Differential Effects of Childhood Abuse and Neglect on Executive and Reflective Functioning Across the Lifespan

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Chapter 1: Systematic Review

The differential effects of child abuse and neglect on reflective functioning across the lifespan: A meta-analysis

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Abstract

Childhood maltreatment is highlighted as a distal risk factor for subsequent difficulties in reflective functioning (RF). This meta-analytic review aimed to synthesize the literature on the relationship between exposure to childhood abuse and neglect and difficulties in RF and its subcomponents, uncertainty and certainty.

Systematic searches were carried out across five databases. Thirty-one studies were included. Effect sizes (*r)* were synthesized using a random effects model. There was a significant positive association between both childhood abuse and neglect and overall difficulties in RF and uncertainty in RF. In contrast, childhood abuse and neglect exhibited a very small negative association with certainty in RF.

Both childhood abuse and neglect have similar associations with RF. Notably, both exposures were linked to difficulties in RF generally and in uncertainty in RF, but not with certainty in RF. Further research is required to clarify the concept of certainty in RF and its relationship with experiences of childhood maltreatment.

Keywords: Childhood maltreatment, reflective functioning, abuse, neglect, meta-analysis

Introduction

Childhood maltreatment is associated with a wide range of physical and mental health outcomes over time, with those exposed displaying higher rates of mental health difficulties, physical illness and familial dysfunction (Montgomery et al., 2019). The World Health Organization (WHO) defines childhood maltreatment as "all forms of physical and/or emotional ill treatment, sexual abuse, neglect or negligent treatment…" (Horswell & Istfan, 2006, p.3). There is extensive evidence linking childhood maltreatment to alterations in neurobiological structures, systems and functions, such as stress susceptible brain regions (Teicher & Samson, 2016) that underpin important higher order cognitive processes, such as reflective functioning (Gould et al., 2012).

Reflective functioning (RF) is defined as an individual's ability to interpret and understand the inner mental states of others (e.g., thoughts, feelings and emotions) and their subsequent behaviour (Fonagy & Target, 1997). As well as understanding the mental states of others, it also encompasses the capacity to comprehend oneself and our own internal state (Yang & Huang et al 2024). RF is the measurable counterpart of mentalizing and is often used synonymously with it (Fonagy et al., 1998). Poor RF skills include issues interpreting and understanding the thoughts and intentions of others or understanding one's own thoughts and motivations (van Rensburg et al., 2023). Deficits in RF have been linked to several clinical difficulties and psychopathology, including anxiety and stress related disorders (Ensink et al., 2014) and mood disorders (Durmaz & Baykan, 2020; Fischer-Kern & Tmej, 2019), making it an important transdiagnostic process in clinical work.

RF is considered an essential developmental achievement (Ensink & Mayes, 2010) and is optimally achieved within secure attachment relationships, wherein a child feels safe and secure to express and recognize their thoughts and feelings with a caregiver who will seek to help them understand their experiences (Fonagy et al., 2018). Based on normative developmental trajectories, RF undergoes a rapid increase in sophistication during adolescence, when RF increases in complexity and becomes comparable to adult-level thinking (Poznyak et al., 2019). This developmental trajectory is proposed to be adversely impacted by childhood abuse and/or neglect (Garon-Bissonnette et al., 2023). The literature on this association has yielded mixed findings with some finding significant associations between childhood maltreatment and RF difficulties (e.g., Penner et al., 2019; Quek et al., 2017) and others reporting on non-significant associations (e.g., Riva Crugnola et al., 2019; Stacks et al., 2014). A recently conducted review has sought to

summarize and quantify the relationship between childhood maltreatment and general RF. Yang & Huang (2024) conducted a meta-analysis on a cumulative measure of childhood maltreatment and overall mentalizing capacity (reflective functioning) across child and adult samples, concluding that individuals with a history of childhood maltreatment exhibited lower mentalizing capacity compared to those without this history.

Two important and potentially distinguishing factors in the variation in associations between maltreatment and RF include the type of maltreatment considered and RF domain examined, which have not been considered to date. In terms of maltreatment type, the dimensions of childhood adversity and maltreatment model proposed by Mc Laughlin et al. (2014), frames adversity and maltreatment across distinct dimensions, distinguishing between various forms of maltreatment and how they may uniquely impact development and functioning across a range of outcomes. Based on this model, neglect and abuse types are distinguished by experiences of deprivation and threat, respectively. Threat includes events that involve actual or threatened injury or violence and as such include exposure to physical, sexual abuse and other interpersonal abuse and violence, whereas deprivation relates to lack of cognitive and social inputs and environmental stimuli, including exposure to neglect, poverty, and institutionalization (Mc Laughlin et al., 2014). The second important factor is the type of RF. RF impairments are divided into two domains, including uncertainty about mental states (i.e., hypomentalizing) and certainty about mental states of others (i.e., hypermentalizing) (Fonagy et al., 2002). In instances of uncertainty in RF, individuals find it difficult to identify and link the mental states of others, leading to confusion, which also impacts individuals' capacity to infer, understand and consider complex mental states (Fonagy et al 2016). In contrast, certainty in RF involves an excessive certainty about mental states, in the absence of sufficient evidence (Sharp et al., 2013). Although certainty and uncertainty in RF were both conceptualized as deficits or impairments, recent empirical evidence suggests an adaptive level of certainty in RF (e.g., Morosan et al., 2020; Schwarzer et al., 2021). An adaptive level of RF generally, is considered a balanced and flexible approach to understanding the mental states of oneself and others (Handeland et al., 2019). As such more recent research has proposed that certainty in RF as measured using the RFQ (Fonagy, 2016) may indicate that engaging in some level of certainty in RF may be associated with a more adaptive level of RF. However, further research is required to clarify and understand what level of certainty in RF that may be considered adaptive. Uncertainty in RF on the other hand has been consistently viewed as an impaired form of RF strongly linked to various markers of psychopathology (Müller et al., 2022). Therefore, a review distinguishing the associations

between types of childhood maltreatment and RF outcomes will allow for a fulsome and nuanced understanding of this association.

The Current Review: Aims and Objectives

Overall, research to date has yielded mixed findings on the association between childhood maltreatment and RF across the lifespan. A small number of reviews have attempted to synthesize this relationship; however, prior reviews have primarily focused on a cumulative measure of childhood maltreatment exposure in relation to RF. Furthermore, previous reviews have not considered the subcomponents of RF, instead focusing on general RF capacities and/or difficulties. Thus, a gap exists in the literature to both further investigate and better characterize this relationship by exploring and quantifying the potentially distinct associations between various types of childhood abuse and neglect with RF and its subcomponents (certainty and uncertainty) across the lifespan. The present systematic review utilized a meta-analytic approach to examine the differential associations between childhood abuse and neglect and RF. Specifically, the two questions addressed included:

1. What are the associations between childhood abuse and neglect and reflective functioning across the lifespan?
2. What are the associations between childhood abuse and neglect and subcomponents of reflective functioning, certainty and uncertainty, across the lifespan?

Method

This systematic review was planned, conducted and reported in line with the Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) guidelines (Page et al., 2021). The protocol for this review was registered by the PROSPERO international prospective registry for systematic reviews on 22nd July 2024 (reference CRD42024564260).

Search strategy

Preliminary searches were carried out to explore an appropriate scope for this review. The search strategy was developed in collaboration with a librarian at the University of Glasgow. In addition, the search strategy for a previous, published systematic review (van Rensburg et al., 2023; looked at child maltreatment and parental reflective functioning) was also consulted and incorporated in this search strategy (see Appendix B for sample of the search terms used). Five databases were searched for studies published up until 30th September 2024; Embase, Web of Science, PsycINFO, Medline, and Cinahl. These databases were chosen for their suitability in capturing this research area.

Inclusion & Exclusion criteria

The following inclusion and exclusion criteria were used to identify and select relevant quantitative papers. Papers were not excluded based on publication date or location.

Inclusion criteria

1. Published peer-reviewed empirical articles
2. Observational studies
3. Quantitative studies
4. Intervention studies (observing pre-treatment only)
5. Longitudinal studies (observing first wave only)
6. Studies in English (or with English translation)
7. Exposure to child maltreatment before 18 years

In addition to the above, included studies must have measures of:

- Experience of childhood maltreatment (e.g., CTQ) that reports on the associations or differences in respect to each type of maltreatment (abuse versus neglect) or uses a binary measure that selects participants exposed to any of the subtypes; sexual abuse, physical abuse, emotional abuse, physical neglect, emotional neglect.
- A measure of reflective functioning (can include any general RF such as general RF, parental RF, youth RF, and/or subtypes of certainty and uncertainty).
- A measure of the association between child abuse and/or neglect and the outcome.

Exclusion criteria

1. Qualitative studies
2. Case studies
3. Editorial letters, conference abstracts
4. Grey literature
5. Systematic reviews

Screening process

All screening processes were conducted in Rayyan, a web-based tool designed for researchers conducting systematic reviews. The primary researcher (also the author of this paper) reviewed 100% of titles and abstracts to identify relevant studies and exclude papers that did not meet the eligibility criteria. A second researcher, another doctoral clinical psychology trainee, screened 20% of abstracts and found 99% agreement between raters. Next, the primary researcher independently reviewed the full texts of the remaining studies and selected those that met the eligibility criteria. An excel table was created which annotated the reason for exclusion of papers. Again, 20% of full text papers were reviewed by the second reviewer and found 96% agreement. All disagreements between raters at both stages were resolved by discussion and consensus.

Quality appraisal process

Included papers were appraised for quality and risk of bias using the Crowe Critical Appraisal Tool (CCAT; Crowe, 2013). This tool was chosen due to its suitability to be used for diverse study designs, with good interrater reliability reported (Crowe & Sheppard, 2011). The CCAT uses 22 items to assess studies, divided into the following eight domains: preliminaries (such as title, abstract, and writing clarity), introduction, design, sampling, data collection, ethical matters, results and discussion. Based on the CCAT guidelines, the reviewer scores each domain on a scale of 0 to 5, leading to a total score of 0 to 40 (Crowe, 2013). A score of less than 20 (50%) is considered poor quality; a score of 20 to 30 (50-75%) is considered moderate quality; and a score above 30 (75%) is considered high quality. The second reviewer randomly selected and appraised 20% (six papers) of the included studies independently using the CCAT. There was 100% agreement on ratings of the overall quality of studies, and no more than a one-point difference in ratings across all categories. These were discussed and a consensus was reached.

Data extraction and synthesis of findings

Data extraction. An excel table was created for extracting the following from the included papers for this review:

a) Key study characteristics: Author/s, year of publication, study location, study design
b) Sample characteristics: total sample size, age, sex and sample type (e.g., clinical, community, mixed sample).
c) Outcomes measures: Childhood abuse and/or neglect measure and measure of reflective functioning.
d) Analysis and effect: analysis of association and correlations, analysis of differences between groups.

The data was extracted by the primary researcher and then a second reviewer checked 20% (six papers) of raw data extraction tables to ensure accuracy. There were no disagreements between the researchers. The above data were then summarized and tabulated for review purposes.

Synthesis. A meta-analysis of correlations was conducted using the R package metafor (Viechtabuer, 2010) in RStudio (R version 4.33, R Core Team, 2014). Six separate meta-analytic models were estimated for the associations between neglect and abuse with total RF, RF uncertainty, and RF certainty.

A random-effects model was used with the restricted maximum-likelihood estimator, as it allows for heterogeneity of data and parameters across studies (Vevea & Coburn, 2015). Initially, using metafor, the individual correlation coefficients were transformed using Fisher's z transformation to undertake the meta-analysis. Those effects were then transformed back to r correlations to aid with the interpretation. Separate forest plots visually depicted the correlations and combined correlations, along with 95% confidence intervals for the separate models estimated. Cohen's criteria (Cohen ,1988) for small (r=.10 -.29), medium (r=.30-.49), and large (r>.50) effect sizes were used to evaluate the magnitude of effect sizes. Heterogeneity among studies was analysed using the Cochrane's Q test (significant heterogeneity was determined at $p < .05$). The I^2 was also used to characterize heterogeneity as small = 25%, moderate = 50%, and large = 75% (Higgins et al., 2003). If heterogeneity was large, outliers were detected through examination of the study's 95% confidence intervals (CI). If a study's 95% CI did not overlap with the CI of the pooled effect size, this study was classified as an outlier (Harrer et al., 2021). Once outliers were detected, those were removed and the model re-run.

Effect size. The effect size of each study was extracted and recorded individually. If a study reported both a correlation and differences between groups effect size, the "r" effect size was used. An online effect size converter was used to convert odds ratio and standardized regression coefficients to r (Lenhard & Lenhard, 2022). Where reported, effects sizes were documented for each subtype of abuse and neglect with RF outcomes, including total RF, RF uncertainty and RF certainty. Where various effect sizes for each subtype of abuse and/or neglect with RF outcomes were reported, an average was taken. For example, if studies reported on multiple types of abuse separately, the effects were averaged to remain consistent with the overall aim of looking at abuse and neglect dimensions broadly. To ensure comparison of consistent effect sizes across studies in the meta-analysis, for those studies which reported total RF as a capacity, effect sizes were reversed to be consistent with conceptualization of impairment/deficit/or difficulty (See Results section for further details).

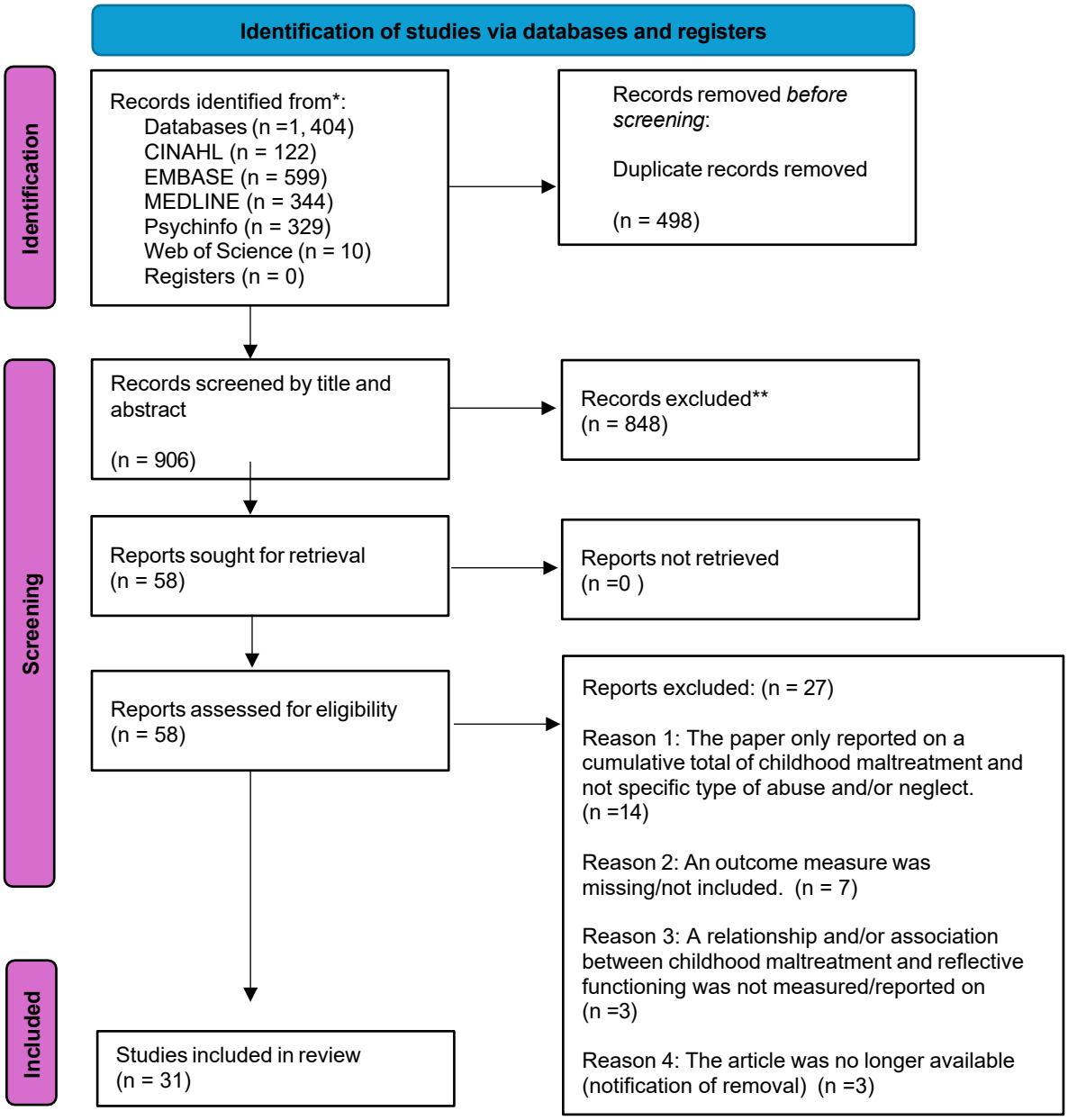
Results

Screening and Selection

Database searches were completed on 30th September 2024 and exported to Rayyan for abstract and full text screening. The screening and selection process is outlined in Figure 1 (PRISMA, Page et al., 2021). A total of 31 studies were eligible for inclusion.

