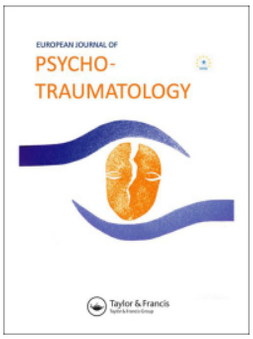

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Adverse childhood experience is associated with an increased risk of reporting chronic pain in adulthood: a stystematic review and meta-analysis

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REVIEW ARTICLE

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Adverse childhood experience is associated with an increased risk of reporting chronic pain in adulthood: a stystematic review and meta-analysis

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ABSTRACT

Background: Adverse childhood experiences (ACEs) have been shown to negatively affect health in adulthood. Estimates of associations between ACEs and chronic painful conditions are lacking.

Objectives: This systematic review and meta-analysis aimed to evaluate associations between exposure to ACEs and chronic pain and pain-related disability in adults.

Methods: We searched 10 electronic databases from inception to February 2023. We included observational studies assessing associations between direct ACEs (childhood sexual, physical, emotional abuse, or neglect) alone or in combination with indirect ACEs (witnessing domestic violence, household mental illness), and adult chronic pain (≥3 months duration) and pain-related disability (daily activities limited by chronic pain). Pairs of reviewers independently extracted data and assessed study risks of bias. Random-effect models were used to calculate pooled adjusted odds ratios [aOR]. Tau square [T^2], 95% prediction intervals [95% PI] and I^2 expressed the amount of heterogeneity, and meta-regressions and subgroup meta-analyses investigated sources of heterogeneity (PROSPERO: CRD42020150230).

Results: We identified 85 studies including 826,452 adults of which 57 studies were included in meta-analyses. Study quality was generally good or fair ($n = 70$). The odds of reporting chronic pain in adulthood were significantly higher among individuals exposed to a direct ACE (aOR, 1.45, 95%CI, 1.38–1.53). Individuals reporting childhood physical abuse were significantly more likely to report both chronic pain (aOR, 1.50, 95CI, 1.39–1.64) and pain-related disability (1.46, 95CI, 1.03–2.08) during adulthood. Exposure to any ACEs alone or combined with indirect ACEs significantly increase the odds of adult chronic painful conditions (aOR, 1.53, 95%CI, 1.42–1.65) and pain-related disability (aOR, 1.29; 95%CI, 1.01–1.66). The risk of chronic pain in adulthood significantly increased from one ACE (aOR, 1.29, 95%CI, 1.22–1.37) to four or more ACEs (1.95, 95%CI, 1.73–2.19).

Conclusions: Single and cumulative ACEs are significantly associated with reporting of chronic pain and pain-related disability as an adult.

Las experiencias adversas en la infancia se asocian con un mayor riesgo de informar dolor crónico en la edad adulta: una revisión sistemática y un metaanálisis

Antecedentes: Se ha demostrado que las experiencias adversas en la infancia (ACE, por sus siglas en inglés) afectan negativamente la salud en la edad adulta. Faltan estimaciones de las asociaciones entre las ACEs y las enfermedades dolorosas crónicas.

Objetivos: Esta revisión sistemática y metaanálisis tuvo como objetivo evaluar las asociaciones entre la exposición a ACE y el dolor crónico y la discapacidad relacionada con el dolor en adultos.

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KEYWORDS
Adverse childhood experiences; physical abuse; sexual abuse; emotional abuse; neglect; chronic pain; pain-related disability; systematic review; meta-analysis; musculoskeletal pain

PALABRAS CLAVE
Experiencia adversa en la infancia; abuso físico; abuso sexual; abuso emocional; negligencia; dolor crónico; discapacidad relacionada con el dolor; revisión sistemática; metaanálisis; dolor musculoesquelético

HIGHLIGHTS

- Previous meta-analyses highlighted the negative impact of adverse childhood experiences on physical, psychological, and behavioural health across the lifespan.
- We found exposure to any direct adverse childhood experience, i.e. childhood sexual, physical, emotional abuse, or neglect alone or combined, increased the risk of reporting chronic pain and pain-related disability in adulthood.
- The risk of reporting chronic

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Métodos: Buscamos en 10 bases de datos electrónicas desde su inicio hasta febrero de 2023. Incluimos estudios observacionales que evaluaron las asociaciones entre ACEs directas (abuso sexual, físico, y emocional en la infancia, o negligencia) solas o en combinación con ACEs indirectas (presenciar violencia doméstica, enfermedad mental en el hogar), y dolor crónico en adultos (≥3 meses de duración) y discapacidad relacionada con el dolor (actividades diarias limitadas por el dolor crónico). Pares de revisores extrajeron los datos de forma independiente y evaluaron los riesgos de sesgo de los estudios. Se utilizaron modelos de efectos aleatorios para calcular las medidas agrupadas de probabilidades ajustadas [aOR]. Tau cuadrado [T2], intervalos de predicción del 95% [PI 95%] e I2 expresaron la cantidad de heterogeneidad, y las meta regresiones y los metaanálisis de subgrupos investigaron las fuentes de heterogeneidad (PROSPERO: CRD42020150230).
Resultados: Identificamos 85 estudios que incluyeron 826.452 adultos, de los cuales 57 estudios se incluyeron en los metaanálisis. La calidad de los estudios fue en general buena o regular ($n = 70$). Las probabilidades de reportar dolor crónico en la edad adulta fueron significativamente mayores entre las personas expuestas a una ACE directa (ORa, 1,45; IC del 95%, 1,38–1,53). Las personas que reportaron abuso físico en la infancia tenían significativamente más probabilidades de reportar tanto dolor crónico (ORa, 1,50, IC 95, 1,39–1,64) como discapacidad relacionada con el dolor (1,46, IC 95, 1,03–2,08) durante la edad adulta. La exposición a cualquier ACE sola o combinada con ACEs indirectas aumenta significativamente las probabilidades de sufrir afecciones dolorosas crónicas en adultos (ORa, 1,54; IC del 95%, 1,44–1,65) y la discapacidad relacionada con el dolor (ORa, 1,29; IC del 95%, 1,01–1,66). El riesgo de dolor crónico en la edad adulta aumentó significativamente desde un ACE (aOR, 1.29, 95%CI, 1.22–1.37) a cuatro o más ACEs (1.95, 95%CI, 1.73–2.19).
Conclusiones: Las ACE únicas y acumulativas se asocian significativamente con el reporte de dolor crónico y discapacidad relacionada con el dolor en la edad adulta.

painful disorders increased with increasing numbers of adverse childhood experiences.

1. Introduction

Adverse childhood experiences (ACEs) are harms directly occurring to a child or teenager such as physical, sexual, or emotional abuse, or neglect by a parent or caregiver, or can be indirect through household dysfunction or living environments such as parental death, divorce, substance abuse, or severe sickness of a parent or sibling (Control, 2019). Over 1 billion children – half of all children in the world – are exposed to ACEs each year (Hillis et al., 2016), and in 2019, the estimated past-year prevalence of ACEs were 44% in high-income countries (Hillis et al., 2016), and 59% in low- and middle-income countries (Hillis et al., 2016). 19% of European adults report having experienced two or more ACEs and 16% of US adults report having experienced four or more types of ACEs (Control, 2019).

Prior reviews have highlighted the negative impact of ACEs on physical,(Hughes et al., 2017) psychological (Moore et al., 2015), and behavioural health (Kalmakis & Chandler, 2015), and even early mortality (Grummitt et al., 2021).

ACEs are estimated to result in 37.5 million disability-adjusted life years globally and carry an estimated financial cost of $1.3 trillion per annum across North America and Europe, with over 75% of these costs arising in individuals reporting two or more ACEs (Bellis et al., 2019).

Chronic pain is defined as *an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage* (Nicholas et al., 2019). Highly prevalent chronic pain conditions including musculoskeletal disorders (MSDs) and non-musculoskeletal disorders (non-MSDs) such as headache and migraine, are leading causes of years lived with disability (James et al., 2018). In the US alone, medical costs and lost productivity of chronic pain including joint pain and arthritis amount to between US$560 and US$635 billion per year, exceeding the costs of diagnoses such as heart or lung disease, injuries, diabetes, or cancer (Gaskin & Richard, 2012).

Prior reviews examining the link between ACEs and chronic pain and pain-related disability have included studies with insufficient attention to the design of control groups and to sample size (Davis et al., 2005; Häuser et al., 2011; Irish et al., 2010; Paras et al., 2009; Romans & Cohen, 2008), and have generated mixed results, particularly in terms of which ACEs (e.g. physical abuse, sexual abuse, or neglect) are associated with specific chronic pain condition later in life (Arnow, 2004; Bombay et al., 2009; Bussières et al., 2020; Davis et al., 2005; Norman et al., 2012; Paras et al., 2009; Sachs-Ericsson et al., 2009; Tidmarsh et al., 2022; Wegman & Stetler, 2009). Previous meta-analyses reporting an increase odds of long-term musculoskeletal (MSK) and general pain symptoms from childhood sexual abuse failed to clearly define symptom duration and type of painful conditions (Irish et al., 2010) or to report the effect of ACEs on somatic pain and headache separately (Petruccelli et al., 2019).

Other reviews suggested an increased risks of poor health outcomes with multiple ACE exposures (≥ 2 vs no ACE (Bellis et al., 2019) and ≥ 4 vs no ACE (Hughes et al., 2017)), but whether a dose–response relationship exists between the number of ACEs and persistent pain or pain-related disability remains

unclear. Therefore a comprehensive synthesis is needed (Bussières et al., 2020).

We aimed to determine the extent of the relationship between exposure to ACEs and adult chronic pain and its related disability. We also explored whether unique and cumulative ACEs exposure (type and number) increase the risk of developing chronic pain and related disability (i.e. daily activities limited by chronic pain) in adulthood.

2. Methods

This review is reported according to the MOOSE Guidelines for Meta-Analyses and Systematic Reviews of Observational Studies and the PRISMA-P (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols) guidelines (Shamseer et al., 2015; Stroup et al., 2000). Our published protocol (Bussières et al., 2020) mirrored recent recommendations on methods for systematic reviews and meta-analyses of observational studies (Dekkers et al., 2019; Mueller et al., 2018), and was prospectively registered in PROSPERO (CRD42020150230).

2.1. Search strategy

The MEDLINE (Ovid) strategy was developed by a health science librarian (JB), peer-reviewed by a second librarian using the PRESS standard (Bethell et al., 2017; McGowan et al., 2016), and adapted in nine other databases using search filter to identify observational studies (SIGN, 2019), reporting associations and risks of chronic pain from single or multiple ACEs. For complete search history see: https://doi.org/10.5683/SP3/BMAR8N. Bibliographies of relevant articles were searched for other relevant articles. Authors were contacted and asked to provide any non-significant or unpublished findings regarding ACEs and physical health. No additional studies were obtained by this method.

2.2. Selection criteria

The search was performed on 29 August 2019, with no language restrictions, and last updated on 22 February 2023 (Figure 1). Results were imported into Rayyan Intelligent systematic review system (Ouzzani et al., 2016). Two authors double screened 25% of the references to establish coder reliability, and then pairs of reviewers independently screened citations and abstracts, and proceeded similarly for full text screening of potentially eligible articles. Any discrepancies were discussed and resolved through consensus. For inclusion, studies had to meet the following criteria:

(1) report single or cumulative measures of ACEs during the first 18 years of life spanning either direct types (childhood sexual, physical, emotional abuse or neglect) (WHO, 2006), alone or in combination, with indirect types (household dysfunction including witnessing domestic violence, frequent fear of family member, parental divorce, caregiver death, incarcerated household member, serious childhood illness/injury, economic hardship, parental unemployment, household mental illness, bullying, witnessing a violent crime) (Bethell et al., 2017; Hughes et al., 2017) and compared them with individuals who had not suffered any ACEs. Reports comparing a single ACE to cumulative ACEs were also eligible;
(2) report definitions and measurements for chronic pain in accordance with the IASP definition and indicators of disability such as activity limitation due to chronic pain using discrete and/or continuous outcomes (Nicholas et al., 2019);
(3) test the associations between (1) and (2);
(4) be a cross-sectional, case control, nested case–control, or cohort study measuring chronic pain or chronic pain-disability in adulthood, with a sample size of at least 100 in each group or 200 for continuous outcomes as per recent recommendations when conducting systematic reviews of observational studies (Dekkers et al., 2019; Hughes et al., 2017). Single case studies and randomized controlled trials were not included.

We excluded studies based on high-risk populations (eg, people who are homeless, incarcerated or have a primary diagnosis of substance abuse) because few individuals have low ACE exposure in such populations. In addition, these individuals are at higher risk of adult victimization, self-harm, and overall poor physical and mental health; these factors possibly confound the association between ACEs and chronic pain and disability, thereby producing non-generalizable results (Hughes et al., 2017; Liu et al., 2021; Sheahan & Wardrop, 2023). We also excluded studies including people born severely prematurely, which is known to modify the pain pathway leading to altered pain in adulthood (Williams & Lascelles, 2020); investigating the assessment, treatment or mechanisms of chronic pain; and of adults with clear medical explanations for their pain, such as fractures, sprains, burns, visceral disease, neuropathic injury, or cancer. When findings from iterations of the same survey were reported, we included data only from the most recent. For studies with insufficient data to evaluate eligibility, we contacted the study authors twice for clarification before excluding.

2.3. Data extraction

We extracted study characteristics; ACE exposure (type, description, setting, frequency of abuse, self-

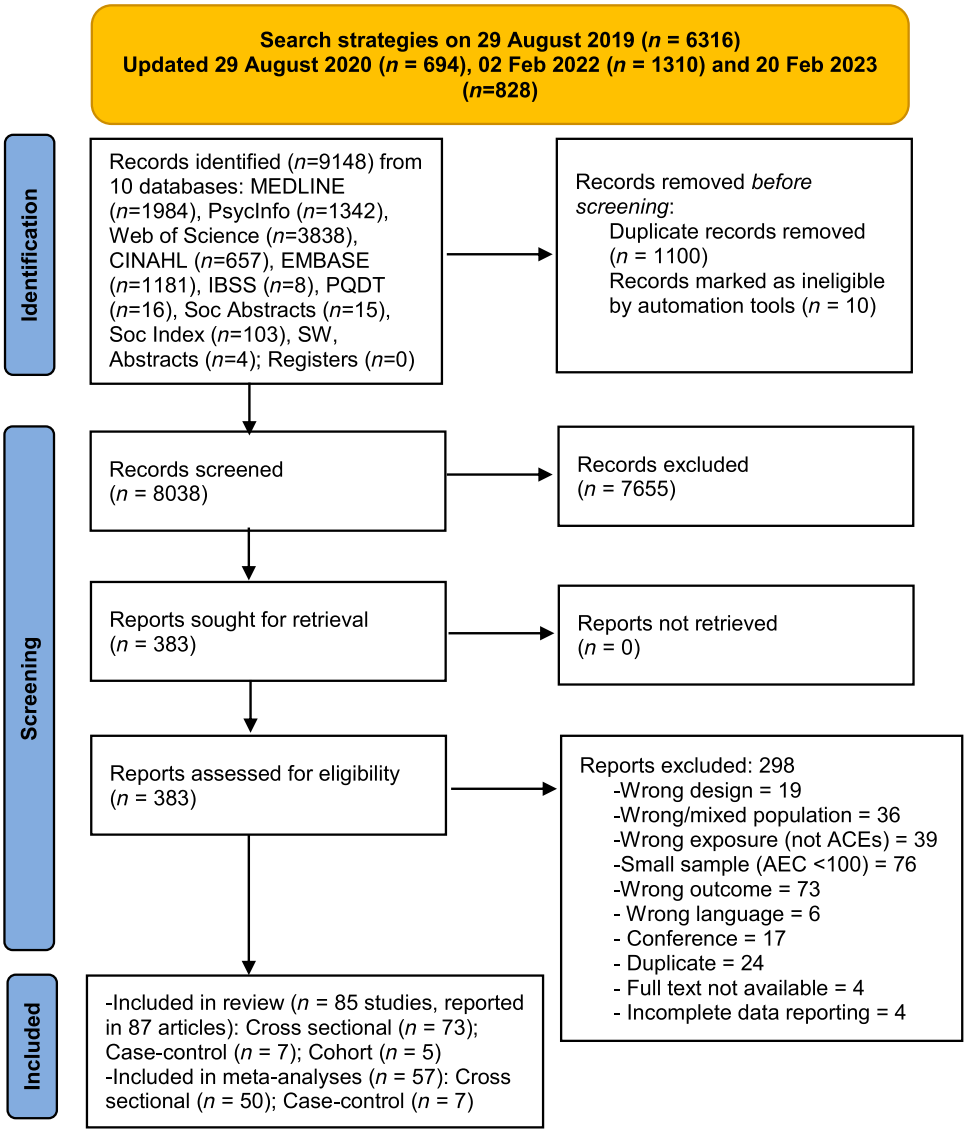

Figure 1. PRISMA flow diagram.

report vs objectively verifiable methods); painful condition; comparison group; measurement (pain, disability, timeframe); unadjusted and adjusted estimates for discrete and continuous outcomes, and precision measures. When multiple studies reported data for the same sample and outcome, we included the report based on largest sample size or with the longest follow-up time.

2.4. Study quality

Included articles were independently assessed for methodological quality by pairs of assessors using a modified form adapted from the Scottish Intercollegiate Guidelines Network (SIGN) checklist for cohort and case–control studies (Baker et al., 2010), and the Joanna Briggs Institute (JBI) tool for cross sectional studies (Moola et al., 2017). Individual criteria were rated as recommended by these tools (e.g. 'yes', 'no', 'can't determine', 'not applicable', 'not reported') based on the information reported in the study. The overall quality of individual studies was also rated as 'high', 'fair', or 'poor' (eTables 1–3 in the Supplement). Any discrepancies were resolved through consensus.

2.5. Data synthesis

We performed a qualitative synthesis of findings and stratified results based on the type of chronic pain disorders (MSDs or non-MSDs) and direct ACEs alone or combined with indirect ACE exposures. Data were then summarized and tabulated according to the variables listed above and reported narratively.

Meta-analysis was done separately for outcomes of chronic pain and pain-related disability and for individuals exposed to direct ACEs and to at least two types of ACEs (vs no ACE) using Comprehensive Meta-Analysis Version 3 Pro, Biostat Inc. *P* values less than 0.05 were considered significant. We calculated pooled ORs with the Hartung-Knapp-Sidik-Jonkman method for random effects meta-analysis, which has been shown to outperform the standard

DerSimonian-Laird method we had originally planned on using (Schmidt et al., 2009). As the majority of studies reported sociodemographic adjustments and adjusted ORs, we elected not to transform these into RRs (Grant, 2014). Adjusted positive and negative counts by condition and ACEs category were generated for use in the meta-analysis. Covariates from proportional hazards models were treated as RRs. For each study, all categories of ORs for more than one ACEs were combined to give an OR for two or more ACEs by use of a weighted mean method.

We used visual inspection of forest plots and the I^2 statistic to assess heterogeneity among pooled studies (Higgins et al., 2022). Prespecified subgroup analyses were conducted to explore consistency across results by various factors including study design, type of condition, and if there was at least two studies available (Häuser et al., 2011). To test the hypotheses of a subgroup effect, a test of interaction with a predetermined 2-tailed alpha level of 0.05 was used (Altman & Bland, 2003). We conducted sensitivity analyses by excluding outlying studies (so that study 95% CIs did not overlap those of pooled measures), and by exploring the impact of the risk of different biases on the results in regression analyses. When possible, we explored potential sources of heterogeneity, for outcomes with at least ten samples and high heterogeneity between estimates, by meta-regression. We did univariate analyses to test the individual association of the following covariates (when relevant) with pooled estimates: number of ACEs measured, study setting (general population, community, clinical), country (North America, Europe, Asia), and year of publication. We explored risk of publication bias using visual inspection of funnel plots when at least ten samples were included in the meta-analysis.(Higgins et al., 2022) We generated forest plots showing ORs and 95% CIs for each study and the overall random-effects pooled estimate. We also performed the Begg and Mazumdar rank correlation test and Egger tests (Häuser et al., 2011).

3. Results

Our search identified 8320 articles, from which we included 85 studies reported in 87 articles (Figure 1). 73 studies used a cross-sectional (Afifi et al., 2016; 2013; Alhalal et al., 2018; Anno et al., 2015; Badley et al., 2019; Baiden et al., 2021; Barron, 1997; Bendixen et al., 1994; Bottiroli et al., 2018; Brennenstuhl & Fuller-Thomson, 2015; Brown et al., 2018; Chartier et al., 2007, 2010; Coles et al., 2015; Dennis et al., 2019; Díaz-Olavarrieta et al., 2002; England-Mason et al., 2018; Eriksen et al., 2016; Fowler et al., 2020; 2009; 2011; Hammond & Colman, 2020; Hanlon et al., 2020; Hart-Johnson & Green, 2012; Häuser et al., 2018; Jamieson & Steege, 1997; Jiao et al., 2015; Kamiya et al., 2016; Kascakova et al., 2020; Lee et al., 2009; Lin et al., 2021; Mays et al., 2021; McBeth et al., 2015; Nicol et al., 2016; Noteboom et al., 2021; Park et al., 2014a; Pebole et al., 2022; Pierce et al., 2020; Reuchlein et al., 2016; Riedl et al., 2019; Sachs-Ericsson et al., 2007; 2017; Schrepf et al., 2018; Scott et al., 2011; Sheikh, 2018, 2019; Shields et al., 2015; Sprang et al., 2020; Springer et al., 2007; Stickley et al., 2015; Talley et al., 1998; 1994; Tietjen et al., 2009; 2010; 2017; Varinen et al., 2017; 2019; Viana et al., 2018; Waehrer et al., 2020; Walker et al., 1999; Wuest et al., 2009; 2010; 2008; Xu et al., 2013; You et al., 2019), seven case–control (Bradford et al., 2012; Häuser et al., 2012; Ju et al., 2020; Park et al., 2016; Rahal et al., 2020; Sumanen et al., 2007; Tietjen et al., 2015), and five cohort design (Chandan et al., 2020; Kopec & Sayre, 2005; Raphael et al., 2001; Raphael & Widom, 2011; Swanson et al., 2013), of which 57 studies were included in at least one of the meta-analyses (Afifi et al., 2016; 2013; Anda et al., 2010; Anno et al., 2015; As-Sanie et al., 2014; Badley et al., 2019; Baiden et al., 2021; Barron, 1997; Bellis et al., 2018; Bendixen et al., 1994; Bottiroli et al., 2018; Brennenstuhl & Fuller-Thomson, 2015; Chartier et al., 2007; Coles et al., 2015; Daily et al., 2022; Díaz-Olavarrieta et al., 2002; England-Mason et al., 2018; Eriksen et al., 2016; Fowler et al., 2020; Fuller-Thomson et al., 2009; Hammond & Colman, 2020; Hanlon et al., 2020; Häuser et al., 2018; Jiao et al., 2015; Kamiya et al., 2016; Lee et al., 2009; Mays et al., 2021; McBeth et al., 2015; Nicol et al., 2016; Park et al., 2014a; 2016; Pebole et al., 2022; Pierce et al., 2020; Rahal et al., 2020; Sachs-Ericsson et al., 2007; Santo et al., 2022; Scott et al., 2011; Sheikh, 2018; Shields et al., 2015; Sprang et al., 2020; Springer et al., 2007; Stickley et al., 2015; Sumanen et al., 2007; Talley et al., 1998; Talley et al., 1994; Tietjen et al., 2009; 2010; 2015; 2017; Varinen et al., 2017; Viana et al., 2018; Waehrer et al., 2020; Walker et al., 1999; Xu et al., 2013; You et al., 2019).

