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Research article

A systematic review and meta-analysis on adverse childhood experiences: Prevalence in youth offenders and their effects on youth recidivism

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ABSTRACT

Background: Adverse childhood experiences (ACEs) have been found to be more prevalent among youth involved with the criminal justice system compared to their counterparts in the general population. The present study aims to systematically review the existing empirical studies to provide a comprehensive understanding of the prevalence of ACEs among youth offenders aged between 10 and 19 years, and the effects of both cumulative ACEs and individual ACE items on youth recidivism.

Method: A systematic review approach was employed. Narrative synthesis and meta-analysis were performed to synthesise the data in 31 included studies.

Results: The pooled prevalence of cumulative ACEs was 39.4 %. The pooled prevalence of individual ACEs ranged between 13.7 % to 51.4 %. Cumulative ACEs and neglect were positively associated with youth recidivism, with OR = 1.966, 95%CI [1.582, 2.444] and OR = 1.328, 95% CI [1.078, 1.637], respectively. Physical and sexual abuse were not significantly associated with youth recidivism. Regarding the mechanisms underlying the relationship between ACEs and recidivism; moderators included gender, positive childhood experiences, strong social bonds, and empathy. Mediators included child welfare placement, emotional and behavioural problems, drug use, mental health problems, and negative emotionality.

Conclusion: Developing programs to youth offenders aiming to address the impact of cumulative and individual ACE exposure, strengthen the protective factors and weaken the risk factors would be useful to reduce youth recidivism.

1. Introduction

Adverse childhood experiences (ACEs) refer to potentially traumatic events experienced before a child reaches 18 years of age (Anda et al., 2003). These traumatic events consist of household dysfunction and various forms of abuse and neglect (Graf et al., 2021). The first ACE Study was by Felitti et al. (1998), which found that childhood abuse and household dysfunction were positively related to chronic disease in adults. Seven categories of ACEs were studied in the first wave of Felitti et al.'s (1998) study, and three categories of neglect were added in the second wave (Felitti & Anda, 2010).

According to literature (Anda et al., 2003; Baglivio & Wolff, 2021; Felitti et al., 1998; Felitti & Anda, 2010), the ten ACEs are: 1)

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Emotional abuse—parents and/or carers being hostile, berating, and/or belittling to the child; 2) physical abuse—the child being victimised or physically abused by a family member; 3) sexual abuse—the child being the victim of sexual abuse or rape; 4) emotional neglect—the child receiving little or no support from the family and/or not feeling close to any family members; 5) physical neglect—being the victim of physically negligent acts or omission, resulting in danger to the child's health, welfare, and safety; including failure to provide food, shelter, clothing, nurturing, and/or health care); 6) family violence—domestic violence and/or sexual abuse in the home where the child witnesses violence; 7) household substance abuse—parents and/or siblings in the household engaging in alcohol and/or drug abuse; 8) household mental illness—parents and/or siblings in the household having mental health conditions; 9) parental separation/divorce—parents separate or divorce, resulting in the child not living with both parents; and 10) incarceration of household member—family members having a history of being jailed or imprisoned. Each ACE is measured dichotomously (yes = 1, no = 0), resulting in a cumulative ACE score ranging from 0 (no exposures to any ACEs) to 10 (exposure to all of the 10 ACEs) (Baglivio & Wolff, 2021; Felitti & Anda, 2010).

Research reports that ACEs are more prevalent among youth involved in the criminal justice system compared to their counterparts in the general population (Baglivio et al., 2014). A Canadian study reported that 50 % male and 72 % female youth offenders experienced one ACE; 26 % males and 45 % females experienced two or more ACEs (Vitopoulos et al., 2019). A USA study found that ACE prevalence varied from 7 % male prevalence for sexual abuse to 84 % female prevalence for both family violence and parental separation or divorce. The prevalence of sexual abuse was reported to be 31 % by females and 7 % by males, indicating that females experience sexual abuse 4.4 times more frequently than their male counterparts (Baglivio et al., 2014).

Studies on ACEs shed light on the direct link between exposure to ACEs and youth offending. Graf et al.'s (2021) systematic review on the association between ACEs and justice system contact in a juvenile population suggested that elevated cumulative ACE scores are associated with increased risk of juvenile justice system contact, and exposure to childhood maltreatment in juvenile delinquents is reported to increase the likelihood of future criminal behaviour by approximately 50 %. Compared to the general population, youth offenders were found to be 13 times more likely to have at least one ACE and four times more likely to be exposed to four or more ACEs (Wolff and Baglivio, 2017). Youth with higher prevalence of ACEs have also been found to be more likely to become serious, violent, and chronic juvenile offenders (Fox et al., 2015).

Among juvenile offending, recidivism has become a pressing issue in many countries (Wolff et al., 2017) and is a key motivator to understand youth offenders and their offending behaviour (Payne, 2017). The definition of recidivism varies across studies. Generally, recidivism is defined as the involvement of reoffending within a certain timeframe, typically ranging from one to three years (Myner et al., 1998). Some studies measure reoffending within one year from the current violation (Niarhos & Routh, 1992). Some research measures reoffending as a new violation after release from the correctional facilities within one year (Craig, Zettler, Wolff, and Baglivio, 2019b; Wolff et al., 2017) or for at least one year (Chauhan et al., 2009). Others measure reoffending as a rearrest within 12 months following completion of the community-based placement (Craig, 2019), or a formally convicted offence over three years after the first formally convicted offence (Cho & Lee, 2021). Data sources of reoffending also vary across studies, including data from police, court and correction records and self-report data (Payne, 2017). Payne (2017) has pointed out that due to the differences in the definitions of reoffending and data sources, measures of recidivism are likely to be different. It is thus important that researchers locate their measures for recidivism within the broader theoretical and empirical work to help translate recidivism research into practice. In the current study, the operational definition of recidivism is the involvement of reoffending (including reoffending within one year from the current violation; a new violation after release from the correctional facilities within one year or for at least one year; a rearrest within 12 months following completion of the community-based placement; or a formally convicted offence over three years after the first formally convicted offence) from police, court and correction records or self-report data.

Since the 1990s, criminology researchers have shown great interest in examining and identifying criminogenic risk factors, including the impact of ACEs on youth recidivism (Craig, Zettler, Wolff, and Baglivio, 2019b). Existing literature highlights the positive correlations between ACEs and youth recidivism; that is, greater exposures to ACEs are associated with an increased risk of reoffending. For example, youth with four or more ACEs were 15.4 % (OR = 1.154, $p < .001$) more likely to be rearrested within one year completing their community-based placement and 20.6 % (OR = 1.206, $p < .001$) more likely to be re-convicted for an offence that was committed during that year (Baglivio & Wolff, 2021).

