Childhood Maltreatment and Violent Outcomes: A Systematic Review and Meta-analysis of Prospective Studies

Abstract

The risk of violence following childhood maltreatment is uncertain. This meta-analytic review identifies prospective studies that have examined this association. We systematically searched three electronic databases (PsycINFO, EMBASE, and MEDLINE) and completed a targeted search on Google Scholar. These were supplemented with scan of reference lists and correspondence with authors. We considered non-English-language and unpublished studies. Studies were included if childhood maltreatment was measured before age 18 years and occurred before violent outcomes. We identified 18 eligible studies with data on 39,271 participants. We conducted meta-analysis to calculate odds ratios using random-effects models. Heterogeneity was explored through subgroup analyses and meta-regression. The overall odds ratio of violent outcomes in childhood maltreatment was 1.8 (95% CI 1.4-2.3) with substantial heterogeneity (I^2 = 92%). Meta-regression suggested that risk of violence following childhood maltreatment was higher in samples with higher percentage of females, in higher quality studies, in studies with case-linkage methods compared to studies that followed up participants over time, in studies with general population or matched controls than selected population controls, and with older age when violent outcomes were assessed. In conclusion, the risk of violence perpetration was increased in individuals with childhood maltreatment. Preventive strategies and interventions for childhood maltreatment may have an important role in violence reduction. Methodological issues and recommendations for future research are discussed.

Keywords: Child Abuse, Violent Offenders, Violence Exposure, Neglect

Introduction

Traumatic events in childhood are common, over one third of individuals in the general population experience at least one traumatic event in childhood (Copeland, Keeler, Angold, & Costello, 2007). Child maltreatment is the most frequent form of childhood trauma. Estimates of worldwide prevalence rates of abuse and neglect range from 10% to 29% (Sethi et al., 2013), and is associated with a wide range of negative outcomes in adulthood, which contribute substantially to the global burden of disease (Norman et al., 2012). It has been consistently linked to various forms of psychopathology, physical illness, health-risk behaviours, and suicidal behaviours (Anda et al., 2006; Gilbert et al., 2009; Maniglio, 2009; Norman et al., 2012). Child maltreatment is also associated with criminal and violent behaviours (Maas, Herrenkohl, & Sousa, 2008; Malvaso, Delfabbro, & Day, 2016), and high prevalence rates of childhood maltreatment have been identified in offender samples. In the UK, nearly one third of adult prisoners report having experienced child abuse (Ministry of Justice, 2012). Almost half of children in custody samples have experienced abuse, with 38% witnessing domestic violence (Glover & Hibbert, 2009).

Although the link between childhood maltreatment and violence has been studied, this relationship is complex and not clearly understood. Findings are inconsistent and not all studies have found evidence of this relationship. Explanations for these discrepancies have been focused on the methodological differences between studies (Ertem et al., 2000; Thornberry et al., 2012). Previous reviews in this area have focused on the effects of child maltreatment on general antisocial behaviours, criminal offences, and intergenerational continuity of child maltreatment perpetration rather than on all types of violent outcomes (Kerig & Becker, 2015; Malvaso et al., 2016; Schofield, Lee, & Merrick, 2013; Thornberry et al., 2012; Wilson et al., 2009). In other reviews, specific violent outcomes such as intergenerational violence (Ertem, Leventhal, & Dobbs, 2000), intimate partner violence

(Haselschwerdt, Savasuk-Luxton, & Hlavaty, 2017) and sexual offending (Jespersen et al., 2009) have been investigated, but not overall violence. Previous reviews that have focused on generic violent behaviours have primarily assessed outcomes in adolescence, have not employed meta-analytic methods and now dated (Falshaw et al., 1996; Maas et al., 2008). Thus, in this review, we aim to undertake a systematic review and meta-analysis on the risk of all types of physical violence in individuals who have experienced childhood maltreatment and to assess the effect of potential moderating characteristics on risk estimates.

Synthesising research on the relationship between childhood maltreatment and violence is complicated by inconsistent definitions and study designs. Common methodological problems include reliance on self-report measures, lack of measurement of the severity or chronicity of childhood trauma, absence of control groups, and selective sampling (Thornberry, Knight, & Lovegrove, 2012; Widom, 1989a). Many studies have used cross-sectional designs with retrospective measurement of childhood maltreatment where there was no control over temporal ordering of exposure and outcome, providing unreliable estimates of the effect. Thus, in this systematic review, we aimed to focus on prospective studies. This approach has been adopted by another recent systematic review in this field as Malvaso and Colleagues (2018, in press) assessed the methodological features of prospective and longitudinal studies on the maltreatment-offending association.

Understanding the association between childhood maltreatment and future violence can help to develop effective preventive strategies and interventions, particularly in mental health and criminal justice contexts (Harner & Burgess, 2011; Heide & Solomon, 2006; Martin, Eljdupovic, Mckenzie, & Colman, 2015). This may be important within prison settings as it is suggested that such environments trigger past trauma resulting from maltreatment and increase trauma-related behaviours that can impede rehabilitation (Ardino,

2012). Thus, knowledge on the relationship can be used to guide trauma-informed care that is becoming increasingly common within correctional settings (Miller & Najavits, 2012).

Methods

Search Strategy

We followed the Preferred Reporting Items for Systematic Review and Meta-analysis Protocols (PRISMA) guidelines (Shamseer et al., 2014) and prospectively registered it on PROSPERO (CRD42016048541). We conducted systematic searches on EMBASE (1st January 1980 - 31st October 2017, MEDLINE (1st January 1946 – 31st October 2017), and PsycINFO (1st January 1806 – 31st October 2017). Combinations of search terms relating to childhood maltreatment (e.g. child* and maltreat* or trauma* or abuse* or neglect* or rape*) and violent outcomes (e.g. viol* or crim* or offend* or aggress* or danger*) were used. On PsycINFO, additional limits were used for the methodology (prospective, follow-up, longitudinal), the other databases did not provide the function to apply these limits. These searches were supplemented by a targeted search on Google Scholar (completed on 31st October 2017) using the key search terms as well as the 'cited by' function to explore similar papers to those identified for inclusion. The reference lists of the included papers were searched to identify any additional articles. Both published and unpublished studies were considered for the review. The first author (L.F.) conducted the literature search.

