Review Article

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Examining associations, moderators and mediators between childhood maltreatment, social functioning, and social cognition in psychotic disorders: a systematic review and meta-analysis

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Abstract

Childhood maltreatment (CM) has been related to social functioning and social cognition impairment in people with psychotic disorders (PD); however, evidence across different CM subtypes and social domains remains less clear. We conducted a systematic review and meta-analysis to quantify associations between CM, overall and its different subtypes (physical/emotional/sexual abuse, physical/emotional neglect), and domains of social functioning and social cognition in adults with PD. We also examined moderators and mediators of these associations. A PRISMA-compliant systematic search was performed on 24 November 2022 (PROSPERO CRD42020175244). Fifty-three studies ($N = 13\,635$ individuals with PD) were included in qualitative synthesis, of which 51 studies ($N = 13\,260$) with 125 effects sizes were pooled in meta-analyses. We found that CM was negatively associated with global social functioning and interpersonal relations, and positively associated with aggressive behaviour, but unrelated to independent living or occupational functioning. There was no meta-analytic evidence of associations between CM and social cognition. Meta-regression analyses did not identify any consistent moderation pattern. Narrative synthesis identified sex and timing of CM as potential moderators, and depressive symptoms and maladaptive personality traits as possible mediators between CM and social outcomes. Associations were of small magnitude and limited number of studies assessing CM subtypes and social cognition are available. Nevertheless, adults with PD are at risk of social functioning problems after CM exposure, an effect observed across multiple CM subtypes, social domains, diagnoses and illness stages. Maltreated adults with PD may thus benefit from trauma-related and psychosocial interventions targeting social relationships and functioning.

Introduction

Psychotic disorders (PD), comprising schizophrenia spectrum and affective psychoses, are among the leading causes of disability (Navarro-Mateu et al., 2017) and a public health concern worldwide (Anderson, 2019). Impairments of both social functioning (i.e. the ability to fulfil expected roles at work, social activities, and social relations with partners and family) (Long, Stansfeld, Davies, Crellin, & Moncrieff, 2022) and social cognition (i.e. the ability to decode the intentions and behaviours of others) (Green, 2016) are core features of PD and are thought to underlie severe functional disabilities (de Winter et al., 2021; Vita et al., 2022). About two-thirds of individuals with PD are unable to fulfil basic social roles as spouse, parent, or worker. Possibly related to a lack of early interventions (Birchwood, McGorry, & Jackson, 1997; McGorry, 2015), these social problems can remain remarkably stable in the years after the first episode of psychosis (FEP) (Velthorst et al., 2017), also when psychotic symptoms are in remission (Bellack et al., 2007). Accordingly, identifying factors that

potentially hinder social functions is a major aim in recovery-oriented treatment and research (Albert, Uddin, & Nordentoft, 2018; Javed & Charles, 2018; Yamada et al., 2019).

Childhood maltreatment (CM), i.e. physical, emotional or sexual abuse, as well as physical and/or emotional neglect, including witnessing domestic violence and bullying occurring before age 18 years (Teicher & Samson, 2013), is one of the most serious environmental risk factors for the development of physical or mental illness (Gilbert et al., 2009; Hughes et al., 2017), including PD (Morgan & Fisher, 2007; Varese et al., 2012). Prevalence can vary across populations, but some reports show rates as high as 85% in schizophrenia spectrum disorders and 77% in affective psychoses (Larsson et al., 2013). At least one subtype of CM is reported by around half of individuals with FEP (Vila-Badia et al., 2022), and schizophrenia (Morgan & Fisher, 2007).

CM is thought to play a key role in the aetiology and course of PD (Varese et al., 2012). CM is further related to neurobiological and clinical characteristics (McCrory, De Brito, & Viding, 2011; Teicher & Samson, 2013) that may lead to difficulties of individuals with PD to engage with and navigate the social world (McCrory, Foulkes, & Viding, 2022). At a neurobiological level, the diathesis-stress or vulnerability-stress model (Read, Fosse, Moskowitz, & Perry, 2014; van Winkel, Stefanis, & Myin-Germeys, 2008; Vargas, Conley, & Mittal, 2020) posits that experiencing highly stressful or traumatic events, such as CM, may impact on later expression of PD by increasing stress sensitivity to later adversity (Lardinois, Lataster, Mengelers, Van Os, & Myin-Germeys, 2011; Lataster, Myin-Germeys, Lieb, Wittchen, & van Os, 2012). It may further have long-lasting effects on the neurobiological processes required to manage the multifaceted roles that are undertaken as part of daily functioning. CM constitutes a stressor that can occur at sensitive periods of development (Schaefer, Cheng, & Dunn, 2022), affecting the regular functioning of brain areas involved in the response to stress (e.g. the hypothalamic–pituitary–adrenal axis) (Teicher, Samson, Anderson, & Ohashi, 2016). These brain alterations may lead to impaired emotion regulation skills and maladaptive coping strategies (Lincoln, Marin, & Jaya, 2017), which in turn can lead to poor social functioning in those with PD, as manifested in various areas of their daily life such as occupational functioning (Hjelseng et al., 2020; Stain et al., 2014) and interpersonal relations (Rodriguez et al., 2021), including a reduction in the quality and quantity of relationships (McCrory, Ogle, Gerin, & Viding, 2019; McCrory et al., 2022). Neurobiological alterations might also contribute to social cognition difficulties (Aas et al., 2014; Rokita, Dauvermann, & Donohoe, 2018). For instance, CM has been associated with altered (facial) emotion recognition and processing (Pfaltz et al., 2019; Rokita et al., 2020) and poorer or altered understanding of people's beliefs (theory of mind) (Dorn et al., 2021; Pang et al., 2022), all of which might contribute to diminished social involvement in those with PD.

Moreover, a heightened emotional reactivity to daily stressors seems robustly related to the severity of psychotic experiences and negative affect (Paetzold et al., 2021; Reininghaus et al., 2016; van Nierop et al., 2018). CM relates to depressive symptoms and suicide attempts, and the occurrence, severity and persistence of both hallucinations and delusions, as well as negative symptoms (Alameda et al., 2021). All these domains of symptoms might be related to diminished social involvement in individuals with PD during early (Stain et al., 2014) and active illness phases, as well as during remission (Hjelseng et al., 2020; Pruessner et al., 2021). In fact, differential effects of CM on clinical outcome may not be apparent at PD onset, but only become evident through poor symptomatic remission and global social functioning over time (Aas et al., 2016; Pruessner et al., 2021).

Despite the well-established link between CM and PD (Schäfer & Fisher, 2011; Stanton, Denietolis, Goodwin, & Dvir, 2020) across specific subtypes of CM (Ajnakina et al., 2018) and symptoms dimensions (Alameda et al., 2021), and increasing recognition that social functions are closely related to adverse experiences in childhood in adults with PD (Turner et al., 2020), meta-analytic research assessing the magnitude and consistency of associations between different subtypes of CM and domains of social functioning and social cognition in PD is lacking. Lately, the research about PD and CM has generated wide interest in researchers. One prior meta-analysis has quantitatively examined associations between broadly defined and specific types of childhood adversities and functional outcomes in PD. This study found small negative associations of CM with global social functioning and no association with occupational functioning. This study, however, focused on global aspects of functional outcomes, as well as on the social and occupational domains independently (Christy et al., 2022). Furthermore, the nature of the association between overall, broadly defined CM, and specific subtypes, across global and specific domains of social functioning and social cognition has not been appraised. Examination of whether there are differences between diagnoses (non-affective *v.* affective psychoses) in how CM relates to social outcomes in different illness stages (FEP *v.* chronic PD) (Breitborde, Srihari, & Woods, 2009) is also warranted, given fundamental differences in how these disorders present (Chen, Liu, Liu, Zhang, & Wu, 2021; de Winter et al., 2021; Torrent et al., 2018).

Moreover, some factors are thought to moderate between CM and social outcomes (e.g. age at the time of exposure) (Alameda et al., 2015, 2016) in PD. In addition, knowledge on possible mediators (depressive symptoms) (Alameda et al., 2020) of proposed association between CM and both impairments in social functioning and social cognition could help to understand underlying mechanisms to design interventions that might be more effective for those with PD and CM. To date the possible mediators and moderators in the association between CM and social functioning and social cognition in PD have never been reviewed and synthesised. The respective synthesis would improve our understanding of whether CM relates to social functioning and social cognition and might provide targets to develop preventive strategies and effective interventions to improve social outcomes in people with PD and CM histories.

Therefore, the first aim of our systematic review and meta-analysis was to provide an estimate on the magnitude and consistency of associations between CM (overall and its subtypes) and global and different domains of social functioning and social cognition in adults with PD. The second aim was to examine and narratively summarise moderators and mediators of these associations. We hypothesised that CM would be related to poorer social functioning and social cognition in individuals with PD.

Methods

This Study protocol was registered on PROSPERO (CRD42020 175244) and published elsewhere before completion of the study (Fares-Otero, Pfaltz, Rodriguez-Jimenez, Schäfer, & Trautmann, 2021). This review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guideline (Page et al., 2021) (see ST1 and ST2 in the

supplement), the Meta-analysis of Observational Studies in Epidemiology (MOOSE) (Stroup et al., 2000) (see ST3 in the supplement), and the Enhancing the Quality and Transparency of Health Research (EQUATOR) (Altman, Simera, Hoey, Moher, & Schulz, 2008) reporting guidelines. For a comprehensive glossary of terms used in this work, see SA1 in the supplement.

Search strategy and selection criteria

A systematic literature search using multiple Medical Subject Headings and keywords related to: (1) 'psychosis'; (2) 'childhood maltreatment'; (3) 'social functioning' OR 'social cognition' using the Boolean operator 'AND' (see the search strategy and terms appended in SA2 in the supplement) was conducted in PubMed (Medline), PsycINFO, Embase, Web of Science (Core Collection), and PILOTS, initially searched for inception from 1990 until 25 June 2021, and updated twice, on 4 March 2022, and on 24 November 2022. The following filters were used: human samples, written in English, German, and Spanish, and removal of duplicates. To identify additional eligible articles, the reference lists of the included articles and relevant studies already included in the previously identified meta-analysis (Christy et al., 2022) were cross referenced manually.

Titles and abstracts of articles were independently screened by three reviewers (NEF-O, L-MN, SW) (89.15% agreement); discrepancies were resolved through discussion with an independent reviewer (ST). After excluding irrelevant articles, full-texts were independently assessed for eligibility by three reviewers (NEF-O, L-MN, SW) (88.90% agreement); full-text discrepancies were screened by an independent reviewer (ST) and resolved through consensus. The software Zotero was used to manage citations and remove duplicates. The software Rayyan QCRI (https://rayyan.qcri.org/) was used to manage citations, remove duplicates, and screening in the search updates. Because of high agreement during first screening, NEF-O independently conducted the search updates; discrepancies were resolved through discussion with an independent reviewer (ST).

Inclusion and exclusion criteria

According to the **PICO** framework, studies were included if they: (1) **(P)** were conducted in individuals with PD spectrum, including non-affective PD (schizophrenia, schizophreniform disorder) and affective PD (bipolar disorder, major depression with psychotic features) based on ICD (World Health Organization, 1993) and DSM (DSM-5 Diagnostic Classification, 2013) criteria (see manual codes of PD diagnoses in ST4 in the supplement); (2) **(I)** assessed the presence of CM defined as physical/emotional/sexual abuse and/or physical/emotional neglect, including domestic violence and bullying, occurring before age 18 (Teicher & Samson, 2013) and measured as overall (total) or specific CM subtypes (3) **(C)** compared individuals with and without CM within the same sample population of individuals with PD; (4) **(O)** evaluated social functioning or social cognition with validated instruments (see details in section 2.3); (5) quantitatively examined and reported associations between CM (exposure variable) and social functioning or social cognition (outcome variable) or data that allowed correlations to be calculated, or provided these data on request (see the definition and operationalisation of exposure and outcome variables in SA3 in the supplement); (6) were original research articles published in a peer-reviewed journal.

Studies were excluded if they: (1) were reviews, clinical case studies, abstracts, conference proceedings, study protocols, letters to the editor not reporting original data, theoretical pieces, or grey literature; (2) only recruited children or adolescents; (3) only investigated animals; (4) involved interventions and/or assessed treatment outcomes not providing baseline data.

Study outcomes

After study selection, we categorised the study outcomes into six separate domains of social functioning and four separate domains of social cognition. The selection of outcome domains was based on outcomes examined in the included studies, and categorisations used in previous meta-analyses in the field (Christy et al., 2022; de Winter et al., 2021; Fares-Otero et al., 2023).

