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ORIGINAL ARTICLE

Modifiable predictors of depression following childhood maltreatment: a systematic review and meta-analysis

EC Braithwaite[1,2], RM O'Connor[3], M Degli-Esposti[1], N Luke[4] and L Bowes[1]

Although maltreatment experiences in childhood increase the risk for depression, not all maltreated children become depressed. This review aims to systematically examine the existing literature to identify modifiable factors that increase vulnerability to, or act as a buffer against, depression, and could therefore inform the development of targeted interventions. Thirteen databases (including Medline, PsychINFO, SCOPUS) were searched (between 1984 and 2014) for prospective, longitudinal studies published in English that included at least 300 participants and assessed associations between childhood maltreatment and later depression. The study quality was assessed using an adapted Newcastle–Ottawa Scale checklist. Meta-analyses (random effects models) were performed on combined data to estimate the effect size of the association between maltreatment and depression. Meta-regressions were used to explore effects of study size and quality. We identified 22 eligible articles ($N = 12\,210$ participants), of which 6 examined potential modifiable predictors of depression following maltreatment. No more than two studies examined the same modifiable predictor; therefore, it was not possible to examine combined effects of modifiable predictors with meta-regression. It is thus difficult to draw firm conclusions from this study, but initial findings indicate that interpersonal relationships, cognitive vulnerabilities and behavioral difficulties may be modifiable predictors of depression following maltreatment. There is a lack of well-designed, prospective studies on modifiable predictors of depression following maltreatment. A small amount of initial research suggests that modifiable predictors of depression may be specific to maltreatment subtypes and gender. Corroboration and further investigation of causal mechanisms is required to identify novel targets for intervention, and to inform guidelines for the effective treatment of maltreated children.

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INTRODUCTION

Depression is among the most common psychiatric disorders worldwide, with a 12-month prevalence rate estimated between 10% and 17%, and lifetime prevalence between 17% and 40%.[1,2] The World Health Organization estimates that depression is the fourth leading cause of disability-adjusted life years lost, and is ranked first among the causes of years lived with disability.[3] Further, economic costs of major depression in the USA in 2010 were $210.5 billion, an estimated 21.5% increase since 2000.[4] Given the high prevalence and economic burden, there is a clear impetus to understand depression etiology.

Meta-analyses of cross-sectional and longitudinal studies have consistently found that childhood maltreatment is strongly associated with clinical depression across the life course.[5,6] A meta-analysis of 16 longitudinal studies, totaling 23 544 participants, also found that maltreatment was associated with an elevated risk of recurrent and persistent depressive episodes, and a lack of response or remission during treatment.[7]

Despite the increased risk of depression following maltreatment, not all children who are abused will develop depression symptomatology. Key questions regarding which subgroups of children may be more vulnerable to depression, and the pathways by which maltreatment leads to depression onset within subgroups, remain unanswered. The primary aim of our review is to therefore systematically assess the existing research to increase our understanding of factors that have the potential to be strengthened or changed to reduce the likelihood of depression onset among maltreated children. We defined a 'modifiable predictor' of depression as one potentially changeable through lifestyle or existing medical treatment. Given the complex nature of the question, this review includes only the strongest non-experimental studies; those that are longitudinal and prospective. Consideration of study design is vital when addressing questions of causality, and the temporal order of factors that may influence causal pathways, as is the case in this review. This research is of clinical importance, as it has implications for the identification of causal mechanisms in depression onset following maltreatment. A greater understanding of causal mechanisms may result in the identification of novel therapeutic targets to prevent depression onset, and to inform guidelines for the effective treatment of maltreated children.

MATERIALS AND METHODS

Search strategy and selection criteria

We conducted a systematic literature search for studies published in English between 1984 (the year that the Child Protection Act was introduced in the United States) and 2014, to identify primary research studies that investigated relationships between childhood maltreatment and later depression. Our search terms were: ("harsh parenting" OR

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"abuse*" OR "neglect*" OR "maltreat*" OR "foster care*" OR "foster famil*" OR "substitute famil*" OR "residential care" OR "out-of-home care" OR "out of home care" OR "congregate care" OR "group home" OR "alternative care") AND ("child*" OR "youth*" OR "adolescent*" OR "infant*") AND ("depress*" OR "Major Depress*" OR "Dysphoria" OR "Psychopathology" OR "Affective Disorder*" OR "Dysthym*" OR "Mood Disorder*" OR "resilience" OR "internalizing" OR "internalizing" OR "suicid*" OR "self-harm") AND ("longitudinal" OR "prospective"). As different terms are used to describe modifiable predictors in different disciplines, we did not restrict our search to terms relating to modifiable predictors, but rather used broad search terms, and extracted information regarding factors that would be included in our definition of modifiable predictors of depression along with other study information. Thirteen databases were searched: ASSIA, Australian Education Index, British Education Index, Cochrane Library, Conference Proceedings Citation Index & Social Sciences Citation Index, ERIC, International Bibliography of Social Sciences, Medline, PsychINFO, SCOPUS, Social Care Online, Social Policy & Practice, Social Services Abstracts. The reference lists were manually checked for studies not retrieved via electronic search.

