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Nilsson, Kristine Kahr; Nygaard, Signe; Ebsen, Simone; Østergård, Ole Karkov

RESEARCH ARTICLE

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Valence in the eyes: An emotion decoding profile of adults with major depressive disorder and a history of childhood maltreatment

Kristine Kahr Nilsson | Signe Nygaard | Simone Ebsen | Ole Karkov Østergård

Department of Communication and Psychology, Aalborg University, Aalborg, Denmark

Correspondence
Kristine Kahr Nilsson, Department of Communication and Psychology, Psychotherapy Research Unit, Aalborg University, Teglgaards Plads 1, Aalborg 9000, Denmark.
Email: kkn@ikp.aau.dk

Abstract

Background: Individuals with major depressive disorder (MDD) and childhood maltreatment have been proposed to constitute a subgroup with worse illness course and outcomes. To elucidate a potential social cognitive vulnerability in this subgroup, this study compared the emotion decoding abilities of MDD patients with and without a history of childhood maltreatment.

Methods: Participants with a diagnosis of MDD were recruited from nationwide mental health organizations. Emotion decoding abilities were assessed using the Reading the Mind in the Eyes Test, while childhood maltreatment was measured with the Adverse Childhood Experiences Questionnaire.

Results: The MDD patients with a history of childhood maltreatment exhibited poorer emotion decoding abilities than MDD patients without such past. This difference applied specifically to the decoding of positive and negative emotions, while no group differences emerged for the decoding of neutral emotions. When specific maltreatment types were considered as predictors only emotional neglect was associated with lower emotion decoding abilities. These associations remained when adjusting for demographic and clinical covariates.

Conclusions: By indicating that emotion decoding difficulties characterize the MDD subgroup with childhood maltreatment, the findings highlight a potential vulnerability that merits further examination in terms of its developmental antecedents and prognostic relevance.

KEYWORDS
adverse childhood experiences, depression, emotion decoding, emotion understanding, Reading the Mind in the Eyes Test, theory of mind

1 | INTRODUCTION

Major depression disorder (MDD) is a common mental disorder with an estimated lifetime prevalence of 15% (World Health Organization, 2017). For many individuals, MDD involves recurrent depressive episodes, decreased functioning and lower quality of life (Hirschfeld et al., 2000). Although several attempts have been made to identify specific aetiological processes, the findings have often

been inconsistent (Fried & Nesse, 2015). Such inconsistencies likely reflect that MDD is a heterogeneous mental disorder with considerable individual variation in symptomatology, course, treatment response, and neurobiology (Flint & Kendler, 2014). Rather than reflecting a single disease entity, MDD can be conceived as a spectrum of symptoms caused by different factors and subsuming different forms (Antonijevic, 2006; Harald & Gordon, 2012; Hays et al., 1995). An increasing number of studies have, therefore, attempted to delineate subtypes of MDD. Most of this research has focused on subtypes based on symptomatology, illness course, or neurobiology (Beijers et al., 2019; Harald & Gordon, 2012; Liang et al., 2020; Nguyen et al., 2022). In recent years, developmental history has also become of interest as a subtype marker in MDD. It has been proposed that a history of childhood adversity constitutes an ecophenotypic subtype within major mental disorders, including MDD (Teicher & Samson, 2013). Childhood adversity refers to adverse life events, circumstances, and experiences that seriously threaten a child's physical or psychological well-being and development (McLaughlin et al., 2017). A subcategory of childhood adversity is childhood maltreatment which involves abuse and neglect that results in actual or potential harm to the child's survival, health, and dignity in the context of a relationship of responsibility, trust, or power (World Health Organization, 2022). In most cases, maltreated children are maltreated by their parents (Sedlak et al., 2010).