Data were collected from a total of 826,452 participants (mean age of 44 years; range: 18–90 years), from community ($n = 48$ studies) (Afifi et al., 2013; 2016; Alhalal et al., 2018; Badley et al., 2019; Baiden et al., 2021; Brennenstuhl & Fuller-Thomson, 2015; Brown et al., 2018; Chartier et al., 2007, 2010; Coles et al., 2015; England-Mason et al., 2018; Eriksen et al., 2016; Fowler et al., 2020; Fuller-Thomson et al., 2009; 2011; Hammond & Colman, 2020; Hanlon et al., 2020; Kamiya et al., 2016; Kascakova et al., 2020; Kopec & Sayre, 2005; Lee et al., 2009; Lin et al., 2021; Noteboom et al., 2021; Park et al., 2014a; Reuchlein et al., 2016; Sachs-Ericsson et al., 2007; 2017; Scott et al., 2011; Sheikh, 2018, 2019; Shields et al., 2015; Stickley et al., 2015; Sumanen et al., 2007; Talley et al., 1994; 1998; Tietjen et al., 2015; 2017; Varinen et al., 2017; 2019; Wuest et al., 2008;

2009; 2010; Xu et al., 2013), clinical care ($n = 19$) (As-Sanie et al., 2014; Barron, 1997; Chandan et al., 2020; Dennis et al., 2019; Díaz-Olavarrieta et al., 2002; Hart-Johnson & Green, 2012; Jamieson & Steege, 1997; Jiao et al., 2015; Ju et al., 2020; Mays et al., 2021; Nicol et al., 2016; Pebole et al., 2022; Pierce et al., 2020; Schrepf et al., 2018; Tietjen et al., 2009; 2010; Viana et al., 2018), general population ($n = 8$) (Anno et al., 2015; Häuser et al., 2018; McBeth et al., 2015; Park et al., 2016; Sprang et al., 2020; Springer et al., 2007; Swanson et al., 2013; Waehrer et al., 2020), students ($n = 4$) (Bendixen et al., 1994; Bottiroli et al., 2018; Riedl et al., 2019; You et al., 2019), combined community and clinical care settings ($n = 3$) (Bradford et al., 2012; Häuser et al., 2012; Rahal et al., 2020), health maintenance organizations ($n = 2$) (Anda et al., 2010; Walker et al., 1999), and criminal court cases ($n = 2$) (Raphael et al., 2001; Raphael & Widom, 2011). Most studies were conducted in North America ($n = 50$) (Afifi et al., 2016; 2013; Anda et al., 2010; As-Sanie et al., 2014; Badley et al., 2019; Baiden et al., 2021; Barron, 1997; Bradford et al., 2012; Brennenstuhl & Fuller-Thomson, 2015; Chartier et al., 2007, 2010; Daily et al., 2022; Dennis et al., 2019; Díaz-Olavarrieta et al., 2002; England-Mason et al., 2018; Fuller-Thomson et al., 2009; 2011; Hammond & Colman, 2020; Hart-Johnson & Green, 2012; Jamieson & Steege, 1997; Jiao et al., 2015; Ju et al., 2020; Kopec & Sayre, 2005; Nicol et al., 2016; Park et al., 2016; Pebole et al., 2022; Pierce et al., 2020; 2022; Rahal et al., 2020; Raphael et al., 2001; Raphael & Widom, 2011; Sachs-Ericsson et al., 2007; 2017; Schlauch et al., 2022; Schrepf et al., 2018; Shields et al., 2015; Sprang et al., 2020; Springer et al., 2007; Swanson et al., 2013; Talley et al., 1994; Tietjen et al., 2009; 2010; 2015; 2017; Waehrer et al., 2020; Walker et al., 1999; Wuest et al., 2009; 2010; 2008; You et al., 2019), Europe ($n = 24$) (Bacon & White, 2022; Bellis et al., 2018; Bendixen et al., 1994; Bottiroli et al., 2018; Brown et al., 2018; Chandan et al., 2020; Eriksen et al., 2016; Fowler et al., 2020; Hanlon et al., 2020; Häuser et al., 2012; 2018; Kamiya et al., 2016; Kascakova et al., 2020; Mays et al., 2021; McBeth et al., 2015; Noteboom et al., 2021; Piontek et al., 2021; Riedl et al., 2019; Sheikh, 2018, 2019; Sumanen et al., 2007; Varinen et al., 2017; 2019; Viana et al., 2018), Australasia ($n = 9$) (Anno et al., 2015; Coles et al., 2015; Li et al., 2022; Lin et al., 2021; Park et al., 2014a; Santo et al., 2022; Stickley et al., 2015; Talley et al., 1998; Xu et al., 2013), and one in Saudi Arabia ($n = 1$) (Alhalal et al., 2018). Three studies covered multiple countries (Lee et al., 2009; Reuchlein et al., 2016; Scott et al., 2011), ACEs were collected through self-reported questionnaires ($n = 76$) (Afifi et al., 2016; 2013; Alhalal et al., 2018; Anda et al., 2010; As-Sanie et al., 2014; Bacon & White, 2022; Badley et al., 2019; Baiden et al., 2021; Barron, 1997; Bellis et al., 2018; Bendixen et al., 1994; Bottiroli et al., 2018; Bradford et al., 2012; Brennenstuhl & Fuller-Thomson, 2015; Brown et al., 2018; Chartier et al., 2007, 2010; Coles et al., 2015; Daily et al., 2022; Dennis et al., 2019; Díaz-Olavarrieta et al., 2002; England-Mason et al., 2018; Eriksen et al., 2016; Fowler et al., 2020; Fuller-Thomson et al., 2009; 2011; Hammond & Colman, 2020; Hanlon et al., 2020; Hart-Johnson & Green, 2012; Häuser et al., 2012; 2018; Jamieson & Steege, 1997; Ju et al., 2020; Kamiya et al., 2016; Kascakova et al., 2020; Kopec & Sayre, 2005; Li et al., 2022; Lin et al., 2021; Mays et al., 2021; McBeth et al., 2015; Nicol et al., 2016; Park et al., 2016; Pebole et al., 2022; Pierce et al., 2020; 2022; Piontek et al., 2021; Rahal et al., 2020; Raphael et al., 2001; Reuchlein et al., 2016; Riedl et al., 2019; Schlauch et al., 2022; Schrepf et al., 2018; Sheikh, 2018, 2019; Shields et al., 2015; Sprang et al., 2020; Springer et al., 2007; Stickley et al., 2015; Sumanen et al., 2007; Swanson et al., 2013; Talley et al., 1998; 1994; Tietjen et al., 2009; 2010; 2015; 2017; Varinen et al., 2017; 2019; Viana et al., 2018; Waehrer et al., 2020; Walker et al., 1999; Wuest et al., 2009; 2010; 2008; Xu et al., 2013; You et al., 2019), documented court cases ($n = 2$)(Raphael et al., 2001; Raphael & Widom, 2011), interviews ($n = 8$) (Jiao et al., 2015; Lee et al., 2009; Noteboom et al., 2021; Park et al., 2014a; Sachs-Ericsson et al., 2007; 2017; Santo et al., 2022; Scott et al., 2011) or clinical assessment ($n = 1$) (Chandan et al., 2020). Complaints of chronic pain and disability were assessed using validated patient reported health questionnaires ($n = 76$) (Afifi et al., 2016; 2013; Alhalal et al., 2018; Anno et al., 2015; Badley et al., 2019; Baiden et al., 2021; Barron, 1997; Bendixen et al., 1994; Bottiroli et al., 2018; Brennenstuhl & Fuller-Thomson, 2015; Brown et al., 2018; Chartier et al., 2007, 2010; Coles et al., 2015; Dennis et al., 2019; Díaz-Olavarrieta et al., 2002; England-Mason et al., 2018; Eriksen et al., 2016; Fowler et al., 2020; Fuller-Thomson et al., 2009; 2011; Hammond & Colman, 2020; Hanlon et al., 2020; Hart-Johnson & Green, 2012; Häuser et al., 2018; Jamieson & Steege, 1997; Jiao et al., 2015; Kamiya et al., 2016; Kascakova et al., 2020; Lee et al., 2009; Lin et al., 2021; Mays et al., 2021; McBeth et al., 2015; Nicol et al., 2016; Noteboom et al., 2021; Park et al., 2014a; Pebole et al., 2022; Pierce et al., 2020; Reuchlein et al., 2016; Riedl et al., 2019; Sachs-Ericsson et al., 2007; 2017; Schrepf et al., 2018; Scott et al., 2011; Sheikh, 2018, 2019; Shields et al., 2015; Sprang et al., 2020; Springer et al., 2007; Stickley et al., 2015; Talley et al., 1998; 1994; Tietjen et al., 2009; 2010; 2017; Varinen et al., 2017; 2019; Viana et al., 2018; Waehrer et al., 2020; Walker et al., 1999; Wuest et al., 2009; 2010; 2008; Xu et al., 2013; You et al., 2019), while other studies utilized clinical assessment techniques by a health professional ($n = 11$) (Badley et al., 2019; Bottiroli et al., 2018; Chandan et al., 2020; Häuser et al., 2012; Jiao et al., 2015; Ju

et al., 2020; Nicol et al., 2016; Tietjen et al., 2009; 2010; Viana et al., 2018; Walker et al., 1999) (Table 1).

Thirty seven studies reported on any direct, with or without indirect ACEs (Bacon & White, 2022; Bellis et al., 2018; Daily et al., 2022; Fuller-Thomson et al., 2011; Hanlon et al., 2020; Kascakova et al., 2020; Kopec & Sayre, 2005; Li et al., 2022; Lin et al., 2021; McBeth et al., 2015; Park et al., 2014a; 2016; Pierce et al., 2022; Piontek et al., 2021; Rahal et al., 2020; Raphael et al., 2001; Raphael & Widom, 2011; Sachs-Ericsson et al., 2007; Santo et al., 2022; Schlauch et al., 2022; Sheikh, 2018, 2019; Sprang et al., 2020; Stickley et al., 2015; Talley et al., 1994; 1998; 2015; 2017; Viana et al., 2018; Waehrer et al., 2020; Walker et al., 1999; Wuest et al., 2008; 2009; 2010; Xu et al., 2013; You et al., 2019). Direct ACEs concerned physical abuse (60 studies, 69%) (Afifi et al., 2016; 2013; Anda et al., 2010; As-Sanie et al., 2014; Badley et al., 2019; Baiden et al., 2021; Barron, 1997; Bottiroli et al., 2018; Brennenstuhl & Fuller-Thomson, 2015; Brown et al., 2018; Chandan et al., 2020; Chartier et al., 2007, 2010; Dennis et al., 2019; Díaz-Olavarrieta et al., 2002; England-Mason et al., 2018; Eriksen et al., 2016; Fowler et al., 2020; Fuller-Thomson et al., 2009; 2011; Hammond & Colman, 2020; Hanlon et al., 2020; Hart-Johnson & Green, 2012; Häuser et al., 2012; 2018; Jiao et al., 2015; Ju et al., 2020; Kascakova et al., 2020; Kopec & Sayre, 2005; Lee et al., 2009; Lin et al., 2021; Mays et al., 2021; McBeth et al., 2015; Nicol et al., 2016; Noteboom et al., 2021; Park et al., 2014a; 2016; Pebole et al., 2022; Pierce et al., 2020; Raphael et al., 2001; Raphael & Widom, 2011; Reuchlein et al., 2016; Riedl et al., 2019; Sachs-Ericsson et al., 2007; 2017; Schrepf et al., 2018; Scott et al., 2011; Sheikh, 2018; Shields et al., 2015; Sprang et al., 2020; Springer et al., 2007; Stickley et al., 2015; Swanson et al., 2013; Talley et al., 1998; 1994; Tietjen et al., 2009; 2010; 2017; Walker et al., 1999; You et al., 2019), sexual abuse ($n = 56$, 64%) (Afifi et al., 2016; Anda et al., 2010; As-Sanie et al., 2014; Badley et al., 2019; Baiden et al., 2021; Barron, 1997; Bendixen et al., 1994; Bradford et al., 2012; Brennenstuhl & Fuller-Thomson, 2015; Brown et al., 2018; Chandan et al., 2020; Chartier et al., 2007, 2010; Coles et al., 2015; Dennis et al., 2019; Díaz-Olavarrieta et al., 2002; England-Mason et al., 2018; Eriksen et al., 2016; Fowler et al., 2020; Hanlon et al., 2020; Hart-Johnson & Green, 2012; Häuser et al., 2012; 2018; Jamieson & Steege, 1997; Jiao et al., 2015; Ju et al., 2020; Kamiya et al., 2016; Kascakova et al., 2020; Lee et al., 2009; Mays et al., 2021; McBeth et al., 2015; Nicol et al., 2016; Noteboom et al., 2021; Park et al., 2014a; Park et al., 2016; Pebole et al., 2022; Pierce et al., 2020; Raphael et al., 2001; Raphael & Widom, 2011; Reuchlein et al., 2016; Riedl et al., 2019; Sachs-Ericsson et al., 2007; 2017; Schrepf et al., 2018; Scott et al., 2011; Sheikh, 2018; Sprang et al., 2020; Stickley et al., 2015; Talley et al., 1998; 1994; 2009; 2010; Tietjen et al., 2015; 2017; Walker et al., 1999; You et al., 2019), emotional abuse ($n = 36$, 41%) (Anda et al., 2010; Barron, 1997; Bottiroli et al., 2018; Bradford et al., 2012; Brown et al., 2018; Chandan et al., 2020; Dennis et al., 2019; Eriksen et al., 2016; Hammond & Colman, 2020; Hanlon et al., 2020; Häuser et al., 2012; 2018; Jiao et al., 2015; Kascakova et al., 2020; Kopec & Sayre, 2005; Lin et al., 2021; Mays et al., 2021; McBeth et al., 2015; Noteboom et al., 2021; Park et al., 2014a; 2016; Pebole et al., 2022; Riedl et al., 2019; Sachs-Ericsson et al., 2017; Sheikh, 2019; Sumanen et al., 2007; Talley et al., 1994; Tietjen et al., 2009; 2010; 2015; 2017; Varinen et al., 2017; 2019; Walker et al., 1999; Xu et al., 2013; You et al., 2019), and neglect ($n = 9$, 10%) (Anno et al., 2015; Chandan et al., 2020; Fowler et al., 2020; Hanlon et al., 2020; Lee et al., 2009; Riedl et al., 2019; Scott et al., 2011; Stickley et al., 2015; Xu et al., 2013), where emotional ($n = 15$, 16%) (Bottiroli et al., 2018; Bradford et al., 2012; Brown et al., 2018; Dennis et al., 2019; Häuser et al., 2012; 2018; Kascakova et al., 2020; Mays et al., 2021; Pebole et al., 2022; Tietjen et al., 2009; 2010; 2015; Walker et al., 1999) or physical neglect ($n = 15$, 17%) (Bottiroli et al., 2018; Brown et al., 2018; Dennis et al., 2019; Häuser et al., 2012; 2018; Kascakova et al., 2020; Mays et al., 2021; Pebole et al., 2022; Raphael et al., 2001; Raphael & Widom, 2011; Reuchlein et al., 2016; Talley et al., 1998; Tietjen et al., 2009; 2010; Walker et al., 1999) was specified. Further, 47 of the 85 studies also reported one indirect ACE or more, including witnessing intimate partner violence, parental unemployment, substance abuse, mental illness, criminality, divorce, loss or death, and financial difficulties (Afifi et al., 2013; 2016; Anda et al., 2010; Bacon & White, 2022; Badley et al., 2019; Barron, 1997; Bellis et al., 2018; Bottiroli et al., 2018; Bradford et al., 2012; Brennenstuhl & Fuller-Thomson, 2015; Brown et al., 2018; Chandan et al., 2020; Chartier et al., 2010; Daily et al., 2022; Dennis et al., 2019; England-Mason et al., 2018; Fowler et al., 2020; Fuller-Thomson et al., 2009; 2011; Hammond & Colman, 2020; Ju et al., 2020; Kopec & Sayre, 2005; Lee et al., 2009; Li et al., 2022; Lin et al., 2021; Noteboom et al., 2021; Park et al., 2014a; Park et al., 2016; Piontek et al., 2021; Reuchlein et al., 2016; Riedl et al., 2019; Sachs-Ericsson et al., 2007; 2017; Santo et al., 2022; Schlauch et al., 2022; Schrepf et al., 2018; Scott et al., 2011; Sheikh, 2018; Sprang et al., 2020; Springer et al., 2007; Stickley et al., 2015; Sumanen et al., 2007; Swanson et al., 2013; Talley et al., 1998; Varinen et al., 2017; 2019; Waehrer et al., 2020; You et al., 2019). Thirty three studies reported a dose–response relationship between direct ACEs (with or without indirect ACEs) and chronic pain and pain-related disability (Afifi et al., 2016; Anda et al., 2010; Bellis et al., 2018; Bottiroli et al.,

Table 1. Study Characteristics, risk estimates of long-term chronic pain and pain-related disability outcomes following adverse childhood experience.

Source Country (Study design)	Population Setting (sample size) Mean age in years (female gender)	Allocated (ACEs / No ACEs)	Total number of ACEs exposure (direct)	Direct ACE n (%)	Indirect ACE	ACE assessment (Self-reported questionnaires unless indicate otherwise)	Outcomes (Clinical assessment; Questionnaire)	Pain (adjusted) ORs (95% CI) *unless mentioned otherwise*	Disability (adjusted) ORs (95% CI) *unless mentioned otherwise*	Cumulative (adjusted) ORs (95% CI) *unless mentioned otherwise*	Quality
Afifi et al. (2013)[32] USA (CS)	Community (34,226) N/A N/A	N/A	5 (4)	Any ACEs: 3375 (24.1%) PA: 293 (22.5%)	Witness IPV	CTS; CTQ	Arthritis (Questionnaire)	Any ACE: 1.27 (1.17–1.37)*** PA: 1.25 (1.01–1.54)*	N/A	N/A	Fair
Afifi et al. (2016)[33] Canada (CS)	Community (23,395) N/A (NA)	N/A	3 (2)	Any ACEs: 8422 (36%) PA (any health condition): 6785 (29%) SA (any health condition): 2924 (12.8%)	Witness IPV	CEVQ (Standardized definitions)	Arthrites, back pain, migraine, (Questionnaire)	Arthritis Any ACE: 1.4 (1.3, 1.6)*** PA: 1.1 (0.9, 1.2) SA: 1.0 (0.8, 1.2) Back problems 1 ACE: 1.6 (1.4–1.7)*** Migraine 1 ACE: 1.9 (1.6–2.2)***	N/A	Arthritis 2 ACEs: 1.2 (0.9–1.6) 3 ACEs: 1.4 (1.0–2.0)* Back problems 2 ACEs: 1.5 (1.2–1.8)*** 3 ACEs: 1.0 (0.7–1.4) Migraine 2 ACEs: 1.9 (1.4–2.6)*** 3 ACEs: 2.0 (1.3–3.0)***	Good
Alhalal et al. (2018)[34] Saudi Arabia (CS)	Community (299) 36.1 yrs (100%)	N/A	3	PA: 91 (30.4%) SA: 115 (38.4%) EA: 136 (45.5%)	N/A	CTQ	Chronic pain (Questionnaire)	N/A	N/A	ACEs (PA + SA + EA) with PTSD: β= 0.056, SE= 0.071, p=.432 Indirect ACEs with PTSD: β= 0.108, SE= 0.040, p= .004*	Fair
Anda et al. (2010)[109] USA (CS)	HMO (17,337) 65 yrs (54%)	N/A	8 (3)	SA: 3519 (20.7%) PA: 4905 (28.3%) EA: 1838 (10.6%)	PSA, PMI, PC, PMC, PSD	CTS	Frequent headache (Questionnaire)	PA: 1.4 (1.3–1.5) SA: 1.3 (1.1–1.4) EA: 1.6 (1.4–1.7)	N/A	1 ACE: 1.2 (1.1–1.3) 2 ACEs: 1.4 (1.3–1.6) 3 ACEs: 1.7 (1.5–1.9) 4 ACEs: 2 (1.7–2.3) $\geq$ 5 ACEs: 2.1 (1.8–2.4)***	Fair
Anno et al. (2015)[35] Japan (CS)	General (760) 59.3 yrs (62.4%)	107/653	1	N: 107 (14.1%)	N/A	Parental Bonding Instrument	Chronic pain (Questionnaire)	Father Neglect: 1.41 (0.84–2.37)** Mother Neglect: 1.51 (0.91–2.53)	N/A	N/A	Fair
			2		N/A					N/A	Fair

As-Saine et al. (2014)[110] USA (CS)	Clinical (210) 34.8 yrs (100%)	PA: 65/155 SA: 77/ 167		PA: 65 (23.8%) SA: 77 (28.2%)		Sexual and Physical Abuse History Questionnaire	Chronic pelvic pain (Questionnaire)	PA: 0.57 (0.20–1.57) SA: 0.80 (0.29–2.24)	PA: 0.82 (0.37–1.82) SA: 0.58 (0.25–1.34)		
Badley et al. (2019)[36] Canada (CS)	Community (21,889) N/A (N/A)	N/A	3 (2)	PA: 5910 (27%) SA: 7004 (32%)	Witness IPV	CEVQ	Arthritis (Clinical assessment)	PA (Severe/ frequent): 2.3 (1.5–3.4)* PA (Severe): 1.3 (1.1–1.6)* SA (Severe /frequent): 1.9 (1.4–2.5)** SA Severe 1.8 (1.5–2.3)**	N/A	N/A	Fair
Baiden et al. (2021)[37] USA (CS)	Community (75,717) N/A (49.7%)	PA: 19388/ 56379 SA: 4260/ 71457	2	PA: 19388 (25.5%) SA: 4260 (5.6%)	N/A	Family Health History and Health Appraisal Questionnaire (CDC- Kaiser ACE)	Chronic pain (arthritis, FM) (Questionnaire)	PA: 1.36 (1.28–1.46)*** SA: 1.74 (1.54–1.97)***	N/A	N/A	Fair
Bacon et al. (2022) [117] UK (CS)	Community (723) FM:42.3 yrs / HCs: 36.9 yrs (FM: 100% / HCs: 100%)	569/154	10 (5)	Any ACE: 569 (78.7%)	PSD, PSA, IPV, PMI, PC	ACE Scale	FM (Questionnaire)	Standardized Coefficients (95% CI) Any ACE: 0.11 (0.02,0.07)***	N/A	N/A	Fair
Barron et al. (1997)[38] USA (CS)	Clinical (239) 45 yrs (70%)	PA: 58/181 SA: 33/ 206 EA: 102/ 137	5 (3)	PA: 58 (24%) SA: 33 (14%) EA: 102 (42%)	PLD, PSA	Computerized Pain History Questionnaire	Chronic pain (Questionnaire)	PA: $t(237) = -1.27$ SA: $t(237) = -0.40$ EA: $t(237) = -1.58$	N/A	N/A	Poor
Bellis et al. (2018)[113] UK (CS)	Community (2452) N/A (54.5%)	1190/1262	10 (5)	PA: 382 (32.1%) SA: 184 (15.5%) EA: 481 (40.4%) PN: 101 (8.5%) EN:184 (15.5%)	PSD, PSA, IPV, PMI, PC	CDC-ACE Tool and Short Child Maltreatment Questionnaire	Frequent headache (Questionnaire)	1 ACE: 1.48 (1.14–1.92)**	N/A	3 ACEs: 1.75 (1.33–2.28)*** ≥4 ACEs: 2.71 (2.05–3.59)***	Fair
Bendixen et al. (1994)[39] Norway (CS)	Students (996) 22.7 yrs (51.2%)	Male 17/469 Female 99/411	1	Male SA: 17 (3.5%) Female SA: 99 (19.4%)	N/A	Questionnaire (Standardized definition of SA)	Chronic pain (pelvic pain, headache, abdominal pain, muscular pain) (Questionnaire)	Any ACEs: RR (SE): 1.38 (0.01)***		N/A	Poor
Bottiroli et al. (2018)[40] Italy (CS)	Students (331) 42.9 yrs (80%)	N/A	62 (4)	PA (EM/ EM+MOH): 12 (8%) /26 (15%), EA (EM/ EM +MOH): 11 (7%)/ 20 (11%), EN (EM/ EM +MOH): 51 (34%)/84 (47%) PN (EM/ EM +MOH): 31 (20%)/54 (30%)	Stressful life-events (62 items)	CTQ	Chronic migraine (Clinical assessment)	N/A	N/A	EA + EN: 2.66 (1.15–6.12)* PA + PN + SA: 1.84 (1.13–2.98)*	Good

(*Continued*)

Table 1. Continued.

