The Role of Mentalizing in the Association between Childhood Trauma and Emotion Regulation in Borderline Personality Disorder

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Thesis declaration form

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signature: 

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Date: 2/6/2023

Overview

This thesis explores the effect of mentalizing in the relationship between experiences of childhood trauma and emotion regulation difficulties, in both individuals with a diagnosis of borderline personality disorder (BPD) and healthy controls. The first part of the thesis presents a systematic review and meta-analysis that investigated the use of the Movie for the Assessment of Social Cognition (MASC) to discriminate mentalizing ability between clinical and non-clinical groups, and explored the differences in type of mentalizing impairments across different clinical groups. The results supported the use of the MASC in clinical populations, as well as contributed to the growing evidence of mentalizing impairments in a range of psychopathologies and the possibility of disorder-specific profiles of mentalizing deficits.

The second part of this thesis presents an empirical paper which investigated whether mentalizing capacity impacts the relationship between experiences of childhood trauma and emotion regulation difficulties in individuals with BPD and healthy controls. The findings of the study suggested that mentalizing partially mediates the effect of childhood trauma on emotion regulation difficulties. This effect was not observed when looking at the BPD or healthy controls groups separately, and the possible explanations for this are discussed.

The third part of the thesis consists of a critical appraisal of the research, which reflects on the process of conducting the research, the challenges encountered and the potential clinical implications of the findings.

Impact Statement

This thesis is comprised of two sections: a systematic review and an empirical paper. The first part is a systematic review and meta-analysis that looked to compare mentalizing capacity, as measured by the Movie for the Assessment of Social Cognition (MASC), between different clinical and non-clinical groups. The second part is a research paper which explored the role of mentalizing in the relationship between experiences of childhood trauma and emotion regulation difficulties in borderline personality disorder.

The findings of the systematic review supported the use of Movie for the Assessment of Social Cognition (MASC) in clinical populations and suggested to the presence of disorder-specific profiles of mentalizing deficits. These findings increase the knowledge of mentalizing deficits in different psychopathologies, which in turn could be used to inform clinical practice, such as routinely assessing mentalizing ability, considering the role of mentalizing deficits in the therapeutic relationship, and identifying mentalizing as a possible therapeutic target. The findings could also support NHS services in their understanding of challenges faced and inform the development of intervention or prevention strategies which target mentalizing. Additionally, the findings highlight the need for further research into differences in mentalizing impairments across psychopathologies, and into mentalization as a potential etiological mechanism.

The empirical paper found that mentalizing has an impact on the relationship between childhood trauma and emotion regulation difficulties. This finding supports the perspective that mentalizing may be a key component in the development of emotion regulation difficulties, and therefore could inform clinical practice. Largely, the findings highlight mentalizing as a beneficial therapeutic target when addressing difficulties with, or risk of, emotion dysregulation, particularly with individuals who have experiences of childhood trauma, and lend support to the use of mentalization-based therapies. The findings of the thesis also contribute to the growing emphasis of trauma-informed practice in the NHS, with consideration to the impact of mentalizing impairments in persons who have experienced early life trauma.

Table of Contents

List of Tables

List of Figures

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Part 1: Literature Review

A Comparison of Mentalizing Capacity between Clinical and Non-Clinical Samples: A Systematic Review and Meta-Analysis of the Movie for the Assessment of Social Cognition (MASC)

Abstract

Background: Impairments in mentalizing capacity have been implicated in a range of psychological and neurodevelopmental disorders. There is increasing support for mentalization as a therapeutic target, and it has been proposed to be a potential factor in the development of psychopathology. Despite the growing knowledge of ineffective mentalizing in different disorders, the evidence base is inconsistent and has not been synthesised. This inconsistency can, in part, be attributed to the use of a variety of measures of mentalizing, which often lack ecological validity. The Movie for the Assessment of Social Cognition (MASC) was developed to better approximate real-life situations, compared to other existing measures of mentalizing. Despite the growing support for the use of the MASC, it is less established than other measures.

Aims: The review aimed to summarise existing studies which utilise the MASC to discriminate mentalizing ability between different psychopathologies and healthy controls, as well as meta-analytically aggregate these differences. The secondary aim of the review was to identify whether differences in mentalizing impairments varied across disorders, as assessed by the MASC.

Methods: The inclusion criteria for the review consisted of studies with adults (18+ years old) or adolescents (12-18 years old) with a mental health condition determined by a validated measure or diagnostic assessment tool. Studies were excluded if they did not have a healthy control comparison group, did not utilise the MASC, or were not available in English. Seven electronic databases were searched to identify relevant studies (EMBASE, PsycINFO, MEDLINE, Emcare, CINAHL, Cochrane Central Register of Controlled Trials (CENTRAL) and ASSIA). Two reviewers carried out the risk of bias assessment of relevant papers using the Joanna Briggs Institute critical appraisal tool. Data was synthesised using R studio to pool effect sizes and present the findings in forest plots.

Results: n=38 studies were included in the review. Of these, the majority looked at adult groups (n=28). A range of disorders were represented including. Overall, clinical groups were found to have significantly lower mentalizing ability compared to healthy controls, and the MASC was demonstrated to be able to discriminate between clinical groups and healthy controls. Findings demonstrated differences in type of mentalizing errors across clinical groups.

Discussion: Findings contribute to the evidence base for the use of the MASC in clinical populations, as well as support the proposition that mentalizing impairments may be transdiagnostic, and yet disorders may have specific profiles of mentalizing deficits. The review could have important clinical implications including supporting interventions which target mentalizing capacity, increasing understanding of ineffective mentalizing in different disorders, and considering mentalizing as a potential etiological factor for psychopathology.

Introduction

Mentalization

Mentalization is a social-cognitive construct which can be used to explain how humans make sense of the social world. Mentalizing refers to the ability to perceive, understand and reflect on human behaviour in terms of intentional mental states (e.g., desires, beliefs, wishes), with regard to self and others (Fonagy & Target, 1997; Luyten et al., 2020; Fonagy & Luyten, 2009; Fonagy &Allison, 2011; Fonagy et al., 2016). Mentalizing is often used as an umbrella term for the capacity to understand behaviour in terms of mental states, including concepts such as social cognition or theory of mind (Bo et al., 2017). The ability to mentalize is thought to be adaptive as it enables humans to navigate complex social interactions, including cooperation and competition, by being able to predict and interpret the behaviour of others (Fonagy & Allison, 2011; Luyten et al., 2020). Furthermore, mentalizing has been associated with the development of the self and the capacity for affect regulation and representation (Fonagy & Luyten, 2009).

The acquisition of mentalizing is considered to be a developmental process that occurs within the context of secure early attachment relationships, particularly with caregivers (Fonagy & Allison, 2014). More recently, a social-communicative perspective on mentalizing has been proposed which accommodates the influence of a broader set of factors including family, the community, and sociocultural contexts (Luyten et al. 2020). Nonetheless, the acquisition of an effective mentalizing ability is thought to depend on ‘good enough’ relationships and can therefore be considered a “developmental achievement” rather than a “constitutional given” (Fonagy & Luyten, 2009, p.1357). Disruptions to early attachment relationships, for example through trauma, maltreatment, or neglect, have been associated with disruptions to an individual’s mentalizing capacity (Fonagy & Luyten, 2009; Fonagy et al., 2016). For example, deficits in mentalizing abilities such as difficulty with emotional understanding, social cognition deficits and delayed theory of mind have been reported in maltreated children (Fonagy & Allison 2011).

Deficits in mentalizing have been proposed to differ in terms of the nature of specific impairments. Two main types of ineffective mentalizing have been identified: hypermentalizing and under-mentalizing. Hypermentalizing can be defined as excessive mentalizing in which attributions of mental states to oneself and others are made without observable evidence to support it. The result is that attributions appear distorted or even paranoid (Fonagy & Luyten, 2009). Most prominently, hypermentalizing has been associated with emerging BPD (Sharp & Vanwoerden, 2015), however it has also been identified in a range of other clinical disorders including Autism Spectrum Disorder (ASD), schizophrenia, and social anxiety disorder (McLaren et al., 2022).

Under-mentalizing refers to a reduced ability to mentalize (Canty et al., 2017). This can include hypomentalizing or 'absence of mentalizing'. Hypomentalizing can be defined as the insufficient or impoverished mental state attribution and reflects an inability to consider the "complex models of one's mind and/or that of others" (Fonagy et al., 2016, p.3). Hypomentalizing has been implicated in a range of disorders, for example, depression (e.g., Fischer-Kern et al., 2022), ASD (e.g., Chung et al., 2014) and schizophrenia (e.g., Alfimova et al., 2023). Absence of mentalizing, or 'no theory of mind', refers to the inability to represent mental states, with a tendency to make attributions that are completely unrelated to the evidence, i.e., attributions that are based on a non-mentalistic frame of reference, for example a sociological or physicalistic model of reference (Canty et al., 2017).

Mentalizing is also posited to be a multidimensional construct, underpinned by distinct neural systems with both interpersonal and self-reflective components, composed of four dimensions. The dimensions are proposed to be (a) automatic vs. controlled mentalizing, (b) mentalizing with regard to the self and about others, (c) mentalizing based on external or internal features of the self and others, and (d) cognitive vs. affective mentalizing (Luyten et al., 2020). The theory suggests that a balance of these neural systems or dimensions enable individuals to mentalize, however this balance is thought to be disrupted by early life adversity, e.g., trauma or neglect (Luyten et al., 2020; Fonagy & Allison, 2011).

Mentalization and Psychopathology

Differences in mentalizing capacity have been implicated in a range of psychological and neurodevelopmental disorders (Fonagy & Luyten, 2009; Luyten et al., 2020). These include borderline personality disorder (BPD) (e.g., Bora, 2021; Luyten et al., 2020), antisocial personality disorder (ASPD) (e.g., Newbury-Helps et al., 2019), narcissistic personality disorder (NPD) (e.g., Ritter et al., 2011), schizophrenia (e.g., Bora et al., 2009, Chung et al., 2014, Salva et al, 2013), bipolar affective disorder (BPAD) (e.g., Bora et al. 2016), post-traumatic stress disorder (PTSD) (e.g., Stevens et al., 2019), ASD and Attention deficit hyperactivity disorder (ADHD) (Bora & Pantelis, 2016), eating disorders (e.g., Rothschild-Yakar et al., 2010) and depression (e.g., Berecz et al., 2016; Bora & Berk, 2016).

Further support for the role of mentalizing in psychopathology is the increasing empirical evidence for interventions aimed at improving mentalizing capacity, for example Mentalization-Based Therapy (MBT). The efficacy of mentalization-based interventions has been demonstrated chiefly in BPD populations, however preliminary evidence also supports its application in other psychological disorders, such as ASPD, eating disorders and depression (Luyten et al., 2020). In addition, good mentalizing has been shown to be a protective factor in the development of psychopathology (Rothschild-Yakar et al., 2010) and is theorised to be a mechanism of resilience against adversity (Stein et al., 2006). As such there is a clear rationale for the need to increase the understanding of mentalizing deficits across psychopathologies, which could in turn be used to develop targeted psychosocial intervention strategies.

Mentalizing has also been proposed as a potential developmental factor or mechanism in psychopathology, as deficits have been identified in adolescent populations, e.g., emerging BPD (Bo et al., 2017). This lends greater support to the role of mentalizing in psychopathology, as well as provides a rationale for further research towards determining its role in the development of psychopathology and potential opportunities for early intervention.

Despite the increasing findings which implicate ineffective mentalizing in different psychopathologies, the evidence base lacks consistency. Previous studies have had mixed

findings of mentalizing deficits in a range of disorders for example, anxiety and related disorders (Sloover et al., 2022), psychosis (Johnson et al., 2022), and BPD (Bo et al., 2017). Other studies that have focused on types of ineffective mentalizing also paint an unclear picture. While some studies have identified specific mentalizing deficits, e.g., hypermentalizing, in a range of disorders, such as schizophrenia, ASD, social anxiety, and ADHD, others have also failed to discriminate these differences from healthy controls (McLaren et al. 2022).

One explanation for the inconsistency in the evidence base is the use of a range of different measures. Given that mentalizing is an umbrella term that can encompass a variety of notions related to the capacity to understand and infer mental states (e.g., social cognition, theory of mind, reflective functioning), existing measures may have operationalised the construct or some of its sub-components differently, resulting in mixed findings (Bo et al. 2017). As such, existing reviews of mentalizing capacity within different psychopathologies are limited by the inclusion of these various measures, which limit the conclusions that can be drawn and may contribute to the inconsistency of the evidence base. Furthermore, this limitation may be compounded by the use of measures which lack ecological validity as they fail to sufficiently reflect real life social interactions (Normann-Eide et al., 2020).

Existing Measures

Numerous measures have been developed to assess mentalizing in adults, adolescents, and children, including interviews, self-report questionnaires and experimental tasks. These measures typically assess how accurately individuals infer mental states based on the person-related and contextual information provided (Achim et al., 2013).

While several measures exist and have been used in previous studies, they have limitations that warrant comment. Interview-based measures that assess mentalizing include the Reflective Functioning Scale (Fonagy et al.,1998). While validated, this measure is

considered time-consuming and labour intensive, and therefore more difficult to use with larger samples (Fonagy et al. 2016).

Some examples of self-report questionnaires that are commonly used include the Reflective Functioning Questionnaire (Fonagy et al., 2016), the Mentalization Questionnaire (Hausberg et al., 2012), and the Certainty About Mental States Questionnaire (Müller et al., 2023). While these measures can be considered easier to administer, they are inherently limited by their self-report design as they require a certain level of mentalizing capacity to complete the measure (Fonagy et al., 2016). Furthermore, this type of measure looks at "offline" mentalizing, meaning that the measure is not assessing real-time mentalizing and is therefore arguably less ecologically valid than measures that involve "online" mentalizing (Luyten et al., 2019, p.57).

There are also experimental tasks, such as the Faux-pas test (Baron-Cohen et al. 1999), the Strange Stories Task (Happé, 1994), or Reading the Mind in the Eyes test (RMET; Baron-Cohen et al., 2001). While perhaps advantageous to self-report measures as they require more real-time mentalizing, these measures often focus on a single dimension of mentalizing. For example, the RMET only looks at the inference of mental states via visual information (black and white images of eyes depicting an underlying state of mind). A critique of such measures identifies that in real-life situations there are typically several sources of information (e.g., visual, verbal, and auditory) that are used to make mental state attributions about the person and the context. As such, many of the existing experimental measures of mentalizing lack ecological validity as they do not accurately reflect real life situations where a combination of components of social cognition (e.g., contextual information, facial expressions, body language, gestures, aspects of language such as irony/sarcasm) would occur (Lahera et al., 2014).

Video-based instruments have been developed to better approximate real life social interactions and increase ecological validity. Examples of these instruments are the Awkward Moment Test (Heavey et al., 2000) or the Reading the Mind in Films Task (Golan et al., 2006). While these have increased test sensitivity and more readily reflect the demands of

everyday life social cognition, each have limitations which impact the conclusions that can be drawn. For example, the Awkward Moment Test uses clips from adverts which may imply some exaggeration in the depiction of social situations and therefore impact the conclusions that can be drawn (Golan et al., 2006).

It is evident that there are few measures of mentalizing that sufficiently approximate real-life social interactions and assess “online” mentalizing. This in turn has a considerable impact on the generalisability of findings and the conclusions that can be drawn. Furthermore, despite the increasing knowledge of different types mentalizing deficits across disorders, there are few tools designed to assess them. While some other measures can identify hypermentalizing, their validity has been questioned (e.g., The Reflective Functioning Questionnaire) or they have rarely been used in previous studies (e.g., the Hypermentalizing Questionnaire or the Self-Referential Hinting Task) (Mclaren et al., 2022). The development of The Movie for the Assessment of Social Cognition (MASC; Dziobek et al., 2006) served to address a gap by creating a measure that approximates real-life social interactions, as well as has the unique ability to distinguish between different types of mentalizing impairments.

Movie for the Assessment of Social Cognition

The Movie for the Assessment of Social Cognition (MASC) was developed by Dziobek et al. (2006) in collaboration with the Max Planck Institute for Neurological research in Cologne. The tool has been translated and used to assess social cognition in a range of different clinical populations in German (e.g., Dziobek et al; Abdel-Hamid et al., 2019.), English (e.g., Newbury-Helps et al., 2017), Spanish (e.g., Lahera et al.2014; Ortega-Diaz et al., 2021) and Italian (e.g., Somma et al., 2019).

The MASC is a naturalistic, video-based tool for assessing social cognition that was developed with the aim to approximate real-life social interactions. The tool is comprised of a 15-minute film in which a group of four characters are getting ready for a dinner party. At 45 different timepoints, the film is stopped, and the viewer is asked a question about the

thoughts, feelings, or intentions of the characters on the screen. The original version of the tool included 46 questions (Dziobek et al., 2006), however subsequent versions are comprised of 45 questions and 6 control questions. The control questions do not require any mentalization and serve to assess attention, general comprehension, and memory (Newbury-Helps et al., 2017).

The characters are each designed to display stable but different characteristics (e.g., shy, outgoing) and encounter experiences during the film that elicit different emotions and mental states (e.g., jealousy, fear, disgust). The different relationships of varying intimacy between characters also requires viewers to draw on different social reference systems to make inferences about their mental states. Viewers will have to take into consideration verbal content, tone, facial expressions, and body language (Eidenmueller et al., 2021). The design of the MASC lends greater ecological validity than other existing video-based instruments for identifying impairments in mentalizing in clinical populations. The test integrates visual, auditory, and verbal input channels (Lahera et al., 2014) and a broad range of mental state modalities (e.g., thoughts, emotions, and intentions) with different valences (e.g., positive, negative, neutral), and social cognition concepts (e.g., faux pas, sarcasm, metaphors, false beliefs) (Dziobek et al., 2006).

Furthermore, the task classifies different types of mentalizing deficits into hypomentalizing, hypermentalizing, and non-mentalizing errors. For each question posed, the available answers can be classified as ‘correct’ inference of mental state, ‘non-mentalizing’ (answer unrelated to mental state), ‘under-mentalizing (overly simplified or insufficient inference of mental state), or ‘over-mentalizing’ (over interpreted mental state) (Eidenmueller et al., 2021). Please see sample questions of the MASC in appendix 4.

The MASC has demonstrated good reliability (α=0.84-0.86; Dziobek et al., 2006; Lahera et al., 2014) and has been shown to be able to discriminate between healthy controls and clinical groups, such as ASD (Lahera et al., 2014; Dziobek et al., 2006), adults with schizophrenia (e.g., Montag et al., 2011) or ASPD (e.g., Newbury-Helps et al., 2017). The

MASC has also demonstrated reliability and validity as a measure of social cognition for adolescent populations (e.g., Muller et al., 2016).

Despite the growing evidence base for the MASC, the use of this tool in clinical populations is less established than other measures. While the MASC has been shown to discriminate between healthy controls and clinical groups in some studies, others have failed to do so (e.g., Andreou et al., 2015). Indeed, the existing evidence of mentalizing impairments assessed using the MASC has not yet been synthesised across disorders and the caveats in knowledge about the specific differences in mentalizing impairments across psychopathologies are not defined. Thus, there is a clear rationale for a review which summarises the existing evidence for the use of the MASC in clinical populations.

Aims of the Review

The primary aim of this review was to summarise the existing studies which utilise the MASC to discriminate mentalizing ability between clinical groups and healthy controls and to meta-analytically aggregate these differences. The review also aimed to compare the use of the MASC and mentalizing ability between adult and adolescent samples. A secondary aim of the review was to determine whether there are differences across clinical groups in the type of mentalizing impairment, as identified by the MASC.

Methods

The protocol for this systematic review and meta-analysis was registered on PROSPERO (ID=CRD420223462680) and reported in line with PRISMA guidelines (Moher et al., 2009). There were no significant deviations from the registered protocol, with the exception that time constraints prohibited contacting researchers about missing data.

Search Strategy

Seven bibliographic databases were systematically searched: EMBASE (via OVID), PsycINFO (via OVID), MEDLINE (via OVID), Emcare (via OVID), CINAHL, Cochrane Central

Register of Controlled Trials (CENTRAL) and ASSIA. Search dates were 2006 to 31st August 2022. The decision to limit the search dates to 2006 was based on the year that the Movie for the Assessment of Social Cognition (MASC) tool was introduced (Dziobek et al., 2006) and the expectation that searches which included years preceding 2006 would not find relevant studies which utilised the MASC. The full search strategy is available in appendix 1.

Inclusion and Exclusion Criteria

The following inclusion and exclusion criteria were used to identify studies.

Participants

- Adults (18+ years old) and Adolescents (12-18 years old)
    - Studies with samples that did not distinguish between adolescents and adults were included in the review to ensure that all available MASC data was included in the primary analysis, however, were excluded from subgroup analysis comparing adults and adolescents.
- Participants experiencing clinically significant symptoms of, or diagnosed with, a mental health condition. Studies were considered eligible if the presence of a mental health disorder was determined using a validated measure of diagnostic assessment tool. Considering the aims of this review, studies were excluded if they did not include a comparison group of individuals without any mental health condition (i.e., healthy controls).

Types of Studies

- No restrictions were applied to the type of study included in this review. The purpose of the review was to compare the mentalizing ability, measured using the Movie for the Assessment of Social Cognition tool (MASC), of individuals experiencing symptoms of, or diagnosed with, a mental health condition, and individuals without a mental health condition (healthy control group). The review therefore included any

studies which utilised the Movie for the Assessment of Social Cognition tool (MASC) and compared at least one clinical group with a healthy control group.

- Due to time and resource limitations for acquiring translations, studies that were not written or available in English were excluded.

Outcomes

The primary outcome for this review was mentalizing capacity measured by the total score on the MASC, reported as mean and standard deviation.

Additional outcomes were type of mentalizing error, measured by the score for each mentalizing error subscale in the MASC. The MASC can identify three types of error: 1) hyper- or over- mentalizing, 2) hypo- or under- mentalizing, 3) non or absence of mentalizing, all three of which were considered secondary outcomes.

Data Extraction

Relevant studies were identified by first screening titles and abstracts from the systematic search of seven bibliographic databases. The results were exported to EndNote 20 (Team, 2013) and duplicates were removed. Studies that appeared to meet the inclusion criteria from initial screening were then subject to further assessment by the primary and secondary reviewers. At the time, the secondary reviewer was working as a research intern in a research lab at the Anna Freud Centre. While the primary reviewer conducted the search, the secondary reviewer completed a screen of a random sample of 10% of the titles and abstracts to check inter-rater reliability. At this stage, there was no disagreement between reviewers that required resolution.

The primary reviewer assessed the screened studies which potentially met inclusion criteria. Studies were assessed for eligibility by reviewing the full text and reasons for excluding studies were recorded.

Relevant data for all included studies was independently extracted to a Microsoft excel document by both the primary and secondary reviewer. Extracted data was compared for accuracy and no discrepancies were identified. The following data was extracted from identified studies where possible: authors, date of publication, sample size (clinical groups and control groups), primary diagnosis, how the diagnosis was determined, mean age, IQ, gender, years of education, mean total MASC score, mean score on each error type (if reported). Of note, ethnicity was not extracted as this data was missing from a considerable number of included studies. Studies which did not report sufficient data on MASC performance were excluded.

Quality Assessment

The assessment of the methodological quality of the studies included in the review was conducted using the Joanna Briggs Institute (JBI) critical appraisal tool for analytical cross-sectional studies (Moola et al., 2020). This tool is an 8-point checklist which requires reviewers to consider whether: (1) the criteria for inclusion in the sample is clearly defined, (2) the study subjects and the setting are described in detail, (3) the exposure is measured in a valid and reliable way, (4) objective and standard criteria were used for measurement of the condition, (5) confounding factors were identified, (6) strategies to deal with confounders were stated, (7) outcomes were measured in a valid and reliable way, and (8) appropriate statistical analysis was used. Reviewers were tasked to assign ratings of 'No', 'Yes' or 'Not applicable' for each of the items and use these ratings to determine whether the study should be included, excluded, or if further information was required (Moola et al., 2020). See appendix 2.

The quality assessment was carried out by both primary and secondary reviewers independently. Each reviewer's decisions to include versus exclude studies were then compared to check inter-rater reliability. Cohen's kappa was used as this coefficient can be used with small sample sizes (McHugh, 2012). The outcome indicated moderate or

substantial agreement (k=0.728), which can be considered adequate for the review (McHugh, 2012). Both reviewers were in agreement that the n=38 studies ultimately included in the review had sufficient methodological quality.

Statistical Analysis

Statistical analysis was conducted using R Studio (R Core Team, 2022) using the meta package (v. 6.5-0; Balduzzi et al., 2019). Considering anticipated between-study heterogeneity, a random-effects model was used to pool effect sizes. Hedge's g was used to calculate standardised mean differences between clinical and non-clinical groups and reported with 95% confidence intervals. As recommended for continuous data (Harrer et al., 2021), the restricted maximum likelihood estimator (Viechtbauer, 2005) was used to calculate heterogeneity. The Knapp-Hartung adjustment (Knapp & Hartung, 2003) was used to calculate the confidence intervals for the pooled effect. The Knapp-Hartung adjustment was chosen as it attempts to control for uncertainty when estimating between-study heterogeneity in random effects models (Harrer et al., 2021).

Heterogeneity was assessed using an I^2 test and interpreted as: 0% indicating no heterogeneity, 0-40% indicating 'might not be important' heterogeneity, 30 -60% indicating moderate heterogeneity, 50-90% indicating substantial heterogeneity, and 75-100% indicating considerable heterogeneity (Higgins et al., 2022). If high levels of between-study heterogeneity were observed, sensitivity analyses were conducted to identify studies that may be influencing the results. Conducting sensitivity analysis may also have helped towards identifying clinical or methodological heterogeneity between studies (Patsopoulos et al., 2008).