Longitudinal studies have consistently suggested that childhood maltreatment, such as childhood neglect or abuse, increases the risk of MDD later in life (Li et al., 2016). It has been estimated that 46% of MDD patients report a history of childhood maltreatment (Nelson et al., 2017). Studies have found that the subgroup of MDD patients with childhood maltreatment tends to have an earlier age of onset, greater depression severity, more depressive recurrences, and respond less to standard treatments (Nelson et al., 2017). Therefore, emerging research has begun to investigate the vulnerabilities that characterize this subgroup and potentially explain their more severe and retractable illness course (Vallati et al., 2020). Much of this research has focused on neurobiological markers suggesting that sensitization of the neuroendocrine stress response (Heim et al., 2008), hippocampal atrophy (Opel et al., 2014), and alterations of insula connectivity (He et al., 2022) may contribute to the onset and exacerbation of MDD in maltreatment-exposed individuals. Other research has sought to identify emotional and behavioural vulnerabilities that characterize this MDD subgroup. For instance, studies have found that individuals with childhood maltreatment tend to engage in more repetitive negative thinking, such as rumination and worry, as well as hold more dysfunctional meta-cognitive beliefs compared with individuals without such past (Mansueto et al., 2019, 2021). Resonating with these findings, individuals with MDD and childhood maltreatment have been found to exhibit more avoidance of threatening stimuli than individuals with MDD without such past (Bodenschatz et al., 2019). While these studies highlight important characteristics of the MDD subgroup with childhood maltreatment, there are also other salient areas to consider. An

Key Practitioner Messages
- Among individuals with major depressive disorder (MDD), the subgroup with a history of childhood maltreatment displays lower emotion decoding abilities.
- These emotion decoding difficulties apply specifically to positive and negative emotions and not neutral emotions.
- Emotion decoding abilities merit further consideration as a potential target in the psychotherapeutic treatment of MDD patients with childhood maltreatment histories.

important area in this regard is emotion decoding, which involves the ability to detect emotional expressions correctly. This ability is essential for positive social interactions and relationships and, therefore, also individuals' mental well-being (Carton et al., 1999; Suslow et al., 2023). According to mentalization theory, the ability to understand mental states is acquired during development through attachment relationships with sensitive caregivers who possess parental reflective functioning. Parental reflective functioning refers to the caregiver's capacity to reflect upon their own internal mental experiences as well as those of the child (Fonagy et al., 2018). In families where child maltreatment occurs, the caregivers typically have low parental reflective functioning as they fail to consider the child's perspective and basic needs (Allen, 2018). In these circumstances, children therefore lack the critical conditions for acquiring an understanding of the mental states in self and others (Allen, 2018; Fonagy et al., 2018). Consistent with these assumptions, studies have shown that individuals who have been exposed to childhood maltreatment often are less able to accurately recognize emotions, especially expressions of anger and fear (Bérubé et al., 2023). Moreover, emotion decoding difficulties have also been demonstrated in MDD (Weightman et al., 2014), a clinical population in which almost half report a history of childhood maltreatment (Nelson et al., 2017). Thus, a salient question is whether such difficulties specifically apply to the MDD subgroup with childhood maltreatment. Two recent studies address this question. Both studies found that individuals with MDD who had a history of childhood maltreatment exhibited poorer emotion decoding abilities compared with individuals with MDD without such past (Rnic et al., 2018; Simon et al., 2019). The results of these studies, nevertheless, diverged in terms of whether such differences pertained to positive emotions, negative emotions, or both (Rnic et al., 2018; Simon et al., 2019). It should be noted that both used rather small samples consisting, respectively, of untreated young adults (Rnic et al., 2018) and inpatients in a psychiatric mood disorder unit (Simon et al., 2019). Since MDD affects all age groups (Brody et al., 2018) and most MDD patients receive outpatient rather than inpatient treatment (Hasin et al., 2018), it is unclear whether the findings of these studies generalize to the broader MDD population. Therefore, the present study aimed to compare the emotion decoding abilities of MDD patients with and without a history of childhood maltreatment in a larger sample that

was not confined to a specific age group or inpatients or outpatients. Based on the assumptions of mentalization theory (Allen, 2018; Fonagy et al., 2018) and the results of the cited studies (Rnic et al., 2018; Simon et al., 2019), it was hypothesized that individuals with MDD with a history of childhood maltreatment would display poorer emotion decoding abilities than individuals with MDD without such past.

2 | METHODS

2.1 | Study design

The study was designed as a nationwide cross-sectional study. It was advertised on targeted national online platforms addressing depression, mental health, and mental health stigmatization for four delimited weeks, where permission to recruit participants from these sites was granted.