We identified articles satisfying the following criteria: original, peer-reviewed studies that had a prospective, longitudinal design (over any time period) whereby the measure of maltreatment preceded the measure of depression, and were cohort or case–control studies. Childhood maltreatment or harsh and neglectful parenting was defined as any act or series of acts of commission (physical abuse, sexual abuse, emotional/psychological abuse or harsh parenting) or omission (neglect) by a parent, caregiver or other person that leads to harm, the potential for harm or the threat of harm to a child (up to 18 years of age). Depression was assessed either as a clinical depression diagnosis or continuous measure of depressive symptoms using scales with reported validity and reliability. The participants were children (10 years or over at outcome measure) or adults in any country and in any setting, including inpatients. We excluded studies if they were cross-sectional, reviews, discussion papers, non-research letters, editorials, case studies or case series, animal studies, qualitative studies without a quantitative element or articles not published in English. Our goal was to include as many relevant studies as possible. However, analyses based on a small number of small samples can be statistically unstable, a problem exacerbated in models involving multiple covariates and interaction terms. Thus, we required participating studies to have at least 300 individuals to maximize statistical power.[8]

Data extraction

ECB and RMO independently extracted data from eligible articles. Inconsistencies were resolved in consensus meetings and confirmed with the authors of primary studies where necessary. For samples where more than one article was published, we chose one article to include in the review based on (i) the inclusion of modifiable predictors and (ii) larger total sample size. Missing information was requested from authors.

Assessing study quality

Two authors (ECB and LB) independently evaluated study quality against criteria devised from the Newcastle–Ottawa Scale (NOS), a quality checklist designed to assess the quality of nonrandomized studies in meta-analyses.[9] Consensus was evaluated on 20% of ratings and was acceptable. The NOS yields a score from 0 to 9 (one point per item, one item is worth two points), with higher scores indicating higher quality. We rated articles that scored 0–3 as 'lower quality'; 4–6 as 'moderate quality'; and 7–9 as 'higher quality'.

No quality checklists exist to assess modifiable predictor variables in longitudinal research. To assess the quality of modifiable predictors, we created three additional criteria. These were:

1. Clear theoretical justification for assessing the modifiable predictor.
2. The modifiable predictor was assessed longitudinally after maltreatment and before depression.
3. The modifiable predictor was assessed using a validated measure.

We assessed the quality of modifiable predictors on a scale of 0–3; each item was scored one point if present.

Analytic strategy

The extracted data were converted into odds ratios (ORs), and we calculated combined OR and 95% confidence intervals (CIs) using random effects models, where weights reflect the inverse variance of each study's effect estimate. Heterogeneity of effects was assessed using Cochrane Q tests and quantified using I^2 tests.[10] Forest plots were created to visually examine ORs and CIs of each study, and across studies included in meta-analyses. Publication bias was evaluated by visually investigating funnel plot asymmetry and sensitivity was checked using trim and fill analysis.[11]

We conducted analyses in three stages. First, we examined combined OR and CIs in all studies that reported unadjusted associations between maltreatment (of any type) and depression ($N = 13$ studies). We then repeated this to examine adjusted associations ($N = 7$ studies), including studies that accounted for any confounder or covariate. Sensitivity analysis examined unadjusted ORs in the group of studies for which both the unadjusted and adjusted associations were reported ($N = 7$). Due to power constraints, this analysis only included studies where the extracted data were not split by maltreatment type. Second, meta-regressions assessed whether unadjusted associations were influenced by study size or quality. The third stage of analysis aimed to use meta-analysis and meta-regression to test effects of modifiable predictors in associations between maltreatment and depression, where data from three or more studies could be combined. Unfortunately, no more than two included studies assessed the same modifiable predictor. Therefore, modifiable predictors of depression are reviewed narratively.

RESULTS

Literature search

The literature search yielded 4575 unique articles. 4189 were discarded as irrelevant/ineligible based on titles and abstracts. The remaining 386 articles were assessed for inclusion using the full text, and 364 were excluded. This resulted in 22 articles that met inclusion criteria for the systematic review (see Figure 1). Of the 22 articles, 3 did not report associations between maltreatment and depression,[12–14] and one reported ORs but not CIs and therefore we were unable to include this in analyses.[15] We were unable to contact authors of three articles to request further information,[12–14] and one author no longer had access to data.[15] Thus, 18 articles were included in the meta-analysis ($N = 12\,210$).

