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Metacognitive beliefs prospectively predict level of personality functioning beyond maladaptive personality traits within-individuals: Results from a four-wave longitudinal study

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ABSTRACT

Identifying within-person dynamic factors influencing personality functioning (operationalized as self- and interpersonal functioning) above maladaptive personality traits could increase the applicability of the alternative DSM-5 model and help inform clinical interventions of personality difficulties. Founded in the metacognitive model of psychological disorders, we conducted a four-wave longitudinal survey study, where 1418 individuals aged 18 or above were recruited using convenience sampling. We used latent growth modelling to investigate whether metacognitive beliefs, emphasized as a mechanism of disorder in the metacognitive model, predicted the trajectory of self- and interpersonal functioning within individuals over time beyond baseline maladaptive personality traits. The results were that all personality traits were significantly associated with self- and interpersonal functioning at baseline, except for anankastia for the self-factor. Further, all metacognitive belief domains except cognitive self-consciousness for the interpersonal functioning factor showed an additional contribution across self- and interpersonal functioning over time. Overall, negative metacognitive beliefs was the strongest individual predictor among the metacognitive domains followed by cognitive confidence. These findings suggests that targeting metacognitions could be relevant for treatment aiming to increase personality functioning even beyond maladaptive personality traits. Treatment implications related to the within-person level of analysis based on these results are briefly discussed.

1. Introduction

Level of personality functioning (LPF) is a general and dimensional personality disorder severity feature. It entails core impairments in self and interpersonal functioning proposed as criterion A when diagnosing personality disorders (PD) in the Alternative DSM-5 Model (American Psychiatric Association, 2013). The B criteria of the AMPD specifies a set of maladaptive personality traits (e.g., negative affectivity and disinhibition) intended to capture stable "styles" observed in PDs. Evidence suggests that an increase in maladaptive traits parallels increase in PD severity with some arguing that criterion A and B overlap to the extent that they might account for each other (Bastiaens et al., 2021; Morey et al., 2022). Further, maladaptive traits have been criticized in terms of clinical utility because they tend to be relatively stable over time, may be less amendable to change, and less predictive of therapeutic outcomes compared to severity measures (Hopwood, 2018; Wright et al., 2016). Therefore, identifying factors that dynamically influence and relate to individuals' LPF above and beyond established trait-domains could be of great relevance to inform clinical practice and further research (Hopwood, 2018).

Although not emphasized in the current proposal of the AMPD, "metacognition" has been proposed as an important marker for personality functioning. Constructs sometimes labelled "metacognitive" such as "mentalization" and "emotional schemas" have further been linked to PDs (Bateman & Fonagy, 2016; Edwards et al., 2022; Katznelson, 2014). However, which constructs that are "true metacognitive" is debated (e.g., Capobianco & Wells, 2018; Moritz & Lysaker, 2018) and differing operationalizations of metacognition is a challenge within

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psychology as a field. Metacognition operationalized as "cognition applied to cognition" was in clinical psychology first emphasized in the Self-Regulatory Executive Functioning model (S-REF model; Wells & Matthews, 1994; Wells, 2019). This model suggests that dysfunctional metacognitive beliefs are the most central mechanism of psychopathology in general (see Capobianco & Nordahl, 2023 for a brief history of the model). Metacognitive beliefs have been found to be significantly elevated compared to healthy controls across a variety of psychiatric diagnoses (Sun et al., 2017), including higher for patients with PDs compared to patients without PDs (Spada et al., 2021). They further correlate with interpersonal problems (Nordahl et al., 2021; Strand et al., 2018; Strand, Hjemdal, et al., 2023; Strand, Nordahl, et al., 2023), trait-anxiety (Nordahl et al., 2019) and are associated with a low self-esteem (Solheim et al., 2024). While the link between metacognitions and personality difficulties is less explored, a recent cross-sectional study (Strand et al., 2024) reported unique correlations between LPF and metacognitive beliefs in the form of uncontrollability beliefs and cognitive confidence even when controlling maladaptive personality traits and other relevant covariates. This is interesting given that metacognitions can effectively be modified with the potential of increasing individuals' personality functioning, independently of personality trait-configuration.