Study Eligibility

Childhood maltreatment was defined as abuse, neglect, or witnessing domestic abuse before the age of 18 years. Violent outcomes were defined as all types of physical violence against others including general violent acts and specific types of violence (e.g., sexual offences, dating violence). In addition, violent outcomes of all severity (e.g., assault, homicide) and frequency (single assault, repeated battery) were included. Aggression and

violent thoughts were not included within the definition of violent outcomes. Studies were included if: (a) they assessed the direct link between childhood maltreatment and violent outcomes; (b) this relationship was assessed using a prospective design where the exposure (childhood maltreatment) was measured before the outcome (violence); (c) childhood maltreatment occurred, and was recorded before 18 years old; and (d) violent outcomes were measured as physical acts of interpersonal violence, rather than aggression or violent thoughts.

Exclusion criteria included: (a) violent outcomes were measured in combination with non-violent acts; (b) if there was no comparison group not exposed to child maltreatment (for example Salter et al., 2003); (c) childhood maltreatment was assessed in a sample pre-identified as violent; or (d) use of the same dataset as another study (in these cases the study with the largest sample size and/or the one that provided the most relevant data were included). When suitability for inclusion was in question this was resolved through discussion between authors. Figure 1 illustrates the paper selection process.

Data Extraction

A standardised form was used to extract data from the studies. Data extraction was completed by the first author (L.F.) and cross-checked by the second author (R.Y.). The following information were collected: the geographical location, sample size, participant group, gender ratio, age of exposure to childhood maltreatment and violent outcomes (taken as the mean age when provided or median age if only the range was given) and the duration between these periods, definitions and measures of childhood maltreatment and violent outcomes, attrition rate, type of statistical test used and outcome, and risk estimates for the number of individuals with or without child maltreatment and violent outcomes. When studies did not directly report odds ratios (ORs), these were calculated based on information on the number of participants with or without child maltreatment cross-classified by violence.

If data were reported as frequencies or proportions ORs were calculated directly with the corresponding 95% confidence intervals (Morris & Gardner, 1988). Regression coefficients were converted to ORs using the exponential function (Miller, Reardon, & Safi, 2001); Chi-square values were converted to correlation coefficients (Rosenthal, 1994) and correlation coefficients were converted to Cohen's *d* and then log-transformed to ORs (Chinn, 2000; Rosenthal & DiMatteo, 2001); Analysis of variance *F* values were converted to ORs using Cohen's *d* (Thalheimer & Cook, 2002). All ORs were reported to one decimal place. The calculations were cross-referenced by one of the co-authors, to ensure conversion accuracy.

Quality Assessment

Quality was assessed using the Newcastle-Ottawa Quality Assessment Scale for Cohort Studies (Wells et al., 2004), a tool that evaluates the selection of cohorts, comparability of cohorts, and assessment of outcome. The scale provides a rating score where high-quality choices are awarded a star, and each study can have a maximum of nine stars. Uncertainties about quality were resolved through discussions between co-authors.

Statistical Analysis

The overall analysis and subgroup analyses were performed using STATA version 14, for Mac (StataCorp, 2015). Random-effects models were used when heterogeneity was considered high based on I^2 values (Low, medium, and high heterogeneity relate to I^2 values of 25%, 50%, and 75%, respectively; Higgins et al., 2003). Random-effects models use more balanced weighting of studies and account for within- and between-study variance, which results in larger confidence intervals than fixed-effects models (Borenstein, Hedges, Higgins & Rothstein, 2009). The I^2 statistic was used to measure heterogeneity, which describes the percentage variation across studies due to heterogeneity rather than chance (Higgins, Thompson, Deeks, & Altman, 2003). Subgroup analyses and meta-regression analyses were conducted to explore factors associated with observed heterogeneity. To compare the risk

estimates of different groups, subgroup analyses were performed by age, gender, sample size, duration between exposure and outcome, publication year, research method, and quality assessment score. When the heterogeneity was medium or high between studies, meta-regression and subgroup analyses were conducted to estimate the extent to which one or more measured covariates explained the observed heterogeneity in risk estimates (Higgins & Thompson, 2002). Publication bias was assessed using Begg's test that assesses the correlation between the log-OR and the study weight (Begg & Mazumdar, 1994). The influence of individual studies on the summary effect was explored using an influence analysis, whereby magnitude of change in overall OR was assessed following removal of each study.

Results

Study Characteristics

We identified 18 eligible studies, see Table 1 for a summary (and Appendix A for references). The included studies were published between 1989 and 2016, in four different countries, and included information on 39,271 cases. All but three of the papers were published in peer-reviewed journals: English et al. (2002) was published as a governmental report; Ogloff et al. (2012) was published in a peer-reviewed governmental series; and Thomas (2007) was an unpublished dissertation.

The majority (78%) of the studies were conducted in the USA. Participants were selected from the general population, child protection cases, and specifically selected groups (often 'high risk' groups such as those in poverty). More males were sampled than females (27,096 males, 12,175 females), with four studies including only males and one study including only females. Racial demographic information was provided in 78% of the papers. The majority of the studies (61%) had contact with the participants and followed them over

time measuring the exposure and/or outcome directly. The remaining investigations used case-linkage approach. The average follow-up time was 17 years in case-linkage and 13 years in follow-up studies. The most frequently used definitions of childhood maltreatment were combinations of physical abuse, sexual abuse, neglect, emotional abuse, and witnessing domestic violence (72% of studies).

Quality Assessment

Among the included studies, four met full criteria on the Newcastle-Ottawa scale (9 marks), four received seven-to-eight, and the remaining 10 studies scored six or less. The most common methodological limitation, identified in eight studies, was a below-adequate duration between outcome and exposure (<10 years; if duration was not explicitly stated this was estimated from the longest possible time between age of childhood maltreatment and violent outcome).