2.2 | Participants and procedure

To be included in the study, the participants were required to have been diagnosed with MDD, defined as having had at least one major depressive episode determined by a medical doctor. In addition to this, the participants were required to be receiving antidepressant medication which is the most widely used treatment for depression worldwide (OECD, 2017). This eligibility criterion served two functions. First, considering that antidepressants have been found to improve emotion decoding in depressed patients (Anderson et al., 2011), it ensured that the participants were comparable in this regard. Second, that they received antidepressant medication also implied that they had been formally diagnosed with MDD by doctors adhering to the same principles. This is because, in Denmark, all doctors must adhere to the clinical standards established by the Danish health authorities (Rådet for Anvendelse af Dyr Sygehusmedicin, 2015) which specifies that a prescription of antidepressant requires a formal diagnosis of MDD conforming to the International Classification of Diseases (ICD-11; World Health Organization, 2019). It furthermore specifies that in order to render this diagnosis a clinical evaluation must be conducted over at least two separate consultations during which depressive symptoms are evaluated using measures such as the Hamilton Depression Rating Scale (HDRS-17; Bobo et al., 2016; Hamilton, 1967) or the Montgomery–Asberg Depression Rating Scale (MADRS; Montgomery & Åsberg, 1979). The doctors must further ensure that the depressive symptoms are not explained by somatic illnesses and conditions. They must also consider differential diagnoses that present with similar symptoms but diagnostically exclude a diagnosis of MDD such as, for example, bipolar disorder and adjustment disorder.

The participants provided written informed consent, and the study was conducted in agreement with Danish Data Protection Agency and the local ethics board.

2.3 | Measures

Depressive symptoms were measured with The Major Depression Inventory (MDI; Bech et al., 2001) which is a self-rating inventory developed to measure the presence and severity of depressive symptoms. The MDI contains 10 items corresponding to the core symptoms that define MDD.

Childhood maltreatment was measured with a subsection of the Adverse Childhood Experience Questionnaire (ACE-Q; Felitti et al., 1998). This subsection contains binary questions regarding exposure to five types of childhood maltreatment: emotional, physical, and sexual abuse, as well as emotional and physical neglect during the individual's first 18 years of life (Felitti et al., 1998). The ACE-Q has been used extensively in research worldwide (Zarse et al., 2019).

Emotion decoding abilities were examined using the revised version of the Reading the Mind in the Eyes Test (RMET; Baron-Cohen et al., 2001). The RMET is a performance-based psychometric test that measures the capacity to decode complex mental states from the subtle features of eye expressions (Baron-Cohen et al., 2001; Rnic et al., 2018). It contains 36 sub-tests that request the respondent to determine the emotional state expressed by the photos of faces in a fixed choice paradigm. The responses can be summarized into a total score of correct answers as well as into scores reflecting performance on sub-tests involving neutral, negative, and positive emotions (Harkness et al., 2005).

In this study, Cronbach's alpha coefficients were computed to estimate the internal consistencies of the applied measures. The internal consistencies were satisfactory for the REMT ($\alpha = .61$) and the ACE-Q ($\alpha = .67$) and good for the MDI ($\alpha = .92$) according to guidelines within the field (Taber, 2018).

In addition to these measures, the participants were also asked to complete questions about their gender, current age, and history of psychotherapeutic treatment defined as whether they had received psychotherapy at any point in time including both individual and group formats.

2.4 | Statistical analyses

Individuals with and without a history of childhood maltreatment were first compared on demographic and illness characteristics using chi-square and t-tests for categorical and continuous variables, respectively. Bivariate t-tests were conducted to test the hypothesis that the MDD subgroup with childhood maltreatment would exhibit poorer emotion decoding abilities than the MDD subgroup without such past. Effect sizes, estimating the magnitude of these differences, were computed with Hedges' g and 95% confidence intervals. A two-step hierarchical regression model was performed to test whether childhood maltreatment was an independent predictor of emotion decoding abilities when adjusting for demographic and clinical covariates. In step 1, childhood maltreatment was entered along with age and gender as basic demographic covariates. In step 2, depressive symptoms and history of psychotherapeutic treatment were added as

clinical covariates. Depressive symptoms (MDI-total score) were selected as a possible confounder because emotion decoding performance has been found to be influenced by mood symptoms (Leppänen, 2006) but also because MDD patients with childhood maltreatment are statistically more likely to be depressed due to this MDD subgroup having more depressive recurrences (Nelson et al., 2017). History of psychotherapy was selected as another potential confounder due to studies reporting improved emotion decoding abilities following psychotherapy (Ajilchi et al., 2020; De Raedt et al., 2012). Two-step hierarchical regression analyses were also performed to test the relative contribution of the different types of maltreatment to emotion decoding. In step one, the five maltreatment types that were measured in the study were entered as predictors. In step two, the variables that were used as demographic and clinical covariates in the first line of hierarchical regression analyses (i.e., age, gender, depressive symptoms, and history of psychotherapeutic treatment) were further added to the model.