Using longitudinal data, the current study aims to test metacognitive beliefs as prospective within-person predictors of LPF when controlling for baseline maladaptive personality traits. In agreement with a large body of research associating maladaptive personality traits to LPF we expected them to be significantly associated with both baseline levels and the developmental trajectory of LPF. Because of their documented stability over time (Vergauwe et al., 2023) these were treated as time-invariant predictors in our analyses. We further expected metacognitive beliefs to dynamically relate to the trajectory of LPF above and beyond the maladaptive traits with beliefs about the uncontrollability and danger of worry as the most important domain based on its theoretical and empirically supported significance for maladaptive self-regulation (Wells, 2019).

2. Methods

2.1. Participants and procedure

An online survey advertised through social media platforms administered 4 times separated by 5 weeks intervals was conducted. Participants were gathered at convenience and had to be 18 years or above and able to read Norwegian to participate. No other inclusion or exclusion criteria was employed. All participants provided informed consent to participate. The study was approved by the Regional Committees for Medical and Health Research Ethics (Ref nr: 467342) and registered with the Norwegian Centre for Research data (Ref nr: 686857). Our targeted sample size was to have enough participants to ensure statistical power for conducting Structural Equation Modelling over the four time points with no upper limit (of note, the time-limit for the first round of data-collection was set to two weeks, participants answering in this time-window could participate). The sample at time 1 consisted of 1418 individuals where 669 (47.2 %) were men, 728 (51.3 %) women, 14 (1.0 %) identified as non-binary, and 4 (0.3 %) answered that these categories did not fit how they identified, and 3 (0.2 %) provided no information. As our study did not entail any specific hypotheses related to gender or gender-identification, only participants reporting to be male or female were included. The mean age of the sample were 29.75 years ($SD = 11.67$, range = 18–79). A total of 753 (53.1 %) were in a relationship, cohabitants or married, and 774 (54.5 %) had a university degree of 3 years or more as their highest completed education. In terms of mental health problems, 478 (33.7 %) reported having been diagnosed with a mental disorder during their lifetime.

2.2. Measures

The Level of Personality Functioning Scale Brief Form 2.0 (LPFS-BF; Weekers et al., 2019) has 12 items measuring impairment in self- and interpersonal functioning in agreement with the 12 facets of the LPFS in Section III (DSM-5; American Psychiatric Association, 2013) measuring Criterion A. In the current study the internal consistency was good ($\alpha = 0.84$, $\omega = 0.83$) for the self-domain and acceptable ($\alpha = 0.73$, $\omega = 0.72$) for the interpersonal domain.

The Personality Inventory for DSM-5 and ICD-11 – Brief Form Modified (PID5BF + M; Kerber et al., 2022) measures six dimensional maladaptive personality traits each containing 6 items (36 items in total): Negative affectivity, Detachment, Antagonism, Disinhibition, Psychoticism, and Anankastia. In the current study the internal consistency for the traits were acceptable to good (α = 0.73–0.83, ω = 0.74–0.83).

The Metacognitions Questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) measure five domains of dysfunctional metacognitive beliefs with 6 items for each domain (30 in total). The internal consistency for the subscales in the current study were acceptable to good: positive metacognitive beliefs ($\alpha = 0.84$, $\omega = 0.84$), negative metacognitive beliefs ($\alpha = 0.87$, $\omega = 0.87$), cognitive confidence ($\alpha = 0.89$, $\omega = 0.89$), need for control ($\alpha = 0.76$, $\omega = 0.76$), and cognitive self-consciousness ($\alpha = 0.81$, $\omega = 0.81$).

