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Research article

Adverse childhood experiences and associated health outcomes: A systematic review and meta-analysis

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ABSTRACT

Background: The Center for Disease Control (CDC) and Kaiser Permanente developed the Adverse Childhood Experiences (ACE) scale to identify negative experiences in childhood. The goal of this study is to systematically review outcomes associated with the ACEs in the CDC-Kaiser ACE scale to understand the diversity of outcomes associated with this scale.

Methods: The authors conducted a search of English language articles published through September 30, 2016 using OVID Medline[®]; Ovid Medline[®] Daily; Epub Ahead of Print, In-Process & Other Non-indexed citations; ERIC[®]; HAPI[®]; and SCOPUS[®]. Articles were selected by trained reviewers based on a priori inclusion criteria including: research, healthy sample, used the CDC-Kaiser ACE scale, and assessed some health outcome. Two reviewers used an abstraction form to independently collect data from each study. Unadjusted and adjusted odds ratio associated with ACE scale scores were aggregated and compared.

Results: From 3167 unique titles, we identified 96 articles that assessed health outcomes associated with the ACEs in the CDC-Kaiser ACE scale. There were more studies focusing on psychosocial/behavioral outcomes than medical outcomes. The majority of the included studies were retrospective, observational, and relied on the same data set. Psychosocial/behavioral outcomes had higher odds ratio than medical outcomes with increasing ACE scale scores.

Conclusions: Exposure to multiple ACEs is associated with a wide variety of outcomes. This data suggests a benefit of screening for ACEs using this scale and highlights the need to find interventions to ameliorate their effects.

1. Introduction

Early life experiences are becoming increasingly recognized as important factors in health outcomes later in life. To that end, Kaiser Permanente researchers and the Centers for Disease Control and Prevention (CDC) teamed to develop and study the “Adverse Childhood Experiences” (ACE) scale to measure negative early life experiences (Felitti, Anda, Nordenberg, Williamson, & Spitz, 1998). Since then, studies have found the higher the ACE score, the greater the risk of experiencing risky health behaviors, chronic health conditions, low quality of life potential, and early death (*About adverse Childhood Experiences*, 2016).

Adverse childhood experiences (ACEs) are psychosocial factors with significant negative impact on health. The ACE scale is a specific scale to measure several negative experiences in childhood. The term ACE is similar to and often used interchangeably with

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<p><u>Abuse</u></p> <ol style="list-style-type: none"> 1. Physical 2. Emotional 3. Sexual <p><u>Neglect</u></p> <ol style="list-style-type: none"> 4. Physical* 5. Emotional* <p><u>Household dysfunction</u></p> <ol style="list-style-type: none"> 6. Substance abuse 7. Mental illness 8. Domestic violence 9. Incarceration 10. Parental separation*
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Fig. 1. Adverse childhood experiences included in the Kaiser/CDC ACE scale.

*Indicates the 3 ACEs which were added during Wave 2 of data collection for the original ACE study by Felitti et al.

childhood trauma or childhood maltreatment, and there are several scales in the literature which measure various components and types of adversity. The CDC-Kaiser ACE scale is a distinct scale used to measure these outcomes. The term ACEs originally referred to the following types of events: physical abuse, verbal abuse, sexual abuse, and household dysfunction such as domestic violence, household substance abuse, mental illness, and criminal activity. Later studies added physical and emotional neglect and parental separation as ACEs. The events included on the scale are summarized in Fig. 1. Additions and modifications to the ACE scale have been recommended and include adding other forms of adversity, e.g. bullying and living in foster care (Cronholm, Forke, & Wade, 2015). Many studies have continued to show a relationship between increased ACE exposure in childhood and detrimental effects on long term health (Exley, Norman, & Hyland, 2015; Huang, Yan, & Shan, 2015; Kajeepeta, Gelaye, Jackson, & Williams, 2015; Kalmakis & Chandler, 2015).

Previous systematic reviews and meta-analyses have looked at quantifying specific health outcomes associated with ACEs, including type 2 diabetes (Huang et al., 2015), sleep disorders (Kajeepeta et al., 2015), and asthma (Exley et al., 2015). A 2015 systematic review lists health outcomes associated with trauma exposure, but this review uses several different scales, had a wide range of samples, identified only 41 relevant articles, and made no attempt to quantify relationships between health outcomes (Kalmakis & Chandler, 2015). The CDC continues to encourage a systematic review of the literature on the topic (*Adverse Childhood Experience Resources*, 2016). Therefore, we set out to do a systematic review of the literature with two goals: to identify the breadth of health-related outcomes that have been associated with ACEs as measured by the CDC-Kaiser ACE Scale and to quantify the relationship of those outcomes to the number of items endorsed using the CDC-Kaiser ACE scale.

2. Methods

Our institution found our study protocol exempt from needing institutional review board review. This study was conducted in accordance with Preferred Reporting in Systematic Reviews and Meta-Analysis (PRISMA) Guidelines (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009).

2.1. Search techniques

The authors conducted a thorough and systematic literature search of English language articles published on adverse childhood experiences from inception to September 30, 2016 (exact search dates in Supplemental Table 1) using OVID Medline®, Ovid Medline® Daily, Epub Ahead of Print, In-Process & Other Non-indexed citations; ERIC® (Educational Resource Information Collection); HAPI® (Healthcare and Psychosocial Instruments); and SCOPUS® databases. For the searches, we selected Medical Subject Headings (MeSH) and keywords to capture the concepts of adverse childhood experiences or trauma. The databases were used to remove duplicates and

the results were manually downloaded and exported to a word processing software. Full details of the search are available in Supplemental Table 1.

All titles and abstracts were independently reviewed for possible inclusion by two trained reviewers (JD, KP). Prior to beginning the review, both team members met to discuss inclusion criteria and agreed to err on the side of inclusion. This was to allow for robust discussion of any questionable articles based on title and abstract. A sample of 100 titles and abstracts was also reviewed by both reviewers to ensure a shared understanding of inclusion criteria. If either reviewer selected a reference, the full text was ordered for further review. Using this strategy, 507 articles were selected for further review. Two reviewers (JD, KP) again reviewed these full text articles and selected articles for inclusion. Any discrepancies or questions on inclusion were minor and were resolved by a consensus meeting of the two reviewers and consultation with a senior author (TB). The reference sections of all included articles and relevant systematic reviews were checked for additional potentially relevant articles.

An abstraction form was developed by the authors using an iterative process and sample of included articles. The abstraction form was designed to systematically collect and categorize relevant information from included articles to help with synthesis and included the following fields: author name, year of publication, location, sample size and population, type of study, health outcome measured, number of ACEs measured, and results. This abstraction form was then used by two independent abstractors (JD, KP) to abstract relevant information from the articles. The team then met to combine their independent abstraction forms into a single form and resolve any disagreements via consensus.

2.2. Inclusion and exclusion criteria

Articles meeting the following criteria were eligible for review: research of any type, included a general population sample, English language, used the CDC-Kaiser ACE scale, assessed some health outcome, addressed our research question “What health outcomes are associated with adverse childhood experiences in the general population using the CDC-Kaiser scale?” Health outcome was broadly defined as any medical or psychosocial outcome, acknowledging that psychosocial outcomes can be just as detrimental, if not more harmful, to overall quality of life and health than medical diagnoses can be. There was no date restriction.

Exclusion criteria included: no data or descriptive only, case reports or less than 5 subjects, exclusively inpatient or participants who already have a specific diagnosis or outcome, a total count for ACEs was not reported or analyzed, data were not reported for total ACE counts or analyzed separately, did not include all components of the ACE scale (seven or ten components were accepted – we included articles that used both the original seven-item scale and the expanded ten-item scale), identified ACEs as a mediating factor between another variable and a health outcome, and non-peer reviewed publications (reviews, abstracts, newsletters, editorials). Studies of specific populations were excluded, as were studies without control subjects (i.e., patients also not exposed to ACEs) in those specific studies; this was done in order to prevent data from being skewed by potentially unidentified mediating factors. Studies investigating the mediating effects of ACEs were also excluded to maintain the focus of this study on the cumulative effects of individual ACEs. Data reported with total ACE counts and the use of the full CDC-Kaiser ACE Scale were criteria necessary to meet the objectives of this study.