Source Country (Study design)	Population Setting (sample size) Mean age in years (female gender)	Allocated (ACEs / No ACEs)	Total number of ACEs exposure (direct)	Direct ACE n (%)	Indirect ACE	ACE assessment (Self-reported questionnaires unless indicate otherwise)	Outcomes (Clinical assessment; Questionnaire)	Pain (adjusted) ORs (95% CI) *unless mentioned otherwise*	Disability (adjusted) ORs (95% CI) *unless mentioned otherwise*	Cumulative (adjusted) ORs (95% CI) *unless mentioned otherwise*	Quality
Bradford et al. (2012)[97] USA (CC)	Clinical and Community (729) IBS:36.3 yrs / HCs: 29.5 yrs (IBS: 79% / HCs: 76.7%)	N/A	4 (3)	PA (IBS/Control): 178 (60%)/ 214 (49.2%) SA (IBS/Control): 92(31.2%)/ 78 (17.9%) EA (IBS/Control): 161(54.9%)/ 117 (27%)	General trauma (e.g. PLD, FEI)	Early Adverse Life Events Questionnaire	IBS (Questionnaire)	EA: 2.26*** EN (often ignored): 3.08*** EN (treated in a cold, uncaring way or not loved): 2.64*** SA (forced or coerced to touch someone intimate part): 2.92*** SA (had genital sex against will): 4.05***	N/A	N/A	Good
Brennenstuhl et al. (2015)[41] Canada (CS)	Community (22,996) 47.7 yrs (52.7%)	5072/ 15681	3 (2)	Male PA: 3201 (30.9%) SA (touching): 228 (2.2%) SA (forced sex): 373 (3.6%) Female PA: 2692 (21.3%) SA (touching): 784 (6.2%) SA (forced sex): 1024 (8.1%)	Witness IPV	CEVQ	Migraine (Questionnaire)	Men Any ACE: 1.43 (1.25–1.62) PA: 1.50 (1.25–1.80) SA (only touching): 1.14 (0.70, 1.86) SA (forced): 1.70 (1.22–2.36) Women Any ACE: 1.36 (1.13–1.65) PA: 1.61 (1.42, 1.83) SA (only touching): 0.83 (0.66–1.04) SA (forced): 1.32 (1.11–1.57)	N/A	Men ≥2 ACEs: 2.32 (1.97–2.73) ≥ 3 ACEs: 2.85 (2.25–3.60) Women ≥2 ACEs: 2.51 (1.94–3.25) ≥ 3 ACEs: 3.26 (2.09–5.07)	Fair
Brown et al. (2018)[42] Germany (CS)	Community (2,510) 48.3 yrs (53.2%)	N/A	6 (5)	SA: 343 (16.8%) PA: 309 (14.3%) EA: 462 (22.9%) EN: 1027 (72.3%) PN: 1028 (71.4%)	Bullying	CTQ	Chronic pain, bodily pain, headache, spine pain (Questionnaire)	Standardized Coefficients PA: 0.08,*** SA: 0.09*** EA: 0.09*** EN: −0.06** PN: 0.07**	N/A	N/A	Good
Chandan et al. (2020)[104] UK (Retrospective	Clinical (241,971)	80,657/ 161,314	5 (4)	PA, SA, EA, N (PN, EN): 80,657 (33.3%)	Witness IPV	Childhood maltreatment EMR code	Chronic LBP, TMJ disorders, myofascial pain syndrome (MPS)	IRR (95%CI) Chronic LBP: 1.99*** (1.68–	N/A	N/A	Poor

cohort – 2.2 yrs median follow-up)	23.3 yrs (58.3%)					(Objectively verifiable methods)	FM, IBS, chronic headache, vulvodynia (Clinical assessment)	2.35) TMJ disorder: 1.00 (0.88–1.13) MFP syndrome: 0.88 (0.36–2.14) Combined chronic MSDs: 1.41 (1.31–1.53)*** Fibromyalgia: 2.06 (1.71 −2.48)*** Headache: 1.04 (0.59–1.86) IBS: 1.15 (1.08–1.22)*** Vulvodynia: 0.65 (0.34–1.26) Combined chronic non-MSDs (visceral) syndrome: 1.14 (1.07–1.22)***			
Chartier et al. (2007)[43] Canada (CS)	Community (9,953) N/A (27.5%)	3,212/ 6,741	2	PA: 2414 (26%) SA: 798 (8.6%) (PA+SA): 426 (4.3%)	N/A	CTS	Chronic pain (Questionnaire)	PA: 1.68 (1.30–2.16)* SA: 1.34 (0.90–1.99)	PA: 1.64 (1.33–2.01)* SA: 1.81 (1.33–2.46)*	N/A	Fair
Chartier et al. (2010)[44] Canada (CS)	Community (9,953) N/A (27.5%)	3,212/ 6,741	4 (2)	PA: 2414 (26%) SA: 798 (8.6%) (PA+SA): 426 (4.3%)	PMC, PMI	CTS	Chronic pain (Questionnaire)	PA: 1.51 (1.14–1.98)* SA: 0.96 (0.63–1.45)	PA: 1.41 (1.13–1.76)* SA: 1.34 (0.97–1.86)	1–6 ACEs Pain: 1.24 (1.14–1.36)* Disability: 1.24 (1.15–1.33)*	Good
Coles et al. (2015)[45] Australia (CS)	Community (9,145) 30.6 yrs (100%)	889/6,264	1	SA: 889 (9.7%)	N/A	Questionnaire (Standardized definition of SA)	Chronic pain (Questionnaire)	SA: 1.37 (1.19–1.58)*	N/A	N/A	Fair
Daily et al. (2022)[112] USA (CS)	Community (2831) N/A (76.3%)	1443/1388	10 (5)	Any ACE: 1443 (51%)	PSD, PSA, IPV, PMI, PC	Brief Family History Questionnaire	Chronic pain (Questionnaire)	Any ACEs: 1.61 (1.38–1.87)**	N/A	N/A	Fair
Dennis et al. (2019)[46] USA (CS)	Clinical (326) 40.3 yrs (100%)	274/ 52	10 (5)	PA: 98 (30.1%) SA: 113 (34.7%) EA: 156 (47.9%) EN: 146 (44.8%), PN: 54 (16.6%)	PSA, PMI, PC, PMC PSD	CTS; The Wyatt Sexual History Questionnaire	Chronic pain, (generalized pain, FM, widespread pain) (Questionnaire)	Mean Mothers with pain = 3.72 Mothers without pain = 3.17	N/A		Good
Díaz-Olavarrieta et al. (2020)[47] Mexico (CS)	Clinical (1,780)	259/1053	2	PA + SA: 259 (14.6%)	N/A	Abuse Assessment Screen Questionnaire	Pelvic pain, headache, spine pain (Questionnaire)	Unajusted OR (SE) PA and/or SA: PSS: 1.82 (0.16)*	N/A	N/A	Fair

(*Continued*)

Table 1. Continued.

Source Country (Study design)	Population Setting (sample size) Mean age in years (female gender)	Allocated (ACEs / No ACEs)	Total number of ACEs exposure (direct)	Direct ACE n (%)	Indirect ACE	ACE assessment (Self-reported questionnaires unless indicate otherwise)	Outcomes (Clinical assessment; Questionnaire)	Pain (adjusted) ORs (95% CI) *unless mentioned otherwise*	Disability (adjusted) ORs (95% CI) *unless mentioned otherwise*	Cumulative (adjusted) ORs (95% CI) *unless mentioned otherwise*	Quality
	44.8 yrs (100%)							Headache: 1.82 (0.14)* Spine: 1.77 (0.15)*			
England-Masson et al. (2018)[48] Canada (CS)	Community (23,846) N/A (48.07%)	7700/ 16,191	3 (2)	PA: 6070 (26.1%) SA: 2760 (10.1%)	Witness IPV	CEVQ	Chronic migraine headaches, chronic back pain (Questionnaire)	Any ACEs: 1.38 (1.11–1.73)* PA: 1.64 (1.33–2.02)* SA: 1.34 (1.00–1.80)*	N/A	2 ACEs: 2.07 (1.46–2.94)* 3 ACEs: 1.85 (1.05–3.26)*	Good
Eriksen et al. (2016)[49] Norway (CS)	Community (11,130) N/A (61.6%)	2358/ 8773	3	Female PA: 615 (9.9%) SA: 785 (12.6%) EA: 882 (14.2%) Male PA: 414 (8.4%) SA: 191 (3.8%) EA: 676 (13.7%)	N/A	SAMINOR 2 Questionnaire	Chronic painful MSDs (neck/shoulder, back pain), Chest pain; stomach/pelvic pain (Questionnaire)	Women (RR, 95%CI) Any ACEs: 1.5 (1.3–1.7) Neck/shoulder pain: 1.4 (1.2–1.6) Back pain: 1.6 (1.4–1.8) Chest pain: 1.7 (1.4–2.1) Stomach/Pelvic pain: 1.8 (1.5–2.1) Men (RR, 95%CI) Any ACEs: 1.5 (1.3–1.7) Neck/shoulder pain: 1.5 (1.3–1.8) Back pain: 1.4 (1.2–1.7) Chest pain: 1.6 (1.2–2.1) Stomach/Pelvic pain: 1.7 (1.4–2.1)	N/A	N/A	Poor
Fowler et al. (2020)[50] Ukraine (CS)	Community (1,720) 46 yrs (55%)	N/A	10 (3)	PA: 234 (13.7%) SA: 26 (1.5%) N: 237 (14%)	PSD, PLD, leaving home, PMI, PSA, PC	Kessler ACE Scale	Chronic pain (neck or back problems, arthritis or rheumatism, frequent or severe headaches) (Questionnaire)	1–2 ACEs: 1.49 (1.06, 2.10)*	1–2 ACEs: 1.09 (0.80, 1.47)	Pain 1–2 ACE: 1.49 (1.06, 2.10)* ≥ 3 ACEs: 3.81 (2.19, 6.60)*** Disability 1–2 ACEs: 1.09 (0.80, 1.47) ≥ 3 ACEs: 2.72 (1.69, 4.37)***	Good

Fuller-Thompson et al. (2009)[51] Canada (CS)	Community (11,108) N/A (51.4%)	854/ 10,254	4 (1)	PA: 854 (6.9%)	PU, PSA, PSD,	CCHS	OA (Questionnaire)	PA (all age): 1.56 (1.21–2.00)* 40–49 yrs: 8.67 (6.07–12.38)* 50–59 yrs: 25.10 (17.81–35.38)* 60–69 yrs: 36.98 (25.88–52.86)* 70–79 yrs: 49.07 (33.85–71.14)* ≥80 yrs: 63.67 (42.48–95.43)*	N/A	N/A	Poor
Fuller-Thompson et al. (2011)[52] Canada (CS)	Community (7,342) N/A (100%)	705/6637	4 (1)	PA: 705 (9.6%)	PU, PSA, PSD,	CCHS	FM, IBS (Questionnaire)	Any ACEs (FM): 3.8 (1.4–3.1) PA (FM): 1.65 (1.08–2.52)* Any ACE (IBS): 1.49 (1.1–2.2) PA (IBS): 1.14 (0.79–1.65)	N/A	N/A	Poor
Hammond et al. (2020)[53] Canada (CS)	Community (11,910) N/A (50.2%)	N/A	6 (2)	PA: 1555 (9.7%); EA: 2668 (22.4%)	Hospitalized as child, PU, PSA, PSD	CCHS	Chronic migraine (Questionnaire)	Any ACE: 1.18 (1.01–1.39)*	N/A	Poor	Poor
Hanlon et al. (2020)[54] UK (CS)	Community (157,357) N/A (56%)	52,675/ 102,798	4	PA: 29,799 (18.9%) SA: 13,647 (8.7%) EA: 24,552 (15.6%) N: 9005 (5.7%)	N/A	CTQ	Widespread pain (Questionnaire)	Any ACE: 1.57 (1.26–1.97) PA: 1.51 (1.23–1.86) SA: 1.65 (1.28–2.11) EA: 1.7 (1.38–2.1) N: 1.76 (1.34–2.32)	N/A	2 ACEs: 1.75 (1.32–2.33) 3 ACEs: 2.24 (1.54–3.27) 4 ACEs: 3.19 (1.87–5.44)	Good
Hart-Johnson et al. (2012)[55] USA (CS)	Clinical (164) 38.2 yrs (64%)	N/A	3	PA: 79 (48.4%) SA (Intercourse): 80 (48.9%) SA (Molestation): 48 (29.1%)	N/A	Drossman Abuse Questionnaire	Chronic painful MSDs (leg, back, hip/pelvis or arm/shoulder) (Questionnaire)	($R^2\Delta$, F, β, *P*) SA (molestation): 0.01, 0.74, −0.07, 0.39 SA (penetration): 0.01, 1.04, 0.09, 0.31 PA: 0.01, 1.88, 0.12, 0.17 ($R^2\Delta$, F, β, *P*) SA (molestation): 0.00, 0.03, −0.01, 0.87 SA (penetration): 0.31, 0.04, 6.70, 0.21 PA: 0.04, 6.46, 0.21, 0.01	($R^2\Delta$, F, β, *P*) SA (molestation): 0.02, 2.48, 0.13, 0.12 SA (penetration): 0.04, 5.65, 0.20, 0.02 PA: 0.01, 1.76, 0.11, 0.19	N/A	Good

(*Continued*)

Table 1. Continued.

Source Country (Study design)	Population Setting (sample size) Mean age in years (female gender)	Allocated (ACEs / No ACEs)	Total number of ACEs exposure (direct)	Direct ACE n (%)	Indirect ACE	ACE assessment (Self-reported questionnaires unless indicate otherwise)	Outcomes (Clinical assessment; Questionnaire)	Pain (adjusted) ORs (95% CI) *unless mentioned otherwise*	Disability (adjusted) ORs (95% CI) *unless mentioned otherwise*	Cumulative (adjusted) ORs (95% CI) *unless mentioned otherwise*	Quality
Häuser et al. (2012)[98] Germany (CC)	Clinical and community (306) 50.3 yrs (FM: 87.6%/ HC: 86.9%)	FM:153/ HC:153	4	Fibromyalgia / Control EA (Moderate-Severe): 15 (9.8)/ 4 (2.6) EA (Severe-Extreme): 34 (22.2)/1 (0.7) PA (Moderate-Severe): 18 (11.8)/ 3 (2.0) PA (Severe-Extreme): 14 (9.2)/3 (2.0) SA (Moderate-Severe): 12 (7.8)/ 10 (10.5) SA (Severe-Extreme): 24 (15.7)/ 4 (2.6) EN (Moderate-Severe): 22 (14.4)/ 16 (10.5) EN (Severe-Extreme): 20 (26.1)/ 14 (9.2) PN (Moderate-Severe): 20 (13.1)/ 30 (19.6) PN (Severe-Extreme): 26 (17.0)/ 15 (9.8)	N/A	CTQ	FM (Clinical assessment)	PA: partial eta^2 = 0.009, d-0,1906 SA: partial eta^2 = 0.02, *d*=0,026* EA: partial eta^2 = 0.05, *d*=0,459* EN: partial eta^2 = 0.0003, *d*=0.0345	N/A	N/A	Poor
Häuser et al. (2018)[56] Germany (CS)	General (2,425) 50.8 yrs (53.5%)	N/A	5	PA: 670 (27.6%) SA: 230 (9.3%) EA: 1560 (64.4%) EN: 569 (23.4%) PN: 1319 (54.4%)	N/A	CTQ	Chronic pain (bodily pain) (Questionnaire)	PA: 0.86 (0.58–1.33) SA: 0.51 (0.34–0.78)* EA: 0.85 (0.54–1.33) EN: 1.42 (0.92–2.22) PN: 1.03 (0.74–1.34)	EA: 1.52 (0.68–3.41) PA: 0.61 (0.30–1.24) SA: 0.36 (0.16–0.80)* EN: 1.04 (0.46–2.35) PN: 1.56 (0.87–2.82)	N/A	Good
Jamieson et al. (1997)[57] USA (CS)	Clinical (581) N/A (100%)	150/354	1	SA: 150 (25.8%)	N/A	Drossman Abuse Questionnaire	IBS (Questionnaire)	SA: 2.77 (1.04–7.37)	N/A	N/A	Fair
		289/673	4		N/A	Interviews				N/A	Poor

Jiao et al. (2015)[58] USA (CS)	Clinical (962) 46.9 yrs (97.9%)			Any ACE: 289 (30%) Unique ACE: 113 (41%), including: PA: 11 (10%) SA: 31 (27%) EA: 71 (62.3%) Cumulative ACEs: 161 (59%)			FM (Clinical assessment)	Mean (SD) Any ACE (Physical function): 5.05 (2.21)*** Any ACE (Pain): 7.41 (1.99)	Mean (SD) Any ACE (Physical function): 35.44 (21.04)*** Any ACE (Pain): 21.82 (15.22)***		
Ju et al. (2020)[99] USA (CC)	Clinical (362) 30.3 yrs (72%)	N/A	6 (2)	PA: 68 (18.8%) SA: 59 (16.2%)	PLD, PMC, PEI, other major upheavals	CTES	IBS (Clinical assessment)	PA: 2.59 (1.31–5.12)** SA: 3.36 (1.54–7.34)**	N/A	≥ 2 ACEs: 1.14–1.62); $p < .001$	Fair
Kamiya et al. (2016)[59] Ireland (CS)	Community (6,897) 60.4 yrs (56%)	451/6442	1	SA: 451 (6.6%)	N/A	Stressful Life Events Inventory	Chronic painful MSDs (back, hips, knee, feet, mouth), arthritis (Questionnaire)	SA: Chronic painful MSDs: 1.23 (0.99–1.53) Arthritis: 0.24 (0.002, 0.48)*	N/A	N/A	Poor
Kascakova et al. (2020)[60] Czech Republic (CS)	Community (1,800) 46.4 yrs (51.3%)	N/A	5	PA (migraine): 31 (13.9%) PA (Other pain): 82 (13.0%) SA (migraine): 21 (9.4%) SA (Other pain): 41 (6.5%) EA (migraine): 46 (20.6%) EA (Other pain): 103 (16.3%) EN (migraine): 57 (25.6%) EN (Other pain): 128 (20.3%) PN (migraine): 85 (38.1%) PN (Other pain): 254 (40.2%)	N/A	CTQ	Chronic pain (back pain, arthritis, migraine) (Questionnaire)	SEM (SE) Any ACE (migraine): 0.101 (0.039)* Any ACE (other pain): 0.050 (0.032)	N/A	N/A	Fair
Kopec et al. (2005)[105] Canada (Retrospective cohort – 4 yrs follow-up)	Community (9,552) N/A (55.4%)	N/A	6 (2)	PA: 625 (6.5%) EA: 1804 (18.9%)	Hospitalized as child, PSA, PSD, PU, leave home	Questionnaire: National Population Health Survey	Back pain (Questionnaire)	RR (95% CI) Any ACE: 1.17 (0.97–1.41) PA: 1.04 (0.78–1.4) EA: 1.24 (1–1.54)	N/A	RR (95%CI) Overall 2+ ACEs: 1.49 (1.21–1.84) Male 1 ACE: 0.97 2+ ACEs: 1.41* Female 1 ACE: 1.34* 2+ ACEs: 1.63*	Good
		7152/9403	10 (4)			Interviews			N/A		Fair

(*Continued*)

Table 1. Continued.