2.3. Data analyses

Systematic analyses of missing data patterns and trajectory plots were examined prior to the main analyses. Statistical analyses were performed in Mplus 8.9 (Muthén & Muthén, 1998-2023), using Structural Equation Modelling (SEM) with Full-information Maximum Likelihood (FIML) method and robust estimation (MLR). In the first stage of the analyses, well-fitting latent growth curve models (LGCM) were used to determine the overall trajectory of both outcome variables (i.e., self and interpersonal domains). The LGCM was used to describe the initial status and the rate of change of the outcome variables through two latent variables – *intercept* and *slope* growth factors. In the second stage of analyses, maladaptive personality traits were introduced into the growth models to explain between-person differences in the initial status and rate of change. In the third stage, the time-varying effect of dysfunctional metacognitive beliefs were then introduced as dynamic predictors of the variation in self and interpersonal functioning over time.

Growth factors and known baseline time-invariant covariates represent level 2 effects (or between-person differences) while the exogenous time-varying effect of dysfunctional metacognitive factors represent level 1 effects (or time level variations). The following fit indices determined adequate fit: Standardized Root Mean Square Residual (SRMSR <0.08), Root Mean Square Error of Approximation (RMSEA ≤ 0.06) (Browne & Cudeck, 1993) Comparative Fit Index (CFI ≥ 0.90) and a non-Normed Fit index (NNFI; aka TLI ≥ 0.90) (Hu & Bentler, 1999). Mplus codes and output from analyses can be freely accessed here osf.io/5em8a.

3. Results

3.1. Analysis of missing data patterns

Incomplete data patterns can be represented as the proportion of data or coverage for each covariance of scores between two variables. The highest available data was 99 % of the participants and the lowest coverage was 35 %. Tables S1 in the Supplementary Material show the pattern of data covariance coverage. Additional missing data analyses revealed that there were no differences between completers and non-completers at T2 – T4 with respect to T1 scores (Table S2). We also used logistic regression to estimate the extent to which variables in

previous times (i.e., T1 – T3) predict attrition from subsequent times (T2 – T4). If variables in the analysis model are related to attrition, it is unlikely that dropout occurred completely at random (i.e., resulting in data that are missing completely at random, MCAR). The results indicated that the logistic regression models were not significant in the extent to which variables in previous times predict attrition from subsequent ones (Table S3). Finally, Little's Missing Completely at Random (MCAR) test supported missing at random: self ($\chi^2 = 16.82$, $df = 18$, $p = .535$), and interpersonal functioning ($\chi^2 = 16.04$, $df = 18$, $p = .590$).

These results support random missingness in the data, and the plausibility of FIML. FIML is regarded as a state-of-the-art missing data technique because it improves the accuracy and the power of the analyses relative to other missing data handling methods (Schafer & Graham, 2002).

3.2. Preliminary results

Table 1 presents the means, standard deviations, and correlations across time for all outcome variables. Fig. S1 in the Supplementary Material is a display of observed individual trajectory plots for a random sub-sample ($n = 50$) of the participants in both outcome variables. The means and standard deviations show a simple pattern with decreases in self- and interpersonal functioning over time, coupled with increases in variation. The correlations over time also present a simple pattern with most correlations suggesting a relatively high level of stability of individual differences (e.g., $r > 0.50$).

3.3. Unconditional growth model of self- and interpersonal functioning

For self-functioning, the linear growth model indicated a very good fit between the model and data ($\chi^2 = 2.06$, $df = 5$; $p = .84$; $SRMR = 0.01$; $RMSEA = 0.00$; $CFI = 1.00$; $TLI = 1.00$). The intercept ($b = 12.53$, $p < .001$) and slope growth factor ($b = -0.09$, $p < .01$) were all significant, with significant variance estimates, (17.39, $p < .001$) and (0.15, $p < .05$), indicating significant individual differences in the initial levels and the declining rate of change over time. The R^2 values (i.e., explained variance) ranged between 86.30 % to 91.20 %. Similarly, the model fit for interpersonal functioning was very good ($\chi^2 = 4.74$, $df = 5$; $p = .45$; $SRMR = 0.01$; $RMSEA = 0.00$; $CFI = 1.00$; $TLI = 1.00$). The intercept was significant ($b = 9.65$, $p < .001$), but not the slope ($b = 0.03$, $p \leq .249$). The variance of the intercept was significant (7.39, $p < .001$), but not the slope growth factor (−0.01, $p = .819$), indicating significant individual differences in the initial levels, but not the rate of change over time. As the variance of the slope growth factor was not significant and negative, it was fixed to zero without worsening fit ($\chi^2 = 19.04$, $df = 7$; $p < .01$; $SRMR = 0.06$; $RMSEA = 0.03$; $CFI = 0.99$; $TLI = 0.99$). The R^2 values ranged between 75.90 % to 83.0 %.