Social functioning

(1) **Global social functioning**: overall functioning in a social setting or role in any social domain (Aas et al., 2016; de Winter et al., 2021); (2) **Independent living**: independent functioning (Monfort-Escrig & Pena-Garijo, 2021), autonomy, and financial management (Shah et al., 2014); (3) **Occupational functioning**: vocational functioning, involvement into (competitive) employment/work (Lindgren et al., 2017); (4) **Interpersonal relations**: social relationships and community functioning; (5) **Aggressive behaviour**: social violent behaviour, including hostility and criminality (Bosqui et al., 2014); and (6) **Psychosocial problems:** Axis IV psychosocial and environmental problems (Ramsay, Flanagan, Gantt, Broussard, & Compton, 2011).

Social cognition

(1) **Theory of mind**: ability to reason about mental states and understand intentions, dispositions, emotions, and beliefs of both oneself and others or mentalising (Brüne, 2005; Kincaid et al., 2018); (2) **Emotion processing:** ability to manage emotions, and to identify, recognise, understand (facial) emotions of others (Aas et al., 2017); (3) **Attributional style/bias**: the way in which individuals infer the causes of particular social events (Chalker et al., 2022; Kim et al., 2019); and (4) **Empathy:** ability to comprehend and share the emotions of others (Bonfils, Lysaker, Minor, & Salyers, 2017).

Appendix SA3 in the supplement provides a complete definition and operationalisation of each outcome domain, and ST5 provides a complete overview of assessments of each outcome domain.

Data extraction and quality assessment

Data from eligible studies were extracted and tracked in Microsoft Excel by three independent reviewers (NEF-O, L-MN, SW) using a structured coding form; discrepancies were resolved through consensus with an additional reviewer (ST) to ensure high quality of data extraction.

Descriptive variables extracted included first author and publication year, country/region, sample size, mean age (with standard deviation), percentage of males in the sample, study design, type of diagnosis in the sample, type and instrument for diagnosis (and criteria), duration (in years) of the illness, CM instrument used and type of CM exposure reported (overall CM and/or subtypes), social functioning or social cognition instrument/measure, results on the association between CM and social functioning or social cognition (including p value, effect size and descriptive

summary), confounders, moderators, and mediators investigated in the included studies (if reported).

Correlation coefficients (*r*) and 95% confidence intervals (CI) were extracted as measures of effect size. If not reported, information was transformed from available statistics (e.g. mean and standard deviations between groups comparisons, unstandardised regression coefficients, and standardised *β* coefficients, and odds ratios), as per procedures used in previous meta-analyses (Alameda et al., 2021; Christy et al., 2022; Fares-Otero et al., 2023), using established formulas (Practical Meta-Analysis, 2022). Corresponding authors were contacted by email to retrieve additional information if necessary. Studies that reported either an overall (total) continuous score of CM, or binary category (high/low exposure), and/or a score for the CM subtypes (subscales) were included into one or more of the meta-analyses conducted. In the case where no overall CM effect was reported, only the effects of specific subtypes of CM were extracted to be included in meta-analyses. For longitudinal studies, data indicating associations at baseline were extracted (see a detailed description of the extracted variables in SA4 in the supplement).

The quality and risk of bias assessment was independently assessed by two independent reviewers (NEF-O, ST) using an adapted version of the Newcastle Ottawa Scale (NOS) (Wells et al., 2014) for non-randomised (cross-sectional and longitudinal) studies which contains additional items to assess sample size, confounders, and statistical tests, recommended by Cochrane Handbook (Higgins et al., 2011) (see SA5, ST5 and ST6 in the supplement).

Statistical analysis

All quantitative analyses were performed using Comprehensive Meta-Analysis v4.0 (CMA, version 4 -meta-analysis.com) (Borenstein, 2022a). A PRISMA-compliant systematic review (Page et al., 2021) and random-effect meta-analyses (Borenstein, Hedges, Higgins, & Rothstein, 2011) were conducted applying the DerSimonian-Laird estimator (Higgins et al., 2022), when a minimum of five studies were available (Jackson & Turner, 2017). If the number of available effect sizes did not allow random effects meta-analysis, study findings were summarised and appraised qualitatively.

We conducted separate meta-analyses with random-effect estimates to quantify associations between each CM subtype or overall CM and social functioning (global, independent living, occupational functioning, interpersonal relations, aggressive behaviour) or social cognition (theory of mind and emotion processing) domain. For studies conducting separate analyses for men and women (Penney, Pruessner, Malla, Joober, & Lepage, 2022), physical and verbal aggression (Spidel, Lecomte, Greaves, Sahlstrom, & Yuille, 2010), independence competence and performance (Monfort-Escrig & Pena-Garijo, 2021), and disorganised attachment styles (Aydin et al., 2016; Hodann-Caudevilla, García, & Julián, 2021), results were pooled using correction estimates (Olkin & Pratt, 1958) before inclusion to meta-analyses.

For those studies not reporting correlation coefficients, the 'Practical Meta-Analysis Effect Size Calculator' (Practical Meta-Analysis, 2022) was used to convert the reported statistics. Pearson correlation coefficients (effect sizes) were Fisher's *Z* transformed and back transformed after pooling. Thus, all pooled effects are reported as correlation coefficients. A small number of effects (1.9%) were reported as null findings without sufficient information to calculate effect sizes. These effects were not excluded to avoid upward bias of effect estimation. Instead, they were set to zero, resulting in rather conservative pooled effect size estimations (Albajes-Eizagirre, Solanes, & Radua, 2019).

Analyses for heterogeneity were performed using Cochran's *Q*-test and I^2 statistics with significant heterogeneity being indicated by $I^2 \geqslant 50\%$ (Higgins, Thompson, Deeks, & Altman, 2003) [25, 50, and 75% defining thresholds for low, moderate, and high heterogeneity (Higgins et al., 2022)]. Alongside the 95% CI and the mean pooled effect provided, the prediction intervals, to estimate to which extent effect sizes vary across studies (Borenstein, 2022b), were displayed as part of the forest plots (marked in red).

The forest plots were explored, and one-study-removed sensitivity analyses were conducted to determine whether a particular study or a set of studies were contributing to the potential heterogeneity (Borenstein, 2022a).

To further examine potential factors explaining heterogeneity, a series of random-effect meta-regressions (López-López, Van den Noortgate, Tanner-Smith, Wilson, & Lipsey, 2017) were conducted on pre-selected variables: mean sample age, percentage of male individuals, non-affective *v.* affective psychosis samples, FEP (illness duration <2 years) *v.* chronic PD samples, diagnostic instrument (structured interview *v.* clinical judgment), use of Childhood Trauma Questionnaire (CTQ) *v.* any other instrument to assess CM, use of self-report *v.* clinician judgment to assess social functioning, use of behavioural data *v.* any other instrument to assess social cognition, and study quality (NOS rating) as per procedures used in previous meta-analyses (Christy et al., 2022; de Winter et al., 2021; Fares-Otero et al., 2023). Because of the limited number of included studies in some analyses (*n* < 10) (Borenstein, 2022a; Higgins & Thompson, 2004), meta-regression analyses should be considered exploratory. Other evidence of confounders (section 3.2., Table 1) and effect moderators and mediators examined in the included studies (section 3.7. Fig. 3) on associations between CM and social outcomes was narratively synthesised (Popay et al., 2006).

To examine publication bias, funnel plots were visually inspected, investigating possible outliers or studies going in the opposite direction of all the others, and the intercept Egger's test was used to numerically explore the risk of publication bias (namely Egger's test *p* value <0.05) (Higgins et al., 2011; Lin & Chu, 2018). Where indications for publication biases were found, corrected effect sizes using the Duval and Tweedie's trim-and-fill method were additionally reported to correct for significant publication bias (Duval & Tweedie, 2000).

Statistical significance was evaluated two-sided at the 5% threshold (two tailed). Interpretation of correlations coefficients was based on predefined cut-offs as follows: *r* values between 0 and 0.3 indicate small, values between 0.3 and 0.7 indicate moderate, and values above 0.7 indicate strong associations (Ratner, 2009).

Results

Study inclusion and characteristics

Of 5350 eligible studies, 283 were full text screened, and 53 were included in the qualitative synthesis, of which 51 studies were included in the quantitative synthesis, contributing to 125 effect sizes pooled in meta-analyses (see the process of study selection in detail in Fig. 1, the full list of included studies in SA6, and excluded studies with reasons in SA7 in the supplement).

Table 1. Sociodemographic and clinical characteristics of included studies

Country/Region	Study ID	Total n (PD)	Diagnosis % or n (if reported)	Mean age (SD)	% Male	Instrument and criteria used for PD diagnosis	Instrument to assess CM	Type of CM	Instrument to assess social functioning or social cognition	Study outcome (social functioning or social cognition domains)	Confounders	NOS score (Max=8)
Norway/Europe	Aas et al. (2016)	96	40 SCZ spectrum: 30 SCZ, 3 schizophreniform, 7 schizoaffective, 17 other PD, 39 psychotic affective disorder	27.4 (8.3)	56.3	SCID-I based on DSM-IV	CTQ	Overall CM, PA, SA, EA, EN, PN	GAF-F	Global social functioning	Gender, premorbid social and academic functioning	7
Norway/Europe	Aas et al. (2017)	101	35 SCZ spectrum: 26 SCZ, 5 schizophreniform, 4 schizoaffective, 15 other PD, 51 psychotic affective disorder	31.3 (10.1)	55.5	SCID-I based on DSM-IV	CTQ	Overall CM	Face Emotion Paradigm	Emotion processing	Age, sex, type of PD diagnosis	5
Turkey/Europe-Asia	Akbey et al. (2019)	100	SCZ	38.7 (10.5)	69	SCID-I based on DSM-IV	CTQ	Overall CM, PA, EA, SA, PN, EN	GAF SANS	Functioning Interpersonal Relations		4
France/Europe	Andrianarisoa et al. (2017)	544	SCZ	32.3 (9.8)	74.1	SCID-I based on DSM-IV-TR	CTQ	Overall CM	SQoL 18	Interpersonal relations Independent living	Gender, socio-demographics	7
Turkey/Europe-Asia	Aydin et al. (2016)	35	SCZ	29.9 (7.4)	62.9	IPII based on DSM-IV-TR	CTQ	EA, PA, PN, EN, SA	MAS-A ECR-R	ToM Interpersonal relations		4
Ireland/Europe	Bosqui et al. (2014)	41	30 SCZ, 3 schizoaffective, 3 psychotic depression, 5 psychotic episode NS	40.8 (12.5)	85.4	Clinical diagnosis based on DSM-IV	CTQ	Overall CM, EA, PA, SA, EN, PN	HCR-20	Aggressive behaviour		7
Netherlands/Europe	Boyette et al. (2014)	195	74.15% SCZ, 1.65% schizophreniform, 11.8% schizoaffective, 0.6% delusional, 11.8% PD NS	30.3 (7.1)	81.3	CASH based on DSM-IV	CTQ-SF	Overall CM	WHOQOL-BREF SFS	Global social functioning Interpersonal relations Independent living Occupational functioning		5
Spain/Europe	Brañas et al. (2022)	62	NA (early psychosis, duration of illness <5 years)	31.2 (8.0)	47.5	Clinical rating based on DSM-IV-TR	Semi-structured interview	Physical or emotional abuse, SA	DFAR Hinting Task	Emotion processing ToM	Sex	5
USA/North America	Chalker et al. (2022)	96	17 BD with psychotic features (16.7%), 37 SCZ (38.5%), 41 schizoaffective (42.7%), 2 MDD with psychotic features (2.1%)	43.9 (11.2)	44.8	SCID-5	CTQ	EA, PA, SA, EN, PN	INQ AIHQ-blame	Interpersonal relations Attributional style/bias	Age, current depression, severity of psychotic symptoms	6

(Continued)

Table 1. (Continued.)