Study characteristics

Characteristics of the 22 included studies are shown in Table 1. The study samples ranged from 355 to 4664 participants, and were published between 2001 and 2014. In the majority of studies, participants' self-reported symptoms of depression on a continuous scale ($N = 18$), and five studies assessed depression via diagnostic interview.[14,16–19] Childhood maltreatment (including harsh parenting) was measured using various methods. Six studies accessed official records,[15,20–24] and the remaining studies used self-reported experiences of maltreatment, where the participants reported experiences either as adolescents[13,19,25–30] or adults.[12,14,18,31,32]

Childhood maltreatment and depression

Our analysis confirmed an association between maltreatment and depression in all studies where maltreatment was not split by type. The combined unadjusted association ($N = 13$ studies) was OR = 1.59 (95% CI = 1.46–1.75, $P < 0.001$), indicating that maltreated children were more likely than non-maltreated children to develop depression. Significant heterogeneity was observed among these studies ($I^2 = 80.1$, $P < 0.001$; Figure 2a). The combined adjusted association ($N = 7$ studies) was OR = 1.50 (95% CI = 1.32–1.70, $P < 0.001$), again indicating that maltreated children were more likely to develop depression than their non-maltreated peers, and significant heterogeneity was observed ($I^2 = 92.4$, $P < 0.001$; Figure 2b). In sensitivity analyses, the unadjusted association was OR = 1.71 (95% CI = 1.51–1.94) and heterogeneity was evident ($I^2 = 48.83\%$, $P < 0.001$).

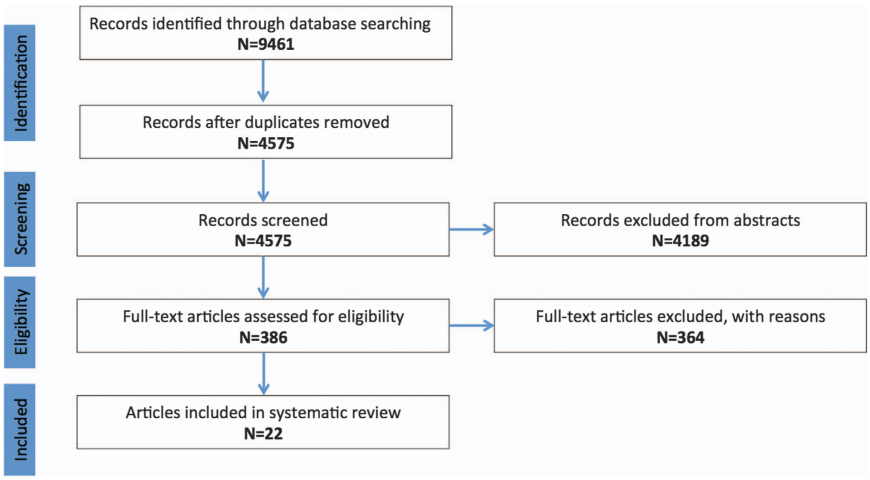

Figure 1. Study selection procedure for a systematic review of the association between childhood maltreatment and later depression, examined in prospective, longitudinal studies.

We then evaluated the relation of study quality and size with observed risk through meta-regression of study quality ratings and sample size with ORs. The unadjusted association ($N = 13$ studies) between maltreatment and depression, adjusted in meta-regression analysis for study quality was OR = 1.48 (95% CI = 0.47–4.62), suggesting only a very small influence of quality on effect size. The same analysis adjusted for sample size was OR = 2.06 (95% CI = 1.06–4.02), and the association was in a negative direction, indicating larger studies reported smaller effects. Publication bias was evident. A funnel plot revealed that smaller studies reporting weak associations had not been published. Correction for bias slightly reduced the unadjusted association (OR = 1.30, 95%CI = 1.13–1.49).

Modifiable predictors of depression following maltreatment

Six studies examined modifiable predictors of depression, and these were categorized as: interpersonal relationships, cognitive vulnerabilities and behavioral difficulties (See Table 2).

Interpersonal relationships. Two studies, which we rated as higher and moderate quality, examined the role of social support.[19,24] Sperry & Widom[24] assessed 388 adults with documented histories of maltreatment and 308 matched controls. The participants self-reported social support at age 39.5 using the Interpersonal Support Evaluation List, which includes four items: appraisal, belonging, self-esteem and tangible support. This measure met all three of our quality criteria. Participants reported depression at age 41.2. When adjusting for age, gender and race, maltreated individuals reported significantly lower total social support in adulthood, and also lower subtypes of social support. Total social support, and subtypes, conferred vulnerability to depression following maltreatment, such that maltreatment predicted lower social support and lower social support predicted higher depression. Similarly, Salazar *et al.*[19] followed 513 youth exiting the foster care system. Participants' self-reported pre-care and during-care maltreatment at age 17. Perceived social support was self-reported at age 19, and met all quality criteria. This measure was an overall perceived social support composite, calculated by standardizing and taking the mean of two social support measures: The Medical Outcomes Study Social Support Survey and a social network sufficiency measure. Depression was assessed via clinical interview at age 21. Both pre-care and during-care maltreatment were associated with depression as a young adult. Maltreated individuals who perceived higher social support were less vulnerable to develop depression compared with maltreated individuals who perceived lower social support. However, buffering effects of social support were stronger for participants with fewer maltreatment experiences, and diminished as maltreatment histories became more complex.