Several studies included multiple clinical groups being compared to one non-clinical group. In order to use multiple clinical groups from one study in the meta-analysis, the sample size of the healthy control group was divided by the number of clinical groups it was compared to. This strategy addressed the unit-of-analysis error created by the correlations

between multiple comparisons and is recommended by the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2022).

Secondary analyses were conducted to investigate differences between psychiatric groups for total correct MASC scores and mentalizing errors. Studies were therefore grouped according to DSM 5 classifications (American Psychiatric Association, 2013). These groups were (1) Neurodevelopmental Disorders, (2) Mood and Anxiety disorders, (3) Personality Disorders, and (4) Schizophrenia and Other Psychotic Disorders. A small number of studies (n=7) included disorders which did not fit within these four groups and therefore were categorised into 'Other' and excluded, e.g., substance dependency, eating disorders, obsessive compulsive disorder (Knoll et al., 2014; SAMHSA, 2016).

Results

The initial search through seven databases (PsycINFO, CINAHL, ASSIA, MEDLINE, CENTRAL, Emcare, EMBASE) returned n=5530 studies and n=1 study was identified through reference searches. Once duplicates were removed, n=4564 studies were screened and the remaining n=139 studies from the initial screening were assessed for eligibility. Of these studies, n=38 were included in the review and n=101 were excluded. Of the studies excluded, n=21 studies did not utilise the MASC tool, n=31 did not include a comparison group of individuals without the presence of a mental health condition, n=13 either did not include a clinical group or the clinical group did not consist of mental health conditions, n=8 had missing or insufficient data, n=5 had duplicated samples and data, n=14 were conference abstracts without peer-reviewed articles available, n=2 did not have an English version available, n=4 had a study design which impacted the available data (e.g., recorded MASC following an intervention, a twin study), and n=3 were not empirical papers. A PRISMA flow diagram of the study selection is presented in figure 1. Of the n=38 studies included in the review, n=35 reported total correct MASC scores and were included in the analysis of the main outcomes. N=2 studies only reported data for mentalizing errors and

were included in the secondary analyses. A summary of the sample demographics of the included studies is presented in table 1.

Figure 1

PRISMA Flow Diagram

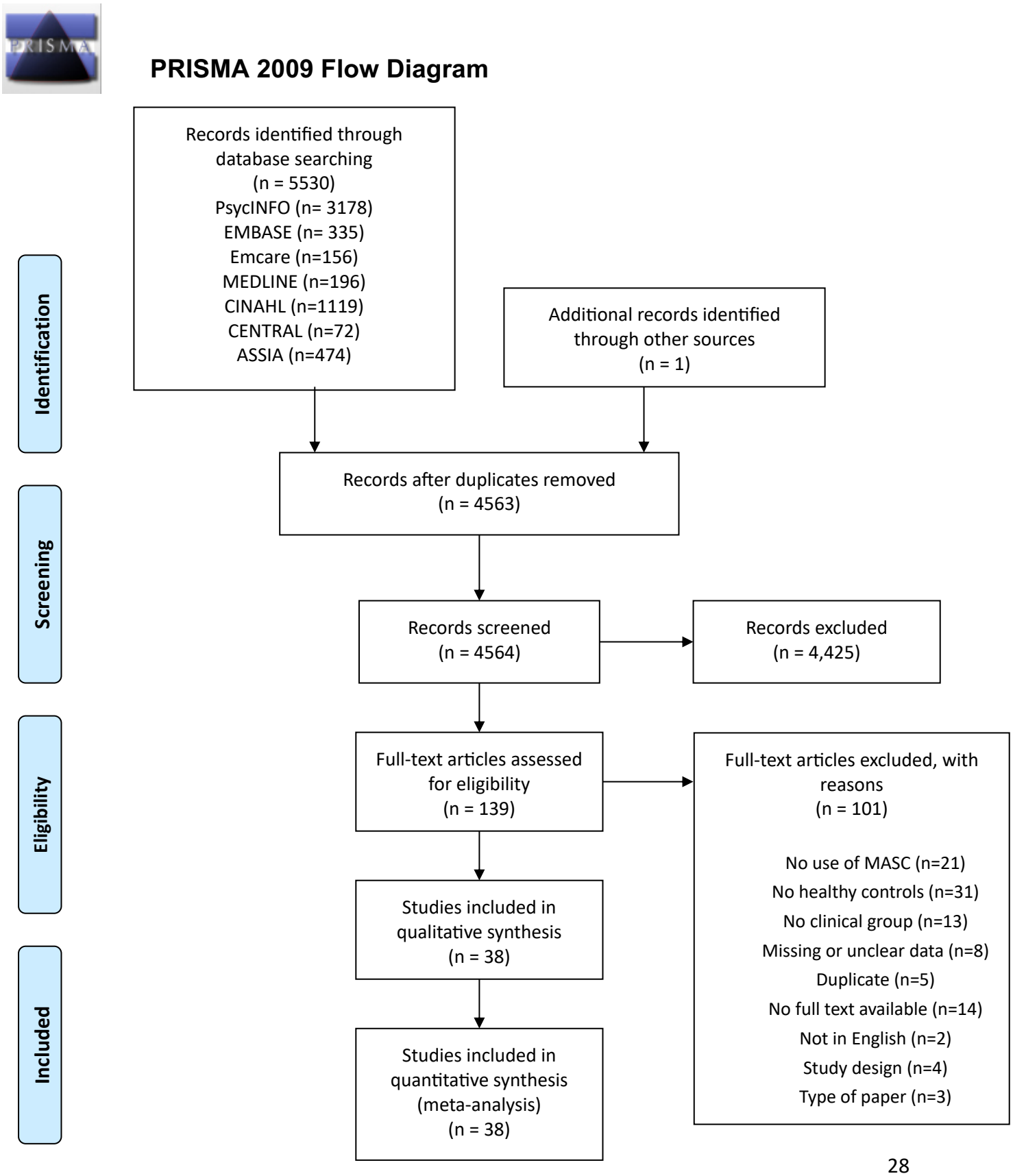


Table 1

A Summary of the Sample Demographics of the Included Studies, Presented in Alphabetical Order, Grouped by Age Group and Diagnosis

Study	Year	Group	Clinical Group						Healthy Controls			
			Diagnosis	MH Group*	n	Age m (sd)	Gender M(F)	Years of edu m (sd)	n	Age m (sd)	Gender M(F)	Years of edu m (sd)
Abdel-Hamid et al.	2019	Adult	ADHD	Neurodevelopmental disorders	30	34.5 (6.81)	15(15)	-	30	35.83 (11.68)	15(15)	-
Aidelbaum & Goghari	2022	Adult	BPAD	Mood and anxiety disorders	26	38.29 (11.79)	8(18)	14.42 (2.69)	25	38.32 (10.36)	8(17)	15.96 (1.93)
Andrade-Gonzalez et al.	2021	Adult	SCZ	Schizophrenia and other psychotic disorders	53	37.49 (10.8)	36(17)	-	42	37.7 (10.7)	27(15)	-
Andreou et al.	2015	Adult	BPD	Personality disorders	44	29(8.9)	6(38)	-	38*	32.92 (12.6)	16(22)	-
		Adult	SCZ	Schizophrenia and other psychotic disorders	36	32.34 (11.44)	20(16)	-	38**	32.92 (12.6)	16(22)	-
Bast et al.	2019	Adolescent	ASD	Neurodevelopmental disorders	23	15.9 (2.8)	18(5)	-	24	15.8 (2.4)	19(5)	-
Buhlmann et al.	2015	Adult	BDD	Other	35	33.46 (11.3)	14(21)	15.94 (2.01)	35**	32.74 (10.98)	14(21)	16.66 (1.85)
		Adult	Social Anxiety	Mood and anxiety disorders	35	32.2 (8.85)	14(21)	16.14 (2.46)	35**	32.74 (10.98)	14(21)	16.66 (1.85)
		Adult	OCD	Other	35	34.03 (9.07)	18(17)	16.13 (2.3)	35**	32.74 (10.98)	14(21)	16.66 (1.85)

Study	Year	Group	Clinical Group						Healthy Controls			
			Diagnosis	MH Group*	n	Age m (sd)	Gender M(F)	Years of edu m (sd)	n	Age m (sd)	Gender M(F)	Years of edu m (sd)
Catalan et al.	2018	Adult	First-episode Psychosis	Schizophrenia and other psychotic disorders	32	37.8 (13)	13(19)	15.9(3)	32	27.9 (11.2)	13(19)	18.2 (2.5)
Corsi et al.	2021	Adult	Eating Disorder	Other	78	26.14 (7.46)	0(78)	16.01 (2.9)	66	27.43 (8.57)	0(66)	17.02 (2.19)
Cortes-Garcia et al.	2021	Adolescent	Eating Disorder	Other	128	15.38 (1.47)	17(111)		184	15.41 (1.21)	52(123)	
Dziobek et al.	2006	Adult	Asperger Syndrome	Neurodevelopmental disorders	19	41.6 (10.4)	19(2)	16.7 (1.7)	20	39.9 (12.6)	18(2)	16.8 (1.4)
Duque-Alarcon et al.	2019	Adult	BPD	Personality disorders	18	31.17 (9.5)	0(18)	15.06 (2.2)	15	32.8 (8.6)	0(15)	15.22 (2.5)
Eidenmueller et al.	2021	Adult	Opioid Dependent with comorbidity	Other	66	43.38 (8.62)	45(21)		66	41.22 (10.51)	36(30)	-
Engelstad et al.	2019	Adult	SCZ/ Schizoaffective disorder (homicide offenders)	Schizophrenia and other psychotic disorders	26	38.2 (7.3)	25(1)	9.6 (2.2)	71**	29.3 (7.7)	42(29)	14.2 (2.1)
.		Adult	SCZ / Schizoaffective Disorder (no history of violence)	Schizophrenia and other psychotic disorders	28	36.7 (10.1)	25(3)	11.1 (1.6)	71**	29.3 (7.7)	42(29)	14.2 (2.1)
Fossati et al.	2018	Adult	PD	Personality disorders	59	37.02 (10.42)	21(38)	-	193	32.77 (11.38)	78(115)	
Lahera et al.	2014	Adult/ Adolescent	Asperger Syndrome	Neurodevelopmental disorders	22	21 (6.6)	4(18)	13.8 (1.9)	25	22.7 (4.7)	8(17)	14.5 (1.9)

Study	Year	Group	Clinical Group						Healthy Controls			
			Diagnosis	MH Group*	n	Age m (sd)	Gender M(F)	Years of edu m (sd)	n	Age m (sd)	Gender M(F)	Years of edu m (sd)
Martinez et al.	2017	Adult	ASD	Neurodevelopmental disorders	19	22.7 (4.1)	15(4)	12 (2.5)	20**	23. (3.6)	17(3)	14.6 (1.9)
		Adult	SCZ	Schizophrenia and other psychotic disorders	36	23.4 (3.5)	30(6)	12.6 (2.5)	20**	23.4 (3.6)	17(3)	14.6 (1.9)
Montag et al.	2010	Adult	BPAD	Mood and anxiety disorders	29	44 (12.9)	10(19)	15.3 (3)	29	39.7 (10.9)	13(16)	15.3 (2.3)
Montag et al.	2011	Adult	Paranoid SCZ	Schizophrenia and other psychotic disorder	80	39.1 (10.7)	47(33)	14 (2.8)	80	38.4 (12.3)	41(39)	15.4 (2.3)
Muller et al.	2016	Adolescent	ASD	Neurodevelopmental disorders	33	15.6 (1.9)	27(6)	-	23	16.3 (2.4)	14(9)	-
Newbury-Helps et al.	2017	Adult	ASPD (offenders)	Personality disorders	54	31.7 (10.4)	54(0)	9.5(2)	42	37.5 (15.9)	42(0)	10.8 (2.4)
Normann-Eide et al.	2020	Adult	BPD	Personality disorders	53	26.5 (4.6)	5(48)	14.3 (2.7)	71	29.3 (7.7)	42(29)	
Oakley et al.	2016	Adult	ASD	Neurodevelopmental disorders	19	30.89 (11.86)	1(5)	-	24	30.13 (12.21)	13(11)	-
Penner et al.	2020	Adolescent	BPD	Personality disorders	139	15.31 (1.51)	29(110)	-	134	15.32 (1.22)	39(95)	-
Porter-Vignola et al.	2022	Adolescent	Depression	Mood and anxiety disorders	43	16.19 (1.24)	0(43)	-	40	15.44 (1.24)	0(40)	-
Preisler et al.	2010	Adult	BPD	Personality disorders	64	29.2 (8.9)	0(64)	-	38	31.7 (10.3)	0(38)	-

Study	Year	Group	Clinical Group						Healthy Controls			
			Diagnosis	MH Group*	n	Age m (sd)	Gender M(F)	Years of edu m (sd)	n	Age m (sd)	Gender M(F)	Years of edu m (sd)
Quek et al.	2018	Adolescent	BPD	Personality disorders	26	15.65 (1.09)	3(23)	-	25	15.12 (1.56)	5(20)	-
Ritter et al.	2011	Adult	NPD (total)	Personality disorders	47	32.4 (8)	23(24)	-	53**	33.2 (10.7)	24(29)	--
		Adult	NPD (without BPD)	Personality disorders	22	34.3 (8.3)	14(8)	-	53**	33.2 (10.7)	24(29)	-
		Adult	BPD (without NPD)	Personality disorders	27	30 (8.3)	2(25)	-	53**	33.2 (10.7	24(29)	-
Sahl et al.	2022	Adult	High IQ SCZ or schizoaffective disorder	Schizophrenia and other psychotic disorders	17	30.7 (8.1)	9(8)	13.1 (1.7)	71**	29.3 (7.7)	42(29)	14.2 (2.1)
		Adult	Low IQ SCZ or schizoaffective disorder	Schizophrenia and other psychotic disorders	31	27.9 (7.6)	22(9)	11 (2.2)	71**	29.3 (7.7)	42(29)	14.2 (2.1)
Santos et al.	2017	Adult	BPAD (euthymic)	Mood and anxiety disorders	31	41.48 (11.7)	14(17)	-	31	39.87 (11.81)	14(17)	-
Schonenberg et al.	2014	Adult	Persistent Somatoform Pain Disorder	Other	19	47.05 (8.92)	0(19)	10.47 (2.14)	19	46.21 (10.06)	0(19)	10.89 (2.05)

Study	Year	Group	Clinical Group						Healthy Controls			
			Diagnosis	MH Group*	n	Age m (sd)	Gender M(F)	Years of edu m (sd)	n	Age m (sd)	Gender M(F)	Years of edu m (sd)
Seitz et al.	2022	Adult	PTSD	Mood and anxiety disorders	33	34.33 (12.48)	5(28)	11.97 (1.61)	35**	29.34 (9.69)	7(28)	12.63 (1.06)
		Adult	MDD	Mood and anxiety disorders	33	30.45 (11.12)	10(23)	12.48 (1.25)	35**	29.34 (9.69)	7(28)	12.63 (1.06)
		Adult	Somatic Symptom Disorder	Other	36	30.42 (11.82)	8(28)	11.89 (1.62)	35**	29.34 (9.69)	7(28)	12.63 (1.06)
Somma et al.	2019	Adolescent	BPD	Personality disorders	20	-	3(17)	-	373	17.13 (1.35)	135(238)	-
Vaskinn et al.	2015	Adult	BPD	Personality disorders	25	30.7 (5.9)	0(25)	13.6 (2.7)	25**	30.6 (8.6)	0(25)	14.3 (2.4)
		Adult	SCZ	Schizophrenia and other psychotic disorders	25	30.8 (10)	0(25)	12.5 (2.2)	25**	30.6 (8.6)	0(25)	14.3 (2.4)
Vaskinn et al.	2021	Adult	SCZ	Schizophrenia and other psychotic disorders	68	29.4 (8.1)	43(25)	12.3 (2.5)	70	29.4 (7.7)	42(28)	14.2 (2.1)
Vaskinn et al.	2018	Adult	SCZ or schizoaffective disorder	Schizophrenia and other psychotic disorders	91	29.1 (8.4)	57(34)	12.2 (2.4)	71	29.3 (7.7)	42(29)	14.2 (2.1)

Study	Year	Group	Clinical Group						Healthy Controls			
			Diagnosis	MH Group*	n	Age m (sd)	Gender M(F)	Years of edu m (sd)	n	Age m (sd)	Gender M(F)	Years of edu m (sd)
Washburn et al.	2016	Adult/ Adolescent	MDD (lifetime)	Mood and anxiety disorders	40	19.73 (3.43)	12(28)	-	43**	18.74 (1.71)	15(28)	-
		Adult/ Adolescent	Social Anxiety	Mood and anxiety disorders	12	19.83 (4.11)	5(7)	-	43**	18.74 (1.71)	15(28)	-
		Adult/ Adolescent	Comorbid Social anxiety and MDD	Mood and anxiety disorders	24	19.71 (2.81)	6(18)	-	43**	18.74 (1.71)	15(28)	-
Wastler & Lenzenweger	2021	Adult/ Adolescent	Schizotypy	Schizophrenia and other psychotic disorders	40	19.90 (3.21)	9(31)	14.3 (2.17)	46**	19.09 (1.01)	18(28)	13.61 (1.27)
		Adult/ Adolescent	Negative affect	Mood and anxiety disorders	30	19 (0.98)	7(23)	13.5 (1.31)	46**	19.09 (1.01)	18(28)	13.61 (1.27)
Wolkenstein et al.	2011	Adult	MDD	Mood and anxiety disorders	24	37.17 (10.35)	11(13)	-	20	35.7 (11.15)	8(12)	-

*Category created based on DSM 5 diagnostic categories

**Divided by the number of comparisons in the meta-analysis

M=male; F=female; sd=standard deviation; m=mean; PD: personality disorder; SCZ: Schizophrenia; MDD: Major depressive disorder; BDD: Body dysmorphic disorder; BPAD: bipolar affective disorder; ASD: Autism spectrum disorder; ADHD; attention deficit hyperactivity disorder; OCD: obsessive compulsive disorder; NPD: narcissistic personality disorder; PTSD: posttraumatic stress disorder; ASPD: antisocial personality disorder; MH Group: mental health group; Edu: education

Summary of Studies

N= 38 studies were included in the review. Of these n= 35 were included in the meta-analysis of total correct MASC scores, while only n=23 studies reported mentalizing error scores and were included in the secondary analyses. All studies compared one or more clinical groups to healthy controls and spanned a range of psychological and neurological disorders, namely ADHD (k=1), BPAD (k=3), schizophrenia (k=11), BPD (k=9), ASD (k=4), Body dysmorphic disorder (BDD) (k=1), social anxiety (k=2), Obsessive compulsive disorder (OCD) (k=1), first episode psychosis (k=1), eating disorders (ED) (k=2), Asperger's syndrome (k=2), opioid dependency (k=1), personality disorder (k=1), ASPD (k=1), depression or Major depressive disorder (MDD) (k=4), NPD (k=2), persistent somatoform pain disorder (k=1), PTSD (k=1), somatic symptom disorder k=1), comorbid social anxiety and MDD (k=1), schizotypy (k=1), negative affect (k=1). Studies predominantly looked at adult groups (n=28), however n=7 studies looked at adolescent and n=3 studies did not distinguish between adults and adolescents (denoted as adult/adolescents in table 1 and appendix 3). The seven studies including adolescent groups were limited in the range of psychological disorders (BPD: n=3; ASD: n=2; ED: n=1; Depression: n=1).

Studies were categorised into clinical subgroups described above. The defined categories included n=11 studies which assessed the mentalizing capacity in individuals with a personality disorder diagnosis, n=7 studies which assessed individuals with neurodevelopmental disorders, n=12 studies looked at mood and anxiety disorders, and n=13 studies assessed individuals with a diagnosis of schizophrenia or another psychotic disorder.

The main outcomes reported in the included studies are summarised in appendix 3. These consist of the mean total MASC scores for clinical and healthy control groups, as well as the mean mentalizing error scores if reported.

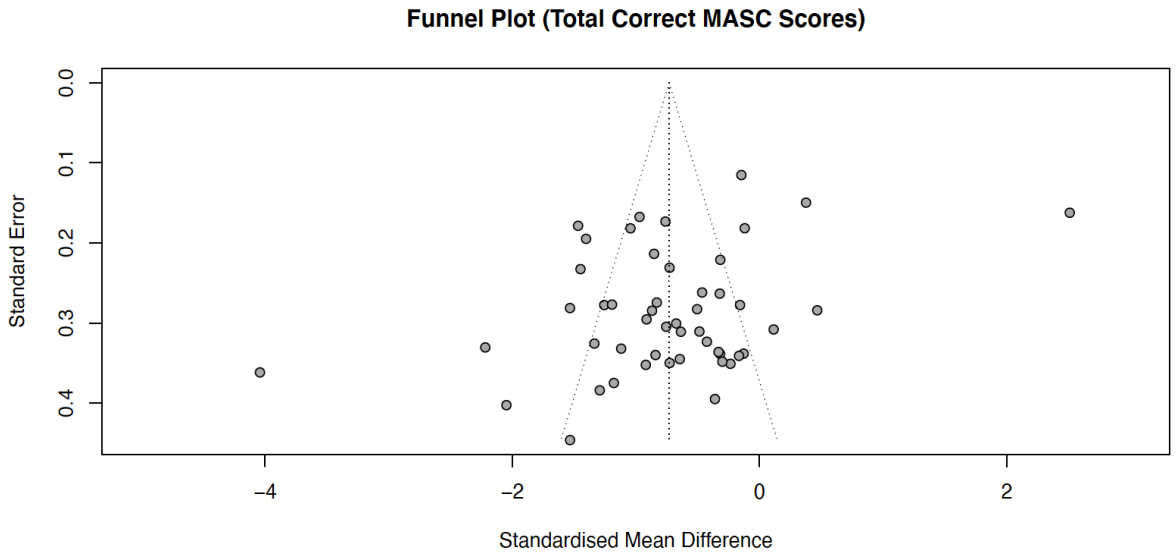
Main Outcomes

N= 35 studies (k=49 comparisons) were included in the meta-analysis of total correct MASC scores finding a medium effect size in which clinical groups had significantly lower total MASC scores compared to healthy controls (K=49, Hedge's g=-0.73 [95% CI: -0.98 to -0.48], $p < 0.001$). There was high heterogeneity observed in this model (I^2= 93.1%).

Four of the studies were observed to have very large effect sizes (i.e., greater than 2 or lower than -2) compared to other included studies (Dziobek et al., 2006; Engelstad et al., 2019; Newbury-Helps et al., 2017; Penner et al. 2020), which were considered extreme compared to the other studies. This threshold was chosen based on the methodology of a previous meta-analysis (Arundell et al., 2021). The funnel plot in figure 2 shows an asymmetrical pattern and demonstrates the large effect sizes of the n=4 studies. Three can be identified in the bottom left corner of the plot (Dziobek et al., 2006; Engelstad et al., 2019; Newbury-Helps et al., 2017) and one in the top right corner of the plot (Penner et al., 2020). These studies represented the personality disorders subgroup (BPD: Penner et al., 2020; ASPD: Newbury-Helps et al., 2017), the neurodevelopmental disorders subgroup (Asperger's syndrome: Dziobek et al., 2006), and the schizophrenia subgroup (Schizophrenia: Engelstad et al., 2019).

Figure 2

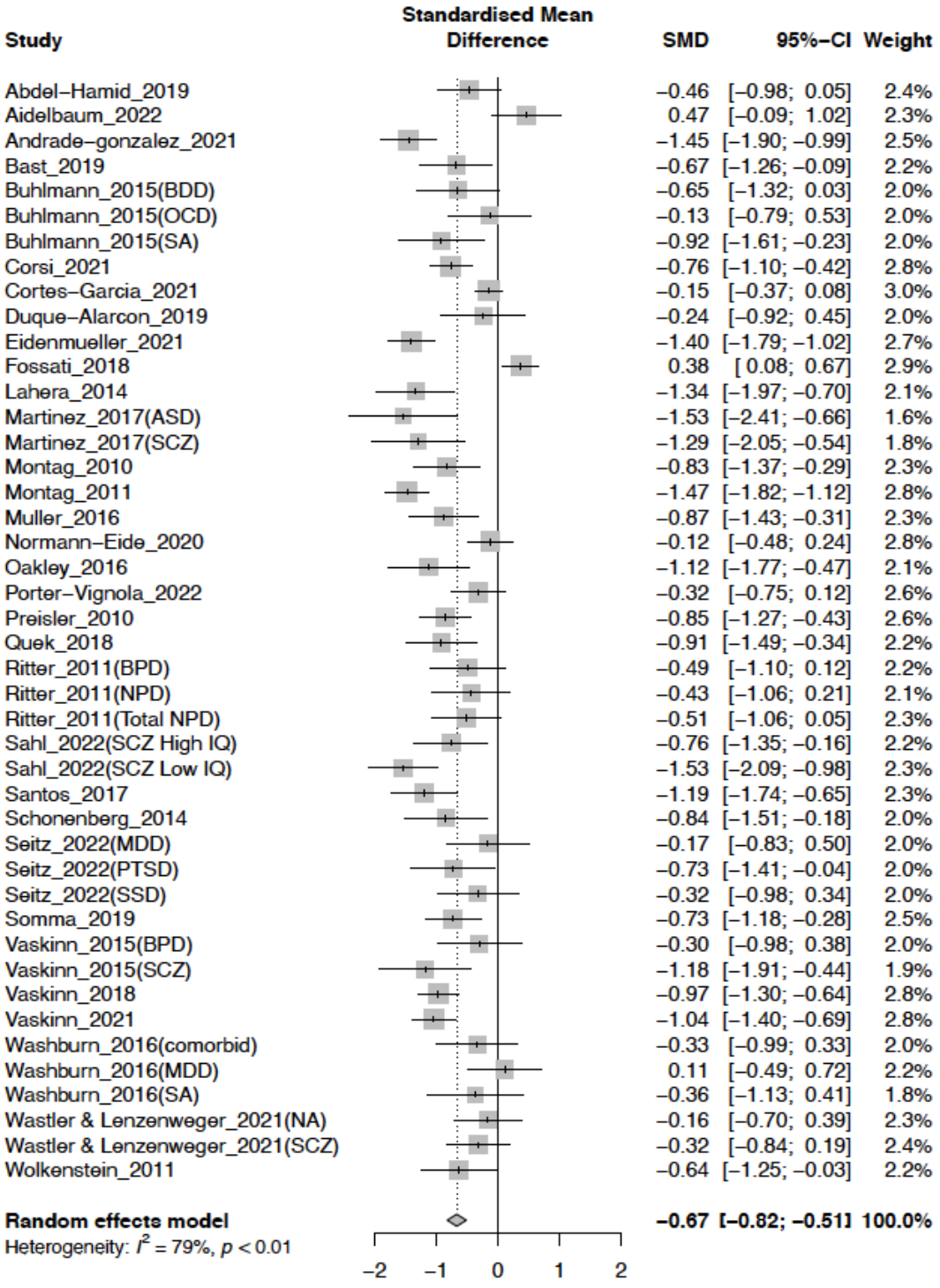
A Funnel Plot Depicting the Distribution of Effect Sizes



A sensitivity analysis was run removing these four studies (five comparisons) and found that the effect size was reduced but remained medium sized (k=44, Hedge's g=-0.67 [95% C1: -0.82; -0.51], p<0.001). Heterogeneity also reduced but remained considerable (I^2 =78.7%). The results are summarised in a forest plot (figure 3). Considering the results of this sensitivity analysis, further analyses of total correct MASC scores were conducted with n=32 studies, excluding the four studies with extreme effect sizes.