3.3.1. Conditional growth models with time-invariant and time-varying covariates

The model with the baseline time-invariant covariates (LGCM-TIC) showed an adequate fit to the data for self- ($\chi^2 = 19.31$, $df = 17$; $p = .31$; $SRMR = 0.01$; $RMSEA = 0.01$; $CFI = 0.99$; $TLI = 0.99$) and interpersonal functioning ($\chi^2 = 41.01$, $df = 25$; $p < .05$; $SRMR = 0.04$; $RMSEA = 0.02$; $CFI = 0.99$; $TLI = 0.99$) as was the model with the time-varying effect of dysfunctional metacognitive beliefs included (LGCM-TIC and TVC) for self- ($\chi^2 = 98.45$, $df = 77$; $p = .05$; $SRMR = 0.01$; $RMSEA = 0.01$; $CFI = 0.99$; $TLI = 0.99$), and interpersonal functioning ($\chi^2 = 81.06$, $df = 85$; $p = .60$; $SRMR = 0.01$; $RMSEA = 0.00$; $CFI = 1.00$; $TLI = 1.00$). Parameter estimates for both LGCM – TIC, and LGCM – TIC and TVC models are shown in Table 2. Fig. 1 shows the final LGCM – TIC and TVC model.

Baseline maladaptive personality trait variables were not regressed on the slope growth factor for interpersonal functioning since it was fixed. Antagonism predicted higher self-functioning ($b = -0.09$, $p < .01$), but worse interpersonal functioning ($b = 0.06$, $p < .05$) at baseline. Anankastia did not predict self-functioning ($b = 0.03$, $p = .17$), but significantly predicted greater interpersonal dysfunction ($b = 0.09$, $p < .001$). Negative affectivity, detachment, disinhibition, and psychoticism all predicted worse self- and interpersonal functioning.

In the model including the time-varying effect of dysfunctional metacognitive beliefs, the explained variance in self-functioning ranged between 88.0 % to 93.0 % from 86.0 % to 92 % in the model without dysfunctional metacognitive beliefs, indicating additional variance explained. With dysfunctional metacognitive beliefs included, psychoticism no longer predicted worse self-functioning ($b = 0.02$, $p = .44$), antagonism still predicted higher self-functioning ($b = -0.08$, $p < .05$), and anankastia was still not significant ($b = 0.00$, $p = .86$). However, for interpersonal functioning, only negative affectivity was no longer significant ($b = 0.00$, $p = .88$).

Most importantly, the controlled effect of dysfunctional metacognitive beliefs on self-and interpersonal functioning ranged between $b = 0.01$ and $b = 0.22$, with standardized coefficient as effect sizes ranging between $\beta = 0.03$ and $\beta = 0.23$ for self-functioning, but $\beta = 0.04$ and $\beta = 0.13$ for interpersonal functioning. Cognitive self-consciousness did not uniquely predict interpersonal functioning over time ($b = 0.01$, $p = .68$) and was the weakest predictor for self-functioning over time ($b = 0.03$, $p < .05$). All the other dysfunctional metacognitive belief domains positively and uniquely predicted self- and interpersonal functioning over time, indicating that dysfunctional metacognitive beliefs predict personality functioning over and above maladaptive personality traits.

