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STUDY PROTOCOL

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Child maltreatment and resilience in adulthood: a protocol for a systematic review and meta-analysis

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ABSTRACT

Background: Although child maltreatment (CM) has been linked to health problems and poor psychosocial functioning, not all individuals exposed to CM develop or experience negative consequences later in life. This suggests that some individuals show resilience after being exposed to CM. However, conclusions have been limited by inconsistent findings across different CM subtypes and resilience domains.

Objective: To develop a protocol for conducting a systematic review and meta-analysis to quantify associations between CM (overall and its subtypes) and resilience (global and its multiple domains) in adulthood, and to examine moderators and mediators of these associations.

Method: PubMed, PsycINFO, Embase, Scopus, and Web of Science will be searched to identify relevant studies on the association between CM (exposure) and resilience (outcome) in adults (≥ 18 years). Data will be screened and extracted by at least two independent reviewers. The methodological quality of the included studies will be independently assessed with a modified version of the Newcastle–Ottawa Scale (NOS). If deemed viable, a meta-analysis will be conducted using a random effects model. Heterogeneity of evidence will be estimated with the I^2 statistic, and publication bias will be assessed. The effects of potential moderators (e.g. timing and severity of CM, age, sex, family cohesion, socio-economic status, country/region) will be analysed using meta-regression and subgroup analyses, and meta-analytical structural equation modelling will be employed to synthesise indirect mediation effects. Candidate moderators and mediators (e.g. genetic factors, brain functioning, attachment style, personality traits, physical activity, and social support) will be also examined qualitatively.

Conclusions: This protocol will facilitate a systematic review and meta-analysis that has the potential to enhance our knowledge about the association between CM exposure in early life and resilience in adulthood. Understanding associations and underlying mechanisms between CM and resilience is potentially important in informing prevention and interventions to sustain health and improve outcomes among adults with a history of CM.

PROSPERO registration: CRD42023394120.

Maltrato infantil y resiliencia en la adultez: un protocolo para una revisión sistemática y metanálisis

Antecedentes: Aunque el maltrato infantil (MI) se ha relacionado con problemas de salud y un pobre funcionamiento psicosocial, no todas las personas expuestas al MI desarrollan o experimentan consecuencias negativas a lo largo de su vida. Esto sugiere que algunos individuos muestran resiliencia después de haber estado expuestos al MI.

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PALABRAS CLAVE
Trauma infantil; negligencia; acoso escolar; estrés traumático; afrontamiento adaptativo; salud mental; funcionamiento resiliente; bienestar psicológico; apoyo social; adultos

关键词
童年期创伤；忽视；霸凌；创伤性应激；适应性应对；心理健康韧性功能；心理幸福感；社会支持；成人

HIGHLIGHTS

- In this study protocol, we propose to quantitatively summarise the existing literature on the relationship between child maltreatment and resilience with regard to mental health consequences and psychosocial functioning

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Objetivo: Desarrollar un protocolo para realizar una revisión sistemática y un meta-análisis para cuantificar las asociaciones entre el MI (total y sus subtipos) y resiliencia (global y sus múltiples dominios) en la edad adulta y examinar los moderadores y mediadores de estas asociaciones.
Método: Se buscará en PubMed, PsycINFO, Embase, Scopus y Web of Science para identificar estudios relevantes sobre la asociación entre MI (exposición) y resiliencia (resultado) en adultos (≥ 18 años). Los datos serán examinados y extraídos de forma independiente por al menos dos revisores. La calidad metodológica de los estudios incluidos se evaluará de forma independiente con una versión modificada de la escala Newcastle-Ottawa (NOS). Si es viable, se realizará un meta-análisis utilizando el modelo de efectos aleatorios. Se estimará la heterogeneidad de la evidencia con el estadístico I^2 y se evaluará el sesgo de publicación. Los efectos de potenciales moderadores (p. ej., comienzo, duración y severidad del MI, edad, sexo, cohesión familiar, estatus socioeconómico y país/región) se analizarán mediante meta-regresiones y análisis de subgrupos, y se emplearán modelos meta-analíticos de ecuaciones estructurales para sintetizar los efectos indirectos de mediación. Los posibles moderadores y mediadores (p. ej., factores genéticos, funcionamiento cerebral, estilo de apego, rasgos de personalidad, actividad física y apoyo social) también serán examinados cualitativamente.
Conclusiones: Este protocolo de revisión sistemática y meta-análisis tiene el potencial de incrementar el conocimiento sobre la asociación entre la exposición al MI en la edad temprana y la resiliencia en la adultez. Comprender las asociaciones y los mecanismos subyacentes entre el MI y la resiliencia tiene potencial importancia para informar programas preventivos y de intervención que promuevan una mejora en la salud y el funcionamiento en adultos con antecedentes de MI.
Registro en PROSPERO: CRD42023394120.