Source Country (Study design)	Population Setting (sample size) Mean age in years (female gender)	Allocated (ACEs / No ACEs)	Total number of ACEs exposure (direct)	Direct ACE n (%)	Indirect ACE	ACE assessment (Self-reported questionnaires unless indicate otherwise)	Outcomes (Clinical assessment; Questionnaire)	Pain (adjusted) ORs (95% CI) *unless mentioned otherwise*	Disability (adjusted) ORs (95% CI) *unless mentioned otherwise*	Cumulative (adjusted) ORs (95% CI) *unless mentioned otherwise*	Quality
Lee et al. (2009)[61] Multiple countries (Colombia, Mexico, United States, Belgium, France, Germany, Italy, Netherlands, Spain, Japan) (CS)	Community (16,555) 46.2 yrs (52.5%)			PA: 1589 (9.6%) SA: 414 (2.5%) N: 1076 (6.5%)	PLD, PSD, PMI, FFD, FC, PSA		Chronic headache (Questionnaire)	HR (95% CI) 1 ACE: 1.40 (1.22–1.60) PA: 1.64 (1.44–1.88)*** SA: 1.73 (1.38–2.17)*** N: 1.21 (1.02–1.43)*		2 ACE: 1.41 (1.19–1.67) 3+ACE: 1.63 (1.37–1.95)	
Li et al. (2022)[119] China (CS)	Community (10,651) N/A (23.1%)	1061/9590	13 (3)	Any ACEs (PA, SA, EN): 9590 (90.1%)	Witness IPV, PSA, PMI, PC, PSD, PLD, parental disability, bullying, Peer rejection, Unsafe neighbourhood	Life history survey	Arthritis (Questionnaire)	N/A	Any ACEs: Low-mild vs low-low trajectory: 2.22 (2.02,2.44)*** Mild-increasing vs low-low trajectory: 3.85 (3.32,4.47)***	Disability (4+ ACEs) Low-mild trajectory: 1.32 (1.11–1.57)*** mild-increasing trajectory: 1.41 (1.06–1.89)***	Fair
Lin et al. (2021)[62] China (CS)	Community (1,972) 59.9 yrs (51.6%)	1755/377	10 (2)	PA: 607 (30.8%) EA: 680 (34.5%)	Witness IPV, PSA, PMI, PC, PSD, bullying, PLD, parental disability	Life history survey	Arthritis (Questionnaire)	Any ACE: 1.06 (0.91–1.23)	N/A	2 ACEs: 1.42 (1.22–1.66)*** 3 ACEs: 1.62 (1.37–1.93)*** 4+ ACEs: 1.97 (1.67–2.33)***	Fair
Mays et al. (2021)[63] Ireland (CS)	Clinical (507) 39.8 yrs (89.9%)	N/A	5	PA Moderate-Severe: 20 (3.9%) Severe-Extreme: 36 (7.1%) SA Moderate-Severe: 26 (5.1%) Severe-Extreme: 48 (9.5%) EA Moderate-Severe: 50 (9.9%) Severe-Extreme: 86 (17%) EN Moderate-Severe: 52 (10.3%) Severe-Extreme: 74 (14.6%) PN	N/A	CTQ	Chronic migraine (Questionnaire)	PA (Mod-Severe): 2.96 (0.83–10.56) PA (Severe-Extreme): 4.30 (1.44–12.83)*** SA (Severe-Extreme): 0.73 (0.32–1.68) EA (Mod-Severe): 0.56 (0.55–1.38) EA (Severe-Extreme): 1.49 (0.57–3.84) EN (Mod-Severe): 0.96 (0.37–2.48) EN (Severe-Extreme): 0.20 (0.06–0.63)** PN (Mod-Severe): 0.59 (0.29–1.22) PN (Severe-	N/A	N/A	Fair

				Moderate-Severe: 85 (16.8%) Severe-Extreme: 36 (7.1%)				Extreme): 2.44 (0.84–7.05) SA (Mod-Severe): 1.74 (0.60–5.00)			
McBeth et al. (2015)[64] UK (CS)	General (990) N/A (55%)	650/337	4	PA: 350 (35.4%) SA: 112 (11.3%) EA: 510 (51.5%)	Parental bonding	Childhood Physical and Sexual Abuse Questionnaire	FM (Questionnaire)	Any ACEs: 1.9 (0.9–4.1) SA: 1.6 (0.8–2.9) EA: 2.3 (1.05–5.2) PA: 2.1 (0.8–5.7)	N/A	N/A	Fair
Nicol et al. (2016)[65] USA (CS)	Clinical (3,081) 45.7 yrs (83.7%)	375/2706	2	PA + SA: 470 (56.14%)	N/A	Questionnaire (traumatic events)	Chronic body pain (Clinical assessment)	PA/SA: 1.04 (0.94–1.16) PA/SA: 0.87 (0.78–0.97)*	PA/SA: 0.96 (0.94–0.98)***	N/A	Fair
Noteboom et al. (2021)[66] Netherlands (CS)	Community (13,489) 42.6 yrs (54%)	4054/9435	4	Any ACE: 4054 (28.7%) PA: 1049 (7.8%) SA: 1122 (7.6%) EA: 2663 (19.8%)	N/A	Interview	Chronic painful MSDs, migraine (Questionnaire)	N/A	N/A	Painful MSDs 1–2 ACEs: 1.21 (1.06–1.39)** ≥ 3 AECs: 1.75 (1.51–2.03)*** Migraine 1–2 ACEs: 1.42 (1.16–1.75)*** ≥ 3 AECs: 1.66 (1.31–2.10)*	Fair
Park et al. (2014)[67] Korea (CS)	Community (6,027) N/A (55.5%)	239/5782	5 (2)	1 ACE: 166 (2.75%) PA: 35 (0.58%) SA: 42 (0.7%) Other: 89 (1.48%) ≥2 ACEs: 73 (1.21%)	Sudden injury/ accident, military combat, or natural disaster	Interview	Chronic pain (Questionnaire)	Any ACE: 1.76 (1.12–2.75)**	Any ACE: 1.83 (0.91–3.67)**	Pain ≥ 2 ACE: 4.11 (2.44–6.94)*** Mobility: ≥ 2 ACE: 3.84 (1.91–7.71)***	Good
Park et al. (2016)[100] USA (CC)	General (294) IBS: 30.3 yrs /HCs: 31.1 yrs (IBS: 73%/ HCs: 59%)	N/A	8 (3)	Any ACEs (IBS/HC): 75.7%/ 59.7% PA (IBS/HC): (12.2%/ 7.8%) SA (IBS/HC): 19.6%/ 9.74% EA (IBS/HC): 27.0%/ 13.6%	PSA, PSD, PMI, PC, PMC	Adverse Childhood Events Questionnaire; ETI	IBS (Questionnaire)	Any ACE: 2.05 (1.21–3.48)**	N/A	1–3 ACEs: 1.77 (1.03–3.06)* 4–6 ACEs: 3.83 (1.66–8.89)** 7–9 ACEs: 4.08 (0.68–24.46)	Good
Pebole et al. (2021)[68] USA (CS)	Clinical (643) N/A (69.8%)	N/A	5	PA: 318 (49.4%) SA: 281 (43.6%) EA: 452 (70.2%) PN: 341 (53%) EN: 493 (76.6%)	N/A	CTQ	Chronic bodily pain (Questionnaire)	PA: 1.53 (1.01–2.33)* PN: 1.01 (0.65–1.56) SA: 1.18 (0.79–1.77) EA: 1.46 (0.87–2.45) EN: 1.08 (0.62–1.87)	PA: 2.03 (1.35–3.06)* PN: 0.92 (0.60–1.41) SA: 1.11 (0.75–1.66) EA: 1.35 (0.84–2.18) EN: 0.84 (0.51–1.39)	N/A	Good
		320/2798	2		N/A				N/A		Fair

(*Continued*)

Table 1. Continued.

Source Country (Study design)	Population Setting (sample size) Mean age in years (female gender)	Allocated (ACEs / No ACEs)	Total number of ACEs exposure (direct)	Direct ACE n (%)	Indirect ACE	ACE assessment (Self-reported questionnaires unless indicate otherwise)	Outcomes (Clinical assessment; Questionnaire)	Pain (adjusted) ORs (95% CI) *unless mentioned otherwise*	Disability (adjusted) ORs (95% CI) *unless mentioned otherwise*	Cumulative (adjusted) ORs (95% CI) *unless mentioned otherwise*	Quality
Pierce et al. (2020)[69] USA (CS)	Clinical (3,118) 50.3 yrs (59.5%)			PA + SA: 205 (11.48%)		Questionnaire (traumatic events)	FM (Questionnaire)	Standardized Coefficients FM Survey Score: 0.16***		Standardized Coefficients FM Survey Score: 0.16***	
Pierce et al. (2022)[115] USA (CS)	Clinical (1,542) 54.0 yrs (54.9%)	300/1242	3	Any (PA, SA, EA): 300 (19.5%)		Questionnaire (traumatic events)	FM, Chronic pain (Questionnaire)	Standardized Coefficients Any ACEs: FM survey score: 1.93 (1.12-2.74)*** Chronic pain: 0.30 (0.07–0.53)*	N/A	N/A	Fair
Piontek et al. (2021)[118] Germany (CS)	Clinical (234) 47.9 yrs (55.98%)	106/128	10 (5)	Any ACEs (SA, PA, EA EN, PN): 106 (45.3%)	PSD, PSA, IPV, PMI, PC	ACE Scale	Pelvic pain (Questionnaire)	Pearson's correlation coefficient Any ACEs: 0.198** Mediation analysis (direct): B=0.786**	N/A	N/A	Fair
Rahal et al. (2020)[101] USA (CC)	Clinical and community (862) IBS: 34.4 yrs/ HCs: 30.4 (IBS: 77% / HCs: 70%)	862/0	4 (3)	Any ACEs (PA, SA, EA): 862 (84%)	General trauma (e.g. PLD, FEI)	ETI	IBS (Questionnaire)	Any ACEs: 1.10 (1.06, 1.14)***	N/A	N/A	Good
Raphael et al. (2001)[106] USA (Prospective cohort – 20 yrs follow-up)	Court (1196) 28.7 yrs (48.7%)	676/520	3	Objective report AECs: 676 (56.5%) PA: 100 (8.4%) SA: 96 (8.0%) PN: 480 (40.1%) Self-reported ACEs: 743 (62.1%) PA: 610 (51.0%) SA: 291 (24.3%) PN: 384 (32.1%)	N/A	Documented court cases Self-reported childhood victimization.	Chronic pain (MSDs and non-MSDs) (Questionnaire)	Documented ACEs Any ACEs: 1.20 (0.92–1.57) PA: 1.23 (0.74–2.05) SA: 1.39 (0.85–2.26) PN: 1.20 (0.89–1.61) Self-reported ACEs Any ACEs: 1.98 (1.50, 2.62)*** PA: 2.07 (1.55–2.77)*** SA: 2.20 (1.54–3.15)*** PN: 2.38 (1.70–3.32)***	N/A	N/A	Good

Raphael et al. (2011)[107] USA (Prospective cohort – 30 yrs follow-up)	Court (807) 41.2 yrs (53%)	458/349	3	Objective report PA: 78 (9.7%) SA: 61 (7.6%) PN: 349 (43.2%)	N/A	Documented court cases	Chronic Pain (MSDs and non-MSDs) (Questionnaire)	Documented ACEs Mean (SE) Any ACEs (n = 458) / No ACE (n = 349): 2.24 (0.10) / 1.77 (0.11)** PN (n = 370) / No ACE (n = 349): 2.19 (0.11) 1.75 (0.10)**	Mean (SE) Any ACEs (n = 458) / No ACE (n = 349): 1.98 (.09) 1.66 (0.10)** PN (n = 370) / No ACE (n = 349): 1.92 (.10) 1.63 (0.10)*	N/A	Fair
Reuchlein et al. (2016)[70] Poland, Germany (CS)	Community (1,008) 41.8 yrs (53.2%)	1008/0	9 (3)	PA: N/A SA: 30 (3%) PN: N/A	PSD, Witness IPV, PMC, FFD, did not grow with birth parents	Adverse Childhood Experiences International Questionnaire	Chronic headache (Questionnaire)	PA: 1.14 SA: 0.97 N: 2.78***	N/A	N/A	Poor
Reidl et al. (2019)[71] Austria (CS)	Students (1,480) 42.1 yrs (55.2%)	562/924	5 (3)	PA: (6.1%) SA: (5.0%) EA: (18.6%) N: (12.9%)	Witness IPV, peer abuse	Maltreatment and Abuse Chronology of Exposure	Chronic pain, Chronic painful MSDs (Questionnaire)	N/A	N/A	Chronic pain 1–3 ACEs: 1.72 (1.33–2.21) 4+ ACEs: 3.73 (2.38–5.84) Painful MSDs 1–3 ACEs: 1.52 (1.11–2.09) 4+ ACEs: 2.50 (1.48–4.23)	Good
Sachs-Ericsson et al. (2007)[72] USA (CS)	Community (5,877) 33.2 yrs (ACEs: 73.7% / No ACEs: 50.2%)	623/1257	6 (2)	PA: 223 (3.8%) SA: 294 (5.0%) SA+PA: 105 (1.8%)	PLD, PSD, FFD, PMI	Interview	Chronic pain (arthritis or rheumatism, or other bone and joint diseases, chronic pain, stomach pain) (Questionnaire)	Any ACE: 1.40 (1.22–1.60)	N/A	N/A	Poor
Sachs-Ericsson et al. (2017)[73] USA (CS)	Community (5,001) 43.0 yrs (N/A)	2926/2075	5 (3)	PA: 240 (4.8%) SA: 200 (4%) EA: 2435 (48.7%)	PLD, PMI	Interview	Chronic pain (arthritis, chronic back or neck problems, frequent or severe headaches, any other chronic pain) (Questionnaire)	Poisson Regression (β, 95% CI) PA: 0.040 (0.985, 1.100) SA: 0.184 (1.114, 1.296)*** EA: 0.092 (1.062, 1.132)***	N/A	Mean (SD) 0 ACE: 0.66 (0.9) 1 ACE: 0.84 (0.99) 2 ACEs: 0.93 (1.1) 3 ACEs: 1.1 (1.1) 4 -7 ACEs: 1.3 (1.3) Poisson Regression (β, 95% CI) $\geq$1 ACEs: 0.071 (052, .090)***	Good
Santo et al. (2022) [114] Australia (CS)	Community (1,418) 57.4 yrs (65.6%)	653/765	5(4)	Any ACEs (PA, SA, EA, PN): 329 (23%) SA + EA: 324 (23%)	Witness IPV:	Interview	Chronic pain (spine pain (64%), arthritis (29%), visceral pain, HA, FM. CRPS) (Questionnaire)	Any ACEs: 1.18 (1.09–1.27)*** SA + EA: 1.04 (0.97–1.12);	Any ACEs: 1.35 (1.27–1.45)*** SA + EA: 1.10 (1.04–1.17)***	N/A	Fair

(*Continued*)

Table 1. Continued.

Source Country (Study design)	Population Setting (sample size) Mean age in years (female gender)	Allocated (ACEs / No ACEs)	Total number of ACEs exposure (direct)	Direct ACE n (%)	Indirect ACE	ACE assessment (Self-reported questionnaires unless indicate otherwise)	Outcomes (Clinical assessment; Questionnaire)	Pain (adjusted) ORs (95% CI) *unless mentioned otherwise*	Disability (adjusted) ORs (95% CI) *unless mentioned otherwise*	Cumulative (adjusted) ORs (95% CI) *unless mentioned otherwise*	Quality
Schrepf et al. (2018)[74] USA (CS)	Clinical (835) 43 yrs (55%)	N/A	6 (2)	SA: 85 (20%) PA: 65 (15%)	PLD, PSD, FEI, Other trauma	CTES	Widespread pain (Questionnaire)	N/A	N/A	Mean (SD), F-Value ≥1 ACEs: 1.69 (1.41), 32.81***	Fair
Schlauch et al. (2022)[116] USA (CS)	Community (16,581) N/A (N/A)	10,904/ 5,677	10 (5)	Any AECs (PA,SA, EA, EN, PN): 10,904 (65.8%)	PSA, PMI, PC, PMC, Witness IPV, PSD	Questionnaire	Chronic pain, Back pain, Migraine, Chronic pain syndrome (Questionnaire)	Any AECs Back pain: 1.09 (1.08–1.09) Migraine: 1.11 (1.10–1.11) Chronic pain syndrome: 1.22 (1.22–1.23)	N/A	4+ AECs (24.1%) Chronic pain: 1,65 (1,65–1,66) Back pain: 1.58 (1.58–1.59) Migraine: 1,79 (1,78–1,8) Chronic pain syndrome: 3,29 (3,26- 3,32)	Fair
Scott et al. (2011)[75] Multiple countries (Colombia, Mexico, United States, Belgium, France, Germany, Italy, Netherlands, Spain, Japan) (CS)	Community (16,555) 46.2 yrs (52.5%)	7152/9403	11 (3)	PA: N/A SA: N/A N: N/A	PLD, PSD, Other loss, PMI, FFD, PC, PSA, Witness IPV	Interview	Chronic spine pain, Frequent, severe headache (Questionnaire)	HR (95% CI) Spinal Pain Any ACE: 1.13 (1.02–1.25)* PA: 1.61 (1.43–1.82) SA: 1.62 (1.28–2.06)* N: 1.33 (1.15–1.34)* Frequent or Severe HA Any ACE: 1.40 (1.22–1.60)* PA: 1.64 (1.44–1.88)* SA: 1.73 (1.38–2.17)* N: 1.21 (1.02–1.43)*	N/A	HR (95% CI) Spinal pain 2 ACEs: 1.34 (1.17–1.54)* ≥ 3 ACEs: 1.59 (1.36–1.82)* Frequent or Severe HA 2 ACEs: 1.41 (1.19–1.67)* ≥ 3 AECs: 1.63 (1.37–1.95)*	Poor
Sheikh et al. (2018)[76] Norway (CS)	Community (10,325) 47.0 yrs (54%)	1015/9310	3 (2)	Either PA or EA: 658 (6.4%) Both PA + EA: 357 (3.5%)	FFD	Tromsø VI Questionnaire	Chronic migraine (Questionnaire)	RR (95% CI) Any ACE: 1.21 (1.10–1.33)	N/A	N/A	Fair
Sheikh et al. (2019)[77] Norway (CS)	Community (11,885) 57.5 yrs (53.4%)	1028/ 10857	1	EA: 1028 (8.6%)	N/A	Tromsø VI Questionnaire	Chronic migraine (Questionnaire)	RR (95% CI) Any ACE: 1.28 (1.04–1.53)	N/A	N/A	Fair

Shields et al. (2015)[78] Canada (CS)	Community (15,027) N/A (N/A)	704/7461	1	PA: 704 (4.7%)	N/A	National Population Health Survey	Chronic migraine (Questionnaire)	PA: 2.9 (2.0–4.1)*	PA: 3.6 (2.5–5.1)*	N/A	Fair
Sprang et al. (2017)[79] USA (CS)	General (16,096) N/A (100%)	4028/ 12065	2	PA: 916 (5.7%) SA: 284 (1.8%) PA + SA: 170 (1.1%)	N/A	The Kentucky Women's Health Registry Survey	Chronic painful MSDs (muscles or joints) (Questionnaire)	PRR (95% CI) Any ACE: 1.53 (1.45–1.60) PA: 1.38 (1.25–1.53) SA: 1.32 (1.11–1.57)	N/A	PPR (95% CI) PA + SA: 1.76 (1.48–2.11)	Fair
Springer et al. (2007)[80] USA (CS)	General (2,051) 55 yrs (52.3%)	234/1817	5 (1)	PA: 234 (11.4%)	PSA, PMC, PSD witness IPV	CTS	Chronic painful MSDs; Arthritis/ rheumatism (aching muscles, back pain/strain, stiff/ swollen joints, skin problems, and bone pain) (Questionnaire)	Chronic painful MSDs Any ACE: 1.29 (1.02–1.63)* Arthritis/ rheumatism Any ACE: 1.34 (1.05–1.72)*	N/A	N/A	Poor
Stickley et al. (2015)[81] Japan (CS)	Community (1,740) 51.2 yrs (N/A)	539/1201	10 (3)	PA: 127 (7.3%) SA: 12 (0.7%) N: 21 (1.2%)	PLD, PSD, PMI, PSA, PC, Witness IPV	World Mental Health Survey – Japan	Chronic pain (arthritis/ rheumatism, back/ neck problems, frequent/ severe headache) (Questionnaire)	HR (95% CI) Any chronic pain PA: 1.88 (1.24–2.86)** SA: 2.84 (1.01–8.01)* N: 1.56 (0.72–3.38) Chronic neck/ back pain PA: 2.55 (1.64–3.98)*** SA: 1.77 (0.58–5.45) N: 1.44 (0.58–3.57) Arthritis/ rheumatism PA: 0.73 (0.33–1.65) SA: N/A N: N/A Frequent/severe headache PA: 1.58 (0.71–3.49) SA: N/A N: N/A	N/A	HR (95% CI) 1–2 ACEs Chronic pain: 1.33 (1.02–1.73)* Neck/back pain: 1.41* (1.04–1.93)* Arthritis/ rheumatism: 1.21 (0.75–1.93) Frequent/ severe headache: 1.53 (0.91–2.57) ≥ 3 ACEs Chronic pain: 2.83 (1.77–4.53)** Neck/back pain: 2.86 (1.66–4.94)** Arthritis/ rheumatism: 1.19 (0.41–3.45) Frequent/ severe headache: 2.02 (0.63–6.45)	Poor
		N/A	6 (1)					EA: 1.12 (0.99–1.26)	N/A	N/A	Fair

(*Continued*)

Table 1. Continued.