Country/ Region	Study ID	Total n (PD)	Diagnosis % or n (if reported)	Mean age (SD)	% Male	Instrument and criteria used for PD diagnosis	Instrument to assess CM	Type of CM	Instrument to assess social functioning or social cognition	Study outcome (social functioning or social cognition domains)	Confounders	NOS score (Max=8)
Korea/Asia	Cui et al. (2019)	314	64.3% SCZ, 15.6% schizophreniform, 2.9% schizoaffective, 13.4% other SCZ spectrum and PD, 1.3% delusional, 2.5% brief PD	27.5 (7.2)	43	MINI based on DSM-5	ETISR-SF	Overall CM	BES	Empathy		5
Poland/ Europe	Engelstad et al. (2019)	54	SCZ and schizoaffective	37.5 (8.7)	92.5	Clinical diagnosis based on ICD-10	CTQ	PA, SA EA, EN, PN	Gunn-Robertson Violence scale	Aggressive behaviour		4
Netherlands and Belgium/ Europe	Faay et al. (2020)	1119	84% SCZ and related disorders, 13% other PD, 1% organic	27.6 (8.0)	76.1	Clinical diagnosis based on DSM-IV	CTQ-SF	Overall CM	PANSS-single Question CANSAS – Safety to Others	Aggressive behaviour		5
Spain/ Europe	Garcia et al. (2016)	79	NA – FEP	25.6 (5.2)	60.7	OPCRIT based on DSM-IV	CTQ	Overall CM, EA, SA, PA, EN, PN	GAF MSCEIT-ME (MCCB)	Global social functioning Emotion processing	Sex	5
Brazil/South America	Gil et al. (2009)	99	SCZ	38.4 (10.0)	77	OPCRIT based on DSM-IV and ICD-10	CTQ	EA, SA, PA, EN, PN	WHO/DAS	Global social functioning		4
Norway/ Denmark	Haahr et al. (2018)	191	NA – FEP	27.9 (9.9)	60	SCID-I based on DSM-IV	BBTS	Overall CM	GAF-F Strauss-Carpenter scale	Global social functioning Occupational functioning Independent living Interpersonal relations		5
Australia/ Oceania	Hachtel et al. (2020)	69	FEP	21.6 (2.8)	100	Clinical diagnosis based on ICD-10	CTQ	PA, SA, EN, PN, EA	LHA-A	Aggressive behaviour	Duration of untreated illness	6
Norway/ Europe	Hjelseng et al. (2020)	348	190 SCZ, 28 schizophreniform, 50 schizoaffective, 80 other PD	28.7 (9.4)	59.5	SCID based on DSM-IV	CTQ	Overall CM	SFS	Global social functioning	Sex	6
Spain/ Europe	Hodann-Caudevilla et al. (2021)	109	SCZ spectrum: 68% paranoid SCZ, 27% residual, 10% schizoaffective, 4% delusional	47.6 (9.7)	93.6	NA	ExpTra-S	Overall CM	PAM ISMI SF-36	Interpersonal relations Global social functioning	Cognitive functioning	5
South Africa/ Africa	Kilian et al. (2018)	56	Non-affective FEP	23.8 (6.2)	75	SCID based on DSM-IV	CTQ-SF	Abuse, Neglect	MSCEIT-ME (MCCB)	Emotion processing	Education	5

Korea/Asia	Kim et al. (2019)	27	SCZ	42.5 (12.6)	40.7	SCID based on DSM-IV	CTQ	EA, PA, SA, EN, PN	QSF SAT-MC BES	Global social functioning Attributional style/bias Empathy	Gender, age, duration of illness, antipsychotic medication	5
Northern Ireland/ Europe	Kincaid et al. (2018)	66	SCZ	45 (11.4)	79	Research interview based on DSM-IV	TEC	Overall CM, EN, EA, PA, SA	Hinting Task	ToM		5
Canada/ North America	Lecomte et al. (2020)	418	SCZ 41%, schizoaffective 19%, other PD 27%, mood disorder with psychotic features 4%, substance induced PD 9%	38.9 (13.9)	546	Clinical diagnosis based on ICD-10	CEVQ	Overall CM	WHO/DAS	Global social functioning		5
Beijing, China/Asia	Li et al. (2015)	182	SCZ	42.2 (14.3)	62.6	Clinical diagnosis based on DSM-IV	CTQ-SF	Overall CM, PA, SA, EA, EN, PN	Clinical research form	Aggressive behaviour	Parents education level, residence (city v. rural area), family income socioeconomic status, illness onset, parental mental illness	8
Finland/ Europe	Lindgren et al. (2017)	75	FEP – SCZ spectrum	26.4 (6)	65.3	SCID based on DSM-IV	Finnish population-based survey	Overall CM	SOFAS GAF	Occupational functioning Global social functioning		6
Spain/ Europe	Lopez-Mongay et al. (2021)	50	SCZ, and schizoaffective	40.2 (9.7)	50.1	Clinical diagnosis based on DSM-5	CTQ-SF	SA	QoL scale	Global social functioning Interpersonal relations Occupational functioning	Gender, personality traits	5
USA/North America	Lysaker et al. (2001)	54	66.66% SCZ, 33.33% schizoaffective	44.0 (9.3)	96.3	SCID-I based on DSM-IV	CSTQ	SA	QoL scale	Interpersonal relations Occupational functioning		4
USA/North America	Lysaker et al. (2002)	36	22 SCZ (61.1%), 14 schizoaffective (38.9%)	46.0 (10)	100	SCID-I based on DSM-IV	CAQ	PA	BDHI	Aggressive behaviour	Severity of positive symptoms and hospitalisation history	4
USA/North America	Lysaker et al. (2011)	101	67 SCZ, 34 schizoaffective	46.3 (9.7)	85.2	SCID-I based on DSM-IV	TAA-R	SA	BLERT	Emotion processing	Education	4
Netherlands/ Europe	Mansueto et al. (2019)	757	Non-affective PD	27.66 (7.6)	75	Clinical Diagnosis based on DSM-IV	CTQ-SF	SA, Sum of sexual, emotional, and physical abuse	Hinting Task	ToM	Cannabis use, duration of the illness	7
Spain/ Europe	Monfort-Escrig & Pena-Garijo (2021)	43	24 (55,8%) SCZ, 5 (11,6%) schizoaffective, 14 (32,6%) PD NS	36.3 (9.3)	76.7	Clinical Diagnosis based on DSM-5	CAMIR	Overall CM	Spanish short version SFS-R Status Educational Level Unemployment	Interpersonal relations Independent living Global social functioning	Gender, attachment dimensions	5

(Continued)

Table 1. (*Continued.*)

Country/Region	Study ID	Total n (PD)	Diagnosis % or n (if reported)	Mean age (SD)	% Male	Instrument and criteria used for PD diagnosis	Instrument to assess CM	Type of CM	Instrument to assess social functioning or social cognition	Study outcome (social functioning or social cognition domains)	Confounders	NOS score (Max=8)
UK/Europe	Oakley et al. (2016)	54	SCZ	36 (NA)	100	SCID-I based on DSM-IV	CECA-Q	PA, SA, Separation from parents, Domestic violence	Gunn – Robert – Violence scale	Aggressive behaviour	Lifetime substance use disorders, psychopathy	5
Spain/Europe	Ortega et al. (2020)	81	NA – FEP	23.6 (4.9)	72.9	SCAN based on DSM-IV	CTQ	Overall CM	SASS	Interpersonal relations Occupational functioning		4
Spain/Europe	Pena-Garijo & Monfort-Escrig (2021)	25	18 FEP (72%)	29.6 (10.3)	68	Clinical Diagnosis based on DSM-5	CAMIR	Overall CM	Hinting Task PERE	ToM Emotion processing		4
Canada/North America	Penney et al. (2022)	83	FEP	24.5 (5.2)	62.7	Clinical rating	CTQ	Overall CM	GAF SOFAS SECT	Global social functioning Occupational functioning Emotion processing	Age at psychosis onset	6
Australia/Oceania	Quide et al. (2018)	79	50 SCZ, 29 schizoaffective	42.5 (11.1)	57	OPCRIT Diagnosis based on DSM-IV	CTQ-SF	Overall CM	FEEST	Emotion processing	Sex	5
Australia/Oceania	Quide et al. (2017)	47	29 SCZ, 18 schizoaffective	38.8 (10.6)	63.8	OPCRIT Diagnosis based on DSM-IV	CTQ-SF	Overall CM	Visual Cartoon ToM Task	ToM		4
USA/North America	Ramsay et al. (2011)	61	FEP: 20 SCZ paranoid, 9 schizophreniform, 9 PD NS, 7 SCZ (undifferentiated type), 7 schizoaffective (depressive type), 3 schizoaffective (bipolar type), 2 SCZ, disorganised type, 2 brief PD, 2 delusional	NA (NA)	72.1	SCID-I based on DSM-IV	CTQ-SF TEC Parental harsh discipline score Violence exposure 12-18 years scale of seven questions	Overall CM, EA, PA, SA, EN, PN Parental harsh discipline	Axis IV problems	Psychosocial problems		5
Ireland/Europe	Rokita et al. (2021)	74	51 SCZ, 23 schizoaffective	44.6 (10.8)	67.6	SCID-I based on DSM-IV	CTQ-SF	Overall CM, PN	RMET ERT	ToM Emotion processing	Parental styles	5

USA/North America	Rosenberg et al. (2007)	596	399 SCZ, 170 schizoaffective	42 (9)	64.8	SCID based on DSM-IV	SA exposure questionnaire Violence subscale of the Conflict Tactics scales Single questions	Overall CM, SA	GAS Homelessness in the past 6 months Work functioning (in the past year) Criminal justice Involvement	Global social functioning Independent living Occupational functioning Aggressive behaviour	Gender, ethnicity	7
Germany/ Europe	Schalinski et al. (2018)	168	76.2% SCZ, 10.7% schizoaffective, 13.1% acute polymorphic PD	27.9 (8.4)	66.7	Clinical diagnosis based on ICD-10	MACE	Overall CM	MSCEIT-ME (MCCB)	Emotion processing	Gender, Education years	6
Australia/ Oceania	Shah et al. (2014)	1825	68.1% Non-affective psychosis, 21.9% affective psychosis	38.4 (11.2)	59.6	A computer algorithm provides diagnostic classification in accordance to ICD-10 and DSM-IV and other criteria on the basis of the DIP scores	Face-to-face interview	SA, PA, EA, EN, PN	Multi- dimensional scale of independent functioning Occupational functioning Dysfunction in socialising (past year), weekly or daily contact with family and friends Has ever had a confiding relationship	Global social functioning Independent living Occupational functioning Interpersonal relations	Sex, socio-economic status	6
Northern Ireland/ Europe	Spence et al. (2006)	40	57% SCZ	42.6 (12.6)	62.5	Clinical diagnosis based on DSM-IV criteria	THQ	Overall CM	Recreation Occupational Inter-communication Independent performance/ competence	Global social functioning Occupational functioning Interpersonal relations Independent living		4
Canada/ North America	Spidel et al. (2010)	118	56% SCZ, 22% schizoaffective, 11% BD, 10% psychosis NS	25.1 (6.8)	64.1	Clinical Diagnosis based on DSM-III-R and ICD-10	CTQ	Overall CM	MOAS	Aggressive behaviour		4
USA/North America	Swanson et al. (2006)	1410	SCZ	40.5 (NA)	74.3	SCID-I based on DSM-IV	SCID: childhood adversity and conduct problems	PA, SA	MacArthur Community violence interview	Aggressive behaviour		6
Australia/ Oceania	Sweeney et al. (2015)	391	PD (NA type)	38.4 (10.5)	58.3	A computer algorithm provides diagnostic classification in accordance to ICD-10 and DSM-IV and other criteria on the basis of the DIP scores	SHIP interview for childhood adversity	PA, SA, EA, EN, PN	SHIP interview	Occupational functioning	Sex	6
Denmark/ Europe	Trauelsen et al. (2016)	101	FEP 91% SCZ, 3% schizophrenia, 4% schizoaffective, 5% NS	26.5 (NA)	74	OPCRIT clinical diagnosis based on ICD-10	CTQ	Overall CM	GAF Occupational status Living status	Global social functioning Occupational functioning Independent living		5

Table 1. (*Continued.*)