Figure 3

A Forest Plot of The Meta-Analysis of Total Correct MASC Scores

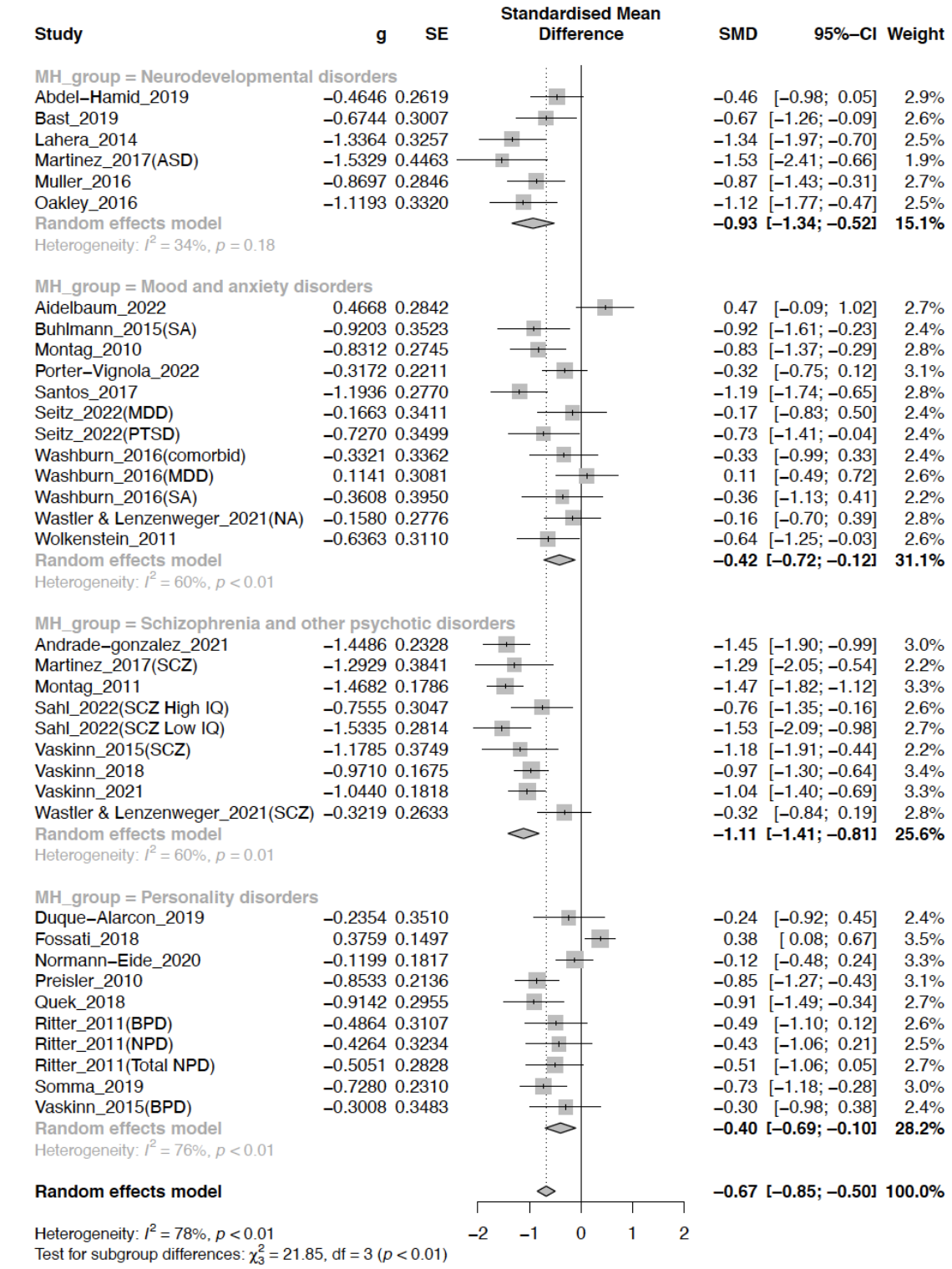


A further meta-analysis was conducted to compare total correct MASC scores between the four clinical subgroups created based on the DSM 5 diagnostic groups.

The meta-analysis of total correct MASC scores for the clinical subgroups found two large effect size for the 'schizophrenia and other psychotic disorders' subgroup (k=9, Hedge's g=-1.11[95%CI: -1.41; -0.81], p<0.001) and the 'neurodevelopmental disorders' subgroup (k=6, Hedge's g= -0.93 [95%CI: -1.34; -0.52], p=0.002) which had significantly lower total correct MASC scores compared to healthy controls. Small but significant effect sizes were found for the 'mood and anxiety disorders' (k=12, Hedge's g= -0.42[95% CI -0.72; -0.12], p=0.011) and 'personality disorders' (k=10, Hedge's g= -0.40 [95% CI: -0.69; -0.10], p=0.014) subgroups. A summary of the results is presented in figure 4.

Figure 4

A Forest Plot of the Meta-Analysis of Total Correct MASC Scores Separated by Clinical Subgroup

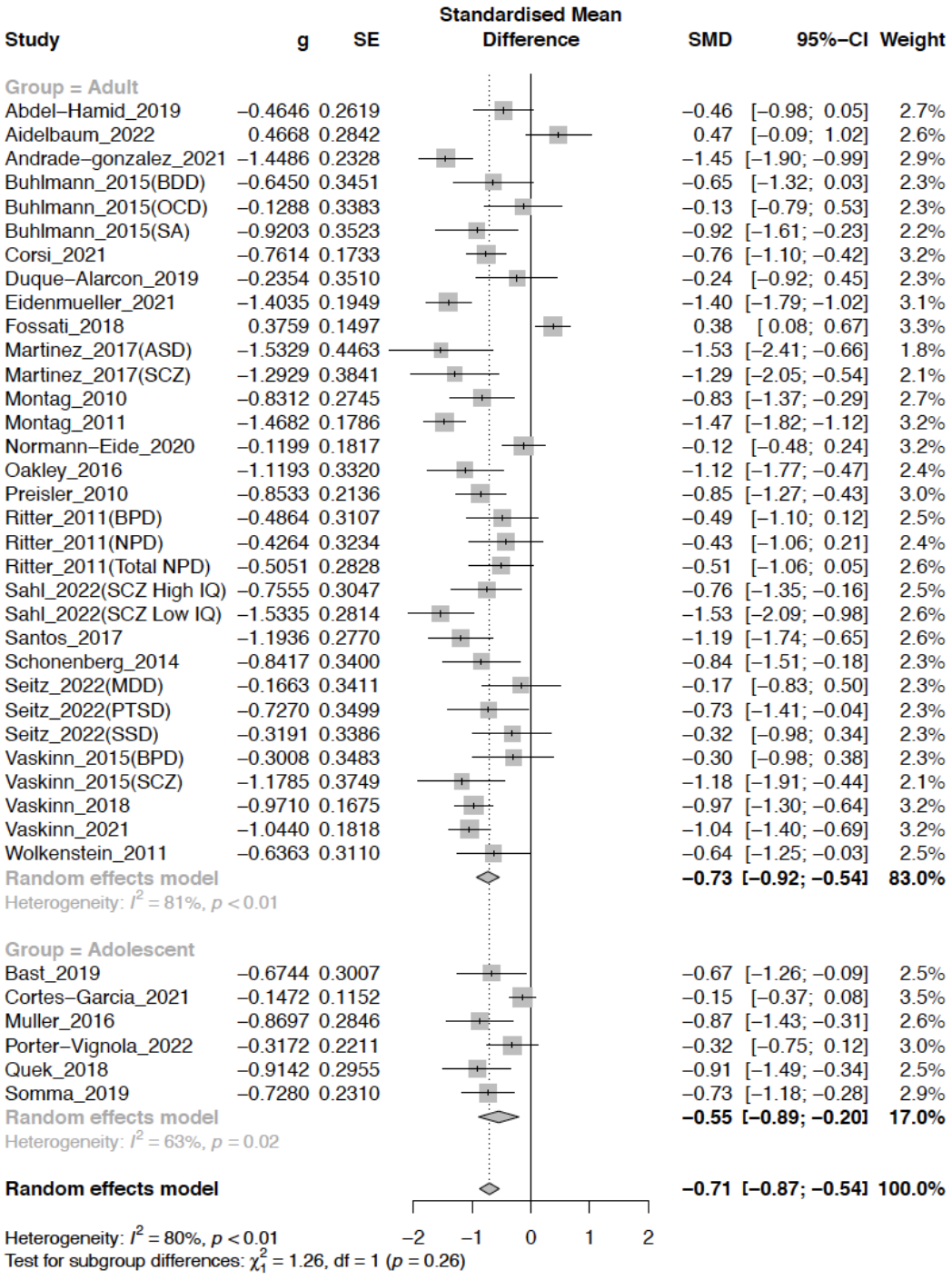


A further meta-analysis of total correct MASC scores was conducted to compare adult and adolescent populations. Studies which grouped adolescent and adult participants together were excluded from this analysis (Lahera et al. 2014; Washburn et al., 2016; Wastler & Lenzenweger, 2021). The results are summarised in figure 5. N=23 studies were included for adult sample groups and n= 6 studies were included for adolescent sample groups.

The meta-analysis for adult clinical groups found a medium effect size in which clinical groups had significantly lower MASC scores than non-clinical groups (k=32, Hedges' g= -0.73[95 CI =-0.92; -0.54], I^2= 80.8%). The meta-analysis for adolescent clinical groups also found a medium effect size in which clinical groups had lower MASC scores compared to control groups (k=6, Hedge's g=-0.55, [95 CI=-0.89; -0.20], I^2= 63.1%). The test for subgroup differences did not find a significant difference between the adult and adolescent subgroups (p=0.262).

Figure 5

A Forest Plot of the Meta-Analysis of Total Correct MASC Scores Separated by Age Group



Secondary Analyses

Secondary analyses were conducted to investigate differences in types of mentalizing errors between clinical and non-clinical groups. Subgroup analyses were run for

hypermentalizing errors, hypomentalizing errors and non-mentalizing errors. A summary of the mentalizing error scores can be found in appendix 3.

Non-Mentalizing Errors

N=23 studies (k=30 comparisons) were included in the meta-analysis of scores indicating non-mentalizing and found a medium effect size in which clinical groups had significantly higher errors of non-mentalizing compared to healthy controls (k=30, Hedge's g=0.70 [95% CI:0.42; 0.98], p< 0.001). High heterogeneity was found (I^2= 86.9%).

Sensitivity analyses were performed as one study was observed to have a large effect size (g=3.63) compared to other included studies (Newbury-Helps et al., 2017). The effect size was reduced but remained medium-sized (k=29, Hedge's g=0.61 [95% CI: 0.41; 0.81], p<0.001). Heterogeneity reduced but remained high (I^2= 80.2%).

In order to investigate differences in error types between subgroups, analyses of the frequency of non-mentalizing errors for the four clinical subgroups were conducted. A medium effect size was found for the 'neurodevelopmental disorders' subgroup (k=3, Hedge's g=0.71 [95% CI: 0.20; 1.21]) which had significantly higher non-mentalizing error scores compared to non-clinical groups. A small effect size was found for the 'mood and anxiety disorders' subgroup (k=7, Hedge's g=0.36 [95% CI: 0.03; 0.69]) which had significantly higher error scores than the non-clinical groups. A large effect size was found for the 'schizophrenia and other psychotic disorders' subgroup (k=12, Hedge's g=1.10 [95% CI: 0.98; 1.22]) in which the clinical groups had significantly higher error scores than non-clinical comparisons. Finally, a negligible and non-significant effect size was found for the 'personality disorders' subgroup (k=7, Hedge's g=-0.08 [95% CI: -0.27; 0.12). A summary of the results is presented in table 2.

Subgroup analyses found significant differences between subgroups when comparing the 'personality disorders' subgroup with the 'neurodevelopmental disorders' subgroup (p<.001), the 'schizophrenia and other psychotic disorders' subgroup (p<.001), and the 'mood and anxiety disorders' subgroup (p=0.006).

Table 2

Summary of Meta-Analysis for Non-Mentalizing Errors

Clinical subgroup	K	Hedge's g	95% CI	I^2
Neurodevelopmental Disorders	3	0.71	0.20; 1.21	0%
Mood and Anxiety disorders	7	0.36	0.03; 0.69	33.8%
Schizophrenia and Other Psychotic Disorders	12	1.10	0.98; 1.22	0%
Personality Disorders	7	-0.08	-0.27; 0.12	0%

K= number of comparisons

Hypomentalizing Errors

N=23 studies (k=30 comparisons) were included in the meta-analysis of hypomentalizing error scores finding a medium effect size in which clinical groups had significantly higher hypomentalizing errors compared to healthy controls (k=30, Hedge's g=0.67 [95% CI: 0.33; 1.02], p<.0001). High heterogeneity was found (I^2= 89.0%).

A sensitivity analysis was also run as two studies were observed to have large effect sizes compared to other included studies (Newbury-Helps et al., 2017; Englestad et al., 2019). The effect size was reduced to small (k=29, Hedge's g=0.48 [95% CI: 0.26; 0.71], p<.001). Heterogeneity remained high (I^2= 80.7%).

An analysis of the four clinical subgroups was conducted. A large effect size was found for the 'schizophrenia and other psychotic disorders' subgroup (k=10, Hedge's g=1.05 [95% CI: 0.88; 1.21) which had significantly higher hypomentalizing error scores compared to controls. The other clinical subgroups did not yield statistically significant differences between clinical and non-clinical groups. A summary of the results is presented in table 3.

Subgroup analyses found significant differences between subgroups when comparing the 'personality disorders' subgroup with the 'neurodevelopmental disorders'

subgroup (p<.001), the 'schizophrenia and other psychotic disorders' subgroup (p<.001), and the 'mood and anxiety disorders' subgroup (p=0.006).

Table 3

Summary of Meta-Analysis for Hypomentalizing Errors

Clinical subgroup	K	Hedge's g	95% CI	I^2
Neurodevelopmental Disorders	3	0.66	-0.88; 2.20	77.1%
Mood and Anxiety disorders	7	0.11	-0.24; 0.46	41.8%
Schizophrenia and Other Psychotic Disorders	10	1.05	0.88; 1.21	0%
Personality Disorders	7	0.01	-0.22; 0.24	12.1%

K= number of comparisons

Hypermentalizing Errors

N=22 studies reported hypermentalizing error scores and were included in the meta-analysis (k=29 comparisons). Clinical groups were found to have a significantly higher hypermentalizing error scores compared to controls, with a small effect size (k=29, Hedge's g=0.40 [95% CI: 0.29; 0.52], p< 0.001). Minimal heterogeneity was observed (I^2= 29.4%)

Subgroup analyses were conducted and found two significant differences between clinical and non-clinical groups. A medium effect size was found in which the 'personality disorders' subgroup (k=7, Hedge's g=0.53 [95% CI: 0.19; 0.87) had significantly higher hypermentalizing errors compared to controls. A small effect size was found in which the 'schizophrenia and other psychotic disorders' subgroup (k=12, Hedge's g=0.37 [95% CI: 0.21; 0.53) had significantly higher error scores compared to controls. A summary of the results is presented in table 4.

Subgroup analyses did not find significant differences between subgroups when comparing the 'personality disorders' subgroup with the 'neurodevelopmental disorders'

subgroup (p=0.735), the 'schizophrenia and other psychotic disorders' subgroup (p=0.272), and the 'mood and anxiety disorders' subgroup (p=0.753).

Table 4

Summary of Meta-Analysis for Hypermentalizing Errors

Clinical subgroup	K	Hedge's g	95% CI	I^2
Neurodevelopmental Disorders	3	0.68	-0.11; 1.47	4.2%
Mood and Anxiety disorders	7	0.23	-0.01; 0.46	0%
Schizophrenia and Other Psychotic Disorders	12	0.37	0.21; 0.53	18.6%
Personality Disorders	7	0.53	0.19; 0.87	54.6%

K= number of comparisons

Discussion

Summary of Findings

This meta-analysis investigated mentalizing ability in a range of psychological disorders, using the MASC, in comparison with healthy controls. In the primary analysis, a significant difference in total correct MASC scores between clinical groups and healthy controls was identified. All clinical groups were found to have significantly lower mentalizing ability compared to healthy controls, and such impairments were present across a range of psychological and neurodevelopmental disorders. These findings were replicated in adult and adolescent groups. In the secondary analysis, significant differences in all mentalizing errors were found between clinical groups and healthy controls, with clinical groups having greater error scores compared to controls. Furthermore, differences in the type of mentalizing error (i.e., hypermentalizing, hypomentalizing or non-mentalizing) were found between the different clinical groups, and which are discussed below.

In line with the first aim of this review, the identification of differences in mentalizing across a range of disorders demonstrates the ability of the MASC to discriminate between

clinical groups and healthy controls. Furthermore, the results of this review contribute to the evidence base for the use of the MASC as a measure of social cognition in clinical populations.

A secondary aim of the review was to determine whether specific clinical groups had different 'profiles' of mentalizing deficits. This was addressed by investigating total correct MASC scores and types of mentalizing errors between clinical groups. Significant differences in total correct MASC scores were found for each of the clinical subgroups compared to those of healthy controls. This finding supports the theory that impairments in mentalizing capacity are present transdiagnostically (Luyten et al. 2020). However, the meta-analysis identified the largest difference between clinical groups and healthy controls in the 'schizophrenia and other psychotic disorders' subgroup and the 'neurodevelopmental disorders' subgroup, suggesting to more pronounced deficits in mentalizing capacity in disorders that fall within these two clinical categories. Given that the MASC requires participants to make inferences about the mental states of the characters in the film, the findings may reflect the observed difficulty that individuals with psychotic disorders, and individuals with neurodevelopmental disorders such as ASD, have in understanding or inferring the mental states of others (Weijers et al., 2020; Baron-Cohen et al. 2000; Chung et al., 2014).

The small, yet significant, effect sizes found for the 'personality disorders' and 'mood and anxiety disorders' subgroups reflects the knowledge of mentalizing deficits within these clinical disorders (Luyten et al., 2020; Sloover et al., 2022). Of note, conclusions about specific disorders are limited by the considerable differences in the number of studies looking at specific disorders. For example, only one study looked at individuals with PTSD and found significant differences in mentalizing capacity (Seitz et al., 2022). While this finding is consistent with a recent meta-analysis which identified a large deficit in social cognition in PTSD groups compared to healthy controls (Stevens & Jovanovic, 2019), the inclusion of only one study on mentalizing in PTSD reflects the need for further research into this area. Notably, premorbid deficits in mentalizing were associated with increased risk of

developing PTSD, providing further rationale for future research (Stevens & Jovanovic, 2019; Luyten et al., 2020).

Secondary analyses of the different mentalizing errors highlighted differences in type of impairment across disorders. The 'schizophrenia and other psychotic disorders' group scored significantly higher for hypomentalizing, hypermentalizing and non-mentalizing errors, compared to controls. Large effect sizes were found for hypomentalizing and non-mentalizing errors, while there was only a small effect size for hypermentalizing. The 'neurodevelopmental disorders' subgroup only had a significant effect size for the non-mentalizing error type, indicating a greater frequency of this error type compared to controls. Similarly, the 'mood and anxiety disorders' subgroup only had a significant but small effect size for non- mentalizing errors. Finally, the 'personality disorders' group only had a significant difference from controls in the hypermentalizing error type. Broadly, the findings demonstrate differences in the type of mentalizing errors across different disorders, supporting the proposition of disorder-specific 'profiles' of mentalizing deficits (Luyten et al., 2020).

An additional aim of the review was to compare mentalizing performance using the MASC in adult and adolescent populations. The review found that, similarly to adult clinical groups, adolescent clinical groups had significantly lower total correct MASC scores compared to healthy controls group. No significant difference was found between studies looking at adults versus those looking at adolescent groups. Of the studies included in the meta-analysis, only the studies looking at BPD and ASD found significant differences in correct MASC scores compared to healthy controls. This finding adds to the existing knowledge base on mentalizing deficits in adolescents with BPD (Quek et al., 2018; Somma et al 2019), as well as ASD (Bast et al., 2019, Muller et al., 2016).

The similarities in the existence of mentalizing deficits in adolescents and adults reflects the view that the development of effective mentalizing commences in early life through adolescence into adulthood (Fehlbaum et al., 2022). Consequently, disruptions to the development of mentalizing, e.g., in early childhood by trauma, which has been linked

with mentalizing impairments in adult clinical populations may also present in earlier stages of development, such as adolescence. In turn, this finding supports the suggestion that mentalizing is an underlying mechanism in the development of disorders such as BPD and presents a potential target for intervention to change the developmental trajectory of the disorder (Bo et al., 2017).

Furthermore, the ability of the MASC to identify mentalizing impairments in adolescent populations, in a range of clinical presentations, supports the use of the MASC with adolescents. The findings also support the use of the MASC in future research investigating mentalizing capacity in adolescence. This could have important clinical implications, particularly with consideration to adolescence being a developmental period which could provide an opportunity for early intervention or prevention (Penner et al., 2020).

Discussion of Findings for the Clinical Subgroups

Personality Disorders

The meta-analysis of total correct MASC scores identified mentalizing impairments in a range of personality disorders, including BPD, NPD and ASPD. This is an expected finding given the established understanding that personality disorders are characterised by deficits in mentalizing capacity (Luyten et al., 2020).

When examining type of mentalizing error, except for one study which looked at ASPD (Newbury-Helps et al., 2017), the 'personality disorders' studies only included participants with BPD. This is likely a reflection of the field which, until recently, has predominantly focused on applying the mentalizing approach to BPD. Hypermentalizing was the only error type that was significantly different between controls and individuals with a personality disorder diagnosis. Hypermentalizing can be explained as being quick to lose controlled mentalizing, and an overreliance on automatic mentalizing. In turn, individuals can end up "jumping to conclusions" and making misinterpretations of other people's behaviour (Luyten et al., 2020; Penner et al., 2020).

The findings are consistent with previous findings of hypermentalizing errors in both adults and adolescents with BPD (Luyten et al., 2020; Penner et al., 2020). Indeed, previous studies have identified that impairments in mentalizing in BPD individuals are more of an altered mentalizing style (rather than loss of mentalizing ability), namely a hypermentalizing style (Sharp & Vanwoerden, 2015; Sharp et al., 2011). The hypermentalizing model (Sharp, 2014; Sharp & Vanwoerden, 2015) proposes an explanation for these findings, in which the heightened sensitivity to interpersonal/social threat in BPD individuals, e.g., vague or unclear social cues, can lead to increased arousal, leading to confusion between self vs. other mental states and a switch to automatic-explicit mentalizing, ultimately resulting in an over-attribution of mental states and misinterpretation of the behaviours of others (Sharp & Vanwoerden, 2015). The model suggests that this is an iterative process, in which hypermentalizing can heighten emotional arousal, further increasing the over-attribution of mental states (Sharp & Vanwoerden, 2015).

The significant difference in hypermentalizing error scores between persons with a diagnosis of ASPD and healthy controls (Newbury-Helps et al., 2017) are in line with previous studies that have identified characteristic automatic and affective-dominated mentalizing in some individuals with ASPD (Luyten et al., 2020). The findings support the suggestion of specific types of mentalizing impairments across psychiatric disorders, e.g., hypermentalizing in personality disorders, particularly BPD (Sharp et al.,2011).

Schizophrenia and Other Psychotic Disorders

Thirteen studies assessed individuals with a diagnosis of schizophrenia or other psychotic disorders, and significant differences in mentalizing ability was identified between this clinical group and healthy controls. Specifically, studies within the ‘schizophrenia and other psychotic disorders’ subgroup had significant differences in the occurrence of non-mentalizing (medium effect size), hypomentalizing (large effect size) and hypermentalizing (small effect size) errors. The findings are consistent with previous findings of mentalizing

impairments in individuals with schizophrenia, across different measures or assessment tools (Bora et al., 2009). Indeed, individuals with psychotic disorders have been observed to have difficulty inferring mental states of others, as well identifying their own sensory-affective experiences (Weijers et al., 2020). These impairments have been associated with both negative and positive symptoms of non-affective psychotic disorders (Weijers et al., 2020). The identification of medium-large effect sizes in non-mentalizing and hypomentalizing errors supports both the presence of mentalizing deficits, as well as the use of interventions targeting mentalizing, in this clinical population (Andrade-Gonzalez et al., 2021).