儿童虐待和成年后的心理韧性：系统综述和元分析方案

背景：尽管儿童虐待 (CM) 与健康问题和心理社会功能不良有关，但并非所有接触过 CM 的人都会在以后的生活中出现或经历负面后果。这表明一些人在接触 CM 后表现出心理韧性。 然而，由于不同 CM 亚型和心理韧性领域的不一致的发现，结论受到限制。
目的：制定一项系统综述和元分析方案，以量化成年期 CM（整体及其亚型）和心理韧性（整体及其多个领域）之间的关联，并考查这些关联的调节者和中介者。
方法：将检索 PubMed、PsycINFO、Embase、Scopus 和 Web of Science，以确定有关 CM 与成人心理韧性之间关系的相关研究。数据将由至少两名独立评审员筛选和提取。纳入研究的方法学质量将使用纽卡斯尔-渥太华量表的修改版本进行独立评估。如果认为可行，将使用随机效应模型进行元分析。将使用 I2 统计量估计证据的异质性，并评估发表偏倚。将使用元回归和亚组分析来分析潜在调节因素（例如 CM 的时间/严重程度、年龄、性别、家庭凝聚力、社会经济地位、国家/地区）的影响，并使用元分析结构方程模型用于综合间接中介效应。候选调节因素和中介因素（例如遗传因素、大脑功能、依恋风格、人格特征、身体活动和社会支持）也将进行定性考查。
结论：本方案将促进有可能增强我们对早期生活中 CM 暴露与成年心理韧性之间关系了解的系统综述和元分析。了解 CM 和心理韧性之间的关联和潜在机制对于为有 CM 病史的成人提供预防和干预措施以维持健康和改善预后具有潜在重要意义。

later in life.
- This preregistered systematic review and meta-analysis will establish the procedures to investigate associations between an overall classification of child maltreatment and its different associated subtypes, and a global/trait classification of resilience and its different domains in adults.
- This protocol will further determine the analytical approach to explore and summarise effect moderators and mediators of the association between child maltreatment and resilience in adulthood.
- The resulting synthesis, that will be based on this protocol, could enhance our understanding of the strength of the association between child maltreatment and resilience and inform prevention strategies and clinical interventions to improve health and psychosocial functioning in adult survivors.

1. Introduction

Approximately half of children worldwide experience child maltreatment (CM) during their first 18 years of life (Hillis et al., 2016; Stoltenborgh et al., 2015). CM is typically described as any form of abuse or neglect inflicted by a parent or caregiver including emotional, physical, and sexual abuse as well as emotional and physical neglect (Moody et al., 2018; Stoltenborgh et al., 2015). However, recent years have seen a more nuanced conceptualisation of CM that includes adverse experiences such as bullying (i.e. emotional and physical abuse by peers), discrimination, and exposure to community or domestic violence (i.e. household dysfunction, witnessed violence towards parents and/or siblings) (Teicher & Parigger, 2015).

CM is associated with a lifelong multitude of negative health and psychosocial outcomes and is a major environmental risk factor for the development of physical and mental illnesses later in one's life (Chandan et al., 2019; Souama et al., 2023; Winters et al., 2022). CM is thought to play a key role in the aetiology and clinical course of highly debilitating mental disorders such as psychotic disorders (Schalinski et al., 2015, 2019; Varese et al., 2012), bipolar and depressive disorders (Agnew-Blais & Danese, 2016; Humphreys et al., 2020), post-traumatic stress disorder (Rameckers et al., 2021), and personality disorders (Mielke et al., 2023) in adulthood. Furthermore, the existing literature highlights the association between CM exposure and subsequent negative consequences in terms of cognitive (Schalinski et al., 2018), behavioural, emotional (Flechsenhar et al., 2022; Pfaltz et al., 2019; Seitz et al., 2022), and psychosocial maladjustment in adults (Fares-Otero, Alameda, et al., 2023; Fares-Otero, De Prisco, et al., 2023; McCrory et al., 2022; Pfaltz et al., 2022).

However, some individuals with a history of CM demonstrate resilience and achieve positive (or good) outcomes despite growing up in aversive

environments with serious threats to adaptation or development (Masten, 2001). More specifically, outcomes regarding consequences of CM vary widely and not all individuals exposed to CM develop mental disorders or experience the same level or range of negative mental health issues (Collishaw et al., 2007) or psychosocial consequences (Walsh et al., 2010). Some individuals who have faced CM might also adapt to such negative experiences using assets and resources that could be available in their surroundings. Alternatively, CM survivors might experience a trajectory of posttraumatic growth manifested by an increased sense of personal strength and/or appreciation for life in general, and/or more meaningful interpersonal relationships (Tedeschi & Calhoun, 1996, 2004).

Indeed, resilience is the capacity of an individual to adapt successfully to highly adverse events and to maintain healthy functioning by harnessing resources (Southwick et al., 2014). Resilience may also enhance perceptions about one's personal qualities such as self-confidence, adaptability, and the ability to endure stress (Choi et al., 2019). Importantly, one should be aware that there are different concepts of resilience. Resilience can be defined as a personal characteristic (or trait) captured in personal resources and social resources, and it can also be perceived as a process comprising immunity, bouncing back, and growth (Ayed et al., 2019). Most studies investigating resilience have evaluated the psychological trait of resilience using the Connor-Davidson Resilience Scale (CD-RISC) (Connor & Davidson, 2003) to measure dimensions such as personal competence, trust, positive acceptance, control, and spiritual influence (Ye et al., 2022). As a personal trait, resilience is conceived as a relatively stable, innate characteristic that is featured by psychological hardiness, ego resilience, and coping efficacy (Connor & Davidson, 2003). Yet, as a dynamic system (Liu & Duan, 2023) and complex process of adaptation rather than a fixed trait (Denckla et al., 2020), resilience refers to the ability to function competently and face future challenges or adversities successfully (Cicchetti, 2010; Cicchetti & Rogosch, 2009). Resilience does not preclude a response to an adverse stimulus but rather refers to the capacity for recovery and can thus be regarded as both the process of returning to pre-exposure health and wellbeing, and an outcome of one's reaction to a stressful event (Bhatnagar, 2021).