Relationship between Childhood Trauma and Violent Outcomes

Across the 18 studies the random-effects pooled OR of violent outcomes was 1.8 (95% CI = 1.4 – 2.3) in individuals with childhood maltreatment (Figure 2). There was a high heterogeneity between studies (I^2 = 92%). Absolute risk was calculated from 9 out of 18 studies that had data available for this. The total number of individuals with childhood maltreatment in these studies was 11,163, of whom 1,690 (17%) were involved in violent behaviours. These persons were compared with 20,938 individuals without childhood maltreatment, of whom 1164 (10%) had committed violent behaviours.

Subgroup and meta-regression analyses were conducted to explore sources of between-study heterogeneity. Higher percentage of female in a sample, older age at time of violent outcome, case-linkage studies (versus cohort studies), types of control group, and quality assessment score were significantly associated with heterogeneity in univariate meta-regression analyses (see Table 2). However, when the four significant findings from the

meta-regression were entered simultaneously, only the effect of age at time of violent outcome remained significant (p = .05, see Appendix B).

There was a significant difference in risk estimates between studies of child protection samples (OR = 2.6 [1.7 - 4.1]) and those included other samples (general population or specially selected groups: OR = 1.3 [1.1 - 1.5]). The OR in studies using case-linkage methodology (OR = 2.7 [1.6 – 2.5]) was higher than those followed up a population (OR = 1.4 [1.1 – 1.6]). In addition, the OR in studies with general population or matched controls was higher than in those with an unmatched control group from the same population (OR = 2.4 [1.6 – 3.7] vs. OR = 1.3 [1.0 – 1.6], Figure 3). Furthermore, the OR was higher in female group than in male group (OR = 2.1 [1.0 – 4.4] vs. 1.5 [1.1 – 2.0]), although the confidence interval overlapped (Figure 4). Begg's test for publication bias was not significant (rank correlation method; Kendall tau = 1.23, p = .53).

Other Characteristics

There were no significant differences in risk estimates by other characteristics including sample size, type of maltreatment, duration between exposure and outcome, etc. (Table 3).

Discussion

This meta-analysis assessed the relationship between childhood maltreatment and violent outcomes in prospective studies, and identified 18 investigations involving 39,271 individuals. The overall finding was that child maltreatment (defined as child abuse and neglect) increased the risk of violence with a pooled OR of 1.8 (95% CI: 1.4-2.3). To our knowledge, this is the first meta-analysis that assesses the relationship between child maltreatment and all types of violence across the age range with quantitative examination of heterogeneity.

The principal finding that childhood maltreatment is an important determinant of violence later in life, nearly doubling the risk of violent outcomes, builds on previous work by providing an estimate of the effect and its uncertainty. We have also presented some information on absolute risks that provide important context for the relative risks reported. The absolute risk of violence was 17% in individuals who experienced maltreatment and 10% in control populations. These findings provides further support for theories on the 'cycle of violence' (Widom, 1989c) that propose that those victimised as children are more likely to go on to victimise others. We did not find evidence that specific types of child maltreatment were stronger predictors of violence than others. As has been suggested in other reviews assessing negative outcomes following child maltreatment, it may be that age of child maltreatment, multi-victimisation, and severity may be more important variables than type of maltreatment (Varese et al., 2012). However, data were not available to explore this in the current review.

A second main finding was that the risk of violent outcomes following childhood maltreatment was higher in studies with higher percentage of females. In the follow up subgroup analyse by gender categorized as female, mixed gender, and male, there was also a trend that the odds of violent outcomes was higher in maltreated females than males. This is consistent with a study of youth intimate partner violence perpetration following child maltreatment, where it was suggested that females may be more vulnerable than males to the effects of child maltreatment (Mass et al., 2008). However, other reviews in this area have either not found a gender difference (for childhood violence exposure and juvenile antisocial behaviour, Wilson et al., 2009) or have, in contrast to this review, identified a greater risk of violent outcomes for males (for sex offending following sexual abuse, Jespersen et al., 2009; and for any offending following child maltreatment, Malvaso et al., 2016). One possible

explanation for the increased effect on women is that of the low prevalence of violence, and hence any effect of any exposure leading to higher odds of violent outcomes.

Another finding was that the older the age violence was assessed the stronger the association between child maltreatment and violent outcomes. This would be expected given that the opportunity for violence and the probability of future violence increases with older age (Fogel, 2009). Effects of prior violence were not adjusted for in the current review as it was only measured in three studies (Rebellon & van Gundy, 2005; Thomas, 2007; Wright & Fagan, 2013). Overall, it was not possible to determine whether the age effect observed can be explained by prior violence.

We found that the risk of violent outcomes following child maltreatment was higher in studies with a case-linkage methodology compared to studies individually following participants over time and higher in studies with child protection samples than in general population and specifically selected samples. Type of control group seemed to modify the association between child maltreatment and violent outcomes as risk estimates were higher in studies with general population or a separately recruited matched group (e.g., a matched sample with no abuse) as controls than in studies with controls from the same selected population (e.g., poverty sample). However, there were significant overlaps among these subgroups. For instance, all but one of the child protection samples used a case-linkage methodology. Studies with selected controls were more likely to be child protection samples. It was therefore challenging to disentangle the effects of study methods, sample type, and control group. For instance, the selection of specifically child protection samples could add bias through selection of the most severe cases. However, these cases are likely to receive some form of intervention for child maltreatment whereas cases unknown to child protection services may not (Stuart et al., 2012). Furthermore, different localities have different thresholds for access to child protection services, which might add further bias (Malvaso,

2018, in press). Social desirability bias is a particular concern for self-report of maltreatment and violence, especially in studies that rely on parental reports of maltreatment where they themselves may be the perpetrators (Ertem et al., 2000).

Finally we found that the strength of the association between childhood maltreatment and violent outcomes increased with score on the quality assessment scale. This finding conflicts with those of Wilson and colleagues (2009) who found that the relationship was stronger in lower quality (cross-sectional) studies for antisocial outcomes in adolescents. While lower quality studies are open to more bias that might inflate the size of the association between childhood maltreatment and violence, this does not appear to be the case here. It might be that the most methodologically rigorous studies are the most sensitive to detect and measure the relationship between childhood maltreatment and violence, and underscores the importance of high quality research going forward.