The homoscedasticity assumption of the regression models was tested using the White test, and violation of this assumption resolved using heteroscedasticity-consistent robust standard errors. The Variance Inflation Factor was used to detect multicollinearity. Following the recommendation by Johnston et al. (2018), VIF below 2.5 was deemed acceptable. All statistical analyses were computed in STATA, version 17 (StataCorp, 2021).

3 | RESULTS

In total, 390 participants completed the study during the confined period of 4 weeks. Of these, 342 individuals meet the inclusion criteria. The ages of the participants ranged from 19 to 74, with a mean of 37.28 ($SD = 11.04$). Descriptive characteristics of the sample are presented in Table 1. Within the sample, 230 individuals (67.3%) reported exposure to at least one form of childhood

TABLE 1 Descriptive characteristics of major depressive disorder (MDD) patients with and without a history of childhood maltreatment.

	MDD patients with CM ($n = 230$)	MDD patients without CM ($n = 112$)	
	Mean (SD)/n (%)	Mean (SD)/n (%)	p
Age (years)	38.00 (11.03)	35.79 (10.94)	.082
Female sex	209 (91%)	93 (83%)	.034
Depressive symptoms (MDI-total)	22.33 (11.46)	18.91 (11.09)	.009
History of psychotherapeutic treatment	206 (90%)	90 (80%)	.027
Type of maltreatment			
Emotional abuse	144 (63%)		
Physical abuse	68 (30%)		
Sexual abuse	58 (25%)		
Emotional neglect	190 (83%)		
Physical neglect	54 (24%)		
Number of maltreatments			
1	78 (34%)		
2	68 (30%)		
3	40 (17%)		
4–5	44 (19%)		

Abbreviations: CM, childhood maltreatment; MDD, major depressive disorder; MDI, Major Depression Inventory (Bech et al., 2001).

TABLE 2 Bivariate comparisons of emotion decoding abilities in patients with major depressive disorder (MDD) with and without a history of childhood maltreatment.

	MDD patients with CM ($n = 230$)	MDD patients without CM ($n = 112$)	
RMET dimensions	Mean (SD)	Mean (SD)	p
Emotion decoding ability (RMET total)	25.69 (4.03)	27.29 (3.80)	<.001
Valence-specific emotion decoding abilities			
Positive emotions	6.00 (1.58)	6.50 (1.34)	.004
Negative emotions	8.52 (2.09)	9.18 (1.85)	.005
Neutral emotions	10.53 (1.93)	10.96 (2.06)	.066

Abbreviations: CM, childhood maltreatment; MDD, major depressive disorder; RMET, Reading the Mind in the Eyes Test (Baron-Cohen et al., 2001).

maltreatment, while the remaining 112 (32.7%) reported no such exposures. Within the maltreatment subgroup, most had experienced either one (34%) or two (30%) types of maltreatment, while fewer had experienced three (17%) or four to five (19%) types of maltreatment. The most frequently reported type of childhood maltreatment was emotional neglect ($n = 190$ [83%]), followed by emotional abuse ($n = 144$ [63%]). Within the maltreatment subgroup, no significant dose–response associations were found between the total number of maltreatment types and emotion decoding abilities (see Data S1).

The subgroup of MDD patients with childhood maltreatments contained more females ($p = .047$) and had more depressive symptoms ($p = .010$) than the MDD subgroup without such past. Results of the bivariate comparisons between the two MDD subgroups in terms of emotion decoding abilities are presented in Table 2. The MDD patients with childhood maltreatment exhibited a lower performance on the REMT overall ($g = -0.40$, $p = < .001$) as well as on the REMT tasks involving positive emotions ($g = -0.33$, $p = .004$) and negative emotions ($g = -0.33$, $p = .005$), while the difference be on neutral emotions did not reach significance ($g = -0.22$, $p = .066$). As shown in Figure 1, effect sizes (Hedges' g) were small to medium.

The results of the multivariate hierarchical regression analyses are presented in Table 3. In step 1, which adjusted for age and gender, childhood maltreatment significantly predicted lower REMT total score ($\beta = -.17$, $p = .002$) and lower scores on REMT tasks involving positive ($\beta = -.15$, $p = .001$) and negative emotions ($\beta = -.19$, $p = .013$). These results remained in step 2 when depressive symptoms and history of psychotherapeutic treatment were added as covariates. Childhood maltreatment did not predict performance on RMET tasks involving neutral emotions at any of these steps.