The developmental and life-course criminology (DLC) theories lend theoretical support to the examination and identification of ACEs as a risk factor for increased prevalence and seriousness of youth recidivism (Craig, Piquero, Farrington, and Ttofi, 2017b). DLC theories seek to understand the individual causes of criminal (re)offending and how these individual factors are differentially associated with (re)offending at various stages of life (Farrington, 2003). DLC theories consist of three sub-theories: The development of offending and anti-social behaviour, risk factors at different ages, and effects of life events (e.g., ACEs) on the course of the development of offending (Farrington, 2003). Employing the term 'cumulative disadvantage', DLC theory emphasises the cumulative impact of a specific form of disadvantage (e.g., an individual ACE item) and/or the accumulation of multiple, interactive forms of disadvantage (e.g., cumulative ACEs) on youth (re)offending, both within and across stages of life (Kurlychek & Johnson, 2019). Consequently, cumulative disadvantage of ACEs shapes the likelihood of youth coming into contact with the justice system in the first place, and their sequential involvement with the justice systems due to recidivism (Kurlychek & Johnson, 2019).

Although the evidence that ACEs are positively associated with youth recidivism has been well established, the mechanisms underlying this relationship (e.g., moderating and mediating effects) have received limited empirical attention. The analysis of the mechanisms by which ACEs increase or decrease youth recidivism will provide a better understanding of contributing factors for the relationship between ACEs and youth recidivism. These factors may modify or improve youth's response to ACEs, which thus may weaken (e.g., protective factors) or strengthen (e.g., risk factors) the positive relationship between ACEs and youth recidivism (Baglivio & Wolff, 2021). The analysis could offer evidence for service providers to assist youth with access to opportunities to enhance

the extent of positive experiences or reduce the extent of negative experiences that youth may be exposed to (Baglivio & Wolff, 2021). To the authors' knowledge, there is no systematic review on the mechanisms underlying the relationships between ACEs and youth recidivism. The current review aims to address this research gap.

Systematic reviews on prevalence of ACEs among youth offenders and the relationship between ACEs and youth recidivism are limited. A search in Cochrane, PROSPERO, and seven databases found no studies meta-analysing prevalence of ACEs in the youth offending population. Systematically reviewing evidence on prevalence of ACE is important because prevalence of ACEs can inform criminology researchers, intervention developers, and policymakers about the burden of ACEs among justice system-involved youth. This could also support the process of identifying priorities in healthcare to these young people and their families (Harder, 2014). Moreover, data on the prevalence of ACEs in juvenile recidivist populations could be particularly useful in countries where there is considerable uncertainty about the number of youth offenders experiencing ACEs because of incomplete coverage or measurement of youth experiences (Who, 2011). This study aims to offer a meta-analysis on prevalence of ACEs in youth offending population.

A further database search on the relationship between ACEs and youth recidivism found one systematic review. Yohros (2022) systematically reviewed and meta-analysed the relationship between recidivism and cumulative ACE scores in youth offender populations, and found that cumulative ACEs increase the risk of youth recidivism. Reporting ACEs with a cumulative ACE score is the leading model in ACE research (LaNoue et al., 2020). This cumulative approach to ACE research is founded on the presumption that there is a cumulative effect of increased frequency and exposure to individual ACEs (Baglivio & Wolff, 2021; Felitti et al., 1998; LaNoue et al., 2020). The cumulative approach also acknowledges that children commonly experience multiple forms of ACEs at the same time, and it is therefore difficult to separate the unique effects of individual ACE exposure (Baglivio & Wolff, 2021). However, the cumulative ACE approach assumes that the ten ACEs have equal effects (Negriff, 2020) on youth recidivism. It largely discounts the individual ACEs, and the distinction of individual ACE items, on youth recidivism (LaNoue et al., 2020; Negriff, 2020). The current systematic review aims to provide a comprehensive understanding on the effects of both cumulative ACEs and individual ACE items on youth recidivism.

Moreover, Yohros', 2022 systematic review was conducted by a sole author, which may cast doubt on the rigour of the methodology and findings. Teamwork and coproduction are essential for producing high-quality research synthesis (Uttley & Montgomery, 2017). Systematic reviews thus should be undertaken by a team that includes experts in the research field and methodology (Lasserson et al., 2022). The Cochrane Handbook for Systematic Review (Higgins et al., 2022) states that working in a team can ensure that the process of the selection of studies for eligibility, data extraction, and rating the certainty of the evidence will be performed by at least two researchers independently. Such processes can minimise the likelihood of errors. To overcome this limitation in Yohros' systematic review, the current study is co-authored by experts in the fields of mental health, forensic psychiatry, child and adolescent psychiatry, psychology, systematic reviews, and meta-analyses. The shared knowledge of the co-authors adds to the rigour of the review and the findings.

To provide a comprehensive understanding on the prevalence of ACEs among youth offenders and the effects of both cumulative ACEs and individual ACE items on youth recidivism, three research questions (RQs) are proposed:

RQ1. What is the pooled prevalence of cumulative ACEs and individual ACE items in recidivist youth offenders?

RQ2. What are the pooled effect sizes of cumulative ACEs and individual ACE items on youth recidivism?

RQ3. What are mechanisms (e.g., moderating and mediating effects) underlying the relationship between ACEs and youth recidivism?

2. Methods

This systematic review and meta-analysis followed the guideline of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and was registered in PROSPERO (Reg: CRD42021265911).

2.1. Inclusion and exclusion criteria

The age of youth offenders varies across countries, ranging from 10 to 19 years old (Barra et al., 2017; Cho & Lee, 2021; Craig & Zettler, 2021; Craig, Zettler, Wolff, and Baglivio, 2019b; Lambie et al., 2013; Miura & Fuchigami, 2020; Moore et al., 2013; Root et al., 2008). Hence, qualitative and quantitative studies on the relationships between ACEs and recidivism among youth offenders aged between 10 and 19 years were eligible for inclusion if they were published in peer-reviewed journals. The following articles were excluded: 1) articles that did not meet the inclusion criteria; 2) case reports, case studies, reviews, editorials and grey literature; and 3) non-English publications.

2.2. Search strategy

Seven electronic databases (CINAHL Complete, Medline Complete, PubMed, PsycInfo, Embase, Emcare, and PTDSpubs) were searched using both Medical Subject Headings (MeSH) terms and keywords, between 11 April and 18 April 2021 by the first two authors, to include the articles published between inception of the databases to the search dates. The search was repeated on 2 October 2022 to include the articles published between April 2021 to October 2022. Table 1 presents the search strategy structured in line with the PICO (Participant, Interventions or exposure, Comparisons, Outcomes) search elements (Higgins et al., 2022).

2.3. Study selection

The first step of study selection was the title and abstract screening against the inclusion and exclusion criteria. The first two authors (BA and WL) individually assessed titles and abstracts of the retrieved articles using the codes of 'yes', 'no', or 'maybe' to determine whether the article met the inclusion and exclusion criteria (Li et al., 2021). The studies unanimously coded as 'yes' and 'no' were included or excluded in the full text review, respectively. Disagreements between the assessors were resolved through discussion.