Together, our approach to resilience in this protocol is that resilience is both a trait and a dynamic process. Thus, resilience can be categorised into global resilience or stable trait resilience (personal characteristic) as measured when using the CD-RISC (Connor & Davidson, 2003). It can also be considered as a concept with multiple separate subdomains. More specifically: 1. resilience is most often measured by questionnaires which have frequently focused on one of the measures related to well-known protective factors or resources, such as sense of self-efficacy, self-esteem, sense of mastery, optimism, good emotion regulation skills, or sense of coherence (Southwick et al., 2014); 2. other important building blocks of resilience were considered such as one's attachment history, the experience of positive emotions, and having a purpose in life, all of which are biological and psychological qualities of wellbeing and mental health that enable successful adaptation or swift recovery from life adversity (Rutten et al., 2013); and 3. other additional traits and behaviours were also at times described as 'resilience-promoting', including personality variables, supportive resources, financial and educational assets, and coping (Bonanno et al., 2011, 2015).

Some factors, e.g. type or dimensions of threat (abuse) vs. deprivation (neglect) (Berman et al., 2022; McLaughlin et al., 2014), timing and severity of CM exposure (Cowell et al., 2015; Jaffee & Maikovich-Fong, 2011; Schalinski & Teicher, 2015; Teicher & Samson, 2013), maltreated individual's age or developmental or life stage (Yoon et al., 2021), sex or gender (White & Kaffman, 2019), level of family cohesion (Daniels & Bryan, 2021), socio-economic status and country/region (Milas et al., 2019; Ungar & Liebenberg, 2011) could be potential moderators of the association between CM and resilience in adulthood. Additionally, knowledge of potential mediators of the relationship between CM and resilience, e.g. (epi)-genetic factors (Cahill et al., 2022; Choi et al., 2019; Cicchetti & Rogosch, 2012; Gallardo-Pujol et al., 2013; Goldberg et al., 2013; Miu et al., 2017; Ramo-Fernández et al., 2019), brain structure (Roeckner et al., 2021) and functioning (McCrory et al., 2017; Ohashi et al., 2017; Teicher et al., 2020; Teicher & Samson, 2016), past or current mental disorder or medical condition (Ashy et al., 2020; Perini et al., 2023), personality traits (Mrazek & Mrazek, 1987), (insecure) attachment styles (Citak & Erten, 2021; Stein, 2006), physical activity or exercise (Arida & Teixeira-Machado, 2020), perceived loneliness, social network size and services, and coping strategies (Reinhard et al., 2022; Su et al., 2022; Ungar, 2013) could facilitate an understanding of the mechanisms underlying this association. This knowledge is important for developing risk stratification models of adverse psychosocial health outcomes and targeted effective prevention and intervention strategies for individuals with histories of CM exposure.

Of particular interest, consistent findings in the literature have, to date, generally suggested that social support could potentially play a unique role in enhancing resilience when facing CM early in life (Cheong et al., 2017), as compared to the assortment of factors indicated above (Afifi & Macmillan, 2011; Meng et al.,

2018). Various studies have indicated that social support could likely serve as a moderator (Esposito & Clum, 2002; Schury et al., 2017) or mediator (Brunton et al., 2022; Pepin & Banyard, 2006; Su et al., 2022), or both (Sperry & Widom, 2013) in the association between CM and resilience. Understanding associations, modifiers, and underlying mechanisms between CM and resilience is important in informing treatment strategies and goals (Ohashi et al., 2019; Teicher et al., 2020; Ungar & Theron, 2020), and improving health and psychosocial outcomes among individuals affected by CM. Possible moderators and mediators of the association between CM and resilience in adults are described in detail in Table 1.

Resilience following CM has received substantial empirical attention, with the number of studies on this construct growing exponentially in the past decade (Nugent et al., 2014). One prior systematic review explored the association between CM and protective factors associated with adaptive functioning and resilience at individual, familial, and societal levels, and reported that the most consistent findings, acting across the lifespan, are related to familial factors, such as maternal attachment and care (Meng et al., 2018). Another review of resilience factors that were influential in the association between childhood adversity and mental health in young people (aged 13-24) has found that numerous individual-level (e.g. high self-esteem, low rumination), family-level (e.g. high family cohesion, high parental involvement), and one community-level resilience factors (i.e. high social support) were beneficial for CM survivors' mental health (Fritz et al., 2018). A more recent review on resilience factors that were influential with regards to psychosocial outcomes (e.g. education and work, independent living, criminal behaviour, social adjustment) was not able to draw firm conclusions about the types of resilience factors that were consistently associated with a particular psychosocial outcome in one's transition to adulthood following an exposure to childhood victimisation (Latham et al., 2023).

To date, one prior meta-analysis has examined the association of violence exposure and protective factors for resilience in children, and it has found that the most robust predictors of resilience were self-regulation, family support, school support, and peer support across any type of violence experienced, i.e. maltreatment, intimate partner violence, or community violence (Yule et al., 2019). A recent multivariate meta-analysis examining associations between childhood trauma, trait resilience and depression found that these variables were significantly associated and that trait resilience significantly mediated the relationship between trauma and depression (Watters et al., 2023). An umbrella synthesis of meta-analyses on CM antecedents and interventions has also found that resilient individuals were characterised by a lower degree of susceptibility to changes in the environment, and that those who were more susceptible were more dependent on a supportive environment as a buffer against adversities (van IJzendoorn et al., 2020); and the association between resilience

Table 1. Potential moderator and mediator variables in the association between child maltreatment and resilience in adults.