Source Country (Study design)	Population Setting (sample size) Mean age in years (female gender)	Allocated (ACEs / No ACEs)	Total number of ACEs exposure (direct)	Direct ACE n (%)	Indirect ACE	ACE assessment (Self-reported questionnaires unless indicate otherwise)	Outcomes (Clinical assessment; Questionnaire)	Pain (adjusted) ORs (95% CI) *unless mentioned otherwise*	Disability (adjusted) ORs (95% CI) *unless mentioned otherwise*	Cumulative (adjusted) ORs (95% CI) *unless mentioned otherwise*	Quality
Sumanen et al. (2007)[103] Finland (CC)	Community (4,046) N/A (59%)			EA (male): 14.4% EA (female): 20.1%	PSD, FFD, PMC, FEI, PSA	The Health and Social Support Survey	Chronic migraine (Questionnaire)				
Swanson et al. (2013)[108] Canada (Prospective cohort – 8 yrs follow-up)	General (6,339) 40.8 yrs (47%)	4539/4194	5 (1)	PA: 4539 (71.6%)	PSD, hospitalized, PU, PSA	National Population Health Survey	Chronic migraine (Questionnaire)	HRs (95%CI): 1 ACE: 0.90 (0.60–1.33)	N/A	HR (95%) 2+ ACE: 1.09 (0.79–1.51)	Poor
Talley et al. (1994)[82] USA (CS)	Community (919) 39.6 yrs (13.3%)	165/754	3	PA: 14 (1.5%) SA: 38 (4.1%) SA (exposure): 80 (8.7%) SA (threat of sex): 40 (4.4%) SA (touched subject): 83 (9.0%) SA (subject touched other): 46 (5.0%) SA (rape or incest): 39 (4.3%) EA: 55 (6.0%)	N/A	Drossman Abuse Questionnaire	IBS; dyspepsia (frequent pain or discomfort in the upper abdomen); heartburn (burning retrosternal pain) (Questionnaire)	Any ACE (IBS): 2.0 (1.1–3.6)*	N/A	N/A	Good
Talley et al. (1998)[83] Australia (CS)	Community (730) 45.2 yrs (53.4%)	N/A	4 (3)	PA: 130 (17.9%) SA: 146 (20.1%) EA: 182 (25.0%)	Bullied	Drossman Abuse Questionnaire	IBS (Questionnaire)	Any ACEs: 1.34 (0.83–2.17) SA: 0.90 (0.51–1.58) EA: 2.90 (1.56–5.40)**	N/A	N/A	Fair
Tietjen et al. (2009)[111] USA, Canada (CS)	Clinical (1,348) 41 yrs (88%)	781/567	5	PA: 283 (21%) SA: 337 (25%) EA: 512 (38%) PN: 297 (22%) EN: 512 (38%)	N/A	CTQ	Chronic migraine (Clinical assessment)	PA: 1.79 (1.17–2.77)*** SA: 1.44 (0.90–2.29)* EA: 2.01 (1.36–2.97)*** EN 1.54 (1.03–2.31)* PN: 1.69 (1.08–2.66)*	PA: 1.45 (0.94–2.23) SA: 1.47 (0.92–2.35) EA: 1.54 (1.04–2.29)* EN: 1.29 (0.86–1.95) PN: 1.33 (0.82–2.16)	N/A	Fair
Tietjen et al. (2010)[85] USA, Canada (CS)	Clinical (1,348) 41 yrs (88%)	781/567	5	PA: 283 (21%) SA: 337 (25%) EA: 512 (38%) PN: 297 (22%) EN: 512 (38%)	N/A	CTQ	Chronic pain, IBS, FM, arthritis (Clinical assessment)	OR (SE) Chronic pain EA: 1.69 (0.17)* PN: 1.73 (0.18)* Arthritis	N/A	N/A	Fair

								PA: 1.54 (0.43)* SA: 1.38 (0.32)* EA: 1.61 (0.48)* EN 1.5 (0.41)* PN: 1.5 (0.15)* IBS PA: 1.51 (0.41)* SA: 1.42 (0.35)** EA: 3.33 (0.13)* EN 1.16 (0.12)* PN: 1.38 (0.33)* FM, widespread pain PA: 1.52 (0.21)* SA: 2.09 (0.19)** EA: 2.17 (0.18)* EN 1.54 (0.18)* PN: 1.81 (0.19)*			
Tietjen et al. (2015)[102] USA (CC)	Community (9,737) Migraine: 48.7 yrs/ Controls: 51.4 yrs (Migraine: 80.4%/ Controls: 72.5%)	N/A	3	Any ACE (Migraine/ Control): 2,984 (40.2%)/ 432 (34.2%) SA (Migraine/ Control): 1,147 (17.7%)/ 154 (13.3%) EA (Migraine/ Control): 1,800 (22.5%)/ 229 (16.7%) EN (Migraine/ Control): 1,946 (24.5%)/ 291 (21.5%)	N/A	CTQ	Chronic migraine (Questionnaire)	Any ACEs: 1.19 (1.04–1.36)* SA: 1.18 (0.97–1.44) EA: 1.33 (1.13–1.57)* EN: 1.16 (1.00–1.34)	N/A	2 ACEs: 1.37 (1.12–1.68)	Fair
Tietjen et al. (2017)[86] USA (CS)	Community (14,365) 29.5 yrs (53.%)	7261/7095	3	Any ACEs: 7261 (50.6%) PA: 2656 (18.5%) SA: 734 (5.1%) EA: 6774 (47.2%)	N/A	CTQ	FM (Questionnaire)	Any ACEs: 1.59 (1.39–1.83)* 1 ACE: 1.51 (1.31–1.74)* PA: 1.06 (0.89–1.27) SA: 1.25 (0.93–1.68) EA: 1.57 (1.38–1.79)*	N/A	2 AECs: 1.73 (1.42–2.10)* 3 AECs: 1.98 (1.31–3.01)*	Fair
Varinen et al. (2017),[87] (2019)[88] Finland (CS)	Community (11,924) N/A (FM: 80%/ HCs: 61.9%)	N/A	6 (1)	EA (FM/HC): 98 (22.4%) / 1314 (12.9%)	PSD, FFD, PSA, PMC, FEI	The Health and Social Support Survey	FM (Questionnaire)	EA: 1.60 (1.28–2.01)	N/A	1–2 ACEs: 1.54 (1.25–1.91) 3–6 ACEs: 2.15 (1.69–2.73)	Fair
Viana et al. (2018)[89] Italy (CS)	Clinical (318) 42.1 yrs (80.8%)	N/A	5	Any abuse (PA, SA, EA, PN, EN)	N/A	CTQ	Chronic pain (Migraine, SCID, Chronic painful MSDs) (Clinical assessment)	Any ACEs: 1.48 (1.09–2.02)***	N/A	N/A	Fair

(*Continued*)

Table 1. Continued.

Source Country (Study design)	Population Setting (sample size) Mean age in years (female gender)	Allocated (ACEs / No ACEs)	Total number of ACEs exposure (direct)	Direct ACE n (%)	Indirect ACE	ACE assessment (Self-reported questionnaires unless indicate otherwise)	Outcomes (Clinical assessment; Questionnaire)	Pain (adjusted) ORs (95% CI) *unless mentioned otherwise*	Disability (adjusted) ORs (95% CI) *unless mentioned otherwise*	Cumulative (adjusted) ORs (95% CI) *unless mentioned otherwise*	Quality
Walker et al. (1999)[90] USA (CS)	HMO (1,225) 42 yrs (100%)	527/698	5	PA: 172 (32.6%) SA: 221 (41.9%) EA: 294 (55.8%) EN: 257 (48.8%) PN: 147 (27.9%)	N/A	CTQ	Back pain, joint pain, abdominal pain, headache, chest pain, pelvic pain (Clinical assessment)	Any ACE (back pain): 1.0 (0.8–1.2) Any ACE (joint pain): 1.0 (0.8–1.2) Any ACE (abdominal pain): 1.0 (0.7–1.2) Any ACE (headache): 1.2 (1.0–1.4) Any ACE (chest pain): 1.0 (0.6–1.4) Any ACE (TMJ pain): 1.0 (0.8–1.3) Any ACE (Dyspareunia): 1.0 (0.7–1.3) SA (back pain): 1.3 (1.1–1.5)* SA (joint pain): 1.3 (1.1–1.5) SA (abdominal pain): 1.3 (1.1–1.5) SA (headache): 1.3 (1.1–1.6) SA (chest pain): 1.5 (1.1–1.9) SA (TMJ pain): 1.6 (1.4–1.9) SA (Dyspareunia): 1.8 (1.5–2.0)	Any ACE: 1.5 (1.3–1.7)	N/A	Good
Waehrer et al. (2020)[91] USA (CS)	General (110,076) N/A (51.6%)	63866/ 46210	8(3)	Any ACEs (SA, PA, EA): 26,648 (40%)	PSD, PC, PSA, PMI, Witness IPV	Family Health History and Health Appraisal Questionnaire (CDC- Kaiser ACE)	Arthritis (Questionnaire)	1 ACE: 1.25 (1.17, 1.34)**	N/A	2–3 ACEs: 1.43 (1.33–1.53)** ≥4 ACEs: 1.80 (1.64–1.97)**	Fair
Wuest et al. (2008[92], 2009[93], 2010[94]) Canada (CS)	Community (292) 39.4 yrs (100%)	193/292	3	Any ACEs (SA, EA, EN): 193 (61%)	N/A	Childhood Adversity Questionnaire	Chronic pain (back pain, aches and pains, headaches, pelvic/ vaginal pain, upset stomach/ heartburn) (Questionnaire)	Standardized coefficients Any ACE: 0.14*	N/A	N/A	Fair

Xu et al. (2013)[95] China (CS)	Community (720) 43.1 yrs (59.6%)	336/384	2	EN + EA: 336 (20.5%)	N/A	Childhood Adversity Questionnaire	IBS (Questionnaire)	Any ACE: 2.02 (1.27–3.22)**	N/A	N/A	Fair
You et al. (2019)[96] USA (CS)	Students (3,073) 18.8 yrs (72%)	2823/250	8 (3)	Any ACEs: 2674 (78%) PA: 2243 (73%) SA: 615 (20%) EA: 1352 (44%)	Natural disaster, hospitalized, FEI, PSA	ETI	Headache or migraine, chronic pain, back pain (Questionnaire)	Any chronic Pain PA: 1.08 (0.85–1.36) EA: 1.11 (0.91–1.35) SA: 1.15 (0.92–1.44) Chronic back Pain PA: 1.14 (0.82–1.60) SA: 1.24 (0.93–1.66) EA:1.42 (1.08–1.87)* Chronic HA PA: 0.94 (0.69–1.29) SA: 0.91 (0.67–1.25) EA: 1.03 (0.76–1.32)	N/A	Chronic Pain Any ACEs (PA + EA + SA): 1.18 (1.01–1.38)* Chronic Back Pain Any ACEs (PA + EA + SA): 1.23 (1.01–1.51)* Chronic Headache Any ACEs (PA + EA + SA): 1.25 (1.02–1.54)*	Good

Note. CS = Cross-sectional; CC = Case-control; N/A = Not applicable; HMO = Health Managed Organization; ACE = Adverse Child Experience; PA = Physical abuse; SA = Sexual abuse, EA = Emotional abuse; PN = Physical Neglect; N = Neglect; EN = Emotional Neglect; IPV = Intimate partner violence; FM = Fibromyalgia; IBS = Irritable Bowel Syndrome; LB*P* = Low back pain; MSDs = Musculoskeletal disorders; EM = Episodic migraine; MOH = Medication Overuse Headache; HC = Healthy Controls; PU = Parental Unemployment; PSA = Parental Substance Abuse (Alcohol/Drugs); PMI = Parental Mental Illness; PC = Parental Criminality; PSD = Parental Separation or Divorce; PMC = Parental Marital Conflict; PLD = Parental Loss or Death; FFD = Family Financial Difficulties; FEI = Family Extreme Illness; CTS = Conflict Tactics Scale; CTQ = Childhood Trauma Questionnaire; CCHS = Canadian Community Health Survey; EMR = Electronic Medical Records; ETI = Early Trauma Inventory; CEVQ = Childhood Experiences of Violence Questionnaire; CTES = Childhood Traumatic Events Scale; CDC = Centers for Disease Control and Prevention; PTSD = Posttraumatic stress syndrome; FM = Fibromyalgia; IBS = Irritable Bowel Syndrome; LB*P* = Low back pain; MSD = Musculoskeletal disorder; N/A = Not applicable; OR = Odds ratio; RR = Relative risk; HA = Headache; HR = Hazard ratio; IRR = Incidence rate ratio; MD = Mean difference; MF*P* = Myofascial pain; SCID = Severe combined immunodeficiency; Social Health Determinant Questionnaire = SHDQ; SMD = Standard mean difference; 95% CI = 95% Confidence interval; SD = Standard deviation; IQR = Interquartile range; β = Beta coefficient; SE = Standard error; *P* = *p*-value; * $p < .05$; ** $p > .01$; *** $p > .001$.

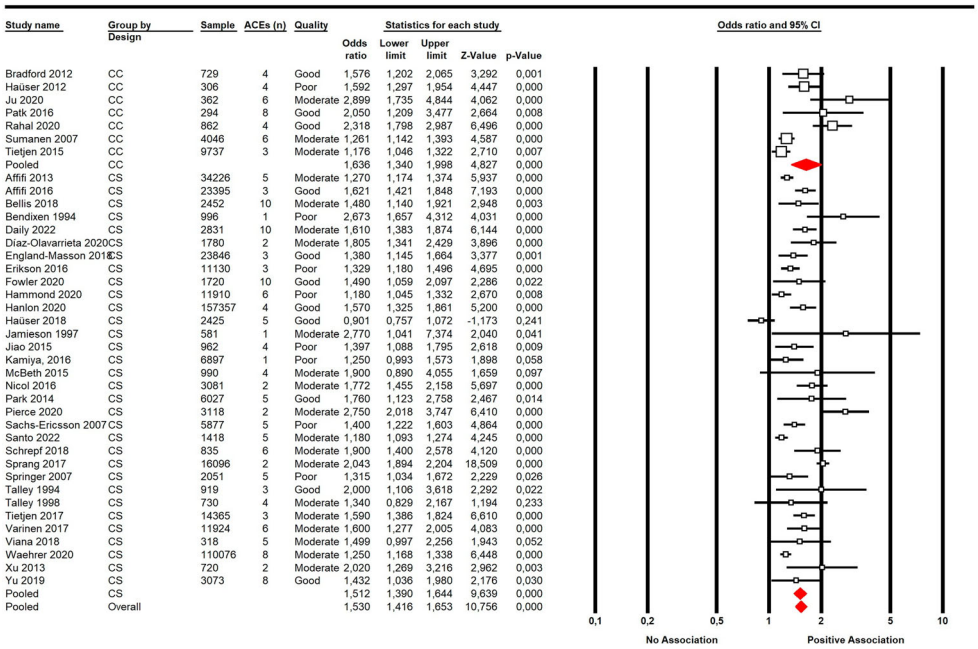

Figure 2. Pooled adjusted odd ratios for the effect of any adverse childhood exposure on chronic painful conditions – Case-control studies and cross-sectional studies.

2018; Brennenstuhl & Fuller-Thomson, 2015; Brown et al., 2018; Chartier et al., 2010; England-Mason et al., 2018; Fowler et al., 2020; Hammond & Colman, 2020; Hanlon et al., 2020; Ju et al., 2020; Kopec & Sayre, 2005; Lee et al., 2009; Li et al., 2022; Lin et al., 2021; Noteboom et al., 2021; Park et al., 2014a; 2016; Riedl et al., 2019; Sachs-Ericsson et al., 2017; Schlauch et al., 2022; Schrepf et al., 2018; Scott et al., 2011; Sprang et al., 2020; Stickley et al., 2015; Swanson et al., 2013; Tietjen et al., 2015; 2017; Varinen et al., 2017; Waehrer et al., 2020; You et al., 2019). Health outcomes comprised undifferentiated chronic pain ($n = 25$ studies) (Alhalal et al., 2018; Anno et al., 2015; Baiden et al., 2021; Barron, 1997; Bendixen et al., 1994; Chartier et al., 2007, 2010; Coles et al., 2015; Daily et al., 2022; Fowler et al., 2020; Häuser et al., 2018; Kascakova et al., 2020; Nicol et al., 2016; Park et al., 2014a; Raphael et al., 2001; Raphael & Widom, 2011; Riedl et al., 2019; Sachs-Ericsson et al., 2007; 2017; Santo et al., 2022; Stickley et al., 2015; Wuest et al., 2008; 2009; 2010; You et al., 2019), chronic painful MSDs ($n = 12$) (Afifi et al., 2013; Badley et al., 2019; Fuller-Thomson et al., 2009; Hart-Johnson & Green, 2012; Kamiya et al., 2016; Kopec & Sayre, 2005; Li et al., 2022; Lin et al., 2021; Pebole et al., 2022; Riedl et al., 2019; Springer et al., 2007; Viana et al., 2018; Waehrer et al., 2020), painful non-MSDs such as widespread pain or fibromyalgia; headache or migraine, visceral pain including irritable bowel syndrome, posterior pelvic pain ($n = 36$) (Anda et al., 2010; As-Sanie et al., 2014; Bacon & White, 2022; Bellis et al., 2018; Bottiroli et al., 2018; Bradford et al., 2012; Brennenstuhl & Fuller-Thomson, 2015; Díaz-Olavarrieta et al., 2002; Fuller-Thomson et al., 2011; Hammond & Colman, 2020; Hanlon et al., 2020; Häuser et al., 2012; Jamieson & Steege, 1997; Jiao et al., 2015; Ju et al., 2020; Lee et al., 2009; Mays et al., 2021; McBeth et al., 2015; Park et al., 2016; Pierce et al., 2020; Piontek et al., 2021; Rahal et al., 2020; Reuchlein et al., 2016; Schrepf et al., 2018; Sheikh, 2018, 2019; Shields et al., 2015; Swanson et al., 2013; Talley et al., 1994; 1998; Tietjen et al., 2009; 2015; 2017; Varinen et al., 2017; 2019; Xu et al., 2013) or both painful MSDs and non-MSDs ($n = 15$) (Afifi et al., 2016; Bendixen et al., 1994; Brown et al., 2018; Chandan et al., 2020; Dennis et al., 2019; England-Mason et al., 2018; Eriksen et al., 2016; Noteboom et al., 2021; Pierce et al., 2022; Schlauch et al., 2022; Scott et al., 2011; Stickley et al., 2015; Tietjen et al., 2010; Walker et al., 1999; You et al., 2019) Pain-related disability was reported in 16 studies (Badley et al., 2019; Chartier et al., 2007, 2010; Fowler et al., 2020; Hart-Johnson & Green, 2012; Häuser et al., 2018; Jiao et al., 2015; Nicol et al., 2016; Park et al., 2014a; Pebole et al., 2022; Piontek et al., 2021; Raphael & Widom, 2011; Santo et al., 2022; Shields et al., 2015; Tietjen et al., 2009; Walker et al., 1999) (Table 1).

3.1. Study quality

Study quality was generally good (25%; $n = 22$) (Afifi et al., 2016; Bottiroli et al., 2018; Bradford et al., 2012; Brown et al., 2018; Chartier et al., 2010; Dennis et al., 2019; England-Mason et al., 2018; Fowler et al., 2020; Hanlon et al., 2020; Hart-Johnson & Green, 2012; Häuser et al., 2018; Kopec & Sayre, 2005; Park et al., 2014a; 2016; Pebole et al., 2022; Rahal et al., 2020; Raphael

Table 2. Pooled aORs from random-effects meta-analyses on the association of chronic painful conditions and disability with direct types of adverse childhood experiences and with any of adverse childhood experiences – Cross-sectional studies.

	Chronic painful conditions			Pain-related disability					Chronic painful conditions		
Direct ACE	Number of studies	aOR (95% CI)	I^2; Tau^2; 95% PI	Number of studies	OR (95% CI)	I^2; Tau^2; 95% PI	Any ACEs	Number of studies	Painful disorders	aOR (95% CI)	I^2; Tau^2; 95% PI
Physical Abuse	27	1.50 (1.39–1.64)***		8	1.46 (1.03–2.08)*		Any ACEs	8	Chronic pain (undifferentiated)	1.65 (1.46–1.87)***	
Sexual Abuse	27	1.37 (1.25–1.49)***		8	0.96 (0.67–1.37)		Any ACEs	6	Arthritis	1.32 (1.17–1.48)***	
Emotional Abuse	12	1.56 (1.36–1.78)***		2	1.49 (0.68–3.24)		Any ACEs	7	Spine pain	1.32 (1.18–1.47)***	
Neglect	7	1.38 (1.15–1.66)***		NA			Any ACEs	2	Musculoskeletal pain	1.39 (1.04–1.86)*	
Physical Neglect	4	1.44 (1.08–1.90)**		2	0.74 (0.34–1.61)		Any ACEs	6	Fibromyalgia	1.74 (1.49–2.03)***	
Emotional Neglect	3	1.41 (1.06–1.89)*		2	1.03 (0.47–2.25)		Any ACEs	2	Chronic Headache	1.75 (1.32–2.32)***	
Overall	80	1.45 (1.38–1.53)***	71,8%; 0.031; 1.02–2.07	22	1.13 (0.81–1.57)	81.9%; 0.208; 0.41–3.11	Any ACEs	4	Migraine	1.48 (1.28–1.72)***	
							Any ACEs	4	Irritable bowel syndrome	1.81 (1.33–2.47)***	
							Any ACEs	3	Posterior Pelvic Pain	1.85 (1.53–2.24)***	
							Overall	43		1.54 (1.44–1.65)***	85.1%; 0.040; 1.06–2.30
							Any ACEs	5	**Pain-related disability** Chronic pain (undifferentiated)	1.29 (1.01–1.66)*	96.3% 0.060; 0.53–3.12

Note. aOR = Adjusted Odds ratio; 95% CI = 95% Confidence Intervals; I^2=Heterogeneity; PI=Prediction Interval.
* $P < .05$; ** $P < .01$; *** $P < .001$.
ACE = Adverse child experiences; Any ACE = Any direct ACEs (physical, sexual or emotional abuse, physical or emotional neglect), with or without indirect AECs; Neglect (physical and/or emotional neglect).
Chronic Painful Conditions = Chronic pain (undifferentiated), arthritis, back or neck pain, musculoskeletal pain, fibromyalgia, chronic headache, migraine, irritable bowel syndrome, posterior pelvic pain.

et al., 2001; Riedl et al., 2019; Sachs-Ericsson et al., 2017; Talley et al., 1994; Walker et al., 1999; You et al., 2019) or fair (55%; $n = 48$) (Afifi et al., 2013; Alhalal et al., 2018; Anda et al., 2010; Anno et al., 2015; As-Sanie et al., 2014; Bacon & White, 2022; Badley et al., 2019; Baiden et al., 2021; Bellis et al., 2018; Brennenstuhl & Fuller-Thomson, 2015; Chartier et al., 2007; Coles et al., 2015; Daily et al., 2022; Díaz-Olavarrieta et al., 2002; Jamieson & Steege, 1997; Ju et al., 2020; Kascakova et al., 2020; Lee et al., 2009; Li et al., 2022; Lin et al., 2021; Mays et al., 2021; McBeth et al., 2015; Nicol et al., 2016; Noteboom et al., 2021; Pierce et al., 2020; Piontek et al., 2021; Raphael & Widom, 2011; Santo et al., 2022; Schrepf et al., 2018; Sheikh, 2018, 2019; Shields et al., 2015; Sprang et al., 2020; Sumanen et al., 2007; Talley et al., 1994; Tietjen et al., 2009; 2010; 2015; 2017; Varinen et al., 2017; 2019; Viana et al., 2018; Waehrer et al., 2020; Wuest et al., 2008; 2009; 2010; Xu et al., 2013), with around 20% ($n = 17$) rated as poor quality (Barron, 1997; Bendixen et al., 1994; Chandan et al., 2020; Eriksen et al., 2016; Fuller-Thomson et al., 2009; 2011; Hammond & Colman, 2020; Häuser et al., 2012; Jiao et al., 2015; Kamiya et al., 2016; Pierce et al., 2022; Reuchlein et al., 2016; Sachs-Ericsson et al., 2007; Scott et al., 2011; Springer et al., 2007; Stickley et al., 2015; Swanson et al., 2013) (eTables 1–3 in the Supplement).

3.2. Meta-analysis

Compared to those who reported no ACE, the odds of reporting chronic pain conditions later in life was significantly higher among individuals exposed to a direct ACE (aOR, 1.45; 95%CI, 1.38–1.53; Tau square (T^2) = 0.031; prediction interval (95%PI) = 1.02–2.07; I^2 = 71.8%), including childhood neglect (aOR, 1.38; 95%CI 1.15–1.66; 7 studies), sexual abuse (aOR, 1.37; 95%CI, 1.25–1.49; 27 studies), and emotional abuse (aOR, 1.56; 95%CI, 1.36–1.78; 12 studies). Individuals reporting childhood physical abuse were significantly more likely to report chronic pain (aOR, 1.50; 95%CI, 1.39–1.64; 27 studies) and pain-related disability (aOR, 1.46; 95%CI, 1.03–2.08; 8 studies) during adulthood (Table 2, Supplementary figures 1–4). Results remained unchanged after removing lower quality studies. There was no significant difference in the odds of pain-related disability among individuals reporting sexual or emotional abuse or neglect, compared to individuals without AECs.