A study that we rated as moderate quality, analyzed insecure attachment style as a potential modifiable predictor of depression following maltreatment. Hankin *et al.*[27] examined 652 undergraduate students with a mean age of 18.7, who retrospectively reported experiences of maltreatment during childhood and depressive symptoms at a later time point. They also reported insecure attachment style on the Adult Attachment Questionnaire. However, this measure did not meet all our quality criteria as it was assessed at the same time as depression. Emotional abuse in childhood, but not other abuse subtypes, was associated with an increase in depressive symptoms and insecure attachment styles in young adulthood. Further, it appeared that an insecure attachment increased vulnerability to depression following emotional abuse.

Cognitive vulnerabilities. The results presented by Paredes & Calvete,[37] which we rated to be moderate quality, suggests that a certain cognitive vulnerability, brooding, may be a modifiable predictor of depression. This was a three-phase longitudinal study of 998 adolescents aged 13 to 17. At the first assessment, the participants retrospectively reported emotional abuse during childhood, and at the second assessment cognitive vulnerabilities were measured using the Children's Response Style Scales and the Adolescent Cognitive Style Questionnaire. These included two components of rumination (brooding and reflection), and negative inferential styles, and this measure met all three of our quality criteria. The participants self-reported depression at all stages. Emotional abuse was associated with increased brooding, which in turn was associated with depression, indicating that increases in brooding may increase vulnerability to depression. However, neither reflection nor negative inferential styles increased vulnerability. Hankin *et al.*[27], described above, also assessed negative cognitive style as a modifiable predictor of depression using the Cognitive Style Questionnaire. A negative cognitive style, in part, conferred vulnerability to depression following emotional abuse in univariate analyses. However, in multivariate analyses, which controlled for baseline depression, effects minimized and became nonsignificant, suggesting a weak relationship.

Behavioral difficulties. Two studies, that we rated to be moderate quality, investigated aspects of behavior as modifiable predictors. Brensilver *et al.*[20] assessed a group of 303 children (aged 9–12)

Table 1. Selected characteristics of included studies investigating the association between childhood maltreatment and depression

Author(s)	*Total* N	*Location*	*Maltreatment*			*Depression*		*Confounders*	*Covariates*	*Modifiable predictor*	*Study quality (NOS)*
			Type	*Measure*	*Mean age (s.d.) or range*	*Measure*	*Mean (s.d.) age or range*				
Brensilver *et al.*[20]	454	USA	Neglect, physical, sexual, emotional, caretaker incapacity	Official report	11 (1.5)	Children's Depression Inventory (CDI)	12.73 (1.21)	—	Child's age, ethnicity, household income, caretaker depression/ anxiety	Externalizing behavior	6
Brody *et al.*[25]	368	USA	Physical	4 items from Harsh/ Inconsistent Parenting Scale	11.2 (0.34)	Centre for Epidemiologic Studies Depression Scale (CES-D)	19.2 (0.34)	Gender, SES, 5-HTTLPR genotype	—	Youth anger	5
Clark *et al.*[26]	455	Not reported	Physical and sexual	Expanded assessment for PTSD, part of the SADS for DSM-IV criteria	8.4 (5.4)	Beck Depression Inventory (BDI)	19 (s.d. not reported)	—	Gender, ethnicity, SES	—	5
Danese *et al.*[16]	892	New Zealand	Neglect, physical, sexual, harsh discipline	Cumulative exposure index based on: age 3 mother-child interactions, parental report of harsh discipline at age 7 & 9, retrospective reports of physical and sexual abuse at age 26.	3 to 11	Diagnostic Interview	32 (s.d. not reported)	—	Family history, CV disease and depression, birth weight, child BMI, SES, smoking, physical activity, diet, medications	—	7
Fergusson *et al.*[17]	893	New Zealand	Physical and sexual	Retrospective reports at age 18 and 21	0 to 16	Diagnostic Interview	30 (s.d not reported)	5-HTTLPE genotype	—	—	5
Hankin[27]	652	Not reported	Physical, sexual, emotional	Life Experiences Questionnsire (LEQ)	0 to 14	Composite depressive symptom variable, comprised of a standardized score on the BDI, and two subscales of the Mood and Anxiety Symptom Questionnaire (MASQ)	18.7 (0.96)	Other abuse, baseline depression	—	Insecure attachment and negative cognitive style	4
Herrenkohl *et al.*[21]	355	USA	Not reported	Official report	1.5 to 6	Beck Depression Inventory (BDI)	36 (s.d. not reported)	Gender, SES, age, marital status, education	—	—	5
Lee *et al.*[22]	849	USA	Physical, emotional, neglect, moral/	Official report	0 to 11	Moods and Feelings Questionnaire	24 to 25	Ethnicity, SES, cohort	—	—	5