2.3. Analysis

As odds ratios were the most commonly reported statistic and are easily able to be combined in meta-analysis, two meta-analyses were planned for publication reporting similar health outcomes using odds ratios. The first meta-analysis used unadjusted odds ratio for outcomes and weighted according to the Mantel-Haenzel (Mantel & Haenzel, 1959) method. The Mantel-Haenzel method produces a single, summary measure that reduces confounding from different samples or potential confounding variables. The second method incorporated adjusted odds ratios, where reported, and used inverse variance weighting (as sample sizes were not consistently reported in all studies). Inverse variance is one of the most common methods used to pool estimates in meta-analyses. This choice of weight minimizes the imprecision of the pooled effect estimate over weights based solely on sample size.

Data were collected or calculated directly from that reported in publications. Where possible (i.e., dichotomous variables), in studies with missing data or variables, the study authors were contacted via email in order to attempt to obtain needed data to calculate odds ratios, with at least one additional follow-up email if an initial response was not received. Where authors did not respond to emails and data were aggregated across more than one ACE level in original studies, an equal weight was assigned to each ACE level (ACE level referring to the number of ACEs reported by participants). Six articles required email contact; five of those either did not respond or were not able to provide the requested data (Logan-Greene, Green, Nurius, & Longhu, 2014; Sacco, George, Vessicchio, Easton, & Prigerson, 2007; Skjothaug, Smith, Wentzel-Larsen, & Moe, 2015; Su, Wang, & Polluck, 2015; Walsh & Cawthon, 2014). Those five publications were included in this review, but their data were not incorporated into the meta-analyses due to missing data. In some studies, health outcomes had to be pooled within studies. Where health outcomes had to be pooled like this (i.e., current smoker and former smoker into “lifetime tobacco problem”), the odds ratios were weighted. For unadjusted meta-analysis, the outcomes were weighted equally. For adjusted outcomes, they were weighted with inverse variance weighting. For each health outcome, only one data set from each study was included. A detailed list of what went into each pooled outcome is available from the authors.

Health outcomes were categorized by demographics and outcome type – medical or psychosocial/behavioral. This judgement was based upon discussion among the 2 reviewers (JD, KP). There were several instances (i.e. early pregnancy, IV drug use) that could not be easily categorized in this framework. A final decision was agreed upon for each outcome, recognizing that the other option may be reasonable. Age was not included as a variable because this was based more on study characteristics than relationship to ACEs and

would not be able to be interpreted in isolation.

Unadjusted and adjusted odds ratios were calculated for each outcome and organized based on the number of items endorsed on the ACE scale, providing an ACE level – 1, 2, 3, 4+, and “highest.” Studies reported ACE levels differently so data reported for any ACE level greater than or equal to 4 were identified as ACE level 4+. The “ACE highest” level of ACEs refers to the highest reported ACE level in each study. The actual number varied in each study. We reported the ORs separate for 4+ ACEs and the “ACE highest” level to best account for the varying levels used in different studies. For the adjusted odds ratio, the numbers reported were weighted based on number of unique databases and not total number of studies.

2.4. Quality assessment

We assessed quality and risk of bias using the Newcastle-Ottawa (Deeks, Dinnes, & D’Amico, 2003; Wells, Shea, & O’Connell, 2009) scale for case control or cohort studies, where appropriate. This was done by two reviewers in collaboration (JD, KP). For this scale, some decisions specific to this paper were made by the authors: (1) the target population was the general population, (2) the most important factor to control for was socioeconomic status or a surrogate (income, education level), and (3) a response or follow-up rate of greater than 70% or if non-responder demographics were shown to be similar to responders, making the poor response rate unlikely to affect results. Because ACEs are potentially sensitive, a study was also given credit on the Newcastle-Ottawa scale for a “structured interview” for ascertainment of exposure (or an adequate case definition, depending on study type) if a study representative was present during administration of the ACE survey. Some studies measured outcomes that can only reasonably be collected via questionnaires (sexual orientation, lifetime drug use, age at sexual initiation). These studies were given credit for ascertainment of outcome/exposure. Where more than one measure or outcome was used, studies were given credit for the highest applicable level they achieved. Due to the heterogeneity of outcomes assessed, no assessment of between-study heterogeneity was performed.

3. Results

Our search identified 3,167 potential articles (4,419 with duplicates). Initial title and abstract review identified 507 articles for full text review. Many of the articles removed at this initial step did not address our primary research question, were not primary literature, or were qualitative reports only. After reviewing the full text of these articles, 96 were determined to meet inclusion criteria and no exclusion criteria. Many articles that were excluded at this stage did not use the full CDC-Kaiser ACE Scale, were conducted in specialized populations without control subjects, or did not report data in terms of ACE counts. No articles were identified from reference review of either included articles nor related systematic reviews. This left 96 total articles included in this review (Fig. 2) (Anda, Brown, Dube et al., 2008; Anda, Brown, Felitti, Dube, & Giles, 2008; Anda, Croft, & Felitti, 1999; Anda, Chapman, & Felitti, 2002; Anda, Felitti, & Bremner, 2006, 2007; Anda, Dong, & Brown, 2009; Anda, Tietjen, Schulman, Felitti, & Croft, 2010; Anderson & Blossnich, 2013; Austin, Herrick, & Proescholdbell, 2016; Austin, Herrick, Proescholdbell, & Simmons, 2016; Balistreri & Alvira-Hammond, 2016; Balistreri, 2015; Baron-Lee, Bonner, Knapp, Bright, & Hinojosa, 2015; Bellis, Hughes, Leckenby, Perkins, & Lowey, 2014, 2014b; Bellis, Lowey, Leckenby, Hughes, & Harrison, 2013; Blossnich & Andersen, 2015; Blossnich, Dichter, Cerulli, Batten, & Bossarte, 2014; Bright, Alford, Hinojosa, Knapp, & Fernaandez-Baca, 2015; Brockie, Dana-Sacco, Wallen, Wilcox, & Campbell, 2015; Brown, Masho, Perera, Mezuk, & Cohen, 2015; Brown, Perera, Masho, Mezuk, & Cohen, 2015; Brown et al., 2007; Brown, Anda, & Tiemeier, 2009; Brown, Anda, & Felitti, 2010; Bruska & Tessin, 2013; Bublitz & Stroud, 2013; Bublitz, Parade, & Stroud, 2014; Burke, Hellman, Scott, Weems, & Carrion, 2011; Cavanaugh, Petras, & Martins, 2015; Chapman et al., 2004; Chapman, Wheaton, & Anda, 2011; Chapman, Liu, & Presley-Cantrell, 2013; Chartier, Walker, & Naimark, 2010; Christiaens, Hegadoren, & Olson, 2015; Clarkson Freeman, 2014; Corcoran, Gallagher, Keeley, Arensman, & Perry, 2006; Corso, Edwards, Fang, & Mercy, 2008; Cunningham et al., 2014; Dietz, Spitz, & Anda, 1999; Dong, Dube, Felitti, Giles, & Anda, 2003; Dong, Giles, & Felitti, 2004; Dong, Anda, & Felitti, 2005; Drevin, Stern, & Annerback, 2015; Dube, Felitti, Dong, Chapman et al., 2003; Dube, Felitti, Dong, Giles, & Anda, 2003; Dube, Miller, & Brown, 2006, 2009; Duke, Pettingell, McMorris, & Borowsky, 2010; Felitti et al., 1998; Ford, Anda, & Edwards, 2011; Frankenberger, Clements-Nolle, & Yang, 2015; Gilbert, Breiding, & Merrick, 2015; Hillis, Anda, Felitti, Nordenberg, & Marchbanks, 2000; Hillis, Anda, Felitti, & Marchbanks, 2001; Hostinar, Lachman, Mroczek, Seeman, & Miller, 2015; Jacobs, Boynton-Jarrett, & Harville, 2015; Jimenez, Wade, Lin, Morrow, & Reichman, 2016; Kalmakis, Meyer, Chiodo, & Leung, 2015; Liu, Croft, & Chapman, 2013; Logan-Greene et al., 2014; Mair, Cunradi, & Todd, 2012; McCall-Hosenfeld, Winter, Heeren, & Liebschutz, 2014; McCauley, Blossnich, & Dichter, 2015; Mills, Van Hoof, Baur, & McFarlane, 2012; Montgomery, Cutuli, Evans-Chase, Treglia, & Culhane, 2013; Murphy, Steele, & Dube, 2014; Nurius, Logan-Greene, & Green, 2012; Nurius, Green, Logan-Greene, & Borja, 2015; O’Malley, Randell, & Dowd, 2016; Ports, Ford, & Merrick, 2016; Ramiro, Madrid, & Brown, 2010; Raposo, Mackenzie, Henriksen, & Affi, 2014; Reiser, McMillan, Wright, & Asmundson, 2014; Remigo-Baker, Hayes, & Reyes-Salvail, 2014; Remigo-Baker, Hayes, & Reyes-Salvail, 2015; Ryttilä-Manninen, Lindberg, & Haravuori, 2014; Sacco et al., 2007; Salinas-Miranda, Salemi, & King, 2015; Schüssler-Fiorenza Rose, Xie, & Stineman, 2014; Sinnott, McHugh, Fitzgerald, Bradley, & Kearney, 2015; Skjothaug et al., 2015; Strine, Dube, & Edwards, 2012; Strine, Edwards, & Dube, 2012; Su, Wang, & Kapuku, 2014, 2015; Teicher, Anderson, & Polcari, 2012; Thompson & Jaque, 2015; Tietjen, Khubchandani, Herial, & Shah, 2012; Vander Weg, 2011; Walsh & Cawthon, 2014; Whitaker et al., 2014; Whitfield, Dube, Felitti, & Anda, 2005; Ye & Reyes-Salvail, 2014; Yeoman, Safranek, Buss, Cadwell, & Mannino, 2013).