Country/ Region	Study ID	Total n (PD)	Diagnosis % or n (if reported)	Mean age (SD)	% Male	Instrument and criteria used for PD diagnosis	Instrument to assess CM	Type of CM	Instrument to assess social functioning or social cognition	Study outcome (social functioning or social cognition domains)	Confounders	NOS score (Max=8)
Denmark/ Europe	Trauelsen et al. (2019)	92	90.2% FEP SCZ, 3.3% SCZ, 4.3% schizoaffective, 5.4% NS	22.4 (NA)	72.8	OPCRIT clinical diagnosis based on ICD-10	CTQ	PA, SA, EA, EN, PN	MAS-A	ToM	Gender, first-degree relative mental illness	7
England/ Europe	Trotta et al. (2016)	285	F20–29, F30–33 SCZ spectrum and affective psychosis	28.9 (9.3)	60.4	Clinical diagnosis based on ICD-10	CECA-Q	Overall CM, SA, PA	GAF- F	Global social functioning		4
Australia/ Oceania	Turner et al. (2019)	1825	47% SCZ, 16% schizoaffective, 18% bipolar, 9% depression, 5% delusional disorder, 4% depressive psychosis, 1% screened positive for psychosis	NA (NA)	60	Clinical diagnosis based on ICD-10	Self-developed interview	Overall CM	PSPS Opiate Treatment Index: Criminality Homelessness and Mental Health Survey	Global social functioning Aggressive behaviour Independent living	Born in Australia (yes, no), school-level qualification, family mental illness, and socioeconomic status of the participant, residence	8
Netherlands/ Europe	van Nierop et al. (2016)	105 427	Non-affective PD	NA (NA)	NA	Clinical diagnosis based on DSM-IV	CTQ	Overall CM	Free question Unemployment	Occupational functioning	Gender	6
Norway/ Europe	Vaskinn et al. (2021)	68	54 SCZ, 14 schizoaffective	29.4 (8.1)	63.2	SCID-I based on DSM-IV	CTQ	Overall CM, SA, PN, PA, EA, EN	MASC	ToM	IQ	5
Spain/ Europe	Vila-Badia et al. (2022)	75	FEP	24.9 (7.9)	69.3	Clinical rating	CTQ	EA, PA, SA EN, PN	PSPS	Global social functioning		6
Netherlands/ Europe	Weijers et al. (2018)	87	63,2% SCZ, 16.1% PD NS, 13.8% schizoaffective disorder, 4.6% brief PD, 2.3% delusional	31.7 (8.2)	64.4	Assessment of history and symptoms interview based on DSM-IV	CECA-Q	Overall CM	Hinting Task SFS	ToM Global social functioning		4

AoM, Awareness of the Mind of the Other; BBTS, The Brief Betrayal Trauma Survey; BD, Bipolar Disorder; BDHI, Buss-Durkee Hostility Inventory; BES, The Basic Empathy Scale; BLERT, Bell Lysaker Emotional Recognition Task; CAMIR-R, from French; *Cartes-Modeles Individuels de Relations* (Short form); CAQ, Childhood Abuse Questionnaire; CASH, The Comprehensive Assessment of Symptoms and History; CECA-Q, Childhood Experiences of Care and Abuse Questionnaire; CEVQ, Childhood Experiences of Violence Questionnaire; CSTQ, Childhood Sexual Trauma Questionnaire; CT, Childhood Trauma; CTQ (-SF), Childhood Trauma Questionnaire (-Short Form); DFAR, The degraded facial affect recognition task; DIP, Diagnostic Interview for Psychosis; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders; DV, Domestic Violence; EA, Emotional Abuse; ECR-R, Experience in Close Relationships Revised; EN, Emotional Neglect; ERT, Emotion Recognition Task; ETISR-SF, The Early Trauma Inventory Self Report-Short Form; ExpTra-S, Screening of Early Traumatic Experiences in Patients with Severe Mental Illness; FAST, Functioning Assessment Short Test; FEEST, Facial Expressions of Emotion Stimuli and Tests; FEP, First Episode Psychosis; GAF (-F), Global Assessment of functioning (Function subscale); GAS, Global Assessment Scale; HCR-20, The Historical Clinical Risk Management-20; ICD-10, International Statistical Classification of Diseases and Related Health Problems 10th revision; INQ, Interpersonal Needs Questionnaire; IPII, The Indiana Psychiatric Illness Interview; ISMI, Internalised Stigma – Social Withdrawal; IQ, Intelligence quotient; LHA-A, Lifetime History of Aggression Scale-Aggression Subscale; MACE, Maltreatment and Abuse Chronology of Exposure Scale; MAS-A, Metacognition Assessment Scale-Abbreviated; MASC, Movie for the Assessment of Social Cognition; MCCB, MATRICS Consensus Cognitive Battery; MDD, Major Depressive Disorder; MINI, Mini International Neuropsychiatric Interview; MOAS, Modified Overt Aggression Scale; MSCEIT, Mayer Salovery Caruso Emotional Intelligence Test; NS, Not specified, OPCRIT, Operational Criteria Checklist for Psychotic Illness and Affective Illness (v.4.0.: checklist to generate DSM-IV diagnoses for PD); PA, Psychical Abuse; PAM, Psychosis Attachment Measure; PD, Psychotic Disorder; PERE, from Spanish; *Prueba de Reconocimiento de Emociones* or Emotion recognition Task; PN, Physical Neglect; PSPS, Personal and Social Performance Scale; PsyQol, Psychological Quality of Life; QoL, Quality of Life; QSF, Questionnaire of Social Functioning; RMET, Reading the Mind in the Eyes Task; SA, Sexual Abuse; SASS, Social Adaptation Task-Multiple Choice; SANS, Scale for Assessment of Negative Symptoms; SAT-MC, Social Attribution Task-Multiple Choice; SCAN, Schedules for Clinical Assessment in Neuropsychiatry; SCID-I, Structured Clinical Interview for DSM Disorders – Axis I; SECT, Social Emotional Cognition Task; SFS, Social Functioning Scale; SCZ, Schizophrenia; SF-36, Short Form-36 Health-related QoL-Psychological Subscore; SOFAS, Social and Occupational Functioning; SQoL, Social Quality of Life; TAA, Trauma Assessment for Adults; TASIT, The Awareness of Social Inference Test; TEC, Traumatic Experience Checklist; ToM, Theory of Mind; WHOQOL_BREF, World Health Organization Quality of Life.
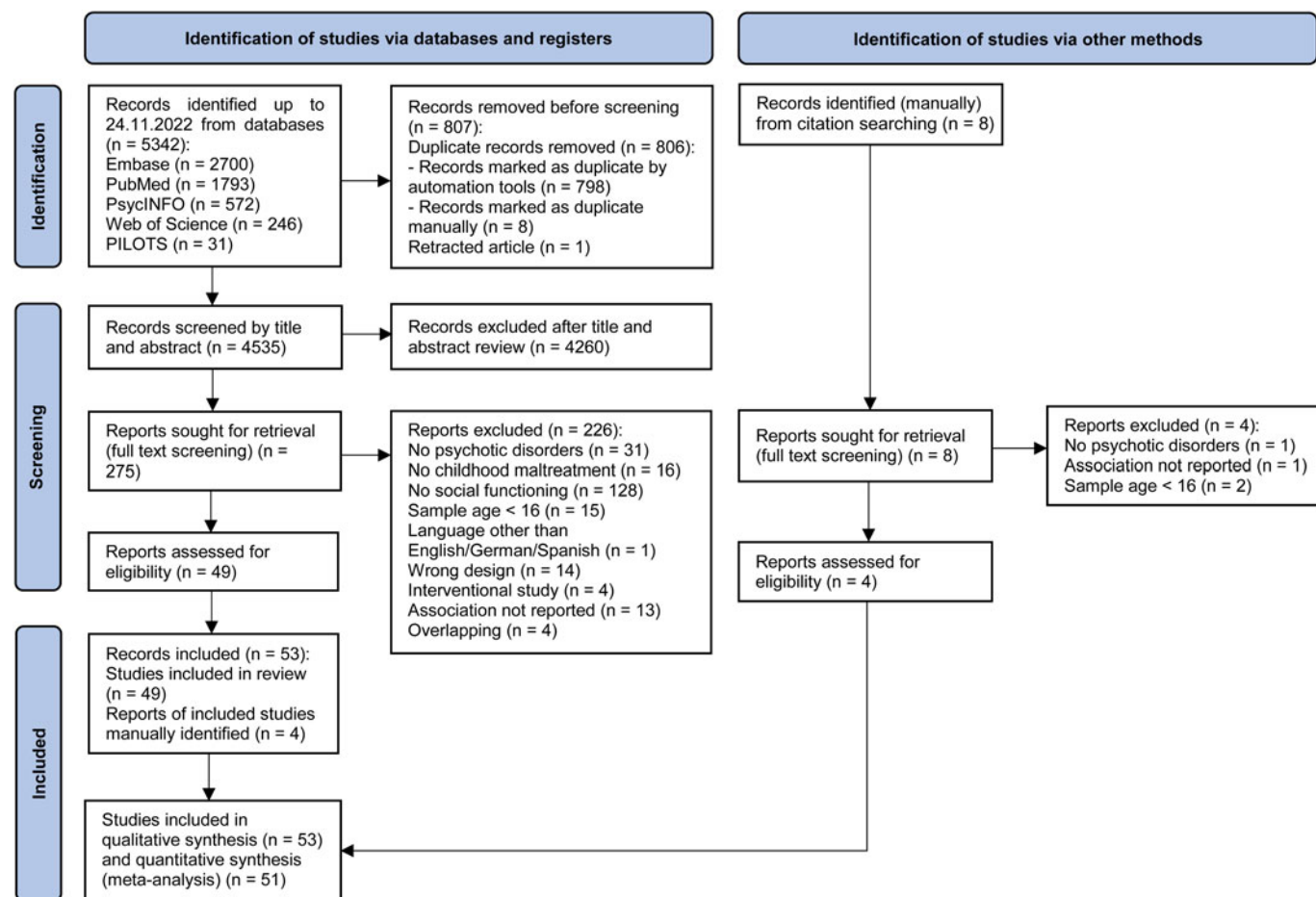
Figure 1. PRISMA 2020 flowchart outlining the study selection process.

The total sample of the included studies compromised 13 635 individuals with PD (sample size range 25–1825), of which 9429 (69.2%) were male. The mean age was 33.9 (s.d. = 7.7; range = 22–48) years. Of the 53 included studies, 14 (26.4%) studies included samples with non-affective PD, and 10 (19.2%) studies included samples with FEP.

Sample sizes of the 51 included studies included in the meta-analyses ranged from 25 to 1825, comprising a total of 13 260 individuals with PD, of which 9236 (69.7%) were male. The mean age was 34.02 (s.d. = 7.44; range = 22–48) years. Fourteen (27.5%) of the samples of the 51 included studies fulfilled criteria for non-affective PD, and 9 (18%) studies included samples with FEP.

A structured clinical interview was used in 32 (60.4%) of the included studies for the assessment of PD. The SCID-Structured Clinical Interview for DSM (First & Gibbon, 2004) was the most frequently used diagnostic instrument. It was used in 17 (32.7%) studies, followed by the OPCRIT electronic system (Rucker et al., 2011) in 5 (9.4%) studies. Ten (18.9%) studies used an unstructured clinical interview based on DSM, while five (9.4%) studies used ICD criteria, and six (11.3%) studies used a clinical judgment (non-specified criteria).

Fifty (94.3%) of the 53 included studies were cross-sectional. The CTQ, including shortened (Bernstein et al., 2003) or translated versions, was the most used instrument to measure CM in 31 (58.5%) studies, and the Childhood Experience of Care and

Abuse Questionnaire (CECA.Q) (Bifulco, Bernazzani, Moran, & Jacobs, 2005) was used in three (5.7%) studies. Four (7.6%) studies reported CM results from a clinical interview.

Overall CM was the most frequently assessed variable, being examined in 34 (62.75%) of the included studies, while 28 (52.8%) studies examined only CM subtypes, and eight (15.1%) studies examined both overall CM and all subtypes. Twenty-five (47.2%) studies examined physical abuse, 27 (50.9%) studies examined sexual abuse, 18 (34.0%) studies examined emotional abuse, 18 (34.0%) studies examined emotional neglect, and 17 (32.1%) studies examined physical neglect.