The second step of the study selection was to methodologically appraise the full text of the articles using the Mixed Methods Appraisal Tool (MMAT) Version 2018 (Hong et al., 2019). BA, WL, BM, and CL independently completed the MMAT. The eligibility of studies was determined using the inter-rater agreement measure of Fleiss' kappa (k) with the cut-off points of $k = 0.20, 0.40, 0.60$ and 0.80 suggesting poor, fair, moderate, substantial, and perfect agreements, respectively (Fleiss, 1971). Studies with $k \leq 0.40$ were discussed until a consensus was reached for inclusion or exclusion in the review.

2.4. Data extraction

A standardised data extraction form was created to collate the relevant data; this included first author, publication year, country of the study, sample size, analysis method, measures, participant age, participant gender, participant culture, prevalence of ACEs, and relationship between ACE/s and recidivism. BA, WL, BM, and CL independently assessed the extracted data to evaluate the evidence for findings claimed in each study, using codes of 'unequivocal', 'credible', or 'unsupported' (Li et al., 2021). All included studies were eligible for data synthesis as the evaluation agreement indexes ($(N_{\text{unequivocal}} + N_{\text{credible}}) / N_{\text{reviewers}}$) were higher than 0.80 (Li et al., 2021).

2.5. Data synthesis

The data synthesis included narrative synthesis and meta-analysis. Four steps were followed in the narrative synthesis (Higgins et al., 2022; Ryan, 2013). First, the DLC theory was employed as the theoretical framework to guide the review. Second, an initial synthesis of the findings was conducted by summarising the findings of each study, grouping the studies by cumulative ACEs and individual ACE items for the analysis of prevalence (RQ1) and effect size (RQ2). Third, moderating and mediating variables (RQ3) were identified across the studies. Fourth, an assessment of the robustness of the synthesis was conducted to appraise the strength of the evidence for making inferences and ensuring the methods applied reduced bias.

The meta-analysis was conducted using the Comprehensive Meta-Analysis (CMA) V3 (Borenstein et al., 2013). For studies reporting multiple effect sizes that were non-independent (e.g., the effects of an ACE were investigated by gender in a single study), a two-level meta-analysis was employed: A meta-analysis for the mean effect size of the multiple effect sizes in a single study was first performed, using the fixed-effect model, to obtain one synthetic effect size for the study. This synthetic effect size was then entered to the main meta-analysis, using the random-effects model, to yield the overall effect size across studies (Hedges, 2019).

Odds ratio was used to report pooled effect size. Different types of effect sizes were entered in the analysis, including odds ratio (OR), log odds ratio (log OR), Chi-squared for 2×2 (χ^2) and Pearson correlation coefficient (r). In the studies using beta coefficients (β) to report the effect size, β were first converted to r : $r = \beta + 0.05\lambda$, where λ equals 1 when β is non-negative, and 0 when β is negative (Peterson & Brown, 2005).

Heterogeneity was evaluated using I squared (I^2). $I^2 = 25, 50$, and over 75 represent low, medium, and high heterogeneity, respectively (Borenstein, 2019). The value of I^2 indicates the percentage (e.g., 25 %, 50 % and 75 %) of variance of the observed effect size reflecting the true variance rather than sampling error. Publication bias was assessed using the Egger's regression test, where insignificant p values indicate publication bias was not detected. Publication bias was not assessed for meta-analysis on prevalence because publication bias procedures are established based on the assumption that studies may not be published due to their findings being statistically non-significant (Borenstein, 2019) and prevalence studies are not involved in statistical significance test.

2.6. Assessing risk of bias in included studies

BA and WL assessed the risk of bias of each included study in four domains (e.g., participants, predictors, outcome, and analysis) using the Prediction Model Study Risk of Bias Assessment Tool (PROBAST) (Wolff et al., 2019). The rating of risk of bias included low, high, or unclear (risk of bias). An overall risk of bias evaluation was conducted to reach overall adjudgment across all assessed

Table 1

PICO (Participants, Intervention/Exposure, Comparisons, Outcomes) systematic search strategy.

PICO	MeSH terms	Keyword search
Participants	Youth offenders	Criminal behavio* OR criminal conduct OR criminal intent OR illicit behavio* OR unlawful behavio* OR illegal behavio* OR offend* OR delinquen* OR juvenile delinquen* OR youth offend* OR youth crim*
Intervention/ Exposure	Childhood adversity	Adverse childhood experience* OR early life stress* OR early-life stress* OR psychological trauma OR childhood adversity* OR childhood maltreatment OR child* abuse
Comparisons	N/A	N/A
Outcomes	Recidivism	Recidivi* OR re-offend* OR reoffend* OR repeat offend*

domains. The overall risk of biases of all included articles were rated as low.

3. Results

3.1. Characteristics of included studies

PRISMA flow diagram of included and excluded articles in this review is presented in Fig. 1. Thirty-one studies, all of which were quantitative studies, were included in the systematic review and meta-analysis. Two studies (Craig et al., 2017a, b; Craig, Intravia, Wolff, and Baglivio, 2019a) used the same participant pool, but reporting on different outcomes. The studies were thus regarded as two separate studies.

Of the 31 studies, 24 were conducted in the USA, followed by two in Canada and two in Switzerland. The remaining studies were completed in Australia (n = 1), New Zealand (n = 1), and Japan (n = 1). The sample size of the individual studies varied significantly (n = 21–99,602), with 423,972 total participants. The summary of the study characteristics is presented in Table 2.

3.2. The analysis of RQ1: prevalence of cumulative and individual ACE items in youth offenders

Of the 31 included studies, eight reported prevalence of cumulative ACEs, ranging from 11.7 % to 72.0 % (Baglivio & Wolff, 2021; Barra et al., 2022; Barrett et al., 2014; Cho & Lee, 2021; Kowalski, 2019; Root et al., 2008; Ryan, 2006; Vitopoulos et al., 2019). The pooled prevalence of cumulative ACEs was 39.4 %, 95%CI [0.227, 0.590]. Fig. 2 presents the forest plot of the results. The