Table 1. (Continued)

Author(s)	*Total* N	*Location*	*Maltreatment*			*Depression*		*Confounders*	*Covariates*	*Modifiable predictor*	*Study quality (NOS)*
			Type	*Measure*	*Mean age (s.d.) or range*	*Measure*	*Mean (s.d.) age or range*				
Lev-Wiesel *et al.*[12]	1003	Israel	legal/ educational Sexual	The Childs Sexual Assults Scale	0 to 14	Centre for Epidemiologic Studies Depression Scale (CES-D)	18 to 44	—	—	—	2
Mersky & Topitzes[23]	1071	USA	Mixed (no specifics reported)	Official report	0 to 18	5 items from the Derogatis Brief Symptom Inventory Depression Subscale	22 to 24	Gender, ethnicity, birth weight, neighborhood poverty, household (crowding, parent-status, welfare reciept), mother (teen parent, employment, education)	CPC prescool participation and school-age participation	—	5
Munson & McMillen[13]	404	USA	Physical, sexual, neglect	Child Trauma Questionnaire	0 to 17	11-item Depression-Arkansas Scale (D-ARK)	17 to 19	Gender, ethnicity, current living situation, alcohol, marijuana use, family history of mental health and suicide, criminal history	—	—	5
O'Connor *et al.*[28]	500	UK	Sexual	Lifestyle and Coping Questionnaire	Not reported	Hospital Anxiety and Depression Scale (HADS)	15 to 16	—	—	—	2
Paredes & Calvete,[37]	998	Spain	Emotional	Conflict Tactics Scale parent-to-child version (CTS-PC)	13 to 17	Centre for Epidemiologic Studies Depression Scale (CES-D)	11.33 (5.73)	—	—	Negative cognitive style, and two components of rumination (brooding and reflection)	4
Rich *et al.*[31]	524	USA	Physical, emotional, sexual	Conflict Tactics Scale (CTS) and The Child Sexual Victimisation Questionnaire	0 to 14	Beck Depression Inventory (BDI)	18 to 19	—	Dating violence and sexual victimisation in adolescence	—	4
Robertson-Blackmore *et al.*[18]	374	USA	Physical, emotional, sexual	PTSD section of the SCID (structured clinical interview)	Not reported	Diagnostic Interview	24.5 (3.7)	—	Age, parity, ethnicity, education, marital status, history of depression	—	5

Table 1. (Continued)

Author(s)	*Total* N	*Location*	*Maltreatment*			*Depression*		*Confounders*	*Covariates*	*Modifiable predictor*	*Study quality (NOS)*
			Type	*Measure*	*Mean age (s.d.) or range*	*Measure*	*Mean (s.d.) age or range*				
Salazar *et al.*[19]	513	USA	Phycial, sexual, psychological, neglect	Life Experiences Questionnsire (LEQ)	17.39 (0.49)	Diagnostic Interview	21.09 (no s.d. reported)	Gender, ethnicity	—	Social support	5
Schilling *et al.*[29]	1093	USA	Physical and neglect	Self-report	Not reported	Centre for Epidemiologic Studies Depression Scale (CES-D)	Not reported	Gender, ethnicity, parents education	—	—	5
Seng *et al.*[32]	566	USA	Physical, sexual, emotional, neglect	Life Stressor checklist	0 to 16	Postpartum Depression Screening Scale (PDSS)	27 (5.4)	Quality of life, peri-traumatic dissociation in labor	History of depression or PTSD	—	3
Smit *et al.*[14]	4664	The Netherlands	Phycial, sexual, emotional, psychological, neglect	Self-report	0 to 16	Diagnostic Interview	40.08 to 41.5	Gender, age, living situation, ethnicity, education, urbanization, risk exposure time	—	—	6
Sperry & Widom,[24]	696	USA	Physical, sexual, neglect	Official report	0 to 11	Centre for Epidemiologic Studies Depression Scale (CES-D)	41.2 (3.53)	Gender, age, ethnicity, mental health history	—	Social support	7
Thornberry *et al.*[15]	738	USA	Physical, sexual, neglect, moral/ legal/ educational	Official report	0 to 18	Centre for Epidemiologic Studies Depression Scale (CES-D)	17.9 (s.d. not reported)	Gender, ethnicity, parental education, family structure, economic disadvantage, community poverty	—	—	5
Wu[30]	1273	Taiwan	Physical, emotional, neglect	Self-report	Not reported	Symptom Checklist-90- Revised (SCL-90-R)	Not reported	—	—	—	4

Abbreviations: BMI, body mass index; CV, cardiovascular; NOS, Newcastle-Ottawa Scale; PTSD, posttraumatic stress disorder; SES, socio-economic status.