Strengths, Limitations, and Future Directions

This review has several strengths. First, it is the first attempt to quantitatively synthesize evidence of the association between child maltreatment and all types of violent outcomes. Second, this review only selected studies using a prospective design which provide a clearer indication of the temporal sequence and a more accurate estimation of the association between childhood maltreatment and later violence outcomes than retrospective and cross-sectional studies. The latter study designs are subject to hindsight bias (where individuals may over-report histories of childhood maltreatment as a way to explain their current negative behaviours). Such bias could inflate the link between child maltreatment and violence. In addition, other confounding factors are also more difficult to account in cross-sectional and retrospective designs, such as effects of forgetting (Hardt & Rutter, 2004) and subsequent life-events (Tajima, Herrenkohl, Huang, & Whitney, 2004) on the likelihood of disclosure of traumatic experiences. Third, the use of meta-regression is important as it helps

to rigorously explore factors associated with the large variations in the reported associations. The findings can assist in better designed studies in the future. For example, results from the meta-regression analyses suggest that future studies of the link between childhood maltreatment and violent outcomes should consider stratifying by age, separating gender, and including more information on subtypes of maltreatment and violent outcomes.

We suggest a number of considerations for future studies. First, it is important that research in this area uses well-matched comparison samples, as there are common demographic and family risk factors for childhood maltreatment and violence (Malvaso et al., 2018, in press). An inherent challenge in this area of research is ensuring that the comparison sample has not been exposed to maltreatment. Second, efforts should be made to retain participants as failure to include cases lost to follow-up can add further bias, especially as these participants can have higher rates of antisocial behaviours (Thornberry, Bjerregaard, & Miles, 1993). Third, more information on severity and frequency could help to determine whether a dose-response relationship exists. However, in the current review, only two studies (Smith & Thornberry, 1995; Zingraff et al., 1993) provided data on maltreatment frequency and its association to violent outcomes. Mixed results have been reported. The first of these studies found that children with more than one reported incident of maltreatment were not at a greater risk of violent outcomes than children with just one report of maltreatment (Zingraff et al., 1993). However, the second found that the strength of the association between maltreatment and violent delinquency increased with the number of incidents of maltreatment (Smith & Thornberry, 1995). Future studies are necessary to enable a systematic examination of the association between child maltreatment frequency and later violent outcomes.

Other forms of victimisation such as bullying and revictimisation were not assessed in this review. Although some studies additionally measured dating violence victimisation (Lansford et al., 2007; Narayan et al., 2014), theft victimisation (Pardini et al., 2014) and a

range of other revictimisations such as sexual assault, stalking, and deception (Ogloff et al., 2012), they provided data on these variables in relationship to either violent outcomes or child maltreatment (Lansford et al., 2007; Narayan et al., 2014; Ogloff et al., 2012; Pardini et al., 2014). Hence, we could not assess whether other forms of victimisation could moderate the association between child maltreatment and later violence perpetration. In addition, as this review focused on violence perpetration, we did not conduct a systematic search for studies with future violence victimisation as an outcome. Future studies are encouraged to systematically evaluate the evidence of associations between child maltreatment and later violence victimisation.

It was not possible to assess the impact of timing of child maltreatment due to lack of detail in the papers. It was also not clear whether the age provided for child maltreatment reflected the age it occurred or the age it was reported. The lack of distinction with reported age of maltreatment has been highlighted as a common problem (Malvaso et al., 2016). Single measures of maltreatment up to a certain age are limited as maltreatment could continue from this point and might even be a consequence of delinquent and violent behaviour (Malvaso et al., 2018, in press). This bi-directional relationship between maltreatment and violence cannot be ruled out, especially in cases where temporal order is not established.

The analyses in the current review are limited in that it was not possible to compare violent outcomes by type of maltreatment for all studies. Furthermore, the subgroup analysis for emotional abuse should be interpreted with caution as it is based only on three studies and likely to be underpowered. If differences were identified between type of maltreatment and type of violence, they could inform theories on the 'cycle of violence' (Jespersen et al., 2009; Wilson et al., 2009). However, in this study, when studies assessed multiple forms of maltreatment, aggregated results were chosen (i.e. all forms of abuse and neglect together),

followed by physical abuse (as this was the most frequently assessed form of maltreatment). As a result, physical abuse is likely to be overrepresented in the findings. In addition, although the outcomes included all types of violent perpetrations, the majority of included studies provided data on generic violence, rather than focusing on a specific type of violence. Out of 18 included studies, only two focused on sub-categories of violence, with one assessing sexual offences (Leach et al., 2016) and another dating violence (Narayan et al., 2014). We did not identify any eligible studies examining other specific types of violence, such as perpetration of physical child abuse.

Pathways from childhood maltreatment to violence are complex, and many individual, social, and contextual factors have been implicated in this process (Malvaso et al., 2016). These include attachment (Mitchell & Beech, 2011), social learning (Dodge et al., 1990; Wiersma, 2013), mental health and dissociation (Daisy & Hien, 2003), substance abuse (Boles & Miott, 2003; Khoury et al., 2010), and neurobiological factors such as long-term changes in the limbic structures (amygdala, orbitofrontal cortex, and anterior cingulate cortex) and the frontal control systems resulting from childhood maltreatment that can lead to an insufficient modulation of aggression, with increases in violent behaviour (Heide & Solomon, 2006; Siever, 2008). Such factors have not been addressed in the current review and investigating mediation is required. Furthermore, modifiable risk factors like mental health and substance abuse need further research. The gender difference identified requires further research to determine whether there are gender-specific pathways between child maltreatment and violence. Gender differences may indicate that interventions targeting violence following child maltreatment may need to incorporate a broad range of factors specific to each gender (Lee, Herrenkohl, Jung, Skinner, & Kilka, 2015).