Pooled estimates from seven case–control studies (Bradford et al., 2012; Häuser et al., 2012; Ju et al., 2020; Park et al., 2016; Rahal et al., 2020; Sumanen et al., 2007; Tietjen et al., 2015) and 32 cross-sectional studies (Afifi et al., 2013; 2016; Bellis et al., 2018; Bendixen et al., 1994; Daily et al., 2022; Díaz-Olavarrieta et al., 2002; England-Mason et al., 2018; Eriksen et al., 2016; Fowler et al., 2020; Hammond & Colman, 2020; Hanlon et al., 2020; Häuser et al., 2018; Jamieson & Steege, 1997; Jiao et al., 2015; Kamiya et al., 2016; McBeth et al., 2015; Nicol et al., 2016; Park et al., 2014a; Pierce et al., 2020; Sachs-Ericsson et al., 2007; Santo et al., 2022; Sheikh, 2018; Sprang et al., 2020; Springer et al., 2007; Talley et al., 1994; 1998; Tietjen et al., 2017; Varinen et al., 2017; Viana et al., 2018; Waehrer et al., 2020; Xu et al., 2013; You et al., 2019) of individuals exposed to any ACEs with or without indirect ACEs were significantly more likely to report chronic painful conditions during adulthood (aOR, 1.53; 95%CI, 1.42–1.65), including undifferentiated chronic pain, any painful MSDs, arthritis, back or

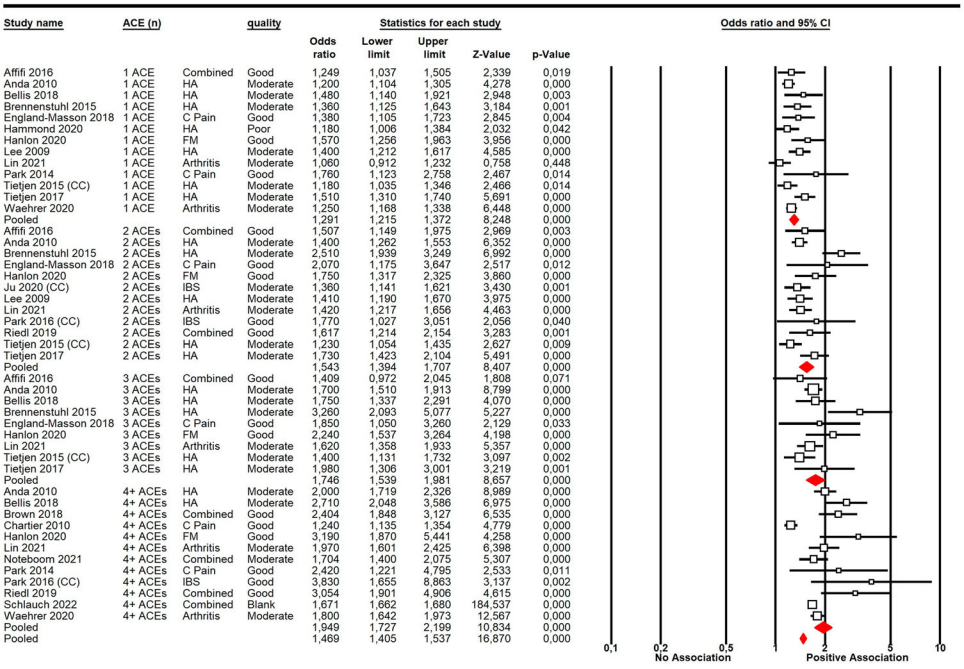

Figure 3. Pooled adjusted odd ratios for the effect of cumulative adverse childhood exposure on chronic painful conditions.

Table 3. Pooled aORs from random-effects meta-analyses for cumulative adverse childhood experiences (ACEs) and chronic pain outcomes.

Cumulative ACEs	Any chronic painful conditions			Chronic musculoskeletal disorders			Chronic non-musculoskeletal disorders		
	Studies (*n*)	OR (95 CI)	I^2; Tau^2; PI	Studies (*n*)	OR (95% CI)	I^2; Tau^2; PI	Studies (*n*)	OR (95% CI)	I^2; Tau^2; PI
1 ACE	13	1.29 (1.22–1.37)***		3	1.19 (1.09–1.23)***		9	1.33 (1.21–1.47)***	
2 ACEs	12	1.54 (1.39-1.71)***		3	1.42 (1.24–1.62)***		9	1.57 (1.40–1.75)***	
3 ACEs	9	1.75 (1.54–1.98)***		2	1.50 (1.26–1.79)**		7	1.84 (1.59–2.12)***	
4+ ACEs	12	1.95 (1.73–2.19)***		6	1.81 (1.63–2.00)***		7	2.01 (1.75–2.29)***	
Overall	46	1.47 (1.41–1.54)***	94.6%; 0.029; 1.04–2.07	14	1.45 (1.16–1.82)***	88.5%; 0.019; 0.98–2.15	32	1.66 (1.37–2.02)***	89,2%; 0.037 1.07–2.57

Note. aOR = Adjusted Odds ratio; 95% CI = 95% Confidence Intervals; I^2=Heterogeneity; PI = Prediction Interval.
*P < .05; **P < .01; ***P < .001.
ACE = Adverse Child Experience; MSDs = Musculoskeletal disorders; Any chronic painful conditions includes Chronic pain (undifferentiated) + Chronic musculoskeletal disorders (arthritis, back or neck pain, and general musculoskeletal pain) + Chronic non-musculoskeletal disorders (fibromyalgia; chronic headache, migraine; irritable bowel syndrome; posterior pelvic pain).

neck pain, fibromyalgia, headache and migraine, irritable bowel syndrome, and posterior pelvic pain (Figure 2). Exposure to any ACEs increased the odds of pain-related disability (Dennis et al., 2019; Fowler et al., 2020; Nicol et al., 2016; Park et al., 2014b; Santo et al., 2022) (aOR, 1.29; 95%CI, 1.01–1.66) (Table 2, Supplementary figure 5).

Pooled aORs for the association between any ACEs and nine specific types of chronic primary pain conditions ranged from aOR, 1.29 (95%CI, 1.22–1.37) for spine pain and arthritis to aOR, 1.95 (95%CI, 1.73–2.19) for chronic pelvic pain syndrome (Table 2). Effect size slightly increased after removing lower quality studies (aOR, 1.6; 95%CI 1.44–1.76; Q=8.95, *df*=2; *p*=.01).

The risk of any chronic pain in adulthood significantly increased from one AEC (Afifi et al., 2016; Anda et al., 2010; Bellis et al., 2018; Brennenstuhl & Fuller-Thomson, 2015; England-Mason et al., 2018; Hammond & Colman, 2020; Hanlon et al., 2020; Lee et al., 2009; Lin et al., 2021; Park et al., 2016; Tietjen et al., 2015; 2017; Waehrer et al., 2020) (aOR, 1.29; 95% CI, 1.22–1.37) to four or more ACEs (Anda et al., 2010; Bellis et al., 2018; Brown et al., 2018; Chartier et al., 2010; Hanlon et al., 2020; Lin et al., 2021; Noteboom et al., 2021; Park et al., 2014a, 2016; Riedl et al., 2019; Schlauch et al., 2022; Waehrer et al., 2020) (aOR, 1.95; 95%CI, 1.73–2.10) regardless of the pain condition (Figure 3), and for specific MSDs and non-MSDs (Table 3). Lastly, pooled ORs from three studies (Chartier et al., 2010; Fowler et al., 2020; Gilliam et al., 2020) reporting on cumulative ACEs (n = 2–6 exposures) in relation to disability suggested an increased risk but it was not statistically significant (aOR, 1.77; 95%CI, 0.82–3.82).

3.3. Heterogeneity and publication bias

There was considerable heterogeneity between estimates for all outcomes. In sensitivity analysis, excluding fifteen outlying studies (As-Sanie et al., 2014; Badley et al., 2019; Bendixen et al., 1994; Bradford et al., 2012; Hammond & Colman, 2020; Hanlon et al., 2020; Häuser et al., 2018; Ju et al., 2020; Mays et al., 2021; McBeth et al., 2015; Schrepf et al., 2018; Sprang et al., 2020; Stickley et al., 2015; Talley et al., 1994; Tietjen et al., 2010), exposure to physical or emotional neglect were no longer significant for chronic pain. Excluding eight studies (Bendixen et al., 1994; Häuser et al., 2018; Jamieson & Steege, 1997; Ju et al., 2020; Pierce et al., 2020; Rahal et al., 2020; Schrepf et al., 2018; Sprang et al., 2020) slightly reduced pooled ORs for chronic painful conditions. In contrast, excluding six outlying studies (As-Sanie et al., 2014; Dennis et al., 2019; Fowler et al., 2020; Häuser et al., 2018; Mays et al., 2021; Walker et al., 1999) significantly increased the odds of pain-related disability for sexual abuse (eTables 4 in the Supplement). We identified no outliers for other outcomes. Sub-group analysis by study design suggested cross-sectional studies produced similar estimates to case control studies. In meta-regression, studies measuring fewer ACEs generally reported significantly higher odds of poor health outcomes (β = –0·04; se[β] = 0·01) compared to those measuring over 5 ACEs and low quality studies reported significantly lower odds compared to high quality studies (β = –0·21; se[β] = 0·09). Number of ACEs and study quality explained approximately 52% of the variance (R^2 = 0.52) (eModel 1 in the supplement). We noted no significant association between pooled estimates for the outcome of chronic pain (eModel 2 in the Supplement) or pain-related disability (eModel 3 in the supplement) and any measured covariate including country, setting or year of publication. Univariate analysis revealed no association between pooled estimates for the outcome of chronic pain for cumulative exposure and any measured covariate (country, setting, year of publication, sample, number of ACEs, study quality) (eModel 4 in the supplement).

Visual inspection of the funnel plots revealed some asymmetry suggesting publication bias for any ACEs and cumulative ACEs for chronic painful conditions. Begg and Mazumdar rank correlation

test and Egger's regression intercept were also significant. However, no publication bias was found for direct types of ACEs on chronic painful conditions (Supplementary figures 6–8).

4. Discussion

We consistently found that ACE exposures are associated with chronic pain conditions in adulthood across types of ACEs, types of painful conditions, geographical location, and over time. Pooled aORs ranged from 1.31 for single exposure to 1.98 for multiple exposures. We also found a statistically significant dose–response relationship. Pooling ORs revealed significant associations between individuals reporting a single type of abuse or neglect and adult chronic pain. Because these painful disorders are very common, a modest increase in risk implies a large number of additional cases and thus an important impact on population health.

Over 1 billion children – half of all children in the world – are exposed to physical, sexual, or emotional violence or neglect each year (Hillis et al., 2016). The endemic magnitude of ACEs, their health consequences (Hughes et al., 2017), and their combined attributable costs (estimates between 2–6% of gross domestic product in European countries) (Hughes et al., 2021), compel urgent action. For optimum impact, policies and programmes designed to prevent and detect ACEs, and treat related consequences should be multisector, spanning health, social services, education, and justice sectors (Control, 2019; WHO, 2014).

Our findings suggest ACE exposure is associated with the most common and costly chronic pain conditions, including back and neck pain and other MSDs, which account for the highest total health care spending compared to other health conditions (Dieleman et al., 2020). People with ACEs tend to have a higher chronic disease burden, barriers to treatment engagement, and greater health care utilization in adulthood (Hargreaves et al., 2019). Adult patients exposed to ACEs may not be achieving optimal health outcomes due to the physiological and psychological effects of toxic stress (Tidmarsh et al., 2022; Werthman et al., 2022). While the relative contributions of these mechanisms are not yet well understood, emerging evidence links ACEs to changes in genetic expressions that affect structural and functional changes in the brain and clinical phenomena in adulthood (Lobo et al., 2022). ACEs may be associated with heightened pain sensitivity later in life (Pierce et al., 2023). Childhood neglect also predicts a flattened cortisol profile in adults, which, in turn, predicts elevated daily pain and emotional symptoms (Yeung et al., 2015). Further, a wide range of psychological, social, and contextual factors need to be considered in the development, maintenance, and treatment of chronic pain conditions (Mao, 2017). Our findings support the need to broaden healthcare provider understanding of the associations between ACEs and chronic pain, and adequately prepare them to provide trauma-informed care (TIC) pain management (Ranjbar & Erb, 2019; Tidmarsh et al., 2022). In the clinical setting, TIC encompasses the prevention, identification, and assessment of trauma, response to trauma, and recovery from trauma as a focus of all services (Forkey et al., 2021). TIC emphasizes physical, psychological, and emotional safety and creates opportunities for patients to rebuild a sense of control and empowerment (Ranjbar & Erb, 2019). Specific recommendations have been offered for TIC practices in rehabilitation settings (Baca & Salsbury, 2023; Ranjbar & Erb, 2019). Results from a recent observational study suggest that adults with and without ACEs endorsed significant improvements in pain and functioning following participation in an intensive interdisciplinary pain rehabilitation programme 2 to 3 times per week for 2 to 4 h each day over a period of 10 weeks (Craner & Lake, 2021). Treatment included individual pain psychology, physical and occupational therapy, and medical visits with opioid tapering with a focus on functional restoration focus, rather than seeking to relieve pain, to help patients increase engagement in physical reconditioning and valued life activities. Current efforts to improve the management of chronic pain conditions might be more successful if we broaden professional understanding of the links between ACEs and chronic pain. Adding early childhood adversities as a risk factor for chronic pain and disability to pain management competency profile to guide entry-level education (Augeard et al., 2022) may increase educators and future clinicians awareness and promote reflexivity.

We aimed to overcome limitations of prior reviews (Davis et al., 2005; Häuser et al., 2011; Irish et al., 2010; Norman et al., 2012; Petruccelli et al., 2019; Wegman & Stetler, 2009) by having two expert librarians create and independently review search strategies performed in 10 databases, only including studies with samples of over 100 subjects per arm, using strict definitions for ACE exposure and chronic pain and disability, and including only studies using validated instruments to measure both exposure and outcomes. Pooling ORs revealed significant associations, not previously summarized elsewhere, between individuals reporting a single type of abuse (physical, sexual, emotional) or neglect (emotional, physical) and adult chronic pain. While our findings align with prior meta-analyses examining the effect of ACEs on chronic pain (Davis et al., 2005; Irish et al., 2010), arthritis (Norman et al., 2012), migraine and/or chronic headache (Norman et al., 2012), and fibromyalgia (Häuser et al.,

2011), we also found significant associations between any ACE and spine pain, musculoskeletal pain, chronic headache, migraine, irritable bowel syndrome, and posterior pelvic pain. Few meta-analyses have explored the cumulative effect of ACEs on chronic pain. A recent meta-analysis (Petruccelli et al., 2019) reported that the odds of combined somatic pain and headache during adulthood gradually increased with multiple ACEs. Our review supports a substantial gradual increased risk from 1 ACE to ≥4 ACEs for any adult chronic pain, and for painful MSDs and non-MSDs pooled separately. The small differences observed between 2 to 3 ACEs and 3 to 4 or more ACEs respectively may be due to the relatively small number of included studies per level, the varying type, severity, number, duration, timing, and method of assessment of ACEs and chronic painful conditions. Further, the response to an ACE may vary depending on the individual's underlying characteristics, resilience, and vulnerability (Finlay et al., 2022).

Methodological challenges included the varying terminology, operational definitions of "child abuse and neglect", and tools used to measure ACEs across studies. Further, different subtypes of child maltreatment are correlated with one another, which makes it difficult to extract the impact of a specific type of maltreatment with an outcome variable. The accuracy of self-reported ACEs is also uncertain. Nonetheless, due to the hidden nature of ACEs, global data suggests self-reported child sexual abuse is 30 times higher and physical abuse is 75 times higher than official reports (Hillis et al., 2015). Thus, self-reports are considered an essential measurement tool, and the fact that results were consistent adds credibility. Other environmental/indirect ACEs such as major natural disasters, school shootings, and warzones are often not measured, further exacerbating the issue of underreporting (Abdelhamid et al., 2023; Holloway et al., 2023). There is an urgent need to more comprehensively identify individuals who have experienced ACEs as well as the timing, duration, and subjective severity of such experiences. The majority (84%) of included studies used a cross-sectional design. While these are useful designs to identify associations, they do not permit distinction between cause and effect, and are prone to selection and recall bias (Mann, 2003). However, the findings from the case–control studies revealing significant increased risks of adult chronic painful conditions (Bradford et al., 2012; Ju et al., 2020; Park et al., 2016; Rahal et al., 2020; Sumanen et al., 2007; Tietjen et al., 2015), were consistent with four of the five cohort studies with follow-up times ranging from 4 to 30 years, included in this review (Chandan et al., 2020; Kopec & Sayre, 2005; Raphael et al., 2001; Raphael & Widom, 2011; Swanson et al., 2013). We were unable to pool results from cohort studies. Nonetheless, consistent results across populations, geography, and study design add credibility to our conclusions. Still, confounding variables are the major problem in analysing cohort studies (Mann, 2003).

Substantial heterogeneity was present for most outcomes, which could only partially be explained by subgroup and sensitivity analyses. Further, the analyses of subgroup differences were underpowered because of the small number of studies included for each ACE (Cuijpers et al., 2021). Only the association between pain-related disability and any ACEs as well as physical abuse could be confirmed by meta-analysis. Few studies were eligible to explore the association between emotional abuse or neglect and disability. Emotional abuse and neglect are difficult to operationalize, and these were defined differently across the studies. Therefore, the strength of this association might be underestimated.

Future research should aim to prospectively assess the association between ACEs and chronic pain and disability employing analytic methods to enhance causal inference (e.g. Propensity scores, G-Methods, Causal mediation analysis, Fixed effects regression) described elsewhere (Visontay et al., 2021). ACEs may be more accurately understood in terms of classes, rather than using summative scores, resulting in more accurate predictive models (O'Donnell et al., 2017) Latent class analyses can provide deeper understanding of how certain risk factors may differentially be associated with ACE subgroups by maximizing the homogeneity within groups, (i.e. individuals within a class would respond similarly to certain maltreatment items) and the heterogeneity between groups, (i.e. individuals between classes will respond differently) (Elklit & Murphy, 2022). In addition, to mitigate their impact, future research is needed to understand the biological mechanisms by which ACEs influence health and disease throughout the lifespan.

In conclusion, single and cumulative ACEs appears to significantly increase the risk of reporting adult chronic pain and related disability. There is a need to reduce ACEs worldwide and address their associated societal burden.

Abbreviations

ACE:	Adverse Childhood Experience
PA:	Physical Abuse
SA:	Sexual Abuse
EA:	Emotional Abuse
N:	Neglect
ICD-11:	International Classification of Diseases
JBI:	Joanna Briggs Institute
MSD:	Musculoskeletal disorder
PRISMA-P:	Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols
PTSD:	Posttraumatic Stress Disorder
SIGN:	Scottish Intercollegiate Guidelines Network

Authors contributions

Dr Bussières had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: Bussières, Hancock, Hartvigsen with input from all authors

Acquisition, analysis, or interpretation of data: all authors

Drafting of the manuscript: Bussières, Hancock, Hartvigsen

Critical revision of the manuscript for important intellectual content: all authors

Statistical analysis: Bussières

Administrative, technical, or material support: Bussières, Chaudhry, Tolentino

Supervision: Bussières, Hancock, Hartvigsen

Other – review of excluded and included studies: all authors developed the search: Boruff, Al Zoubi, Bussières

Disclosure statement

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/disclosure-of-interest/ and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

The lead author AB (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Data availability

The authors confirm that the data supporting the findings of this study are available within the article, its supplementary materials, and the published protocol.

Dissemination to participants and related patient and public communities

The dissemination plan targets a wide audience, including members of the public, patients, patient and public communities, health professionals, and experts in the specialty through various channels: written communication, events and conferences, networks, and social media.

Provenance and peer review

Not commissioned; externally peer reviewed.

Additional contributions

We thank Nazi Torabi, MLIS (University of Toronto), for peer review of the MEDLINE search strategy.

Completed checklist – MOOSE Guidelines for Meta-Analyses and Systematic Reviews of Observational Studies and the PRISMA-P (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols)

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References

Abdelhamid, S., Kraaijenvanger, E., Fischer, J., & Steinisch, M. (2023). Assessing adverse childhood experiences in young refugees: A systematic review of available questionnaires. *Preprints*, https://doi.org/10.20944/preprints202303.0027.v1

Afifi, T. O., MacMillan, H. L., Boyle, M., Cheung, K., Taillieu, T., Turner, S., & Sareen, J. (2016). Child abuse and physical health in adulthood. *Health Reports*, *27*(3), 10–18.