Of note, five studies investigated types of maltreatment that could not be pooled in meta-analysis ($n < 5$ and/or $k < 5$) (Jackson & Turner, 2017) such as aggregated scores for abuse and neglect (Brañas, Lahera, Barrigón, Canal-Rivero, & Ruiz-Veguilla, 2022; Kilian et al., 2018; Mansueto et al., 2019), separation from parents and domestic violence (Oakley, Harris, Fahy, Murphy, & Picchioni, 2016), and parental harsh discipline (Ramsay et al., 2011). Among these studies, a negative association between neglect (but not abuse) and emotion processing [$r = -0.45$ (CI -0.64 to -0.21), $p < 0.001$] was found in individuals with schizophrenia spectrum disorders (Kilian et al., 2018). Yet no association between abuse and theory of mind was found in individuals with non-affective PD (Mansueto et al., 2019). While others found no association between abuse and theory of mind or emotion recognition of different emotions

except for better recognition of fearful faces ($r = 0.32$ (CI 0.05–0.54)] in FEP (Brañas et al., 2022). A positive association between childhood exposure to domestic violence [$r = 0.54$ (CI 0.32 to −0.71), $p = 0.001$] and separation from parents [$r = 0.34$ (CI 0.08–0.56), $p = 0.015$] but not child abuse and propensity to violent behaviour was found in adults with schizophrenia (Oakley et al., 2016). Finally, a positive association between parental harsh discipline and psychosocial problems was found [$r = 0.28$ (CI 0.03–0.50)] in people with FEP (Ramsay et al., 2011).

Of the 53 included studies, 34 (70.8%) examined social functioning, of which 21 (61.8%) used self-report questionnaires (v. clinician judgment). Nineteen studies examined social cognition, of which ten (52.6%) used behavioural data (v. any other instrument). Across studies, five social functioning and four social cognition domains were examined, of which four domains of social functioning and two domains of social cognition had sufficient data for meta-analysis.

Of the 51 included studies in the meta-analyses, 33 (62.3%) examined social functioning. Global social functioning was most frequently examined in a total of 21 (39.6%) studies. In terms of social functioning domains, eight (15.1%) studies examined independent living, 13 (24.5%) studies examined occupational functioning, 14 (26.4%) studies examined interpersonal relations, and 11 (20.8%) studies examined aggressive behaviour. No studies examined associations between CM subtypes and independent living or occupational functioning, or interpersonal relations (except for sexual abuse) in PD. No studies examined the association between CM subtypes (except for physical and sexual abuse) and aggressive behaviour. One above-mentioned study concerning a positive association between parental harsh discipline and psychosocial problems in FEP (Ramsay et al., 2011) could not be meta-analysed.

In terms of social cognition domains, a total of 19 (34.0%) studies were examined, of which ten (18.9%) studies examined theory of mind, and 11 (20.8%) examined emotion processing. No studies examined the relationship between CM subtypes and emotion processing or (except for sexual abuse) theory of mind. Two studies concerning associations of CM with empathy (Cui et al., 2019; Kim et al., 2019), and two studies concerning associations of CM with attributional style/bias (Chalker et al., 2022; Kim et al., 2019) could not be meta-analysed. Among these studies, no association between overall CM and empathy was found in FEP (Cui et al., 2019). Although a negative association between emotional neglect and empathy (cognitive trait) [$r = −0.47$ (95% CI 0.72 to −0.11)] was found in individuals with schizophrenia, no significant correlation was observed after controlling for gender, age, duration of illness, and medication (Kim et al., 2019). Furthermore, the same study (Kim et al., 2019) found no association between CM and attributional style, while others found that only emotional abuse was associated with more negative and hostile social attributional biases in PD (Chalker et al., 2022).

Twenty-nine studies controlled for confounders in their analysis, and several adjusted for sex (Brañas et al., 2022; Quide et al., 2018; Sweeney, Air, Zannettino, & Galletly, 2015) or gender (Kim et al., 2019; Monfort-Escrig & Pena-Garijo, 2021; van Nierop et al., 2016). A wide range of confounders were considered. These included family income and socioeconomic status (Turner et al., 2020), residence (city v. rural area), parental styles (Rokita et al., 2021), attachment dimensions (Hjelseng et al., 2020), and first-degree relative mental illness (Trauelsen et al., 2019). Also, child premorbid social, cognitive (Hodann-Caudevilla et al., 2021), and academic functioning (Aas et al.,

2016), IQ (Vaskinn, Melle, Aas, & Berg, 2021), educational level (yeas of education) (Schalinski, Teicher, Carolus, & Rockstroh, 2018) as well as gender (Kim et al., 2019; Monfort-Escrig & Pena-Garijo, 2021; van Nierop et al., 2016), sex (Brañas et al., 2022; Quide et al., 2018; Sweeney et al., 2015), ethnicity (Rosenberg, Lu, Mueser, Jankowski, & Cournos, 2007), age at psychosis onset (Penney et al., 2022), duration of illness (Mansueto et al., 2019), severity of positive symptoms (Lysaker, Wright, Clements, & Plascak-Hallberg, 2002), type of PD diagnosis (Aas et al., 2017), psychopathy, lifetime substance use disorders (Oakley et al., 2016), cannabis use (Mansueto et al., 2019) and antipsychotic medication (Kim et al., 2019) were considered.

The included studies were published between 2001 and 2022 and were conducted in Europe ($n = 30$), North America ($n = 10$), Asia ($n = 3$), Australia ($n = 6$), Turkey ($n = 2$), Brazil ($n = 1$), and South Africa ($n = 1$) (see a detailed description of demographic and clinical characteristics of the included studies in Table 1).

Study quality assessment

The mean quality rating (range between 0 and 8) of the included studies was 5.28 (S.D. = 1.09), range 4–8. Overall, 14 (26.4%) studies were rated as 'poor' (NOS score = 4), 20 (37.7%) studies were rated as 'fair' (NOS score = 5), 11 (20.8%) studies were rated as 'good' (NOS score = 6), and 8 (15.1%) studies received a rating considered as 'high' (NOS score >6). Of those rated as 'high', six (11.3%) studies (Aas et al., 2016; Andrianarisoa et al., 2017; Bosqui et al., 2014; Li et al., 2015; Rosenberg et al., 2007; Turner et al., 2020) examined social functioning, and two (3.8%) studies (Mansueto et al., 2019; Trauelsen et al., 2019) examined social cognition (see further details of the study quality assessment in ST6 and ST7 in the supplement).

The representativeness of samples was mixed, and most of the included studies did not report either on non-response or a priori power analyses or otherwise justified their sample sizes. More than half of the included studies ($n = 29$) controlled for confounders in their design or analysis, and several adjusted for sex (Brañas et al., 2022; Quide et al., 2018; Sweeney et al., 2015) or gender (Kim et al., 2019; Monfort-Escrig & Pena-Garijo, 2021; van Nierop et al., 2016) (see section 3.1. and Table 1). Many studies did not fully report results from statistical tests, e.g. omitting named effect estimates, p values, or measures of precision if appropriate (such as standard errors or confidence intervals).

Meta-analyses of associations between childhood maltreatment and social functioning

Overall childhood maltreatment

Overall CM was negatively associated with global social functioning [$n = 19$, $k = 19$, $r = −0.104$ (95% CI −0.142 to −0.066), $p < 0.001$], as well as interpersonal relations [$n = 9$, $k = 9$, $r = −0.114$ (95% CI −0.180 to −0.046), $p = 001$], and positively associated with aggressive behaviour [$n = 6$, $k = 6$, $r = 0.181$ (CI 0.140–0.222), $p < 0.001$] (see Table 2 and forest plots in Fig. 2).

Childhood maltreatment subtypes

All subtypes of CM were negatively associated with global social functioning: physical abuse: [$n = 7$, $k = 7$, $r = −0.123$ (95% CI −0.216 to −0.027), $p < 0.001$]; emotional abuse: [$n = 6$, $k = 6$, $r = −0.138$ (95% CI −0.226 to −0.047), $p = 0.003$]; sexual abuse:

Table 2. Meta-analyses of associations between childhood maltreatment and social outcomes in individuals with psychotic disorders

Childhood maltreatment (CM) total/subtypes	Number of studies (n), effect sizes (k)	Pooled sample size	Correlation coefficient			Heterogeneity		Prediction intervals	Publication bias			
			r	95% CI	p-value	I^2 (%)	Q test p-value		Funnel plot asymmetry	Trim & Fill imputed studies	Trim & Fill adjusted R coefficient (95% CI)	Egger test p-value
Social Functioning												
Global Social Functioning												
Overall CM	19 (*19*)	5213	**-0.104**	-0.142; -0.066	**<.001**	30	0.109	-0.200; -0.006	-	0	-	0.602
Physical abuse	7 (*7*)	761	**-0.123**	-0.216; -0.027	**0.012**	36	0.155	-0.341; 0.109	-	0	-	0.523
Sexual abuse	9 (*9*)	2636	**-0.087**	-0.147; -0.026	**0.005**	23	0.237	-0.210; 0.039	Left	1	-0.092 [-0.153; -0.031]	0.600
Emotional abuse	6 (*6*)	476	**-0.138**	-0.226; -0.047	**0.003**	0	0	-	Left	2	-0.168 [-0.247; -0.086]	0.514
Physical neglect	6 (*6*)	476	**-0.241**	-0.349; -0.127	**<.001**	37	0.157	-0.497; 0.053	Left	2	-0.288 [-0.389; -0.179]	0.389
Emotional neglect	6 (*6*)	476	**-0.226**	-0.323; -0.125	**<.001**	21	0.272	-0.426; -0.006	-	0	-	0.0502
Independent Living												
Overall CM	8 (*8*)	3550	-0.075	-0.184; 0.037	0.190	87	**<.001**	-0.415; 0.284	Left	4	-0.211 [-0.315; -0.103]	**0.004**
Occupational Functioning												
Overall CM	12 (*13*)*	3101	-0.010	-0.061; 0.041	0.695	42	0.057	-0.146; 0.126	-	0	-	0.766
Interpersonal Relations												
Overall CM	9 (*9*)	3128	**-0.114**	-0.180; -0.046	**0.001**	52	**0.036**	-0.284; 0.064	-	0	-	0.704
Sexual abuse	7 (*7*)	509	**-0.102**	-0.189; -0.013	**0.024**	0	0	-	-	0	-	0.744
Aggressive Behaviour												
Overall CM	6 (*6*)	3881	**0.181**	0.140; 0.222	**<0.001**	28	0.226	-0.086; 0.273	Left	2	0.169 [0.117; 0.220]	0.101
Physical abuse	6 (*6*)	1792	**0.230**	0.119; 0.334	**<0.001**	54	0.054	-0.078; 0.497	Left	3	0.142 [0.031; 0.251]	**0.002**
Sexual abuse	5 (*5*)	1756	**0.126**	0.042; 0.208	**0.003**	29	0.229	-0.090; 0.331	-	0	-	0.732
Social Cognition												
Theory of Mind												
Overall CM	6 (*6*)	393	-0.003	-0.130; 0.195	0.692	60	**0.003**	-0.430; 0.483	Left	2	-0.065 [-0.239; 0.112]	0.184
Sexual abuse	6 (*6*)	1080	0.021	-0.078; 0.119	0.679	33	0.186	-0.216; 0.255	-	0	-	0.756
Emotion Processing												
Overall CM	6 (*6*)	508	-0.105	-0.219; 0.011	0.076	37	0.157	-0.380; 0.187	Left	1	-0.129 [-0.249, -0.004]	0.180

Note: *Two effect sizes from two different populations in the same study were meta-analysed.

[$n = 9$, $k = 9$, $r = -0.087$ (95% CI -0.216 to -0.027), $p = 0.012$]; physical neglect: [$n = 6$, $k = 6$, $r = -0.241$ (95% CI -0.349 to -0.127), $p < 0.001$]; emotional neglect: [$n = 6$, $k = 6$, $r = -0.226$ (95% CI -0.323 to -0.125), $p < 0.001$].

Physical abuse [$n = 6$, $k = 6$, $r = 0.230$ (95% CI 0.119–0.334), $p < 0.001$], and sexual abuse [$n = 5$, $k = 5$, $r = 0.126$ (95% CI 0.042–0.208), $p = 0.003$] were positively associated with aggressive behaviour. Sexual abuse was also negatively associated with interpersonal relations [$n = 7$, $k = 7$, $r = -0.102$ (95% CI -0.189 to -0.013), $p = 0.024$] (see Table 2 and forest plots in SF1 in the supplement).

Meta-analyses of associations between childhood maltreatment and social cognition

No significant associations were found of associations between Overall CM ($n = 6$, $k = 6$, $r = -0.003$) and sexual abuse ($n = 6$, $k = 6$, $r = 0.021$, $p = 0.679$) and theory of mind. In addition, no significant association was found between overall CM and emotion processing ($n = 6$, $k = 6$, $r = -0.105$, $p = 0.076$) (see Table 2 and forest plots in SF1b and SF1d in the supplement).