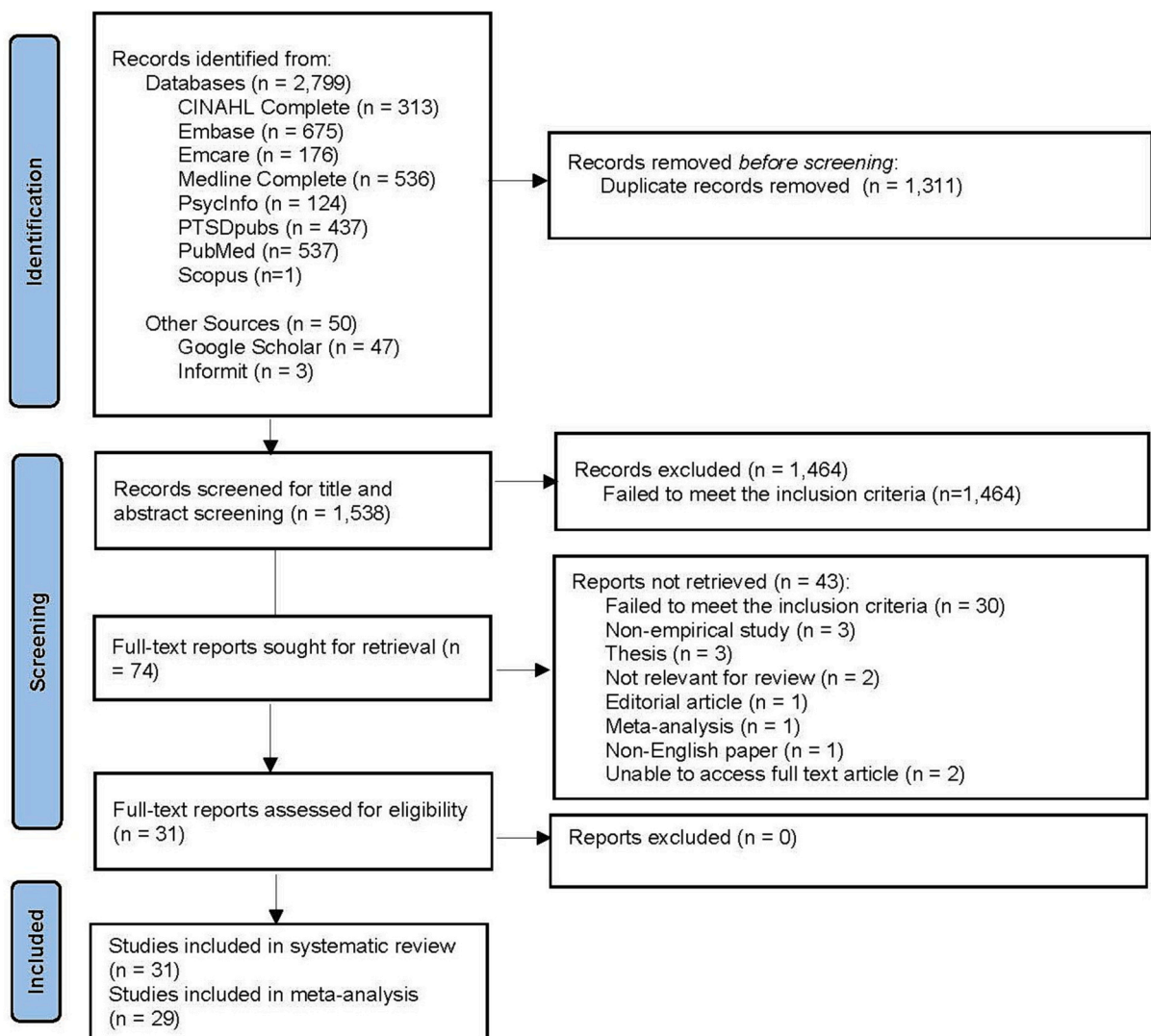


Fig. 1. The PRISMA flow diagram.

Table 2
Summary of the characteristics of the included studies.

Author and year	Country	Data source	Sample size	Age (M(SD))	Gender (%)	Culture (%)
Baglivio et al. (2016)	USA	Correction record	12,955	17.17 (1.21)	Female: 15 % Male: 85 %	Black: 54 %; Hispanic: 11 %; White and other: 35 %
Baglivio and Wolff (2021)	USA	Correction record	28,048	17.01 (1.67)	Female: 22.9 % Male: 77.1 %	White: 38.47 %; Black: 46.30 %; Hispanic: 15.23 %
Barra et al. (2017)	Switzerland	Correction record	278	14.64 (1.58)	Male: 100 %	Swiss Nationals: 70.8 % Other: 29.2 %
Barra et al. (2022)	Switzerland	Correction record	342	15.74 (1.61)	Female: 35.1 % Male: 64.9 %	Swiss nationals: 85.7 % Other: 14.3 %
Barrett et al. (2014)	USA	Correction record	99,602	14.47 (1.94)	Female: 35 % Male: 65 %	Black: 51 %; White: 48 %; Other: 1 %
Chauhan et al. (2009)	USA	Correction record	122	16.78 (1.24)	Female: 100 %	White: 43.4 %; Black: 56.6 %
Cho and Lee (2021)	USA	Court record	1396	14.00 (SD unavailable)	Female: 38 % Male: 62 %	White: 39 %; African American: 40 %; Native American: 14 %; Hispanic: 7 %
Conrad et al. (2014)	USA	Court record	402	14.80 (1.6)	Female: 40.3 % Male: 59.7 %	White: 60 %; African American: 6 %; Hispanic/Latino: 18 %; Other/no data: 16 %
Craig, 2019	USA	Correction record	25,461	17.00 (SD unavailable)	Female: 23 % Male: 77 %	Black: 47 %; Hispanic: 15 %; White/other: 38 %
Craig et al. (2017a, b)	USA	Correction record	28,169	17.01 (SD unavailable)	Female: 23 % Male: 77 %	Black: 46 %; Hispanic: 15 %; White/other: 39 %
Craig et al. (2019a)	USA	Correction record	28,169	17.01 (1.67)	Female: 23 % Male: 77 %	Black: 46 %; Hispanic: 15 %; White/other: 39 %
Craig et al. (2020)	USA	Correction record	621	16.36 (1.02)	Female: 3 % Male: 97 %	Black: 37 %; Hispanic: 45 %; White: 18 %
Craig, Zettler, Wolff, and Baglivio (2019b)	USA	Correction record	28,047	17.02 (1.67)	Female: 22.9 % Male: 77.1 %	Black: 46 %; Hispanic: 15 %; White/other: 39 %
Craig and Zettler (2021)	USA	Correction record	11,788	18.07 (1.09)	Female: 9 % Male: 91 %	Black: 35 %; Hispanic: 44 %; White: 20 %; Other: 1 %
Kowalski (2019)	USA	Correction record	50,826	Age range: 12–18	Female: 26.1 % Male: 74.6 %	White: 61.0 %; African American: 13.9 %; Latino / Latina: 15.5 %; Other: 9.6 %
Lambie et al. (2013)	New Zealand	Self-report	182	N/A	Female: 8.8 % Male: 91.2 %	Maori: 20.9 %; NZ European: 72 %; Pacific Islander: 6 %; Other: 1.1 %
Lewis et al. (1991)	USA	Self-report and police/FBI records	21	14.9 (SD unavailable)	Female: 100 %	White: 85.7 %; Black: 9.5 %; Hispanic: 4.7 %
Miura and Fuchigami (2020)	Japan	Correction record	290	N/A	Female: 8.6 % Male: 91.4 %	Japanese: 100 %
Moore et al. (2013)	Australia	Correction record	291	17 (SD unavailable)	Female: 13 % Male: 87 %	Aboriginal: 48 %; Non-Aboriginal: 5 %
Narvey, Yang, Wolff, Baglivio, Piquero (2021a, 2021b)	USA	Correction record	11,053	16.5 (1.31)	Female: 14.4 % Male: 85.6 %	Black: 52.6 %; Hispanic: 11.5 %; Other: 36.5 %
Root et al. (2008)	Canada	Child protection record	205	11.2 (3.08)	Female: 13.2 % Male: 86.8 %	N/A