The other hierarchical regression analyses, that were performed to test the relative contribution of different maltreatment types to emotion decoding, are presented in Table 4. In step 1, which included all maltreatment types, only emotional neglect independently predicted RMET performance in terms of lower total score ($\beta = -.16$, $p = .014$) as well as lower scores on RMET tasks involving positive ($\beta = -.15$, $p = .015$) and negative emotions ($\beta = -.15$, $p = .020$). As the only significant result in the opposite direction, sexual abuse

predicted a higher score on RMET tasks involving positive emotions ($\beta = .14$, $p = .010$). In step 2, these significant predictors remained when adjusting for demographic and clinical confounders except for emotional neglect as predictor of performance on RMET tasks involving negative emotions which, nevertheless, bordered significance ($\beta = -.12$, $p = .054$).

All VIF values were below 2.5, indicating no substantial collinearity. Heteroscedasticity was found in step 1 of the hierarchical regression analyses that tested different maltreatment types as predictors of the RMET total score ($\chi^2 = 27.16$, $p = .027$) and score for RMET tasks involving negative emotions ($\chi^2 = 25.92$, $p = .039$). Thus, these analyses were computed with heteroscedasticity-consistent standard errors. The significant maltreatment predictors were the same in the original and the heteroscedasticity-adjusted regression models.

4 | DISCUSSION

In this study, individuals with MDD and a history of childhood maltreatment exhibited poorer emotion decoding abilities than individuals with MDD without such past. Overall, these results are consistent with the studies by Rnic et al. (2018) and Simon et al. (2019), who investigated this topic in smaller samples consisting of untreated youth and psychiatric inpatients, respectively. Compared with these studies, this study included a much larger sample with a broader age range. Accordingly, the emotion decoding differences observed in this study are likely to be identifiable in the broader population with MDD.

Given that this result remained after adjusting for age, depressive symptoms, and psychotherapeutic treatment, it is likely that emotion decoding difficulties are relatively persistent in individuals with MDD and childhood maltreatment. This could potentially reflect a more fundamental vulnerability in this MDD subgroup. According to mentalization theory, the ability to understand mental states is acquired during development through attachment relationships with caregivers who possess reflective functioning and who adequately mediate the child's discovery of own and others' mental states (Fonagy et al., 2018). In families where child maltreatment occurs, the caregivers typically have low reflective functioning and, therefore, fail to facilitate the
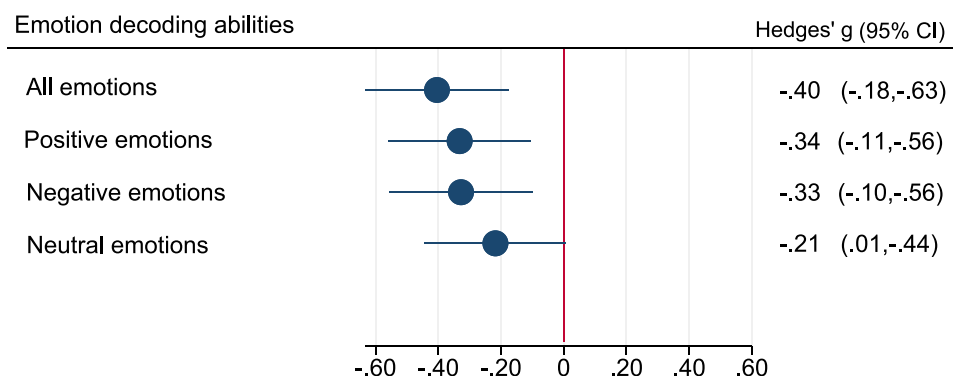
FIGURE 1 Standardized effect sizes for group differences on dimensions of emotion decoding.