The Original CDC-Kaiser study data were used by 29 studies (Anda, Brown, Dube et al., 2008, 2008b; Anda et al., 1999, 2002; Anda et al., 2006, 2007; Anda et al., 2009, 2010; Brown et al., 2007, 2009; Brown et al., 2010; Chapman et al., 2004, 2011; Corso et al., 2008; Dietz et al., 1999; Dong et al., 2003, 2004; Dong et al., 2005; Dube, Felitti, Dong, Chapman et al., 2003, 2003b; Dube

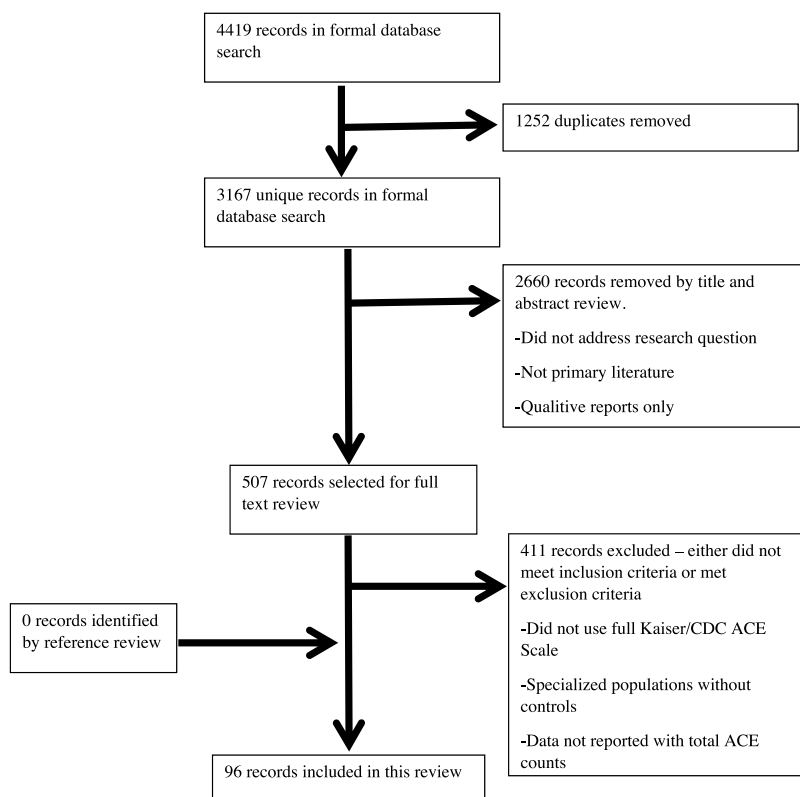


Fig. 2. Flowchart of included studies in a systematic review of the health outcomes associated with the CDC/Kaiser Adverse Childhood Experiences Scale.

et al., 2006, 2009; Felitti et al., 1998; Hillis et al., 2000, 2001; Ports et al., 2016; Strine, Dube et al., 2012, 2012b; Whitfield et al., 2005). Of the included articles, 83 were conducted in the United States, 8 in Europe (Bellis, Hughes, Leckenby, Perkins et al., 2014, 2014b; Bellis et al., 2013; Corcoran et al., 2006; Drevin et al., 2015; Rytälä-Manninen et al., 2014; Sinnott et al., 2015; Skjothaug et al., 2015), 2 in Canada (Christiaens et al., 2015; Reiser et al., 2014), 1 in the Philippines (Ramiro et al., 2010), and 1 in Australia (Mills et al., 2012). Table 1 shows demographic data for included studies. The overall rate of ACEs – the percentage of participants that had at least 1 ACE – in the included studies was 45.5%.

Tables 2 and 3 show the meta-analyses of health outcomes with greater than one study reported odds ratios for the outcome. For unadjusted odds ratios, the outcomes or variables with the most studies included gender ($n = 24$), tobacco use ($n = 13$), alcohol problem ($n = 12$), risky sexual behavior ($n = 11$), and depressed mood ($n = 8$). For adjusted odds ratios, the outcomes or variables with the most studies included tobacco use ($n = 18$), alcohol problem ($n = 18$), depressed mood ($n = 14$), risky sexual behavior ($n = 13$), and illicit drug use ($n = 8$).

There was a graded relationship of females reporting more ACEs than males; at each ACE level, females were more likely to have that many ACEs and that likelihood was higher at higher ACE levels. While non-white race/ethnicity, low education, and low socioeconomic status were all significantly associated with reporting an ACE (compared to not reporting an ACE), the graded relationship at higher levels was not evident. There were far more studies on psychosocial/behavioral health outcomes (14 outcomes, 5 unadjusted and 8 adjusted had greater than 5 studies on them) than medical outcomes (8 adjusted and 11 unadjusted outcomes with no outcome with greater than 5 studies on it).