(continued on next page)

Table 2 (continued)

Author and year	Country	Data source	Sample size	Age (M(SD))	Gender (%)	Culture (%)
Rubinstein et al. (1993)	USA	Police/FBI and correction records	77	15.0 (SD unavailable)	Male: 100 %	Sexually assaultive participants: White: 21 %; Black: 57.9 %; Hispanic: 15.8 %; Native American: 15.3 % Non-Sexually Assaultive Participants: White: 32.7 %; Black: 44.9 %; Hispanic: 22.4 %
Ryan (2006)	USA	Police record	286	15.7 (4.3)	N/A	African American: 67 %; White: 28 %; Hispanic: 5 %
Ryan et al. (2013)	USA	Child welfare system record	19,833	15.9 (1.5)	Female: 24 % Male: 76 %	African American: 13 %; Hispanic: 8 %; White: 71 %; Native American: 5 %; Asian: 4 %
van der Put (2013)	USA	Court record	71	15.9 (1.55)	Female: 100 %	European Americans: 61 %; African American: 10 %; Hispanic Americans: 3 %; Other: 3 %
van der Put and de Ruiter (2016)	USA	Child protection record	13,613	N/A	Female: 25.7 % Male: 74.3 %	N/A
Vitopoulos et al. (2019)	Canada	Participants' clinical files	100	15.98 (1.48)	Female: 50 % Male: 50 %	White: 30 %; Black: 40 %; East/West/South Asian: 11 %; Other: 19 %
Weber and Lynch (2021)	USA	Correction record	417	14.85 (1.53)	Female: 29 % Male: 71 %	White/non-Hispanic: 69.5 %; Hispanic: 16.1 %; American Indian/Alaska Native: 11.5 %; Black/African American: 1.2 %
Wolff and Baglivio (2017)	USA	Community service record	27,720	17.0 (1.67)	Female: 23 % Male: 77 %	Black: 46 %; Hispanic: 15 %; White/other: 39 %
Wolff et al. (2017)	USA	Police record	27,867	16.3 (1.64)	Female: 23 % Male: 77 %	Black: 46 %; Hispanic: 15 %; White: 38 %; Other: 0.5 %
Yampolskaya and Chuang (2012)	USA	Correction record	5720	11.6 (3.33)	Female: 53 % Male: 47 %	Caucasian: 55 %; African American: 36 %; Hispanic: 9 %

heterogeneity test demonstrated a substantial level of heterogeneity ($I^2 = 99.974, p < .001$).

Fourteen studies reported 54 estimates of prevalence of the individual ACEs items (Barra et al., 2017; Conrad et al., 2014; Craig et al., 2020; Kowalski, 2019; Lewis et al., 1991; Moore et al., 2013; Root et al., 2008; Rubinstein et al., 1993; Ryan, 2006; Ryan et al., 2013; van der Put, 2013; van der Put & de Ruiter, 2016; Vitopoulos et al., 2019; Yampolskaya & Chuang, 2012). While prevalence of parental separation/divorce was not reported, the pooled prevalence of emotional abuse, physical abuse, sexual abuse, emotional neglect, physical neglect, overall neglect, family violence, household substance abuse, household mental illness, and incarceration of a household member were 31.4 % (95%CI [0.235, 0.406]); 25.2 % (95%CI [0.196, 0.319]); 16.2 % (95%CI [0.125, 0.207]); 42.6 % (95%CI [0.299, 0.565]); 29.0 % (95%CI [0.201, 0.399]); 25.3 % (95%CI [0.179, 0.345]); 51.4 % (95%CI [0.361, 0.665]); 29.1 % (95%CI [0.208, 0.319]); 13.7 % (95%CI [0.082, 0.221]); and 47.6 % (95%CI [0.357, 0.599]), respectively. Fig. 3 presents the forest plot of the results. The heterogeneity indicator I^2 ranged between 89.029 and 99.797 with all p values < 0.001, indicating substantial levels of heterogeneity.

Due to the limited data on gender differences, meta-analysis on gender comparison in prevalence was not conducted. Instead,

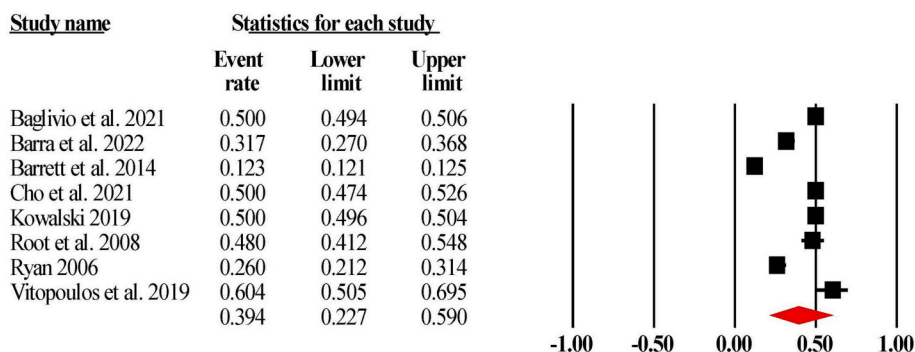


Fig. 2. The forest plot of the prevalence of cumulative ACEs among youth offenders.