Preventive and Treatment Implications

The current review provides further evidence for the importance of preventive and treatment strategies for child maltreatment in preventing violence. This could be achieved through allocation of resources to parenting and family programmes, and education strategies for children and adolescents on victimisation and perpetration (Radford et al., 2010). Tighter safeguards, specialist training, and interdisciplinary working can help ensure maltreatment are identified, especially within healthcare, school, childcare, and criminal justice contexts (Ko et al., 2008; Radford et al., 2010). Children experiencing maltreatment should be offered timely interventions and it is important to consider addressing child maltreatment and associated trauma when offering interventions to violent individuals.

Conclusion

This review indicates that individuals subjected to childhood maltreatment have a higher risk of violent outcomes. There is some evidence that this risk is increased in females, although future research is required to better understand gender effects. A minority who experience childhood maltreatment become violent in later life, and continued research into moderating and mediating factors of the association between childhood maltreatment and violence is needed. Early interventions targeting childhood maltreatment may prevent future violence, and trauma-informed care may assist in the management of violent individuals.

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Table 1. Summary of Included Studies on Risk of Violence in Individuals who Experienced Childhood Maltreatment

Study	Country	Sample (*n*, % male, race when given)	Type of child maltreatment	Type of violent outcome	Mean age/age range (years) (1) Maltreatment (2) Violence	Measures (1) Maltreatment (2) Violence	% with violence in maltreatment group	% with violence in comparison group	Quality assessment stars received
Caspi et al., 2002	New Zealand	National sample of consecutive births. 442. 100% male.	Abuse (physical, emotional, sexual) and neglect	Violent offences	(1) 3-11 (2) 26	(1) Two of: behavioural observation, parental reports, retrospective adult reports[a] (2) Official (court) records	24%	9%	8
English et al., 2002	USA	Sample of abused and neglected children made dependents of the court and comparison matched non-maltreated controls from the same jurisdiction. 1754. 47% male. 70% Caucasian, 22% African-American, 6% Native American, 2% Other.	Abuse (physical, emotional, sexual) and neglect	Violent offences	(1) Birth to11 (2) 24 (and a juvenile sample younger than 18)	(1) Official (court) records (2) Official (arrest) records	27%[b]	9%	9
Herrenkohl et al., 1997	USA	Two groups of families from child welfare abuse and protective service programs and three from Head-Start classrooms, day-care programmes, and private nursery programmes. 418. 54% male. 83% White, 12% Spanish, and 5% African-American.	Severe physical discipline; neglect; severe emotional discipline	Violent behaviour	(1) 1.5-10 (2) 14-22	(1) Self-report – interview with mother (2) Self-report – interview with adolescent/adult	-	-	5
Herrera & McCloskey, 2001	USA	Children of women that had co-resided with a man in the last 12 months (battered women were oversampled, recruited from both shelters and the community). Comparison group of mothers recruited from the same area that had not experienced partner abuse. A comparison sample from the same city was recruited through requesting participation of mothers with a school-aged child for a study on the family. 299. 51% male. 56 % Anglo-European, 34% Hispanic, 4% African-American, 4% Native-American, 2% Asian Other.	Family violence (spouse abuse) and marital violence; physical parental punishment	Violent offences	(1) 6-12 (2) 11-18	(1) Self-report – interview with mother and child (2) Official (court) records	17%	5%	5
Lansford et al., 2007	USA	General population sample of children entering Kindergarten. 574. 52% male. 81% were European-American, 17% African-American, 2% Other.	Physical abuse	Violent offences	(1) 1-5 (2) 5-18	(1) Self-report – interview with mother (2) Self report – interview with adolescent/adult and official (court) records	-	-	4.5[c]
Leach	Australia	Children with a maltreatment history with either a	Abuse	Sexual	(1) Mean 7 (at first	(1) Official (child	2%	1%	8

et al., 2016		child protection notification, police caution, finalised juvenile court appearance, or finalised adult court appearance. 15146. 100% male.	(physical, emotional, sexual) and neglect	offences[d]	notification) 9 (at last notification) (2) Up to 25	protection) records (2) Official (police and court) records			
Millett et al., 2013	USA	Families with low or no income with children who had been investigated for abuse or neglect and a matched comparison group from the same population. 5377. 50% male. 79% African-American, 11% White-American.	Abuse (physical, sexual) and neglect	Intimate partner violence and other violent offences	(1) Up to 17 (2) Up to 27	(1) Official (child protection) records (2) Official (police and court) records	20%	9%	9
Narayan et al., 2014	USA	Children of mothers considered at risk due to poverty. 182. 54% male. 67% Caucasian, 11 % African-American, 18% other, 4 % Unreported.	Abuse (physical and Sexual), neglect, and inter-parental violence	Dating violence[e]	(1) Birth to 5.3 (2) 23	(1) Self-report – mother, home observation, and official (child protection) records (2) Self-report – adult questionnaire	-	-	4
Ogloff et al., 2012	Australia	Children from a forensic medicine department medically confirmed to have experienced sexual abuse and a matched comparison sample from the same locality. 5436. 20% male.	Sexual abuse	Violent offences[f]	(1) 10 (2) 36	(1) Official (medical) records (2) Official (police) records	10%	1%	9
Pardini et al., 2012	USA	Boys from public schools that scored within the upper 30% of an antisocial behaviour screening measure and a comparison sample from the same group that did not. 503. 100% male. 40% White, 56% African-American, 4% Other.	Abuse (physical and Sexual) and neglect	Violent acts	(1) 12 (2) 13-18[g]	(1) Official (children services) records (2) Self report – interview with adolescent/adult	-	-	4
Rebellon & van Gundy, 2005	USA	National probability sample of adolescents. 1524. 53% male. 15% African-American, 85% Other.	Physical abuse	Violent offences[e]	(1) 11-17 (2) 13-19	(1) Self-report – interview with adolescent (2) Self-report – interview with adolescent[h]	-	-	4
Siegel & Williams, 2003	USA	Emergency room records from one hospital – sexual abuse victims and matched comparison sample with no sexual abuse. 411. 0% male. 84% African-American, 16% Other.	Sexual abuse	Violent offences	(1) 1-12 (2) Up to 35[i]	(1) Medical records and interview with child or family member (2) Official (court and arrest) records	9%	4%	8.5[j]