Emotion decoding abilities	Hedges' g (95% CI)
All emotions	-.40 (-.18,-.63)
Positive emotions	-.34 (-.11,-.56)
Negative emotions	-.33 (-.10,-.56)
Neutral emotions	-.21 (.01,-.44)

TABLE 3 Multivariate hierarchical regression analyses of the associations between childhood maltreatment and emotion decoding abilities in major depressive disorder (MDD).

| | Emotion decoding ability (total RMET score) | | | Valence-specific emotion decoding abilities | | |
| | | | | Positive emotions | | |
	Beta (95% CI)	β	p	Beta (95% CI)	β	p
Step 1.						
Childhood maltreatment	−1.46 (−2.36, −0.56)	−.17	.002	−0.49 (−0.83, −0.15)	−.15	.006
Gender	0.76 (−0.56, 2.08)	.06	.256	−0.27 (−0.24, 0.77)	.06	.296
Age	−0.04 (−0.07, 0.00)	−.10	.066	0.00 (−0.01, 0.02)	.02	.710
Model						
R		.22			.17	
R^2		.05			.03	
F		5.59			3.26	
p		.001			.022	
Step 2.						
Childhood maltreatment	1.27 (−2.17, −0.36)	−.15	.006	−0.43 (−0.78, −0.09)	−.14	.013
Gender	0.64 (−0.67, 1.94)	.05	.337	0.23 (−0.27, 0.73)	.05	.366
Age	−0.04 (−0.08, −0.01)	−.12	.026	0.00 (−0.01, 0.02)	.00	.934
Depressive symptoms	−0.05 (−0.08, −0.01)	−.13	.014	−0.01 (−0.03, 0.00)	−.08	.151
Psychotherapeutic treatment	−0.72 (1.64, 0.20)	−.08	.126	−0.36 (−0.71, −0.01)	−.11	.045
Model						
R		.27			.22	
R^2		.07			.05	
F		5.31			3.36	
p		<.001			.006	
Model change (step 1–step 2)						
ΔR		.02			.02	
ΔF		4.70			3.43	
p		.010			.033	

Abbreviation: RMET, Reading the Mind in the Eyes Test (Baron-Cohen et al., 2001).

TABLE 3 (Continued)

	Valence-specific emotion decoding abilities					
	Negative emotions			Neutral emotions		
	Beta (95% CI)	β	p	Beta (95% CI)	β	p
Step 1.						
Childhood maltreatment	−0.58 (−1.04, −0.12)	−.19	.013	−0.36 (−0.81, 0.09)	−.09	.116
Gender	0.52 (−0.15, 1.19)	.08	.130	0.01 (−0.65, 0.66)	−.00	.985
Age	−0.02 (−0.03, 0.01)	−.08	.136	−0.03 (−0.05, −0.01)	−.16	.005
Model						
R			.19			.18
R^2			.04			.03
F			4.09			3.80
p			.007			.011
Step 2.						
Childhood maltreatment	0.52 (−0.98, −0.05)	−.12	.029	−0.29 (−0.74, 0.16)	−.07	.210
Gender	0.48 (−0.20, 1.14)	.08	.164	−0.03 (−0.69, 0.62)	−.01	.919
Age	−0.02 (−0.04, 0.00)	−.09	.081	−0.03 (−0.05, 0.01)	−.17	.002
Depressive symptoms	−0.02 (−0.04, 0.00)	−.09	.101	−0.02 (−0.04, 0.00)	−.11	.048
Psychotherapeutic treatment	−0.27 (−0.74, 0.21)	−.06	.266	−0.10 (−0.56, 0.37)	−.02	.685
Model						
R			.22			.21
R^2			.05			.05
F			5.36			3.16
p			.006			.008
Model change (step 1–step 2)						
ΔR			.01			.01
ΔF			2.22			2.18
p			.111			.115

Abbreviation: RMET, Reading the Mind in the Eyes Test (Baron-Cohen et al., 2001).

TABLE 4 Multivariate hierarchical regression analyses of the associations between different types of childhood maltreatment and emotion decoding in major depressive disorder (MDD).