Figure 1

PRISMA 2020 flow diagram (adapted from Page et al., 2021)



Study characteristics

Table 1 outlines the key characteristics of the 31 studies included. All studies were published between 2014 and 2024 and completed in 14 different countries, across different continents. The majority were conducted in Italy (five studies), four in Canada and United States, three in Iran and United Kingdom, two in Norway, Germany and Switzerland and one in each of Australia, China, Chile, Denmark, Korea and Israel (See Table 1). The total number of participants across the 31 studies was 15,050 with an age range from 14 years to 41 years. Seven studies did not report a mean age and/or age range of the total sample. All the studies included employed a cross-sectional design.

Sample

The sample sizes varied across the studies, with the smallest study including just 36 participants (Mohaupt et al., 2016) and the largest including over 4,000 participants (Huang & Hou, 2023). Twenty-three studies reported a majority female sample, four reported an even split between males and females, one study included males only (Mohaupt et al., 2016) and two majority males (Hunag & Hoi, 2023; Shayegh et al., 2024). One study (Bloch et al., 2024) did not provide details on gender distribution. Studies were also characterized based on recruitment setting, with majority of studies including a community sample (16 studies), nine studies included a clinical sample and six studies a mixed sample of both community and clinical. In terms of lifespan range, eight studies consisted of an adolescent sample, 22 studies an adult sample, and one child sample (Ensink et al., 2017).

Measures

Childhood maltreatment. To measure childhood abuse and/or neglect, 17 studies used the Childhood Trauma Questionnaire (CTQ, Berstein et al., 2003) and/or the short form (CTQ-SF) of this measure. Four studies used the Childhood Exposure of Care and Abuse Questionnaire (CECA.Q, Bifulco et al., 2005), two studies used the Traumatic Experiences Checklist (TEC, Nijenhuis et al., 2002) and two studies used a clinical interview format. Other measures used included, Traumatic Antecedent Questionnaire (TAQ, Van der Kolk et al., 1995), Adverse Childhood Experiences Questionnaire (ACE, Felitti et al., 1998), Maltreatment and Abuse Chronology of Exposure (MACE, Teicher & Parigger, 2015), Child Abuse and Trauma Scale

(CATS, Sanders & Becker Lausen, 1995), Brief Physical and Sexual Abuse Questionnaire (BPSAQ, Marshall et al., 1998), Traumatic Life Events Questionnaire, Kubany et al., 2000), Childhood Abuse Scale (Muhammadkhani et al., 2001) (See Table 1).

Reflective functioning. In relation to measures used to assess RF, seven studies used the Reflective Functioning Questionnaire for Youths (RFQ-Y, Sharp et al., 2009), five studies used the Reflective Functioning Questionnaire (RFQ, Fonagy et al., 2016) seven studies used the short form version of the Reflective Functioning Questionnaire (RFQ-SF, Fonagy et al., 2016), five studies used the Parental Reflective Functioning Questionnaire (PRFQ, Slade et al., 2005)), two studies used the Reflective Functioning Uncertainty subscale (RFQu, Fonagy et al., 2016), two studies used the Reflective Functioning Scale (RFS, Fonagy et al., 1998), one study used the Mentalization Questionnaire (MZQ, Hausberg et al., 2012), one study used the Mentalization Scale (MentS, Dimitrijevic et al., 2018), and one study used the Child Reflective Functioning Scale (CRFS, Ensink et al., 2013) (See Table 1)

In relation to conceptualization of RF, some studies regarded RF as a capacity (i.e., higher scores on a measure represented greater RF capacities), whereas other studies conceptualized RF as a difficulty (i.e., higher scores on measures indicated greater difficulty or impairment in RF). A total of nine studies conceptualized RF as a capacity, while the remaining studies conceptualized RF as a difficulty (See Table 1 for full breakdown).

Table 1

Study Characteristics

Study **Year**	***N***	**Country**	**Sample characteristics**	**Sample setting**	**Child abuse/ neglect measure**	**RF measure & conceptualization**
Bassi et al. **2024**	1, 614	Italy	Adult, Mean age = 23.84, 50% females	Community	CTQ	RFQu (difficulty)
Bateman et al. **2023**	72	Switzerland	Adult, mean age = not reported, majority female	Clinical	CTQ	RFQ (difficulty)
Benzi et al. **2023**	469	Italy	Adult, Mean age = 24.91, 71.85% females	Community	CTQ-SF	RFQ-Y (difficulty)
Beradelli et al. **2022**	252	Rome, Italy	Adult, mean age = 38.63, 50.4% females	Clinical	CTQ	MZQ (difficulty)
Bloch et al. **2024**	661	Denmark	Adult, Does not report on mean age or age ranges of sample or gender distribution	Mixed	Clinical interview	RFQ (difficulty)
Chisea & Fonagy **2014**	234	United Kingdom	Adult, mean age = total sample not reported, majority females	Clinical	Clinical interview	RFS (capacity)
Choi **2023**	661	Korea	Adult, Mean age = 41.13, 100% females	Community	CTQ	RFQ (difficulty)

Condon et al. 2022	97	United States	Adult, Mean age = 27, all females	Community	CTQ-SF	PRFQ (difficulty)
Duval et al. 2018	263	Canada	Adolescence, Mean age = 17, 78% female	Community	CECA.Q	RFQ-Y (difficulty)
Ensink et al. 2024	193	Canada	Adolescence, Mean age = 14.89, 68.5% females	Community	CECA.Q	RFQ-Y (difficulty)
Ensink et al. 2017	168	Canada	Child, Mean age = not reported, 57.14% females	Mixed	File review	CRFS (difficulty)
Hakansson et al. 2018	43	Norway	Adult, Mean age = 31.1, all females	Clinical	TAQ	PRF (capacity)
Hormozi et al. 2023	496	Iran	Adult, Mean age = 30.03, 84.48 % females	Community	CTQ	RFQ (difficulty)
Huang et al. 2020	295	United Kingdom	Adult, Mean age = not reported, majority females	Mixed	CTQ	RFQ-SF (difficulty)
Huang & Hou 2023	4873	China	Adult, mean age = not reported, 44.9% females	Community	CTQ-SF	MentS (capacity)
Lassri et al. 2024	667	Israel	Adults, Mean age = 31.81, 91.6% females	Community	CTQ	RFQ-SF (difficulty)
Li et al. 2020	205	Scotland	Adult, Mean age = 28.2, 80.5% females	Community	ACE & CATS	RFQ-SF (difficulty)

Macfie et al. 2020	93	United States	Adult, Mean age = 27.2, all females	Clinical	MACE	RFQ-SF (difficulty)
Martin-Gangon et al. 2023	94	Canada	Adolescence, Mean age = 16.11, 74% females	Mixed	CECA.Q	RFQ-Y (difficulty)
Mohaupt et al. 2016	36	Norway	Adults, Mean age = 36.6 years, 100% males	Clinical	TEC	PRF (capacity)
Moser et al. 2019	48	Switzerland	Adult, Mean age = 33.6, all females	Clinical	BPSAQ & TLEQ	PRF (difficulty)
Musetti et al. 2021	1308	Italy	Adolescence, Mean age = 16.27, 51.98% females	Community	CTQ-SF	RFQu (difficulty)
Musetti et al. 2023	769	Italy	Adult, Mean age = 28.44, 48.1% females	Community	TEC	RFQ (difficulty)
Penner et al. 2019	107	United States	Adolescence, Mean age = 15.36, 75.7% females	Clinical	CTQ-SF	RFQ-Y (capacity)
Quek et al. 2017	51	Australia	Adolescence, Mean age= 15.89, 84.31% females	Mixed	CTQ	RFQ-Y (capacity)
Salarhaji et al. 2024	219	Iran	Adult, Mean age = 21.9, 58.4% females	Community	CTQ	RFQ-SF (difficulty)
San Cristobal et al. 2017	124	Chile	Adult, Mean age = 29.68, 100% females	Community	CTQ	PRFQ (difficulty)

Schwarzer et al. **2021**	214	Germany	Adult, Mean age = 23.01, 79.4% females	Community	CTQ	RFQ-SF (difficulty)
Shayegh et al. **2023**	290	Iran	Adult, Mean age = 30, 7.4% females	Community	CAS	RFQ-SF (difficulty)
Taubner et al. **2016**	161	Germany	Adolescence, Mean age = 16.5, 52.8% females	Mixed	CECA.Q	RFS (capacity)
Wais et al. **2024**	273	United States	Adolescence, Mean age = 15.5, 65.2% females	Clinical	CTQ	RFQ-Y (capacity)

Note. CTQ = Childhood Trauma Questionnaire, CTQ-SF = Childhood Trauma Questionnaire-Short Form, CECA.Q = Childhood Exposure of Care and Abuse Questionnaire, TAQ = Traumatic Antecedent Questionnaire, ACE = Adverse Childhood Experiences Questionnaire, CATS = Child Abuse and Trauma Scale, MACE = Maltreatment and Abuse Chronology of Exposure, BPSAQ = Brief Physical and Sexual Abuse Questionnaire, TLEQ = Traumatic Life Events Questionnaire, TEC = Traumatic Events Checklist, CAS = Childhood Abuse Scale, RFQu = Reflective Functioning Questionnaire, Uncertainty scale, RFQ = Reflective Functioning Questionnaire, RFQ-SF = Reflective Functioning Questionnaire – Short Form, RFQ-Y = Reflective Functioning Questionnaire – Youth, MZQ = Mentalization Questionnaire, RFS = Reflective Functioning Scale, PRFQ = Parental Reflective Functioning Questionnaire, PRF = Parental Reflective Functioning, CRFS = Child Reflective Functioning Scale, MentS = Mentalization Scale.

Quality Assessment

Table 2 presents a summary of the quality appraisal of the studies. Of the 31 studies included, 25 were rated as high quality, six as moderate quality, and none were rated as poor quality. All were considered eligible for inclusion in the meta-analysis. In summary, the introduction and discussion sections of the papers were of good quality, outlining clear aims, rationales and hypotheses and identified both the strengths and limitations of the studies. Additionally, most studies used validated measures of child abuse and neglect exposure. Given the cross-sectional design of the studies, limitations in terms of causation and generalizability were consistently highlighted across studies. Some methodological weaknesses were identified, including an overall lack of reference to power analysis to establish necessary sample size for their study. However, Lassri et al. (2024) references the use of G Power analysis. In relation to ethical considerations, some studies did not provide sufficient detail regarding issues such as consent, particularly some studies which sampled a child/adolescent sample, for example Ensink et al (2024).

Table 2

Quality Appraisal of Studies Using the CCAT (Crowe, 2013)

Author	Year	Preliminaries	Introduction	Design	Sampling	Data collection	Ethical matters	Results	Discussion	Total score	Total %	Quality rating
Bassi et al	2024	5	5	4	5	4	4	4	4	35	88%	High
Bateman et al	2023	5	4	4	5	4	4	3	5	34	85%	High
Benzi et al	2023	5	4	4	5	5	5	4	5	37	93%	High
Beradelli et al	2022	5	4	3	3	4	5	5	5	34	85%	High
Bloch et al	2024	5	5	4	4	4	4	4	4	34	85%	High
Chisea & Fonagy	2014	5	5	5	5	4	4	3	5	36	90%	High
Choi	2023	5	5	4	4	4	4	4	5	35	88%	High
Condon et al	2022	5	5	4	5	4	3	4	5	35	88%	High
Duval et al	2018	5	5	3	3	3	5	4	5	33	83%	High
Ensink et al	2017	5	4	5	5	4	3	4	5	35	88%	High
Ensink et al	2024	4	4	4	3	3	3	4	4	29	73%	Moderate
Hakansson et al	2018	4	4	4	4	3	3	5	5	32	80%	High
Hormozi et al	2023	5	5	4	5	5	5	5	4	38	95%	High
Huang & Hou	2023	5	5	3	4	4	4	4	5	34	85%	High
Huang et al	2020	5	5	5	5	4	4	5	5	37	93%	High
Lassri et al	2024	4	4	4	4	3	3	3	4	29	73%	Moderate
Li et al	2020	5	5	4	5	5	4	4	5	37	93%	High
Macfie et al	2020	5	5	4	5	4	4	5	5	37	93%	High

Martin-Gangon et al	2023	5	5	3	3	4	4	5	5	34	85%	High
Mohaupt et al	2016	4	4	3	3	4	3	3	4	27	68%	Moderate
Moser et al	2019	5	5	5	5	5	4	5	5	39	98%	High
Musetti et al	2021	5	5	5	5	4	4	4	5	37	93%	High
Musetti et al	2023	4	4	3	3	3	3	3	4	27	68%	Moderate
Penner et al	2019	5	5	4	3	3	2	4	5	31	78%	High
Quek et al	2017	5	4	3	4	3	4	4	5	32	80%	High
Salarhaji et al	2024	5	3	4	5	4	4	4	4	28	70%	Moderate
San Cristobal	2017	3	4	3	3	3	3	3	3	25	63%	Moderate
Schwarzer et al	2021	5	5	5	4	5	4	4	5	37	93%	High
Shayegh et al	2023	4	4	3	5	5	4	5	4	34	85%	High
Taubner et al	2016	5	4	3	4	4	3	4	5	32	80%	High
Wais et al	2024	5	5	5	5	4	4	4	5	37	93%	High