Silva et al., 2012	Canada	Children at kindergarten in neighbourhoods with the lowest socioeconomic status. 851[k]. 100% male.	Abuse (physical and emotional) and neglect	Violent offences	(1) 10-12 (2) 12-24	(1) Self-report – child questionnaire (2) Official (criminal) records	-	-	4[k]
Smith & Thornberry, 1995	USA	Stratified general population sample to over-represent delinquency and drug use. 889. 74% male. 18% White, 66% African-American, 16% Hispanic.	Abuse (physical, emotional, sexual) and neglect	Violent offences	(1) Before 12 (2) 14	(1) Official (child protection) records (2) Self-report – adolescent questionnaire	-	-	5
Thomas, 2007	USA	Sample from a juvenile detention centre. 1604. 63% male. 56% African-American, 16% non-Hispanic White, 27% Hispanic, 1% other.	Abuse (physical and Sexual) and neglect	Violent offences	(1) 15 (2) 20	(1) Official (court) records and self-report – interview with child/adolescent (2) Self-report – interview with adolescent/adult	47%	50%	4
Widom, 1989b	USA	Sample of validated court cases of abused and neglected children with a matched non-abused sample from the same community. 1575. 49%. 67% White, 31% African-American, 2% Other.	Abuse (physical and Sexual) and neglect	Violent offences	(1) 5 (2) 26	(1) Official (court) records (2) Official (criminal) records	9%	6%	9
Wright & Fagan, 2013	USA	Sample from stratified probability sample of 80 neighbourhood clusters in one city. 1372. 51% male. 32% African-American, 17% Caucasian, 47% Hispanic, 4% Other.	Physical abuse	Violent acts[f]	(1) 9-15 (2) 12-18	(1) Self-report – interview with parent (2) Self-report – adolescent/adult questionnaire	-	-	6
Zingraff et al., 1993	USA	Children with a substantiated maltreatment from one county and comparison school and poverty samples from the same area. 914[l]. 46% male. Overall sample 46% White, 54% Other.	Abuse (physical and Sexual) and neglect	Violent offences[e]	(1) 9 (2) 15	(1) Official (social service) records (2) Official (court) records	3%	1%[l]	7

Note. *n* given is what the analysis was based on, whereas the demographics (gender, race) provided in the paper are often based on the whole sample. Percentage with violence is provided when available in paper; percentages of violence provided are based on the main study findings or results for aggregated categories of maltreatment. Quality assessment is based on the data used in the analysis. [a] For severe maltreatment measured in the review. [b] Data for both adult and juvenile offences. [c] 4 stars for self-report outcome, 5 stars for official record outcome. [d] The authors were contacted for data on violent offences also but this was not available. [e] No examples of sexual violence given, not known if it is included. [f] Sexual violence not included. [g] Data on ages 15-18 included in the meta-analysis. [h] The only study to use count data – where the relationship between physical abuse and violent offence counts was assessed. [i] Approximate age, exact not provided. [j] 9 for adult outcomes, 8 for adolescent outcomes. [k] For maltreatment measured at age 12. [l] For maltreatment and school comparison sample (including poverty sample *N*=1091).

Table 2. Univariate meta-regression analyses assessing the relationship between childhood maltreatment and violent outcomes

Characteristic	*b*	Standard Error	*p*
Sample size	.00	.00	.76
Duration	.03	.02	.13
Publication year[a]	-.10	.36	.79
Age of violent outcome	.06	.02	.001
Gender[b]	-.01	.00	.03
Study methodology[c]	.64	.25	.02
Control group	.64	.25	.02
Quality assessment score	.17	.06	.01

Note. [a] Pre 2000 vs. post 2000. [b] Male vs. Female. [c] Case-linkage vs. follow-up. [d] General population vs. selected.

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Table 3. Subgroup analyses examining the relationship between childhood maltreatment and violent outcomes

Characteristic	Random-effects pooled odds ratio	95% CI	Heterogeneity I^2 (%)
Type of childhood maltreatment (four groups)			
Physical abuse	1.5	1.2 - 1.8	66
Sexual abuse	2.4	0.8 - 7.1	94
Neglect	1.6	0.9 - 2.9	90
Emotional abuse	1.3	1.0 - 1.7	37
Type of childhood maltreatment (two groups)			
Sexual abuse	2.0	0.7 - 5.5	93
Any abuse	1.5	1.3 - 1.9	80
Type of violent outcome			
Violent offences only	2.1	1.4 - 3.0	94
Sexual offences, dating violence, and violent behaviours/acts	1.5	1.2 - 1.9	65
Measure of childhood maltreatment			
Official records	2.3	1.5 - 3.6	94
Self-report	1.4	1.1 - 1.8	65
Gender			
Male	1.5	1.1 - 2.0	85
Mixed	1.8	1.4 - 2.4	80
Female	2.1	1.0 - 4.4	86
Age of Violent Outcomes			
< 18 years	1.9	1.4 - 2.6	85
≥ 18 years	2.0	1.4 - 2.9	93
Duration between exposure and outcome			
< 20 years	2.4	1.3 - 4.3	95
≥ 20 years	1.5	1.1 - 1.9	84
Measure of violent outcomes			
Official records	2.1	1.4 - 3.1	94
Self-report	1.5	1.2 - 1.9	76
Study Methodology			
Case linkage	2.7	1.6 - 4.5	94
Follow-up	1.4	1.1 - 1.6	69
Sample			
Child Protection Sample	2.6	1.7 - 4.1	91
Other (General Population and Specially Selected Samples)	1.3	1.1 - 1.5	57
Control group			
General population or separated recruited match	2.4	1.6 - 3.6	92
Selected sample	1.3	1.0 - 1.6	71
Quality Assessment Score[1]			
1-5	1.3	1.0 - 1.6	70
6-9	2.4	1.6 - 3.5	93