Variable	Description and operationalisation
Moderator	
Type of CM (cat)	Physical / emotional / sexual abuse, physical / emotional neglect / domestic violence / bullying
Dimension of CM (cat)	Threat: experiences of harm, or threat of harm, to the physical integrity of the child (abuse) vs. Deprivation: reductions in expected experiences involving social and cognitive stimulation (neglect) / Physical vs. emotional / Intra-familial vs. extra-familial / Experienced vs. witnessed events / Passive vs. active CM / One type vs. multiple types
Timing of CM (co/cat)	Age of onset; chronicity; recency / Duration: Length of time between the first and last CM exposure (in years) / During pre-school vs. middle school vs. high-school
Severity of CM (cat)	None-minimal; moderate; severe; extreme / High vs. low
Age or life stage (co/cat)	Age (in years) / Life stage (development): infancy, toddlerhood, preschool, early school, adolescence
Sex or Gender (cat)	Biological (female; male) or social constructs
Family cohesion level (cat)	Disengaged; separated; connected; enmeshed
SES (cat)	High; middle; low SES (including income, education, employment, and community safety)
Country/region (cat)	Western; non-western / High-income; low-income; lower middle-income; upper middle-income countries / Individualistic; collectivistic cultures
Mediator	
Genetic or epigenetic factors (co/cat)	Genetic variants (e.g. MAOA / COMT / BDNF / FKBP5) and epigenetic profiles (e.g. NR3C1 / CRHR1 / FKBP5)
Brain structure or function (co)	Volume and cortical thickness alterations / HPA axis (dys)regulation / measures of brain activity (e.g. fMRI)
Mental disorder (cat)	Psychotic disorders, affective disorders, PTSD/C-PTSD, personality disorders, SUD
Personality traits (cat)	Five personality traits (extraversion, conscientiousness, emotional stability, agreeableness, openness)
Attachment styles (cat)	Secure; anxious; avoidant; disorganised
Physical activity (cat)	Participation in regular physical activity (yes/no) / Type of exercise
Loneliness (co/cat)	Emotional (absence of meaningful relations) vs. Social (perceived deficit in the quality of social connections)
Moderator and/or Mediator	
Social support (co/cat)	Network of social resources (mutual assistance, guidance, validation about life experiences and decisions)

Note: cat = categorical variable; co = continuous variable; BDNF = Brain-derived neurotrophic factor; CM = Child maltreatment; COMT = Catechol-O-methyltransferase; C-PTSD = Complex-posttraumatic stress disorder; CRHR1 = Corticotropin-releasing hormone receptor 1; FKBP5 = FK506 binding protein; fMRI = Functional magnetic resonance imaging; HPA = Hypothalamic-pituitary-adrenal; MAOA = Monoamine oxidase A; NR3C1 = Glucocorticoid receptor gene; PTSD = Posttraumatic stress disorder; SES = Socioeconomic status; SUD = Substance use disorder.

and susceptibility may be moderated by constitutional and contextual protective factors (van IJzendoorn et al., 2020).

Although the association of CM and resilience was widely recognised in previous work, currently available reviews (Fritz et al., 2018; Latham et al., 2023; Meng et al., 2018) and meta-analyses (van IJzendoorn et al., 2020; Watters et al., 2023; Yule et al., 2019) have focused on broader concepts of childhood experiences of adversity and protective factors that promote resilience or trait resilience. It remains unclear whether CM and its specific subtypes are differentially associated with resilience in adulthood using a multi-domain definition and approach for resilience. Consequently, a systematic review and meta-analysis exploring the magnitude and consistency of associations between overall CM and its different subtypes (e.g. emotional, physical, and sexual abuse, emotional and physical neglect, bullying, domestic violence) and global/trait resilience and its multiple domains (e.g. positive adaptation, successful coping, regulatory flexibility, healthy functioning) in adults, while exploring and summarising moderators and mediators of the association path between CM and resilience, has not been done to date and is therefore much needed.

With this background (see also our research framework on the association, moderation and mediation analyses in Figure 1), we aim to conduct a systematic review and meta-analysis in order to: 1) estimate associations between CM (overall and its subtypes) across global and multiple domains of resilience in adults; and 2) to quantitatively examine, and narratively summarise, potential moderators and mediators of these associations. We hypothesise that CM will show a moderately strong negative association with resilience and that this relationship will be moderated and mediated by several internal (individual level) and external factors (family and community levels) (Southwick et al., 2014).

Overall, if the association between the presence of different CM types and resilience domains is confirmed, the identification of individuals with certain or specific CM experiences and the consideration of clinical, psychological, and biological moderating/mediating factors in the treatment of adult survivors could contribute to improving resilience in those affected by CM (Engert et al., 2020). Findings in the expected direction would underscore the necessity of screening individuals for the presence of CM (including its subtypes) even if they do not present post-traumatic symptoms, while at the same time informing assessments that need to be incorporated into adequately designed research protocols to allow for screening in all health settings (besides early intervention services in which trauma screening is already required), as well as informing more appropriate prevention and intervention strategies for adult survivors.