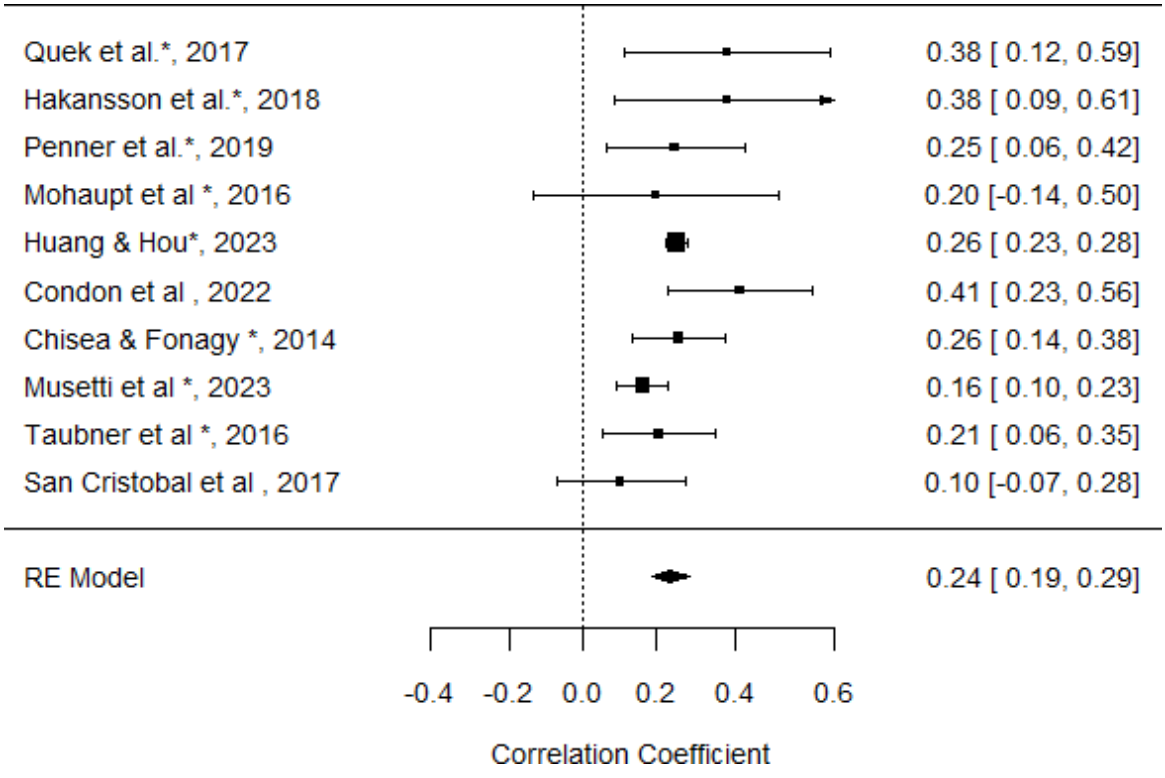
Meta-analysis

A total of 31 studies were included in the meta-analysis, with a final total of 25,337 participants, across six models. To ensure consistency across all studies to conduct the meta-analysis, effect sizes for studies were conceptualized as difficulties in RF. Therefore, any studies which reported RF as a capacity, had their respective effect sizes reversed. Studies for which effect sizes were reversed are denoted by an * in all figures included.

Neglect and total reflective functioning

Ten studies were included in the meta-analysis examining the association between exposure to neglect in childhood and total RF difficulties, providing a total of 6,495 participants. The pooled effect based on the association between neglect exposure and total RF difficulties was $r = 0.24$, 95% CI = .19, .29, which represents a small, significant effect ($p < .0001$). Figure 2 shows the forest plot. There was a small non-significant heterogeneity of effects among the studies (Q = 14.06, $p = 0.120$, $I^2 = 35.95\%$). To assess for publication bias the funnel plot was visually examined and looked approximately symmetrical, suggesting no evidence of publication bias. Further tests for asymmetry conducted were the Test for Funnel Plot Asymmetry (z = 0.92, p = 0.3596) and Rank Correlation Test for Funnel Plot Asymmetry (Kendall's tau = 0.11, p = 0.7275), both of which were non-significant.

Figure 2 Forest plot of neglect and total reflective functioning difficulties

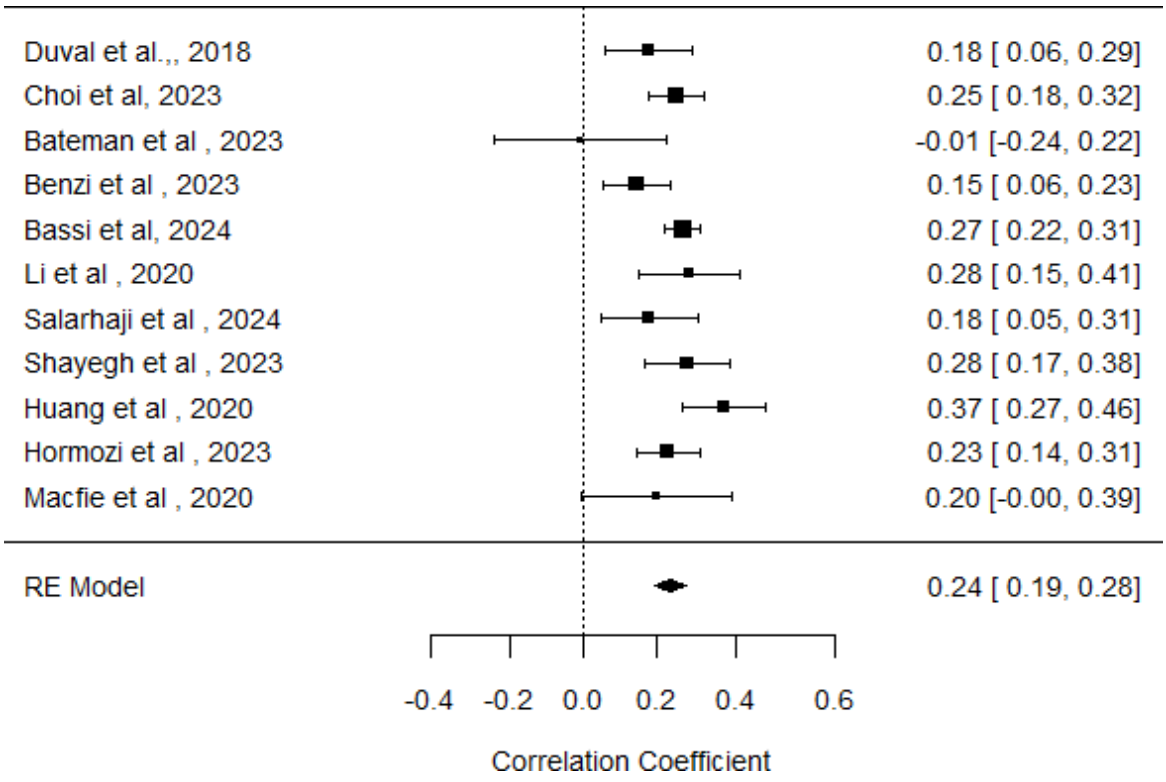


Note. RE = Random-Effects model (*Indicates reversal of effect size).

Neglect and reflective functioning uncertainty

Eleven studies were included in the meta-analysis examining the association between exposure to neglect in childhood and RF uncertainty, providing a total of 4,677 participants. The pooled effect for the association between neglect exposure and RF uncertainty was $r = 0.24$, 95% CI = .19, .28, which represents a small significant effect (p <.0001). There was small significant heterogeneity of effects among the studies (Q = 19.47, $p = 0.034$, $I^2 = 47.02\%$). Figure 3 shows the forest plot. To assess for publication bias the funnel plot was visually examined and looked approximately symmetrical, suggesting no evidence of publication bias. Further tests for asymmetry conducted were the Test for Funnel Plot Asymmetry (z = -1.33, p = 0.1844) and Rank Correlation Test for Funnel Plot Asymmetry (Kendall's tau = -0.31, p = 0.2183). Both tests were non-significant.

Figure 3 Forest plot of neglect and reflective functioning uncertainty



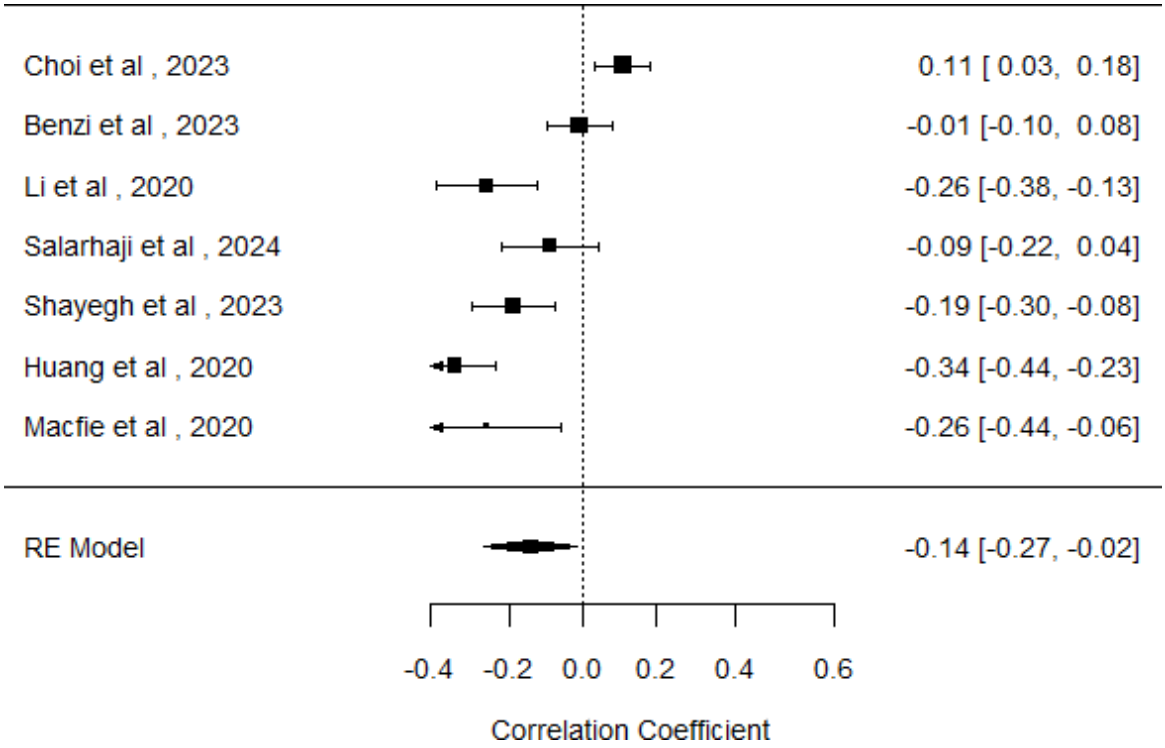
Note. RE = Random-Effects model.

Neglect and reflective functioning certainty

Eight studies were originally included in the initial meta-analysis examining the association between exposure to neglect in childhood and RF certainty. The pooled effect was non-significant, r = -0.10, 95% CI = -.24, .05. Large and significant heterogeneity was detected in this model (Q = 107.04, p < .0001, I^2 = 93%). The forest plot was visually examined, and one study (Hormozi et al., 2023) was identified as an outlier and was removed.

The model was re-run with seven studies, providing a total of 2,232 participants. The meta-analytical result for the association between neglect exposure and RF certainty was r = -0.14, 95% CI = -.27, -.02, which represents a small, yet significant effect. Large, significant heterogeneity of effects remained among the studies (Q = 61.83, p = <.0001, I^2 = 88.24%). Figure 4 shows the forest plot. Tests for asymmetry conducted were the Test for Funnel Plot Asymmetry (z = 0.92, p = 0.3596) and Rank Correlation Test for Funnel Plot Asymmetry (Kendall's tau =0.11, p = 0.7275), both of which were non-significant.

Figure 4 Forest plot of neglect and reflective functioning certainty



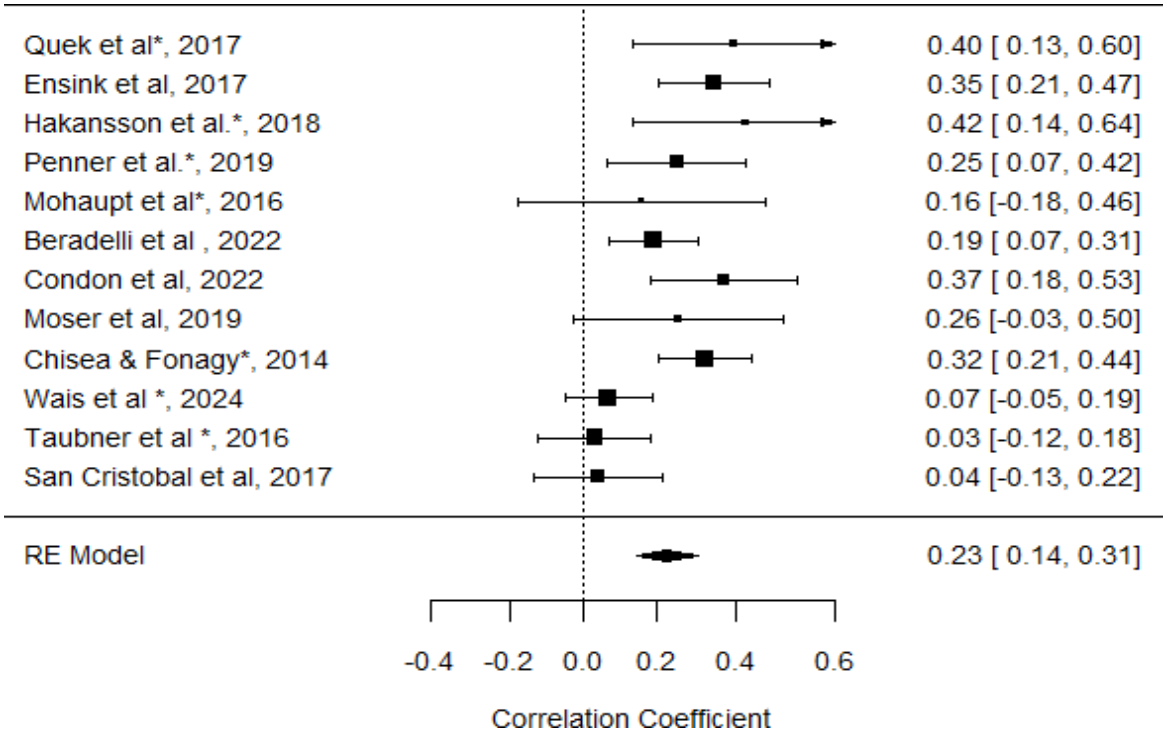
Note. RE = Random-Effects model.

Abuse and total reflective functioning

Fourteen studies were originally included in the initial meta-analysis examining the association between exposure to abuse in childhood and total RF difficulties. The pooled effect was r = .24, 95% CI = .16, .32. Large and significant heterogeneity was detected (Q = 122.18, p < .0001, I^2 = 85.10%). The forest plot was visually examined, and two studies (Huang & Hoi, 2023; Musetti et al., 2023) were identified as outliers and removed.

The model was then re-run with 12 studies, providing a total of 1,594 participants. The meta-analytical result for the association between abuse and total RF difficulties was r = 0.23, 95% CI = .14, .31, which represents a small significant effect. There was moderate significant heterogeneity of effects among the studies (Q = 29.10, p = .0022, I^2 = 62.42%). Figure 5 shows the forest plot. Tests for asymmetry conducted were the Test for Funnel Plot Asymmetry (z = 0.57, p = 0.5686) and Rank Correlation Test for Funnel Plot Asymmetry (Kendall's tau =0.05, p = 0.8299), both of which were non-significant.