Heterogeneity, meta-regression, and sensitivity analyses

Heterogeneity
Meta-analyses showed zero to low heterogeneity in results for most associations with a few exceptions: Associations between

overall CM and independent living ($n = 8$, $k = 8$, $I^2 = 87\%$, $p < 0.001$), interpersonal relations ($n = 9$, $k = 9$, $I^2 = 52\%$, $p = 0.036$) and theory of mind ($n = 6$, $k = 6$, $I^2 = 60\%$, $p = 0.003$), and between physical abuse and aggressive behaviour ($n = 6$, $k = 6$, $I^2 = 54\%$, $p < 0.001$) showed moderate-high heterogeneity (see Table 2).
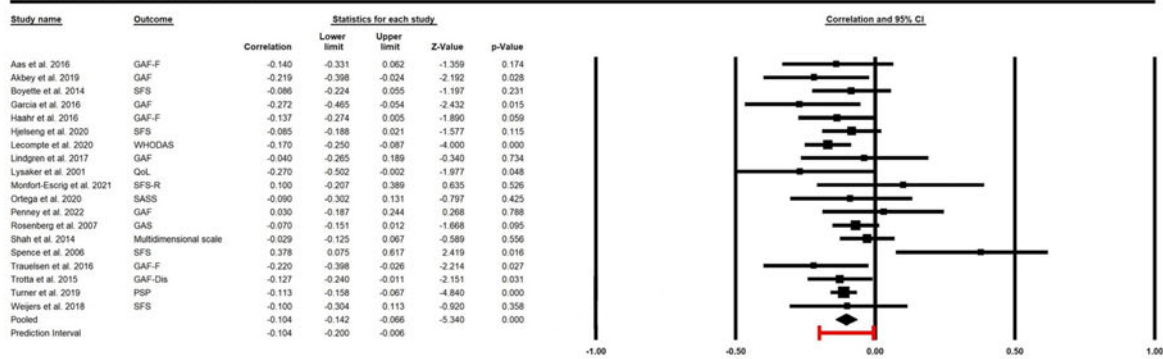
Meta-regressions
Results of meta-regressions for the association between overall and subtypes of CM and social outcomes are provided in ST8 in the supplement. Associations were largely independent from sample age, sex (% male), non-affective *v.* affective psychosis samples, FEP *v.* chronic PD samples, structured interview *v.* unstructured clinical judgment for PD diagnosis, CTQ *v.* any other instrument to assess CM, self-report *v.* clinical judgment to assess social functioning, behavioural data *v.* any other instrument to assess social cognition, and study quality (NOS rating) with a few exceptions.

Social Functioning: The association between physical neglect and global social functioning [$n = 6$, $k = 6$, $\beta = -0.013$, 95% CI (-0.021 to 0.002), $p = 0.025$] was weaker in males (*v.* females). The association between emotional neglect and global social functioning [$n = 6$, $k = 6$, $\beta = -0.415$, 95% CI (-0.826 to -0.004), $p = 0.048$] decreased with using self-report (*v.* clinical judgment). The association between Overall CM and independent living decreased with study quality (NOS rating) [$n = 8$, $k = 8$, $\beta = -0.132$, 95% CI (-0.023 to -0.038), $p = 0.006$]. The association
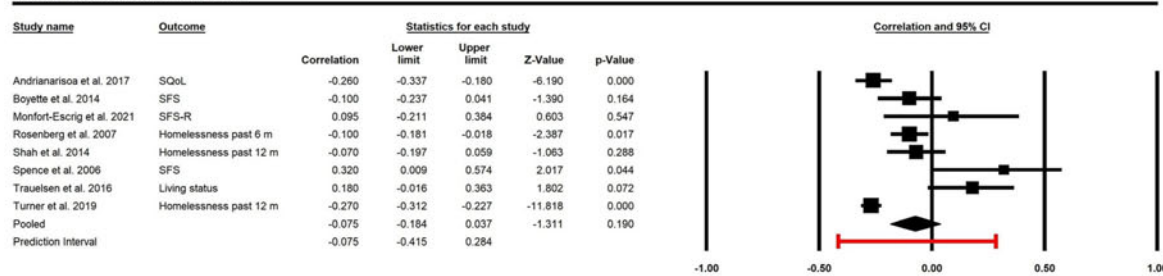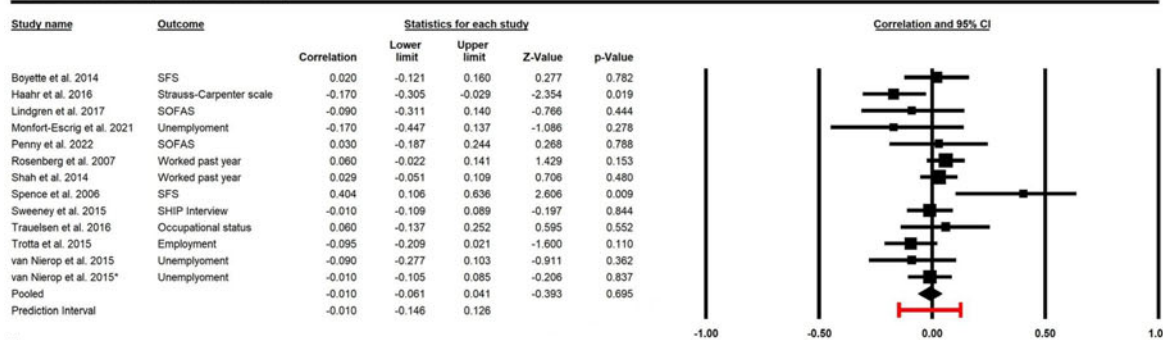
(1)

Overall CM and Global Social Functioning

Study name	Outcome	Correlation	Lower limit	Upper limit	Z-Value	p-Value
Aas et al. 2016	GAF-F	-0.140	-0.331	0.062	-1.359	0.174
Akbey et al. 2019	GAF	-0.219	-0.398	-0.024	-2.192	0.028
Boyette et al. 2014	SFS	-0.086	-0.224	0.055	-1.197	0.231
Garcia et al. 2016	GAF	-0.272	-0.465	-0.054	-2.432	0.015
Haahr et al. 2016	GAF-F	-0.137	-0.274	0.005	-1.890	0.059
Hjelseng et al. 2020	SFS	-0.085	-0.188	0.021	-1.577	0.115
Lecompte et al. 2020	WHODAS	-0.170	-0.250	-0.087	-4.000	0.000
Lindgren et al. 2017	GAF	-0.040	-0.265	0.189	-0.340	0.734
Lysaker et al. 2001	QoL	-0.270	-0.502	-0.002	-1.977	0.048
Monfort-Escrig et al. 2021	SFS-R	0.100	-0.207	0.389	0.635	0.526
Ortega et al. 2020	SASS	-0.090	-0.302	0.131	-0.797	0.425
Penney et al. 2022	GAF	0.030	-0.187	0.244	0.268	0.788
Rosenberg et al. 2007	GAS	-0.070	-0.151	0.012	-1.668	0.095
Shah et al. 2014	Multidimensional scale	-0.029	-0.125	0.067	-0.589	0.556
Spence et al. 2006	SFS	0.378	0.075	0.617	2.419	0.016
Trauelsen et al. 2016	GAF-F	-0.220	-0.398	-0.026	-2.214	0.027
Trotta et al. 2015	GAF-Dis	-0.127	-0.240	-0.011	-2.151	0.031
Turner et al. 2019	PSP	-0.113	-0.158	-0.067	-4.840	0.000
Weijers et al. 2018	SFS	-0.100	-0.304	0.113	-0.920	0.358
Pooled		-0.104	-0.142	-0.066	-5.340	0.000
Prediction Interval		-0.104	-0.200	-0.006		

(2)

Overall CM and Independent Living

Study name	Outcome	Correlation	Lower limit	Upper limit	Z-Value	p-Value
Andrianarisoa et al. 2017	SQoL	-0.260	-0.337	-0.180	-6.190	0.000
Boyette et al. 2014	SFS	-0.100	-0.237	0.041	-1.390	0.164
Monfort-Escrig et al. 2021	SFS-R	0.095	-0.211	0.384	0.603	0.547
Rosenberg et al. 2007	Homelessness past 6 m	-0.100	-0.181	-0.018	-2.387	0.017
Shah et al. 2014	Homelessness past 12 m	-0.070	-0.197	0.059	-1.063	0.288
Spence et al. 2006	SFS	0.320	0.009	0.574	2.017	0.044
Trauelsen et al. 2016	Living status	0.180	-0.016	0.363	1.802	0.072
Turner et al. 2019	Homelessness past 12 m	-0.270	-0.312	-0.227	-11.818	0.000
Pooled		-0.075	-0.184	0.037	-1.311	0.190
Prediction Interval		-0.075	-0.415	0.284		

(3)

Overall CM and Occupational Functioning

Study name	Outcome	Correlation	Lower limit	Upper limit	Z-Value	p-Value
Boyette et al. 2014	SFS	0.020	-0.121	0.160	0.277	0.782
Haahr et al. 2016	Strauss-Carpenter scale	-0.170	-0.305	-0.029	-2.354	0.019
Lindgren et al. 2017	SOFAS	-0.090	-0.311	0.140	-0.766	0.444
Monfort-Escrig et al. 2021	Unemployment	-0.170	-0.447	0.137	-1.086	0.278
Penny et al. 2022	SOFAS	0.030	-0.187	0.244	0.268	0.788
Rosenberg et al. 2007	Worked past year	0.060	-0.022	0.141	1.429	0.153
Shah et al. 2014	Worked past year	0.029	-0.051	0.109	0.706	0.480
Spence et al. 2006	SFS	0.404	0.106	0.636	2.606	0.009
Sweeney et al. 2015	SHIP Interview	-0.010	-0.109	0.089	-0.197	0.844
Trauelsen et al. 2016	Occupational status	0.060	-0.137	0.252	0.595	0.552
Trotta et al. 2015	Employment	-0.095	-0.209	0.021	-1.600	0.110
van Nierop et al. 2015	Unemployment	-0.090	-0.277	0.103	-0.911	0.362
van Nierop et al. 2015*	Unemployment	-0.010	-0.105	0.085	-0.206	0.837
Pooled		-0.010	-0.061	0.041	-0.393	0.695
Prediction Interval		-0.010	-0.146	0.126		

(4)

Overall CM and Interpersonal Relations

Study name	Outcome	Correlation	Lower limit	Upper limit	Z-Value	p-Value
Akbey et al. 2019	SANS	-0.300	-0.469	-0.110	-3.048	0.002
Andrianarisoa et al. 2017	SQoL	-0.200	-0.279	-0.118	-4.715	0.000
Boyette et al. 2014	SFS	-0.110	-0.247	0.031	-1.530	0.126
Haahr et al. 2016	Strauss-Carpenter scale	-0.010	-0.152	0.132	-0.137	0.891
Hoddan-Caudevilla et al. 2021	PAM	-0.040	-0.226	0.149	-0.412	0.680
Monfort-Escrig et al. 2021	SFS-R	0.050	-0.254	0.345	0.316	0.752
Ortega et al. 2020	SASS	-0.240	-0.436	-0.023	-2.162	0.031
Shah et al. 2014	Multidimensional scale	-0.070	-0.116	-0.024	-2.993	0.003
Spence et al. 2006	SFS	0.011	-0.302	0.321	0.067	0.947
Pooled		-0.114	-0.180	-0.046	-3.285	0.001
Prediction Interval		-0.114	-0.284	0.064		

(5)

Overall CM and Aggressive Behaviour

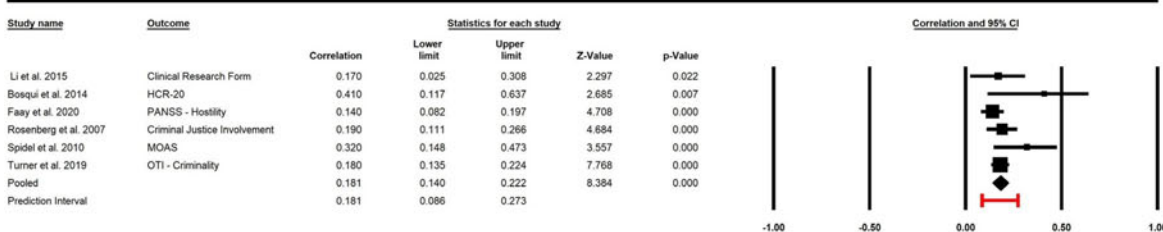| Study name	Outcome	Correlation	Lower limit	Upper limit	Z-Value	p-Value
Li et al. 2015	Clinical Research Form	0.170	0.025	0.308	2.297	0.022
Bosqui et al. 2014	HCR-20	0.410	0.117	0.637	2.685	0.007
Faay et al. 2020	PANSS - Hostility	0.140	0.082	0.197	4.708	0.000
Rosenberg et al. 2007	Criminal Justice Involvement	0.190	0.111	0.266	4.684	0.000
Spidel et al. 2010	MOAS	0.320	0.148	0.473	3.557	0.000
Turner et al. 2019	OTI - Criminality	0.180	0.135	0.224	7.768	0.000
Pooled		0.181	0.140	0.222	8.384	0.000
Prediction Interval		0.181	0.086	0.273		