For psychosocial/behavioral outcomes in both adjusted and unadjusted models, there was a significant association with all psychosocial/behavioral health outcomes except hallucinations with a single ACE. The strongest associations for a single ACE were being an adult victim of violence (unadjusted OR 1.78, 95%CI: 1.40–2.26 and adjusted OR 1.59, 95%CI: 1.21–2.08), illicit drug use (unadjusted OR 1.57, 95%CI: 1.46–1.69 and adjusted OR 1.61, 95%CI: 1.52–1.71), and behavior problems (unadjusted OR 1.45, 95%CI: 1.22–1.72 and adjusted OR 1.90, 95%CI: 1.65–2.19). A clear graded relationship – the more ACEs one has, the higher the OR associated with that negative outcome – was observed for almost all of the psychosocial/behavioral outcomes studied. In the unadjusted OR model, this included tobacco use, alcohol problem, risky sexual behavior, depressed mood, illicit drugs, poor health/quality of life, obesity, behavior problem, psychological distress, suicidal ideation, victim of violence, hallucinations, and panic/anxiety. In the adjusted OR model, this included tobacco use, alcohol problem, depressed mood, risky sexual behavior, illicit drug use, suicide attempt, poor diet, poor health/quality of life, psychological distress, panic/anxiety. Low exercise activity was the only psychosocial/behavioral outcome which did not demonstrate a graded relationship in either model. Being an adult victim of violence and having behavior problems both had adjusted odds ratio of greater than 6 at the highest level of ACEs (8.32 and 6.12,

Table 1

Characteristics of the 96 publications included in a systematic review of health outcomes associated with the CDC/Kaiser Adverse Childhood Experiences Scale.

Characteristics	n (# of studies)
Total included in meta-analysis	96
Year of publication	
< 1990	0
1990–1999	3
2000–2009	22
2010–2016	71
Location of study	
United States	83
England	3
Canada	3
Ireland	2
Finland	1
Norway	1
Sweden	1
Australia	1
Philippines	1
Age of study participants	
Less than 18 years old	12*
Over 18 years old	84**
Newcastle-Ottawa Quality Assessment Scale (possible range 0–9)	
< 4	1
4	6
5	17
6	44
7	22
8	6
Database used	
Healthcare maintenance organization members of Kaiser Permanente primary care clinic	29
Behavioral Risk Factor Surveillance System (BRFSS)	19
National Survey of Children's Health (NSCH)	4
National Epidemiologic Survey on Alcohol and Related Conditions (NESARC)	4
National Survey of Child and Adolescent Well-Being (NSCAW)	1

* One study (Brockie et al., 2015) was done on adolescents aged 15–24.

** One study (Reiser et al., 2014) was done on adults from 17 to 60.

respectively).

For medical outcomes, 5 had a significant association at an ACE level of 1: GI disease, respiratory disease, somatic pain or headache, sleep disturbance, and fracture. In the unadjusted model, memory impairment was significant at an ACE level of 1. With one ACE, in both the adjusted and unadjusted models, respiratory disease was the most strongly associated health outcome (unadjusted OR 1.36, 95%CI: 1.18–1.56 and adjusted OR 1.46, 95%CI: 1.15–1.86). A graded relationship in the unadjusted model was present for respiratory distress, sleep problems, ischemic heart disease, GI disease, somatic pain/headache, and memory impairment. In the adjusted model, a graded relationship was present for respiratory disease and somatic pain/headache. In the adjusted model, at the highest reported ACE level, every outcome except diabetes was significantly associated.

Supplemental Table 2 lists health outcomes with one study on them that reported an odds ratio for each level of ACE and those studies that used other statistics like relative risk and hazard ratio, as these would not fit into the meta-analysis model. There were many more medical outcomes in this group (51 outcomes v. 20 psychosocial/behavioral). Some unique outcomes were measured in this group, including premature mortality (Brown et al., 2009) and prescription drug use (Anda, Brown, Felittie et al., 2008). After adjustment, there appeared to be no association with premature mortality and a mild association with prescription drug amounts. Uniquely, Jimenez et al. (Jimenez et al., 2016) measured teacher reported outcomes compared to parent reported ACEs for children and showed at even 1 ACE exposure a significant association with below average school performance in overall language/literacy, social studies/science, and math but no difference in children not yet able to read books except at the highest ACE exposure level.

Health outcomes where a statistic was not reported by ACE level are shown in Supplemental Table 3. These studies also had a predominance of psychosocial/behavioral outcomes (144 outcomes), however medical (59 outcomes) and even some laboratory outcomes (35 outcomes) were also included. The laboratory outcomes included inflammatory markers (Tietjen et al., 2012), brain size by MRI (Teicher et al., 2012), actual blood pressure measurements (Su et al., 2015), and endothelin levels (Su et al., 2014).

Supplemental Table 4 lists the publications included in this meta-analysis and summarizes the results of the authors' quality assessment. The median quality assessment score was 6 out of 8 (IQR, 5.25–7). Six studies achieved a maximum score of 8 and six studies achieved a score of 4 out of 8. One study achieved a score less than 4, and no studies were removed during the quality scoring stage. The lowest scoring items identified during quality scoring were independent verification of the health outcome (35%, 34/96), prospective or structured interview collection of ACE data (48%, 46/96), and response rates and follow-up (65%, 62/96). Nearly all studies had adequate case (92%, 88/96) and control (100%, 96/96) samples, and had an adequate follow-up or utilized the same

Table 2
Unadjusted odds ratio for adverse childhood experiences and health outcomes by ACE exposure.

	Number of studies*	Unique data sets	1 ACE	95% CI		2 ACEs	95% CI		3 ACEs	95% CI		4+ ACEs	95% CI	
Demographics (referent)														
Gender (male)	24	9	0.94	0.92	0.95	0.89	0.87	0.91	0.79	0.77	0.81	0.76	0.74	0.78
Race (white)	5	4	1.36	1.27	1.47	1.18	1.08	1.30	1.24	1.11	1.39	1.38	1.24	1.52
Education (high)	4	4	1.16	1.11	1.22	1.34	1.23	1.47	1.26	1.14	1.40	1.22	1.17	1.26
Socioeconomic status (high)	5	3	1.22	1.12	1.33	1.30	1.17	1.43	1.59	1.42	1.78	1.80	1.62	2.00
Medical														
Respiratory disease	5	4	1.36	1.18	1.56	1.49	1.27	1.74	1.70	1.42	2.02	2.28	1.95	2.68
Sleep problems	5	4	1.28	1.23	1.35	1.68	1.60	1.77	1.85	1.74	1.96	2.40	2.27	2.52
Diabetes	4	4	1.04	0.87	1.24	0.80	0.62	1.02	1.11	0.86	1.42	1.17	0.91	1.50
Ischemic heart disease	4	3	1.03	0.92	1.15	1.05	0.93	1.20	1.32	1.14	1.54	1.46	0.91	1.50
Gastrointestinal disease	4	3	1.08	0.95	1.23	1.27	1.10	1.47	1.60	1.36	1.89	1.64	1.41	1.90
Somatic pain/headache	4	3	1.22	1.13	1.33	1.61	1.48	1.76	1.79	1.62	1.98	2.55	2.34	2.79
Hypertension	2	2	1.05	0.85	1.29	1.04	0.83	1.31	1.29	1.00	1.66	1.10	0.84	1.44
Stroke	2	2	1.01	0.83	1.22	0.81	0.54	1.25	0.98	0.59	1.62	1.50	0.95	2.36
Cancer	2	2	1.16	0.83	1.63	1.09	0.70	1.70	1.13	0.66	1.92	0.99	0.57	1.72
Fracture	2	2	1.28	1.07	1.53	2.21	1.78	2.75	2.21	1.74	2.81	2.63	2.12	3.25
Memory impairment	2	2	1.34	1.21	1.48	2.22	2.00	2.46	2.77	2.47	3.11	4.89	4.43	5.40
Psychosocial/behavioral														
Tobacco use	13	5	1.23	1.19	1.27	1.45	1.40	1.50	1.65	1.59	1.72	2.11	2.03	2.18
Alcohol problem	12	5	1.39	1.33	1.47	1.92	1.82	2.04	2.11	1.97	2.25	3.16	2.99	3.44
Risky sexual behavior	11	3	1.37	1.29	1.45	1.66	1.56	1.77	1.96	1.82	2.10	2.55	2.39	2.71
Depressed mood	8	4	1.64	1.57	1.72	2.29	2.17	2.41	3.02	2.85	3.20	4.78	4.55	5.03
Illicit drugs	7	3	1.57	1.46	1.69	2.16	2.00	2.33	2.70	2.48	2.94	3.61	3.35	3.89
Poor health/quality of life	5	5	1.43	1.35	1.52	1.61	1.50	1.74	1.69	1.54	1.85	2.58	2.39	2.79
Obesity	5	4	1.27	1.14	1.42	1.46	1.29	1.65	1.64	1.43	1.88	2.08	1.85	2.34
Behavior problem	4	4	1.45	1.22	1.72	2.51	2.11	2.99	2.52	2.08	3.05	4.88	4.17	5.71
Psychological distress	4	4	1.73	1.62	1.86	2.04	1.88	2.21	2.73	2.50	2.98	4.69	4.35	5.05
Suicidal Ideation	5	2	1.73	1.55	1.92	3.16	2.83	3.53	4.08	3.60	4.62	10.48	9.48	11.58
Low exercise	3	2	1.15	1.04	1.28	1.19	1.04	1.35	1.42	1.22	1.64	1.29	1.12	1.50
Violence victim	2	2	1.78	1.40	2.26	2.56	1.99	3.29	3.36	2.57	4.39	6.03	4.83	7.53
Hallucinations	2	1	1.16	0.92	1.45	1.79	1.41	2.26	2.27	1.76	2.93	3.16	2.55	3.93
Panic/Anxiety	2	2	1.79	1.66	1.93	2.13	1.95	2.32	3.02	2.75	3.32	5.22	4.81	5.65