Afifi, T. O., Mota, N., MacMillan, H. L., & Sareen, J. (2013). Harsh physical punishment in childhood and adult physical health. *Pediatrics*, *132*(2), e333–e340. https://doi.org/10.1542/peds.2012-4021

Alhalal, E., Ford-Gilboe, M., Wong, C., & AlBuhairan, F. (2018). Factors mediating the impacts of child abuse and intimate partner violence on chronic pain: A cross-sectional study. *BMC Women's Health*, *18*(1), 160. https://doi.org/10.1186/s12905-018-0642-9

Altman, D. G., & Bland, J. M. (2003). Interaction revisited: The difference between two estimates. *BMJ*, *326*(7382), 219–219. https://doi.org/10.1136/bmj.326.7382.219

Anda, R., Tietjen, G., Schulman, E., Felitti, V., & Croft, J. (2010). Adverse childhood experiences and frequent headaches in adults. *Headache*, *50*(9), 1473–1481. https://doi.org/10.1111/j.1526-4610.2010.01756.x

Anno, K., Shibata, M., Ninomiya, T., Iwaki, R., Kawata, H., Sawamoto, R., Kubo, C., Kiyohara, Y., Sudo, N., & Hosoi, M. (2015). Paternal and maternal bonding styles in childhood are associated with the prevalence of chronic pain in a general adult population: The Hisayama Study. *BMC Psychiatry*, *15*(1), 181. https://doi.org/10.1186/s12888-015-0574-y

Arnow, B. A. (2004). Relationships between childhood maltreatment, adult health and psychiatric outcomes, and medical utilization. *Journal of Clinical Psychiatry*, *65*(1), 10–15. https://doi.org/10.4088/JCP.v65n0103

As-Sanie, S., Clevenger, L. A., Geisser, M. E., Williams, D. A., & Roth, R. S. (2014). History of abuse and its relationship to pain experience and depression in women with chronic pelvic pain. *American Journal of Obstetrics and Gynecology*, *210*(4), 317.e311–317.e318. https://doi.org/10.1016/j.ajog.2013.12.048

Augeard, N., Bostick, G., Miller, J., Walton, D., Tousignant-Laflamme, Y., Hudon, A., Bussières, A., Cooper, L., McNiven, N., Thomas, A., Singer, L., Fishman, S. M., Bement, M. H., Hush, J. M., Sluka, K. A., Watt-Watson, J., Carlesso, L. C., Dufour, S., Fletcher, R., … Wideman, T. H. (2022). Development of a national pain management competency profile to guide entry-level physiotherapy education in Canada. *Canadian Journal of Pain*, *6*(1), 1–11. https://doi.org/10.1080/24740527.2021.2004103

Baca, K. J., & Salsbury, S. A. (2023). Adverse childhood experiences and trauma informed care for chiropractors: A call to awareness and action. *Chiropractic & Manual Therapies*, *31*(1), 30. https://doi.org/10.1186/s12998-023-00503-2

Bacon, A. M., & White, L. (2022). The association between adverse childhood experiences, self-silencing behaviours and symptoms in women with fibromyalgia. *Psychology, Health & Medicine*, *28*, 2073–2083. https://doi.org/10.1080/13548506.2022.2159459

Badley, E. M., Shields, M., O'Donnell, S., Hovdestad, W. E., & Tonmyr, L. (2019). Childhood maltreatment as a risk factor for arthritis: Findings from a population-based survey of Canadian adults. *Arthritis Care & Research*, *71*(10), 1366–1371. https://doi.org/10.1002/acr.23776

Baiden, P., Panisch, L. S., Onyeaka, H. K., LaBrenz, C. A., & Kim, Y. (2021). Association of childhood physical and sexual abuse with arthritis in adulthood: Findings from a population-based study. *Preventive Medicine Reports*, *23*, 101463. https://doi.org/10.1016/j.pmedr.2021.101463

Baker, A., Young, K., Potter, J., & Madan, I. (2010). A review of grading systems for evidence-based guidelines produced by medical specialties. *Clinical Medicine*, *10*(4), 358–363. https://doi.org/10.7861/clinmedicine.10-4-358

Barron, W. (1997). Pain-prone theory: Interrelationships between childhood abuse history and chronic pain in adults [Dissertation Empirical Study]. *Dissertation Abstracts International: Section B: The Sciences and Engineering*, *57*(12-B), 7715.

Bellis, M. A., Hughes, K., Ford, K., Hardcastle, K. A., Sharp, C. A., Wood, S., Homolova, L., & Davies, A. (2018). Adverse childhood experiences and sources of childhood resilience: A retrospective study of their combined relationships with child health and educational attendance. *BMC Public Health*, *18*(1), N.PAG–N.PAG. https://doi.org/10.1186/s12889-018-5699-8

Bellis, M. A., Hughes, K., Ford, K., Ramos Rodriguez, G., Sethi, D., & Passmore, J. (2019). Life course health consequences and associated annual costs of adverse childhood experiences across Europe and North America: a systematic review and meta-analysis. *Lancet Public Health*, *4*(10), e517–e528. https://doi.org/10.1016/s2468-2667(19)30145-8

Bendixen, M., Muus, K. M., & Schei, B. (1994). The impact of child sexual abuse–a study of a random sample of Norwegian students. *Child Abuse & Neglect*, *18*(10), 837–847. https://doi.org/10.1016/0145-2134(94)90063-9

Bethell, C. D., Carle, A., Hudziak, J., Gombojav, N., Powers, K., Wade, R., & Braveman, P. (2017). Methods to assess adverse childhood experiences of children and families: Toward approaches to promote child well-being in policy and practice. *Academic Pediatrics*, *17*(7s), S51–s69. https://doi.org/10.1016/j.acap.2017.04.161

Bombay, A., Matheson, K., & Anisman, H. (2009). Intergenerational trauma: Convergence of multiple processes among First Nations peoples in Canada. *International Journal of Indigenous Health*, *5*(3), 4–47. https://doi.org/10.3138/ijih.v5i3.28987

Bottiroli, S., Galli, F., Viana, M., Sances, G., & Tassorelli, C. (2018). Traumatic experiences, stressful events, and alexithymia in chronic migrainew with medication overuse. *Frontiers in Psychology*, *9*, 9, Article 704. https://doi.org/10.3389/fpsyg.2018.00704

Bradford, K., Shih, W., Videlock, E. J., Presson, A. P., Naliboff, B. D., Mayer, E. A., & Chang, L. (2012). Association between early adverse life events and irritable bowel syndrome. *Clinical Gastroenterology and Hepatology*, *10*(4), 385–U159. https://doi.org/10.1016/j.cgh.2011.12.018

Brennenstuhl, S., & Fuller-Thomson, E. (2015). The painful legacy of childhood violence: Migraine headaches Among adult survivors of adverse childhood experiences. *Headache*, *55*(7), 973–983. https://doi.org/10.1111/head.12614

Brown, R. C., Plener, P. L., Braehler, E., Fegert, J. M., & Huber-Lang, M. (2018). Associations of adverse childhood experiences and bullying on physical pain in the general population of Germany. *Journal of Pain Research*, *11*, 3099–3108. https://doi.org/10.2147/JPR.S169135

Bussières, A., Hartvigsen, J., Ferreira, M. L., Ferreira, P. H., Hancock, M. J., Stone, L. S., Wideman, T. H., Boruff, J., & Elklit, A. (2020). Adverse childhood experience and adult persistent pain and disability: protocol for a systematic review and meta-analysis. *Systematic Reviews*, *9*(1), 215. https://doi.org/10.1186/s13643-020-01474-8

Chandan, J. S., Keerthy, D., Zemedikun, D. T., Okoth, K., Gokhale, K. M., Raza, K., Bandyopadhyay, S., Taylor, J., & Nirantharakumar, K. (2020). The association between exposure to childhood maltreatment and the subsequent development of functional somatic and visceral pain syndromes. *eClinicalMedicine*, *23*, 100392. https://doi.org/10.1016/j.eclinm.2020.100392

Chartier, M. J., Walker, J. R., & Naimark, B. (2007). Childhood abuse, adult health, and health care utilization: Results from a representative community sample. *American Journal of Epidemiology*, *165*(9), 1031–1038. https://doi.org/10.1093/aje/kwk113

Chartier, M. J., Walker, J. R., & Naimark, B. (2010). Separate and cumulative effects of adverse childhood experiences in predicting adult health and health care utilization. *Child Abuse & Neglect*, *34*(6), 454–464. https://doi.org/10.1016/j.chiabu.2009.09.020

Coles, J., Lee, A., Taft, A., Mazza, D., & Loxton, D. (2015). Childhood sexual abuse and Its association With adult physical and mental health. *Journal of Interpersonal Violence*, *30*(11), 1929–1944. https://doi.org/10.1177/0886260514555270

Control, C. f. D. (2019). Centers for Disease Control and Prevention *(2019)*. Preventing Adverse Childhood Experiences: Leveraging the Best Available Evidence. Atlanta, GA: National Center for Injury Prevention and Control, Centers for Disease Control and Prevention: https://www.cdc.gov/violenceprevention/childabuseandneglect/index.html.

Craner, J. R., & Lake, E. S. (2021). Adverse childhood experiences and chronic pain rehabilitation treatment outcomes in adults. *The Clinical Journal of Pain*, *37*(5), 321–329. https://doi.org/10.1097/ajp.0000000000000924

Cuijpers, P., Griffin, J. W., & Furukawa, T. A. (2021). The lack of statistical power of subgroup analyses in meta-analyses: A cautionary note. *Epidemiology and*

Psychiatric Sciences, *30*, e78. https://doi.org/10.1017/s2045796021000664

Daily, S. M., Dyer, A. M., Lilly, C. L., Sarkees, E. A., & Bias, T. K. (2022). Using adverse childhood experiences to explore the usefulness of community health needs assessments to monitor complex determinants of health at the local level. *Evaluation and Program Planning*, *91*, 102044. https://doi.org/10.1016/j.evalprogplan.2021.102044

Davis, D. A., Luecken, L. J., & Zautra, A. J. (2005). Are reports of childhood abuse related to the experience of chronic pain in adulthood? A meta-analytic review of the literature. *The Clinical Journal of Pain*, *21*(5), 398–405. https://doi.org/10.1097/01.ajp.0000149795.08746.31

Dekkers, O. M., Vandenbroucke, J. P., Cevallos, M., Renehan, A. G., Altman, D. G., & Egger, M. (2019). COSMOS-E: Guidance on conducting systematic reviews and meta-analyses of observational studies of etiology. *PLOS Medicine*, *16*(2), e1002742. https://doi.org/10.1371/journal.pmed.1002742

Dennis, C. H., Clohessy, D. S., Stone, A. L., Darnall, B. D., & Wilson, A. C. (2019). Adverse childhood experiences in mothers with chronic pain and intergenerational impact on children. *The Journal of Pain*, *20*(10), 1209–1217. https://doi.org/10.1016/j.jpain.2019.04.004

Dieleman, J. L., Cao, J., Chapin, A., Chen, C., Li, Z., Liu, A., Horst, C., Kaldjian, A., Matyasz, T., Scott, K. W., Bui, A. L., Campbell, M., Duber, H. C., Dunn, A. C., Flaxman, A. D., Fitzmaurice, C., Naghavi, M., Sadat, N., Shieh, P., … Murray, C. J. L. (2020). US health care spending by payer and health condition, 1996-2016. *JAMA*, *323*(9), 863–884. https://doi.org/10.1001/jama.2020.0734

Díaz-Olavarrieta, C., Ellertson, C., Paz, F., Ponce de Leon, S., & Alarcon-Segovia, D. (2002). Prevalence of battering among 1780 outpatients at an internal medicine institution in Mexico. *Social Science & Medicine*, *55*(9), 1589–1602. https://doi.org/10.1016/s0277-9536(01)00293-3

Elklit, A., & Murphy, S. (2022). The nature and extent of child maltreatment in Denmark: Using self-report and administrative data from the 1984 birth cohort. *Child Abuse & Neglect*, *132*, 105786. https://doi.org/10.1016/j.chiabu.2022.105786

England-Mason, G., Casey, R., Ferro, M., MacMillan, H. L., Tonmyr, L., & Gonzalez, A. (2018). Child maltreatment and adult multimorbidity: results from the Canadian community health survey. *Canadian Journal of Public Health*, *109*(4), 561–572. https://doi.org/10.17269/s41997-018-0069-y

Eriksen, A. M., Schei, B., Hansen, K. L., Sorlie, T., Fleten, N., & Javo, C. (2016). Childhood violence and adult chronic pain among indigenous Sami and non-Sami populations in Norway: a SAMINOR 2 questionnaire study. *International Journal of Circumpolar Health*, *75*(1), 32798. https://doi.org/10.3402/ijch.v75.32798

Finlay, S., Roth, C., Zimsen, T., Bridson, T. L., Sarnyai, Z., & McDermott, B. (2022). Adverse childhood experiences and allostatic load: A systematic review. *Neuroscience & Biobehavioral Reviews*, *136*, 104605. https://doi.org/10.1016/j.neubiorev.2022.104605

Forkey, H., Szilagyi, M., Kelly, E. T., & Duffee, J. (2021). Trauma-Informed care. *Pediatrics*, *148*(2), https://doi.org/10.1542/peds.2021-052580

Fowler, C., Homandberg, L., Steele, C., Bolt, M. A., Tintle, N., Van De Griend, K., Ulrich, R., & Christians, M. (2020). Adult correlates of adverse childhood experiences in Ukraine. *Child Abuse & Neglect*, *107*, 104617. https://doi.org/10.1016/j.chiabu.2020.104617

Fuller-Thomson, E., Stefanyk, M., & Brennenstuhl, S. (2009). The robust association between childhood physical abuse and osteoarthritis in adulthood: Findings from a representative community sample. *Arthritis Care & Research*, *61*(11), 1554–1562. https://doi.org/10.1002/art.24871

Fuller-Thomson, E., Sulman, J., Brennenstuhl, S., & Merchant, M. (2011). Functional somatic syndromes and childhood physical abuse in women: Data from a representative community-based sample. *Journal of Aggression, Maltreatment & Trauma*, *20*(4), 445–469. https://doi.org/10.1080/10926771.2011.566035

Gaskin, D. J., & Richard, P. (2012). The economic costs of pain in the United States. *The Journal of Pain*, *13*(8), 715–724. https://doi.org/10.1016/j.jpain.2012.03.009

Gilliam, W. P., Schumann, M. E., Craner, J. R., Cunningham, J. L., Morrison, E. J., Seibel, S., Sawchuk, C., & Sperry, J. A. (2020). Examining the effectiveness of pain rehabilitation on chronic pain and post-traumatic symptoms. *Journal of Behavioral Medicine*, *43*(6), 956–967. https://doi.org/10.1007/s10865-020-00160-3

Grant, R. L. (2014). Converting an odds ratio to a range of plausible relative risks for better communication of research findings. *BMJ*, *348*(1), f7450. https://doi.org/10.1136/bmj.f7450

Grummitt, L. R., Kreski, N. T., Kim, S. G., Platt, J., Keyes, K. M., & McLaughlin, K. A. (2021). Association of childhood adversity with morbidity and mortality in US adults. *JAMA Pediatrics*, *175*(12), 1269–1278. https://doi.org/10.1001/jamapediatrics.2021.2320

Hammond, N. G., & Colman, I. (2020). The role of positive health behaviors in the relationship between early life stress and migraine. *Headache*, *60*(6), 1111–1123. https://doi.org/10.1111/head.13808

Hanlon, P., McCallum, M., Jani, B. D., McQueenie, R., Lee, D., & Mair, F. S. (2020). Association between childhood maltreatment and the prevalence and complexity of multimorbidity: A cross-sectional analysis of 157,357 UK Biobank participants. *Journal of Comorbidity*, *10*, 1–12. https://doi.org/10.1177/2235042X10944344

Hargreaves, M. K., Mouton, C. P., Liu, J., Zhou, Y. E., & Blot, W. J. (2019). Adverse childhood experiences and health care utilization in a low-income population. *Journal of Health Care for the Poor and Underserved*, *30*(2), 749–767. https://doi.org/10.1353/hpu.2019.0054

Hart-Johnson, T., & Green, C. R. (2012). The impact of sexual or physical abuse history on pain-related outcomes Among blacks and whites with chronic pain: Gender influence. *Pain Medicine*, *13*(2), 229–242. https://doi.org/10.1111/j.1526-4637.2011.01312.x

Häuser, W., Bohn, D., Kühn-Becker, H., Erdkönig, R., Brähler, E., & Glaesmer, H. (2012). Is the association of self-reported childhood maltreatments and adult fibromyalgia syndrome attributable to depression? A case control study. *Clinical and Experimental Rheumatology*, *30*(6 Suppl 74), 59–64. https://www.clinexprheumatol.org/abstract.asp?a = 6225.

Häuser, W., Brahler, E., Schmutzer, G., & Glaesmer, H. (2018). The association of adverse childhood experiences and of resilience with chronic noncancer pain in the German adult population - A cross-sectional survey. *European Journal of Pain*, *23*(3), 555–564. https://doi.org/10.1002/ejp.1329

Häuser, W., Kosseva, M., Üceyler, N., Klose, P., & Sommer, C. (2011). Emotional, physical, and sexual abuse in fibromyalgia syndrome: A systematic review with meta-analysis. *Arthritis Care & Research*, *63*(6), 808–820. https://doi.org/10.1002/acr.20328

Higgins, J. P. T, T. J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2022). *Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022*. Available from www.training.cochrane.org/handbook.

Hillis, S. D., Mercy, J. A., Saul, J., Gleckel, J., Abad, N., & Kress, H. (2015). THRIVES: a global technical package to prevent violence against children. https://stacks.cdc.gov/view/cdc/31482.

Hillis, S., Mercy, J., Amobi, A., & Kress, H. (2016). Global prevalence of past-year violence against children: A systematic review and minimum estimates. *Pediatrics*, *137* (3), e20154079. https://doi.org/10.1542/peds.2015-4079

Holloway, K., Cahill, G., Tieu, T., & Njoroge, W. (2023). Reviewing the literature on the impact of Gun violence on early childhood development. *Current Psychiatry Reports*, *25*(7), 273–281. https://doi.org/10.1007/s11920-023-01428-6

Hughes, K., Bellis, M. A., Hardcastle, K. A., Sethi, D., Butchart, A., Mikton, C., Jones, L., & Dunne, M. P. (2017). The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *The Lancet Public Health*, *2*(8), e356–e366. https://doi.org/10.1016/S2468-2667(17)30118-4

Hughes, K., Ford, K., Bellis, M. A., Glendinning, F., Harrison, E., & Passmore, J. (2021). Health and financial costs of adverse childhood experiences in 28 European countries: A systematic review and meta-analysis. *The Lancet Public Health*, *6*(11), e848–e857. https://doi.org/10.1016/S2468-2667(21)00232-2

Irish, L., Kobayashi, I., & Delahanty, D. L. (2010). Long-term physical health consequences of childhood sexual abuse: A meta-analytic review. *Journal of Pediatric Psychology*, *35* (5), 450–461. https://doi.org/10.1093/jpepsy/jsp118

James, S. L., Abate, D., Abate, K. H., Abay, S. M., Abbafati, C., Abbasi, N., Abbastabar, H., Abd-Allah, F., Abdela, J., Abdelalim, A., Abdollahpour, I., Abdulkader, R. S., Abebe, Z., Abera, S. F., Abil, O. Z., Abraha, H. N., Abu-Raddad, L. J., Abu-Rmeileh, N. M. E., Accrombessi, M. M. K., … Murray, C. J. L. (2018). Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the global burden of disease study 2017. *Lancet*, *392* (10159), 1789–1858. https://doi.org/10.1016/S0140-6736(18)32279-7

Jamieson, D. J., & Steege, J. F. (1997). The association of sexual abuse with pelvic pain complaints in a primary care population. *American Journal of Obstetrics and Gynecology*, *177*(6), 1408–1412. https://doi.org/10.1016/s0002-9378(97)70083-8

Jiao, J., Vincent, A., Cha, S. S., Luedtke, C. A., & Oh, T. H. (2015). Association of abuse history with symptom severity and quality of life in patients with fibromyalgia. *Rheumatology International*, *35*(3), 547–553. https://doi.org/10.1007/s00296-014-3113-0

Ju, T., Naliboff, B. D., Shih, W., Presson, A. P., Liu, C., Gupta, A., Mayer, E. A., & Chang, L. (2020). Risk and protective factors related to early adverse life events in irritable bowel syndrome. *Journal of Clinical Gastroenterology*, *54*(1), 63–69. https://doi.org/10.1097/MCG.0000000000001153

Kalmakis, K. A., & Chandler, G. E. (2015). Health consequences of adverse childhood experiences: a systematic review. *Journal of the American Association of Nurse Practitioners*, *27*(8), 457–465. https://doi.org/10.1002/2327-6924.12215

Kamiya, Y., Timonen, V., & Kenny, R. A. (2016). The impact of childhood sexual abuse on the mental and physical health, and healthcare utilization of older adults. *International Psychogeriatrics*, *28*(3), 415–422. https://doi.org/10.1017/s1041610215001672

Kascakova, N., Furstova, J., Hasto, J., Madarasova-Geckova, A., & Tavel, P. (2020). When a head Is about to burst: Attachment mediates the relationship between childhood trauma and migraine. *International Journal of Environmental Research and Public Health*, *17*(12), 25. https://doi.org/10.3390/ijerph17124579

Kopec, J. A., & Sayre, E. C. (2005). Stressful experiences in childhood and chronic back pain in the general population. *The Clinical Journal of Pain*, *21*(6), 478–483. https://doi.org/10.1097/01.ajp.0000139909.97211.e1

Lee, S., Tsang, A., Von Korff, M., de Graaf, R., Benjet, C., Haro, J. M., Angermeyer, M., Demyttenaere, K., de Girolamo, G., Gasquet, I., Merikangas, K., Posada-Villa, J., Takeshima, T., & Kessler, R. C. (2009). Association of headache with childhood adversity and mental disorder: Cross-national study. *British Journal of Psychiatry*, *194*(2), 111–116. https://doi.org/10.1192/bjp.bp.108.052159

Li, J., Lin, S., Yan, X., Pei, L., & Wang, Z. (2022). Adverse childhood experiences and trajectories of ADL disability among middle-aged and older adults in China: Findings from the CHARLS cohort study. *The Journal of Nutrition, Health & Aging*, *26*(12), 1034–1041. https://doi.org/10.1007/s12603-022-1863-z

Lin, L., Wang, H. H., Lu, C., Chen, W., & Guo, V. Y. (2021). Adverse childhood experiences and subsequent chronic diseases among middle-aged or older adults in China and associations with demographic and socioeconomic characteristics. *JAMA Network Open*, *4*(10), e2130143. https://doi.org/10.1001/jamanetworkopen.2021.30143

Liu, M., Luong, L., Lachaud, J., Edalati, H., Reeves, A., & Hwang, S. W. (2021). Adverse childhood experiences and related outcomes among adults experiencing homelessness: A systematic review and meta-analysis. *Lancet Public Health*, *6*(11), e836–e847. https://doi.org/10.1016/S2468-2667(21)00189-4

Lobo, J. J., Ayoub, L. J., Moayedi, M., & Linnstaedt, S. D. (2022). Hippocampal volume, FKBP5 genetic risk alleles, and childhood trauma interact to increase vulnerability to chronic multisite musculoskeletal pain. *Scientific Reports*, *12*(1), 6511. https://doi.org/10.1038/s41598-022-10411-9

Mann, C. J. (2003). Observational research methods. Research design II: cohort, cross sectional, and case-control studies. *Emergency Medicine Journal*, *20*(1), 54–60. https://doi.org/10.1136/emj.20.1.54

Mao, J. (2017). Challenges of managing chronic pain. *BMJ*, *356*, j741. https://doi.org/10.1136/bmj.j741

Mays, I., Flynn, J., McGuire, B., & Egan, J. (2021). The role of attachment style, adverse childhood experiences and dissociation in migraine. *Journal of Trauma & Dissociation*, *23*, 1–34. https://doi.org/10.1080/15299732.2021.1989114

McBeth, J., Tomenson, B., Chew-Graham, C., Macfarlane, G., Jackson, J., Littlewood, A., & Creed, F. (2015). Common and unique associated factors for medically unexplained chronic widespread pain and chronic fatigue. *Journal of Psychosomatic Research*, *79*(6), 484–491. https://doi.org/10.1016/j.jpsychores.2015.10.004

McGowan, J., Sampson, M., Salzwedel, D. M., Cogo, E., Foerster, V., & Lefebvre, C. (2016). PRESS peer review of electronic search strategies: 2015 guideline statement.