	Emotion decoding ability (total RMET score)			Valence-specific emotion decoding abilities		
				Positive emotions		
	Beta (95% CI)	β	p	Beta (95% CI)	β	p
Step 1.						
Emotional abuse	0.20 (−0.89, 1.29)	.02	.725	−0.07 (−0.48, 0.34)	−.02	.735
Physical abuse	−0.69 (−1.95, 0.56)	−.07	.278	−0.13 (−0.60, 0.34)	−.04	.578
Sexual abuse	0.50 (−0.69, 1.68)	.05	.409	0.58 (0.14, 1.02)	.14	.011
Emotional neglect	−1.25 (−2.25, 0.25)	−.16	.014	−0.47 (−0.84, −0.09)	−.15	.015
Physical neglect	0.38 (0.89, 1.65)	.03	.557	0.28 (−0.19, 0.76)	−.07	.244
Model						
R	.16			.19		
R^2	.03			.04		
F	2.12			2.51		
p	.062			.030		
Step 2.						
Emotional abuse	0.16 (−0.92, 1.23)	.03	.776	−0.07 (−0.49, 0.33)	.02	.720
Physical abuse	−0.46 (−1.71, 0.78)	−.04	.466	−0.10 (−0.57, 0.37)	−.05	.674
Sexual abuse	0.37 (−0.80, 1.54)	.04	.531	0.54 (0.09, 0.97)	.04	.018
Emotional neglect	1.01 (−2.01, 0.01)	−.10	.048	−0.39 (−0.77, −0.01)	−.13	.044
Physical neglect	.56 (−0.70, 1.83)	.05	.381	0.33 (−0.15, 0.81)	.05	.171
Gender	0.63 (−0.70, 1.96)	.06	.352	0.24 (−0.27, 0.74)	.05	.358
Age	−0.05 (−0.09, −0.01)	−.13	.015	−0.00 (−0.02, 0.01)	−.13	.886
Depressive symptoms	−0.05 (−0.09, −0.01)	−.14	.013	−0.01 (−0.03, 0.00)	−.14	.120
Psychotherapeutic treatment	−0.72 (−1.66, 0.22)	−.07	.132	−0.33 (−0.69, 0.02)	−.08	.065
Model						
R	.26			.24		
R^2	.07			.06		
F	2.64			2.27		
p	.006			.018		
Model change (step 1–step 2)						
ΔR	.04			.02		
ΔF	3.66			1.95		
p	.006			.103		

Abbreviation: RMET, Reading the Mind in the Eyes Test (Baron-Cohen et al., 2001).

TABLE 4 (Continued)

Valence-specific emotion decoding abilities

	Negative emotions			Neutral emotions		
	Beta (95% CI)	β	p	Beta (95% CI)	β	p
Step 1.						
Emotional abuse	0.25 (−0.30, 0.81)	.06	.368	0.08 (−0.47, 0.62)	.02	.784
Physical abuse	−0.52 (−1.15, 0.11)	−.10	.111	−0.08 (−0.70, 0.55)	−.02	.807
Sexual abuse	−0.14 (0.73, 0.45)	−.03	.652	0.02 (−0.57, 0.61)	.00	.939
Emotional neglect	−0.60 (−1.11, −0.10)	−.15	.020	−0.17 (−0.66, 0.34)	−.04	.517
Physical neglect	0.07 (−0.57, 0.71)	.01	.823	−0.03(−0.66, 0.60)	−.01	.923
Model						
R			.18			.04
R^2			.03			.00
F			2.12			.12
p			.062			.988
Step 2.						
Emotional abuse	0.24 (−0.31, 0.79)	.06	.389	0.05 (−0.49, 0.59)	.013	.850
Physical abuse	−0.44 (−1.07, 0.20)	−.09	.175	0.04 (−0.58, 0.66)	−.01	.899
Sexual abuse	0.18 (−0.77, 0.42)	−.03	.559	−0.01 (−0.60, 0.57)	−.00	.960
Emotional neglect	−0.50 (−1.01, −0.01)	−.12	.054	−0.10 (−0.60, 0.40)	−.03	.686
Physical neglect	0.12 (−0.53, 0.76)	.02	.723	0.05 (−0.58, 0.68)	.01	.871
Gender	0.43 (−0.24, 1.11)	.07	.209	−0.00 (−0.67, 0.66)	.00	.993
Age	−0.02 (−0.04, 0.00)	−.10	.063	−0.03 (−0.05, 0.01)	−.17	.001
Depressive symptoms	−0.01 (−0.03, 0.00)	−.08	.141	−0.02 (−0.04, −0.00)	−.12	.035
Psychotherapeutic treatment	−0.29 (−0.77, 0.17)	−.07	.231	−0.10 (−0.57, 0.37)	−.02	.679
Model						
R			.23			.20
R^2			.06			.04
F			2.13			1.58
p			.027			.010
Model change (step 1–step 2)						
ΔR			.02			.04
ΔF			2.10			3.41
p			.081			.010

Abbreviation: RMET, Reading the Mind in the Eyes Test (Baron-Cohen et al., 2001).

child's understanding of mental states (Allen, 2018). Accordingly, the lower emotion decoding abilities identified in MDD patients with childhood maltreatment may, from this perspective, be attributable to such deficient developmental conditions.