* Studies may be included in more than one health outcome. Some studies had more than one data set. Some studies may have used the same data set for different health outcomes.

method in case and control groups (97%, 93/96).

4. Discussion

Our systematic review identified 96 articles studying health outcomes associated with ACEs as found in the CDC-Kaiser ACE Scale. These articles demonstrated quite a breadth of outcomes that demonstrate correlation with ACE scores, including most major causes of death in US adults (Kochanek, Murphy, Xu, & Arias, 2017) and many psychosocial outcomes related to mental illness and poor health outcomes. The diversity of these outcomes demonstrates the large effect ACEs may have on every child and adult who experience them, making ACEs relevant to many fields. All professionals, including physicians, social workers, psychologists, and educators, working with persons who have experienced ACEs should be aware of ACEs' impacts and consider screening for them. The graded relationships shown by the gradual increase in the unadjusted and adjusted ORs for several of the outcomes demonstrates the potential cumulative effect of ACEs, adding validity to the idea that knowing if someone has experienced adversity or trauma is not enough. Their risks for poor health outcomes can be greatly increased based on just how much they have suffered during their childhood. Even more importantly, this data supports the need for secondary prevention interventions – those interventions which would protect children from additional ACEs after they screen positive for even just one.

Our review supports the notion that early identification of ACEs could identify those at risk for both negative psychosocial/behavioral and medical outcomes. While the diversity of these potentially negative outcomes stirs interest in several professional fields serving both children and adults, the primary care pediatric office is the ideal location for early identification of ACEs. Before school age, medicine is the only human service sector with consistent contact with most families. Bethell et al. recommend asking questions about ACEs as part of a conversation that includes families' strengths and children's resilience (Bethell et al., 2017). However, there is limited data on what successful interventions to employ once ACEs are identified in adults or children. Further research is needed to identify the best interventions to which to refer such families, as well as funding for such programs. Our current systems likely do not have the capacity for the level of interventions that will be needed.

Theory would support that resiliency interventions would be helpful, and these have been piloted (Chandler, Roberts, & Chiodo, 2015) and groups formed to support them (Combating Adverse Childhood Experiences Through Resilience Based Interventions, 2017;

Table 3
Adjusted odds ratio for adverse childhood experiences and health outcomes by ACE exposure.

	Number of studies*	Unique data sets		1 ACE		2 ACEs		3 ACEs		4 + ACEs		Highest amount of ACEs**						
				95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI						
Demographic																		
Socioeconomic status (low)	3	3	3	1.26	1.05	1.53	1.56	1.27	1.91	1.71	1.38	2.12	2.05	1.57	2.69	2.24	1.83	2.74
Medical																		
Ischemic heart disease	4	3	3	.88	0.69	1.13	1.60	1.22	2.10	2.48	2.58	2.38	2.30	1.49	3.55	6.62	5.26	8.34
Gastrointestinal disease	3	2	3	1.18	1.08	1.29	1.53	1.37	1.72	1.60	1.43	1.79	1.50	1.18	1.90	2.92	2.62	3.27
Respiratory disease	3	3	3	1.46	1.15	1.86	1.55	1.23	1.97	2.44	1.80	3.32	2.60	1.33	5.10	3.58	2.59	4.93
Stroke	3	3	3	1.01	0.75	1.34	1.50	.90	2.50	1.19	.76	1.87	2.00	0.89	4.50	2.02	1.34	3.04
Diabetes	3	3	3	1.02	0.84	1.24	0.79	.62	1.01	1.12	0.81	1.56	0.80	0.46	1.40	1.27	0.93	1.75
Somatic pain/headache	4	2	3	1.23	1.16	1.32	1.59	1.44	1.75	1.72	1.56	1.89	2.00	1.74	2.30	2.38	2.15	2.64
Sleep disturbance	3	3	3	1.23	1.15	1.32	1.62	1.53	1.71	1.74	1.59	1.91	1.56	1.20	2.03	2.10	1.89	2.35
Fracture	2	2	2	1.11	1.02	1.21	1.41	1.24	1.59	1.20	1.03	1.40	NR*	1.20	2.03	1.86	1.54	2.25
Psychosocial/behavioral																		
Tobacco use	18	4	4	1.24	1.20	1.26	1.43	1.39	1.47	1.62	1.56	1.68	1.90	1.81	2.00	2.25	2.17	2.34
Alcohol problem	18	5	5	1.46	1.40	1.53	1.89	1.82	1.98	2.99	2.80	3.20	4.31	3.90	4.76	4.86	4.54	5.20
Depressed mood	14	5	5	1.42	1.33	1.51	2.28	2.14	2.43	2.44	2.23	2.66	3.16	2.81	3.54	4.37	3.99	4.80
Risky sexual behavior	13	3	3	1.36	1.31	1.41	1.71	1.65	1.78	2.18	2.07	2.29	2.79	2.57	3.04	3.57	3.40	3.75
Illicit drug use	8	3	3	1.61	1.52	1.71	2.44	2.28	2.62	2.95	2.71	3.21	3.66	3.27	4.09	5.41	5.01	5.85
Suicide attempt	6	2	2	1.57	1.37	1.80	2.19	1.88	2.55	3.43	2.92	4.02	7.30	4.33	12.3	6.30	5.46	7.27
Poor diet	6	4	4	1.23	1.12	1.36	1.37	1.21	1.55	1.44	1.25	1.66	NR*	1.88	1.88	1.88	1.69	2.09
Behavior problem	6	5	5	1.90	1.65	2.19	2.76	2.39	3.20	2.52	2.06	3.09	2.00	1.74	2.30	6.12	5.34	7.01
Poor health/quality of life	5	5	5	1.32	1.20	1.46	1.61	1.43	1.79	1.87	1.62	2.16	2.67	2.00	3.55	2.79	2.47	3.15
Violence victim	3	2	2	1.59	1.21	2.08	3.60	2.81	4.60	2.69	1.87	3.87	5.04	2.70	9.40	8.32	6.73	10.28
Psychological distress	3	3	3	1.23	1.07	1.41	1.59	1.41	1.80	1.65	1.41	1.94	5.60	3.20	9.80	2.50	2.23	2.81
Panic/Anxiety	3	3	3	1.27	1.16	1.39	1.72	1.59	1.85	1.94	1.72	2.20	6.80	4.13	11.20	2.72	2.46	3.00
Hallucinations	2	2	2	1.05	0.84	1.32	1.54	1.23	1.93	1.86	1.42	2.42	1.50	0.98	2.30	3.15	2.39	4.16
Low exercise	2	2	2	1.18	1.03	1.35	1.15	1.00	1.33	1.29	1.08	1.53	0.90	0.58	1.40	1.22	1.02	1.45

* Studies may be included in more than one health outcome. Some studies had more than one data set. Some studies may have used the same data set for different health outcomes.
 ** This number is the highest reported ACE level in each study. The actual number varied in each study.