Figure 5 Forest plot of abuse and total reflective functioning difficulties



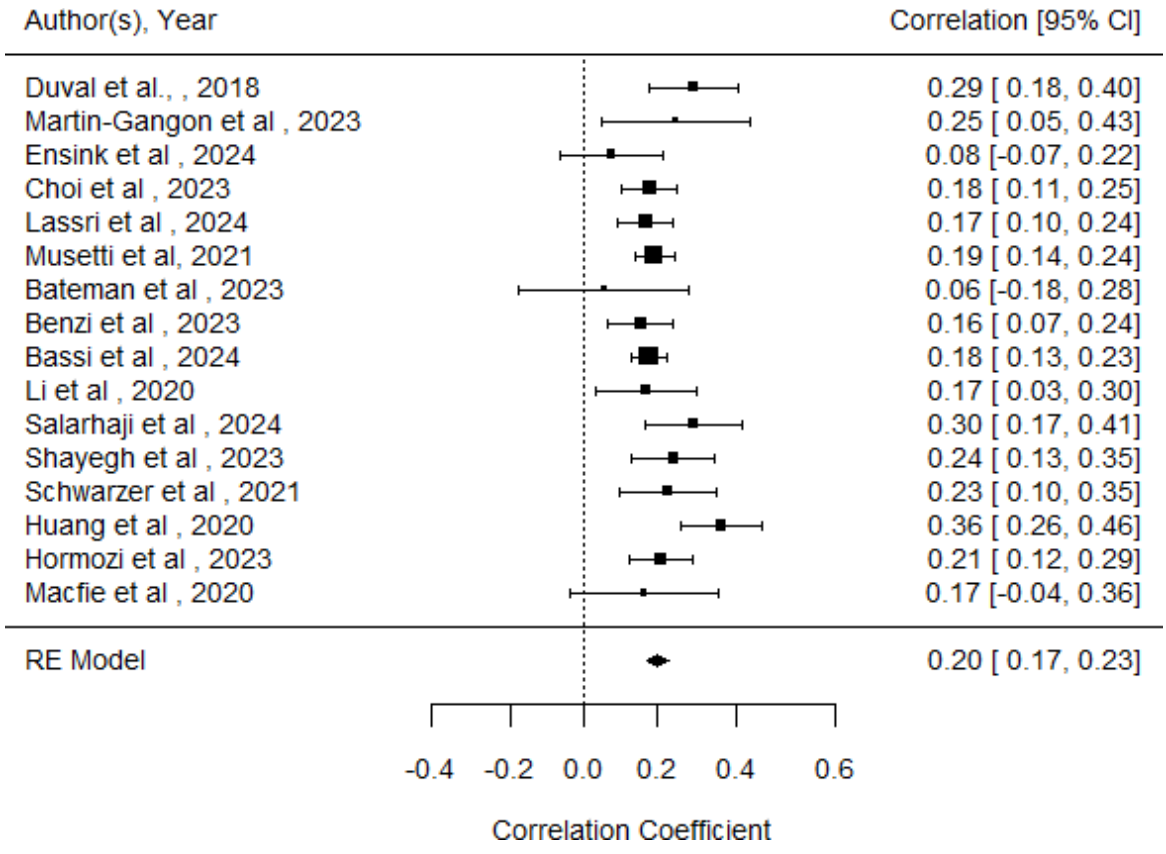
Note. RE = Random-Effects model (*Indicates reversal of effect size).

Abuse and reflective functioning uncertainty

Seventeen studies were originally included in the initial meta-analysis examining the association between exposure to abuse in childhood and RF uncertainty. The pooled effect was r = .24, 95% CI = .16, .31. Large and significant heterogeneity was detected (Q = 219.67, p < .0001, I^2 = 91.19%). The Forest plot was visually examined, and one study (Bloch et al., 2024) was identified as an outlier and removed.

The model was re-run with 16 studies, providing a total of 7,153 participants. The meta-analytical result for the association between abuse and RF uncertainty was r = 0.20, 95% CI = .17, .23, which represents a small significant effect. There was small non-significant heterogeneity of effects among the studies (Q = 22.78, p = .0890, I^2 = 26.68%). Figure 6 shows the forest plot. Both tests for asymmetry were also non-significant, Test for Funnel Plot Asymmetry (z = 0.58, p = 0.5617) and Rank Correlation Test for Funnel Plot Asymmetry (Kendall's tau = 0.0000, p = 1.0000).

Figure 6 Forest plot of abuse and reflective functioning uncertainty



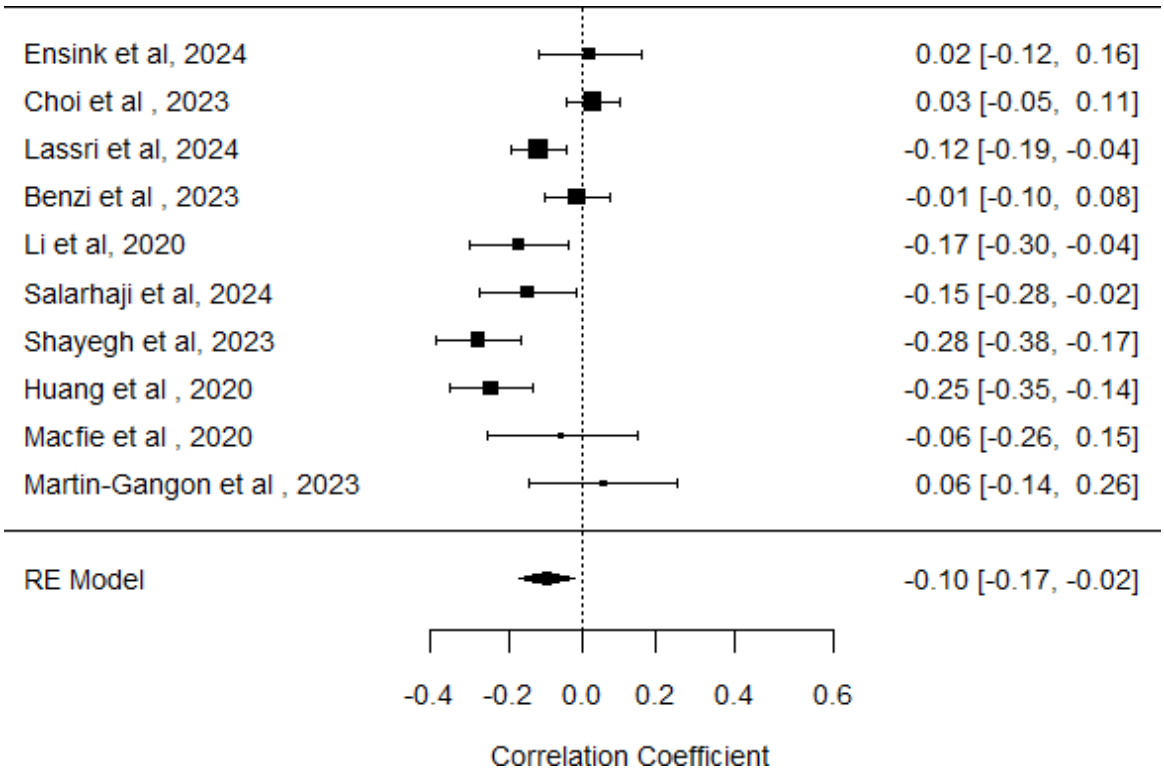
Note RE = Random-Effects model.

Abuse and reflective functioning certainty

Twelve studies were originally included in the initial meta-analysis examining the association between exposure to abuse in childhood and RF certainty. The pooled effect was r = -.01, 95% CI = -.11, .00. Large and significant heterogeneity was detected (Q = 152.85, p < .0001, I^2 = 90.86%). The plot was visually examined, and two studies (Hormozi et al., 2023; Bloch et al., 2024) were identified as outliers and removed.

The model was re-run with 10 studies, providing a total of 3,186 participants. The meta-analytical result for the association between abuse and RF certainty was r = -0.10, 95% CI = -.17, -.02, which represents a very small, yet significant negative effect. Large, significant heterogeneity was still detected (Q = 38.30, p = <.0001, I^2 = 76.41%). Figure 7 shows the forest plot. Further tests for asymmetry conducted were the Test for Funnel Plot Asymmetry (z = 0.37, p = 0.7147) and Rank Correlation Test for Funnel Plot Asymmetry (Kendall's tau =-0.07, p = 0.8618), both of which were non-significant.

Figure 7 Forest plot of abuse and reflective functioning certainty



Note. RE = Random-Effects model.

Discussion

The purpose of this review was to investigate the association between childhood abuse and neglect, and domains of RF and whether differential effects existed. The meta-analysis revealed that childhood abuse and neglect had similar effects across outcomes and that variation in associations depended on the RF domain considered. Individuals who have experienced childhood abuse and/or neglect demonstrated greater difficulties in RF generally and higher uncertainty in RF, with positive effects across all models. On the other hand, childhood abuse and neglect had an opposite effect on certainty in RF, with very small negative associations detected in both models. Overall, this review contributes to the growing evidence base of childhood maltreatment as a possible risk factor, with negative impacts on RF (Belvederi et al., 2017; Li et al., 2020). Importantly, the review offers novel findings delineating the effects based on RF domains with implications for measurement and conceptualization of RF.

The significant positive associations between abuse and neglect and overall RF difficulties found in this review are in line with previous research and the recent meta-analysis conducted by Yang & Huang (2024). Indeed, both abuse and neglect effect sizes were similar to the effect size found when using cumulative childhood maltreatment in Yang & Hunag (2024). This suggests that when examining childhood abuse and neglect separately, they exert similar effects on RF as when examining childhood maltreatment generally (measured as a cumulative score), with no evidence for differential effects. This could be because most individuals exposed to one type of childhood trauma or maltreatment are exposed to other types and thus the exposures overlap to some extent (Rizeq, et al., 2020; Rizeq & McCann, 2023), masking any unique effects.

Considering findings in relation to uncertainty in RF, results indicated that both abuse and neglect are associated with increased uncertainty in RF specifically. The association with uncertainty in RF is consistent with previous research which reported similar associations when examining a cumulative childhood maltreatment measure in a community sample of adults (Berthelot et al., 2019). It is hypothesized that exposure to childhood maltreatment specifically impacts a child's opportunity to obtain reliable and consistent information from caregivers to develop trust and safety, which in turn can impact on a child's ability to accurately interpret information from others and their environment (Berthelot et al., 2019). All of which can impede the development of RF capacities and lead to specific, confused forms of RF, such as

uncertainty (Berthelot et al., 2019). In this meta-analysis, the association with uncertainty was consistent for both abuse and neglect and indicated similar effect sizes, which were also comparable to effect sizes for general RF difficulties. This suggests that conceptualization of uncertainty in RF is consistent with the overall model of RF that characterizes uncertainty as a primary deficit of RF (Horvath et al., 2023).

In contrast, the results in relation to certainty in RF in this review presented with a very small negative association with both childhood abuse and neglect, meaning that higher exposure to childhood abuse and neglect was associated with lower certainty in RF. There are some important considerations when attempting to explain this divergence in findings when examining certainty in RF. Importantly, recent evidence suggests that certainty, as currently measured by the RFQ-8, is tapping into an adaptive component of RF (Morosan et al., 2020; Schwarzer et al., 2021).-Additionally, it is notable that most studies examining certainty used the certainty subscale of the RFQ-8 (Fonagy et al., 2016), which has received some critique recently. Müller et al. (2022) reported that the construct of impaired RF originally outlined and its subcomponents of certainty and uncertainty may not be appropriately captured by the items in the RFQ-8. Other research using alternative measures of certainty (hypermentalizing) such as the MASC (Dziobek et al., 2006), reported positive associations with borderline traits and symptomology, indicating that such measures are tapping into a true representation of certainty in RF, as a deficit (Sharp et al., 2013). This is a relatively new and growing area of research, with papers included in this review spanning only the last ten years, with a considerable number published in the most recent five years. As such, there is a critical need for further investigation and clarification of the model of RF, its subcomponents and their measurement.

Clinical implications

This research provides important considerations from a clinical perspective and its overall application. Difficulties in RF have been implicated as a transdiagnostic feature across a range of psychological disorders, including anxiety (Ensink et al., 2014), depression (Durmaz & Baykan, 2020; Fischer-Kern & Tmej, 2019) and a core feature in personality disorders (Antonsen et al., 2016). This review reinforces the link between childhood abuse and neglect and impaired RF, with implications for psychopathology. These findings highlight critical clinical considerations for individuals exposed to childhood abuse or neglect, who face an increased risk of developing psychopathology (Rizeq & McCann, 2023), including consideration of RF as a key target for interventions. Indeed, the specific associations found

with lower general RF capacity and higher uncertainty in RF indicates a potentially relevant intervention target for those who report a history of childhood maltreatment and present to mental health services. Existing clinical interventions designed to target RF (and mentalizing) difficulties include Mentalization Based Therapy (MBT). Such interventions aim to develop and foster trust in one's mentalizing capabilities (reflective functioning) and to mentalize experiences of abuse and neglect, to facilitate understanding and promote recovery (Martin-Gangon et al., 2023). This in turn, facilitates a reduction in uncertainty in RF. Indeed, incorporation of assessment of childhood maltreatment history and RF (mentalization) into initial clinical assessments may improve treatment planning and individual matching of patients to the most appropriate therapeutic approach, such as MBT. More broadly, RF abilities are crucial for effective emotion regulation and successful social adaptation (Fonagy & Allison, 2013), therefore consideration and support for improving this capacity may improve psychological functioning generally (Muesetti et al., (2021).

Strengths, limitations and future directions

A strength of this review is the large number of studies included with a total of 25,337 number of participants, spanning across the lifespan. Reviews to date have considered childhood maltreatment and its impact on RF generally. Another strength of this review is that it considered the specific impacts of both abuse and neglect on specific aspects of RF (uncertainty and certainty), delineating distinct associations that will guide future research. This review is also subject to limitations. Firstly, the studies included in this review utilized a cross-sectional design. As such, it is impossible to determine the causality and directionality of such associations reported. Future studies should focus on longitudinal designs to further enhance our understanding and reliability of findings. Furthermore, while this review included studies across the lifespan (both adults and child samples) it was not within the scope to examine moderators such as age at which exposure occurred and if this differentially affected RF. Finally, differences in outcomes across clinical versus community samples were not examined, which may offer an important future research direction. This may be especially important when operationalizing clinical levels of impairment in RF versus normative levels.

Conclusions

This review shows a robust association between both abuse and neglect and RF generally. When examining these associations with subcomponents of RF, there was a clear association between exposure to both abuse and neglect and higher difficulties with general RF and

uncertainty in RF and smaller effects on lower certainty in RF. These results provide further support for the of role childhood abuse and neglect as risk factors for impaired RF, whilst also posing outstanding questions regarding the conceptualization of certainty in RF and its role across development. Specifically, further understanding of certainty in RF as a concept, including whether it represents a deficit as originally proposed, or an adaptive subcomponent of RF is required. This research will further expand our knowledge and understanding of this new and growing field within clinical psychology and its implication in childhood maltreatment and its related outcomes across the lifespan.

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Chapter 2: Major Research Project

Dimensional approach to childhood adversity and the association with executive and reflective functioning in adulthood

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Plain Language Summary

Title: Dimensional approach to childhood adversity and the association with executive and reflective functioning in adulthood.

Background

Experiencing difficult life events during childhood increases the risk of developing both physical and mental problems in later life. Recent research suggests that these experiences are also associated with brain development well into adulthood, influencing key abilities such as shifting attention, problem solving, processing information, and understanding both our own and others' thoughts and emotions. This study aims to explore whether different types of adversity have distinct associations with these cognitive and social abilities.

Aims and Questions

This study aimed to investigate links between individuals' cognitive abilities and functioning based on the types of adversity experienced during childhood.