Mood and Anxiety Disorders

While a considerable number of studies (n=12) looked at mood and anxiety disorders, only a small effect size was found when comparing total correct MASC scores of clinical groups to healthy controls. Furthermore, only a small number of the included studies in this subgroup showed significant differences (n=5). This finding is inconsistent with the evidence base. For example, previous studies have identified a significant underperformance in mentalizing in individuals with MDD and anxiety disorders compared to healthy controls (Bora & Berk, 2016; Sloover et al., 2022). Considering that mentalizing capacity is vulnerable to emotional arousal, which can include mood disturbances (Luyten et al., 2020; Nolte et al., 2013; Weijers et al., 2020), the inconsistency with previous findings may be contributed to by clinical heterogeneity within samples, e.g., severity of depressive symptoms, or methodological heterogeneity with the use of a broad range of measures of mentalizing (Bora & Berk, 2016). Another consideration for the small effect size is context, for example mentalizing deficits in social anxiety have been demonstrated to be active in specific contexts which may not have been replicated in the MASC (Ballespi et al., 2019).

Significant differences in mentalizing were found in studies looking at individuals with BPAD compared to controls (Santos et al., 2017; Montag et al., 2010). This result is in line with a previous meta-analysis which found significant impairments in mentalizing capacity in individuals with BPAD, when measured using a range of tasks (Bora et al., 2016).

Only a small effect was identified in the analysis of the mood and anxiety disorders subgroup, with a significant difference for the occurrence of non-mentalizing errors. Of note, it may be that other error types are present across different mood and anxiety disorders that are not reflected in the small number of studies that have been included in this review. For example, other studies have found that social anxiety groups are associated with excessive mentalizing or hypermentalizing (Washburn et al., 2016; Ballepsi et al., 2019).

Neurodevelopmental Disorders

Past research has identified considerable deficits in mentalizing capacity in individuals with ASD. Indeed, deficits in social processing can be considered core to ASD or Asperger's syndrome, typically involving a marked impairment in ability to infer mental state (Dziobek et al., 2006; Lahera et al., 2014). Furthermore, a meta-analysis investigating social cognition in individuals with ADHD compared to healthy controls and ASD found that while social cognition was significantly impaired in ADHD individuals compared to controls, the deficits were more severe in individuals with ASD (Bora & Pantelis, 2016). The findings of this meta-analysis of impairments in mentalizing within studies looking at neurodevelopmental disorders are therefore in line with existing knowledge.

In terms of mentalizing errors, the neurodevelopmental disorders subgroup (including ADHD, ASD, and Asperger's syndrome) only had a significant difference compared to healthy controls for 'non-mentalizing' errors. Of note, only three studies (1 study looking at ADHD and 2 studies looking ASD/Asperger's Syndrome) reported mentalizing errors, which may impact the strength of the conclusions that can be drawn. Nonetheless, the detection of non-mentalizing errors, meaning that participants were making attributions of 'physical causality to social situations and mental states' (Lahera et al., 2014, p.1887), supports the view that people with ASD or Asperger's syndrome may have a "deficit signature" (Lahera et al., 2014, p.1893) in which atypical or incorrect attributions are made to mental states, rather than an inability to make attributions (Lahera et al., 2014). Furthermore, the findings contribute to the evidence for the use of the MASC in detecting deficits in mentalizing in

neurodevelopmental disorders, as well as highlights the need for further research into differences in deficit patterns in different psychiatric conditions.

Limitations of the Review

The review has several limitations that warrant comment. Methodologically, the review is limited by the inclusion criteria of published data and English language studies. While due to time and resource constraints, this may have excluded significant emerging data, studies published in other languages, and studies subjected to publication bias (Owens, 2021). There was a marked imbalance in the number of studies assessing different psychopathologies in adults or adolescents. While this is likely a reflection of the field at the time of the review, it also highlights the need for further research. Additionally, the meta-analysis of total correct MASC scores had high heterogeneity which weakens the strength of the conclusions that can be drawn. One explanation for this is the clinical diversity across the studies, for example, mean age, distribution of gender, or the heterogeneous nature of the disorders themselves. Nonetheless, the studies can be considered homogenous in their use of the MASC to measure mentalizing ability, and the meta-analysis therefore provides a meaningful summary of mentalizing deficits in clinical populations using this tool (Higgins et al., 2022).

The conclusions that can be drawn from this review are attenuated by the limitations of the MASC itself. Firstly, the MASC assesses mentalizing in regard to others, rather than the self. Given that psychopathology is often associated with impairments in the sense of self and ineffective self-mentalizing, (e.g., Luyten et al., 2021; Weijers et al., 2020), these deficits may not have been not captured by the MASC. Furthermore, findings may be impacted as some disorders may be more associated with either self or other mentalizing deficits. This could be addressed in future research by including both the MASC and measures which can distinguish self and other mentalizing capacity, e.g., the CAMSQ (Muller et al., 2023) or the relevant 18 items of the RFQ54 which have been demonstrated to identify both self and other mentalizing (Rogoff et al., 2021). However, these measures have their own limitations which must be considered, such as both being self-report design. The characters in the movie are white,

young adults who seem to depict a middle-class dinner party (Newbury et al., 2017; Penner et al., 2020). While the review was unable to explore the impact of ethnicity, due to the limited available data on the ethnicity distributions of samples, the differences between the characters and the demographically diverse samples within the included studies could impact mentalizing ability. For example, individuals from different backgrounds and cultures may not relate to the characters, language or social rules presented in the story, thus limiting the generalizability of the conclusions, (Newbury et al. 2017; Penner et al., 2020). Another possibility is that the performance on the MASC may be impacted by gender or age effects (Wacker et al., 2017). Indeed, the depiction of an adult dinner party and the different relationships between the characters, are likely outside of the social reference systems of younger individuals (e.g., 12–13-year-olds), which could impact their understanding and their performance on the task. It would be important to consider these factors in future research.

It was beyond the scope of the current review to consider the role of other clinical factors which may influence mentalizing capacity at the point of assessment, such as, severity of symptoms, medication, cognitive functioning, episodic vs. chronic difficulties, clinical or sub-clinical comorbidities. For example, previous research has suggested that non-clinical, subthreshold depressive symptoms can enhance mentalizing abilities (Bora & Berk, 2016). Similarly, mentalizing impairment in schizophrenia has been shown to be strongly influenced by acute psychosis (Bora et al., 2009). Critically, it is likely that clinical groups included co-occurring symptoms or psychological disorders in addition to their primary diagnosis. The findings of this review do not account for this and therefore a more dimensional approach (e.g., HiTOP; Kotov et al., 2017) could be appropriate to explore mentalizing in psychopathology in future research. Of note, while the healthy controls in the included studies did not have a psychiatric diagnosis, the presence of sub-clinical symptoms cannot be ruled out, which could impact mentalizing capacity. Further research should explore whether differences in mentalizing capacity measured by the MASC are impacted by such clinical factors.

Clinical Implications

The findings of this review have several potential clinical implications. Firstly, the review highlights the presence of mentalizing impairments in a range of disorders, as well as the possibility of disorder-specific deficits. This finding lends greater support to the therapies that target mentalizing (Fonagy & Allison, 2011). This has implications for clinical practice, as a greater understanding of mentalizing deficits and how they may map on to different presentations, can help clinicians understand challenging situations in therapy or identify specific interventions towards improving mentalizing (Fonagy & Allison, 2014; Bo et al., 2017). Secondly, the ability of the MASC to identify mentalizing deficits in a range of disorders, for both adults and adolescents, supports the use of this tool with clinical populations. Finally, the identification of deficits in adolescent populations suggests to possible distortions in the development of mentalizing capacity before adulthood and presents a potential mechanism or etiologically contributing factor of a disorder. This could help inform the development of specific preventative or early intervention work towards altering the trajectory of the disorder (Fonagy & Allison, 2011). However, longitudinal studies are needed to further understand the role of mentalizing in the development of clinical disorders.

Conclusion

In conclusion, the review synthesises the existing evidence base of mentalizing deficits within different psychopathologies. The findings were largely in line with previous knowledge and supports the view of mentalizing impairment as a transdiagnostic factor that is associated with vulnerability for psychopathology. Interestingly, the findings of the review also highlight differences in type of mentalizing errors across disorders. This in turn supports the possibility of disorder specific profiles of mentalizing deficits. Despite limitations, the review supports the use of MASC as a tool for identifying mentalizing impairments across a range of clinical presentations. Further research should continue to identify differences in mentalizing error types within different clinical groups, which can help inform interventions. Considering the dearth of studies assessing mentalizing in adolescent populations, and the

potential benefits of mentalizing ability as a target for prevention or early intervention, further research is warranted. Finally, the inherent heterogeneity of clinical presentations highlights the need for further research into clinical factors and disorder-specific mentalizing impairments, towards improving understanding and therapeutic interventions.

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Part 2: Empirical Paper

The Role of Mentalizing in the Association between Childhood Trauma and Emotion Regulation in Borderline Personality Disorder

Abstract

Introduction: The relationship between childhood trauma, emotion regulation difficulties and mentalizing has been well-established in existing literature. However, there is a gap in knowledge around the role that mentalizing may play in the relationship between childhood trauma and emotion regulation in this population. Consequently, this study aimed to investigate whether mentalizing capacity influences the relationship between experiences of childhood trauma and emotion regulation difficulties in individuals with BPD.

Method: The study used data from an ongoing research study entitled "Probing Social Exchanges – A computation neuroscience approach to the understanding of borderline and anti-social personality disorders." Participants who had a diagnosis of borderline personality disorder (BPD) or designated healthy controls (HC: individuals without observed mental health diagnoses), English fluency and did not meet exclusion criteria (no severe learning disabilities, no past neurological disorder or trauma, or no recent experiences of psychosis), were included in the current study. N=1114 participants (n=675 healthy controls and n=439 BPD participants) were ultimately included. Four measures were extracted from the dataset and included in the analysis (the Childhood Trauma Questionnaire, the Movie for the Assessment of Social Cognition, the Difficulties in Emotion Regulation Scale, and the Reflective Functioning Questionnaire). Mediational analyses were conducted using JASP and presented using path models.

Results: Mentalizing capacity was found to have a significant indirect effect (B=0.001, p=0.02) which indicated that mentalizing capacity partially mediated the effect of childhood trauma on emotion regulation difficulties in the combined BPD and HC groups. However, this effect was lost when the BPD and HC groups were analysed separately. The study also explored the role of different types of mentalizing errors and found hypermentalizing to be a partial mediator.

Discussion: Despite limitations, the findings reflect the known associations between childhood trauma, mentalizing and emotion regulation difficulties, and lend support to the proposition that mentalizing is a potential etiological risk factor in the development of BPD symptomology, such as emotion dysregulation. The results provide support for the use of interventions which therapeutically target mentalizing capacity and highlights the need for future longitudinal research which will allow the exploration of causal links.

Introduction

Borderline Personality Disorder

Borderline Personality Disorder (BPD) is a life-long disorder which is associated with significant impairment and distress, increased risk of suicide and increased rates of psychiatric and medical comorbidities (McLaren et al., 2022; Ellison et al., 2018). The prevalence of BPD is estimated to be around 1% in the general population, 12% in community-based clinical populations, and 22% in psychiatric inpatient populations (Ellison et al., 2018). The disorder is characterised by symptoms including impulsivity, interpersonal difficulties, emotion dysregulation and identity disturbance, which begin in early adulthood and are pervasive across several areas of life (American Psychiatric Association, 2013; Chapman et al., 2022).

Childhood Trauma and BPD

Borderline Personality Disorder has been associated with early adverse or traumatising experiences, including experiences of abuse and neglect. Studies have pointed to a dose-response relationship in which more experiences of childhood trauma was associated with greater BPD symptoms and impairment (e.g., Zanarini et al., 2002; Pietrek et al., 2013). However, there is some debate about the nature of the relationship between childhood trauma and BPD (Crowell et al., 2009). While some studies have proposed that experiences of childhood trauma are an etiological risk factor for the development of BPD, given the consistent association found between childhood trauma and BPD (e.g., Battle et al., 2004; Widom et al., 2009), others have argued that the conclusions that can be drawn are limited (Crowell et al., 2009). Although it is currently accepted that experiences of childhood trauma are not the sole risk factor for BPD, these experiences are not uncommon within this clinical population. Past research has demonstrated that individuals with BPD report significantly more experiences of trauma than other psychiatric disorders (Herman et al., 1989) or healthy controls (Carvalho et al., 2014), and high percentages of individuals

with BPD report histories of neglect, physical abuse, emotional abuse, and sexual trauma (Smits et al., 2022, Zanarni, 2000; MacIntosh et al., 2015; Battle et al., 2004).

Indeed, the relationship between experiences of childhood trauma and BPD has been widely established in the literature, for example a review by Stepp et al., (2016) found that exposure to different types of traumas, including physical or sexual abuse and/or neglect, was associated with an increased risk of developing BPD. However, there are mixed findings in regard to the relationship between BPD and the different types of childhood trauma (i.e., emotional and physical neglect; sexual, physical or emotional abuse). For example, whilst there is evidence that sexual and emotional abuse are associated with BPD status (e.g., de Aquino Ferreira et al., 2018; Pietrek et al., 2013; Bozzatello et al., 2021), Fossati et al. (1999) concluded that sexual abuse was not a significant predictor of BPD. Studies have also found other types of childhood trauma to be more associated with BPD (e.g., physical abuse: Golier et al., 2003; Bozzatello et al., 2021), while some studies have found no significant differences between the types of childhood trauma in the risk of developing BPD (MacIntosh et al., 2015). The inconsistency of findings highlights the need for more understanding about the specific impact of different types of childhood trauma on the development of BPD.

Emotional Dysregulation and BPD

Emotion regulation can be defined as the skills, behaviours and strategies that enable an individual to manage emotional arousal (Dollar & Calkins, 2020). Emotion regulation difficulties are considered to comprise of maladaptive strategies for managing and regulating distress, emotional sensitivity and heightened negative affect (Euler et al., 2021; Carpenter & Trull, 2013; Fitzpatrick et al., 2023). In line with being considered a core symptom, studies have found BPD to be associated with emotion regulation difficulties, such as impairments in modulating emotions and recovering from extreme affective states (van Dijke et al.,2013, 2011). Models around emotion regulation difficulties in BPD have

considered the role of interpersonal or attachment relationships, genetic vulnerability, and invalidating environments (e.g., childhood maltreatment), which are thought to both foster and exacerbate emotional dysregulation (Chapman, 2019; Fitzpatrick et al., 2023; Schmahl et al., 2014).

Existing research has provided neurobiological, clinical, and experimental evidence in support of the view that emotion dysregulation is a core feature of BPD (Schmahl et al., 2014). Indeed, emotional dysregulation is widely accepted to be both a major component in the development of BPD symptoms, for example as emphasised in the biosocial model (Crowell et al., 2009; Putman & Silk, 2005), and a core clinical feature of the disorder (e.g., Glenn & Klonksy, 2009). Furthermore, emotion regulation difficulties have been proposed to be central to other characteristic difficulties of BPD such as interpersonal difficulties (Euler et al., 2021), impulsivity (e.g., Krase-Utz et al., 2019), and self-harm (Putman & Silk, 2005). The accepted association between emotion dysregulation and other core difficulties present in BPD highlights the importance of gaining more understanding about the development of emotion regulation problems in BPD which could inform prevention strategies or more targeted interventions (Chapman, 2019).

Childhood Trauma and Emotion Dysregulation

The acquisition of emotion regulation is considered to be a developmental process during infancy and childhood, within the context of the relationships and interactions with caregivers (Dollar & Calkins, 2020). Alongside individual differences, e.g., temperament or emotional sensitivity, acquisition of emotion regulation abilities has been linked to contextual and environmental factors such as the nature of the attachment relationships with caregivers and how emotion regulation and expression is modelled (Dollar & Calkins, 2020). Consequently, experiences of adverse interpersonal events or disruptions to the caregiving relationships, such as early experiences of trauma or maltreatment, can compromise the normal development and acquisition of emotional understanding and regulation abilities.

Emotion dysregulation has been consistently associated with adverse early life experiences. For example, emotion dysregulation is often identified in survivors of childhood trauma (Stevens et al. 2013; Burns et al., 2010). This association has also been consistently found in children and adolescents (MacIntosh et al., 2015). For example, a history of maltreatment was found to predict emotional dysregulation in children (Maughan & Cicchetti, 2002), sexual maltreatment in girls was associated with reduced emotional regulation abilities compared to non-maltreated peers (Shipman et al., 2000), and experiences of neglect were associated with decreased understanding of negative emotions and fewer emotional skills compared to non-abused peers (Shipman et al., 2005).

Childhood Trauma, Emotion Dysregulation and BPD

The relationship between childhood trauma and deficits in emotion regulation has also been identified in individuals with BPD (Crowell et al., 2009). Current theories, such as the biosocial model, highlight the interplay of genetic predispositions and traumatic early life experiences leading to the development of emotion dysregulation in individuals with BPD (Krase-Utz et al., 2019; Carpenter & Trull, 2013; Putman & Silk, 2005; Crowell et al., 2009).

The existing literature emphasises the role of childhood trauma in the development of difficulties in emotion regulation in BPD. For example, it has been proposed that emotion dysregulation may mediate the relationship between childhood trauma and BPD symptomology (Bertele et al., 2022), particularly when the childhood traumatising experiences are perpetrated by the primary caregiver (van Dijke et al., 2013). Emotion regulation difficulties were found to influence the association between childhood emotional abuse and acute BPD symptomology, likely through mediational effects (Carvalho et al., 2014). Emotional maltreatment, encompassing emotional neglect and abuse, has particularly been associated with emotion dysregulation in BPD (e.g., Alafia & Manjula. 2020; Carvalho et al., 2014). For example, emotional maltreatment has been linked with emotion regulation difficulties in BPD (e.g., Carvalho et al., 2014), has been demonstrated to be a

significant predictor of emotional regulation difficulties (e.g., Alafia & Manjula. 2020) and impulsivity (e.g., Krase-Utz et al., 2019), and has been associated with an impaired ability to modulate emotions (van Dijke et al., 2011). Other studies have also pointed to experiences of sexual abuse as being significantly related to emotion dysregulation in BPD (E.g., Zanarini et al., 2002).

Mentalizing and BPD

Mentalizing can be defined as a socio-cognitive process which enables individuals to make sense of the world, in terms of the intentional and subjective mental states (e.g., thoughts, feelings, desires) of self and others (Fonagy & Luyten, 2009). Mentalizing is proposed to be a species-specific capacity which enables humans to navigate complex social and interpersonal situations. The acquisition of mentalizing capacity is posited to be a developmental achievement contingent on early attachment relationships (Luyten & Fonagy, 2015; Fonagy & Allison, 2014), more recently encompassing both primary caregivers and wider contexts, including the community, peers, and family (Luyten et al., 2020). Sensitive and responsive caregiving to infants has been proposed to positively impact the acquisition of adaptive emotion regulation processes, self-control and the ability to reflect on the mental states of others (Luyten & Fonagy, 2015). Furthermore, effective mentalization has been associated with increased levels of resilience to adverse or stressful experiences (Bateman & Fonagy, 2013). Early experiences which disrupt early attachment relationships, such as trauma or maltreatment, have been linked with impairments in mentalizing capacity (Fonagy & Luyten, 2009; Fonagy & Bateman, 2016;). For example, a study by Duque-Alarcon and colleagues (2019) concluded that higher levels of childhood trauma were associated with reduced mentalizing abilities in individuals with BPD, as well as healthy controls.

A mentalization-based theory of BPD has been proposed by Fonagy and colleagues (e.g., Fonagy & Luyten, 2009) which suggests that a vulnerability to misinterpretations of the behaviour of others or misattributions of mental states may contribute to the core features of

BPD (Sharp & Vanwoerden, 2015). The theory suggests that disruptions to the early attachment relationships and environments (e.g., through maltreatment or trauma), alongside genetic vulnerability, can lead to impairments in the development of mentalizing capacities (Bateman & Fonagy, 2013). Within this theory, effective mentalizing is proposed to be a balance between four different dimensions (automatic vs controlled, affective vs. cognitive, self vs. other, and internal vs. external), which enables reflection and awareness of one's own mental states and those of others, based on both external cues (e.g., facial expressions) and knowledge of internal features (McLaren et al., 2022; Luyten et al., 2020; Fonagy & Luyten 2015). The balance of these dimensions can be disrupted by early life adversity, leading to impaired mentalizing capacity. For example, more rapid switching from controlled to automatic mentalizing, which uses biased assumptions about the self and others (Luyten & Fonagy, 2019; Fonagy and Luyten 2015). Characteristically, impaired mentalizing in BPD has been described as a rapid loss of controlled mentalizing and the overreliance on automatic mentalizing (Luyten et al., 2020).

Impairments in mentalizing have been identified in a range of psychopathologies (Luyten et al., 2020) and are suggested to be a risk factor for the development of psychopathologies, including BPD (Chiesa & Fonagy, 2014). Interventions that are focused on ameliorating mentalizing capacity, such as Mentalization Based therapy (MBT), have been demonstrated to be effective in treating BPD (e.g., Volkert et al., 2019). This lends additional support to the proposal that mentalizing is associated with BPD symptomology, as well as the benefits of mentalizing capacity as a therapeutic focus.

Types of Mentalizing Impairments

Impairments in mentalizing can been categorised as under-mentalizing or hypermentalizing. Under-mentalizing, encompassing both hypomentalizing and the absence of mentalizing, is characterised by the insufficient attribution of mental states or the tendency to makes attributions from a non-mentalistic frame of reference (Canty et al., 2017).

Hypermentalizing can be defined as excessive attributions of mental state beyond the observable evidence, based on fast, automatic processing of external cues (McLaren et al., 2022; Fonagy & Luyten, 2009; Sharp & Vanwoerden, 2015).

Mentalizing impairments in BPD have been extensively studied and research has consistently identified significant impairments in mentalizing, relative to controls for both adults (e.g., Preisler et al., 2010; Peterson et al. 2016; Duque-Alarcon et al., 2019) and adolescents (e.g., Penner et al., 2020; Somma et al., 2019). Ineffective mentalizing in BPD has most commonly been associated with hypermentalizing (McLaren et al., 2022; Luyten et al., 2020; Sharp & Vanwoerden, 2015; Sharp et al., 2011). Evidence from studies which use tasks that differentiate between the different types of mentalizing impairments, such as the MASC (Dziobek et al., 2006), highlight the BPD is associated with hypermentalizing or excessive theory of mind. Existing studies have identified significant hypermentalizing to be associated with BPD in adolescents (e.g., Quek et al., 2018; Penner et al., 2020; Somma et al., 2019) and adults (e.g., Andreou et al., 2015; Vaskinn et al., 2015).

Considering the consistent evidence of hypermentalizing impairments in BPD, Sharp and colleagues proposed a hypermentalizing model of BPD (e.g., Sharp, 2014; Sharp & Vanwoerden, 2015). This model suggests that hypermentalizing occurs under conditions of high emotional arousal. In the context of reduced regulatory strategies and more inflexible mentalizing, individuals overattribute mental states, which can lead to jumping to conclusions and misinterpreting the behaviours of others, leading to an increase in emotional activation and, in turn, a further increase in hypermentalizing (McLaren et al., 2022; Sharp & Vanwoerden, 2015).

Mentalizing and Emotion Dysregulation

Mentalizing has been associated with emotion regulation, with the view that secure interpersonal environments in early childhood allow for the acquisition of both mentalizing and emotion regulation capacities (Schwarzer et al., 2021). While there is limited research

investigating mentalizing and emotion regulation, existing studies have found significant associations between mentalizing capacity and emotion regulation in both non-clinical populations (e.g., Schwarzer et al., 2021) and clinical groups, such as BPD (e.g., Euler et al., 2019; Sharp et al. 2011). Furthermore, impairments in mentalization capacity have been found to be associated with an increase in BPD symptoms in adolescents, via emotion regulation difficulties (Kahya & Munguldar, 2023).

Rationale and Aims

While mentalization has been significantly associated in the relationship between childhood trauma and emotion regulation in non-clinical populations (Parada-Fernandez et al., 2021), this relationship has not yet been investigated in BPD populations. Despite the established relationships between experiences of childhood trauma, impaired mentalizing and emotion regulation difficulties in BPD, there is a gap in understanding the role that mentalizing may play in the relationship between childhood trauma and emotion regulation in this population. A better understanding the impact of mentalizing could contribute to the evidence base for assessing and addressing mentalizing impairments in clinical populations, help guide engagement in clinical sessions, and identify mentalizing as a potential therapeutic target for improving emotion regulation and interpersonal difficulties in persons with BPD (Euler et al., 2021). In addition, it would emphasise the potential role of childhood trauma in the development of mentalizing impairments in BPD. The current study, therefore, aimed to investigate whether mentalizing capacity influences the relationship between experiences of childhood trauma and emotion regulation difficulties in individuals with BPD. A description of the hypothesised model is included below and presented in figure 1.

Methods

Participants

The dataset for the current study was collected as part of a wider computational research study entitled “Probing Social Exchanges – A computation neuroscience approach to the understanding of borderline and anti-social personality disorders” (PSE). This study was approved by the ethics committee of Wales (ID: 12/WA/0283). Adult participants with diagnoses of BPD, Antisocial personality disorder (ASPD) and depression were referred from services of seven NHS Mental Health Trusts from Greater London, and healthy controls were recruited from the community around London via Prolific (an online research participant recruitment platform) and online advertising. Consenting participants were interviewed using structured clinical interview for DSM-IV diagnoses, completed a battery of self-report measures, and participated in several tasks including the Movie for the Assessment of Social Cognition (MASC). Participants received renumeration for participating in the study.