Resilience Trumps ACEs, 2017). One proposed intervention would be parenting interventions to teach about decreasing the incidence of ACEs and how to help children cope with them. Another proposed intervention is mindfulness. Mindfulness has shown to be effective in reducing symptoms of anxiety, depression, and post-traumatic stress in adults and youth, as well as improving behavior and somatic symptoms in youth (Ortiz & Sibinga, 2017). However, these interventions require more research in order to assess their long-term effects on improving health outcomes once these youth reach adulthood. Several models have been developed to address ACEs from a biopsychosocial model. Health Outcomes From Positive Experiences (HOPE) provides a framework of positive childhood experiences and health outcomes to ideally combat ACEs (Sege & Harper Browne, 2017). The Safe Environment for Every Kid (SEEK) Model promotes provider education on screening for psychosocial stressors and linking families with community resources in the hopes of preventing further ACEs (Dubowitz, Feigelman, Lane, & Jeongeun, 2009). Taking these initiatives one step further, there are several communities in the U.S. working to institute cross-sector change to address ACEs (Ellis & Dietz, 2017; Jones, Reidy, Hargreaves, & Rog, 2017). These organizations are instituting small changes in community culture and are spreading ACE-awareness, with goals of addressing primary, secondary, and tertiary prevention of ACEs. However, they are still far from directly reaching all children. Screening for ACEs at annual well child visits could directly impact children today by generating conversations with families and making appropriate referrals.

The original CDC-Kaiser ACE study was performed in a limited population that was 79.8% White, 43.4% college graduates (Felitti et al., 1998). However, this review included a heterogeneous group of study populations – from nine different countries and in various settings – which supports the reproducibility of the original CDC-Kaiser ACE Scale results in different populations. The most commonly studied outcomes were psychosocial/behavioral, and included tobacco use, alcohol use, depressed mood, and risky sexual behavior. One potential explanation for the high ORs associated with psychosocial/behavioral outcomes, and the lower, but still persistently increasing, ORs associated with medical outcomes, is a mediating or interrelatedness effect. Psychosocial/behavioral outcomes like smoking, drinking, and depression are known to be associated with poor medical outcomes (Ockene & Miller, 1997; Raine, Haines, & Sensky, 2002; Ronksley, Brien, Turner, Mukamal, & Ghali, 2011). A prominent example of this might be that respiratory disease was the strongest associated outcome at many ACE levels. This could be related to either parental or child tobacco use (as evidenced by the relationship to this in our psychosocial/behavioral outcomes). The role of mediating effects was beyond the scope of this project, and some work has shown mediating effects of behaviors on ACEs and medical outcomes (Messersmith, 2013; Walsh & Cawthon, 2014). Future work should continue to investigate this and determine whether there is a unique association between ACEs and medical outcomes or whether this association is wholly a result of the psychosocial/behavioral outcomes.

4.1. Limitations

The CDC-Kaiser scale has been previously shown to have good test-retest reliability (Dube, Williams, Thompson, & Anda, 2004; Pinto, Correia, & Maia, 2014) and this study adds validity evidence that ACEs are associated with multiple health outcomes. However, many of the included studies were done retrospectively, which opens them to response bias. In other words, there is a possibility that patients who remember ACEs as an adult were affected by them differently than those who may have had them occur but do not remember them. Only 12 studies in our sample were done in children (Balistreri & Alvira-Hammond, 2016; Balistreri, 2015; Baron-Lee et al., 2015; Bright et al., 2015; Brockie et al., 2015; Burke et al., 2011; Clarkson Freeman, 2014; Duke et al., 2010; Jimenez et al., 2016; Ryttilä-Manninen et al., 2014; Su et al., 2014, 2015). Since children have had less time to develop effects from their trauma, it is difficult to compare their data alongside that of adults. However, given the limited number of studies conducted in children, that data was not analyzed separately in this meta-analysis.

Validity evidence for the use of the scale in children is limited, as it was developed for an adult sample. Some of the studies in our sample queried parents on their child's experiences to potentially combat this issue (Clarkson Freeman, 2014; Jimenez et al., 2016). However, that adds another potential source of error. Parents may not be aware of all of the adversity their children have faced, especially when considering abuse. Furthermore, parents may be afraid to answer all of the questions truthfully, again considering abuse. They may fear they will be reported to social services if they report a history of child abuse. This raises the concern that studies which use parental responses may be under-reporting ACEs. Nadine Burke Harris, et al. have also called for further research on validating screening questions for children (Burke Harris, Silverio Marques, Oh, Bucci, & Cloutier, 2017). Despite the concerns about using the scale in children, those studies who surveyed children were not excluded, given the importance of including data from the target population affected by ACEs.

Our review has several additional limitations. Our analysis assumed that each individual ACE had the potential to contribute equally to poor health outcomes. Analyzing the effects of individual ACEs, and potentially demonstrating a larger impact of one ACE compared to another, was beyond the scope of this review, but certainly highlights a future target for research. There is always the potential of missing potentially germane articles; however, we attempted to mitigate this by searching multiple databases, using an established protocol a priori, the use of trained and independent reviewers, and checking references of included articles and systematic reviews identified. Our study is also limited by the data and quality of the original studies. We attempted to reach authors for data, but it was often unavailable or we did not receive a response. Given the breadth of our topic, not all relevant data were reported in a way that could be summarized easily. Similarly, a large number of publications included in this review drew data from the same database; however, our analysis minimized this effect. In addition, our analysis was limited by the heterogeneity of outcomes included, limiting our ability to analyze between-study heterogeneity with measures such as I-squared. Finally, again given the breadth of the topic, our systematic review and meta-analysis is naturally reductionist in nature. That is, there is a minute, but true difference between many of the categories we summarized into our outcomes (e.g. binge drinking, history of alcoholism, and current heavy drinking are different but were combined into the category of "alcohol problem"). Also, there are many scales to measure adverse

childhood experience Bernstein, Fink, Handelsman, and Foote (1994), Sanders and Becker-Lausen (1995), and our study focused only on the CDC-Kaiser scale. While a majority of the data in our study is from the original Kaiser data set, even within our study, minute differences in wording were found (i.e., Behavioral Risk Factor Surveillance Survey), though we determined that this was unlikely to affect responses and outcomes. Nevertheless, we believe this was an important topic to review and summarize.

5. Conclusion

Our systematic review identified 96 articles assessing the association between the CDC-Kaiser ACE scale and health outcomes. Quite often, the association showed a graded response to the number of ACEs to which a child was exposed. This review supports the existing literature associating ACEs with poor health outcomes, summarizing the diversity of outcomes that have been studied thus far – from biological effects and increased risks of the leading causes of death in the US to poor school performance and increased rates of risky behaviors. It supports the need for pediatricians to screen for ACEs, highlighting the importance of future work to identify interventions to prevent ACEs and to intervene on those exposed to ACEs when they are identified. Furthermore, our review establishes the limitations of using retrospective data and surveying parents of children potentially experiencing ACEs, further highlighting the need for validating the CDC-Kaiser ACE scale in children.