Method

Participants: Adults recruited from the general population and a community mental health team.

Recruitment: An anonymous survey was advertised online and within an adult community mental health team.

Study design: The online survey consisted of eight different questionnaires relating to childhood and adulthood adversity, social and cognitive functioning and mental health outcomes (anxiety and depression).

Main Findings and Conclusions

Responses from 119 adults were analysed. The study found links between experiences of adversity in childhood, such as abuse or neglect and important cognitive abilities, including problem solving, decision-making and planning. This in turn impacts the ability to understand both one's own thoughts and emotions, as well as those of others. These results emphasize the importance of assessment and interventions tailored to target such abilities, to support individuals who have experienced early life adversity.

Abstract

Background: It is proposed that the different dimensions of childhood adversity, threat and deprivation, have different impacts on important cognitive functions that support higher order thinking and reflection – executive and reflective functioning. The association between dimensions of childhood adversity and domains of reflective functioning (RF) are yet to be explicated. One important indirect pathway could be through executive functioning (EF).

Objective: This study investigated the mediating effect of EF on the relationship between exposure to threat and deprivation-based childhood maltreatment, abuse and neglect respectively, and domains of RF, in an adult population. The two RF domains included uncertainty and certainty.

Participants and Setting: A sample of 119 adults were recruited from the general population and participating clinics.

Method: Participants completed an online survey with questionnaires measuring childhood maltreatment, difficulties in EF and RF. Correlational and mediation analyses were conducted to examine the direct and indirect associations between variables.

Results: Abuse had stronger direct and indirect associations than neglect. Difficulties in EF mediated the relationship between both dimensions of childhood maltreatment and higher uncertainty in RF (indirect effects ranged between 0.17 and 0.33, all *ps* <.05). On the other hand, difficulties in EF significantly mediated the relationship between abuse and neglect and lower certainty in RF (indirect effects ranged between -0.12 and -0.25, all *ps* <.05).

Conclusions: Abuse and neglect are important distal risk factors for difficulties in RF, especially through EF. Considerations for the conceptualization and measurement of certainty in RF are also notable with important clinical and research implications.

Keywords: Reflective functioning, RFQ, executive functioning, childhood maltreatment, mentalizing

Introduction

There is an established association between adverse childhood experiences (ACE) and long-term negative sequelae of psychological and physical health outcomes (Felitti et al., 1998). ACEs including child maltreatment such abuse and neglect in addition to peer victimization, poverty and exposure to community violence are all associated with long term negative outcomes such as heart and liver disease, substance abuse, depression and suicide (Finkelhor et al., 2015; Letkiewicz et al., 2021). In addition to impacts on psychological and physical outcomes, neurobiological changes are also linked to childhood adversity (Teicher & Samson 2016). A review paper by McCrory et al. (2022) demonstrated that alterations in neurobiology following childhood adversity increase individuals' risk of developing a psychiatric disorder. Specifically, deficits in neurocognitive processes as a function of early adversity such as emotion regulatory skills and executive functioning (EF) have been proposed to underlie negative impacts on psychopathologies, risk behaviours, and academic difficulties (Sheridan et al., 2017). Therefore, it is important to understand how history of childhood adversity and neurocognitive processes like EF impact on relevant outcomes in adulthood, such as reflective functioning (RF) – the ability to reflect on both one's and others mental states, (Choi, 2023).

Associations between childhood adversity and executive functioning

EF include several mental top-down processes involved in goal directed behaviour (Lund et al., 2022). Research suggests that EF consists of three core components which are, inhibitory control, working memory and cognitive flexibility, that underlie our abilities to perform higher order cognitive functions such as reasoning, problem solving and planning (Diamond, 2013).

There is a large body of literature focused on the impacts of early adversity on EF across the life span. The prefrontal cortex, a region implicated in EF development and function, is characterized by a prolonged maturation process, continuing into early adulthood (Lund et al., 2022), with evidence for an association between childhood adversity and EF impairments or difficulties across adolescence well into adulthood. A meta-analysis by Op den Kelder et al. (2018) reported that exposure to adversity during childhood was associated with lower levels of EF, with a small to medium effect size across all three domains of EF in young people ranging from ages 2-25 years. Letkiewicz et al. (2021) found that experiences of maltreatment during childhood predicted poor self-reported EF outcomes and performance on a working memory task in a population of young adults aged 18-22 years old.

Furthermore, more recent systematic reviews conducted found support for associations between childhood adversity and impairments in EF in early and middle adulthood (Lund et al., 2022; Rosa et al., 2023).

Associations between executive functioning and reflective functioning

EF is implicated in self-regulation skills, social competencies, emotional regulation (Lund, et al., 2022) and other higher order processes such as reflective functioning (Stien & Kendall, 2014). Reflective functioning (RF) is defined as the ability to mentalize which is considered an important skill in affect regulation (Kristiansen et al., 2020) and is therefore an important target in psychological interventions. Mentalization (also referred to as RF) is an individual's ability to understand both themselves and others, in relation to thoughts, emotions and behaviours (Fonagy et al., 2002). It is hypothesised that deficits in the core components of EF, such as poor working memory, and/or inhibitory control may impact successful manipulation of information, therefore impacting RF skills (Kristiansen et al., 2020).

RF deficits can be divided into two main categories, certainty in RF and uncertainty in RF (Kristiansen et al., 2020). Uncertainty in RF is a style is characterized by hypomentalizing, which is a concrete and rigid mentalizing style, in which individuals are unable to incorporate complex ways of understanding both their own and others' mental states (Benzi et al., 2023). Certainty in RF also referred to as hypermentalizing, is type of RF in which an individual is certain that their view of the world is the complete truth therefore leading to a lack of mentalising or consideration of others states of mind (Allen & Fonagy, 2006). Extreme certain and uncertain RF is viewed as problematic, as it indicates a difficultly or failure in the ability to consider ambiguity of mental states (Kristiansen et al., 2020). However, more recent empirical research has suggested that certainty in RF represents an adaptive component of RF, particularly in non-clinical samples (Schwarzer et al., 2021), as opposed to a deficit as originally proposed by Fonagy et al. (2016).

Empirical research to date has yielded varied results in the association between childhood maltreatment and deficits in RF, with some reporting significant associations and others non-significant findings (Garon-Bissonnette et al., 2023). For example, a study conducted by Chiesa & Fonagy (2014) demonstrated an association between both abuse and neglect and with decreased RF capabilities generally. A recent review by Yang & Huang (2024) examined the association between childhood maltreatment generally and mentalizing in an adult sample. Findings revealed a strong association between childhood maltreatment and uncertainty in RF

(hypomentalizing) but did not yield a strong association between certainty in RF (hypermentalizing) and childhood maltreatment. Part of this variation in findings could be attributed to the domain of RF examined. Another important consideration for explicating differential effects is by considering the type of exposure and the potential for an indirect pathway between exposure to early adversity and RF through impacts on EF. The dimensional approach to childhood adversity and psychopathology is one framework that can help us explore such effects.

Dimensional approaches to childhood adversity and psychopathology

The dimensional model of adversity and psychopathology (DMAP; Mc Laughlin, et al., 2014), distinguishes between two types of adversity, experiences of deprivation and experiences of threat. This alternative model proposes that while deprivation and threat experiences in childhood do not typically occur independently, they have distinct impacts on cognitive and emotional outcomes (Mc Laughlin et al., 2014). Specifically, this model proposes that exposure to deprivation, which is characterized by absences of social and cognitively stimulating opportunities for learning (e.g., neglect), is associated with disruptions in learning and memory, including development of EF (Sheridan et al., 2017). Whereas exposure to threat, characterized by experiences of harm or threat of harm (e.g., physical and sexual abuse), is associated with disruptions in emotional development (Sheridan et al., 2017). A study by Gould et al. (2012) examined the impacts of various early life adversities including threat-based maltreatment types (physical, sexual, and emotional abuse) and deprivation-based maltreatment (i.e., emotional and physical neglect) on cognitive functioning, including EF. Whilst both abuse and neglect exerted negative impacts on EF, abuse demonstrated a slightly stronger effect overall (Gould et al., 2012).

Additionally, in the recent review by Rosa et al. (2023), a history of physical neglect showed the greatest negative impacts on all cognitive domains including EFs, whereas emotional abuse was associated with poorer working memory within non-clinical samples. As the evidence base for the distinct associations between threat based versus deprivation-based forms of adversity on EF continues to grow, further investigation with varied adult populations with histories of adversity is warranted.

Association between executive and reflective functioning and childhood adversity

As outlined in previous sections, there are clear associations between exposure to various childhood adversity and impairments in EF. Similarly, associations between deficits in RF and childhood maltreatment have been reported (see Chapter 1 for comprehensive review in addition to Yang & Huang (2024), meta-analysis). Considering the role of EF in the development of higher order processes such as RF it is hypothesized that EF may mediate the relationship between these experiences and subsequent impacts on RF. A recent study by Kristiansen and colleagues (2020) investigated the associations among impairments in EF and difficulties in RF as a function of histories of childhood adversity within a sample of mothers with substance abuse disorder. Findings from this study suggest poorer uncertainty in RF in mothers who reported prominent levels of childhood adversity. As such, this study provides initial evidence for potential indirect pathway from early adversity to uncertainty in RF via EF deficits.

In summary, understanding potential impacts on cognitive processes associated with EF and RF has important clinical implications in supporting individuals with histories of adversity. Furthermore, given that difficulties in EF are present across several psychopathologies, research is beginning to consider it from a transdiagnostic perspective. Therefore, expanding our understanding of difficulties in processes such as EF and RF and their association within this population is imperative in considering the role of specific interventions to improve these processes across a range of psychopathologies.

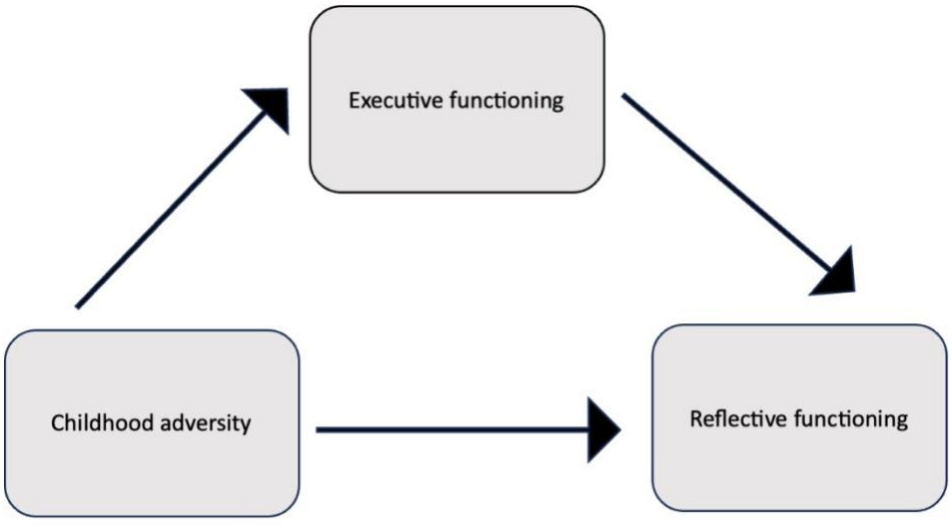
Aims & Research Question

The aim of this study was to investigate the associations between childhood adversity and related outcomes of EF and RF using the threat and deprivation framework. To further characterize this, the study aimed to examine whether an indirect pathway exists from adversity to two domains of RF through EF. To do this, childhood maltreatment was considered as the childhood adversity, with abuse and neglect as the threat and deprivation dimensions, respectively. To illustrate this relationship, a diagram is included (Figure 1).

The following research questions are proposed;

1) Are executive functioning abilities and reflective functioning differentially associated with threat based versus deprivation-based adversity?
2) Is the association between deficits in reflective functioning and childhood adversity (threat-based versus deprivation-based) mediated by deficits in executive functioning?

Figure 1 A schematic illustration of the mediation model



Design, Methods & Procedures

Design and Recruitment

The current study utilized a quantitative, cross sectional, research design using an online survey. Adults over the age of 18 were eligible to participate. Potential participants were recruited through South Ayrshire Community Mental Health Team (CMHT), including those actively engaged with the Psychology service, and from the general population. Recruitment was open from September 2024 until December 2024.

Individuals engaged with Psychology and/or are waitlisted to see Psychology through South Ayrshire CMHT were invited to participate in the study. Initial contact was made by the service, via posting a letter inviting those individuals to take part. Included in this letter was a QR code/study link with online information sheet and consent form. Pamphlets with study QR code were also posted in waiting rooms in the service. Participants from the general population were recruited through sharing the study link/QR code online on social media platforms (e.g., Facebook, Instagram) and with third sector mental health organisations (e.g., charities) or community centres.

Participants and Procedures

Participants completed an online questionnaire via Qualtrics (www.Qualtrics.com) consisting of eight separate questionnaires. Prior to completing the questionnaires, participants were provided with information about the purpose of the research and informed of the voluntary and anonymous nature of the study. Following this, participants were directed to an online consent form, in which they indicated if they wished to proceed and take part in the research.

There was a total of 219 registered responses online, 87 of whom were disregarded as they did not attempt any of the measures. A further 13 were excluded as they did not complete any of the outcome measures. The final sample comprised of 119 participants (101 females, 14 males, 4 non-binary), aged between 19-70 years old (M = 32.56, SD = 9.196). Of the 119 final participants, 90 participants (75.6%) were recruited via social media, five (4.2%) were recruited via a third sector organisation, 19 (16%) participants were recruited through other means, and five (4.2%) were recruited via the CMHT. Seventy-eight participants (65.5%) reported that they were not currently engaged and/or on the waitlist for mental health services, 35 (29.4%) participants were currently engaged with mental health services and six (5%) participants were currently waitlisted for mental health services.

Measures

Primary study measures

Childhood maltreatment. To assess childhood maltreatment prior to age 18 years, participants completed a combination of selected items and subscales from both The Maltreatment and Abuse Chronology of Exposure (MACE) Scale (Teicher & Parigger, 2015) and the Multidimensional Neglectful Behaviour Scale (MNBS) Form A (Adolescent and Adult recall version) – Short Form (Straus et al.,1995). Both scales are recommended as appropriate measures using a dimensional approach to maltreatment, as outlined in a recent paper by Berman et al. (2022) and are freely available for research purposes. The MACE is a 52 item self-report measure used to measure exposure to maltreatment retrospectively with adults. The MACE assesses for 10 different types of adverse experiences in childhood. For this study, exposure to threat-based maltreatment was measured using the following subscales and their associated 21 questions were included; parental physical maltreatment, parental verbal abuse; sexual abuse; witnessing interparental violence. Total scores were calculated by summing scores from the four subscales, with a possible range of 0 to 21. Higher total scores indicated greater exposure to threat based maltreatment. The MNBS is a retrospective self-report measure on experiences of neglect/deprivation. The 8-item short form (which is recommended for research purposes) of the MNBS was administered and total scores were calculated based on responses ranging from 0-8, with higher scores indicating higher experience of deprivation based maltreatment. A total for childhood maltreatment was calculated by combining totals for MACE and MNBS.

Executive functioning. To measure everyday difficulties in EF, the 20-item self-report Dysexecutive Questionnaire was used (DEX; Wilson, 1996). A total score is calculated with scores ranging from zero to 80, with higher scores indicating higher levels of EF difficulties. This is a well validated measure with support for its reliability and validity (Shaw et al., 2015).