Journal of Clinical Epidemiology, *75*, 40–46. https://doi.org/10.1016/j.jclinepi.2016.01.021

Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., Currie, M., Qureshi, R., Mattis, P., Lisy, K., & Mu, P.-F. (2017). Checklist for analytical cross sectional studies. Chapter 7: Systematic reviews of etiology and risk. In E. Aromataris & Z. Munn (Eds.), *Joanna Briggs Institute reviewer's manual*. The Joanna Briggs Institute. https://reviewersmanual.joannabriggs.org/.

Moore, S. E., Scott, J. G., Ferrari, A. J., Mills, R., Dunne, M. P., Erskine, H. E., Devries, K. M., Degenhardt, L., Vos, T., Whiteford, H. A., McCarthy, M., & Norman, R. E. (2015). Burden attributable to child maltreatment in Australia. *Child Abuse & Neglect*, *48*, 208–220. https://doi.org/10.1016/j.chiabu.2015.05.006

Mueller, M., D'Addario, M., Egger, M., Cevallos, M., Dekkers, O., Mugglin, C., & Scott, P. (2018). Methods to systematically review and meta-analyse observational studies: A systematic scoping review of recommendations. *BMC Medical Research Methodology*, *18*(1), 44. https://doi.org/10.1186/s12874-018-0495-9

Nicholas, M., Vlaeyen, J. W. S., Rief, W., Barke, A., Aziz, Q., Benoliel, R., Cohen, M., Evers, S., Giamberardino, M. A., Goebel, A., Korwisi, B., Perrot, S., Svensson, P., Wang, S.-J., Treede, R.-D., & The, I. T. f. t. C. o. C. P. (2019). The IASP classification of chronic pain for ICD-11: Chronic primary pain. *Pain*, *160*(1), 28–37. https://doi.org/10.1097/j.pain.0000000000001390

Nicol, A. L., Sieberg, C. B., Clauw, D. J., Hassett, A. L., Moser, S. E., & Brummett, C. M. (2016). The association between a history of lifetime traumatic events and pain severity, physical function, and affective distress in patients with chronic pain. *The Journal of Pain*, *17*(12), 1334–1348. https://doi.org/10.1016/j.jpain.2016.09.003

Norman, R. E., Byambaa, M., De, R., Butchart, A., Scott, J., & Vos, T. (2012). The long-term health consequences of child physical abuse, emotional abuse, and neglect: A systematic review and meta-analysis. *PLoS Medicine*, *9*(11), e1001349. https://doi.org/10.1371/journal.pmed.1001349

Noteboom, A., Have, M. T., de Graaf, R., Beekman, A. T. F., Penninx, B., & Lamers, F. (2021). The long-lasting impact of childhood trauma on adult chronic physical disorders. *Journal of Psychiatric Research*, *136*, 87–94. https://doi.org/10.1016/j.jpsychires.2021.01.031

O'Donnell, M. L., Schaefer, I., Varker, T., Kartal, D., Forbes, D., Bryant, R. A. A., Silove, D., Creamer, M., McFarlane, A., Malhi, G., Felmingham, K., Van Hoof, M., Hadzi-Pavlovic, D., Nickerson, A., & Steel, Z. (2017). A systematic review of person-centered approaches to investigating patterns of trauma exposure. *Clinical Psychology Review*, *57*, 208–225. https://doi.org/10.1016/j.cpr.2017.08.009

Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan – a web and mobile app for systematic reviews. *Systematic Reviews*, *5*(1), 210. https://doi.org/10.1186/s13643-016-0384-4

Paras, M. L., Murad, M. H., Chen, L. P., Goranson, E. N., Sattler, A. L., Colbenson, K. M., Elamin, M. B., Seime, R. J., Prokop, L. J., & Zirakzadeh, A. (2009). Sexual abuse and lifetime diagnosis of somatic disorders: A systematic review and meta-analysis. *JAMA*, *302*(5), 550–561. https://doi.org/10.1001/jama.2009.1091

Park, S. H., Videlock, E. J., Shih, W., Presson, A. P., Mayer, E. A., & Chang, L. (2016). Adverse childhood experiences are associated with irritable bowel syndrome and gastrointestinal symptom severity. *Neurogastroenterology & Motility*, *28*(8), 1252–1260. https://doi.org/10.1111/nmo.12826

Park, S., Hong, J. P., Bae, J. N., Cho, S. J., Lee, D. W., Lee, J. Y., Chang, S. M., Jeon, H. J., Hahm, B. J., Lee, Y. M., Seong, S., & Cho, M. J. (2014a). Impact of childhood exposure to psychological trauma on the risk of psychiatric disorders and somatic discomfort: Single vs. multiple types of psychological trauma. *Psychiatry Research*, *219*(3), 443–449. https://doi.org/10.1016/j.psychres.2014.06.009

Park, S., Hong, J. P., Bae, J. N., Cho, S. J., Lee, D. W., Lee, J. Y., Chang, S. M., Jeon, H. J., Hahm, B. J., Lee, Y. M., Seong, S., & Cho, M. J. (2014b). Impact of childhood exposure to psychological trauma on the risk of psychiatric disorders and somatic discomfort: Single vs. multiple types of psychological trauma. *Psychiatry Research*, *219*(3), 443–449. https://doi.org/10.1016/j.psychres.2014.06.009

Pebole, M. M., Greco, C. E., Gobin, R. L., Phillips, B. N., & Strauser, D. R. (2022). Impact of childhood maltreatment on psychosomatic outcomes among men and women with disabilities. *Disability and Rehabilitation*, *44*(24), 7491–7499. https://doi.org/10.1080/09638288.2021.1998666

Petruccelli, K, D. J., & Berman, T. (2019). Adverse childhood experiences and associated health outcomes: A systematic review and meta-analysis. *Child Abuse & Neglect*, *1*(97), 104127. https://doi.org/10.1016/j.chiabu.2019.104127

Pierce, J., Harte, S. E., Afari, N., Bradley, C. S., Griffith, J. W., Kim, J., Lutgendorf, S., Naliboff, B. D., Rodriguez, L. V., Taple, B. J., Williams, D., Harris, R. E., Schrepf, A., & Network, o. b. o. t. M. R. (2023). Mediators of the association between childhood trauma and pain sensitivity in adulthood: a multidisciplinary approach to the study of chronic pelvic pain research network analysis. *Pain*, *164*, 1995–2008. https://doi.org/10.1097/j.pain.0000000000002895

Pierce, J., Hassett, A. L., Schneiderhan, J. R., Divers, J., Brummett, C. M., & Goesling, J. (2020). Centralized pain and pain catastrophizing mediate the association between lifetime abuse history and self-reported pain medication side effects. *Regional Anesthesia & Pain Medicine*, *45*(4), 293–300. https://doi.org/10.1136/rapm-2019-101130

Pierce, J., Presto, J., Hinckley, E., Hassett, A. L., Dickens, J., Schneiderhan, J. R., Grace, K., & McAfee, J. (2022). Perceived social support partially mediates the association between childhood abuse and pain-related characteristics. *Frontiers in Pain Research*, *3*, 1075605. https://doi.org/10.3389/fpain.2022.1075605

Piontek, K., Apfelbacher, C., Ketels, G., Brunahl, C., & Lowe, B. (2021). Depression partially mediates the association of adverse childhood experiences with pain intensity in patients with chronic pelvic pain syndrome: Results from a cross-sectional patient survey. *Pain Medicine*, *22*(5), 1174–1184. https://doi.org/10.1093/pm/pnaa325

Rahal, H., Videlock, E. J., Icenhour, A., Shih, W., Naliboff, B., Gupta, A., Mayer, E. A., & Chang, L. (2020). Importance of trauma-related fear in patients with irritable bowel syndrome and early adverse life events. *Neurogastroenterology & Motility*, *32*. https://doi.org/10.1111/nmo.13896

Ranjbar, N., & Erb, M. (2019). Adverse childhood experiences and trauma-informed care in rehabilitation clinical practice. *Archives of Rehabilitation Research and Clinical Translation*, *1*(1-2), 100003. https://doi.org/10.1016/j.arrct.2019.100003

Raphael, K. G., & Widom, C. S. (2011). Post-traumatic stress disorder moderates the relation between documented childhood victimization and pain 30 years later. *Pain*, *152* (1), 163–169. https://doi.org/10.1016/j.pain.2010.10.014

Raphael, K., Widom, C., & Lange, G. (2001). Childhood victimization and pain in adulthood: A prospective investigation. *Pain*, *92*(1-2), 283–293. https://doi.org/10.1016/s0304-3959(01)00270-6

Reuchlein, B., Henn, L., Brian, T., Schier, K., & Hardt, J. (2016). Childhood adversities and adult headache in Poland and Germany. *PLoS One*, *11*(2), e0148162. https://doi.org/10.1371/journal.pone.0148162

Riedl, D., Beck, T., Exenberger, S., Daniels, J., Dejaco, D., Unterberger, I., & Lampe, A. (2019). Violence from childhood to adulthood: The influence of child victimization and domestic violence on physical health in later life. *Journal of Psychosomatic Research*, *116*, 68–74. https://doi.org/10.1016/j.jpsychores.2018.11.019

Romans, S., & Cohen, M. (2008). Unexplained and underpowered: The relationship between psychosomatic disorders and interpersonal abuse – a critical review. *Harvard Review of Psychiatry*, *16*(1), 35–54. https://doi.org/10.1080/10673220801933788

Sachs-Ericsson, N., Cromer, K., Hernandez, A., & Kendall-Tackett, K. (2009). A review of childhood abuse, health, and pain-related problems: The role of psychiatric disorders and current life stress. *Journal of Trauma & Dissociation*, *10*(2), 170–188. https://doi.org/10.1080/15299730802624585

Sachs-Ericsson, N. J., Sheffler, J. L., Stanley, I. H., Piazza, J. R., & Preacher, K. J. (2017). When emotional pain becomes physical: Adverse childhood experiences, pain, and the role of mood and anxiety disorders. *Journal of Clinical Psychology*, *73*(10), 1403–1428. https://doi.org/10.1002/jclp.22444

Sachs-Ericsson, N., Kendall-Tackett, K., & Hernandez, A. (2007). Childhood abuse, chronic pain, and depression in the National Comorbidity Survey. *Child Abuse & Neglect*, *31*(5), 531–547. https://doi.org/10.1016/j.chiabu.2006.12.007

Santo, T., Jr., Campbell, G., Gisev, N., & Degenhardt, L. (2022). Exposure to childhood trauma increases risk of opioid use disorder among people prescribed opioids for chronic non-cancer pain. *Drug and Alcohol Dependence*, *230*, 109199. https://doi.org/10.1016/j.drugalcdep.2021.109199

Schlauch, K. A., Read, R. W., Koning, S. M., Neveux, I., & Grzymski, J. J. (2022). Using phenome-wide association studies and the SF-12 quality of life metric to identify profound consequences of adverse childhood experiences on adult mental and physical health in a Northern Nevadan population. *Frontiers in Psychiatry*, *13*, 984366. https://doi.org/10.3389/fpsyt.2022.984366

Schmidt, F. L., Oh, I.-S., & Hayes, T. L. (2009). Fixed- versus random-effects models in meta-analysis: Model properties and an empirical comparison of differences in results. *The British Journal of Mathematical and Statistical Psychology*, *62*(1), 97–128. https://doi.org/10.1348/000711007(255327

Schrepf, A., Naliboff, B., Williams, D. A., Stephens-Shields, A. J., Landis, J. R., Gupta, A., Mayer, E., Rodriguez, L. V., Lai, H., Luo, Y., Bradley, C., Kreder, K., Lutgendorf, S. K., & Network, M. R. (2018). Adverse childhood experiences and symptoms of urologic chronic pelvic pain syndrome: A multidisciplinary approach to the study of chronic pelvic pain research network study. *Annals of Behavioral Medicine*, *52*(10), 865–877. https://doi.org/10.1093/abm/kax060

Scott, K. M., Von Korff, M., Angermeyer, M. C., Benjet, C., Bruffaerts, R., de Girolamo, G., Haro, J. M., Lepine, J. P., Ormel, J., Posada-Villa, J., Tachimori, H., & Kessler, R. C. (2011). Association of childhood adversities and early-onset mental disorders with adult-onset chronic physical conditions. *Archives of General Psychiatry*, *68*(8), 838–844. https://doi.org/10.1001/archgenpsychiatry.2011.77

Shamseer, L., Moher, D., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: Elaboration and explanation. *BMJ*, *349*(1), g7647. https://doi.org/10.1136/bmj.g7647

Sheahan, C., & Wardrop, K. (2023). The adverse childhood experiences of Canadian federal offenders: Available information and correctional outcomes. Government of Canada. https://doi.org/https://www.csc-scc.gc.ca/research/005008-r445-en.shtml.

Sheikh, M. A. (2018). Childhood adversities and chronic conditions: examination of mediators, recall bias and age at diagnosis. *International Journal of Public Health*, *63*(2), 181–192. https://doi.org/10.1007/s00038-017-1021-2

Sheikh, M. A. (2019). Confounding, mediation, or independent effect? Childhood psychological abuse, mental health, mood/psychological state, COPD, and migraine. *Journal of Interpersonal Violence*, *36*(15-16), NP8706–NP8723. https://doi.org/10.1177/0886260519844773

Shields, M., Hovdestad, W., & Tonmyr, L. (2015). Assessment of the quality of the childhood physical abuse measure in the national population health survey. *Health Reports*, *26*(5), 3–10. https://www150.statcan.gc.ca/n1/pub/82-003-x/2015005/article/14170-eng.pdf.

SIGN. (2019). Scottish Intercollegiate Guidelines Network (SIGN). Observational Studies Search filters. Healthcare Improvement Scotland. Available at: http://www.sign.ac.uk/search-filters.html.

Sprang, G., Bush, H. M., Coker, A. L., & Brancato, C. J. (2020). Types of trauma and self-reported pain that limits functioning in different-aged cohorts. *Journal of Interpersonal Violence*, *35*(23-24), 5953–5975. https://doi.org/10.1177/0886260517723144

Springer, K. W., Sheridan, J., Kuo, D., & Carnes, M. (2007). Long-term physical and mental health consequences of childhood physical abuse: Results from a large population-based sample of men and women. *Child Abuse & Neglect*, *31*(5), 517–530. https://doi.org/10.1016/j.chiabu.2007.01.003

Stickley, A., Koyanagi, A., Kawakami, N., & Group, W. W. M. H. J. S. (2015). Childhood adversities and adult-onset chronic pain: Results from the World Mental Health Survey, Japan. *European Journal of Pain*, *19*(10), 1418–1427. https://doi.org/10.1002/ejp.672

Stroup, D., Berlin, J., Morton, S., Olkin, I., Williamson, G., Rennie, D., Moher, D., Becker, B., Sipe, T., & Thacker, S. (2000). Meta-analysis of observational studies in epidemiology. A proposal for reporting. *JAMA*, *283*(15), 2008–2012. https://doi.org/10.1001/jama.283.15.2008

Sumanen, M., Rantala, A., Sillanmaki, L. H., & Mattila, K. J. (2007). Childhood adversities experienced by working-age migraine patients. *Journal of Psychosomatic Research*, *62*(2), 139–143. https://doi.org/10.1016/j.jpsychores.2006.08.010

Swanson, S. A., Zeng, Y., Weeks, M., & Colman, I. (2013). The contribution of stress to the comorbidity of migraine and major depression: results from a prospective cohort study. *BMJ Open*, *3*(3), 09. https://doi.org/10.1136/bmjopen-2012-002057

Talley, N. J., Boyce, P. M., & Jones, M. (1998). Is the association between irritable bowel syndrome and abuse explained by neuroticism? A population based study. *Gut*, *42*(1), 47–53. https://doi.org/10.1136/gut.42.1.47

Talley, N. J., Fett, S. L., Zinsmeister, A. R., & Melton, L. J., 3rd. (1994). Gastrointestinal tract symptoms and self-reported abuse: A population-based study. *Gastroenterology*, *107*(4), 1040–1049. https://doi.org/10.1016/0016-5085(94)90228-3

Tidmarsh, L. V., Harrison, R., Ravindran, D., Matthews, S. L., & Finlay, K. A. (2022). The influence of adverse childhood experiences in pain management: Mechanisms, processes, and trauma-informed care. *Frontiers in Pain Research*, *3*, 923866. https://doi.org/10.3389/fpain.2022.923866

Tietjen, G. E., Brandes, J. L., Peterlin, B., Eloff, A., Dafer, R. M., Stein, M. R., Drexler, E., Martin, V. T., Hutchinson, S., Aurora, S. K., Recober, A., Herial, N. A., Utley, C., White, L., & Khuder, S. A. (2009). Childhood maltreatment and migraine (Part II). Emotional abuse as a risk factor for headache chronification. *Headache*, *50*(1), 32–41. https://doi.org/10.1111/j.1526-4610.2009.01557.x

Tietjen, G. E., Brandes, J. L., Peterlin, B. L., Eloff, A., Dafer, R. M., Stein, M. R., Drexler, E., Martin, V. T., Hutchinson, S., Aurora, S. K., Recober, A., Herial, N. A., Utley, C., White, L., & Khuder, S. A. (2010). Childhood maltreatment and migraine (part III). association with comorbid pain conditions. *Headache*, *50*(1), 42–51. https://doi.org/10.1111/j.1526-4610.2009.01558.x

Tietjen, G. E., Buse, D. C., Fanning, K. M., Serrano, D., Reed, M. L., & Lipton, R. B. (2015). Recalled maltreatment, migraine, and tension-type headache: Results of the AMPP study. *Neurology*, *84*(2), 132–140. https://doi.org/10.1212/WNL.0000000000001120

Tietjen, G. E., Karmakar, M., & Amialchuk, A. A. (2017). Emotional abuse history and migraine among young adults: A retrospective cross-sectional analysis of the add health dataset. *Headache*, *57*(1), 45–59. https://doi.org/10.1111/head.12994

Varinen, A., Kosunen, E., Mattila, K., Koskela, T., & Sumanen, M. (2017). The relationship between childhood adversities and fibromyalgia in the general population. *Journal of Psychosomatic Research*, *99*, 137–142. https://doi.org/10.1016/j.jpsychores.2017.06.011

Varinen, A., Kosunen, E., Mattila, K., Suominen, S., Sillanmaki, L., & Sumanen, M. (2019). The association between bullying victimization in childhood and fibromyalgia. Data from the nationwide Finnish health and social support (HeSSup) study based on a sample of 64,797 individuals. *Journal of Psychosomatic Research*, *117*, 48–53. https://doi.org/10.1016/j.jpsychores.2018.12.003

Viana, M., Bottiroli, S., Sances, G., Ghiotto, N., Allena, M., Guaschino, E., Nappi, G., & Tassorelli, C. (2018). Factors associated to chronic migraine with medication overuse: A cross-sectional study. *Cephalalgia*, *38*(14), 2045–2057. https://doi.org/10.1177/0333102418761047

Visontay, R., Sunderland, M., Slade, T., Wilson, J., & Mewton, L. (2021). Are there non-linear relationships between alcohol consumption and long-term health? Protocol for a systematic review of observational studies employing approaches to improve causal inference. *BMJ Open*, *11*(3), e043985. https://doi.org/10.1136/bmjopen-2020-043985

Waehrer, G. M., Miller, T. R., Marques, S. C. S., Oh, D. L., & Harris, N. B. (2020). Disease burden of adverse childhood experiences across 14 states. *PLoS One*, *15*(1), e0226134. https://doi.org/10.1371/journal.pone.0226134

Walker, E. A., Gelfand, A., Katon, W. J., Koss, M. P., Von Korff, M., Bernstein, D., & Russo, J. (1999). Adult health status of women with histories of childhood abuse and neglect. *The American Journal of Medicine*, *107*(4), 332–339. https://doi.org/10.1016/S0002-9343(99)00235-1

Wegman, H. L., & Stetler, C. (2009). A meta-analytic review of the effects of childhood abuse on medical outcomes in adulthood. *Psychosomatic Medicine*, *71*(8), 805–812. https://doi.org/10.1097/PSY.0b013e3181bb2b46

Werthman, E. H., Colloca, L., & Oswald, L. M. (2022). Adverse childhood experiences and burn pain: a review of biopsychosocial mechanisms that may influence healing. *PAIN Reports*, *7*(4), e1013. https://doi.org/10.1097/pr9.0000000000001013

WHO. (2006). Preventing child maltreatment: a guide to taking action and generating evidence / World Health Organization and International Society for Prevention of Child Abuse and Neglect. World Health Organization. Retrieved May 11, 2020 from http://www.who.int/iris/handle/10665/43499.

WHO. (2014). *World Health Organization, United Nations. Global status report on violence prevention 2014*. WHO Press. https://www.who.int/publications/i/item/9789241564793.

Williams, M. D., & Lascelles, B. D. X. (2020). Early neonatal pain-a review of clinical and experimental implications on painful conditions later in life. *Frontiers in Pediatrics*, *8*, 30. https://doi.org/10.3389/fped.2020.00030

Wuest, J., Ford-Gilboe, M., Merritt-Gray, M., Varcoe, C., Lent, B., Wilk, P., & Campbell, J. (2009). Abuse-related injury and symptoms of posttraumatic stress disorder as mechanisms of chronic pain in survivors of intimate partner violence. *Pain Medicine*, *10*(4), 739–747. https://doi.org/10.1111/j.1526-4637.2009.00624.x

Wuest, J., Ford-Gilboe, M., Merritt-Gray, M., Wilk, P., Campbell, J. C., Lent, B., Varcoe, C., & Smye, V. (2010). Pathways of chronic pain in survivors of intimate partner violence. *Journal of Women's Health*, *19*(9), 1665–1674. https://doi.org/10.1089/jwh.2009.1856

Wuest, J., Merritt-Gray, M., Ford-Gilboe, M., Lent, B., Varcoe, C., & Campbell, J. C. (2008). Chronic pain in women survivors of intimate partner violence. *The Journal of Pain*, *9*(11), 1049–1057. https://doi.org/10.1016/j.jpain.2008.06.009

Xu, J. R., Shang, L., Si, W. L., Song, Y., Wang, Y., Ma, J. L., & Liu, J. (2013). A population-based study of associations between functional gastrointestinal disorders and psychosocial characteristics in Xi'an, China. *Neurogastroenterology and Motility*, *25*(7), 8. https://doi.org/10.1111/nmo.12124

Yeung, E. W., Davis, M. C., & Ciaramitaro, M. C. (2015). Cortisol profile mediates the relation between childhood neglect and pain and emotional symptoms among patients with fibromyalgia. *Annals of Behavioral Medicine*, *50*(1), 87–97. https://doi.org/10.1007/s12160-015-9734-z

You, D. S., Albu, S., Lisenbardt, H., & Meagher, M. W. (2019). Cumulative childhood adversity as a risk factor for common chronic pain conditions in young adults. *Pain Medicine*, *20*(3), 486–494. https://doi.org/10.1093/pm/pny106