders. Modifying metacognitive beliefs and corresponding CAS-strategies seems to be a promising way to reduce depressive symptoms and could also influence on the content and nature of schemas.

There are some limitations to the current study. First, we use a convenience sample, and the results might not generalize to other settings including those with major depressive disorder. Second, the potential clinical implications of the findings should be interpreted cautiously, since we used self-reported measures, which can throw different results compared to clinician administered tools (Levis et al., 2020) and when used in clinical samples. Third, there was a considerable attrition across the four time points, although missing data analyses showed no significant differences between completers and non-completers. While using FMIL with robust estimation to deal with missing data, we note that attrition can result in impaired reliability and limited generalizability of the results, and caution is warranted in interpreting them. Differences in measurement reliability and variance across constructs may have contributed to differences in the observed predictive associations. Our estimates of multilevel reliability indicated high within- and between-person reliability for depressive symptoms (ωwithin = .87, ωbetween = .98), moderate to high reliability for Disconnection & Rejection (ωwithin = .65, ωbetween = .92), and relatively lower reliability for Impaired Autonomy & Performance (ωwithin = .51, ωbetween = .79). These differences suggest that depressive symptoms were measured more consistently both across individuals and over time, likely enhancing the precision of estimated associations involving this construct. In contrast, the lower within-person reliability for Impaired Autonomy & Performance indicates greater measurement error in capturing change over time, which could have attenuated associations involving this variable. While some differences in predictive strength across outcomes were statistically significant, others were not, and this may partially reflect the varying degrees of reliability across measures. In particular, the relatively stronger associations observed for depressive symptoms may reflect both true effects and more precise measurement. Lastly, the time lag between data points can influence study results, as variable lag schedules can yield different results from fixed ones (Anyan et al., 2020; Selig and Little, 2012). About 80 % of the participants were females, therefore, future research should consider equal gender distribution. Likewise, future clinical studies could exhaustively corroborate our results and test whether cognitions are an output of the CAS, examining also potential mediational effects.

In conclusion, the present study examined the relative contribution of schemas and metacognitive beliefs on depressive symptoms within-persons in a nonclinical sample. We also tested the role of metacognitive beliefs for schemas. The results showed that metacognitive beliefs, specifically positive beliefs about rumination and negative beliefs regarding the uncontrollability of rumination, were associated with depressive symptoms over time. Furthermore, changes in metacognitive beliefs were associated with changes in schemas beyond depression symptoms. Thus, our results point towards metacognitive beliefs as a central target in the treatment of depression, a finding that should be further examined in clinical samples and settings.

CRediT authorship contribution statement

Julia B. Cano-López: Writing – review & editing, Writing – original draft, Investigation, Data curation, Conceptualization. **Henrik Nordahl:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Esperanza García-Sancho:** Writing – review & editing, Writing – original draft, Investigation, Data curation, Conceptualization. **Frederick Anyan:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **José M. Salguero:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Conceptualization.

Availability of data

Data available on request from the authors.

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Declaration of competing interest

The authors whose names are listed immediately below declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2025.10.038.

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