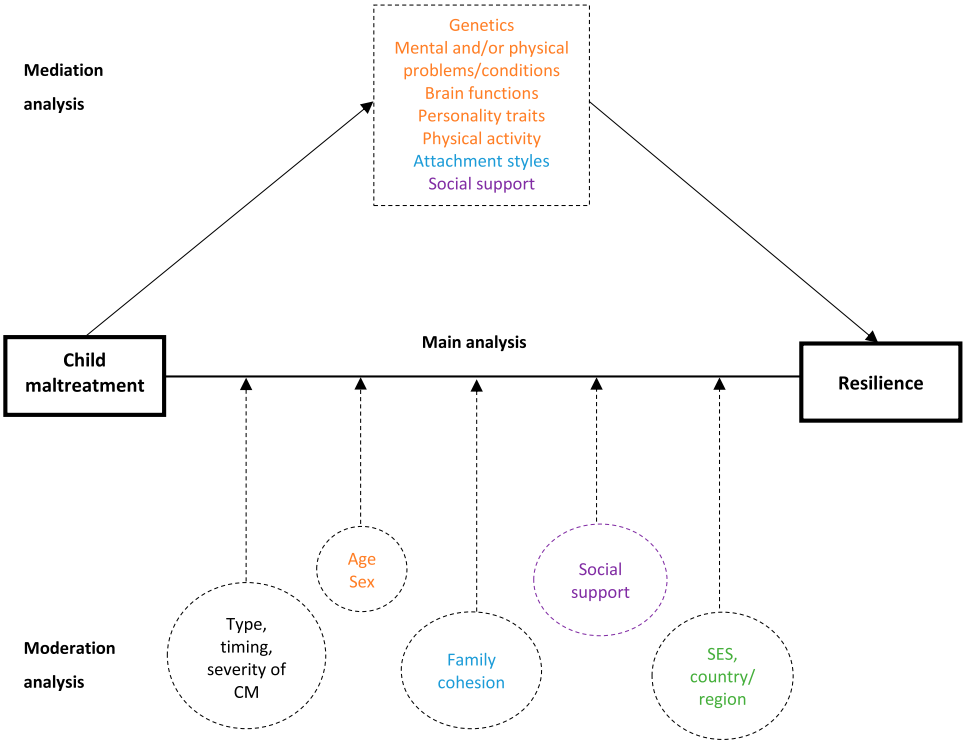


Figure 1. Conceptual framework of the proposed study. Potential moderators between CM and resilience in adulthood are represented by dashed line circles. The potential mediators in this association path are indicated in the dashed line square. The individual level is represented in orange font, the family level is represented in blue font, and the community level is represented in green font. This study will likewise focus on the multifaceted function of social support (potential moderator and/or mediator, family and/or community level) for the association between CM and resilience, represented in violet font. Abbreviations: CM = Child maltreatment, SES = Socioeconomic status

Table 2. PECOS criteria for inclusion and exclusion of studies.

Parameter	Inclusion criteria	Exclusion criteria
Population	Adults ≥ 18 years of age.	Children or adolescents < 18 years of age.
Exposure	CM (emotional, physical, and/or sexual abuse, and/or emotional and/or physical neglect, community/domestic violence, bullying < age 18) as assessed using standardised or validated instruments to determine the relationship between CM (exposure variable) and resilience (outcome variable).	
Comparison	Individuals with vs. without CM.	
Outcome	Resilience global (trait) and/or domains or dimensions, as measured using standardised or validated instruments.	
Study design	Quantitative cross-sectional or longitudinal studies. Original research published in a peer-reviewed journal.	Aim to conduct or evaluate an intervention during the observed study period. Reviews, meta-analyses, case reports, clinical vignettes or case studies, abstracts, conference proceedings, editorials, commentaries, letters to the editor not reporting original data, study protocols, theoretical pieces, randomised controlled trials, books and book chapters. Grey literature. Qualitative studies. Animal studies.

Note: CM = Child maltreatment. PECOS = P: Population/Participants; E: Exposure; C: Comparison; O: Outcomes; S: Study design/Types of Study.

2. Methods

This study protocol has been registered on PROSPERO (CRD42023394120). The protocol follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) for systematic reviews and meta-analysis protocols (Moher et al., 2015) (see supplemental file 1). The final review will also follow PRISMA reporting guidelines, and will include a PRISMA checklist and flowchart describing the selection process, including the number of studies excluded at each stage of the review and the reasons for exclusion (Moher et al., 2009; Page et al., 2021). We will also follow the Meta-Analysis of Observational Studies in Epidemiology MOOSE (Stroup et al., 2000) checklist and the Enhancing the Quality and Transparency of Health Research (EQUATOR) (Altman et al., 2008) reporting guideline.

2.1. Research questions and inclusion/exclusion of studies

Our **PICO** (i.e. Population, Intervention, Comparator, and Outcomes) (Richardson et al., 1995; Thomas et al., 2023) research questions are: To what extent is CM associated with resilience? Are different CM types and resilience domains associated in adults? Which are the moderators and mediators in this association?

Inclusion and exclusion criteria are summarised in Table 2 (Morgan et al., 2018). Only original research articles published in a peer-reviewed journal will be included, without any language or date restrictions. According to the **PICO** framework, studies will be included if they:

(1) **(P)** were conducted on healthy human adults (≥ 18 years) as well as adults with a current/past mental or medical condition who were exposed to CM; (2) **(I)** assessed the presence of CM comprising emotional, physical, and/or sexual abuse, and/or emotional and/or physical neglect, and/or community or domestic violence and/or bullying, occurring during childhood and early adolescence (< 18 years) and measured as overall (total) or specific CM subtypes (Teicher & Samson, 2013) with validated measures such as the Childhood Trauma Questionnaire (CTQ) (Bernstein et al., 2003) or indicated through clinical interviews; (3) **(C)** compared individuals with and without CM. Additionally, studies that considered both CM and trauma in adulthood will be included if the data for CM are separately available; (4) **(O)** evaluated resilience with validated instruments; (5) quantitatively examined and reported associations between CM (exposure variable) and resilience (outcome variable) or data that allowed correlations to be calculated or provided these data on request; (6) were cross-sectional, or longitudinal to understand the dynamic qualities of resilience.