3.3.2. Relative importance of dysfunctional metacognitive factors over time

To get more insight into the relative strength of prediction over time, we evaluated the predictive strengths of each dysfunctional metacognitive belief-domain against the others to determine the most important predictors of the *within-person* effects on self- and interpersonal functioning over time. For self-functioning, the effect of negative beliefs about uncontrollability and worry was significantly greater than positive beliefs about worry ($b = 0.18$, $p < .001$), need to control thoughts ($b = 0.13$, $p < .001$), cognitive confidence ($b = 0.09$, $p < .001$), and cognitive self-consciousness ($b = 0.19$, $p < .001$). The effect of cognitive confidence was also greater than cognitive self-consciousness ($b = 0.09$, $p < .001$), and the effect of positive beliefs about worry was lesser than cognitive confidence ($b = -0.08$, $p < .01$). For interpersonal

Table 1
Descriptive statistics and correlations for variables in repeated assessments.

Variable		*M*	*SD*	1	2	3	4	5	6	7	8
1	Self_T1	12.54	4.45	–							
2	Self _T2	12.54	4.54	0.87**	–						
3	Self _T3	12.44	4.62	0.85**	0.87**	–					
4	Self _T4	12.42	4.68	0.87**	0.89**	0.89**	–				
5	Interpersonal_T1	9.64	3.17	0.55**	0.52**	0.49**	0.54**	–			
6	Interpersonal_T2	9.75	3.19	0.56**	0.58**	0.55**	0.56**	0.80**	–		
7	Interpersonal_T3	9.75	3.31	0.59**	0.59**	0.61**	0.59**	0.79**	0.84**	–	
8	Interpersonal_T4	9.86	3.48	0.57**	0.59**	0.58**	0.62**	0.82**	0.84**	0.83**	–

Note.
** $p < .01$.

Table 2
Parameter estimates for LGCM with time-invariant and time varying covariate models.

	Time-invariant covariate model						Time-invariant with time varying covariate model					
	Self-functioning			Interpersonal functioning			Self-functioning			Interpersonal functioning		
	Est	*S. E*	*p*	*Est*	*S. E*	*p*	*Est*	*S. E*	*p*	*Est*	*S. E*	*p*
Intercept	6.71	0.15	0.000	5.69	0.01	0.000	3.31	0.25	0.000	3.92	0.22	0.000
Slope	−0.09	0.05	0.088	0.03	0.03	0.277	−0.04	0.05	0.437	0.05	0.02	0.047
Intercept variance	6.55	0.40	0.000	3.72	0.21	0.000	5.71	0.37	0.000	3.62	0.21	0.000
Slope variance	0.19	0.07	0.007				0.15	0.05	0.005			
Intercept with Slope	−0.07	0.13	0.602				−0.20	0.11	0.065			
Intercept predicted by												
Negative affectivity	0.47	0.02	0.000	0.09	0.02	0.000	0.27	0.03	0.000	0.00	0.02	0.884
Detachment	0.37	0.02	0.000	0.32	0.02	0.000	0.29	0.02	0.000	0.28	0.02	0.000
Antagonism	−0.09	0.03	0.003	0.06	0.03	0.020	−0.08	0.03	0.011	0.06	0.03	0.012
Disinhibition	0.19	0.03	0.000	0.14	0.02	0.000	0.13	0.03	0.000	0.11	0.02	0.000
Anankastia	0.03	0.02	0.168	0.09	0.02	0.000	0.00	0.02	0.862	0.07	0.02	0.001
Psychoticism	0.09	0.03	0.004	0.09	0.02	0.000	0.02	0.03	0.442	0.05	0.02	0.026
Slope predicted by												
Negative affectivity	−0.01	0.01	0.434				0.00	0.01	0.657			
Detachment	0.00	0.01	0.721				0.00	0.01	0.726			
Antagonism	−0.02	0.01	0.151				−0.01	0.01	0.141			
Disinhibition	0.01	0.01	0.372				0.00	0.01	0.657			
Anankastia	0.01	0.01	0.319				0.01	0.01	0.295			
Psychoticism	0.00	0.01	0.670				0.00	0.01	0.965			
Time varying effects on outcome												
Negative beliefs							0.22	0.02	0.000	0.09	0.02	0.000
Positive beliefs							0.04	0.02	0.028	0.04	0.02	0.010
Lack of cognitive confidence							0.12	0.02	0.000	0.07	0.01	0.000
Need to control thoughts							0.09	0.02	0.000	0.06	0.02	0.004
Cognitive self-consciousness							0.03	0.02	0.038	0.01	0.01	0.680

Note: The variance for the slope was fixed to zero in the model for interpersonal functioning as it was negative and non-significant.