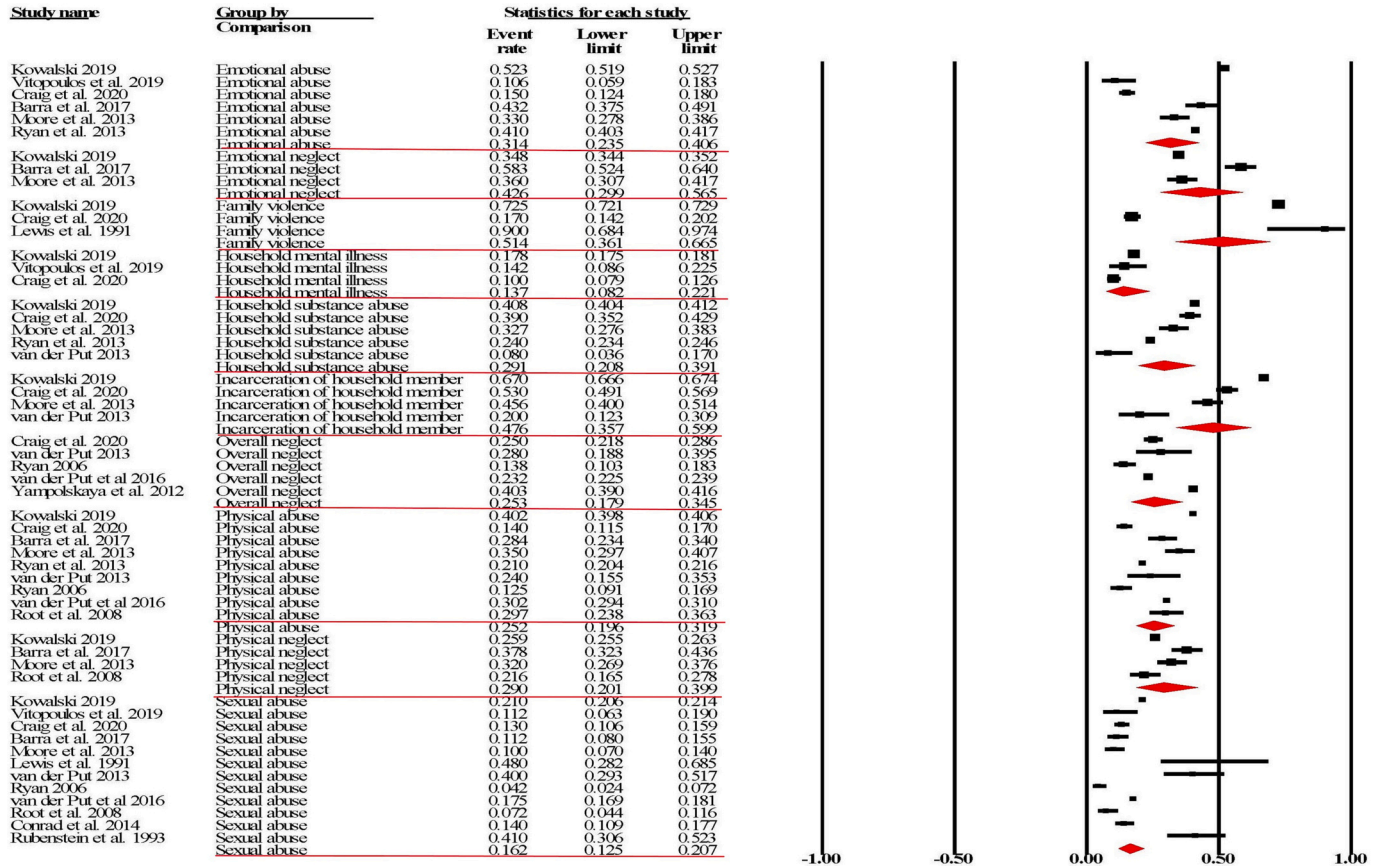


Fig. 3. The forest plot of the prevalence of individual ACEs among youth offenders.

narrative synthesis was performed. It was found that females were more likely to experience cumulative ACEs (Vitopoulos et al., 2019) and neglect (van der Put & de Ruiter, 2016) than their male counterparts. Moreover, female youth offenders had experienced 2 times more sexual abuse (Conrad et al., 2014; Kowalski, 2019; van der Put & de Ruiter, 2016; Vitopoulos et al., 2019); 1.5 times more physical abuse (23.6 % vs 36.0 %) (van der Put & de Ruiter, 2016); almost three times more emotional abuse (van der Put & de Ruiter, 2016); and two times more parental mental illness (Vitopoulos et al., 2019) than male youth offenders. Furthermore, sexual abuse against female offenders was more likely to be perpetrated by non-family members, whereas physical abuse was more likely to be perpetrated by a family member (van der Put, 2013).

3.3. The analysis of RQ2: effects of cumulative and single ACE items on youth recidivism

Of the 31 included studies, 24 reported the effects of cumulative ACEs and single ACE items on youth recidivism. Two studies reported effect sizes, which were rate ratio in Weber and Lynch (2021) and log hazard ratio in Wolff and Baglivio (2017), which could not be converted to OR. As a result, 22 of which were included in the meta-analysis (Baglivio et al., 2016; Baglivio & Wolff, 2021; Barra et al., 2017; Barra et al., 2022; Chauhan et al., 2009; Cho & Lee, 2021; Conrad et al., 2014; Craig, 2019; Craig et al., 2017a, b; Craig et al., 2019a, b; Craig et al., 2020; Craig & Zettler, 2021; Craig, Zettler, Wolff, and Baglivio, 2019b; Kowalski, 2019; Miura & Fuchigami, 2020; Narvey, Yang, Wolff, Baglivio, Piquero, 2021a, 2021b; Root et al., 2008; Ryan et al., 2013; van der Put, 2013; van der Put & de Ruiter, 2016; Vitopoulos et al., 2019; Wolff et al., 2017; Yampolskaya & Chuang, 2012). The results of the meta-analysis in 16 studies showed that cumulative ACEs were positively associated with youth recidivism with a pooled effect size of OR = 1.966, 95%CI [1.582, 2.444], $p < .001$. On average, the odds of recidivism was 1.966 times higher in youth reoffenders experiencing cumulative ACEs compared to those who did not. Fig. 4 presents the forest plot of the results. The heterogeneity indicator $I^2 = 99.910$ ($p < .001$) indicated that heterogeneity was substantial. The Egger's test (intercept = -14.607, $t = 1.221$ $df = 14$; $p = .242$) suggested that publication bias was not detected.

Seven of the 31 studies reported effect sizes of three individual ACE items (sexual abuse, overall neglect, and physical abuse) on youth recidivism (Barra et al., 2017; Chauhan et al., 2009; Conrad et al., 2014; Ryan et al., 2013; van der Put, 2013; van der Put & de Ruiter, 2016; Yampolskaya & Chuang, 2012). The pooled effect sizes of overall neglect, physical abuse, and sexual abuse were OR = 1.328 (95%CI [1.078, 1.637], $p = .008$); OR = 1.382 (95%CI [1.146, 1.667], $p = .001$); and OR = 1.188 (95%CI [0.931, 1.517], $p = .166$), respectively. On average, the odds of recidivism was 1.328 and 1.382 higher in youth reoffenders who experienced overall neglect and physical abuse, respectively, than those who did not. Sexual abuse were not significantly associated with youth recidivism. Fig. 5 presents the forest plot of the results. The heterogeneity indicator I^2 indicated heterogeneity in overall neglect ($I^2 = 65.258$, $p = .035$) and physical abuse ($I^2 = 91.694$, $p < .001$), but not in sexual abuse ($I^2 = 59.702$, $p = .059$). The Egger's regression test (intercept = 0.726, $t = 0.402$ $df = 11$; $p = .695$) suggested that publication biases were not detected.