Studies will be excluded if they: (1) were reviews, meta-analyses, clinical case studies, abstracts, conference proceedings, study protocols, letters to the editor not reporting original data, editorials, commentaries, theoretical pieces, books, book chapters, preprints, or grey literature; (2) only recruited children and/or adolescents; (3) only investigated animals; (4) were studies that exclusively assessed trauma experienced in adulthood (≥ 18 years); (5) were qualitative studies; (6) aimed to conduct or evaluate an intervention and/or to assess treatment outcomes not providing baseline data.

2.2. Information sources and search strategy for electronic databases

A systematic search using multiple terms related to CM and resilience will be implemented on PubMed (Medline), PsycINFO, Embase, Scopus, and Web of Science (core collection) to search and to identify

relevant studies. Also, references of studies of relevance will be searched for additional studies, i.e. we will search reference lists of included studies as well as relevant existing reviews and studies which have referenced these reviews. Such backward and forward citation searching will be carried out in PubMed. If a citation cannot be identified in PubMed, Google Scholar will be used.

The specific search strategies are developed using standardised subject terms, e.g. medical subject headings (MeSH) terms and combination of keywords (using truncation as needed) and adapted according to database thesauruses related to CM and resilience, using the Boolean operators 'OR' and 'AND'. The PICO framework and terms used in previous systematic reviews and meta-analysis in the field (Fares-Otero, Alameda, et al., 2023; Fares-Otero, De Prisco, et al., 2023; Fritz et al., 2018; Latham et al., 2023; Meng et al., 2018) are used to develop the search terms.

The full search strategy for PubMed (Medline) is reported as follows: ('child* maltreatment' OR 'child* trauma' OR 'child* advers*' OR 'early life adversity' OR 'early life stress' OR 'complex trauma' OR 'child* victim*' OR 'child* abuse' OR 'child* neglect' OR 'child* physical abuse' OR 'child* emotional abuse' OR 'child* psychological abuse' OR 'domestic violence' OR 'family violence' OR 'bullying' OR 'child* sexual abuse' OR 'CTQ' OR 'childhood trauma questionnaire' OR 'CECA') AND ('resilience' OR 'resilient' OR 'resiliency' OR 'self-regulation' OR 'self-efficacy' OR 'self-organisation' OR 'self-reliance' OR 'self-esteem' OR 'self-confidence' OR 'adaptive functioning' OR 'adaptive coping' OR 'competent coping' OR 'successful coping' OR 'social competence' OR 'sense of mastery' OR 'problem solving' OR 'social adjustment' OR 'motivation' OR 'emotion regulation' OR 'positive appraisal' OR 'meaning in life' OR 'sense of coherence' OR 'regulatory flexibility' OR 'optimism' OR 'positive affect' OR 'invulnerability' OR 'hardiness' OR ' buffering' OR 'psychological well-being').

Prior to the final data analysis, the searches will be rerun to allow for the inclusion of newly published studies. In addition, corresponding authors will then be contacted for full-texts and other required information for our planned analyses in the event that this information cannot be obtained publicly or via institutional access.

2.3. Data management, selection process, and data extraction

The software Rayyan QCRI (https://rayyan.qcri.org/) will be used to manage citations, remove duplicates, and screen titles and abstracts.

At least two independent reviewers will initially screen the titles and abstracts according to the prespecified eligibility criteria (Table 2). Articles which appear eligible from the abstract, or are of unclear eligibility, will be full-text screened. This will also be carried out by at least two independent reviewers. The process of independent abstract and full-text screening will be repeated for references identified during backward and forward citation searching following an initial screen carried out by the lead researcher.

Data from eligible studies will be extracted and tracked in Microsoft Excel by at least two independent reviewers using a structured coding form. The anticipated data extraction form is presented as supplementary file 2.

Descriptive variables extracted will include first author and publication year, country/region, sample size, mean age, sex (% male), study design, type of diagnosis in the sample (if available), type and instrument(s) for diagnosis and criteria (if available), duration (in years) of the illness (if available), CM instrument used and type and timing of CM reported, resilience instrument/measure, results on the association between CM and resilience (including p value, effect size, and descriptive summary), confounders, moderators, and mediators investigated (if reported). Correlation coefficients (r) with their corresponding 95% confidence intervals will be extracted as measures of effect size. If not reported in the original publication, information will be calculated from available statistics using established formulas (Lipsey & Wilson, 2001) or will be requested from the authors.

Any disagreements over study eligibility and/or data extraction will be discussed, and the lead researcher will be consulted if a consensus cannot be reached; discrepancies will be resolved through general consensus.

2.4. Study outcomes

After study selection, we will categorise the study outcomes into: I) Global or trait resilience (Connor & Davidson, 2003); and II) Multiple separate domains of resilience. The selection of resilience (outcome) domains will be based on resilience outcomes examined in the included studies, previous systematic reviews on well-known protective factors or resources (Fritz et al., 2018; Latham et al., 2023), and categorisations used in the trauma and resilience research fields (Rutten et al., 2013; Southwick et al., 2014). Also, we will consider previous evidence on the important building blocks of resilience (Rutten et al., 2013), as well as traits and behaviours described as 'resilience-promoting' (Bonanno et al., 2011, 2015).

We anticipate that studies will use various measures of global (or trait) resilience and separate resilience subdomains, including but not limited to psychological well-being, positive adaptation, successful coping,

regulatory flexibility, problem solving, meaning in life, and healthy functioning based on standardised assessment scores. Therefore, studies will not be included if they do not measure at least one aspect of resilience using a standardised measure, instead relying on an unclear source.