Figure 2. Forest plots investigating associations between overall childhood maltreatment and social functioning: (1) Global social functioning, (2) Independent living, (3) Occupational functioning, (4) Interpersonal relations, and (5) Aggressive behaviour in individuals with psychotic disorders.
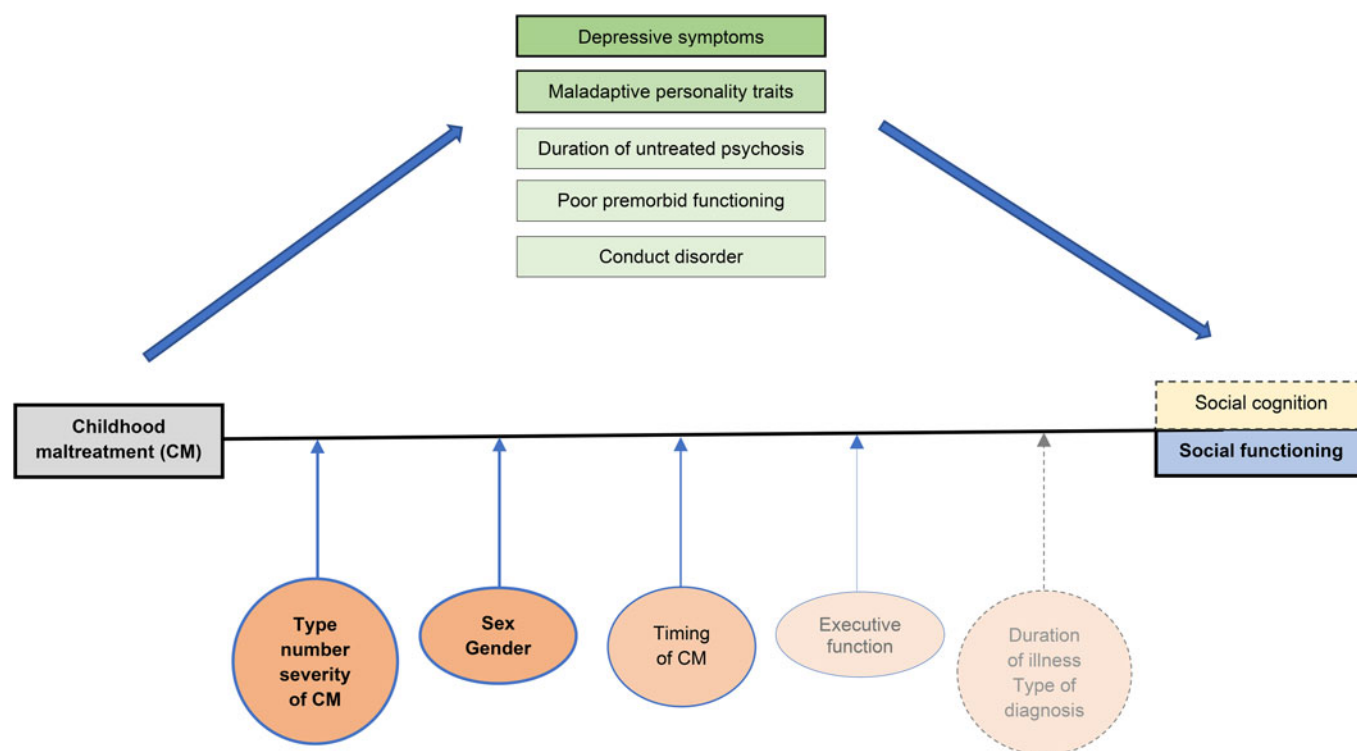
Figure 3. Summary of the evidence on moderators and mediators between childhood maltreatment and social outcomes in psychotic disorders. *Note.* The figure summarises the findings of our narrative synthesis on effect moderators and mediators examined in the included studies. Moderators examined in the included studies are represented by circles/ovals (brick orange in online version). Mediators examined in the included studies are represented by rectangles (green in online version). The colour and thickness of the lines represent the robustness of the evidence, i.e., a stronger colour and thicker line representing major evidence ($n \geq 5$). Lighter colour and thinner lines represent emerging evidence ($n = 1$). Dotted line and grey font indicate where evidence is lacking, and more research is needed.

between overall CM and interpersonal relations ($n = 9$, $k = 9$) was stronger in non-affective (*v.* affective) PD samples [$\beta = 0.135$, 95% CI (0.050–0.221), $p = 0.002$], and decreased with using CTQ *v.* any other instrument to assess CM [$\beta = -0.138$, CI 95% (-0.216 to -0.061), $p = 0.001$]. Finally, the association between physical abuse and aggressive behaviour ($n = 6$, $k = 6$) was stronger in males [$\beta = 0.074$, 95% CI (0.011–0.014), $p = 0.021$] and in non-affective PD samples [$\beta = 0.245$, 95% CI (0.094–0.396), $p = 0.015$], and increased with using self-report [$\beta = 0.243$, 95% CI (0.028–0.457), $p = 0.027$].

Social Cognition: The association between overall CM and theory of mind increased with using CTQ [$n = 6$, $k = 6$, $\beta = 0.291$, 95% CI (0.046–0.536), $p = 0.020$] and with study quality [$n = 6$, $k = 6$, $\beta = 0.093$, 95% CI (0.004–0.183), $p = 0.042$]. The association between overall CM and emotion processing increased with increasing age [$n = 6$, $k = 6$, $\beta = 0.012$, 95% CI (-0.001–0.024), $p = 0.032$].

Of note, as a general rule, estimates of heterogeneity based on $n < 10$ are not likely to be reliable (Borenstein, 2022a; Higgins & Thompson, 2004).

Sensitivity analysis

Results of sensitivity analyses for the association between overall and subtypes of CM and social functioning and social cognition domains are provided in SF2 in the supplement. One-study-removed analysis did not change the patterns of most results with a few exceptions.

Social functioning: For the association between overall CM and independent living, the removal of Spence et al. [$r = -0.109$ (95% CI -0.213 to -0.003), $p = 0.043$] and Trauelsen et al. [$r = -0.115$ (95% CI -0.217 to -0.010), $p = 0.032$] led to a negative association,

which was not observed with the inclusion of these studies (Spence et al., 2006; Trauelsen et al., 2019). For the association between sexual abuse and interpersonal relations, the removal of Akbey, Yildiz, and Gündüz (2019) [$r = -0.080$ (95% CI -0.177 to 0.019, $p = 0.115$] led to a non-significant association.

Social cognition: For the association between overall CM and emotion processing, the removal of Quide et al. [$r = -0.131$ (95% CI -0.253 to -0.005, $p = 0.042$] and Pena-Garijo et al. [$r = -0.131$ (95% CI -0.232 to -0.028, $p = 0.013$] led to a negative association which was not observed with the inclusion of these studies (Pena-Garijo & Monfort-Escrig, 2021; Quide et al., 2018).

Assessment of publication bias

For associations between overall CM and independent living there was indication for publication bias (Egger's $p = 0.004$; 4 hypothetically missing studies identified), and the trim-and-fill adjustment method revealed a higher and significant corrected random effect estimate [$r = -0.211$, 95% CI (-0.315 to -0.103)]. For the association between physical abuse and aggressive behaviour (Egger's $p = 0.002$; 3 hypothetically missing studies identified), the trim-and-fill adjustment method revealed a lower (still significant) corrected random effect estimate [$r = 0.142$, 95% CI (0.031–0.251)] (see Table 2 and the funnel plots in SF3 in the supplement).

Narrative synthesis of moderators and mediators

Twenty-one of the included studies investigated effect moderation and eight studies investigated effect mediation between CM and

social outcomes (see a summary of reported moderators and mediators in the included studies in Fig. 3).

Moderators

The most often investigated moderator was sex or gender ($n = 6$), with four studies finding a stronger association between CM exposure and impaired social functioning (Hjelseng et al., 2020; Lindgren et al., 2017) or social cognition (Mansueto et al., 2019; Penney et al., 2022) in male than in female participants. Yet, Garcia et al., found poor social cognition in males and females but impaired social functioning only in women with FEP (Garcia et al., 2016). Kincaid et al. (2018) found poorer theory of mind performance in males than females with schizophrenia.

There were also two studies supporting a moderating role of timing of CM exposure and emotional neglect, with CM during early childhood (0–6 years) specifically predicting theory of mind impairments in schizophrenia (Kincaid et al., 2018), and neglect experienced at 11–12 years specifically predicting social cognition impairment (Schalinski et al., 2018).

There is consistent evidence for a dose-response-relation (cumulative effect) for severity ($n = 6$) and number of CM experiences ($n = 5$) being linked to more pronounced social functioning or social cognition impairments in PD (Aas et al., 2017; Li et al., 2015; Lindgren et al., 2017; Penney et al., 2022; Schalinski et al., 2018) across all illness stages.

There are mixed results on the moderating effects of different types of CM (Bosqui et al., 2014; Garcia et al., 2016), with seven studies finding both physical and emotional neglect being the strongest predictors of diminished global social functioning (Gil et al., 2009; Kim et al., 2019), interpersonal relations (by anxious attachment) (Aydin et al., 2016), as well as impaired emotion processing (Kilian et al., 2018; Rokita et al., 2021), empathy (cognitive trait) (Kim et al., 2019) and (affective) theory of mind (Vaskinn et al., 2021) in non-affective PD. There is also evidence ($n = 3$) on physical and sexual abuse being the strongest predictors of impaired interpersonal relations (Trotta et al., 2016) and aggressive behaviour in schizophrenia (Bosqui et al., 2014; Hachtel et al., 2020).

Finally, there is little evidence ($n = 1$) for moderating effects of neurocognitive functions, with poorer executive function and physical abuse predicting aggressive behaviour in schizophrenia spectrum disorders (Lysaker et al., 2002).

Of note, none of the included studies examined the potential moderating role of the duration of illness or diagnosis type (e.g. affective *v.* non affective psychosis).

Mediators

There was some evidence ($n = 3$) for a mediation role of depressive symptoms between CM and impaired global social functioning in schizophrenia (Andrianarisoa et al., 2017), and occupational functioning in FEP (Ortega et al., 2020), as well as emotion processing in PD (Aas et al., 2017). There is also evidence ($n = 2$) that maladaptive personality traits (Boyette et al., 2014; Lopez-Mongay et al., 2021) may mediate between CM and social functioning and relations.

There is emerging evidence (from one study in each mediator), through the duration of untreated psychosis and poor premorbid functioning (Aas et al., 2016) in the association between CM and social outcomes. There is also evidence that conduct disorder may mediate between cumulative childhood adversities and adult propensity to aggressive behaviour (Oakley et al., 2016). Finally, Weijers et al., found that in those with non-affective PD, mentalising impairment mediates the relationship between CM and clinical outcomes (e.g. severity of negative and positive symptoms) but not between CM and social (dys)function (Weijers et al., 2018).

Discussion

This systematic review and meta-analysis investigated associations between overall and different subtypes of CM and different domains of social functioning and social cognition in adults with PD. Across the identified studies, we found an association between CM and impaired social functioning in PD. This finding is in line with the vast literature on clinical (Alameda et al., 2021), psychological, neurobiological (Bramon & Murray, 2001; Lim, Radua, & Rubia, 2014; Read, Perry, Moskowitz, & Connolly, 2001; Read et al., 2014; Teicher et al., 2016) and neurocognitive (McCrory et al., 2022) alterations associated with CM that are likely to impact social functioning (Pfaltz et al., 2022). This finding is also in line with our initial hypothesis and with the only previous meta-analysis on the topic (Christy et al., 2022). The associations were overall small (with weak effects), and findings differed essentially in consistency depending on the social domain considered, suggesting differential and specific effects. However, against our initial hypotheses and prior evidence suggesting a link between CM and social cognition (Rodriguez et al., 2021; Rokita et al., 2021), the results of our meta-analysis do not support, with the limited data existing at this stage, an association between CM and social cognition domains in individuals with PD.