Reflective functioning. This was measured using the Reflective Functioning Questionnaire (RFQ-8) (Fonagy et al., 2016). The RFQ-8 measures the degree of certainty and uncertainty of an individual's knowledge of their own and others' mental state. The RFQ-8 is the short form, adapted from the original RFQ, with established evidence of its scores' reliability and validity across both clinical and non-clinical adult populations (Fonagy et al., 2016). A high score on the RFQ-C subscale indicates hypermentalization (certainty in RF) and a high score on the RFQ-U subscale indicates hypomentalization (uncertainty in RF), while a low score on each

dimension indicates a more effective mentalizing ability (Cucchi et al., 2018). Nonetheless, as noted in the introduction, recent empirical evidence suggests that RFQ-C as measured by the RFQ-8 represents an adaptive feature of RF (De Meulemeester et al., 2018; Morosan et al., 2020 ; Schwarzer et al., 2021).

Secondary measures[1]

Adult adversity. The Trauma History Screen was used to assess exposure to adverse and traumatic life events in adulthood (over age of 18) (THS; Carlson et al., 2011). The THS is a brief and easy to administer self-report measure which assesses the occurrence and frequency of 12 types of exposure. Measurement properties including reliability and validity of scores were suggested to be comparable to longer measures of trauma (Carlson et al., 2011).

Mental health. A general screening measure of depression was included, using the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). This is a short screening tool for depression which is widely used in research studies and is free and quick to administer, with good psychometric properties. Clinical cut-off ranges are; 0-4 is minimal, 5-9 is mild. 10-14 is moderate, 15-19 is moderately severe and 20-27 is severe levels of depression. The Generalised Anxiety Disorder Questionnaire was also used to screen for generalized anxiety (GAD-7; Spitzer et al 2006). Clinical cut-off ranges are; 0-4 minimal, 5-9 mild, 10-14 moderate and 15-21 is severe anxiety.

Participants completed questionnaires in the following order 1) Demographic information; 2) The Trauma History Scale; 3) MACE; 4) MNBS; 5) DEX; 6) Reflective Functioning Questionnaire- 8 –; 7) GAD-7; and 8) PHQ-9.

[1] Due to study necessitating recruitment from the general population, secondary measures were included to characterize overall levels of adult trauma and mental health symptoms to ensure variability in the sample recruited. Those measures are not included in the main analysis.

Ethics, Governance and Data Protection

Ethics approval was granted through IRAS process and by NHS Ayrshire & Arran R&D department (Appendices F & G).

The online questionnaire was anonymous and required participants to provide informed, online consent prior to commencing. Participants were informed that as data was anonymous and unidentifiable, it would not be possible to access it and withdraw it once their questionnaires were submitted. The results of the questionnaires were exported as Microsoft Excel files and all data files were stored on a secure University of Glasgow One Drive server. All storage and processing of participant data was conducted in accordance with University of Glasgow and GDPR guidelines.

Analysis

Analysis was conducted using SPSS (IBM, Version 29.0.2.0. (20)). Preliminary screening of data was conducted, and descriptive statistics were generated for variables of interest (See Table 1 for details). Visualised histograms and scatterplots were also generated to assess for normality and linearity, respectively. Levels of depression, generalized anxiety symptoms and exposure to adulthood trauma were used for descriptive purposes. The pairwise approach to handling missing data was used, meaning all available data per participant were utilized in estimating associations to maximize the use of available data.

Due to high levels of exposure to both types of maltreatment in the sample, instead of conducting t-tests to compare groups exposed to neglect vs those exposed to abuse, bivariate Pearson correlations were conducted to assess the strength of the associations between abuse and neglect and relevant variables. For the second research question, simple mediation model analysis was carried out using the PROCESS programme, as outlined by Hayes (2022). Six separate mediation models were conducted with EF deficits as mediator with three separate exposures (total child maltreatment, abuse, and neglect) and two separate RF domains (uncertainty and certainty).

Mediation analysis was carried out using the PROCESS tool for SPSS (Hayes, 2022), using Model 4 for simple mediation analyses, using bootstrapping. For each simple mediation model, the X variable was the independent variable and was defined as childhood maltreatment, neglect (deprivation based) or abuse (threat based). The M variable (mediator variable) was difficulties in EF and remained the same across all models. The Y variable was the dependent variable which was defined as either uncertainty or certainty in RF. Each of these variables

were entered into the PROCESS tool and the number of bootstrapped samples generated to estimate direct and indirect associations was set to 5000.

Sample size

To ensure the study was well powered, a required sample size was determined a priori based on the simulation analysis for mediation models as outlined by Fritz & MacKinnon (2007). Previous research was consulted, which indicated a small to moderate effect size for the association between childhood maltreatment and EF and a moderate effect size between EF and RF. Based on sample size guidelines reported by Fritz & MacKinnon (2007), with effect sizes of approximately 0.26 to 0.29 for path a (mediator regressed on predictor) and 0.40 to 0.47 for path b (outcome regressed on mediator), it was estimated that a sample size of 117 participants was required.

Results

Descriptive statistics and correlations

Analysis was conducted on a total of 119 participants who had completed outcome measures. Descriptive statistics for main study variables are presented in Table 1. Histograms were visually inspected for all variables with no concerns noted with regards to significant deviations from normality.

In total, 57 participants (47.9%) scored above the clinical cut off for depression and 48 participants (40.3%) scored above the clinical cut off for generalized anxiety. Considering maltreatment generally, including both abuse and neglect experiences, one hundred and seventeen participants reported experiencing maltreatment (98.3%), leaving two participants who did not report experiencing abuse or neglect. In addition, on average, participants reported exposure to two or more adult adversities. These findings highlight the variability in terms of severity of mental health symptoms and exposure to childhood and adulthood adversity in this sample of adults.

Table 1

Descriptive statistics for variables in the study

	N	Mean	Standard deviation	Maximum	Minimum
THS	119	2.62	1.98	9.00	.00
Neglect	118	4.54	1.38	8.00	.00
Abuse	118	4.90	4.03	20.00	.00
Depression	119	9.47	6.82	27.00	.00
Anxiety	119	8.30	5.68	21.00	.00
EF	117	26.33	13.64	72.00	2.00
RF uncertainty	119	.77	0.62	2.67	.00
RF certainty	119	.99	0.79	3.00	.00

Note. THS = Adult Trauma History scale, RF uncertainty = Uncertainty in reflective functioning, RF certainty = certainty in reflective functioning.

Table 2 presents the Pearson's correlations among all variables. All scatterplots were inspected and no concerns with linearity noted. Difficulties in EF were significantly associated both with abuse and neglect, with a stronger association noted with abuse (moderate) than with neglect (small). Similarly, difficulties in EF were also associated with exposure to trauma in adulthood (THS). Significant, small positive associations were found between both abuse and neglect and uncertainty in RF, but neither abuse nor neglect were significantly correlated with certainty in RF. Difficulties in EF was moderately to strongly associated with greater uncertainty in RF and moderately associated with less certainty in RF. As would be expected childhood abuse was significantly positively associated with adult adversity and with anxiety and depression symptoms, whereas childhood neglect was only significantly positively correlated with adult adversity.

Table 2

Pearson correlations between main study variables

	1	2	3	4	5	6	7	8
1. Abuse	-			.				
2. Neglect	.25**	-						
3. EF	.46**	.26**	-					
4. RF uncertainty	.22*	.18*	.68**	-				
5. RF certainty	-.15	-.12	-.49**	-.73**	-			
6. Anxiety	.24*	.017	.51**	.41**	-.31**	-		
7. Depression	.21*	-.07	.50**	.37**	-.29**	.79**	-	
8. THS	.49**	.19*	.37**	.24**	-.13	.32**	.37**	-

** $p < 0.01$, * $p < 0.05$

Note. THS = Trauma History scale, RF uncertainty = Uncertainty in reflective functioning, RF certainty = certainty in reflective functioning.

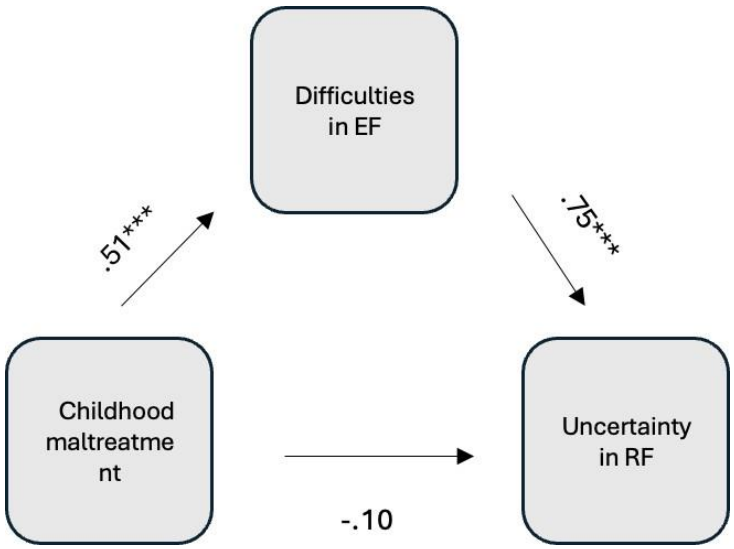
Mediation analysis

To address the second research question six separate mediation models were conducted. Bootstrapping was used to estimate the indirect effect within each mediation model. The direct standardized effects are noted in Figures 2 through 7. The unstandardized coefficients are noted in Appendix 4.

Model 1

The first model assessed the indirect effect of total exposure to total childhood maltreatment (X) on uncertainty in RF (Y) through difficulties in EF (M). The sample consisted of 115 participants. The overall model explained 46.1% of the variance in uncertainty in RF (R^2 = 0.46, F(2,112) = 47.97, p < .001). As seen in Figure 2, the direct effect of total childhood maltreatment on uncertainty in RF was non-significant when controlling for difficulties in EF, which was significantly, uniquely positively correlated with uncertainty in RF. The completely standardized indirect effect was moderate in strength and positive 0.37, SE = 0.06, and significant 95% CI [0.24, 0.49].

Figure 2 Mediation Model 1

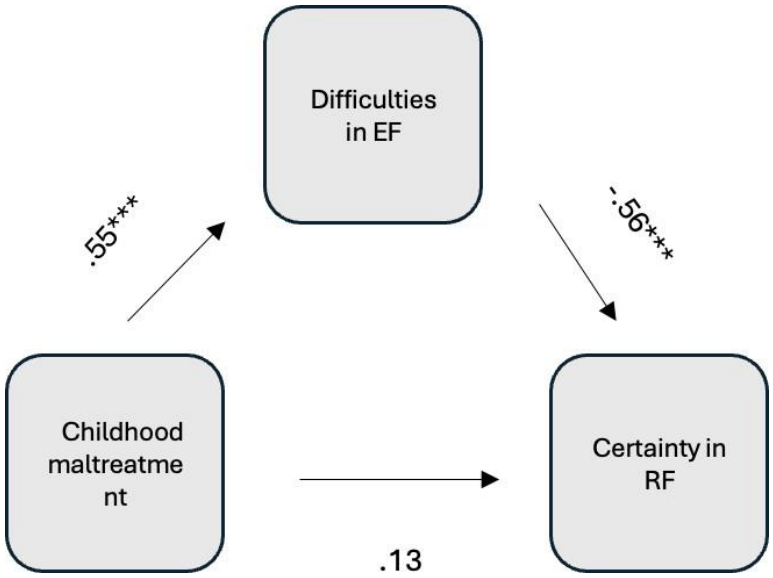


*** p < 0.001, * p < 0.05

Model 2

The second model assessed the indirect effect of total exposure to total childhood maltreatment on certainty in RF through difficulties in EF. The predictor variable was childhood maltreatment total (X), the mediator was difficulties in EF (M), and the outcome variable was certainty in RF (Y). The sample consisted of 115 participants. The overall model explained 25.2% of the variance in certainty in RF $R^2 = 0.25$, $F(2,112) = 18.91$, $p < .001$). As seen in Figure 3 the direct effect of childhood maltreatment on certainty in RF was non-significant after controlling for difficulties in EF, which was significantly, uniquely positively correlated with certainty in RF. The completely standardized indirect effect was small in strength and negative, -0.28, SE = 0.05, and significant 95% CI [-0.39, -0.17].

Figure 3 Mediation Model 2

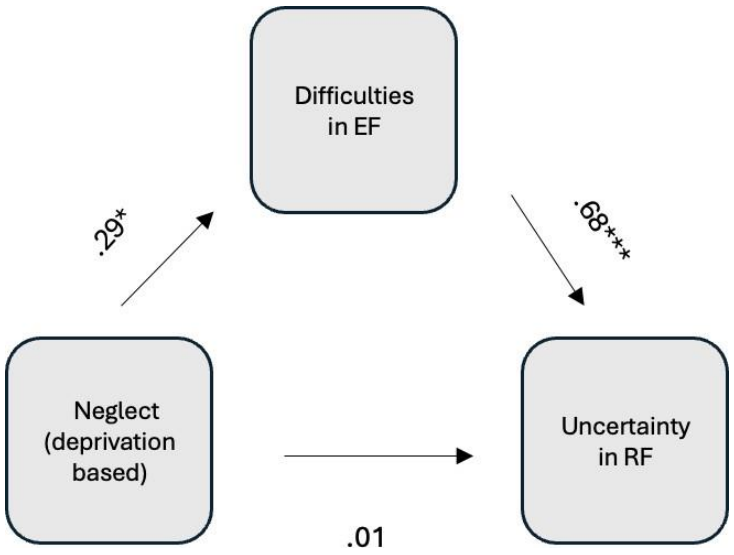


*** $p < 0.001$, * $p < 0.05$

Model 3

The third model assessed the indirect effect of exposure to neglect (deprivation-based maltreatment) on uncertainty in RF through difficulties in EF. The predictor variable was total score on the neglect scale (X), the mediator was difficulties in EF (M) and the outcome variable was uncertainty in RF (Y). The sample consisted of 116 participants. The overall model explained 46.7% of the variance in uncertainty in RF ($R^2 = 0.46$, $F(2,113) = 49.50$, $p < .001$). As seen in Figure 4, the direct effect of neglect on uncertainty in RF was non-significant after controlling for difficulties in EF, which was significantly, uniquely positively correlated with uncertainty in RF. The completely standardized positive indirect effect was significant and small in strength at 0.17, SE = 0.08, 95% CI [0.00, 0.35].

Figure 4 Mediation Model 3

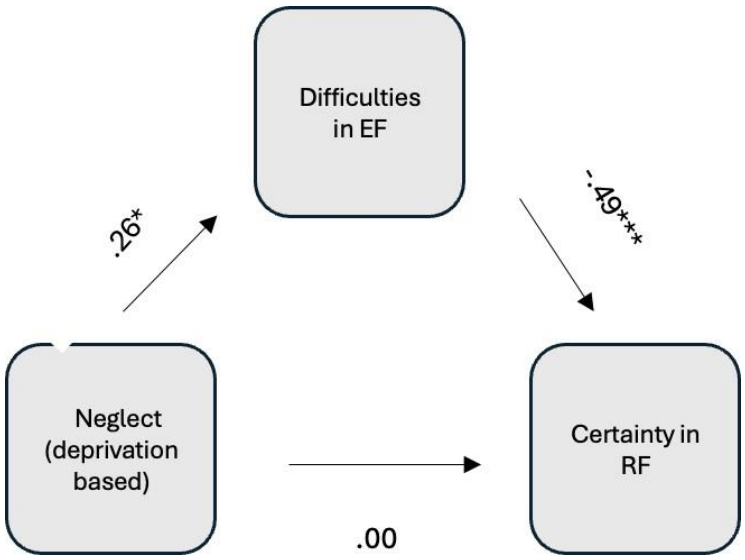


*** $p < 0.001$, * $p < 0.05$

Model 4

This model assessed the indirect exposure of neglect (deprivation-based maltreatment) on certainty in RF through difficulties in EF. The predictor variable was total score on the neglect scale (X), the mediator was difficulties in EF (M), and the outcome variable was certainty in RF (Y). The sample consisted of 116 participants. The overall model explained 24.08% of the variance in certainty in RF ($R^2 = 0.24$, $F(2,113) = 17.92$, $p < .001$). As seen in Figure 5, the direct effect of neglect on certainty in RF was non-significant after controlling for difficulties in EF, which was significantly and uniquely negatively correlated with certainty in RF. The completely standardized indirect effect was small in strength and negative, -0.12, SE = 0.07, and significant 95% CI [-0.27, -0.00].