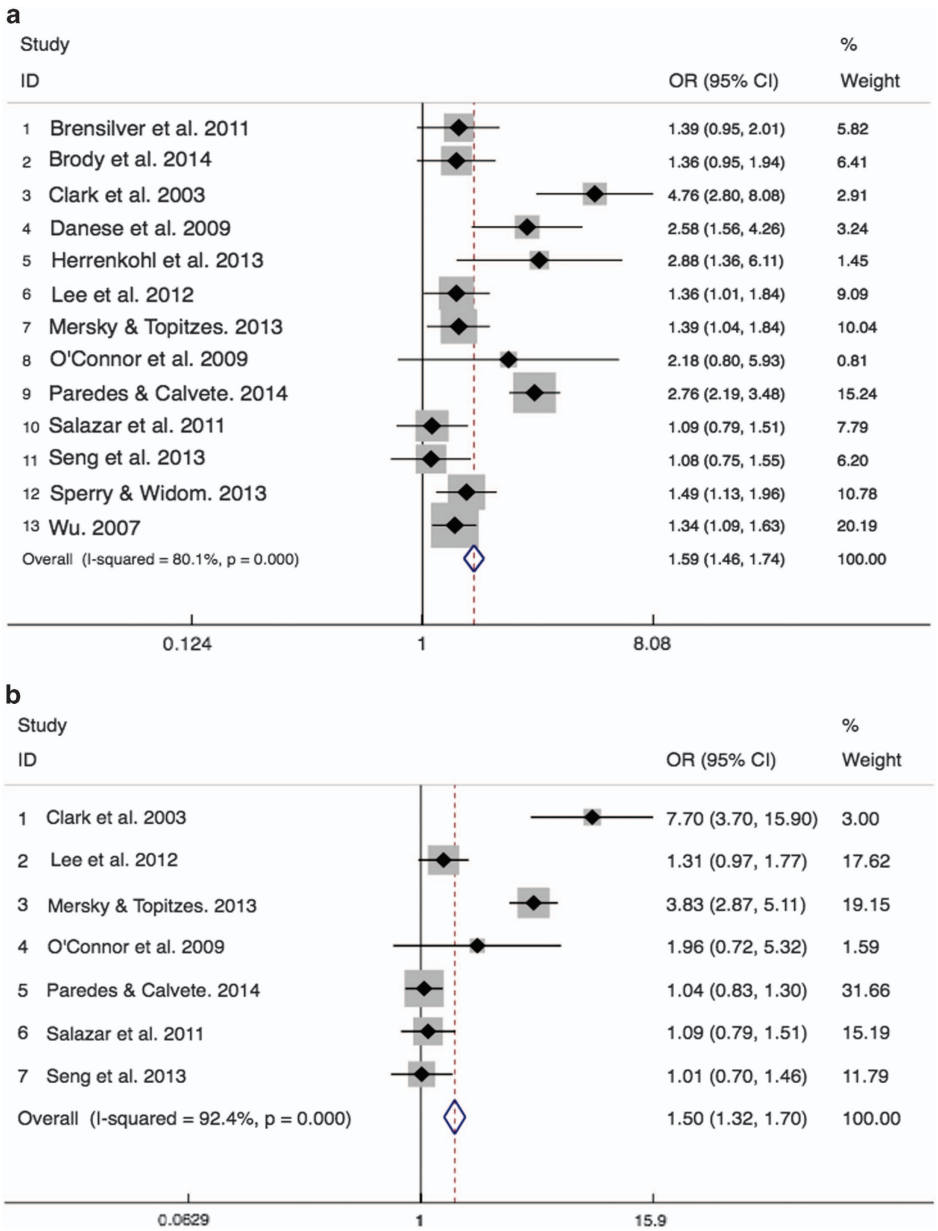

Figure 2. Forest plots of individual and pooled odds ratios (ORs) and 95% confidence intervals (CIs) for childhood maltreatment and depression. The size of the shaded box around the individual study ORs represent the weight of that study in the pooled analysis. (**a**) The unadjusted association between maltreatment of any type and depression, $N = 13$ studies. (**b**) The adjusted (for any confounder, covariate or modifiable predictor) association between maltreatment of any type and depression, $N = 7$ studies.

longitudinally over 1 year, that had documented maltreatment histories, and 151 matched controls. Externalizing behavior was examined using the Youth Self Report, but only met two of our quality criteria as it was not assessed temporally after maltreatment and before depression. Maltreated girls showed a strong relationship between externalizing behavior and depression, such that baseline externalizing problems explained 22% of variance in depressive symptoms. However, this association was not evident among maltreated boys. Brody *et al.*[25] examined relationships between self-reported harsh parenting during preadolescence, anger in adolescence measured with the State-Trait Anger Inventory (which met all three of our quality criteria), and late adolescent health (a latent variable composed of C-reactive protein, depression and poor health) among 368 African American youth. Harsh parenting was associated with increased anger, which was in turn associated with poor health generally. Unfortunately, the authors did not test whether youth anger increased vulnerability to depressive symptoms specifically. However, harsh parenting and depression was significantly and positively correlated.