In our study, the most consistent associations across overall and CM subtypes were found for the impaired interpersonal relations and aggressive behaviour in PD. This is in line with findings of a recent meta-analysis in affective disorders (Fares-Otero et al., 2023), which may reflect a transdiagnostic effect of CM – particularly regarding difficulties in interpersonal behaviour and interactions. These difficulties might reflect early attachment-related problems, maladaptive internalised schemas (Messman-Moore & Coates, 2007), and heightened sensitivity to interpersonal stress, which may have implications for problematic interpersonal adaptation, poor pro-social coping (e.g. overcompensation, avoidance, or surrender), help-seeking, and social withdrawal.

Furthermore, even though the risk of violence perpetration increases in individuals with a history of CM (Fitton, Yu, & Fazel, 2020), our results should not be interpreted as generalised problems in prosocial behaviour or even as antisocial tendencies in individuals with PD and CM. In fact, the incidence of hostile or aggressive behaviour in PD is rather low (Faay et al., 2020; Fusar-Poli, Sunkel, & Patel, 2022). Further (longitudinal) research on associations between all CM subtypes and social interactions, considering comorbid personality traits, impulsivity, substance use, and environmental factors in PD is needed.

Our findings on the association between CM and poor social functioning replicate earlier work (Christy et al., 2022) by showing that CM exposure relates to impairments in global measure of social functioning but not to occupational functioning. Of note, in our study, the finding on the negative association between overall CM and global social functioning in PD can be considered more accurate (than the previous meta-analysis) (Christy et al., 2022) because our inclusion criteria was stricter as we only examined baseline data, without any intervention involved, and only in adults with PD.

Whether social functioning impairment precedes PD, or vice versa remains unclear. Recent evidence (McCrory et al., 2022) indicates that whilst social problems are likely to arise where a history of CM is present, they might also put the child at greater risk

of further negative social experiences and interactions, such as greater maltreatment (e.g. bullying) later in adolescence, and limit future opportunities for social learning and support throughout the lifespan. Therefore, whether associations between CM and social functioning and interactions in PD may in fact be bidirectional should be examined in future prospective studies.

We also replicate previous findings supporting that physical (Gil et al., 2009) and emotional neglect is associated with higher impairment in social functioning in PD (Christy et al., 2022; Sideli et al., 2022) than other CM subtypes. We found associations between sexual abuse and global social functioning, which is a novel finding maybe due to additional (Aas et al., 2016; Akbey et al., 2019; Garcia et al., 2016; Gil et al., 2009) and newly (Vila-Badia et al., 2022) included studies leading to bigger sample sizes to examine this association (that was not significant in the previous meta-analysis) (Christy et al., 2022). The fact that findings generally replicated across subtypes of CM raises further questions about the underlying mechanisms that are altered by these diverse adverse childhood experiences, with likely broad consequences for social outcomes. Understanding these mechanisms could provide new intervention targets for individuals with PD and a history of CM.

We explored independent living, but did not find an association between CM and this important domain in people with PD (Ang, Rekhi, & Lee, 2021). Altogether, it seems that CM exposure relates to social functioning impairment globally and to impaired specific domains, but not to independent living or occupational functioning. Of note, only overall CM was examined, and independent living was mainly based on living status while occupational functioning on employment status measures in the included studies. More studies are needed assessing associations between all CM subtypes and financial issues, and education or academic functioning in PD.

The suggested association between CM and social cognition in previous reviews (Rodriguez et al., 2021; Rokita et al., 2018) was not confirmed in our study using a quantitative approach. Nonetheless, evidence in this area is based on a limited number of studies, with only two social cognition domains having sufficient data for meta-analysis. Further studies are needed on less explored domains such as attributional style/bias and empathy, and on not yet explored domains such as social perception or knowledge. While overall, there was no meta-analytic evidence for a relationship between CM and social cognition, some of the research summarised in our narrative review suggests that for specific subpopulations, there might in fact exist such a relationship. For instance, a relationship between CM and impaired social cognition has been observed (Mansueto et al., 2019; Penney et al., 2022) that maybe stronger in males with PD (Garcia et al., 2016) and in certain development periods (Kincaid et al., 2018), or even found to be positive in FEP (Pena-Garijo & Monfort-Escrig, 2021). Differences in assessment instruments may explain the mixed results as studies using the same social cognition instruments (Hinting Task), but not the same trauma instruments (CTQ, CAMIR, and CECA-Q) found differing results. Future attempts to understand the socio-cognitive underpinnings of associations between CM and wider social functions in PD are critically needed.

There is evidence of a relationship between social functioning and social cognition in PD (Couture, Penn, & Roberts, 2006). Indeed, social cognition refers to the mental operations underlying social interactions (Green, 2016; Green, Horan, & Lee, 2015). There is also evidence supporting the link between adversity and poorer social functioning, and between social cognition and impairment in social functional outcomes in PD, especially in chronic stages (Rodriguez et al., 2021). Yet, in a recent systematic review of longitudinal studies on the relationship between cognition and social functioning in FEP, findings regarding social cognition were not unanimous (Montaner-Ferrer, Gadea, & Sanjuán, 2023). Taken together, there is still a gap in the literature regarding the role of social cognition in the association between CM (and its subtypes) and domains of social functioning, with a particular focus on social interactions, at different stages of PD.

In meta-regression analyses, we found some evidence for associations that may be stronger in non-affective samples – between overall CM and interpersonal relations, and between physical abuse and aggressive behaviour in males. There was some evidence of an association that may be weaker in males between physical neglect and global social functioning. However, findings stem from <10 studies precluding substantial conclusions. In line with previous work (Fares-Otero et al., 2023) there was very little evidence for other moderation effects, and no consistent pattern. Future studies on moderating factors between CM (across all subtypes) and social functioning in PD are needed.

As a main finding, the number of relevant studies on associations between CM subtypes and social functioning, and social cognition was small. Given the major importance of CM for the course of PD (Bentall, Wickham, Shevlin, & Varese, 2012; Schäfer & Fisher, 2011), and that CM is related to various characteristics associated with social impairment (McCrory et al., 2022; Pfaltz et al., 2022), our analysis shows that CM is understudied regarding social features in PD. CM is still less likely to be recognised in PD than other mental disorders (Read, Sampson, & Critchley, 2016). Clinicians themselves report that they are less likely to ask patients about CM histories if they are diagnosed with PD (Neill & Read, 2022; Read, Harper, Tucker, & Kennedy, 2018; Read et al., 2016). However, 32 studies of the 53 included in this work were published within the last five years, which is in line with the growing interest and empirical findings regarding the importance of CM in PD (Kaufman & Torbey, 2019; Teicher, Gordon, & Nemeroff, 2022). This underlines the importance of further investigations (see SA8 in the supplement) of the relationship between CM and PD also regarding social outcomes.

Clinical Implications

The results of our meta-analysis suggest that it would be beneficial to systematically assess CM in routine care as a standard practice in (mental) health settings (Neill & Read, 2022). Clinicians should ask about all types of CM experiences (Read, Hammersley, & Rudegeair, 2007; Read et al., 2018), implement meaningful measures for its detection and provide effective service responses (Campodonico, Varese, & Berry, 2022). Extra-training on CM and its social consequences for (mental) health professionals supporting those with PD is indicated. In addition to trauma-focused therapy (van den Berg et al., 2018), our findings suggest that individuals with PD and different CM subtypes might benefit from additional treatment components, that target social circumstances (Barnett et al., 2022) and interactions (Faay & Sommer, 2021; Flechsenhar, Kanske, Krach, Korn, & Bertsch, 2022) and social (aggressive) behaviour. Interventions to counteract negative social anticipations might also be beneficial. Such approaches might be further supported by corrective, positive relationship experiences, including therapeutic

engagement (Spidel, Lecomte, Kealy, & Daigneault, 2018) and communication (McCabe et al., 2016). Improving social attitudes, building trust and positive beliefs about self and others (Fowler, Hodgekins, & French, 2019), and reducing feelings of guilt and/or shame (Sekowski et al., 2020) might be valuable strategies to improve resilience in individuals with PD and CM at early illness stages (Arango et al., 2022; Vieta & Berk, 2022). Psychoeducation on both PD diagnosis and the consequences of CM might also prove helpful for these individuals.

As suggested in our narrative review, depressive symptoms and maladaptive personality traits might be mediators in the pathway between CM and social functioning (Andrianarisoa et al., 2017; Ortega et al., 2020) which is in line with previous research (Alameda et al., 2017; Kampling et al., 2022) and a model on the affective pathway to psychosis (Alameda, Conus, Ramain, Solida, & Golay, 2022; Alameda et al., 2020), suggesting that treatment of sub-diagnostic levels of depressive symptoms and psychotherapy targeting personality functioning (Kampling et al., 2022) (and therapeutic relationship) (Picken, Berry, Tarrier, & Barrowclough, 2010) could help to improve psychotic symptoms, as well as social outcomes.

Strengths and limitations

Strengths of this study include the rigorous methodology with the systematic search, study selection, and data extraction all performed by independent researchers, the inclusion of studies published in English, German, and Spanish, the evaluation of the quality of individual studies, and other key practices for meta-analysis.

On the other hand, some limitations must be considered when interpreting the presented findings. First, the number of studies available for some meta-analyses was small, as were the sample sizes of many studies, meaning that some analyses may not have been sufficiently powered for detecting small effects, and the capacity to examine heterogeneity and moderators was limited (Jackson & Turner, 2017). Even with the DerSimonian-Laird estimator (Higgins et al., 2022), extra caution is needed for conclusions, particularly if the number of studies in a model is small (Jackson & Turner, 2017). However, we followed the Cochrane recommendations (Higgins et al., 2022) and the number of studies included in meta-analyses was constrained by the limited number of studies that examined CM and social functioning and social cognition in PD. Second, the effect sizes found in our analyses were generally weak. We need to consider that some of the significant results found in this review maybe dependent on sample sizes bias and affected by potential confounding variables not addressed by the included studies (e.g. duration of untreated PD). Third, it was impossible to account for all the possible variations across instruments utilised, although most studies assessed social outcomes with robust tools. Fourth, most of the identified studies were cross-sectional. Recent evidence (McCrory et al., 2022) indicates a potential bidirectional association between CM and social impairment, so whether associations between CM and social outcomes in PD may be bidirectional should be prospectively examined. Fifth, all the included studies used retrospective assessments of CM, which has been criticised (Hardt & Rutter, 2004). However, empirical studies show that retrospective self-reports on the presence of CM are sufficiently reliable, and provide strong support for their validity (Baldwin, Reuben, Newbury, & Danese, 2019; Newbury et al., 2018). Sixth, we did not focus on associations between CM and social outcomes in healthy samples. It would be interesting in

future research to replicate our findings in those without PD and explore whether association effects are similar in consistency and magnitude across social domains or whether associations are specific to individuals with PD. Finally, the exclusion of grey literature may lead to less heterogeneity in study quality but can also cause relevant findings to be missed. Nonetheless, the methodological quality of all included studies was assessed to examine the degree to which study design, conduct and analyses minimised potential errors and bias.

Conclusion

This meta-analysis informs being exposed to CM (abuse and neglect) is related to impaired social relations and functioning in individuals with PD. These social impairments suggest intervention targets and make the development of a trauma and social working model of importance for maltreated adults with PD. However, published studies on the relationship between CM (and its subtypes) and social functioning, and in particular social cognition in PD are scarce, and further longitudinal studies in non-affective psychosis and in FEP are needed. The potential role of moderation and mediation factors (e.g. illness duration, type of diagnosis) in the relationship between CM and social outcomes warrants further investigation. Nevertheless, it seems critical to consider CM with view to the clinical assessment, diagnosis, and interventions for PD. Further research should identify mechanisms through which CM contributes to worsen social functioning to provide a better basis for identifying individuals with specific needs to provide direction for prevention and to inform early tailored interventions targeting not only the reduction of psychopathology, but also enhancing social interactions (Flechsenhar et al., 2022) (e.g. guiding them to establish healthy relationships, reconfiguring behaviour patterns), and functioning (Morse et al., 2022) (e.g. helping them to develop social roles and skills). Addressing depressive symptoms and psychotherapy targeting personality seems also important although more research is needed to test whether such treatments can specifically improve social outcomes in individuals with PD suffering from the consequences of CM.

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Note. References marked with an asterisk indicate studies included in the meta-analysis (see the full list of the included studies in SA6 in the supplement).

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