Figure 5 Mediation Model 4

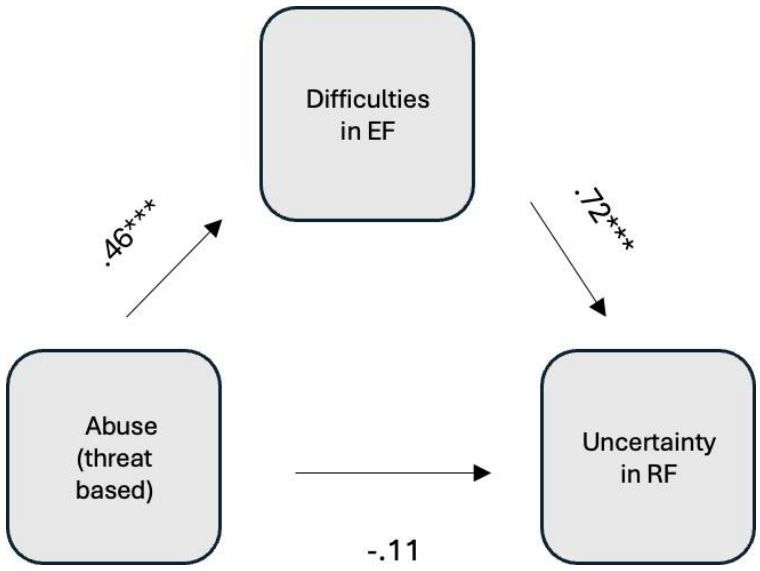


*** $p < 0.001$, * $p < 0.05$

Model 5

This model assessed the indirect effects of abuse (threat-based maltreatment) on uncertainty in RF through difficulties in EF. The predictor variable was total score on the abuse scale (X), the mediator was difficulties in EF (M), and the outcome variable was uncertainty in RF (Y). The sample consisted of 116 participants. The overall model explained 46.09% of the variance in uncertainty in RF ($R^2 = 0.46$, $F(2,113) = 48.31$, $p < .001$). As seen in Figure 6, the direct effect of abuse on uncertainty in RF was non-significant after controlling for difficulties in EF, which was significantly, uniquely and positively associated with uncertainty in RF. The completely standardized indirect effect was moderate in strength and positive, 0.33, SE = 0.06, and significant 95% CI [0.21, 0.45].

Figure 6 Mediation Model 5

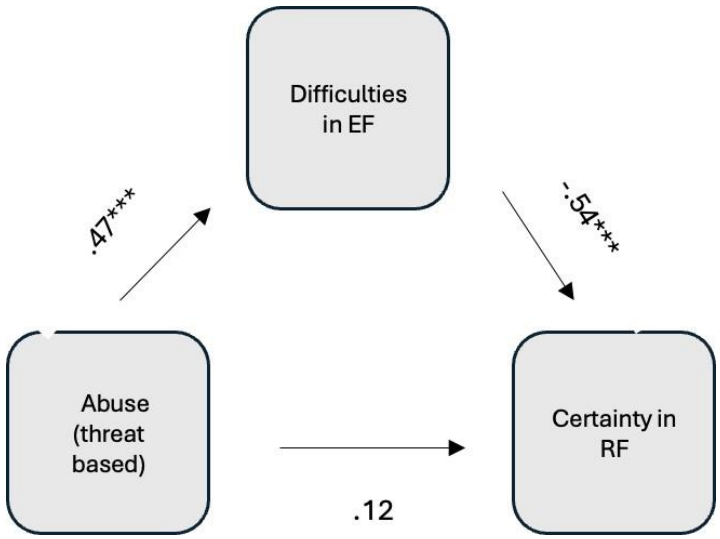


*** $p < 0.001$, * $p < 0.05$

Model 6

This model assessed the indirect effects of abuse (threat-based maltreatment) on certainty in RF through difficulties in EF. The predictor variable was total score on abuse scale (X) the mediator was difficulties in EF (M), and the outcome variable was certainty in RF (Y). The sample consisted of 116 participants. The overall model explained 24.68% of the variance in certainty in RF ($R^2 = 0.24$, $F(2,113) = 18.52$, $p < .001$). As seen in Figure 7, the direct effect of abuse on certainty in RF was non-significant after controlling for difficulties in EF, which was significantly, uniquely and negatively associated with certainty in RF. The completely standardized indirect effect was small in strength and negative -0.25, SE = 0.05, 95% and significant CI [-0.36, -0.15].

Figure 7 Mediation Model 6



*** $p < 0.001$, * $p < 0.05$

Discussion

General summary of findings

The current study sought to investigate whether threat-based (abuse) and deprivation-based (neglect) maltreatment had differential associations with EF and certainty and uncertainty in RF. We also examined if EF mediated the relationship between total childhood maltreatment and difficulties in RF. Specifically, we considered whether differential indirect effects existed between threat-based and deprivation-based maltreatment and subcomponents of RF (i.e., certainty and uncertainty in RF) through EF. Overall, findings suggest that both threat and deprivation-based maltreatment are significantly associated with difficulties in EFs, with stronger associations with threat versus deprivation-based maltreatment. In terms of RF, threat and deprivation-based maltreatment were directly and indirectly associated with higher uncertainty in RF, with similar effects. On the other hand, both threat and deprivation-based maltreatment were indirectly associated with lower certainty in RF, with no significant direct associations found. These findings make an important contribution to the growing evidence base linking different types of childhood maltreatment with various cognitive outcomes across adulthood, with the implications discussed below.

Childhood maltreatment, executive functioning, and reflective functioning

The current findings support the association between experience of childhood maltreatment and difficulties in EF in adulthood. Findings suggested that increased experience of childhood maltreatment generally was associated with increased difficulties in EF. This finding is largely in line with previous research with both clinical and non-clinical samples (Rosa et al., 2023). The current study sought to further characterize the association with specific types of maltreatment, both threat-based and deprivation-based. Findings indicate that both types of maltreatment were uniquely associated with EF difficulties, with stronger effects noted with threat-based exposure, consistent with findings from Gould et al. (2012). Research that has found similar effects hypothesized that exposure to threat-based experiences leads to hypervigilance for danger which in turn negatively impacts on working memory, a domain of EF (Steele, 2002; Clinchard et al., 2024). Overall, these findings are consistent with previous research (Gould et al., 2012), however some studies suggest that deprivation-based exposure leads to stronger deficits in EF (Sheridan et al., 2017).

One consideration for the differences in findings is the overlap of experiences of threat and deprivation-based maltreatment, leading to difficulties detangling their effects. Indeed, the majority of the current sample reported exposure to at least one type of neglect and one type of abuse. Therefore, controlling for and comparison of individuals who only experienced one type, (either threat or deprivation) was not possible. Another consideration is that studies which found greater impacts of deprivation on EF, considered more extreme forms of deprivation. Indeed, it was previously highlighted that impacts of deprivation (e.g., neglect) are more easily detected in groups with extreme forms of prolonged deprivation (Clinchard et al., 2024). Previous research has also highlighted the importance and role of parental difficulties in EF and subsequent increased risk of exposure to childhood maltreatment and potentially maladaptive parenting responses (Crouch et al.,2021). Such parental variables may be an avenue for further research in exploring the association and impacts of parental dysexecutive functioning and subsequent EF difficulties for their children in later life. A final important consideration is the variation across studies in the domains of EF assessed and their measurement, which introduce another layer of variability that may lead to differences in findings. Understandably, with heterogeneity across studies, research remains mixed for the differential effects and requiring further investigation (Clinchard et al., 2024).

In this study, EF difficulties were consistently moderately to strongly associated with higher uncertainty in RF (i.e., deficits in RF), consistent with previous research (Kristiansen et al., 2020). This finding makes an important contribution to the link between EFs an underlying mechanism involved in RF, suggesting that where difficulties in EF occur this may negatively impact on abilities in RF. Similarly, both types of maltreatment were significantly, positively associated with uncertainty in RF, which extends and replicates previous research (Schwarzer et al., 2021; Taubner et al., 2016). Such findings indicate that the development of capacities in RF can be at least partially understood by consistent, safe and sensitive interactions within the caregiver relationship. Hostile relationships with caregivers, characterized by experiences of both threat and deprivation, can be linked with difficulties in RF, including uncertainty in RF (Schwarzer et al., 2021). On the other hand, the results differed in relation to certainty in RF. A negative association was found between certainty in RF and difficulties in EF. This indicates that more difficulties in EF were associated with lower certainty in RF. In addition, neither threat nor deprivation-based maltreatment was significantly associated with certainty in RF. Such findings reflect empirical work that did not find a significant association between exposure to childhood maltreatment and certainty in RF, suggesting that certainty in RF is adaptive (Schwarzer et al., 2021).

Past research has highlighted challenges in consistently establishing a strong connection between childhood maltreatment exposure and poorer RF outcomes with robust empirical support (Garon-Bissonette et al., 2023). However, overall, more consistent effects were found between uncertainty rather than certainty in RF and childhood maltreatment (Garon-Bissonette et al., 2023), which is in line with findings from the current study in relation to maltreatment. Those are also reflected in the negative association between certainty and uncertainty domains in this study and the findings demonstrated in Chapter One, the meta-analytic review, wherein both abuse (i.e., threat based) and neglect (i.e., deprivation based) showed differential impacts with uncertainty and certainty in RF. Together these findings support the proposition that certainty in RF as it is currently measured is representative of an adaptive process. This is further evidenced in associations found between certainty in RF and other psychological outcomes. For example, a study by Morosan et al. (2019) found that certainty in RF was negatively associated with externalizing behaviours in young adults, with higher scores in certainty leading to lower externalizing difficulties. Furthermore, De Meulemeester et al. (2018), examined the impacts of a mentalization based intervention on deficits in RF, specifically certainty and uncertainty in RF. Results found that whereas uncertainty in RF changed as expected, certainty in RF remained unchanged following intervention, suggesting that certainty in RF may be more indicative of a genuine facet (adaptive) of RF. Finally, recent critique of the RFQ-8 measure used to assess certainty and uncertainty in RF (Fonagy et al., 2016), further speaks to these issues (Muller et al., 2022). Specifically, Muller et al. (2022) highlighted the need to reconsider both certainty in RF as a deficit and whether it is appropriately measured by RFQ-8. The current study provides additional evidence in support of our understanding of the relationship between childhood maltreatment generally and certainty in RF. It also poses important considerations and questions in how certainty is conceptualized and understood more broadly, including what level of certainty may be considered adaptive, which has significant research and clinical implications in terms of the measurement and treatment of RF.

Executive functioning as mediator between childhood adversity and reflective functioning

Most notably, findings from the mediation analyses provides further clarity of the relationship between childhood maltreatment, EF and subcomponents of RF. In summary, the path from childhood maltreatment to difficulties in RF is explained by difficulties in EF. Specifically, the indirect paths from both threat and deprivation-based maltreatment to higher uncertainty in RF and lower certainty in RF, were explained by difficulties in EF. It is our understanding that this is the first study to consider mediating effects of EF in the association between childhood

maltreatment subtypes and RF, which provides novel contribution to this expanding evidence base and our understanding of how childhood maltreatment may impact these processes. It appears then that childhood maltreatment is a distal risk factor that is associated with RF outcomes through EF. Greater difficulties with uncertainty in RF have significant clinical implications, which suggests that potentially targeting EFs in treatment could support the promotion of adaptive RF in populations with histories of maltreatment. For example, including the use of mentalization-based interventions to address these challenges and support individuals who have experienced childhood maltreatment (Schwarzer et al., 2021).

Strengths, limitations and future directions

The current study elucidates important pathways between threat and deprivation-based experiences and EF and RF separately. The study was well powered, meeting a priori sample size requirements. In relation to missing data, out of the total 119 participants, a maximum of two participants had missing data per variable and thus this was considered a very small amount of missing data, which was did not require exclusions of participants. Whilst it was planned to have a mixture of both clinical and non-clinical participants, due to unforeseen difficulties with recruitment, majority of the final sample was recruited from the general population. Nevertheless, the sample was varied in terms of engagement with mental health services, symptomatology and adversity. Of the total sample, 34.4% of participants indicated that they are currently engaged and/or waitlisted for mental health services. Furthermore, approximately half the sample reported clinical levels of anxiety or depression. This study then provides valuable insight into the relationship between these variables for those in the general population, who have experienced childhood maltreatment and may not be accessing mental health services. The current study did not control for level of mental health symptomatology as it was beyond the scope of this research. Future studies could consider controlling for such variables if interested in impacts of mental health symptoms on RF. In addition, although common in trauma literature, the majority of this sample consisted of female participants, limiting the generalizability of the findings to other groups.

As previously discussed, there is ongoing debate around the construct relating to certainty in RF and whether this is a true representation of a deficit in RF (Muller et al.,2022; Schwarzer et al., 2021). Establishing clarity is important as the RFQ-8 (Fonagy et al., 2016) is frequently used as a measure in research studies, which was reflected in the meta-analytic review in Chapter One. Indeed, this will also be important from a clinical perspective as well, particularly where interventions are being employed to improve RF capacities. Ensuring that deficits and

appropriate targets for intervention are identified and subsequently measured will be important for intervention efficacy studies, as demonstrated by De Meulemeester et al. (2017). As highlighted by De Meulemeester et al. (2018), an avenue for future research is to compare the subscale measure of certainty in RF (RFQ-C) with other established measures of hypermentalizing such as the Movie Assessment for Social Cognition (MASC; Dziobek et al., 2006; Sharp & Vanwoerden, 2015).

In addition, the use of self-report measures in the current study is considered a further limitation due to the reliance on retrospective self-reports. Nonetheless, this is commonplace in the trauma literature and those measures are considered reliable indices of such exposures and experiences (Berman et al., 2022). Additionally, research has highlighted the potential further exploration of other forms of threat-based and deprivation-based experiences beyond maltreatment would provide further clarity regarding their role in outcomes across adulthood. Finally, due to the correlational approaches used in the current study, causality and directionality cannot be assumed. Nonetheless, all associations measured were informed by strong theoretical and empirical evidence and represent an important starting point for future work in this area. Additionally, conducting multiple separate simple mediation models poses some limitations. For example, separate models do not allow for direct comparisons of effect sizes. An alternative approach is using Structural Equation Modelling (SEM) if one is interested in modelling and examining models with multiple predictors, mediators and/or outcomes. When this model is developed further, an SEM approach may be considered for future studies. Future research should consider longitudinal designs to assess the development of these processes across the lifespan. These types of designs will also further any casual inferences that can be made.