2.5. Assessment of study's methodological quality

The included studies will be assessed for study quality using a modified version of the Newcastle–Ottawa Scale (NOS) (Wells et al., 2008) for non-randomised studies. When using the NOS, studies are rated depending on sample selection, comparability of groups and assessment of exposure or outcome, and the adapted version contains additional items to assess sample size, confounders, and statistical tests (Herzog et al., 2013) as per procedures used in previous meta-analyses (Fares-Otero, Alameda, et al., 2023; Fares-Otero, De Prisco, et al., 2023).

Study quality will be assessed by at least two independent reviewers. Risk of bias assessment will be conducted on the included studies and agreement will be checked. Disagreements will be discussed, and the lead researcher will be consulted if a consensus cannot be reached. Results from the study quality assessment will be taken into consideration when interpreting the strength of evidence for the reported associations and will also be considered in the quantitative analyses (see the *Data synthesis* section).

2.6. Data synthesis and statistical analysis

The sociodemographic and clinical information from the identified studies will be entered into tables to summarise the key study features and results. For each of the outcomes included in the review, the results will be synthesised using tabulation and visual displays via forest plots, as appropriate. The characteristics and findings of included studies will be presented in a data extraction table and will be discussed in a narrative synthesis (Popay et al., 2006). The synthesis will take place in light of overall and different CM subtypes and global resilience and its domains. Also, a narrative synthesis of moderators, mediators, and confounders in the association between CM and resilience will be presented in the results.

If meta-analyses are deemed feasible based on the heterogeneity analysis, in other words, if we identify multiple studies investigating similar exposure and outcome variables, a random-effects model will be used (Borenstein et al., 2011; Harville, 1977). Heterogeneity of effect estimates will be investigated using the cochran's Q test (Cochran, 1950) and Higgins I^2 statistic (Borenstein et al., 2017; Borenstein et al., 2022; Higgins et al., 2023). Additionally, the heterogeneity and content of studies will be qualitatively described. If substantial heterogeneity between the studies is indicated ($I^2 \geq 50\%$) (Higgins et al., 2003; Higgins et al., 2023), possible reasons for the variability will be considered by analysing the characteristics of the studies included.

For any meta-analysis with ≥10 studies, funnel plot asymmetry (Egger et al., 1997) will be visually evaluated and possible explanations for the asymmetry will be considered (e.g. publication bias), if applicable. Publication bias will be also assessed and quantified by Egger's linear regression asymmetry test (Sterne et al., 2000). Because these tests might be underpowered if only a small number of studies are available, the non-parametric trim-and-fill method (Duval & Tweedie, 2000) will be used to examine the extent to which publication bias may contribute to the meta-analysis results if the search yielded few studies.

All statistical analyses will be conducted with RStudio R version 4.1.2 using the metafor R-package (Viechtbauer, 2010) with random-effects modelling and restricted maximum-likelihood estimator. Standard errors and confidence intervals may be calculated as suggested by Knapp & Hartung (Knapp & Hartung, 2003), because this procedure leads to more appropriate false-positive rates than the standard approach when only a few studies contribute to the meta-analysis and the precision of included studies (standard errors) varies (Röver et al., 2015).

2.7. Meta-regressions and subgroup analyses, and moderators and mediators synthesis

Where substantial heterogeneity is indicated ($I^2 \geq 50\%$) and sufficient data are available, meta-regression and subgroup analyses will be performed to explore potential effect modifiers. Meta-regression analyses will be conducted for continuous variables describing participants' characteristics such as demographic features (% males), age (at CM onset) (mean years), and the impact of study quality (NOS rating). Individual subgroup analyses will be conducted for the following categorical variables: trauma type (e.g. threat vs. deprivation), social support, family context (e.g. family cohesion), and socio-demographic features (e.g. socioeconomic status, country/region) (Milas et al., 2019). Other subgroups and potentially important moderators may be informed post hoc by the included studies but will be identified where necessary as such in the final report (Higgins et al., 2023). Sensitivity analyses will be completed to determine the robustness of the meta-analyses (Higgins & Thompson, 2004).

Finally, if multiple studies investigate similar mediator variables for example, with respect to brain

functions, mental and physical health conditions, personality traits, and attachment styles as detailed in the included studies, meta-analytical structural equation modelling will be employed to synthesise indirect mediation effects (Cheung, 2022).

3. Discussion

Here, we present a study protocol for conducting a first-of-its-kind systematic review and meta-analysis in order to examine the magnitude of the relationship between CM (overall and its subtypes) and resilience (global/trait and involving multiple domains) in adults, with the additional aim of investigating mediators and moderators of this association.

An evidence-based model of potential pathways between CM and resilience, resulting from the findings of this systematic review and meta-analysis, could be used to develop novel interventions and clinical guidelines, aimed at improving functioning, well-being, and social integration of adult CM survivors. Findings from the review could shed more light on factors that might contribute to greater resilience among adult CM survivors and to inform more effective forms of intervention for these individuals in the healthcare and community settings.