3.4. The analysis of RQ3: moderating and mediating effects on the relationship between ACEs and youth recidivism

Moderating and mediating effects on the relationship between ACEs and youth recidivism were explored by 11 studies (Baglivio et al., 2016; Baglivio & Wolff, 2021; Conrad et al., 2014; Craig et al., 2017a, b; Craig et al., 2019a; Craig, Zettler, Wolff, and Baglivio, 2019b; Narvey, Yang, Wolff, Baglivio, Piquero, 2021a, 2021b; Root et al., 2008; Vitopoulos et al., 2019; Weber & Lynch, 2021; Wolff & Baglivio, 2017). Gender (Conrad et al., 2014), positive childhood experiences (Baglivio & Wolff, 2021), strong social bonds (Craig et al., 2017a, b), and gains in empathy (Narvey, Yang, Wolff, Baglivio, Piquero, 2021a, 2021b) were found to be moderate for the relationship between ACEs and youth recidivism.

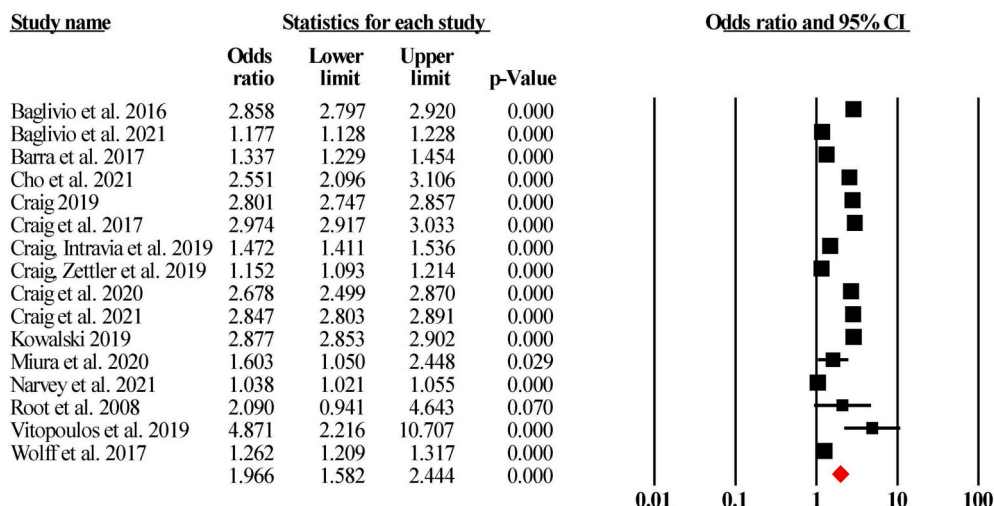


Fig. 4. The forest plot of the effect size of cumulative ACEs on youth recidivism.

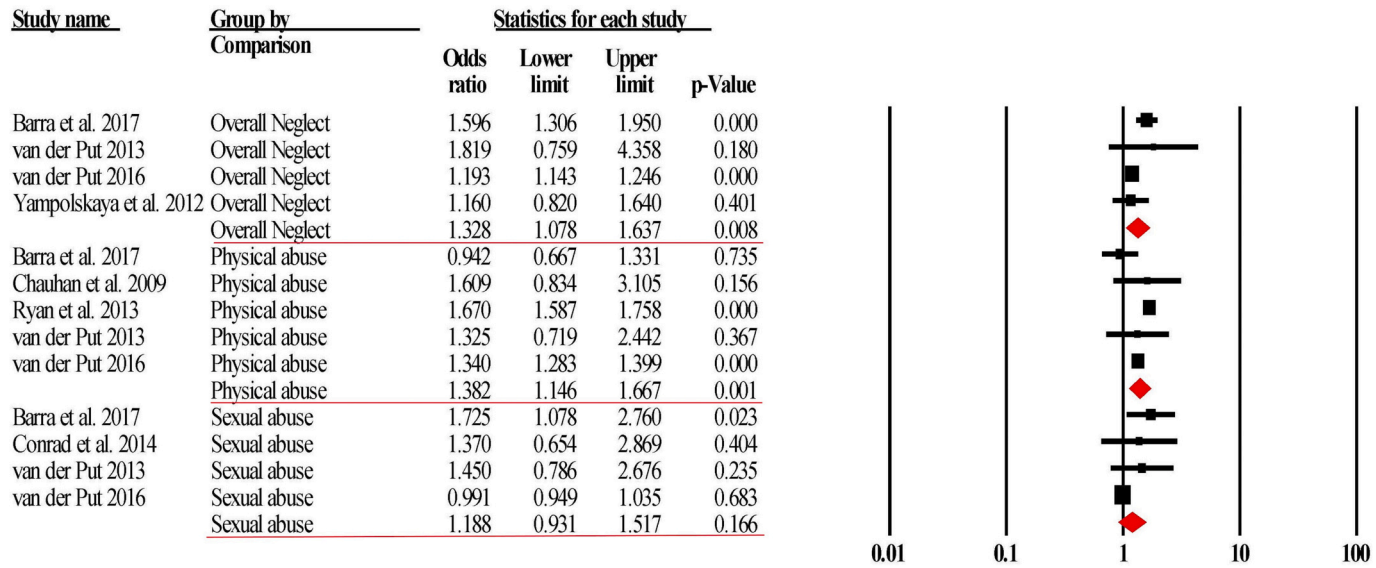


Fig. 5. The forest plot of the effect size of individual ACEs on youth recidivism.

Child welfare placement, children's emotional and behavioural problems, drug use and mental health problems, and negative emotionality were found to be mediators for the relationship between ACEs and youth recidivism. The higher exposure of ACEs was associated with greater degrees of child welfare placement (Baglivio et al., 2016), externalising behaviour (Root et al., 2008), drug abuse (Craig, Zettler, Wolff, and Baglivio, 2019b), comorbid drug abuse and mental health problems (Craig, Zettler, Wolff, and Baglivio, 2019b), and negative emotionality (Wolff & Baglivio, 2017); which in turn associated with higher levels of youth recidivism.

One study employed moderated mediation analysis to investigate whether gender moderated the mediation effects of substance abuse on the relationship between ACEs and youth recidivism (Weber & Lynch, 2021). It was found that substance abuse mediated the relationship between ACEs and recidivism. However, gender did not interact with substance abuse to predict youth recidivism.

4. Discussion

The present study conducted a systematic review and meta-analysis of 31 studies with a combined sample size of 423,972 participants. The pooled prevalence of cumulative ACEs of 39.6 % in youth offenders was estimated in eight of the studies. Fourteen studies reported the prevalence of the 10 individual ACE items with pooled prevalence of the individual ACEs ranging between 13.5 % to 52.3 %. The meta-analysis showed that cumulative ACEs and neglect positively predicted youth recidivism.