Contributions

Kaitlyn Petruccelli: Dr. Petruccelli conceptualized the study, reviewed all titles and abstracts and the selected full text articles, abstracted the included articles, and drafted the manuscript.

Joshua Davis: Dr. Davis conceptualized the study, reviewed all titles and abstracts and the selected full text articles, abstracted the included articles, analyzed the data, and drafted the manuscript. Dr. Davis had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis

Tara Berman: Dr. Berman approved of the search process, supervised data collection, and critically reviewed the final manuscript.

Declaration of Competing Interest

None.

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All authors are listed in the byline with their contributions outlined below. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work. No funding was sought for this study.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.chiabu.2019.104127>.

References

- About adverse Childhood Experiences (2016). *About adverse childhood experiences*. Centers for Disease Control and Prevention. Updated April 1, 2016. Accessed October 10, 2017 https://www.cdc.gov/violenceprevention/acestudy/about_ace.html.
- Adverse Childhood Experience Resources (2016). *Adverse childhood experience resources*. Centers for Disease Control and Prevention. Updated April 1, 2016. Accessed October 10, 2017 <https://www.cdc.gov/violenceprevention/acestudy/resources.html>.
- Anda, R. F., Croft, J. B., Felitti, V. J., Nordenberg, D., Giles, W. H., Williamson, D. F., et al. (1999). Adverse childhood experiences and smoking during adolescence and adulthood. *Journal of the American Medical Association*, 282(17), 1652–1658.
- Anda, R. F., Chapman, D. P., Felitti, V. J., Chapman, D., Edwards, V. J., & Dube, S. R. (2002). Adverse childhood experiences and risk of paternity in teen pregnancy. *Obstetrics and Gynecology*, 100(1), 37–45.
- Anda, R. F., Felitti, V. J., Bremner, J. D., Walker, K. D., Whitfield, C., & Perry, B. D. (2006). The enduring effects of abuse and related adverse experiences in childhood: A convergence of evidence from neurobiology and epidemiology. *European Archives of Psychiatry and Clinical Neuroscience*, 256(3), 174–186.
- Anda, R. F., Brown, D. W., Felitti, V. J., Bremner, J. D., Dube, S. R., & Giles, W. H. (2007). Adverse childhood experiences and prescribed psychotropic medications in adults. *American Journal of Preventive Medicine*, 32(5), 389–394.
- Anda, R. F., Brown, D. W., Dube, S. R., Bremner, J. D., Felitti, V. J., & Giles, W. H. (2008). Adverse childhood experiences and chronic obstructive pulmonary disease in adults. *American Journal of Preventive Medicine*, 34(5), 396–403.
- Anda, R. F., Brown, D. W., Felitti, V. J., Dube, S. R., & Giles, W. H. (2008). Adverse childhood experiences and prescription drug use in a cohort study of adult HMO patients. *BMC Public Health*, 8, 198.
- Anda, R. F., Dong, M., Brown, D. W., Felitti, V. J., Giles, W. H., & Perry, G. H. (2009). The relationship of adverse childhood experiences to a history of premature death of family members. *BMC Public Health*, 9, 106.
- Anda, R., Tietjen, G., Schulman, E., Felitti, V., & Croft, J. (2010). Adverse childhood experiences and frequent headaches in adults. *Headache*, 50(9), 1473–1481.
- Anderson, J. P., & Blossnich, J. (2013). Disparities in adverse childhood experiences among sexual minority and heterosexual adults: Results from a multi-state probability-based sample. *PLoS One*, 8(1), e54691.
- Austin, A., Herrick, H., & Proescholdbell, S. (2016). Adverse childhood experiences related to poor adult health among lesbian, gay, and bisexual individuals. *American Journal of Public Health*, 106(2), 314–320.
- Austin, A., Herrick, H., Proescholdbell, S., & Simmons, J. (2016). Disability and exposure to high levels of adverse childhood experiences: Effect on health and risk