Conclusions and implications

In summary the present study, extends the current evidence base and highlights the associations between threat and deprivation-based childhood maltreatment, difficulties in EF and RF. Specifically, this study demonstrated that exposure to threat and deprivation-based maltreatment in childhood was associated with RF difficulties, which was mediated by difficulties in EF. These findings contribute to the expanding evidence base and our understanding of the potential underlying mechanisms which link the impacts of childhood maltreatment and difficulties in RF. Notably, there remains a need to clarify the construct of certainty in RF and how it is understood within the research. Our findings are in line with work suggesting this form of RF might be adaptive. These findings pose important clinical considerations, such as the promotion of mentalization based treatments for both clinical and

non-clinical populations who have experienced childhood maltreatment and showing deficits in RF. Additionally treatments to target EF difficulties, such as rehabilitation of specific EF domains and cognitive enhancement programs should be considered (Rosa et al., 2023), considering it is a strong correlate of RF and explains the association between childhood maltreatment and RF.

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Appendices

Appendix 1: Systematic Review Reporting Checklist

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Pg. 10
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Pg. 11
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pg. 12-14
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Pg. 14
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Pg. 15-16
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Pg. 15
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Pg. 84
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Pg. 15-16

Section and Topic	Item #	Checklist item	Location where item is reported
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Pg. 17
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Pg. 17-18
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Pg. 17
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Pg. 17
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Pg. 18
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Pg. 17-18
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Pg. 17
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Pg. 18
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	n/a
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Pg. 29-25
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	n/a
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Pg. 19
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Pg. 19
Study characteristics	17	Cite each included study and present its characteristics.	Pg. 20-25
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Pg. 20-25

Section and Topic	Item #	Checklist item	Location where item is reported
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Pg. 30-35
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Pg. 30-35
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Pg. 30-35
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	n/a
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	n/a
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	n/a
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pg 36-39
	23b	Discuss any limitations of the evidence included in the review.	Pg 38-39
	23c	Discuss any limitations of the review processes used.	Pg 38-39
	23d	Discuss implications of the results for practice, policy, and future research.	Pg 37-38
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Pg. 15
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Pg.15
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	
Competing interests	26	Declare any competing interests of review authors.	
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	n/a

Appendix 2: Systematic Review Search Terms

The following search terms were employed in title and abstract searches for the Ebscohost databases (PsychInfo, CINAHL,)

(MH "Child Abuse+") or (MH "Child Abuse, Sexual") or (MH "Adverse Childhood Experiences") or (MH "Child Welfare+") or (MH "Trauma+") or (MH "Emotional Abuse") or (MH "Abuse Recovery: Physical (Iowa NOC)") or (MH "Verbal Abuse")

TI ((child* n4 (abuse or neglect or maltreatment or welfare) or (domestic n1 violence) or advers* or (adverse n2 experience*))) OR AB ((child* n4 (abuse or neglect or maltreatment or welfare) or (domestic n1 violence) or advers* or (adverse n2 experience*)))

TI "reflective function*" OR AB "reflective function*" or (MH "Mentalization")

TI "mentali?ation" OR AB "mentali?ation"

The following search terms were employed in the title and abstract searches for the Ovid databases (Embase and Medline)

exp child abuse/ or (child* adj5 (abuse* or maltreat* or adversity* or welfare)).ti,ab. or exp childhood adversity/ or ((Adverse adj3 Child* Experience*) or ACE?).ti,ab. or trauma*.ti,ab.or ((physical* or emotion*) adj5 (abuse* or neglect*)).ti,ab. or ((sexual* or verbal or psychological) adj5 (abuse* or neglect*)).ti,ab. or exp incest/ or Incest*.ti,ab. or (sex adj5 (offenc* or child* or offens*)).ti,ab. or exp childhood trauma/ or (child* adj5 trauma*).ti,ab.

exp "theory of mind"/ or exp mentalization/ or (mentali#atoin or mentali#ing).ti,ab. or reflective function*.ti,ab.

The following search terms were employed in the title and abstract searches for Web of Science database

"child abuse" or (child* near/4 (abuse* or maltreat* or adversity* or welfare)) or "childhood adversity" or ((Adverse near/3 Child* Experience*) or ACE?) or "trauma" or ((physical* or emotion*) near/4 (abuse* or neglect)) or ((sexual* or verbal or psychological) near/4 (abuse* or neglect*)) or "incest" or (sex near/4 (offenc* or child* or offens*)) or "childhood trauma" or (child* near/4 trauma*)

"theory of mind" or "mentalization" or (mentali?atoin or mentali?ing) or
reflective function* or

The search terms were combined using AND. Truncations (*) were used to increase search sensitivity

Appendix 3: Major Research Project (MRP) Reporting Checklist

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	49
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	51
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	52-55
Objectives	3	State specific objectives, including any prespecified hypotheses	56
Methods			
Study design	4	Present key elements of study design early in the paper	57
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	57
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	57
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	58-59
Bias	9	Describe any efforts to address potential sources of bias	

Study size	10	Explain how the study size was arrived at	60-61
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	60
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	60
		(*b*) Describe any methods used to examine subgroups and interactions	60
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	57
		(b) Give reasons for non-participation at each stage	57
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	62
		(b) Indicate number of participants with missing data for each variable of interest	57
Outcome data	15*	Report numbers of outcome events or summary measures	63-70
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	63-70, Appendices

		(*b*) Report category boundaries when continuous variables were categorized	63-70
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	71-74
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	74-75
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	71-75
Generalisability	21	Discuss the generalisability (external validity) of the study results	74
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

Appendix 4: Unstandardized Results for Mediation Models

Model 1

The first model assessed the indirect effect of total exposure to childhood maltreatment (X) on uncertainty in reflective functioning (RF) (Y) through difficulties in executive functioning (EF) (M). The sample consisted of 115 participants. Results indicated that total childhood maltreatment significantly predicted difficulties in EF, B = 1.52, SE = 0.24, t(113) = 6.33, $p < .001$, 95% CI [1.04, 2.00]. This model explained 26.2% of the variance in difficulties in EF ($R^2 = 0.26$, F(1,113) = 40.09, $p < .001$). When difficulties in EF was entered as a predictor of uncertainty in RF, it was found to be a significant predictor, B = 0.03, SE = 0.00, t(112) = 8.99, $p < .001$, 95% CI [0.02, 0.04]. The direct effect of total childhood maltreatment on uncertainty in RF was non-significant when controlling for difficulties in EF, B = -0.01, SE = 0.01, t(112) = -1.25, $p = .2131$, 95% CI [-0.03, 0.00].

Model 2

The second model assessed the indirect effect of total exposure to total childhood maltreatment on certainty in RF through difficulties in EF. The predictor variable was childhood maltreatment total (X), the mediator was difficulties in EF (M), and the outcome variable was certainty in reflective functioning (Y). The sample consisted of 115 participants. Results indicated that childhood maltreatment significantly predicted totaldex, B = 1.52, SE = 0.24, t(113) = 6.33, $p < .001$, 95% CI [1.04, 2.00]. The model explained 26.2% of the variance difficulties in EF ($R^2 = 0.26$, $F(1,113) = 40.09$, $p < .001$). Difficulties in EF were found to be a significant negative predictor of certainty in reflective functioning, B = -0.03, SE = 0.00, t(112) = -5.86, $p < .001$, 95% CI [-0.04, -0.02]. The direct effect of childhood maltreatment on certainty in reflective functioning was non-significant after controlling for difficulties in EF, B = 0.02, SE = 0.01, t(112) = 1.39, $p = .1646$, 95% CI [-0.00, 0.05].

Model 3

The third model assessed the indirect effect of exposure to neglect (deprivation-based maltreatment) on uncertainty in RF through difficulties in EF. The predictor variable was total score on the neglect scale, the mediator was difficulties in EF (M), and the outcome variable was uncertainty in reflective functioning (Y). The sample consisted of 116 participants. Results indicated that total neglect significantly predicted difficulties in EF, B = 2.56, SE = 0.89, t(114) = 2.86, p = .0049, 95% CI [0.79, 4.33]. The model explained 6.73% of the variance in totaldex ($R^2 = 0.06$, F(1,114) = 8.23, p = .0049). When difficulties in EF was included in the model predicting uncertainty in RF, it was a significant predictor, B = 0.03, SE = 0.00, t(113) = 9.56, p< .001, 95% CI [0.02, 0.03]. The direct effect of neglect on uncertainty in RF was non-significant after controlling for difficulties in EF, B = 0.00, SE = 0.03, t(113) = 0.18, p= .8557, 95% CI [-0.05, 0.06].

Model 4

This model assessed the indirect exposure of neglect (deprivation-based maltreatment) on certainty in RF through difficulties in EF. The predictor variable was total score on the neglect scale (X), the mediator was difficulties in EF (M), and the outcome variable was certainty in RF (Y). The sample consisted of 116 participants. Results indicated that neglect significantly predicted difficulties in EF, B = 2.56, SE = 0.89, t(114) = 2.86, p = .0049, 95% CI [0.79, 4.33]. The model explained 6.73% of the variance in difficulties in EF (R^2 = 0.06, F(1,114) = 8.23, p = .0049). When difficulties in EF was included in the model predicting certainty in RF, it was a significant negative predictor, B = -0.02, SE = 0.00, t(113) = -5.79, p < .001, 95% CI [-0.03, -0.01]. The direct effect of neglect on certainty in RF was non-significant after controlling for difficulties in EF, B = 0.00, SE = 0.04, t(113) = 0.04, p = .9648, 95% CI [-0.09, 0.09].

Model 5

This model assessed the indirect effects of abuse (threat-based maltreatment) on uncertainty in RF through difficulties in EF. The predictor variable was total score on the abuse scale (X), the mediator was difficulties in EF (M), and the outcome variable was uncertainty in RF (Y). The sample consisted of 116 participants. Results indicated that abuse significantly predicted difficulties in EF, B = 1.55, SE = 0.27, t(114) = 5.60, p < .001, 95% CI [1.00, 2.10]. The model explained 21.56% of the variance in difficulties in EF (R^2 = 0.21, F(1,114) = 31.32, p< .001). When difficulties in EF was included in the model predicting uncertainty in RF, it was a significant positive predictor, B = 0.03, SE = 0.0036, t(113) = 9.25, p < .001, 95% CI [0.02, 0.03]. The direct effect of abuse on uncertainty in RF was non-significant after controlling for difficulties in EF, B = -0.01, SE = 0.01, t(113) = -1.36, p = .1752, 95% CI [-0.03, 0.00].

Model 6

This model assessed the indirect effects of abuse (threat-based maltreatment) on certainty in RF through difficulties in EF. The predictor variable was total score on abuse scale (X), the mediator was difficulties in EF (M), and the outcome variable was certainty in RF (Y). The sample consisted of 116 participants. Results indicated that abuse significantly predicted difficulties in EF, B = 1.55, SE = 0.27, t(114) = 5.59, p < .001, 95% CI [1.00, 2.10]. The model explained 21.56% of the variance in difficulties in EF (R^2= 0.21, F(1,114) = 31.32, p < .001). When difficulties in EF was included in the model predicting certainty in RF, it was a significant negative predictor, B = -0.03, SE = 0.00, t(113) = -5.86, p < .001, 95% CI [-0.04, -0.02]. The direct effect of abuse on certainty in RF was non-significant after controlling for totaldex, B = 0.02, SE = 0.01, t(113) = 1.26, p= .2078, 95% CI [-0.01, 0.05].

Appendix 5: MRP Approved Proposal (and most recent version)

Hosted online via Open Science Framework

Approved proposal: https://osf.io/nu85r/files/osfstorage/67b4bde7f6ddd865a50c7f1e

Most recent version: https://osf.io/nu85r/files/osfstorage/67b4be675485de84d419f248

Appendix 6: MRP Project Approval letter

NHS
Health Research Authority

North West - Haydock Research Ethics Committee
2 Redman Place
Stratford
London
E20 1JQ

03 May 2024

Dr Jala Rizeq
School of Health & Wellbeing
Clairce Pears Building, 90 Byres Road
Glasgow
G128TB

Dear Dr Rizeq

Study title:	**Dimensional approach to childhood adversity and the association with executive and reflective functioning in adulthood.**
REC reference:	**24/NW/0135**
IRAS project ID:	**336121**

Thank you for your letter of 3rd May 2024, responding to the Proportionate Review Sub-Committee's request for changes to the documentation for the above study.

The revised documentation has been reviewed and approved on behalf of the PR sub-committee.

Confirmation of ethical opinion

On behalf of the Research Ethics Committee (REC), I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Good practice principles and responsibilities

The UK Policy Framework for Health and Social Care Research sets out principles of good practice in the management and conduct of health and social care research. It also outlines the responsibilities of individuals and organisations, including those related to the four elements of research transparency:

1. registering research studies
2. reporting results
3. informing participants
4. sharing study data and tissue

Appendix 7: MRP Project Approval Letter (R&D Ayrshire & Arran)

NHS Ayrshire & Arran

Research & Development
56a Lister Street
University Hospital Crosshouse
Kilmarnock
KA2 0BB

Dr Jala Rizeq
School of Health & Wellbeing
Clairce Pears Building, 90 Byres Road
Glasgow
G128TB

Date 19 June 2024
Your Ref
Our Ref CM/KLB/CI 2024AA014 (PIC)

Enquiries to R&D Project Team
Extension 25850
Direct line 01563 825850
Fax 01563 825806
Email randdprojectteam@aapct.scot.nhs.uk

Dear Dr Rizeq

Dimensional approach to childhood adversity and the association with executive and reflective functioning inadulthood.

I confirm that NHS Ayrshire and Arran have received the undernoted documents and grant R&D Management approval for this organisation to act as a Participant Identification Centre for the above study.

Documents received:

Document	Version	Date
IRAS Form	6.3.6	08/04/2024
Protocol	1.0	26/02/2024
Ad with Logo	-	-
Participant invitation letter CMHT	1.0	12/02/2024
Participant information sheet patients general public	2.0	26/04/2024
Privacy notice	1.0	27/03/2024
Debrief form	1.0	27/03/2024
Consent Form	1.0	27/03/2024
Demographic information form	1.0	01/04/2024
Schedule of Events	1.0	03/04/2024
PIS Quality Standard Staff Checklist	-	-
DEX measure	-	-
Reflective Functioning Questionnaire	1.0	22/08/2016
Childhood Trauma Questionnaire Short Form	1.0	27/04/2024
Patient health questionnaire (PHQ-9)	-	-

The terms of approval state that the investigator authorised to undertake this study is: -

- Miss Nadine McLaughlin, Trainee Clinical Psychologist, NHS Ayrshire & Arran

Local Collaborator: -

- Miss Nadine McLaughlin, Trainee Clinical Psychologist, NHS Ayrshire & Arran

The sponsors for this study are University of Glasgow

This approval letter is valid until 30 June 2026

Appendix 8: MRP Participant Information Sheet and Consent Form

Hosted online via Open Science Framework

https://osf.io/nu85r/files/osfstorage/67b4be52b82da1055619fb15

Appendix 9: MRP Questionnaires

Web link hosted online via Open Science Framework

https://osf.io/nu85r/files/osfstorage/67b4be765485de84d419f24a

Appendix 10: MRP Data Analysis Plan

Web link hosted online via Open Science Framework

https://osf.io/nu85r/files/osfstorage/67b7535ec0db1e152fa549a6

Appendix 11: Records of Data Analysis Process – Syntax File

Web link hosted online via Open Science Framework

https://osf.io/nu85r/files/osfstorage/67b7536a12555352bba54bb6

Appendix 12: Data Availability Statement

The participants in this study did not provide written consent for their data to be shared publicly and therefore supporting data is not available.