For the current analysis, participants of the PSE study who received a diagnosis of BPD or were designated healthy controls were considered. While the PSE is ongoing, for this study the last data was collected up until 22.03.2023.

For inclusion in the PSE, BPD participants were required to have a diagnosis of BPD according to the DSM-IV criteria and have fluency in English. Individuals who recently experienced a psychotic episode, had severe learning disabilities, or experienced past neurological disorder or trauma, were excluded from the study.

Measures

The following measures were extracted from the dataset and included in the analysis.

Childhood Trauma Questionnaire (CTQ)

The short form version of the CTQ was used to assess experiences and severity of childhood trauma (Bernstein et al. 2003). The original version is a self-report measure which

comprises 70 items asking about experiences of abuse in childhood (Bernstein & Fink, 1998), while the short-form version consists of 28 items. The short form of the CTQ is widely used in research (Baker, 2009). The items are rated on a 5-point scale ranging from 'never true' to 'very often true', with higher total scores indicating greater severity childhood trauma experiences (Bernstein et al., 1994). The CTQ includes five subscales, with 5 items each, defined by the different types of trauma experiences – sexual, emotional, physical abuse, physical and emotional neglect. The CTQ subscales were based on the following definitions of abuse and neglect: sexual abuse was defined as sexual contact or conduct between a child and an adult; emotional abuse was defined as verbal assaults by an adult directed towards a child's self or well-being, or demeaning or humiliating behaviour; physical abuse was defined as assault on a child by an adult which posed risk or inflicted injury; physical neglect was defined as caregivers' failure to provide for a child's basic needs; emotional neglect was defined as caregivers' failure to meet a child's psychological and emotional needs, such as support, love, nurture (Bernstein et al., 2003). The CTQ has been demonstrated to have good internal consistency (Cronbach's α ranged from 0.75 to 0.96 across the 5 trauma subtypes) in a study using the same dataset (Huang et al., 2020)

The Movie for the Assessment of Social Cognition (MASC)

The MASC is a video-based tool which was developed by Dziobek et al., (2006) which was used to assess social cognition. The MASC captures dimensions of cognitive and affective mentalizing about others. The MASC was designed with the aim to approximate real-life social interactions, consisting of a 15-minute video in which four characters are preparing for a dinner party. The tool requires participants to make inferences about the mental states (thoughts, feelings or intentions) of the characters at 45 different timepoints in the film (Dziobek et al., 2006). The MASC has been used to identify mentalizing capacity in a range of psychological and neurodevelopmental disorders, including BPD (e.g., Preisler et al., 2010). The MASC is uniquely able to identify different types of mentalizing impairments, categorised as 'hypomentalizing' (insufficient mental state inference), 'hypermentalizing'

(excessive interpretation of mental state) and 'non-mentalizing' (mental state attribution is unrelated to presented information). As mentioned in my previous chapter, an example of the MASC questions is presented in appendix 4. The design of the MASC is considered to afford it greater ecological validity compared to other existing mentalizing measures, and it has been shown to have good internal consistency (α=0.84) (Dziobek et al., 2006).

The Reflective Functioning Questionnaire (RFQ)

The RFQ is a 54-item self-report measure that was used as another measure to assess mentalizing ability (Fonagy et al., 2016). The measure captures dimensions of mentalizing about self and others, although it is not intended to capture 'online' real-time mentalizing like other measures such as the MASC (Luyten et al., 2019). Items are rated on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The RFQ was developed to assess severe impairments in mentalizing, such as is often observed in individuals with BPD features. The RFQ is comprised of two subscales defined as certainty or uncertainty about mental states. Lower scores on the certainty subscale reflect hypermentalizing, while higher scores on the uncertainty subscale reflect hypomentalizing (Huang et al., 2020; Fonagy et al., 2016). The RFQ has good internal consistency (α=0.70 or greater; Anis et al., 2020) and has demonstrated excellent reliability in both subscales (α RFQc = .87, α RFQu = .87; Euler et al., 2020).

Difficulties in Emotion Regulation Scale (DERS)

The DERS is a 36-item self-report measure which was used to assess emotion regulation difficulties (Gratz & Roemer, 2004). The items are designed to reflect difficulties with "awareness and understanding of emotions", "acceptance of emotions", "ability to engage in goal-directed behaviour, and refrain from impulsive behaviour, when experiencing negative emotions," and "access to emotion regulation strategies perceived as effective" (Gratz & Roemer, 2004, p.43). The items are scored on a scale of 1 ("almost never") to 5 ("almost always"), with higher total scores indicating greater difficulties. The scale has been

found to have high internal consistency (α =0.93) and good test-retest reliability (Gratz & Roemer, 2004).

Covariates

Potential covariates were also identified and extracted for analysis. These consisted of gender (i.e. male, female transgender, other), age, ethnicity (i.e., White, Black/Black British, Asian/Asian British, Mixed, other), which have been proposed to have an impact on mentalizing performance with the MASC (McLaren et al., 2022), as well as education level (i.e., no qualifications, vocational, GCSE, A-Level, higher education, postgraduate, other), number of years of education, household income and employment status (i.e., employed, unemployed, student, internship, retired, carer).

Statistical Analysis

Data cleaning, including assessing and addressing missing values, was performed in SPSS. Descriptive statistics and mediation analyses were performed in JASP 0.16 (JASP, 2021). Descriptive statistics were generated for the variables specified in the model and all potential confounders (see table 1).

Assumptions of normality were checked through calculating kurtosis and skewness, conducting the Shapiro-Wilkes test, and examining distribution plots and boxplots. Kurtosis and skewness were interpreted as values beyond +2 or -2 being indicative of a deviation from the normal distribution. Evidence of deviation from the normal distribution was identified for six variables: skewness in the non-mentalizing subscale (2.08); kurtosis in Total MASC (2.07), hypomentalizing (2.76), non-mentalizing (7.53), CTQ total (2.08), sexual abuse (3.38) and physical abuse (2.46). While the other values of kurtosis and skewness did not suggest to deviations from the normal distribution, the Shapiro-Wilkes test for all variables indicated that the normality assumption was not satisfied ($p<.001$). An examination of the generated boxplots highlighted the presence of outliers. Consequently, Spearman's correlation coefficient was used in the correlational analysis. This coefficient was chosen as it is a non-

parametric measure which is considered to be more robust to outliers compared to Pearson's correlation coefficient (Mukaka et al., 2012).

Correlational analysis was subsequently conducted to explore the relationship between the variables of interest, and all variables that had a significant correlation with the variables specified in the model were included in the mediation analysis.

Mediation was identified through determining the significance of the indirect effect of childhood trauma on emotion regulation difficulties through mentalizing. In line with established methods, bias-corrected bootstrapped 95% confidence intervals (1000 bootstrapped replications) were calculated to support the robustness of the indirect effects (e.g., Brewer et al., 2020). Further analysis was conducted using the RFQ uncertainty and certainty subscales (denoted as LRFc and LRFu) as potential mediators, instead of the MASC, to explore the role of a self-report measure of mentalizing (RFQ). The mediation models were generated for three groups: 1) Healthy controls and BPD together, 2) BPD only, 3) Healthy controls only. Sensitivity testing was conducted to explore how much unobserved covariates may be confounding any observed indirect effects. Categorical covariates were binary coded and added to the model along with continuous covariates.

To explore the impact of type of mentalizing impairments and type of childhood trauma, additional mediation analyses were conducted. For the CTQ, the five subscales for each type of childhood trauma, namely emotional, physical and sexual abuse and physical or emotional neglect, were included as predictor variables. For the MASC, the three error subscales, namely hypomentalizing, hypermentalizing and no mentalizing, were included as potential mediating variables.

Mean imputation was employed to handle individual missing items for measures used in these analyses, before total scores on measures were calculated, but only for observations where at least 50% of items were available for that measure. Following the use of mean imputation, the complete dataset for the four variables of interest in this study was available n=558 participants (50.09%) (See figure 2). Nine variables (DERS total, CTQ total and five CTQ subscales, the two RFQ subscales) had less than 6% missingness, ranging

from 3 and 5.4% missing data. Variables with over 30% missing data included the Total MASC scores and the three error subscales (all with 46.6% missingness).

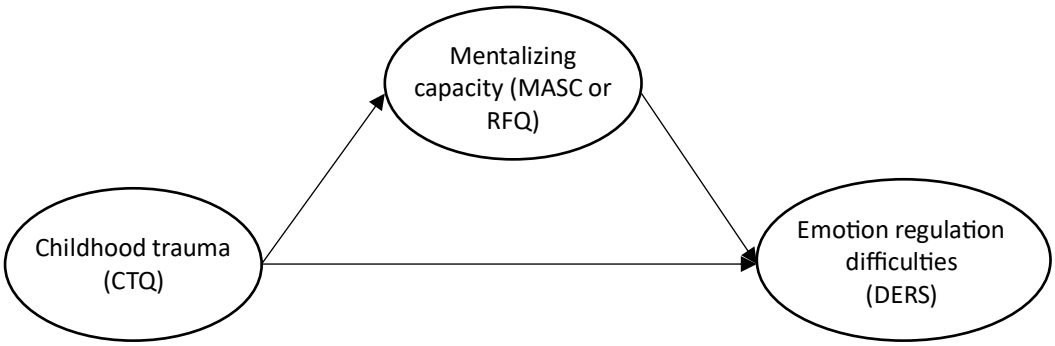
All missing data on measures used in analyses was handled using Full Information Maximum Likelihood, Mplus emulation and the maximum likelihood estimator, as implemented in JASP. Little's Missing Completely at Random test (MCAR) was conducted with relevant variables (CTQ total and the five subscales; DERS total; the two RFQ subscales; MASC total and the three error subscales). The MCAR test indicated that the pattern of missing values was not completely at random (X^2 = 387.84, *df*=118, p<.001). Consequently, sensitivity analyses were conducted using the complete dataset (removing observations with any missingness), to compare findings.

Hypothesised Model

The study hypothesised that mentalizing capacity (measured by the MASC or the RFQ) will mediate the association between childhood trauma (measured by the CTQ) and emotion regulation difficulties (measured by the DERS). Figure 1 depicts the hypothesised model of the relationship between experiences of childhood trauma, emotion dysregulation and mentalizing ability.

Figure 1.

Depiction of Hypothesised Model



Results

The total sample consisted of *n*=1114 participants, with *n*=675 healthy controls (HC) and *n*=439 BPD participants. Of this sample, n=450 healthy controls and *n*=106 BPD participants had missing data on one or more of the measures. Consequently, the complete dataset consisted of *n*=225 healthy controls and *n*=333 BPD participants. This is presented in figure 2. Sample demographics and measure descriptives (Table 1) were generated for relevant variables.

Pairwise correlations were run to explore the relationship between the continuous variables identified in the hypothesised model. A correlational matrix is presented in table 2. All variables significantly correlated with one or more of the other variables. Demographic variables (age, gender, ethnicity, employment status, household income, educational level and years in education) were explored using t-tests and chi-squared goodness of fit tests. The results are presented in table 1.

Independent sample t-tests were conducted to explore differences in continuous variable (age and years of education) between healthy controls and BPD participants. Non-parametric tests (Mann-Whitney U test) were used as neither the normality nor the equality of variances assumptions were met. There was a statistically significant difference between BPD (n=434, m=14.1, SD=3.81) and healthy controls (n=675, m=14.98, SD=3.59) for years of education (t (1107) =126868.50, p<.001). Mean age for BPD participants (n=435, m=30.47, SD=9.54) did not significantly differ from that of healthy controls (n=675, m=31.79, SD=11.16), t (1108) =140658.5, p=0.238.

Chi-squared tests of independence were conducted to explore differences in categorical variables (gender, ethnicity, education level, employment status and household income) between BPD participants and healthy controls. There was a statistically significant difference between BPD and healthy controls for gender (x^2[3, N=1113]=37.25, p<.001), ethnicity (x^2[16, N=1108]=62.82, p<.001), employment status (x^2[8, N=1107]= 185.61,

p<.001), household income ((x^2[6, N=1083)=59.25, p<.001), and level of education (x^2[6, N=1109]=55.88, p<.001).

Figure 2

Patient Flowchart

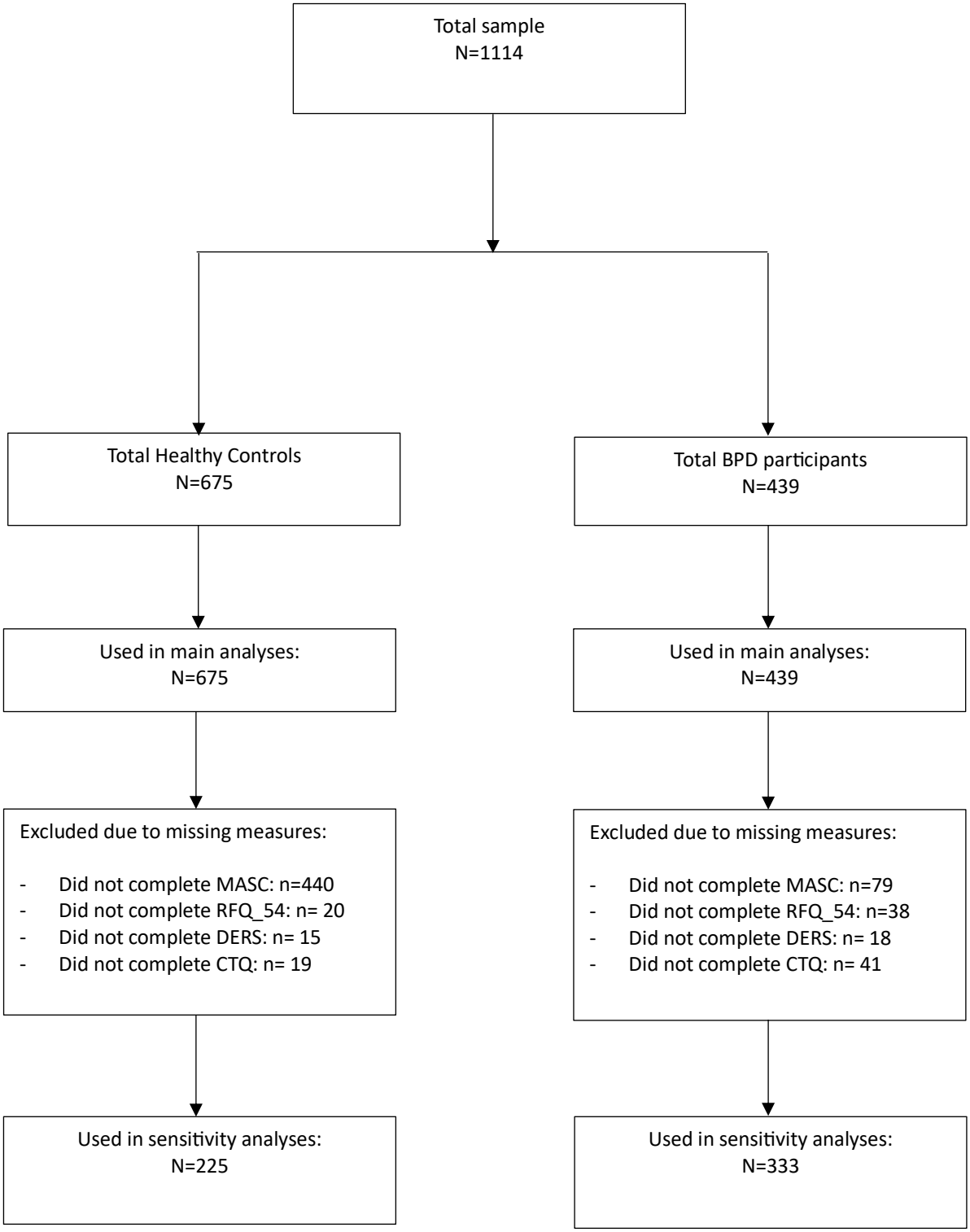


Table 1

Sample Demographics and Measure Descriptives

	BPD				HC				Statistics	
Demographic	***N***	**Missing**	**Mean or %**	**SD**	***N***	**Missing**	**Mean or %**	**SD**	***t* or x^2**	**p-value**
Age (years)	435	4	30.47	9.54	675	0	31.79	11.16	140658.5*	0.238
Gender									37.25	<.001
Male	78		17.77%		228		33.78%			
Female	354		80.64%		445		65.93%			
Transgender	4		0.91%		1		0.15%			
Other	2		0.46%		1		0.15%			
Ethnicity									62.82	<.001
White[a]	319		72.67%		492		72.89%			
Black/Black British[b]	35		7.97%		44		6.52%			
Asian/British Asian[c]	25		5.69%		70		10.37%			
Mixed[d]	45		10.25%		52		7.70%			
Other	9		2.05%		11		1.63%			
Education (years)	434	5	14.10	3.81	675	0	14.98	3.59	126868.5*	<.001
Educational level									55.88	<.001
No qualifications	29		6.61%		12		1.78%			
Other[e]	15		3.42%		13		1.93%			
Vocational[f]	36		8.20%		41		6.07%			
GCSE[g]	83		18.91%		74		10.96%			
A-Level[h]	120		27.33%		221		32.74%			
Higher Education[i]	121		27.56%		202		29.93%			

Postgraduate[j]	30		6.83%		112		16.59%			
Household income									59.25	<.001
<£10,000	202		46.01%		195		28.89%			
£10,000 -£20,000	99		22.55%		150		22.22%			
£20,000-£35,000	53		12.07%		184		27.26%			
£35,000 -£50,000	34		7.74%		76		11.26%			
£50,000-£75,000	21		4.78%		41		6.07%			
£75,000-100,000	7		1.59%		16		2.37%			
£100,000+	4		0.91%		1		0.15%			
Employment Status									185.61	<.001
Employed[k]	137		31.20%		396		58.67%			
Unemployed	225		51.25%		105		15.56%			
Student	63		14.35		151		22.37%			
Internship/Apprenticeship	2		0.46%		7		1.04%			
Retired	4		0.91%		6		0.89%			
Carer	1		0.23%		10		1.48%			
Measure	***n***	**Missing**	**Mean**	**SD**	***n***	**Missing**	**Mean**	**SD**		
MASC_Correct	360	79	32.78	5.82	235	440	34.21	4.92	36863*	0.008
Subscales										
MASC_Less	360	79	4.17	2.87	235	440	4.02	2.94	43800*	0.461
MASC_Exc	360	79	5.75	3.63	235	440	4.87	2.7	47601*	0.009
MASC_No	360	79	2.24	2.12	235	440	1.89	1.74	46425*	0.04
RFQ_LRFu	401	38	28.96	14.50	655	20	11.98	10.32	222000.5*	<.001

RFQ_LRFc	401	38	13.34	10.98	655	20	23.80	14.08	70684.5*	<.001
DERS	421	18	126	17.53	660	15	90.07	18.63	252164.5*	<.001
CTQ_Total	398	41	69.28	14.47	656	19	61.72	10.39	169238*	<.001
Subscales										
CTQ EA	401	38	17.01	5.91	656	19	9	4.71	223475.5*	<.001
CTQ PA	400	39	10.63	6.28	656	19	6.62	3.28	184445*	<.001
CTQ SA	401	38	10.49	6.96	656	19	5.84	2.84	185238*	<.001
CTQ EN	400	39	16.77	5.44	656	19	10.488	5	209280*	<.001
CTQ PN	401	38	10.80	4.66	655	20	7.01	5	203826*	<.001

*Mann-Whitney U test

White[a]= British, Irish, or Other; Black/Black British[b] =Caribbean, African or Other; Asian/British Asian[c] = Indian, Pakistani, Bangladeshi, Chinese, or Other; Mixed[d] = White & Black Caribbean, White & Black African, White & Asian or Other; Other[e]= Other qualification not listed (e.g. certificate); Vocational[f]= Vocational level (e.g. NVQ) 1, GCSE (<5 A-C), or equivalent; GCSE[g] = GCSE (5 or more A*-C), vocational level (e.g. NVQ) 2, or equivalent; A-Level[h]= A level, vocational level (e.g. NVQ) 3, or equivalent; Higher Education[i]= Higher education or professional/vocational equivalent; Postgraduate[j] = Post graduate education or professional/vocational equivalent (e.g. Masters, PhD, MD); Employed[i]= full-time, part-time, self-employed, casual work; MASC= Movie for the Assessment of Social Cognition; Less = under- or hypo- mentalizing errors; Exc = over- or hyper- mentalizing errors; No = non or absence of mentalizing; RFQ_LRFu= Reflective Functioning Questionnaire Uncertainty subscale; RFQ_LRFc = Reflective Functioning Questionnaire Certainty subscale; CTQ= Childhood Trauma Questionnaire; EA = Emotional abuse subscale; PA = Physical abuse; SA= Sexual abuse subscale; EN= Emotional neglect subscale; PN = Physical neglect subscale; DERS= Difficulties in Emotion Regulation Scale*

Table 2

Correlations Among Study Variables (n=1114)

Variable	1	2	3	4	6	7	8	9	10	11	12	13
1. MASC_Correct	—											
2. ExceedingToM_MASC	-0.637***	—										
3. LessToM_MASC	-0.615***	-0.043	—									
4. NoToM_MASC	-0.603***	0.126**	0.330***	—								
5. RFQ_LRFu	-0.225***	0.193***	0.115**	0.076	—							
6. RFQ_LRFc	0.159***	-0.100*	-0.093*	-0.068	-0.685***	—						
7. CTQ EA	-0.173***	0.119**	0.097*	0.074	0.417***	-0.268***	—					
8. CTQ PA	-0.233***	0.112**	0.163***	0.116**	0.292***	-0.200***	0.668***	—				
9. CTQ SA	-0.163***	0.088*	0.107*	0.099*	0.254***	-0.146***	0.508***	0.443***	—			
10. CTQ EN	-0.212***	0.112**	0.156***	0.106*	0.369***	-0.280***	0.751***	0.564***	0.400***	—		
11. CTQ PN	-0.187***	0.085*	0.178***	0.061	0.326***	-0.233***	0.681***	0.562***	0.434***	0.737***	—	
12. CTQ Total	-0.152***	0.116**	0.080	0.070	0.182***	-0.050	0.377***	0.456***	0.529***	-0.050	0.162***	—
13. DERS	-0.167***	0.192***	0.027	0.099*	0.582***	-0.389***	0.527***	0.292***	0.334***	0.397***	0.371***	0.241*** —

MASC= Movie for the Assessment of Social Cognition; Less = under- or hypo- mentalizing errors; Exc = over- or hyper- mentalizing errors; No = non or absence of mentalizing; RFQ_LRFu= Reflective Functioning Questionnaire Uncertainty subscale; RFQ_LRFc = Reflective Functioning Questionnaire Certainty subscale; CTQ= Childhood Trauma Questionnaire; EA = Emotional abuse subscale; PA = Physical abuse; SA= Sexual abuse subscale; EN= Emotional neglect subscale; PN = Physical neglect subscale; DERS= Difficulties in Emotion Regulation Scale

Primary Analyses (BPD and Healthy Controls)

A mediation analysis was performed to examine whether mentalizing capacity, measured by the MASC, mediated the relationship between experiences of childhood trauma and difficulties with emotion regulation. Findings are presented in table 3 and figure 3.

Experiences of childhood trauma had a significant direct effect on emotion regulation difficulties (*B*=0.021*,* p<.001; 95%CI: 0.016;0.025) when controlling for the effects of mentalizing capacity.

A significant indirect effect of mentalizing capacity on the relationship between experiences of childhood trauma and emotion dysregulation difficulties was found (B=0.001, p=0.02). Bias-corrected bootstrapped confidence intervals further confirmed the indirect effect (BC 95% CI: 4.917e-4;0.003). The total effect of experiences of childhood trauma on emotion dysregulation difficulties was statistically significant (p<.001). This suggests that the effect of experiencing childhood trauma on the emotional regulation difficulties is partially mediated by mentalizing capacity. The indirect effect accounted 1.9% of the total effect of experiences of childhood trauma on difficulties with emotion regulation. 9.3% of the variance in emotion regulation difficulties was explained by the model.

Table 3

MASC Mentalizing Capacity: Direct, Total, and Indirect Effects

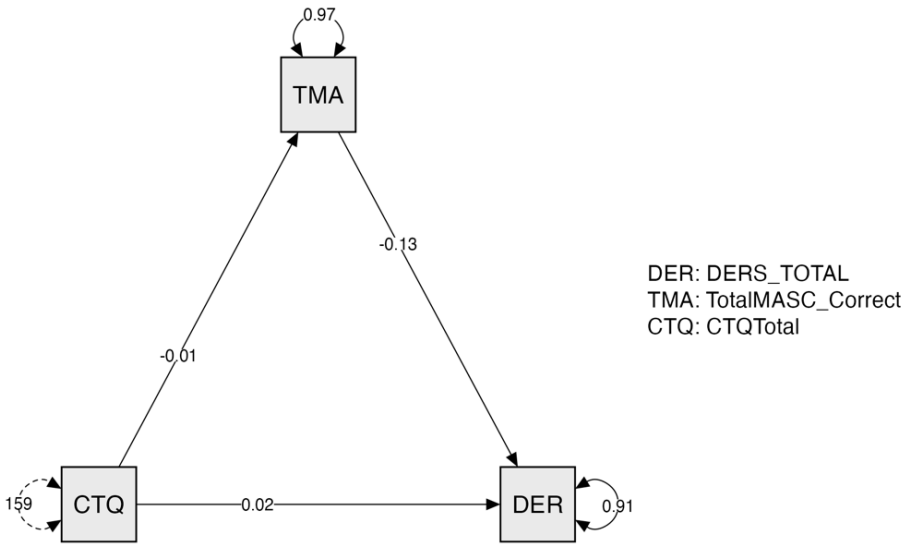
	Direct effects				
Path	*B*	SE *B*	z-value	*p*	95% CI*
CTQ_Total to DERS	0.021	0.002	8.667	< .001	0.016; 0.025
	Indirect effects				
CTQ_Total to MASC_Correct to DERS	0.001	5.704e-4	2.440	0.015	4.917e-4;0.003
	Total effects				
CTQ_Total to DERS	0.022	0.002	9.370	<.001	0.017; 0.026

* 95% bias-corrected percentile bootstrap confidence intervals

B= standardised estimates; *MASC= Movie for the Assessment of Social Cognition; CTQ= Childhood Trauma Questionnaire; DERS= Difficulties in Emotion Regulation Scale*

Figure 3

Diagram for the MASC Mentalizing Capacity Model (N=1114)



Sensitivity Analyses

These findings were replicated when controlling for potential confounders: age, gender, ethnicity, employment status, household income, education level and years in education. The direct effect of experiences of childhood trauma on emotion regulation difficulties remained significant *(B*=0.207<.001; BC 95%CI: 0.147; 0.270). The indirect effect of mentalizing capacity also remained significant (B=0.021, p=0.008; BC 95%CI: 0.007; 0.039). The findings suggest that, even when controlling for potential confounders, the effect of experiences of childhood trauma on difficulties with emotion regulation is partially mediated by mentalizing capacity.