DISCUSSION

We conducted a systematic review to synthesize existing literature that examined modifiable predictors of depression following maltreatment. We used stringent inclusion criteria so that only sufficiently powered, longitudinal studies were included. Combined unadjusted and adjusted associations between maltreatment and depression reported here are consistent with effect sizes reported in existing meta-analyses of this association,[5–7,33]

Table 2. Detailed characteristics of included studies to examine modifiable predictors of depression following maltreatment

Author(s)	*Modifiable predictor*	*Measure of modifiable predictor*	*Time point that modifiable predictor was measured*	*Quality score for assessment of modifiable predictor (/3)*	*Results*
Brensilver *et al.*[20]	Externalizing behavior	The Youth Self Report (YSR); 17-item agression and 16-item delinquency subscales	Time 1 (age ~ 10) and Time 2 (age ~ 12). Depression was also measured at these two time points	2	For maltreated girls, baseline externalizing problems explained 22% of the variance in depressive symptoms at age ~ 12.
Brody *et al.*[25]	Youth anger	State-Trait Anger Experssion Inventory (15-item state anger subscale)	Anger assessed at age 16–18. Maltreatment was assessed at 11–13 and depression at 16–18.	3	Youth anger at age 16–18 partially mediated the association between harsh parenting at age 11–13 and depression at age 16–18.
Hankin[27]	Insecure attachment and negative cognitive style	The Adult Attachment Questionnaire and The Cognitive Style Questionnaire	At age 18.7, participants retrospectively reported malteratment, and completed attachment and cognitive style questionnaires.	2	In a multivariate mediation model, insecure attachment style almost completely mediated the association between childhood emotional abuse and depression. The mediation effect of negative cognitive style did not stand up to multivariate analyses.
Paredes & Calvete,[37]	Negative cognitive style, and two components of rumination (brooding and reflection). Negative inferences	Ruminative responses subscale from the Children's Response Styles Scale and Adolescent Cognitive Style Questionnaire	At time 1, participants self-reported malteratment experiences, at time 2 they completed the modifiable predictor measures, and at time 3, depression was assessed	3	Brooding mediated associations between emotional abuse experiences and depression. Reflection and negative inferences did not mediate this association.
Salazar *et al.*[19]	Social support	Standardised mean of two measures: The Medical Outcomes Study Social Support Survey, and a Social Network Sufficiency Measure	Participants reported maltreatement at ~ 17 years, social support at ~ 19 years, and depression was assessed at ~ 21 years	3	Social support moderated and partially mediated the association between maltreatment and depression. This buffering effect appeared to diminish as malteatment histories became more complex.
Sperry & Widom,[24]	Social support	Interpersonal Support Evaluation List	Participants had documented histories of maltreatment, and a matched control group. Social support was assessed ~ 39.5, and depression ~ 41.2.	3	Individuals with histories of maltreatment reported significantly lower levels of social support in adulthood. Social support mediated the association between malteratment and depression.

demonstrating a clear association when focusing solely on prospective, longitudinal data. Adjusting for study size and quality resulted in only small changes in the effect size. As only six of the identified studies examined potential modifiable predictors of depression, it is difficult to draw firm conclusions from this research.

There is some initial evidence that low social support increases vulnerability to depression following maltreatment.[19,24] This may suggest that maltreated children find it more difficult to form relationships from which they gain high levels of support, and therefore are at greater risk of developing depression. Alternatively, other factors relating to maltreatment may make it difficult for children to access social support. Equally, children with existing high social support appear buffered from the detrimental effects of maltreatment on depression, though this appears more effective for children without the co-occurrence of maltreatment subtypes. Similarly, insecure attachment style was associated with depression in later life, which may be because maltreated children with insecure attachment styles find it difficult to form stable and supportive relationships. That being said, a substantial proportion of children in foster care with insecure attachments to birth parents were able to form secure attachments with foster parents.[34] This highlights that processes underpinning formation of secure attachment relationships are not biologically or genetically driven, and are malleable under different conditions. Thus, attachment relationships may be modifiable, and therefore a key target for intervention. Indeed, a number of relationship-based interventions already exist for maltreated children, which aim to promote secure attachment, and sensitive and responsive parent–child interactions. Examples of these types of therapies include Attachment Biobehavioral Catchup, which helps caregivers re-interpret children's behavioral signals, and Infant Parent Psychotherapy, which aims to improve the parent–child relationship. Meta-analyses demonstrate that these types of intervention effectively improve attachment security, however, effects on externalizing behaviors are minimal.[35] It is unknown whether relationship-based interventions promote resilience to depressive and internalizing symptoms, and addressing this theory is a clear future direction for resilience and intervention research.