Although mentalization theory offers a broader developmental explanation of the findings, it does not explain the different results across maltreatment types. When all maltreatment types were considered, only emotional neglect independently predicted lower emotion decoding abilities. According to the neurodevelopmental model proposed by McLaughlin et al. (2017), childhood neglect has particular deleterious effects on developmental outcomes. This is because the caregivers are presumed to regulate the inputs to which the child is exposed, thereby largely influencing the child's learning opportunities. Thus, in the case of neglectful caregivers, the child is not provided with the necessary learning conditions for acquiring various abilities, including the ability to decode mental states.

Another noteworthy finding was that emotion decoding difficulties in the MDD subgroup with childhood maltreatment were most pronounced on sub-tests involving positive and negative emotions while no significant group differences emerged on the sub-tests involving neutral emotions. While the present investigation does not provide any immediate explanation for this valence specificity, some research hints at implicated mechanisms. For instance, a fMRI study found that individuals, who have been exposed to childhood maltreatment, exhibited amygdala hyper-responsivity in response to emotional faces especially those displaying valenced emotions such as fear, anger, happiness, and sadness (van Harmelen et al., 2013). This hyper-responsivity and limbic arousal may potentially interfere with the ability to correctly decode valenced emotions. While this may partly explain the present findings, it is similarly likely that individuals who are exposed to childhood maltreatment during formative years internalize an impoverished and dysfunctional emotion understanding (Fernyhough, 2008) that specifically apply to valenced emotions. While these explanations may be plausible, further investigations are needed to elucidate the developmental and neurological processes underlying the valence-specific emotion decoding difficulties in individuals with MDD who have a history of childhood maltreatment.

From a clinical perspective, the findings draw attention to the potential presence of lower emotion decoding abilities in MDD patients with a history of childhood maltreatment. Assessments such as those employed in this study can be utilized to evaluate these areas and subsequently inform case-formulation and treatment planning. Especially, emotion decoding abilities may be clinically meaningful to target in the treatment of MDD. A study by Lazarus and Fisher (2021) found that individuals who displayed good emotion decoding abilities generally had better outcomes of psychotherapy. Thus, improving the identified emotion decoding problems in MDD patients with childhood maltreatment may potentially benefit their treatment outcomes. Interventions such as Emotion Recognition Training (ERT) and Mentalization Based Therapy (MBT), which both have been found to have a positive effect on emotion decoding abilities (Bressi et al., 2017; Lawental et al., 2021; Rawdon et al., 2018), may be considered for this purpose. Since MDD patients with a history of childhood maltreatments tend to have a more severe illness course with more frequent depressive recurrences (Nelson et al., 2017; Vallati et al., 2020), it is imperative to improve the treatments for this MDD subgroup. Considering the present findings, it seems pertinent to explore the potential gains of improving emotion decoding abilities in these patients.

Several limitations should be considered when interpreting the findings. First, maltreatment histories were measured retrospectively with a self-report measure and may therefore be affected by memory biases. Autobiographical memories of past events represent the construction of remembered events which are influenced by the individual's disposition and social and affective schemas (Brewin et al., 2011). However, this does not disqualify retrospectively reported childhood maltreatments, which have been found to be more predictive of clinical outcomes than their prospective counterparts, hence highlighting their clinical relevance (Negriff et al., 2017; Newbury et al., 2018). Also, prospective studies might underestimate childhood maltreatment due to parental secrecy or children being unwilling to disclose such information (Newbury et al., 2018). Second, the study did not differentiate between different forms of psychotherapy because we did not expect the participant to be acquainted with the terminology for this. Therefore, it is unclear whether any psychotherapeutic treatments may have specifically influenced emotion decoding in this study.

In conclusion, the results indicate that MDD patients with a history of childhood maltreatment have deficiencies in decoding facial emotions compared with MDD patients without such past. Accordingly, emotion decoding deficits appear to characterize a subgroup of individuals with MDD rather than reflecting a general characteristic of MDD as discussed by others (Leppänen, 2006; Penton-Voak et al., 2017). Considering that this subgroup tends to have a more severe and retractable illness course, it is critical to identify factors that contribute to this (Vallati et al., 2020). Based on the present findings, a relevant avenue for further research is to investigate the prognostic and clinical implications of emotion decoding deficits in individuals with MDD who have a history of childhood maltreatment.

CONFLICT OF INTEREST STATEMENT

None.

ORCID

Ole Karkov Østergård https://orcid.org/0000-0001-8909-1241

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