While notable, existing interventions promoting resilience such as trauma-focused cognitive behavioural therapy-based resilience training (Zalta et al., 2016), mindfulness and mediation techniques (Joyce et al., 2018), physical activity, meaning and purpose in life making, and social support programmes, i.e. therapeutic processes that encourage social ties and therapeutic alliance (Burton et al., 2015; Snijders et al., 2018), well-being enhancing psychotherapeutic strategies (Fava, 1999; Guidi & Fava, 2021), and the innovative somatically-based psychotherapy founded on the Trauma Resiliency Model (Grabbe & Miller-Karas, 2018), have all been shown to be useful in helping adults with traumatic experiences in the past by focusing on maintaining global and functional health. Findings from this systematic review and meta-analysis could nonetheless provide greater clarity as to the specific factors that might be more influential than others in those with CM experiences so that existing interventions could in turn be modified to incorporate such new knowledge to enhance their relevance and effectiveness.

Where possible, meta-regression and subgroup analyses will not only provide insight into the relationships between the different facets of CM and resilience, but will also highlight key themes of investigation, emerging research focus areas, and gaps in the literature. By providing a synthesis of the global evidence-base, it will also be possible to compare groups (e.g. by age, sex, or diagnosis), and contrast high-income regions/countries with the low-and-middle-income ones.

Moreover, if a mediating role of personality traits (and social support – in addition to its proposed role as a moderator) is confirmed in the association between CM and resilience in adulthood, this would mean that we could provide further information on psychotherapeutic approaches targeting personality (disorders), and potentially social support, and advance training to help certain individuals cope with stress in their life that may be preventing them from achieving or maintaining recovery.

Research that aims to improve resilience outcomes can greatly benefit maltreated individuals, including those experiencing mental disorders, by reducing the risk for the development of aberrant health outcomes and by benefiting adversity-informed treatment strategies. This knowledge may reduce the challenges and burden associated with receiving inappropriate and/or suboptimal treatments and also decrease survivors' risk of experiencing negative health and psychosocial consequences in adulthood.

Exploring the association between exposure to CM and adults' resilience outcomes may, thus, assist with the development of even more effective interventions (e.g. modifying existing interventions to incorporate fresh ideas regarding the relative importance of certain proposed resilience-promoting factors [versus others] based on what we may find from our systematic review) for adult survivors, promote even-greater treatment success, and ultimately facilitate even-better recovery and to sustain health. Simply put, clarification of the role that certain factors play in the resilience of adults with CM experiences has translational value with the potential to inform clinical guidelines and practice. A systematic exploration of the available evidence is particularly suitable for this endeavour because it allows for data to be collated from a variety of sources and study designs and can help to highlight gaps in the literature (e.g. sample size limitation) and/or conflicting evidence.

Overall, if we do confirm an association between different CM subtypes and resilience domains through this review, a better recognition of the special needs and the design of specific prevention or interventions strategies that might be more effective for adult individuals with CM histories would be needed. First, it might be important to systematically assess different CM (types) experiences in routine care which has barely been done so far, but still much effort and progress are needed towards a standard practice in (mental) health settings (DeJong et al., 2022; Moog et al., 2021). Second, resilience – as a multifaceted phenomenon on a bio-psycho-socio-ecological level – (Engert et al., 2020) should be monitored closely in adult survivors or patients with mental disorders with a history

of CM. Our findings may call for the development of new strategies to assess different levels of resilience dimensions, such as adaptive skills, and resilience as a determinant of health.

This proposed systematic review will inevitably have some limitations. As data will only be extracted from peer-reviewed, published, full-text articles, some researchers could contend that the coverage of the proposed meta-analyses may not be comprehensive enough without data from unpublished work in the literature (Korevaar et al., 2020; Polanin et al., 2016). However, we would contend that the inclusion of data from unpublished studies can itself introduce bias (Boutron et al., 2023). Including data from the grey literature could inadvertently increase heterogeneity in terms of the study quality of the review. We would put forth that the planned review should instead be based on a comprehensive literature search of studies published in peer reviewed journals in order to ensure that the included studies are representative of the published literature on the link between CM and resilience and that they are of sound scientific quality. Furthermore, the robustness of the findings will also be indicated by publication bias analyses.

4. Conclusion

Overall, to our knowledge, this will be the first systematic (quantitative) synthesis of the association between overall and subtypes of CM and global/trait and multiple resilience domains in adults, integrating a synthesis of the moderators and mediators of these associations into one review. The resulting synthesis, that will be based on this preregistered study protocol, can inform prevention strategies, and help to tailor interventions aimed at improving health and psychosocial functioning of adult CM survivors.

Study status

Initial electronic database searching was conducted on April 18, 2023. The search will be updated prior to completion, with the review expected to be completed in December 2023.

Ethics and dissemination

As this review will make use of already published data, ethical approval will not be sought. On completion, the review will be submitted to a peer-reviewed journal in the field of trauma research for publication. Findings will also be presented at relevant professional and academic conferences. The findings will inform upcoming work on the association between CM and resilience in adulthood.

Data sharing: Data sharing is not applicable to this article as no new data were created or analysed in this study.

Patient consent for publication: Not required.

Author contributions

Term: NEF-O. Conceptualisation: NEF-O, OJ, GS, JSW, CG, JC-N, EV, IS, US, SS. Methodology: NEF-O. Writing–original draft: NEF-O. Writing–reviewing & editing: NEF-O, OJ, GS, JSW, CG, JC-N, EV, IS, US, SS. Data curation: NEF-O, OJ, GS, JSW, CG, GA, TBM, JC-N, J-ME-L. Formal analysis: NEF-O. Investigation: NEF-O. Visualisation: NEF-O. Supervision: EV, IS, US, SS. Project administration: NEF-O. Resources and Funding acquisition: NEF-O, EV, IS. NEF-O, OJ, JW, CG, IS, US, SS revised the manuscript. All authors approved the final version of the submitted manuscript.

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