The analysis of RQ1 indicates that while four in ten youth offenders were exposed to cumulative ACEs (39.6 %), more than half experienced domestic violence (52.3 %), nearly half experienced incarceration of a household member (47.3 %) and emotional abuse (42.7 %). For the remaining ACEs the pooled prevalence rates were around one fifth and one quarter (ranging from 13.5 % to 29.2 %). The high prevalence in youth offenders appears to reflect the hypothesis of the cycle of abuse whereby victims become offenders. According to the cycle of abuse thesis, the perpetrators are often conditioned by their own experience of childhood abuse to normalise the behaviour and early victimization, increasing the risk of offending (Currie & Tekin, 2012; Jespersen et al., 2009). The findings of prevalence also support the notion that each single ACE needs to be acknowledged for their distinct impact on youth offending; a combined exposure of ACEs could obscure the relationship between individual ACEs, and youth offending and recidivism (Grummitt et al., 2022). Moreover, the current systematic analysis finds that the prevalence of sexual abuse was not as high as other individual ACEs. This may be a result of the overall sample in the included studies that provided prevalence in sexual abuse were dominated by males ($N_{\text{male}} = 49,889$ vs. $N_{\text{female}} = 16,625$). Males are substantially less likely than females to report sexual abuse (Haahr-Pedersen et al., 2020).

The present systematic review finds that female youth offenders experienced a wider range of ACEs, and female youth offenders also have higher prevalence of sexual abuse, physical abuse, emotional abuse, and overall neglect, than their male counterparts. On the one hand, these findings support previous research findings that females are more likely to experience childhood abuse and tend to be exposed to more complex and multifaceted traumas (Haahr-Pedersen et al., 2020; Moore et al., 2015; Wellman, 1993). On the other hand, the higher ACE prevalence among female than male youth offenders sexual abuse may be affected by under-reporting in males (Haahr-Pedersen et al., 2020).

The analysis of RQ2 shows that cumulative ACEs had a significant positive effect on predicting recidivism in young offenders. As shown in the pooled effect size of cumulative ACEs on youth recidivism, a greater number of ACEs was associated with a 99.1 % increase in the odds of youth reoffending (OR = 1.991, 95%CI [1.796, 2.208], $p < .001$). The findings reflect the concept of cumulative disadvantage in the DLC theory that the accumulation of multiple, interactive ACEs is a risk factor for youth reoffending (Kurlychek & Johnson, 2019).

The meta-analysis on the effects of three individual ACEs on youth recidivism finds that neglect and physical abuse were positive predictors for youth recidivism; that is, the exposures to childhood neglect and physical abuse were associated with a 44.5 % (OR = 1.445, 95%CI [1.178, 1.773], $p < .001$) and 46.6 % (OR = 1.466, 95%CI [1.220, 1.760], $p < .001$) increase, respectively, in the odds of youth recidivism. Research has found that children who experience neglect and physical abuse often suffer from insecure attachment (Parish-Plass, 2008). According to Bowlby (1969, 1973, 1980), attachment is the unique relationship between an infant and their caregiver(s), providing satisfaction of basic human needs and functioning as the foundation for further healthy development. While individuals with secure attachment relationships are more likely to develop appropriate social attitudes and the ability to interact with others, insecure attachment is often associated with dysfunctional attitudes, low self-esteem, behavioural problems, difficulties in emotional regulation, and social incompetence (Flaherty & Sadler, 2011; Yoder et al., 2020). Insecure attachment thus creates vulnerabilities for criminogenic needs associated with offending behaviours, including violence (Grady et al., 2017; Yoder et al., 2020).

Sexual abuse was not found to be significantly associated with youth recidivism (OR = 1.188, 95%CI [0.931, 1.517], $p = .166$). Research has reported that sexual abuse is associated with recidivism in females, but not males (Conrad et al., 2014). The pooled sample size of sexual abuse in the current study was dominated by males with 10,629 male participants and 3733 females. The gender imbalance in the pooled sample size may contribute to the negative effect of sexual abuse on youth recidivism. Due to the sampling issue, the generalization of this finding needs to be exerted with caution.

Regarding the effects of neglect, sexual abuse, and physical abuse on youth recidivism, the findings support the notion that individual ACE items may have distinct and unique effects on youth recidivism (LaNoue et al., 2020; Negriff, 2020). This again reflects the concept of cumulative disadvantage in the DLC theory, which maintains that cumulative impact of a specific ACE exposure is risky for youth reoffending.

The analysis of RQ3 found various possible mechanisms underlying the relationship between ACEs and youth recidivism. Gender, positive childhood experiences, strong social bonds, and gains in empathy moderated the relationship between ACEs and youth recidivism. Contrastingly, child welfare placement, emotional and behavioural problems, drug use, mental health problems, and negative emotionality mediated the relationship between ACEs and youth recidivism. However, many of the moderating and

mediating effects were limited to individual studies, and more research is required to better understand these mechanisms and the significance of their relationship.

The results of heterogeneity analyses indicate that heterogeneities in the prevalence and effect sizes among the included studies were substantial. The substantial level of heterogeneity suggests that prevalence of ACEs in youth offenders and the effect sizes of ACEs on youth recidivism are low in some populations and high in others (Borenstein, 2019). Hence, caution should be exerted in generalising the results in the current study to all youth offending populations.

There are several limitations in the current study. First, the current meta-analysis on ACE prevalence among youth offenders did not include the prevalence in studies which did not investigate the effects of ACEs on youth recidivism because these studies were excluded from the current review due to the inclusion and exclusion criteria. This limitation justifies future meta-analyses that include all available studies estimating the prevalence of ACEs among youth offenders. Second, due to limited data on the gender differences and the overall sample being dominated by male participants, the current study did not conduct meta-analysis on gender differences in the prevalence of ACEs among youth offenders and the effects of ACEs on youth reoffending. This limitation calls for future studies paying more attention to the effects of ACEs on female youth offenders. Third, although several studies found variations in the effect of ACEs on youth recidivism based on the participants' demographics and the type of offences committed, meta-analyses on the variations were not preformed because of limited data. This limitation thus warrants future studies on these variations.

Despite the limitations, the findings of the present systematic review and meta-analysis yield policy implications for the juvenile justice system. Even though juvenile justice systems are not necessarily responsible for reducing the risks of ACEs for youth reoffenders, the justice system may provide intervention programs to address the impacts of ACEs to recidivist youth while they are being detained and/or treated in the system (Baglivio et al., 2014). Providing programs to these youths aiming to reduce the impact of cumulative and individual ACE exposure would be useful. Moreover, the findings in the current study show that youth reoffending behaviour was influenced by a range of protective (including positive childhood experiences, strong social bonds, and empathy) and risk factors (including child welfare placement, children's emotional and behavioural problems, drug use, mental health problems, and negative emotionality). A wide range of evidence-based prevention and intervention strategies to strengthen the protective factors and weaken the risk factors would also be useful. This research could also be useful in informing and supporting (foster) parents about the protective and risk factors for youth reoffending.

Declaration of competing interest

No funding was received for this project.

Data availability

Data will be made available on request.

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