Findings were also replicated after filtering for all missing data. The final sample was n = 333 (BPD) and n= 225 (HC). The difference in the outcome of this analysis was negligible, with the model also suggesting that mentalizing capacity partially mediates the effect of experiences of childhood trauma on emotion regulation difficulties (*indirect effect: B*=0.001, p=0.014, BC 95% CI: 4.4521e-4; 0.003).

Mediation analysis was then performed using the RFQ uncertainty and certainty subscales, using the same methods as above to handle missing data. The findings are presented in table 4 and figure 4.

Experiences of childhood trauma had a significant direct effect on emotion regulation difficulties (*B*=0.012*,* p<.001; 95%CI: 0.008; 0.016) when controlling for the effects of mentalizing capacity as measured by the RFQ.

A significant indirect effect of the RFQ uncertainty subscale on the relationship between experiences of childhood trauma and emotion dysregulation difficulties was found (*B*=0.009, p<.001; BC 95% CI: 0.007; 0.012). While the indirect effect of the RFQ certainty subscale was not significant (p=0.139), the total indirect effects of RFQ were significant (B=0.01, p<.001; BC 95% CI: 0.008; 0.012), as was the total effect of experiences of childhood trauma on emotion dysregulation difficulties (p<.001). This suggests that the effect of experiencing childhood trauma on the emotional regulation difficulties is partially mediated by mentalizing capacity as measured by the RFQ and, therefore replicates the findings of

mentalizing measured with the MASC. Interestingly, the findings suggest that only uncertainty about mental states, or hypomentalizing, plays a mediating role.

Table 4

RFQ Mentalizing Capacity: Direct, Total and Indirect Effects

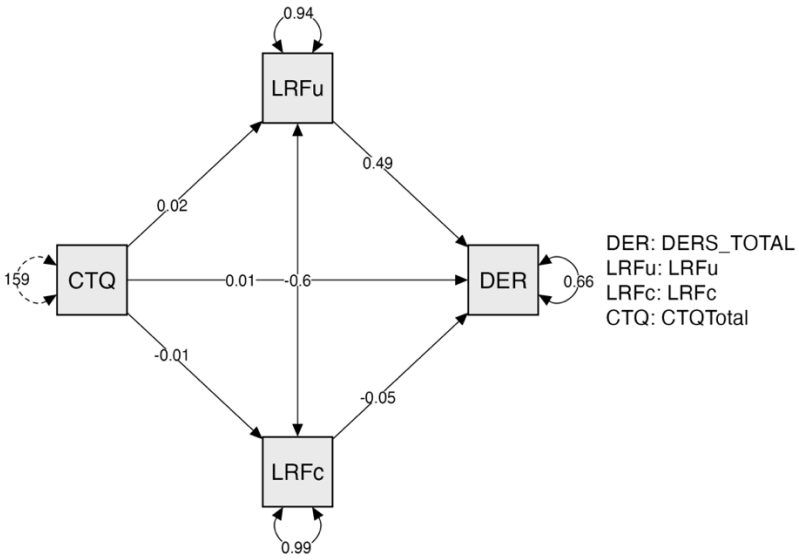
	Direct effects				
Path	*B*	SE *B*	z-value	*p*	95% CI*
CTQ_Total to DERS	0.012	0.002	5.913	< .001	0.008; 0.016
	Indirect effects				
CTQ_Total to RFQ_LRFu to DERS	0.009	0.001	7.141	< .001	0.007; 0.012
CTQ_Total to RFQ_LRFc to DERS	4.009e-4	2.710e-4	1.480	0.139	-1.213e-5; 0.001
	Total effects				
CTQ_Total to DERS	0.022	0.002	9.369	<.001	0.017; 0.026
	Total indirect effects				
CTQ_Total to DERS	0.010	0.001	7.283	< .001	0.008; 0.012

* 95% bias-corrected percentile bootstrap confidence intervals

B= standardised estimates; MASC= Movie for the Assessment of Social Cognition; CTQ= Childhood Trauma Questionnaire; DERS= Difficulties in Emotion Regulation Scale; RFQ_LRFu = Reflective Functioning Questionnaire Uncertainty subscale; RFQ_LRFc = Reflective Functioning Questionnaire Certainty subscale

Figure 4

Diagram for the RFQ Mentalizing Capacity Model (N=1114)



Mediation analysis was also conducted including both the two RFQ subscales and the MASC as potential mediating variables. Childhood trauma was found to have a significant direct effect on difficulties with emotion regulation (*B*=0.012, p<.001; BC 95% CI: 0.008; 0.017). Similarly, to the RFQ only model, the uncertainty subscale had a significant indirect effect on the relationship between experiences of childhood trauma and emotion dysregulation difficulties (*B*= 0.01, p<.001, BC 95% CI: 0.007; 0.012), while the certainty subscale did not (*B*=4.026e-4, p=0.137, BC 95% CI: -4.115e-5; 0.001). Unlike in the MASC only model, total correct MASC scores did not have a significant indirect effect (*B*=-1.712e-4, p=0.651, BC 95% CI: -0.001; 5.892e-4). Nonetheless, total indirect effects (*B*=0.01, p<.001, BC 95% CI; 0.001; 0.012) and total effects (*B*=0.022, p<.001, BC 95% CI: 0.018; 0.0260 were significant. This suggests that the effect of experiencing childhood trauma on the emotional regulation difficulties is partially mediated by mentalizing, specifically hypomentalizing.

Borderline Personality Disorder

A mediation analysis was conducted to explore whether the relationship between experiences of childhood trauma and difficulties with emotion regulation is mediated by mentalizing capacity, as measured by the MASC, in individuals with BPD. This analysis was conducted to explore whether the findings held when the sample included only individuals with BPD and are presented in table 5 and figure 5.

Experiences of childhood trauma did not have a significant direct effect on emotion regulation difficulties (*B*=4.641e-4*,* p=0.893, BC 95%CI: -0.007; 0.008) when controlling for the effects of mentalizing capacity. Similarly, no significant indirect effect of mentalizing capacity on the relationship between experiences of childhood trauma and emotion dysregulation difficulties was found (B=0.001, p=0.069, BC 95% CI: 2.243e-4; 0.003). The total effect of experiences of childhood trauma on emotion dysregulation difficulties was not statistically significant (p<0.607).

These findings were replicated when a complete dataset was used (*N*=333), with all missing measures removed (*Indirect effect: B*=0.001, p=0.057, BC 95% CI: 2.692e-4; 0.004).

Sensitivity Analyses

An analysis was conducted using the two RFQ subscales as mediators in the relationship between experiences of childhood trauma and difficulties with emotion regulation. Similarly, to the MASC, no significant direct effect was found (*B*=-0.002*,* p=0.538; 95%CI: -0.009; 0.005). A significant indirect effect of the RFQ uncertainty subscale was found (*B*=0.003, p=0.031; BC 95% CI: 3.790e-4; 0.006). While the indirect effect of the RFQ certainty subscale was not significant (p=0.193), the total indirect effects of RFQ were significant (B=0.004, p=0.003 BC 95% CI: 0.001; 0.007). The total effect of experiences of childhood trauma on emotion dysregulation difficulties was not statistically significant (p=0.603).

The presence of an indirect effect suggests to the mediating role that mentalizing, as measured by the RFQ, plays in the relationship between childhood trauma and emotion

regulation difficulties. The findings suggest that only uncertainty about mental states, or hypomentalizing, plays the mediating role.

Table 5

MASC Mentalizing Capacity: Direct, Total and Indirect effects

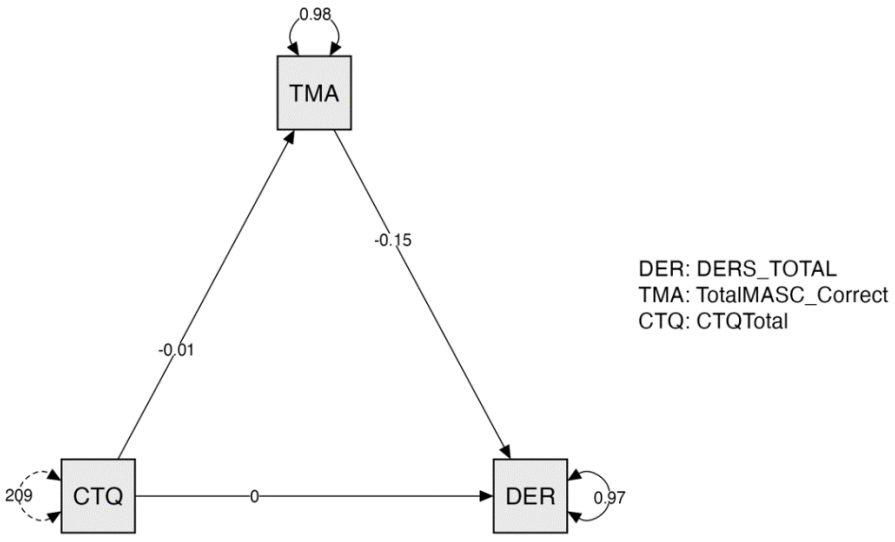
	Direct effects				
Path	*B*	SE *B*	z-value	*p*	95% CI*
CTQ_Total to DERS	4.641e-4	0.003	0.134	0.893	-0.007; 0.008
	Indirect effects				
CTQ_Total to MASC_Total to DERS	0.001	7.237e-4	1.821	0.069	2.243e-4; 0.003
	Total effects				
CTQ_Total to DERS	0.002	0.003	0.515	0.607	-0.006; 0.009

* 95% bias-corrected percentile bootstrap confidence intervals

B= standardised estimates; *MASC= Movie for the Assessment of Social Cognition; CTQ= Childhood Trauma Questionnaire; DERS= Difficulties in Emotion Regulation Scale*

Figure 5

Diagram for the MASC Mentalizing Capacity Model for BPD Participants (N=439)



Healthy Controls

A mediation analysis was also conducted using just healthy controls (*n*=675) to examine the role of mentalizing capacity, as measured by the MASC. Experiences of childhood trauma was found to have a significant direct effect on emotion regulation difficulties (*B*=0.018*,* p<.001; 95%CI: 0.01; 0.025) when controlling for the effects of mentalizing capacity. No significant indirect effect was found (*B*= -1.708e-5, p=0.98; BC 95% CI: -0.002; 0.002). The total effect was statistically significant (p<.001). Findings suggest that mentalizing capacity does not mediate the effect of childhood trauma on emotion dysregulation difficulties in healthy controls.

Sensitivity Analyses

These findings were replicated with a complete dataset (*N*=225), with all missing measures removed (*Indirect effect: B= -2.777e-5*0.001, p=0.963, BC 95% CI: -0.002; 0.002)

Similarly, findings were replicated when using the self-report mentalizing measure (RFQ). Direct effect of childhood trauma on emotion regulation difficulties (p<0.001) and total effects (p<0.001) were significant. Indirect effects were marginally significant for the RFQ uncertainty subscale (p=0.047; BC 95% CI: 4.522e-4; 0.004), but insignificant for the certainty subscale (p=0.598; BC 95% CI: -3.500e-4; 0.001). Total indirect effects were not significant (p=0.073). These findings suggest that RFQ measured mentalizing capacity does not mediate the effect of experiences of childhood trauma on emotion dysregulation difficulties in healthy controls.

Subscale Analyses

Considering the negligible differences between findings when using the dataset with missing values or the complete dataset (with missing values removed), subscale analyses were conducted using the entire dataset, with missing values handled using Full Information Maximum Likelihood, Mplus emulation and the maximum likelihood estimator, as implemented by JASP.

MASC Mentalizing Errors

A mediation analysis of the full dataset (*n*=1114) was conducted to examine whether the different mentalizing errors, measured by the MASC, mediate the relationship between experiences of childhood trauma and difficulties with emotion regulation. Findings are presented in table 6 and figure 6.

Experiences of childhood trauma had a significant direct effect on emotion regulation difficulties (*B*=0.02*,* p<.001; 95%CI: 0.016; 0.025) when controlling for the effects of mentalizing capacity. A significant total indirect effect of mentalizing errors was found (*B*=0.002*,* p<.001; 95%CI: 0.018;0.026). Individual indirect effects were not found to be significant for hypomentalizing (p=0.464; BC 95% CI: -8.099e-4; 2.265e-4) or non-mentalizing errors (p=0.196; BC 95% CI: -8.921e-6; 0.001). A significant indirect effect was found for hypermentalizing errors (p=0.014; BC 95% CI: 4.775e-4; 0.003).

The total effect of experiences of childhood trauma on emotion dysregulation difficulties was statistically significant (p<.001). This suggests that the effect of experiencing childhood trauma on the emotional regulation difficulties is partially mediated by the hypermentalizing error.

The mediation analysis was also conducted with just the BPD participants (*n*=439), which found no significant direct, indirect or total effects.

Table 6

Mentalizing Errors: Direct, Total, and Indirect Effects

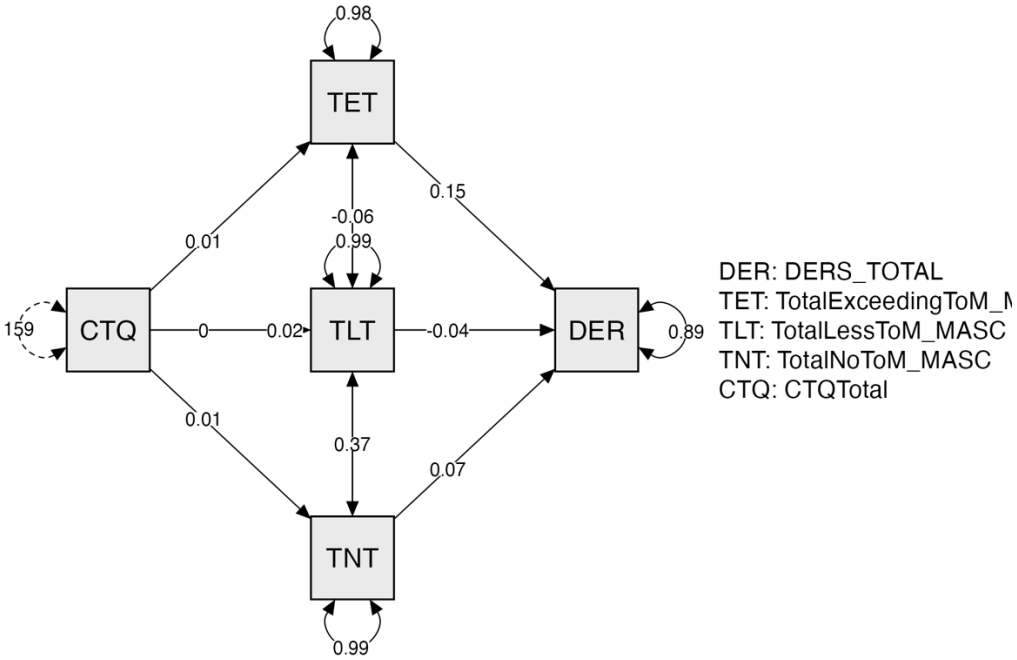
	Direct effects				
Path	*B*	SE *B*	z-value	*p*	95% CI*
CTQ_Total to DERS	0.02	0.002	8.636	<.001	0.016;0.025
	Indirect effects				
CTQ_Total to MASC_Exc to DERS	0.001	5.591e-4	2.454	0.014	4.775e-4; 0.003
CTQ_Total to MASC_Less to DERS	-1.741e-4	2.377e-4	-0.732	0.464	-8.099e-4; 2.265e-4
CTQ_Total to MASC_No to DERS	4.234e-4	2.377e-4	1.292	0.196	-8.921e-6; 0.001
	Total effects				
CTQ_Total to DERS	0.022	0.002	9.369	<.001	0.018; 0.026
	Total indirect effects				
CTQ_Total to DERS	0.002	6.569e-4	2.469	0.014	4.636e-4; 0.003
	Residual Covariances				
MASC_Exc to MASC_Less	-0.062	0.042	-1.500	0.134	-0.142; 0.019
MASC_Exc to MASC_No	0.161	0.042	3.818	<.001	0.078; 0.272
MASC_Less to MASC_No	0.373	0.045	8.381	<.001	0.262; 0.518

* 95% bias-corrected percentile bootstrap confidence intervals

B= standardised estimates; *MASC= Movie for the Assessment of Social Cognition; Less = under- or hypo- mentalizing errors; Exc = over- or hyper- mentalizing errors; No = non or absence of mentalizing; DERS= Difficulties in Emotion Regulation Scale; CTQ= Childhood Trauma Questionnaire*

Figure 6

Diagram for the MASC Mentalizing Errors Model (*N*= 1114)



CTQ Subscales

A mediation analysis of the full dataset (*n*=1114) was conducted to determine whether mentalizing capacity, as measured by the MASC, mediates the effect of subtypes of childhood trauma on emotion regulation difficulties. Findings are presented in table 7 and figure 7.

Significant direct effects of childhood trauma subtypes on difficulties in emotion regulation were found for emotional abuse (*B*=0.085*,* p<.001; 95%CI: 0.068; 0.098), physical abuse (*B*=-0.033*,* p<.001; 95%CI: -0.049; -0.017) and sexual abuse (*B*=0.017*,* p=0.004; 95%CI: 0.005; 0.029). The direct effects of emotional neglect and physical neglect were not significant.

None of the indirect paths from childhood trauma subtypes to difficulties with emotion regulation through mentalizing capacity were significant. The total effects were significant for emotional abuse (*B*=0.084, p<.001), physical abuse (*B*=-0.031, p<.001), and sexual abuse (*B*=0.018, p=0.003). This suggests that accounting for mentalizing capacity, there is a

significant effect of emotional abuse, physical abuse and sexual abuse on difficulties with emotion regulation.

No significant direct, indirect or total effects was found in the mediation analysis conducted with just the BPD participants (*n*=439).

Table 7

Childhood Trauma Subtypes: Direct, Total, and Indirect Effects

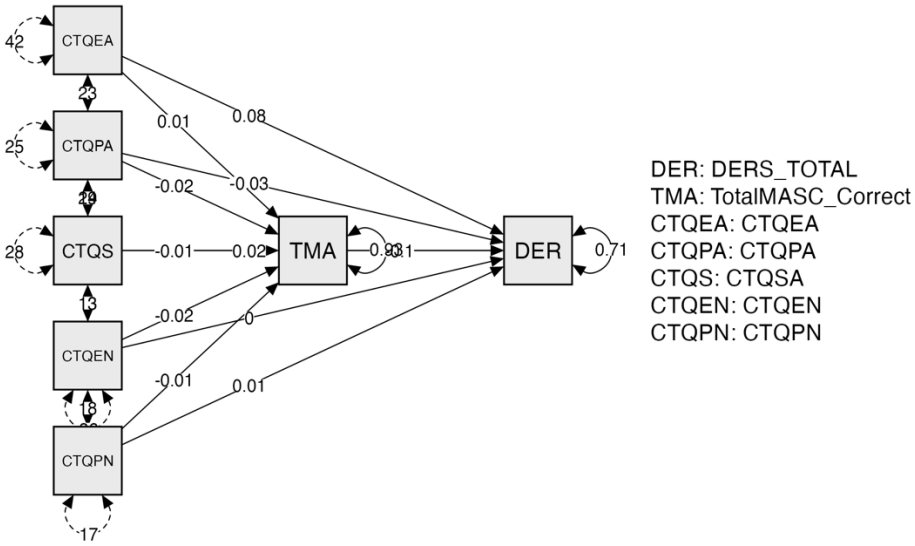
	Direct effects				
Path	*B*	SE *B*	z-value	*p*	95% CI*
CTQEA to DERS	0.085	0.007	11.751	<.001	0.068;0.098
CTQPA to DERS	-0.033	0.008	-4.287	<.001	-0.049; -0.017
CTQSA to DERS	0.017	0.006	2.912	0.004	0.005;0.029
CTQEN to DERS	6.602e-4	0.007	0.091	0.928	-0.015;0.017
CTQPN to DERS	0.006	0.010	0.599	0.549	-0.015;0.025
	Indirect effects				
CTQEA to MASC_Total to DERS	-0.001	0.001	-1.079	0.280	-0.004;9.598e-4
CTQPA to MASC_Total to DERS	0.002	0.001	1.818	0.069	1.732e-4;0.006
CTQSA to MASC_Total to DERS	7.064e-4	8.503e-4	0.831	0.406	-7.910e-4;0.003
CTQEN to MASC_Total to DERS	0.002	0.001	1.792	0.073	1.581e-4;0.006
CTQPN to MASC_Total to DERS	0.001	0.001	0.823	0.411	-0.002;0.006
	Total effects				
CTQEA to DERS	0.084	0.007	11.570	<.001	0.066;0.097
CTQPA to DERS	-0.031	0.008	-3.977	<.001	-0.047; -0.015
CTQSA to DERS	0.018	0.006	3.020	0.003	0.006;0.030
CTQEN to DERS	0.003	0.007	0.435	0.664	-0.013;0.019
CTQPN to DERS	0.007	0.010	0.720	0.472	-0.013;0.026

Note: Delta method standard errors, bias-corrected percentile bootstrap confidence interval, ML estimator.

B= standardised estimates; MASC= Movie for the Assessment of Social Cognition; DERS= Difficulties in Emotion Regulation Scale; CTQ= Childhood Trauma Questionnaire; EA= emotional abuse; PA= physical abuse; SA= sexual abuse; EN= emotional neglect; PN= physical neglect

Figure 7

Diagram for CTQ Subscales Model N= 1114)



Discussion

Primary Analyses

The present study found that mentalizing partially mediates the relationship between experiences of childhood trauma and emotion regulation difficulties in BPD and healthy control (HC) groups. These findings were replicated when potential confounders were included in the model and when mentalizing capacity was measured using a self-report measure (RFQ). While conducting the mediation analysis with a combined group of HC and BPD participants helped to corroborate the associations between childhood trauma experiences, emotion regulation and mentalizing capacity, the partial mediation of mentalizing (as measured by the MASC) was not retained when looking at the BPD or HC groups individually. However, this does not reflect existing evidence of the association between childhood trauma and reduced mentalizing abilities in individuals with BPD (e.g., Duque -Alarcon et al., 2019), nor the association between mentalizing ability and emotion regulation in healthy controls (e.g., Schwarzer et al., 2021) and BPD (e.g., Euler et al.,

2011). One interpretation for the lack of indirect effects is the loss of statistical power when looking at BPD and HC groups separately, attributed to the smaller sample sizes of the groups and potential loss of variance within the variables included in the model (Fritz et al., 2015).

Interestingly, when the RFQ was used as the measure of mentalizing, the study found that hypomentalizing partially mediated the relationship between childhood trauma and emotion regulation difficulties. This does not reflect past studies that have associated BPD with hypermentalizing more than hypomentalizing (e.g., McLaren et al. 2022), and deviates from the findings of the MASC subscale analyses of this study (discussed below). This discrepancy may reflect the recent critique that the RFQ is a unidimensional measure of hypomentalising and is unlikely to capture hypermentalising (Müller et al., 2022). The discrepancy could also be due to differences between self-reported mentalizing ability and objectively measured mentalizing, however it was beyond the scope of this study to explore this further.

Overall, these findings support the study's hypothesis that mentalizing capacity plays a role in the association between experiences of childhood trauma and emotion regulation difficulties. The findings provide more insight into mentalizing as a potential etiological factor in the development of BPD symptomology, i.e., how emotion regulation difficulties develop. This in turn provides greater understanding of the development of other core features of BPD symptomology which have been connected to emotion regulation difficulties, such as impulsivity (e.g., Krause-Utz et al., 2019) or interpersonal difficulties (e.g., Euler et al., 2021), and highlight a potential pathway of intervention to decrease risk of emotion dysregulation (Parada-Fernandez et al.2021). The findings further suggest that mentalizing can affect how childhood trauma impacts the development of emotion dysregulation, emphasising mentalizing as a potential therapeutic target. As such, they add to the growing evidence base for the use of mentalization based therapies in BPD, particularly those with a known trauma history (Smits et al., 2022).