A wealth of depression research suggests that cognitive biases and vulnerabilities increase risk for depression onset and recurrence.[36] Given this existing, extensive field of research, it is surprising that only two studies from the current review investigated cognitive vulnerabilities in susceptibility to depression following maltreatment. One of the main psychological therapies to treat depression, cognitive behavioral therapy, specifically targets negative patterns of thought about the self and world to alter unwanted behavioral patters and improve mood. Cognitive behavioral therapy is certainly the most well evidenced form of therapy for maltreated children and has specific adaptations for sexual abuse, physical abuse and multiple forms of maltreatment.[35] In meta-analyses, cognitive behavioral therapy significantly reduces depression and internalizing symptoms both immediately post treatment and at 1-year follow-up,[35] indicating a causal role of cognitive vulnerabilities in associations between maltreatment and depression. The current review also found behavioral difficulties, specifically externalizing behaviors, may also be modifiable predictors of depression following maltreatment, but there are currently few interventions for maltreated children aimed at managing difficult behaviors. As externalizing behaviors are highly comorbid with depression, it is, however, unclear whether externalizing problems are on the causal pathway to depression, or are an early manifestation of depression. More research is needed to understand this relationship, but if behavioral difficulties are causal, then interventions aimed at behavior management may be effective for reducing depression.

Limitations of this systematic review, and the individual studies, should be considered. Our inclusion criteria were strict so only well-powered longitudinal studies were included; however, there was great variability in the measures of maltreatment and depression. Although all included studies were prospective in design, many included retrospective reports of maltreatment, which is likely to result in recall bias. Accessing official records may be more reliable; however, restricting measures to official records identifies only a small proportion of cases, which may be a biased, unrepresentative subset. Further, many studies assessed depression via clinical interview, but a significant number assessed depression via self-report, which is subject to current mood. It is also important to note that there may be an inherent bias in participants with symptoms depression who are willing to take part in prospective, longitudinal research compared with their counterparts who are not willing to partake in research, and therefore results may not be wholly generalizable to the population. However, this is of course somewhat unavoidable in observational research. Of the six studies to examine modifiable predictors of depression, two utilized official records[20,24] and four assessed maltreatment via youth report.[19,25,27,37] Just one study assessed depression via clinical interview[19] and the remaining used a self-report measure.[20,24,25,27,37]

We assessed the study quality using the NOS. However, there are no existing checklists specifically designed to assess the quality of risk factors in longitudinal research, which may be on causal pathways between exposure and outcome. We thus created three quality criteria for assessing modifiable risk factors, but this has not been validated. The lack of quality checklists is a limitation for any scientific field focused on assessing mechanisms in health and disease. The development and validation of such checklists is of academic and clinical importance. Another limitation is that we focused on depression as an outcome, and therefore studies where depression and other psychiatric and physical conditions were comorbid were not included, as these were beyond the scope of this review. For example, there have been reports of poor physical and psychological outcomes, including substance abuse, for those who experienced childhood abuse.[38] Thus, potentially higher risk groups with comorbidity were not included in the review. We also did not search the gray literature for unpublished data, as we included only peer-reviewed studies published in journal articles.

Many questions remain regarding future research. Well-designed longitudinal, prospective research investigating and characterizing modifiable predictors in associations between maltreatment and depression are lacking. The design of such studies requires careful consideration to elucidate causal mechanisms and identify targets for intervention. For example, measuring and statistically controlling for baseline symptoms is important to understand cyclical relationships and causal links between variables, and to tease apart correlates of exposure and outcome. A critical question concerns the underlying biological processes that may lead to depression onset following maltreatment exposure, and future studies should seek to ameliorate the biological mechanisms underlying potential modifiable predictors, such as cognitive processes and behavior, using physiological and neuroimaging techniques. It is also currently unclear whether different modifiable predictors may be important for subtypes of abuse, and whether modifiable predictors are gender-specific. Just one of the included studies in our review tested for gender differences and reported that for maltreated girls there was a strong association between externalizing symptoms and depression, but this association was not evident in boys. No other studies reported effects by gender, thus we were unable to test overall effects of gender in meta-analyses. However, given the higher prevalence of depression in females, and the emerging idea that mechanisms leading of psychopathology in the context of early-life stress may be sex-specific,[39] it is possible that modifiable

predictors of depression following maltreatment may also be gender-specific.

There is an underdeveloped profile of research regarding modifiable predictors of depression following maltreatment from high-quality, sufficiently powered studies. There is initial evidence to suggest that interpersonal relationships, cognitive vulnerabilities and behavioral difficulties may act as modifiable predictors of this association. Identifying and understanding the mechanisms of modifiable predictors of depression among maltreated children may help us to better understand what works, for which children and why. Such research will enhance the development of targeted interventions for maltreated children.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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