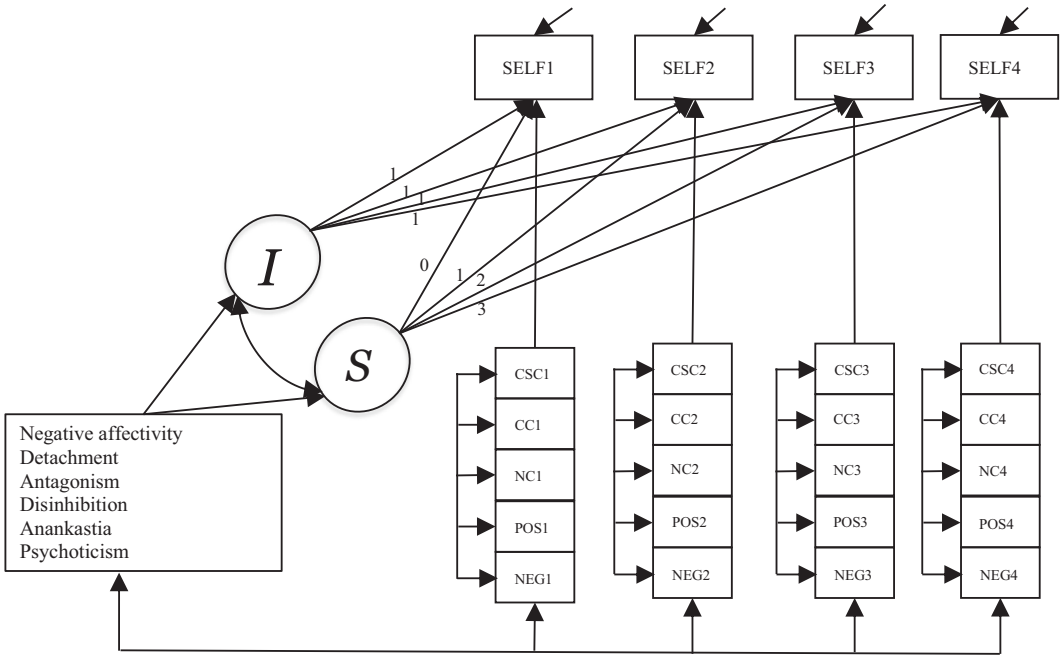

Fig. 1. Latent growth curve model with Time-invariant and Time-varying covariates
Notes: I = Intercept growth factor; S = Slope growth factor. SELF = Self-functioning (Self-functioning was replaced with Interpersonal functioning in separate model). NEG = Negative beliefs about the uncontrollability and danger of worry, POS = Positive beliefs about worry, NC = Need to control thoughts, CC = Lack of cognitive confidence, CSC = Cognitive self-consciousness.

functioning, the effect of negative beliefs about uncontrollability and worry was significantly greater than positive beliefs about worry (b = 0.05, $p < .05$). All other comparisons were non-significant. See Table 3.

4. Discussion

This study set out to test metacognitive beliefs as prospective predictors of LPF when controlling maladaptive personality traits. In line with our hypothesis, we found that all trait domains except anankastia for self-functioning showed unique and significant relationships with self- and interpersonal functioning. After including metacognitive beliefs to the model, all trait domains still contributed as unique predictors of baseline LPF except for anankastia which was still non-significant for self-functioning, psychoticism no longer predicted self-

Table 3
Relative importance of dysfunctional metacognitive beliefs over time.