The findings can be understood in the context of the mentalization model, which proposes that effective mentalizing enables the understanding of the behaviour of others, the identification and understanding of one's own mental states (e.g., desires, emotions, thoughts) and the differentiation between emotional reality and imagined/thoughts. (Parada-Fernandez et al., 2021). Consequently, the failure to acquire effective mentalizing may distort an individual's understanding of the mental states of oneself and others, and impact their ability to interpret and predict behaviour, which in turn is associated with difficulties with emotion regulation (Parada-Fernandez et al., 2021; Bateman & Fonagy, 2019). The model proposes that individuals may fail to acquire these key prerequisite mentalizing processes required for emotion regulation when they have not experienced sensitive caregiving (including adequate affect mirroring and co-regulation of affect), such as in adverse psychosocial environments of abuse or neglect. Affect mirroring by caregivers is thought to engender awareness of "mental interiors" (Fonagy & Luyten, 2009, p.1359), enable the child to experience their emotions as meaningful and controllable, and help build second-order representations of affect (Schwarzer et al., 2021). Second-order representations are thought to facilitate the understanding of mental states as predictive of behaviour and allow for the independent regulation and modification of these mental states (Schwarzer et al., 2021). Consequently, as a result of experiences of childhood trauma where arguably there is an absence of such sensitive caregiving experiences, individuals may fail to acquire these mentalizing processes, contributing to the development of emotion regulation difficulties (Fonagy & Luyten, 2009). Indeed, Fonagy et al (2015) propose that problems such as affect regulation, which stem from dysfunctional early relationships, are mediated by a failure to develop effective "regulatory" and "reflective capacities that mentalizing affords" (Fonagy et al., 2015, p.381). This view helps explain why impaired mentalizing in this study served to mediate the presence of emotion regulation difficulties in individuals with a history of childhood trauma.

Of note, the model only indicates partial mediation of mentalization, suggesting that there are other potential indirect effects which could help explain the effect of childhood

trauma on emotion regulation difficulties (Rucker et al., 2011). While beyond the scope of the study, future research should explore other factors which have been proposed to play a role in the development of emotion regulation difficulties, such as attachment style (e.g., Huang et al., 2020; Parada-Fernandez et al., 2021) or neurobiological vulnerabilities (e.g., Cattane et al., 2017).

Subscale Analyses: MASC mentalizing errors

The study also explored subscale analyses of mentalizing errors and found that hypermentalizing partially mediated the effect of childhood trauma on emotion regulation difficulties. Similarly, to total MASC scores, the BPD only group had no significant indirect effect, which can be explained by the potential loss of statistical power due to the decreased sample size when looking at the BPD independently. Future research could explore this using a larger sample size.

Overall, findings correspond to previous research that identified hypermentalizing, as measured by the MASC, to be robustly associated with BPD (McLaren et al. 2022) and supports the proposition of an altered style of mentalizing in BPD, rather than a loss of mentalizing ability, i.e., under-mentalizing (Sharp & Vanwoerden, 2015; Sharp et al., 2011).

This finding is concordant with the hypermentalizing model proposed by Sharp (2014). The model posits an iterative process in which difficulties with emotion regulation and ineffective mentalizing (hypermentalizing), attributed in part to adverse early life experiences which interfere with the acquisition of such abilities, are activated in conditions of high emotion arousal and maintained by both the over-attribution of mental states of others and the lack of regulation strategies to cope with the resulting emotion arousal, which in turn can increase hypermentalizing (Sharp, 2014). Broadly, the findings extend the primary analyses by identifying hypermentalizing as a partial mediator and underlines the need for longitudinal studies investigating the possible mechanism of hypermentalizing on

the development of emotion regulation difficulties in persons with a history of childhood trauma.

Subscale Analyses: CTQ subscales

The study found no significant indirect effects of mentalizing when using the childhood trauma subtypes as independent variables in the model. Nonetheless, total effects were significant for emotional, physical, and sexual abuse, suggesting that these trauma subtypes have a significant effect on emotion regulation difficulties, accounting for mentalizing performance. This aligns with past research which has highlighted emotional, physical, and sexual abuse as being particularly associated with emotion dysregulation (e.g., Alafia & Manjula, 2020).

The finding of an effect of childhood trauma on emotion regulation, independent of mentalizing could be understood with consideration to other factors that may influence the acquisition of emotion regulation difficulties. For example, disrupted rearing environments, such as those involving different types of abuse and neglect, may lack behavioural modelling of appropriate regulatory skills by caregivers, or lack of an emotionally supportive environment for learning, and in turn impair the acquisition of emotion regulation skills (Kuo et al., 2015). Another consideration is the impact of adverse early environments on neural development in areas associated with emotion regulation (Mclaughlin et al., 2014; Dvir et al., 2014).

Limitations

There are several limitations to the study which should be considered when interpreting the findings. The cross-sectional design precludes any definitive causal conclusions and mediation analyses using cross-sectional data can often generate biased estimates of effect. Consequently, future research should include longitudinal studies, which can provide temporal precedence required for exploration of causal links and gain further

understanding of mentalizing as a potential etiological factor for emotion regulation difficulties (Maxwell & Cole, 2007).

The findings may also be impacted by the limitations of the chosen measures. For example, childhood trauma was assessed using a self-report measure (CTQ). As the items in this measure are both subjectively and retrospectively scored, the results could be affected by recall biases. For example, Krase-Utz et al., (2019) suggests that individuals with BPD recall childhood experiences more negatively. Similarly, the DERS measures subjective appraisals of emotion regulation difficulties, which can be limiting if individuals do not have sufficient awareness of their emotional responses to accurately report (Gratz & Roemer, 2004). Furthermore, the MASC also has limitations that warrant comment. For example, mentalizing performance may be impacted by differences in ethnicity or cultural background between participants and the middle-class, white dinner party depicted in the MASC, or by age or gender effects, which in turn can impact the generalisability of conclusions (Newbury et al. 2017; Penner et al., 2020; Wacker et al., 2017). The MASC has also been suggested to lack two characteristics of real-life mentalizing, namely that the social scenarios are neither personally relevant to the participants nor as emotionally salient than attachment-related situations (McLaren et al., 2022). Consequently, the results of this study may only reflect hypermentalizing in “non-self-referential situations of relatively low emotional salience” (p.26), which are less generalisable to more activating and personally relevant social situations (McLaren et al., 2022).

Finally, there was considerable heterogeneity between BPD and HC groups which attenuates any interpretations or generalisations that can be made. Significant demographic differences were found between the two groups, including education, gender, ethnicity, household income and employment status. Furthermore, it was beyond the scope of the study to consider the possibility of clinical heterogeneity, namely comorbidities or sub-clinical symptoms. Given that comorbidities are common in individuals with BPD (Shah & Zanarini., 2018), further research may benefit from exploring whether the presence of other psychological difficulties impacts the mediation model proposed in this study. Additionally,

considering that trauma inflicted by primary caregivers has been most associated with the development of emotional regulation difficulties (e.g., van Dijke et al., 2013), future research could explore the impact of duration, onset or perpetrator of childhood trauma in order to extend the findings of this study.

Clinical Implications

The findings of this analysis have several important clinical implications. Firstly, the findings suggest that improving mentalizing deficits could impact emotion regulation difficulties. This supports mentalizing as a therapeutic target for intervention, increasing the evidence for the use of mentalization-based therapy (Luyten et al., 2020; Fonagy & Allison, 2014), particularly in those with an early trauma history. Importantly, this could in turn improve other BPD symptomology associated with emotion regulation, e.g., interpersonal difficulties, in individuals with BPD (e.g., Euler et al., 2021). The findings extend the evidence of the potential role of mentalizing in the development of BPD symptomology and supports the theory that mentalizing is a potential etiological factor (e.g., Bo et al., 2017). While these findings are clinically significant as they can inform intervention and prevention planning, they also highlight the need for further, longitudinal research. Finally, results of this study are relevant to trauma-informed practice. Trauma-informed practice refers to the understanding that exposure to trauma can have a vast impact on an individual, including their psychological and social development (Office for Health Improvement & Disparities, 2022). The findings suggest that mentalizing partly influences the effect of experiences of early life trauma on emotion regulation difficulties. Consequently, consideration to potential mentalizing deficits in individuals with a known trauma history, including how this can impact how an individual responds to social or stressful situations, could increase understanding about an individual's presentation and difficulties, help guide therapeutic engagement and intervention, and inform individual formulations and care plans, This could in turn lead to a more trauma-informed approach to care, both on an individual and organisational level.

Conclusion

The findings of the primary mediation analyses support the view that mentalizing partially mediates the association between childhood trauma and emotion regulation difficulties. This reflects the known associations between childhood trauma, mentalizing and emotion regulation difficulties, and extend on the evidence base by suggesting that hypermentalizing may be an etiological risk factor in the development of emotion regulation difficulties. Despite limitations, the findings suggest that interventions which are aimed at improving mentalizing capacity are an important treatment target for individuals with a history of childhood trauma and are at risk of developing emotion regulation difficulties. Importantly, the study highlights the need for prospective, longitudinal research to explore causal links.

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Part 3: Critical Appraisal

Introduction

This critical appraisal is a personal reflection on the experience of completing the major research project. It first reflects on the process of completing a research project as part of the clinical training course, as well as the experience of choosing a topic and joining an on-going study. It then discusses my reflections on conducting both the systematic review and empirical paper, and the challenges encountered while using novel complex statistical analysis methods. Finally, the appraisal concludes with a brief consideration of the knowledge gained from the research and the potential applications to clinical practice.

Reflections on the Process

It is well-established that the doctoral course can feel like a precarious balancing act between clinical commitments, course demands and research work. Trainees can often experience feelings of self-doubt and inadequacy, which can be heightened in individuals who are prone to self-critical perfectionism (Richardson et al. 2020). Completing the thesis often felt like a balancing act with the pressures of other aspects of the course. I often found myself daunted both by the task of learning how to conduct the research, which I had limited experience with, and how time-consuming the process could be when time felt constrained.

I resonated a lot with the literature around the experiences of trainee psychologists (Richardson et al. 2020), particularly as at times it felt more difficult to sit with feelings of self-doubt and not succumb to urges to avoid. On reflection, while I found myself challenged in a myriad of ways, I was able to approach these challenges one step at a time with patience and self-compassion.

Choosing a Research Topic

My background before starting the doctoral training course was mostly clinical, working as an Assistant Psychologist in an acute inpatient psychiatric hospital. I had limited experience with research beyond a systematic review completed as part of my master's

dissertation. Consequently, the research component of the course felt daunting and anxiety-provoking. When first faced with choosing a topic, my strategy was to search for projects in areas I was passionate about, that did not require advanced knowledge of research methods, and which would include supervisors who could offer consistent support in navigating through the process. As a way of coping with the feelings of self-doubt around my abilities, I found myself disregarding interesting topics that were less defined or appeared to require advanced statistical methods.

I was primarily attracted to this project because it focused on my key area of interest and a clinical population that I hoped to work with in the future. My experiences in inpatient settings often included working with individuals who have had adverse early experiences but who had diagnoses of BPD and were often perceived negatively on the ward. I was curious about the opportunity that this project provided in learning more about BPD and exploring a different way to make sense of common presentations which I encountered in my clinical work. I was also drawn by the support that the supervisors on the project could provide, particularly with the data analysis component. Upon reflection, my strong interest in the topic area and the consistently encouraging yet constructive feedback from supervisors, were key in helping me to persevere through the more challenging moments of the process.

Reflections on the Systematic Review

As part of the systematic review, relevant papers are assessed for their quality and reviewers are tasked with deciding whether the study is of sufficient quality to be included. The tool that I selected for this task was the JBI Checklist for cross-sectional studies, which has been designed for appraising studies for systematic reviews (Moola et al., 2020). I found the task of appraising the quality of published studies from experienced researchers challenging and I often felt that I lacked the competence or knowledge to do so properly. Indeed, the design of the appraisal tool meant that reviewers had to make relatively subjective decisions based on the checklist about whether a study was of sufficient methodological quality to be included. Nonetheless, being able to work with a second

reviewer and compare decisions was helpful in feeling more confident in the final decisions that were made, particularly as there was little to no disagreement. In hindsight and in the absence of any time constraints of the clinical training, it may have been beneficial to look at each of the two reviewers' ratings for each item of the checklist, to compare the way that decisions to include or exclude were made.

Given that BPD and mentalization is an extensively researched area, when we first started to outline the procedure for the systematic review, I was anticipating a large number of relevant studies. However, after completing an initial search through the existing literature, I was surprised by the limited number of studies which looked at mentalizing in BPD populations using the MASC. I was particularly surprised that the use of a tool which was introduced in 2006 by Dziobek et al. and considered to be more ecologically valid than existing measures, was not more widely used in clinical populations. This initial search led my supervisors and I to broaden the topic of the review, to include all psychological and neurodevelopmental disorders, in both adults and adolescents. While this decision significantly increased the number of results in my searches and, therefore, increased the time commitment to screening them, it ultimately led to a more interesting and useful outcome. Broadening the scope of the review allowed us to contribute to the evidence base for the use of the MASC in a range of clinical populations, as well as supported the proposition that ineffective mentalizing is present in a range of disorders. Both outcomes could have useful implications in both assessment and treatment aspects of clinical work.

A methodological dilemma I encountered when conducting the meta-analysis was how to define the clinical groups in which the studies would be categorised. I ultimately decided on using the diagnostic groups defined by the DSM 5, as this was predominately the criteria used in the included studies. However, the heterogeneous nature of psychological disorders, including the likelihood of co-occurring symptoms, means that a more dimensional approach could be a beneficial approach in future research.

Reflections on the Empirical Paper

The data I used for my thesis was part of an on-going study and consequently, part of the agreement to use the data was that I would support with recruitment and data collection. Initially, I thought that joining an established study would have the benefits of not having to complete the lengthy process of applying for ethics approval. Additionally, my previous experiences have been primarily clinical, and the limited research I had carried out before left me feeling intimidated by the task of designing a doctoral level study and collecting new data. In hindsight, this approach may have also been a result of doubt in my ability to do it to a high enough standard. Consequently, at the point of selecting a research topic, a secondary data project felt more in line with my abilities.

Over the course of the research, I found there were several benefits to joining an on-going study, which I had not considered before. Most prominently, trying to make sense of a dataset which you have had no part in collecting can often feel like being in the dark. The opportunity to be part of the process of recruiting participants and collecting data, as well occasionally supporting with data imputation, provided insight and understanding of the design of the study, the measures, and the difficulties that can be encountered (e.g., with participants dropping out or not completing measures), which ultimately helped me to make sense of the data.

On reflection, the only drawback to joining an on-going study was that it often felt like my allocated research time was split between carrying out the thesis and following up with participants, particularly when working with a clinical group who can be more difficult to engage and retain in research studies (e.g., Woo et al., 2021).

The main methodological issue that I encountered was the amount of missing data. A key disadvantage of using a secondary dataset is that you have no control over the content, nor much insight into what may have contributed to any missing values. While exploring the dataset for my project, I noticed that there was a significant number of missing values for the variables I was interested in, and I needed to decide how to best handle it. This was challenging as, for some variables, around 50% of values were missing and I worried that

my sample size would be too small to detect mediated effect with 0.8 power (Fritz & MacKinnon, 2007). Luckily, in my initial proposal for the project, I had estimated only required n=71 participants for sufficient power, based on another study which had used the same dataset (e.g., Huang et al., 2020). With the reassurance that I would have a large enough sample size even with the missing data, and in discussion with my supervisor, we were able to determine the best method of handing the missing values, including conducting sensitivity analyses to check if the chosen method had an impact on the findings.

Statistical Analysis

When I first chose to join this project, I was very conscious of my limited knowledge and experience in research, and more worryingly, complex statistical analysis. Over the course of the project, one of the biggest challenges that I encountered was trying to teach myself how to use programmes such as R Studio, when it often felt like a learning a new language. I noticed feeling lost and frustrated when I did not understand how to carry out the analyses and often found myself confronted with feelings of inadequacy and doubt in my abilities. I found myself grappling to understand novel statistical jargon, write R functions and problem-solve puzzling error messages. Alongside the support and resources shared by my supervisor, I also discovered tutorial videos and forums which helped me to make sense of the work.

Upon reflection, my anxiety and fear of failure played a prominent role in my initial approach to the data analysis for both the meta-analysis and the empirical paper. I found myself racing ahead, almost to ‘get it over with’, and then felt stumped when I inevitably hit obstacles. It was only when I was patient with myself and allowed time to make sense of the steps I needed to take, that I was able to conduct the analyses. The process was ultimately an important learning experience which challenged me to take mistakes into my stride and be compassionate rather than critical towards myself. Furthermore, I came out the other side of the process with more confidence in my abilities, as well as greater knowledge of statistical analysis techniques that I can apply in the future.

Mentalization and Clinical Practice

Personality disorders, and more specifically borderline personality disorder, has always been a key interest for me. This is largely due to my early clinical experiences working in acute inpatient settings, where I first encountered the complexity, challenges, and passion for working with this clinical population. Unfortunately, the diagnosis of BPD is often associated with negative perceptions of clients, e.g., behaviour being viewed as challenging or manipulative, as well as the evocation of undesirable feelings in clinicians, such as frustration, anxiety, or confusion (Millar et al., 2012). This reflected a lot of the experiences I had working in inpatient settings, and what inspired my curiosity in trying to make sense of these complex presentations.

The topic of mentalization was novel to me, however I was drawn by the way that the model tried to explain the core features of BPD that are often encountered in clinical work, such as emotion regulation difficulties. As I completed the research and learned more about the mentalizing perspective to BPD, I found myself struck by the limited conversation or consideration to mentalizing abilities in the clinical settings I was working in, particularly when working on inpatient wards where patients often have significant trauma histories, difficulties with emotion regulation and evident impairments in mentalizing capacity.

The knowledge I gained while doing this research on a mentalizing approach to BPD allowed me to reflect on the potential implications for clinical practice. I considered how my experiences in inpatient settings, an inherently stressful environment, could benefit from taking a mentalization-based perspective. In particular, the proposition that mentalizing abilities can fluctuate in response to stressful or interpersonally threatening environments, arguably for both staff and patients, was particularly interesting in understanding how situations can escalate quickly. I considered how this approach could help me to understand the challenges I had encountered in clinical work, but also how it could help shift negative appraisals in teams to more compassionate understanding (Millar et al., 2012). Finally, I also considered the significant role of childhood trauma experiences which are proposed to impede the development of effective mentalizing. The empirical paper found that mentalizing

can mediate the effect of childhood trauma on emotion regulation difficulties, which suggests that consideration of deficits in mentalizing capacity could be part of trauma-informed practice.

Conclusion

While my primary interest when applying for the doctorate were the clinical components of the course, I have learned a lot from the opportunity to complete a major research project. The process introduced me to new statistical programs and analysis skills, which I am confident will be useful for any further clinical research I might undertake in the future. While I found the process challenging, and often outside of my comfort zone, it has also shown me that I can persevere in the face of learning new skills and the inevitable failures that form part of the learning process. What I enjoyed most has been the opportunity to learn more about mentalization and its role in psychopathology, particularly BPD, and see how this knowledge can have direct applications to the clinical population I am passionate about working with.

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Appendix 1

Search Strategy

CENTRAL

1. MeSH descriptor: [Mental Health] explode all trees
2. Mental illness
3. Mental disorders or anxiety disorders or mood disorders or obsessive-compulsive disorder or panic disorder or phobic disorders or phobia, social or "bipolar and related disorders" or bipolar disorder or dissociative disorders or depressive disorder, major or depressive disorder, treatment-resistant or seasonal affective disorder or cyclothymic disorder or neurotic, disorders or personality disorders or psychotic disorders or psychoses or schizophrenia or somatoform disorders or "trauma and stressor related disorders" or adjustment disorders or stress disorders, traumatic
4. Mood disorder* or mood disturbance* or affective disorder* or affective disturbance* or affective ill* or cyclothymi* or depression or depressive or neurotic or neurosis or adjustment disorder* or anxiety disorder* or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somatiSation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia* or affective symptoms or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*
5. "movie for the assessment of social cognition"
6. "MASC"
7. MeSH descriptor: [Mental Disorders] explode all trees
8. #5 OR #6
9. #4 OR #7 OR #3 OR #2 OR #1
10. #9 AND #8
11. (movie for the assessment of social cognition):ab,ti,kw
12. ("movie for the assessment of social cognition"):ab,ti,kw
13. (MASC):ab,ti,kw
14. #12 OR #13
15. #14 AND #9
16. Attention Deficit Disorder with Hyperactivity OR Neurodevelopmental Disorder OR Autism Spectrum Disorders OR neurodevelopmental disorder OR Developmental Disabilities OR Attention Deficit Disorder OR intellectual disorders OR neurodevelopmental disorder OR intellectual disability OR developmental disorder
17. #9 OR #16
18. #17 AND #14
19. #11 Or #13
20. #19 AND #17
21. movie for the assessment of social cognition.ft
22. MeSH descriptor: [Neurodevelopmental Disorders] explode all trees
23. #17 OR #22
24. MeSH descriptor: [Developmental Disabilities] explode all trees
25. MeSH descriptor: [Autism Spectrum Disorder] explode all trees
26. #23 OR #24 OR #25
27. #26 AND #19

CINAHL

1. ((MH "Mental Disorders+") OR (MH "Mental Health") OR (MH "Behavioral and Mental Disorders+")
2. movie for the assessment of social cognition OR (MH "movie for the assessment of social cognition") OR (AB "movie for the assessment of social cognition") OR (TI "movie for the assessment of social cognition")
3. (MH "Affective Disorders, Psychotic+") OR (MH "Psychotic Disorders") OR (MH "Personality Disorders+") OR (MH "Adjustment Disorders+") OR (MH "Mental Disorders") OR (MH "Mental Disorders, Chronic") OR (MH "Mental Disorders Diagnosed in Childhood") OR (MH "Neurotic Disorders+")
4. (MH "Depression") OR (MH "Anxiety+")
5. TI ((Delusion* or hallucinat* or schizophren* or “psychosis” or “schizoaffective” or “psychotic” or “paranoid”)) OR AB ((Delusion* or hallucinat* or schizophren* or “psychosis” or “schizoaffective” or “psychotic” or “paranoid”))
6. TI (("Mood disorder*" or "mood disturbance*" or "affective disorder*" or "affective disturbance*" or "affective ill*" or cyclothymi* or depression or depressive or neurotic or neurosis or "adjustment disorder*" or "anxiety disorder*" or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somati#ation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia* or "affective symptoms" or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*)) OR AB (("Mood disorder*" or "mood disturbance*" or "affective disorder*" or "affective disturbance*" or "affective ill*" or cyclothymi* or depression or depressive or neurotic or neurosis or "adjustment disorder*" or "anxiety disorder*" or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somati#ation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia* or "affective symptoms" or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*))
7. (TI (((mental or psychiatri* or psycholog*) N3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*))) OR AB (((mental or psychiatri* or psycholog*) N3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)))
8. MASC OR (TI "MASC") OR (AB "MASC") OR (MH "MASC)
9. S2 OR S8
10. movie for the assessment of social cognition OR (MH "movie for the assessment of social cognition") OR (AB "movie for the assessment of social cognition") OR (TI "movie for the assessment of social cognition") OR (MH "MASC") OR (AB "MASC") OR (TI "MASC")
11. MASC OR (TI "MASC") OR (AB "MASC") OR (MH "MASC")
12. S2 OR S11
13. S2 OR S11
14. S1 OR S3 OR S4 OR S5 OR S6 OR S7
15. S1 OR S3 OR S4 OR S5 OR S6 OR S7
16. S13 AND S15
17. S13 AND S15
18. S13 AND S15

ASSIA

((((Mental Health) OR (mental illness AND mental disorders) OR ((mental OR psychiatri* OR psycholog*) adj3 (illness* OR health disorder* OR disorder* OR problem* OR health* OR well* OR difficult* OR issue* OR symptom*)) OR ((mental OR psychiatri* OR psycholog*) AND (illness* OR health disorder* OR disorder* OR problem* OR health* OR well* OR difficult* OR issue* OR symptom*)) OR (Mood disorder* OR mood disturbance* OR affective disorder* OR affective disturbance* OR affective ill* OR cyclothymi* OR depression OR depressive OR neurotic OR neurosis OR adjustment disorder* OR anxiety disorder* OR anxious OR EDNOS OR health anxiety OR agoraphobia OR obsess* OR compulsi* OR panic OR phobi* OR ptsd OR posttrauma* OR post trauma* OR somatoform OR somatiSation OR medical* unexplained OR body dysmorphi* OR conversion disorder OR hypochondria* OR trichotillomania OR anhedonia* OR affective symptoms OR mania* OR dysthymia* OR dysthymic disorder* OR disordered personalit* OR personality difficult*) OR (Mental disorders OR anxiety disorders OR mood disorders OR obsessive-compulsive disorder OR panic disorder OR phobic disorders OR phobia, social OR "bipolar and related disorders" OR bipolar disorder OR dissociative disorders OR depressive disorder, major OR depressive disorder, treatment-resistant OR seasonal affective disorder OR cyclothymic disorder OR neurotic, disorders OR personality disorders OR psychotic disorders OR psychoses OR schizophrenia OR somatoform disorders OR "trauma and stressor related disorders" OR adjustment disorders OR stress disorders, traumatic) OR (Delusion* OR hallucinat* OR schizophren* OR "psychosis" OR "schizoaffective" OR "psychotic" OR "paranoid")) OR ((MAINSUBJECT.EXACT("Psychiatric symptoms") OR MAINSUBJECT.EXACT("Psychological disorders") OR MAINSUBJECT.EXACT("Psychological problems") OR MAINSUBJECT.EXACT("Mental health") OR MAINSUBJECT.EXACT("Mental illness")) OR (psychiatr* illness) OR (psycholog* illness))) OR (Attention Deficit Disorder with Hyperactivity OR Neurodevelopmental Disorder OR Autism Spectrum Disorders OR neurodevelopmental disorder OR Developmental Disabilities OR Attention Deficit Disorder OR intellectual disorders OR neurodevelopmental disorder OR intellectual disability OR developmental disorder)) AND ("movie for the assessment of social cognition" OR "MASC")