Note [1] Newcastle-Ottawa Quality Assessment Scale

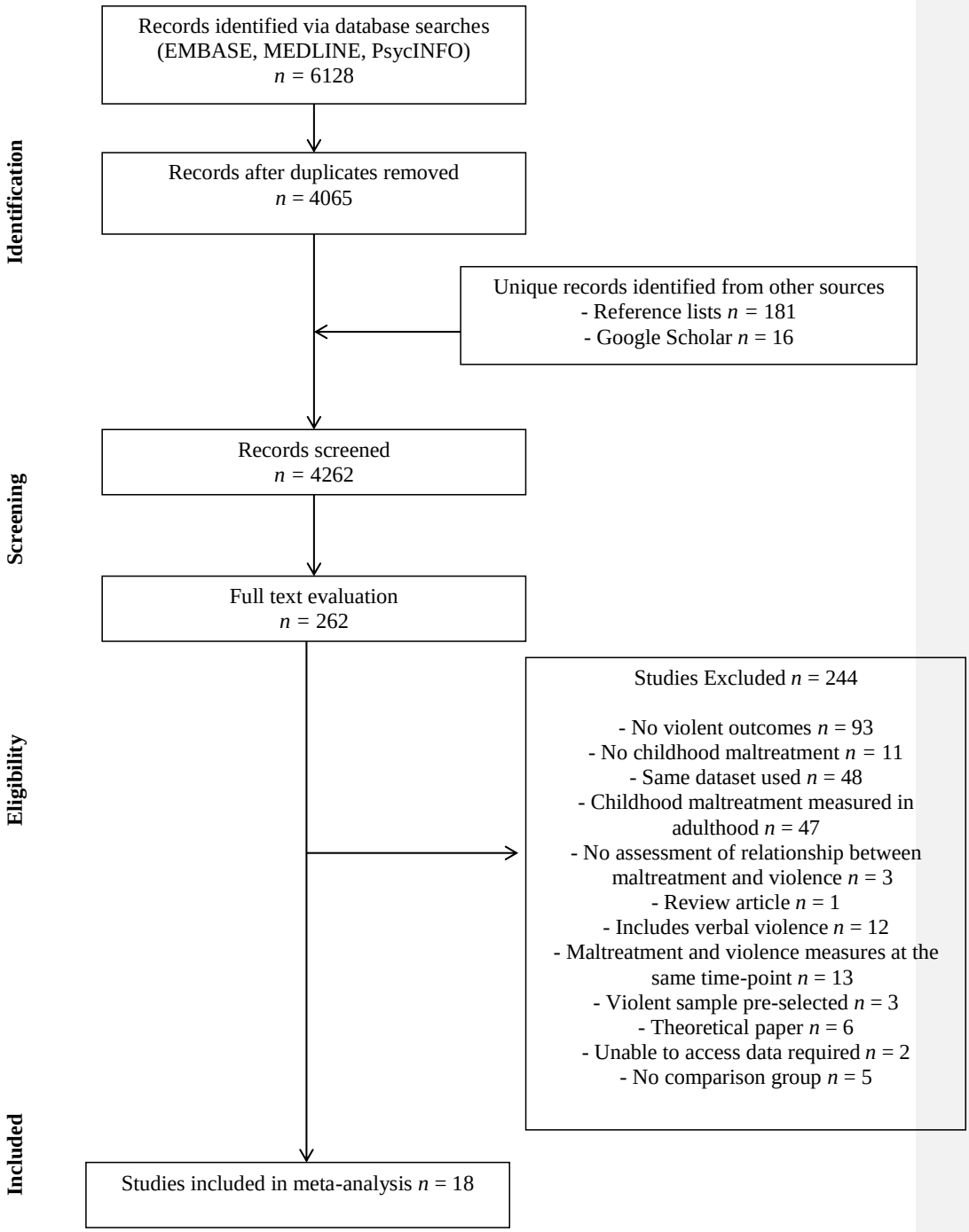

Figure 1. Flowchart of the systematic search strategy.

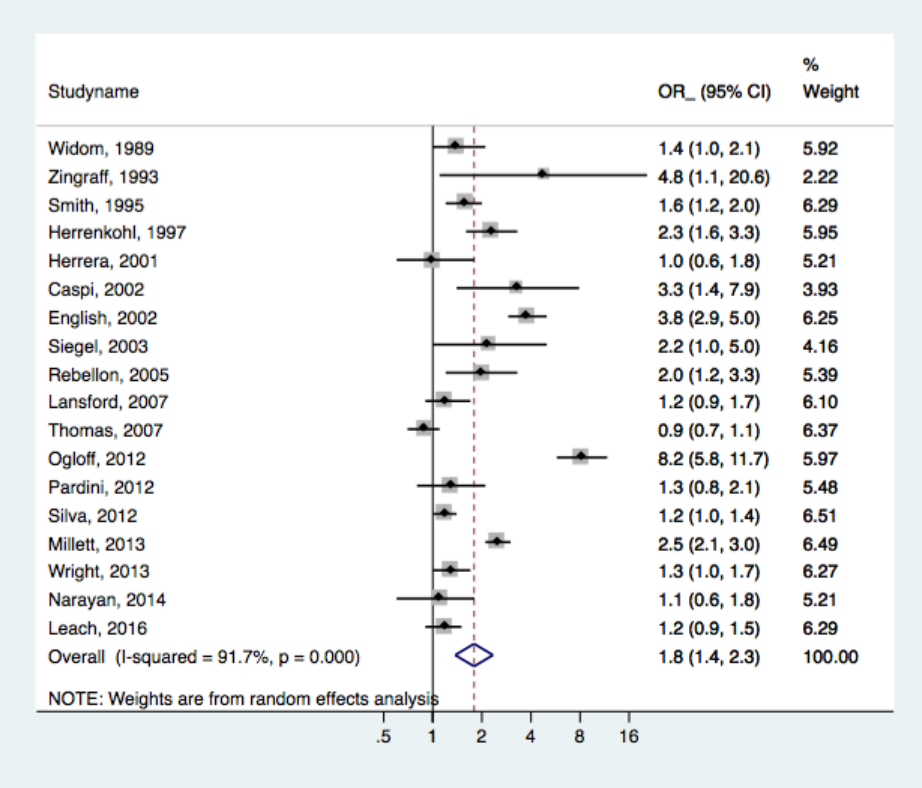

Figure 2. Risk estimate for the association between childhood maltreatment and violent outcomes