Comparisons	Self			Interpersonal		
	Est	*S. E*	*p*	*Est*	*S. E*	*p*
Negative beliefs – Positive beliefs	0.18	0.03	0.000	0.05	0.02	0.040
Negative beliefs – Need to control thought	0.13	0.03	0.000	0.03	0.03	0.348
Negative beliefs – Cognitive confidence	0.09	0.02	0.000	0.02	0.02	0.458
Negative beliefs – Cognitive self-consciousness	0.19	0.03	0.000			
Positive beliefs – Need to control thoughts	−0.05	0.03	0.112	−0.02	0.03	0.511
Positive beliefs – Cognitive confidence	−0.08	0.02	0.001	−0.03	0.02	0.183
Positive beliefs – Cognitive self-consciousness	0.01	0.03	0.777			
Need to control thoughts – Cognitive confidence	−0.04	0.03	0.206	−0.01	0.03	0.657
Need to control thoughts – Cognitive self-consciousness	0.05	0.03	0.076			
Cognitive confidence – Cognitive self-consciousness	0.09	0.02	0.000			

Note: Since cognitive self-consciousness did not significantly predict interpersonal functioning over time, it was not compared with any metacognitive factor.

functioning, and negative affectivity also no longer predicted interpersonal functioning. Contrary to our hypothesis, none of the maladaptive traits measured at time 1 were predictive of the trajectory in self-functioning over time. Further, in support of our hypothesis, all metacognitive belief domains except cognitive self-consciousness for interpersonal functioning showed a unique contribution such that higher levels of dysfunctional metacognitive beliefs were predictive of worse self- and interpersonal functioning whilst controlling baseline maladaptive traits. Negative metacognitive beliefs was as hypothesized overall the strongest individual predictor among the metacognitive belief domains in addition to cognitive confidence.

The finding that most maladaptive traits were significantly related to LPF at baseline is in line with previous research supporting a relationship between LPF and maladaptive personality traits (Bastiaens et al., 2021; Morey et al., 2022). Anankastia which measures tendencies towards perfectionism and rigidity did not account for significant variance in baseline self-functioning. However, as argued by Stricker et al. (2022) anankastia might not capture important aspects of for instance perfectionism which they found to explain variance in personality dysfunction above and beyond maladaptive personality traits. Further, when including metacognitive beliefs, the association between psychoticism and self-functioning became non-significant which suggests that metacognition accounted for this association in the current sample. This could be due to psychoticism being a relatively low-frequent problem in the current sample and that previous research have found this trait to show weak discriminant validity from non-specific distress (Crego et al., 2015). The same pattern occurred between negative affectivity and interpersonal functioning suggesting that metacognitive beliefs accounted for this association. Metacognitive beliefs have been found to be significantly related to interpersonal problems above and beyond attachment styles and neuroticism (Nordahl et al., 2021) and to predict change in interpersonal problems among patients with social anxiety disorder (Strand, Nordahl, et al., 2023) which indicates that they could be an important vulnerability factor underlying interpersonal dysfunction. The maladaptive personality traits at baseline did not predict the trajectory of LPF, however this was at the between-person level and little change occurred for the LPF at this level over time in the sample.

Metacognitive beliefs and especially negative metacognitive beliefs about the uncontrollability and danger of worry and a lower cognitive confidence contributed to the development of both self- and interpersonal dysfunction above and beyond baseline levels of maladaptive personality traits. Negative metacognitive beliefs showed clear evidence of significant superiority among the metacognitive beliefs for self-functioning which aligns with the underlying theory and empirical evidence implicating them as universal mechanisms of psychological disorder and dysfunction (Sun et al., 2017; Wells, 2019). Lower cognitive confidence further showed some superiority as a predictor for self-functioning indicating that memory confidence contributes to self-functioning. The current findings align with a cross-sectional study (Strand et al., 2024) where negative metacognitive beliefs and cognitive confidence were found to significantly explain unique variance in LPF above and beyond personality traits, emotional distress symptoms, and general psychosocial functioning. However, the current study makes an incremental contribution by demonstrating the same pattern longitudinally and at the within-person level. The metacognitive model posits that a Metacognitive Control System (MCS; Wells, 2019) influence strategic self-regulatory efforts. Dysfunctional self-regulatory strategies are in this framework collectively called the Cognitive Attentional Syndrome (CAS; Wells, 2009) and consists of perseverative thinking styles such as worry and rumination, inflexible self-attention/threat monitoring (e.g., looking for signs of disapproval from others), and unhelpful coping behaviors (e.g., avoidance, drug-use and invasive behavior). In this framework, interpersonal functioning and behaviors can thus be viewed as part of or resulting from the CAS (e.g., worrying is perceived as uncontrollable and avoiding social interactions with others is thus used to regulate worry and anxiety) thus impairing an individual's capacity to relate and cooperate with others. Further, Wells (2019) suggests that dysfunctional metacognition could lead to experiences of a “disturbed” self, identity, or self-directedness. Additionally, the CAS (which relies on metacognition) itself could strengthen or sustain negative self-beliefs. For example, rumination and self-criticism can activate and strengthen negative self-beliefs and impair self-confidence (Wells, 2009). In support of this suggestion, a study by Nordahl et al. (2022) found a unidirectional and preceding contribution from metacognitive beliefs to negative social self-beliefs. Further, a recent cross-sectional study found that stronger endorsements of dysfunctional metacognitions were associated with more use of unhelpful metacognitive strategies (i.e., the CAS) which further was significantly related to lower self-esteem even when controlling for psychiatric symptoms and personality traits (Solheim et al., 2024).