EMCARE

Emcare 1995 to present

1. MASC.mp.
2. movie for the assessment of social cognition.mp.
3. movie for the assessment of social cognition.af,ab,kf,kw,ti,tw.
4. MASC.af,ab,kf,kw,ti,tw.
5. 1 or 2 or 3 or 4
6. mental health.af,ab,kf,kw,ti,tw.
7. mental disorders.af,ab,kf,kw,ti,tw.
8. mental health.mp. or mental health/
9. mental disorders.mp. or mental disease/
10. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word]
11. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).af,ab,kf,kw,ti,tw.
12. Mental disorders/ or exp affective disorders/ or exp anxiety disorders/ or exp bipolar disorder/ or exp borderline states/ or exp chronic mental illness/ or exp dissociative disorders/ or exp mental disorders due to general medical conditions/ or exp neurosis/ or exp personality disorders/ or exp psychosis/ or exp serious mental

illness/ or exp somatoform disorders/ or exp "stress and trauma related disorders"/ or exp thought disturbances/
13. exp depression/ or anxiety.mp.
14. (Delusion* or hallucinat* or schizophren* or psychosis or schizoaffective or psychotic or paranoid).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word]

15. (Delusion* or hallucinat* or schizophren* or psychosis or schizoaffective or psychotic or paranoid).af,ab,kf,kw,ti,tw.
16. autism spectrum disorder.mp. or autism/
17. exp Attention Deficit Disorder with Hyperactivity/ or exp Neurodevelopmental Disorders/ or neurodevelopmental disorder.mp. or exp Developmental Disabilities/ or exp Attention Deficit Disorder/
18. intellectual disability.mp. or intellectual impairment/
19. intellectual disability.af,ab,kf,kw,ti,tw.
20. developmental disorder.af,ab,kf,kw,ti,tw.
21. neurodevelopmental disorder.af,ab,kf,kw,ti,tw.
22. exp neurodevelopmental disorder/
23. exp intellectual disability/
24. exp developmental disorder/
25. exp mental health/
26. exp mental disorder/
27. 6 or 7 or 8 or 9 or 10 or 11
28. 5 and 27
29. (Mood disorder* or mood disturbance* or affective disorder* or affective disturbance* or affective ill* or cyclothymi* or depression or depressive or neurotic or neurosis or adjustment disorder* or anxiety disorder* or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somatisation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia* or affective symptoms or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*).af,ab,kf,kw,ti,tw.
30. 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 29
31. 5 and 30
32. limit 31 to yr="2006 -Current"

PSYCHinfo

APA PsycInfo <1806 to August Week 4 2022>

1. "movie for the assessment of social cognition".mp.
2. MASC.mp.
3. 1 or 2
4. mental health.mp. or exp Mental Health/
5. mental disorders.mp. or exp Mental Disorders/
6. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]
7. 4 or 5 or 6
8. 3 and 7
9. exp Mentalization/ or mentalising.mp.
10. theory of mind.mp. or exp "Theory of Mind"/

11. social cognition.mp. or exp Social Cognition/
12. reflective function.mp.
13. 9 or 10 or 11 or 12
14. 8 and 13
15. movie for the assessment of social cognition.mp.
16. movie for the assessment of social cognition.ab,id,ti,tw.
17. movie for the assessment of social cognition.af,ab,id,ti,tw.
18. MASC.af,ab,id,ti,tw.
19. movie for the assessment of social cognition.mp.
20. MASC.mp.
21. 17 or 18 or 19 or 20
22. mental health.af,ab,id,ti,tw.
23. mental disorders.af,ab,id,ti,tw.
24. mental health.mp. or exp Mental Health/
25. mental disorders.mp. or exp Mental Disorders/
26. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).af,ab,id,ti,tw.
27. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word] 547045
28. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).af,ab,id,ti,tw.
29. Mental disorders/ or exp affective disorders/ or exp anxiety disorders/ or exp bipolar disorder/ or exp borderline states/ or exp chronic mental illness/ or exp dissociative disorders/ or exp mental disorders due to general medical conditions/ or exp neurosis/ or exp personality disorders/ or exp psychosis/ or exp serious mental illness/ or exp somatoform disorders/ or exp "stress and trauma related disorders"/ or exp thought disturbances/
30. exp depression/ or anxiety.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]
31. exp Psychiatric Patients/
32. (Delusion* or hallucinat* or schizophren* or psychosis or schizoaffective or psychotic or paranoid).ti,ab,hw,id.
33. (Mood disorder* or mood disturbance* or affective disorder* or affective disturbance* or affective ill* or cyclothymi* or depression or depressive or neurotic or neurosis or adjustment disorder* or anxiety disorder* or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somati#ation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia* or affective symptoms or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*).ti,ab,hw,id.
34. exp Attention Deficit Disorder with Hyperactivity/ or exp Neurodevelopmental Disorders/ or exp Autism Spectrum Disorders/ or neurodevelopmental disorder.mp. or exp Developmental Disabilities/ or exp Attention Deficit Disorder/
35. exp Intellectual Development Disorder/ or intellectual disorders.mp.
36. neurodevelopmental disorder.af,ab,id,ti,tw.
37. intellectual disability.af,ab,id,ti,tw.
38. developmental disorder.af,ab,id,ti,tw.
39. 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38
40. 21 and 39
41. limit 40 to yr="2006 -Current"

EMBASE

1. MASC.af,ab,kf,kw,ti,tw.
2. movie for the assessment of social cognition.af,ab,kf,kw,ti,tw.
3. movie for the assessment of social cognition.mp.
4. MASC.mp.
5. 1 or 2 or 3 or 4
6. mental health.af,ab,kf,kw,ti,tw.
7. mental disorders.af,ab,kf,kw,ti,tw.
8. "mental disorder*".af,ab,kf,kw,ti,tw.
9. mental health.mp. or mental health/
10. mental disorder.mp. or mental disease/
11. Mental Disorders.mp. or mental disease/
12. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).af,ab,kf,kw,ti,tw.
13. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]
14. Mental disorders/ or exp affective disorders/ or exp anxiety disorders/ or exp bipolar disorder/ or exp borderline states/ or exp chronic mental illness/ or exp dissociative disorders/ or exp mental disorders due to general medical conditions/ or exp neurosis/ or exp personality disorders/ or exp psychosis/ or exp serious mental illness/ or exp somatoform disorders/ or exp "stress and trauma related disorders"/ or exp thought disturbances/
15. Mental disorders/ or exp affective disorders/ or exp anxiety disorders/ or exp bipolar disorder/ or exp borderline states/ or exp chronic mental illness/ or exp dissociative disorders/ or exp mental disorders due to general medical conditions/ or exp neurosis/ or exp personality disorders/ or exp psychosis/ or exp serious mental illness/ or exp somatoform disorders/ or exp "stress and trauma related disorders"/ or exp thought disturbances/
16. exp depression/ or anxiety.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word] 819098
17. exp depression/ or anxiety/
18. Psychiatric Patients/
19. (Delusion* or hallucinat* or schizophren* or psychosis or schizoaffective or psychotic or paranoid).af,ab,kf,kw,ti,tw.
20. (Mood disorder* or mood disturbance* or affective disorder* or affective disturbance* or affective ill* or cyclothymi* or depression or depressive or neurotic or neurosis or adjustment disorder* or anxiety disorder* or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somati#ation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia* or affective symptoms or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*).af,ab,kf,kw,ti,tw.
21. (Mood disorder* or mood disturbance* or affective disorder* or affective disturbance* or affective ill* or cyclothymi* or depression or depressive or neurotic or neurosis or adjustment disorder* or anxiety disorder* or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somati#ation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia* or affective symptoms or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*).mp. [mp=title, abstract, heading word, drug trade

name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]
22. autism spectrum disorder.mp. or autism/
23. exp Attention Deficit Disorder with Hyperactivity/ or exp Neurodevelopmental Disorders/ or neurodevelopmental disorder.mp. or exp Developmental Disabilities/ or exp Attention Deficit Disorder/
24. intellectual disability.mp. or intellectual impairment/
25. intellectual disability.af,ab,kf,kw,ti,tw.
26. neurodevelopmental disorder.af,ab,kf,kw,ti,tw.
27. developmental disorder.af,ab,kf,kw,ti,tw.
28. 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27
29. 5 and 28
30. limit 55 to yr="2006 -Current"

MEDLINE

1. MASC.af,ab,hw,kf,ti,tw.
2. movie for the assessment of social cognition.af,ab,kf,ti,tw.
3. movie for the assessment of social cognition.mp.
4. MASC.mp.
5. 1 or 2 or 3 or 4
6. mental health.af,ab,kf,ti,tw.
7. mental disorders.af,ab,kf,ti,tw.
8. mental health.mp. or Mental Health/
9. mental disorder.mp. or Mental Disorders/
10. Mental Disorders/ or mental disorder*.mp.
11. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).af,ab,kf,ti,tw.
12. ((mental or psychiatri* or psycholog*) adj3 (illness* or health disorder* or disorder* or problem* or health* or well* or difficult* or issue* or symptom*)).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
13. Mental disorders/ or exp affective disorders/ or exp anxiety disorders/ or exp bipolar disorder/ or exp borderline states/ or exp chronic mental illness/ or exp dissociative disorders/ or exp mental disorders due to general medical conditions/ or exp neurosis/ or exp personality disorders/ or exp psychosis/ or exp serious mental illness/ or exp somatoform disorders/ or exp "stress and trauma related disorders"/ or exp thought disturbances/
14. exp depression/ or anxiety.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
15. exp depression/ or anxiety/
16. Psychiatric Patients/
17. (Delusion* or hallucinat* or schizophren* or psychosis or schizoaffective or psychotic or paranoid).af,ab,kf,ti,tw.
18. (Mood disorder* or mood disturbance* or affective disorder* or affective disturbance* or affective ill* or cyclothymi* or depression or depressive or neurotic or neurosis or adjustment disorder* or anxiety disorder* or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somati#ation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia*

or affective symptoms or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*).af,ab,kf,ti,tw.

19. (Mood disorder* or mood disturbance* or affective disorder* or affective disturbance* or affective ill* or cyclothymi* or depression or depressive or neurotic or neurosis or adjustment disorder* or anxiety disorder* or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somati#ation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia* or affective symptoms or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
20. (Mood disorder* or mood disturbance* or affective disorder* or affective disturbance* or affective ill* or cyclothymi* or depression or depressive or neurotic or neurosis or adjustment disorder* or anxiety disorder* or anxious or EDNOS or health anxiety or agoraphobia or obsess* or compulsi* or panic or phobi* or ptsd or posttrauma* or post trauma* or somatoform or somati#ation or medical* unexplained or body dysmorphi* or conversion disorder or hypochondria* or trichotillomania or anhedonia* or affective symptoms or mania* or dysthymia* or dysthymic disorder* or disordered personalit* or personality difficult*).af,ab,kf,ti,tw.
21. exp Attention Deficit Disorder with Hyperactivity/ or exp Neurodevelopmental Disorders/ or exp Autism Spectrum Disorders/ or neurodevelopmental disorder.mp. or exp Developmental Disabilities/ or exp Attention Deficit Disorder/
22. exp Intellectual Development Disorder/ or intellectual disorders.mp.
23. exp Intellectual Development Disorder/ or intellectual disorders.mp.
24. neurodevelopmental disorder.af,ab,kf,ti,tw.
25. intellectual disability.af,ab,kf,ti,tw.
26. developmental disorder.af,ab,kf,ti,tw.
27. 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26
28. 5 and 27
29. limit 81 to yr="2006 -Current"

Appendix 2

JBI Checklist of Analytical Cross-Sectional Studies

Reviewer_____
Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

_____
_____
_____
_____

Appendix 3

Summary of Main MASC Outcomes

Study	Year	Age Group	Diagnosis	MH group*	n		Total correct		Non-mentalizing		Hypomentalizing		Hypermentalizing	
					CG	HC	CG m(sd)	HC m(sd)	CG m(sd)	HC m(sd)	CG m(sd)	HC m(sd)	CG m(sd)	HC m(sd)
Abdel-Hamid et al.	2019	Adult	ADHD	Neurodevelopmental disorders	30	30	32.2 (5.18)	34.43 (4.25)	2.67 (1.9)	1.77 (1.38)	4.17 (2.74)	4.07 (2.36)	5.97 (3.78)	4.53 (2.42)
Aidelbaum & Goghari	2022	Adult	BPAD	Mood and anxiety disorders	26	25	35.13 (2.66)	33.28 (4.87)	1.72 (1.4)	1 (1.68)	3.52 (1.94)	4.54 (3.09)	5.12 (2.33)	5.04 (2.17)
Andrade-Gonzalez et al.	2021	Adult	SCZ	Schizophrenia and other psychotic disorders	53	42	21.5 (6.9)	31.2 (6.3)	6.1 (3.9)	2.2 (2.2)	10.2(4.6)	4.7(2.5)	7.2 (3.9)	6.9 (3.1)
Andreou et al.	2015	Adult	BPD	Personality disorders	44	19	-	-	1.89 (2)	1.05 (1)	3.79 (2.2)	2.97 (1.9)	5.88 (3.6)	4.1 (2.2)
Andreou et al.	2015	Adult	SCZ	Schizophrenia and other psychotic disorders	36	19	-	-	3.69 (2.8)	1.05 (1)	5.97 (3.3)	2.97 (1.9)	5.66 (3.8)	4.1 (2.2)
Bast et al.	2019	Adolescent	ASD	Neurodevelopmental disorders	23	24	23.9 (7.2)	28.7 (6.8)	-	-	-	-	-	-
Buhlmann et al.	2015	Adult	BDD	Other	35	11.67	34.23 (4.12)	36.74 (2.68)	-	-	-	-	-	-
Buhlmann et al.	2015	Adult	Social Anxiety	Mood and anxiety disorders	35	11.67	32.57 (4.88)	36.74 (2.68)	-	-	-	-	-	-
Buhlmann et al.	2015	Adult	OCD	Other	35	11.67	36.31 (3.45)	36.74 (2.68)	-	-	-	-	-	-
Catalan et al.	2018	Adult	First-episode Psychosis	Schizophrenia and other psychotic disorders	32	32	-	-	3.9 (2.5)	1.7 (1.8)	7.7 (5.1)	4.2 (2.2)	7.6 (2.8)	5.9 (3.2)

Corsi et al.	2021	Adult	Eating Disorder	Other	78	66	31.63 (6.15)	35.41 (2.91)	-	-	-	-	-	-
Cortes-Garcia et al.	2021	Adolescent	Eating Disorder	Other	128	184	32.46 (4.91)	33.11 (4.02)	-	-	-	-	-	-
Dziobek et al.	2006	Adult	Asperger Syndrome	Neurodevelopmental disorders	19	20	24.4 (5.9)	34.8 (3.9)	-	-	-	-	-	-
Duque-Alarcon et al.	2019	Adult	BPD	Personality disorders	18	15	30 (5.3)	31.03 (2.5)	3.28 (2.19)	3.53 (3.1)	5.83 (4.2)	6.13 (2.7)	6 (2.8)	5.27 (2.6)
Eidenmueller et al.	2021	Adult	Opioid Dependent with comorbidity	Other	66	66	27.29 (5.21)	33.64 (3.65)	-	-	-	-	-	-
Engelstad et al.	2019	Adult	SCZ/ Schizoaffective disorder (homicide offenders)	Schizophrenia and other psychotic disorders	26	35.5	20.58 (8.79)	35.14 (4.05)	6.15 (3.97)	1.59 (1.4)	11.85 (5.47)	3.85 (1.99)	5.85 (3.02)	4.39 (2.81)
Engelstad et al.	2019	Adult	SCZ / Schizoaffective Disorder (no history of violence)	Schizophrenia and other psychotic disorders	28	35.5	27.64 (7.63)	35.14 (4.05)	5.36 (6.3)	1.59 (1.4)	7.21 (4.22)	3.85 (1.99)	5.86 (2.56)	4.39 (2.81)
Fossati et al.	2018	Adult	PD	Personality disorders	59	193	28.53 (4.48)	26.59 (5.33)	3.22 (2.03)	3.76 (2.67)	5.89 (3.41)	5.4 (2.84)	-	-
Lahera et al.	2014	Adult/ Adolescent	Asperger Syndrome	Neurodevelopmental disorders	22	25	25.55 (7.3)	33.56 (4.3)	4.1 (3.5)	1.7 (1.5)	7.5 (4.4)	3.4 (1.8)	8.8 (3.5)	6.3 (3.1)
Martinez et al.	2017	Adult	ASD	Neurodevelopmental disorders	19	10	24.2 (6.6)	33.1 (2.9)	3.2 (2.7)	1.3 (1.3)	9.3 (4.4)	6.2 (2.2)	8.2 (3.6)	4.4 (2.2)
Martinez et al.	2017	Adult	SCZ	Schizophrenia and other psychotic disorders	36	10	28.1 (4)	33.1 (2.9)	2.7 (2.3)	1.3 (1.3)	7.7 (3.7)	6.2 (2.2)	6.6 (2.7)	4.4 (2.2)
Montag et al.	2010	Adult	BPAD	Mood and anxiety disorders	29	29	30.7 (5.4)	34.6 (3.7)	-	-	-	-	-	-

Montag et al.	2011	Adult	Paranoid SCZ	Schizophrenia and other psychotic disorders	80	80	25 (7.9)	34.1 (3.7)	4.9 (3.5)	1.8 (1.4)	9.1 (5.1)	4.5 (2.5)	6.1 (3.7)	4.6 (2.2)
Muller et al.	2016	Adolescent	ASD	Neurodevelopmental disorders	33	23	26.3 (7.3)	32(5)	-	-	-	-	-	-
Newbury-Helps et al.	2017	Adult	ASPD (offenders)	Personality disorders	54	42	61.3 (1.8)	69 (2)	8.7 (0.7)	5.8 (0.9)	14.7 (1)	9.9 (1.1)	15.3 (1.1)	15.3 (1.2)
Normann-Eide et al.	2020	Adult	BPD	Personality disorders	53	71	34.6 (4.2)	35.1 (4.1)	1.4 (1.5)	1.6 (1.4)	3.3 (2.1)	3.9 (2)	5.8 (3.4)	4.4 (2.8)
Oakley et al.	2016	Adult	ASD	Neurodevelopmental disorders	19	24	31.22 (4.6)	35.7 (3.31)	-	-	-	-	-	-
Penner et al.	2020	Adolescent	BPD	Personality disorders	139	134	31.42 (5.27)	20.98 (2.5)	-	-	-	-	-	-
Porter-Vignola et al.	2022	Adolescent	Depression	Mood and anxiety disorders	43	40	29.64 (4.23)	30.93 (3.8)	2.03 (1.9)	1.77 (1.46)	5.48 (2.38)	5.65 (2.3)	7.51 (3.45)	6.63 (3.14)
Preisler et al.	2010	Adult	BPD	Personality disorders	64	38	29.9 (7.8)	35.6 (3.9)	-	-	-	-	-	-
Quek et al.	2018	Adolescent	BPD	Personality disorders	26	25	31.77 (4.72)	35.67 (3.58)	1.23 (1.11)	1.44 (1.71)	2.65 (1.26)	2.64 (2)	8.92 (3.95)	5.2 (3.2)
Ritter et al.	2011	Adult	NPD (total)	Personality disorders	47	17.67	30.77 (4.94)	33.34 (5.26)	-	-	-	-	-	-
Ritter et al.	2011	Adult	NPD (without BPD)	Personality disorders	22	17.67	31.09 (5.1)	33.34 (5.26)	-	-	-	-	-	-
Ritter et al.	2011	Adult	BPD (without NPD)	Personality disorders	27	17.67	29.78 (8.19)	33.34 (5.26)	-	-	-	-	-	-
Sahl et al.	2022	Adult	High IQ SCZ or schizoaffective disorder	Schizophrenia and other psychotic disorders	17	35.5	31.4 (6.1)	35.1 (4.1)	3.5 (2.4)	1.6 (1.4)	6.8 (3.6)	3.8 (2)	3.4 (2.5)	4.4 (2.80)

Sahl et al.	2022	Adult	Low IQ SCZ or schizoaffective disorder	Schizophrenia and other psychotic disorders	31	35.5	25.9 (7.5)	35.1 (4.1)	4.6 (3)	1.6 (1.4)	8 (4)	3.8 (2)	6.6 (3.8)	4.4 (2.8)
Santos et al.	2017	Adult	BPAD (euthymic)	Mood and anxiety disorders	31	31	25.93 (5.9)	32.12 (4.2)	4.41 (3.3)	1.93 (1.5)	6.87 (3.1)	5.2 (2.7)	7.25 (3.8)	5.7 (2.5)
Schonenberg et al.	2014	Adult	Persistent Somatoform Pain Disorder	Other	19	19	29.53 (7.28)	34.58 (4)	-	-	-	-	-	-
Seitz et al.	2022	Adult	PTSD	Mood and anxiety disorders	33	11.67	33.42 (4.85)	36.74 (3.15)	-	-	-	-	-	-
Seitz et al.	2022	Adult	MDD	Mood and anxiety disorders	33	11.67	36.15 (3.59)	36.74 (3.15)	-	-	-	-	-	-
Seitz et al.	2022	Adult	Somatic Symptom Disorder	Other	36	11.67	35.64 (3.59)	36.74 (3.15)	-	-	-	-	-	-
Somma et al.	2019	Adolescent	BPD	Personality disorders	20	373	24.8 (4.99)	28.08 (4.47)	2.95 (2.52)	3.02 (2.27)	4.15 (2.11)	3.94 (2.26)	13.1 (4.27)	10.01 (3.19)
Vaskinn et al.	2015	Adult	BPD	Personality disorders	25	12.5	34.7 (4.5)	36 (3.6)	1.4 (1.5)	1.3 (1.4)	3.1 (2.1)	3.8 (1.8)	5.8 (3.5)	4 (2.2)
Vaskinn et al.	2015	Adult	SCZ	Schizophrenia and other psychotic disorders	25	12.5	29.2 (6.4)	36 (3.6)	3.7 (2.5)	1.3 (1.4)	6.3 (3.3)	3.8 (1.8)	5.7 (4.1)	4 (2.2)
Vaskinn et al.	2021	Adult	SCZ	Schizophrenia and other psychotic disorders	68	70	29.2 (7)	35.2 (4.1)	3.7 (2.4)	1.5 (1.4)	6.6 (3.2)	3.9 (2)	5.5 (3.9)	4.4 (2.8)
Vaskinn et al.	2018	Adult	SCZ or schizoaffective disorder	Schizophrenia and other psychotic disorders	91	71	29.4 (6.9)	35.1 (4.1)	3.7 (2.5)	1.6 (1.4)	6.6 (3.5)	3.9 (2)	5.2 (3.6)	4.4 (2.8)

Washburn et al.	2016	Adult/ Adolescent	MDD (lifetime)	Mood and anxiety disorders	40	14.33	77.94 (8.29)	77 (7.61)	2.67 (2.48)	2.53 (2.81)	6.61 (3.81)	6.51 (4.15)	11.94 (6.89)	13.49 (5.73)
Washburn et al.	2016	Adult/ Adolescent	Social Anxiety	Mood and anxiety disorders	12	14.33	74.07 (8.17)	77 (7.61)	2.22 (2.32)	2.53 (2.81)	5.93 (3.83)	6.51 (4.15)	17.22 (6.22)	13.49 (5.73)
Washburn et al.	2016	Adult/ Adolescent	Comorbid Social anxiety and MDD	Mood and anxiety disorders	24	14.33	74.17 (8.74)	77 (7.61)	3.24 (2.78)	2.53 (2.81)	6.94 (4.11)	6.51 (4.15)	15 (4.83)	13.49 (5.73)
Wastler & Lenzenweger	2021	Ad Adult/ Adolescent	Schizotypy	Schizophrenia and other psychotic disorders	40	23	34.575 (5.434)	36.13 (3.284)	-	-	-	-	-	-
Wastler & Lenzenweger	2021	Adult/ Adolescent	Negative affect	Mood and anxiety disorders	30	23	35.567 (3.674)	36.13 (3.284)	-	-	-	-	-	-
Wolkenstein et al.	2011	Adult	MDD	Mood and anxiety disorders	24	20	32.87 (4.84)	35.9 (4.47)	2.38 (1.93)	1.4 (1.14)	4.88 (2.07)	3.55 (2.01)	4.87 (3.85)	4.15 (2.74)

*Category created based on DSM 5 diagnostic categories

PD: personality disorder; SCZ: Schizophrenia; MDD: Major depressive disorder; BDD: Body dysmorphic disorder; BPAD: bipolar affective disorder; ASD: Autism spectrum disorder; ADHD; attention deficit hyperactivity disorder; OCD: obsessive compulsive disorder; NPD: narcissistic personality disorder; PTSD: posttraumatic stress disorder; ASPD: antisocial personality disorder; MH Group: mental health group; Edu: education

Appendix 4

Examples of MASC questions sourced from the MASC (Dziobek et al., 2006)

1) *Betty says that the recipe calls for 2 cups of cream. Michael responds to her by saying that if it were up to her, she would go for 5 cups of cream.*

   What is Betty feeling?

   (a) Hates Michael and wants him to leave. *(Hypermentalizing (exceeding ToM) error)*
   (b) Five cups of cream would be too much for the sauce. *(No mentalizing (No ToM) error)*
   (c) Offended by Michael's comment. *(Correct mentalizing)*
   (d) Astonished that Michael knows she likes cream. *(Hypomentalizing (less ToM) error)*

2) *Michael has arrived at the dinner party and given Sandra flowers. After Sandra, Michael and Chris sit down, Michael says "those flowers look great in the vase, right?"*

   Why is Michael saying this?

   (a) Because the vase is just right for the flowers. *(No mentalizing (No ToM) error)*
   (b) To expose Cliff, who did not bring anything. *(Hypermentalizing (exceeding ToM) error)*
   (c) To highlight how nice it was of him to bring the flowers. *(Correct mentalizing)*
   (d) To praise her for arranging the flowers nicely. *(Hypomentalizing (less ToM) error)*