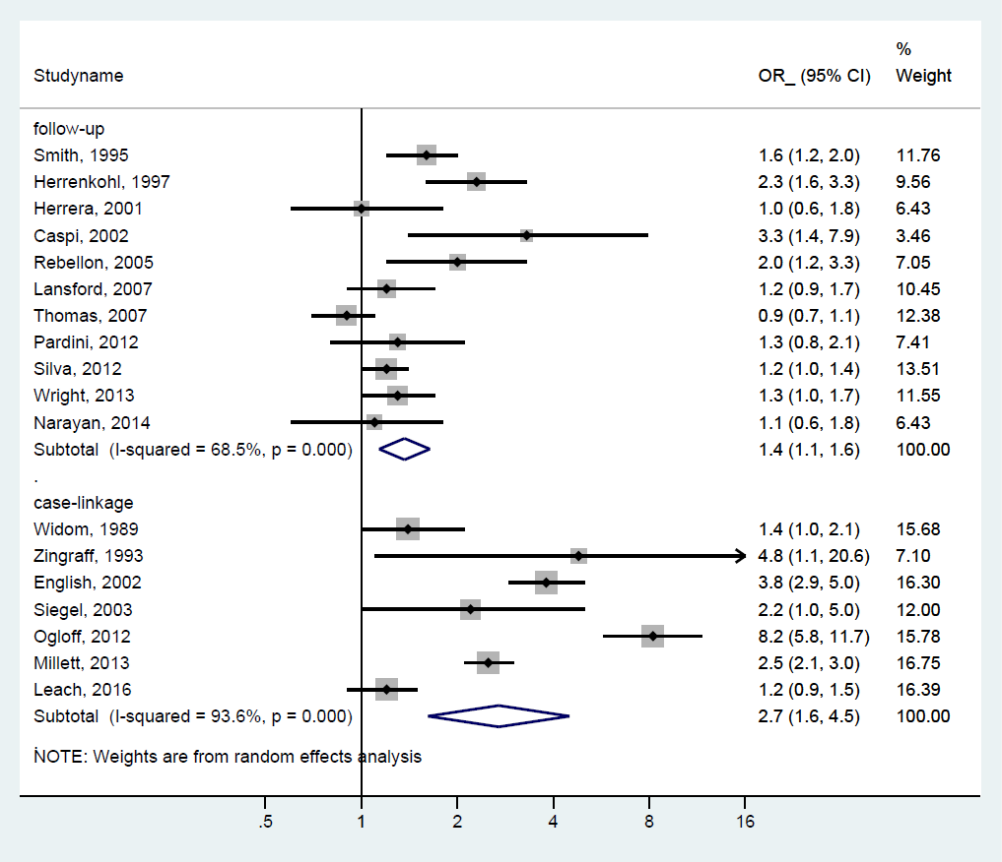

Figure 3. Risk estimate for the association between childhood maltreatment and violent outcomes by study type

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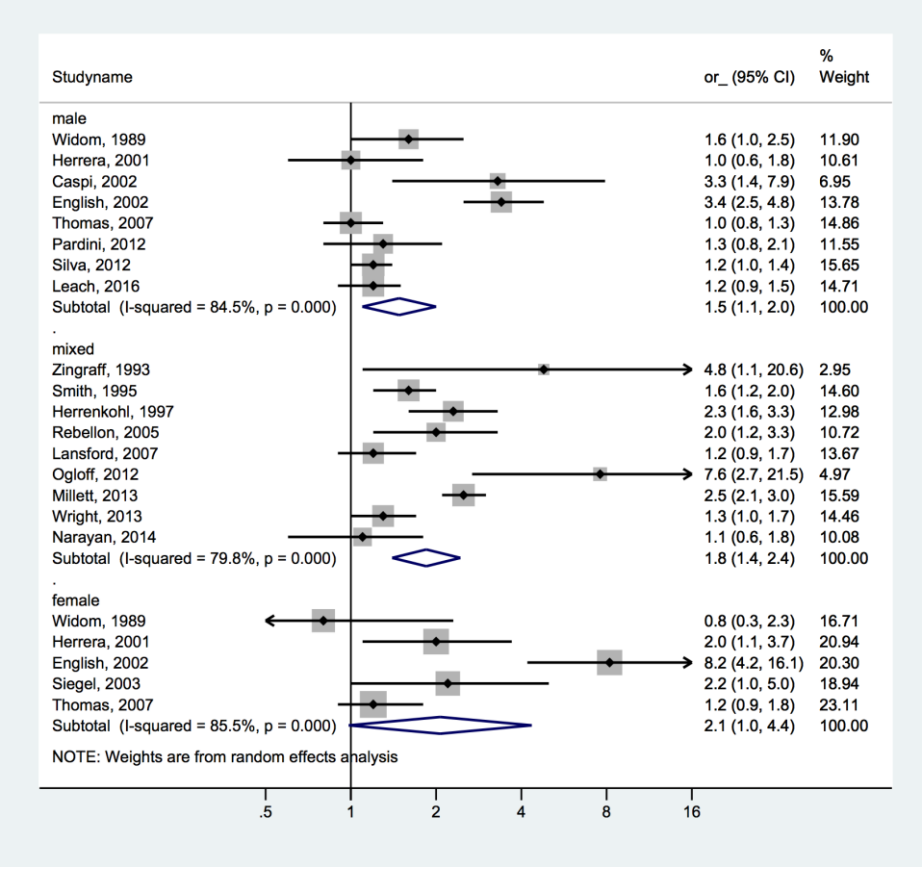

Figure 4. Risk estimate for the association between childhood maltreatment and violent outcomes by gender

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Appendix A

Reference List for Studies Included in the Meta-analysis

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Appendix B

Table B.1 Multivariate meta-regression analyses assessing the relationship between childhood maltreatment and violent outcomes.

Characteristic	*b*	Standard Error	*p*
Age of violent outcome	.05	.02	.06
Gender[a]	-.00	.00	.85
Study methodology[b]	.02	.34	.95
Control group	.24	.30	.44
Quality assessment score	.21	.32	.67

Note. [a] Percentage of Female. [b] Case-linkage vs. follow-up.