The current findings have important implications by demonstrating that metacognitive beliefs contribute to personality functioning over time beyond maladaptive personality traits and at the within-person level which is especially relevant for clinicians who work with mechanisms within individuals. Targeting dysfunctional metacognitive beliefs, and especially negative metacognitive beliefs about cognitive control, which is the central target in Metacognitive therapy (MCT; Wells, 2009) have previously demonstrated large clinical effects on interpersonal problems (e.g., Nordahl et al., 2016; Nordahl et al., 2018; Strand, Veium, et al., 2023; Strand & Nordahl, 2024), comorbid PDs in treatment of depression (Hagen et al., 2017; Hjemdal et al., 2017), and on global self-esteem (Strand, Veium, et al., 2023). Increased mental regulation capabilities corresponding to adaptive content and functioning of the MCS (Wells, 2019) may be important for psychological functioning in general, including personality functioning. Hence, further research should evaluate if MCT can be a feasible and effective treatment of personality dysfunction and disorder.

Several limitations should be acknowledged. We utilized a convenience sample, and primarily relied on self-report measures. When researching LPF the use of several methods of measurement including clinician-administered interviews has been encouraged. Self-report can further mask elements of in example maladaptive personality traits as self-other agreement on these traits have been found to be moderate (Bottesi et al., 2018). Attrition across the time-points were substantial, however we used state of the art methods FIML for handling missing

data. Although we asked the participants of any received lifetime psychiatric diagnosis, no formal diagnostic procedures or interviews were conducted. Further, we did not have more specific information regarding what types of disorders they had received. We could therefore not isolate for instance participants who reported having received a diagnosis of personality disorder, limiting the generalizability to clinical populations. Future research should take these limitations into account and replicate findings in clinical samples using multi-method designs.

5. Conclusion

In conclusion, this is the first study to show that metacognitive beliefs, and especially negative metacognitive beliefs and cognitive confidence are unique predictors of LPF beyond maladaptive personality traits over time within individuals. Dysfunctional metacognitions could therefore be valuable targets in interventions seeking to increase personality functioning and MCT, which directly aim to modify metacognitive beliefs, should be evaluated as a treatment for personality problems.

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CRediT authorship contribution statement

Eivind R. Strand: Writing – original draft, Project administration, Investigation, Conceptualization. **Frederick Anyan:** Writing – review & editing, Methodology, Formal analysis. **Odin Hjemdal:** Writing – review & editing, Supervision, Project administration. **Hans M. Nordahl:** Writing – review & editing, Supervision, Project administration. **Henrik Nordahl:** Writing – review & editing, Supervision, Project administration, Investigation, Conceptualization.

Declaration of competing interest

The authors confirm that they have no conflict of interest to declare.

Data availability

The anonymized data from the current study will be made available upon reasonable request, however, the participants did not consent to the data being made publicly available limiting sharing of the data in an open digital repository.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2024.112812.

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