- behavior. *North Carolina Medical Journal*, 77(1), 30–36.
- Balistreri, K. S. (2015). Adverse childhood experiences, the medical home, and child well-being. *Maternal and Child Health Journal*, 19(11), 2492–2500.
- Balistreri, K. S., & Alvira-Hammond, M. (2016). Adverse childhood experiences, family functioning and adolescent health and emotional well-being. *Public Health*, 132, 72–78.
- Baron-Lee, J., Bonner, B., Knapp, C., Bright, M., & Hinojosa, M. (2015). Factors associated with having a medical home for children at-risk of experiencing negative events: Results from a national study. *Maternal and Child Health Journal*, 19, 2233–2242.
- Bellis, M. A., Lowey, H., Leckenby, N., Hughes, K., & Harrison, D. (2013). Adverse childhood experiences: Retrospective study to determine their impact on adult health behaviors and health outcomes in a UK population. *Journal of Public Health*, 36(1), 81–91.
- Bellis, M. A., Hughes, K., Leckenby, N., Perkins, C., & Lowey, H. (2014). National household survey of adverse childhood experiences and their relationship with resilience to health-harming behaviors in England. *BMC Medicine*, 12, 72.
- Bellis, M. A., Hughes, K., Leckenby, N., Hardcastle, K. A., Perkins, C., & Lowey, H. (2014). Measuring mortality and the burden of adult disease associated with adverse childhood experiences in England: A national survey. *J Pub Health*, 37(3), 445–454.
- Bernstein, D. P., Fink, L., Handelsman, L., & Foote, J. (1994). Initial reliability and validity of a new retrospective measure of child abuse and neglect. *The American Journal of Psychiatry*, 151(8), 1132–1136.
- Bethell, C. D., Carle, A., Hudziak, J., Gombojav, N., Powers, K., Wade, R., et al. (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(7, Supplement), S51–69.
- Blosnich, J. R., & Andersen, J. P. (2015). Thursday's child: The role of adverse childhood experiences in explaining mental health disparities among lesbian, gay, and bisexual U.S. adults. *Social Psychiatry and Psychiatric Epidemiology*, 50(2), 335–338.
- Blosnich, J. R., Dichter, M. E., Cerulli, C., Batten, S. V., & Bossarte, R. M. (2014). Disparities in adverse childhood experiences among individuals with a history of military service. *JAMA Psychiatry*, 71(9), 1041–1048.
- Bright, M. A., Alford, S. M., Hinojosa, M. S., Knapp, C., & Fernaandez-Baca, D. E. (2015). Adverse childhood experiences and dental health in children and adolescents. *Community Dentistry and Oral Epidemiology*, 43(3), 193–199.
- Brockie, T. N., Dana-Sacco, G., Wallen, G. R., Wilcox, H. C., & Campbell, J. C. (2015). The relationship of adverse childhood experiences to PTSD, depression, poly-drug use and suicide attempt in reservation-based Native American adolescents and young adults. *American Journal of Community Psychology*, 55(3–4), 411–421.
- Brown, D. W., Anda, R. F., Edwards, V. J., Felitti, V. J., Dube, S. R., & Giles, W. H. (2007). Adverse childhood experiences and childhood autobiographical memory disturbance. *Child Abuse & Neglect*, 31(9), 961–969.
- Brown, D. W., Anda, R. F., Tiemeier, H., Felitti, V. J., Edwards, C. J., & Croft, J. G. (2009). Adverse childhood experiences and the risk of premature mortality. *American Journal of Preventive Medicine*, 37(5), 389–396.
- Brown, D. W., Anda, R. F., Felitti, V. J., Edwards, V. J., Malarcher, A. M., & Croft, J. B. (2010). Adverse childhood experiences are associated with the risk of lung cancer: A prospective cohort study. *BMC Public Health*, 10, 20.
- Brown, M. J., Masho, S. W., Perera, R. A., Mezuk, B., & Cohen, S. A. (2015). Sex and sexual orientation disparities in adverse childhood experiences and early age at sexual debut in the United States: Results from a national representative sample. *Child Abuse & Neglect*, 46, 89–102.
- Brown, M. J., Perera, R. A., Masho, S. W., Mezuk, B., & Cohen, S. A. (2015). Adverse childhood experiences and intimate partner aggression in the US: Sex differences and similarities in psychosocial mediation. *Social Science & Medicine*, 131, 48–57.
- Bruskas, D., & Tessin, D. H. (2013). Adverse childhood experiences and psychosocial well-being of women who were in foster care as children. *The Permanente Journal*, 17(3), e131–141.
- Bublitz, M. H., & Stroud, L. R. (2013). Maternal history of child abuse moderates the association between daily stress and diurnal cortisol in pregnancy: A pilot study. *Stress*, 16(6), 706–710.
- Bublitz, M. H., Parade, S., & Stroud, L. R. (2014). The effects of childhood sexual abuse on cortisol trajectories in pregnancy are moderated by current family functioning. *Biological Psychology*, 103, 152–157.
- Burke, N. J., Hellman, J. L., Scott, B. G., Weems, C. F., & Carrion, V. G. (2011). The impact of adverse childhood experiences on an urban pediatric population. *Child Abuse & Neglect*, 35(6), 408–413.
- Burke Harris, N., Silverio Marques, S., Oh, D., Bucci, M., & Cloutier, M. (2017). Prevent, screen, heal: Collective action to fight the toxic effects of early life adversity. *Academic Pediatrics*, 17(7, Supplement), S14–15.
- Cavanaugh, C. E., Petras, H., & Martins, S. S. (2015). Gender-specific profiles of adverse childhood experiences, past year mental and substance use disorders, and their associations among a national sample of adults in the United States. *Social Psychiatry and Psychiatric Epidemiology*, 50(8), 1257–1266.
- Chandler, G. E., Roberts, S. J., & Chiodo, L. (2015). Resilience intervention for young adults with adverse childhood experiences. *Journal of the American Psychiatric Nurses Association*, 21(6), 406–416.
- Chapman, D. P., Whiffeld, C. L., Felitti, V. J., Dube, S. R., Edwards, V. J., & Anda, R. F. (2004). Adverse childhood experiences and the risk of depressive disorders in adulthood. *Journal of Affective Disorders*, 82(2), 217–225.
- Chapman, D. P., Wheaton, A. G., Anda, R. F., Croft, J. B., Edwards, V. J., & Yong, L. (2011). Adverse childhood experiences and sleep disturbances in adults. *Sleep Medicine*, 12(8), 773–779.
- Chapman, D. P., Liu, Y., Presley-Cantrell, L. R., Wdwards, V. J., Wheaton, A. G., & Petty, G. C. (2013). Adverse childhood experiences and frequent insufficient sleep in 5 U.S. states, 2009: A retrospective cohort study. *BMC Public Health*, 13, 3.
- 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, 454–464.
- Christiaens, I., Hegadoren, K., & Olson, D. M. (2015). Adverse childhood experiences are associated with spontaneous preterm birth: A case-control study. *BMC Medicine*, 13, 124.
- Clarkson Freeman, P. A. (2014). Prevalence and relationship between adverse childhood experiences and child behavior among young children. *Infant Mental Health Journal*, 35(6), 544–554.
- Combating Adverse Childhood Experiences Through Resilience Based Interventions (2017). *Combating adverse childhood experiences through resilience based interventions*. Urban Childhood Institute. Updated 2017. Accessed October 10, 2017 <http://www.urbanchildinstitute.org/resources/videos/combating-adverse-childhood-experiences-through-resilience-based-interventions>.
- Corcoran, P., Gallagher, J., Keeley, H. S., Arensman, E., & Perry, I. J. (2006). Adverse childhood experiences and lifetime suicide ideation: A cross-sectional study in a non-psychiatric hospital setting. *Irish Medical Journal*, 99(2), 42–45.
- Corso, P. S., Edwards, V. J., Fang, X., & Mercy, J. (2008). Health-related quality of life among adults who experienced maltreatment during childhood. *American Journal of Public Health*, 98(6), 1094–1100.
- Cronholm, P. F., Forke, C. M., Wade, R., Bair Merritt, M., Davis, M., & Harkins-Schwarz, M. (2015). Adverse childhood experiences: Expanding the concept of adversity. *American Journal of Preventive Medicine*, 49, 354–361.
- Cunningham, T. J., Ford, E. S., Croft, J. B., Merrick, M. T., Rolle, I. V., & Giles, W. H. (2014). Sex-specific relationships between adverse childhood experiences and chronic obstructive pulmonary disease in five states. *International Journal of Chronic Obstructive Pulmonary Disease*, 9, 1033–1043.
- Deeks, J. J., Dinnes, J., D'Amico, R., et al. (2003). Evaluating non-randomised intervention studies. *Health Technology Assessment*, 7(27), 1–123.
- Dietz, P. M., Spitz, A. M., Anda, R. F., Williamson, D. F., McMahon, P. M., & Santelli, J. S. (1999). Unintended pregnancy among adult women exposed to abuse or household dysfunction during their childhood. *Journal of the American Medical Association*, 282(14), 1359–1364.
- Dong, M., Dube, S. R., Felitti, V. J., Giles, W. H., & Anda, R. F. (2003). Adverse childhood experiences and self-reported liver disease. *Archives of Internal Medicine*, 163(16), 1949–1956.
- Dong, M., Giles, W. H., Felitti, V. J., Dube, S. R., Williams, J. E., & Chapman, D. P. (2004). Insights into causal pathways for ischemic heart disease. *Circulation*, 110(13), 1761–1766.
- Dong, M., Anda, R. F., Felitti, V. J., Williamson, D. F., Dube, S. R., & Brown, D. W. (2005). Childhood residential mobility and multiple health risks during adolescence

- and adulthood. *Archives of Pediatrics and Adolescent Medicine*, 159, 1104–1110.
- Drevin, J., Stern, J., Annerback, E.-M., Peterson, M., Butler, S., & Tyden, T. (2015). Adverse childhood experiences influence development of pain during pregnancy. *Acta Obstetrica et Gynecologica Scandinavica*, 94(8), 840–846.
- Dube, S. R., Felitti, V. J., Dong, M., Chapman, D. P., Giles, W. H., & Anda, R. F. (2003). Childhood abuse, neglect, and household dysfunction and the risk of illicit drug use: The adverse childhood experiences study. *Pediatrics*, 111(3), 564–572.
- Dube, S. R., Felitti, V. J., Dong, M., Giles, W. H., & Anda, R. F. (2003). The impact of adverse childhood experiences on health problems: Evidence from four birth cohorts dating back to 1900. *Preventive Medicine*, 37(3), 268–277.
- Dube, S. R., Williams, D. F., Thompson, T., & Anda, R. F. (2004). Assessing the reliability of retrospective reports of adverse childhood experiences among adult HMO members attending a primary care clinic. *Child Abuse & Neglect*, 28(7), 729–737.
- Dube, S. R., Miller, J. W., Brown, D. W., Giles, W. H., Felitti, V. J., & Dong, M. (2006). Adverse childhood experiences and the association with ever using alcohol and initiating alcohol use during adolescence. *The Journal of Adolescent Health*, 38(4), 444e1–444e10.
- Dube, S. R., Fairweather, D., Pearson, W. S., Felitti, V. J., Anda, R. F., & Croft, J. B. (2009). Cumulative childhood stress and autoimmune diseases in adults. *Psychosomatic Medicine*, 71(2), 243–250.
- Dubowitz, H., Feigelman, S., Lane, W., & Jeongeun, K. (2009). Pediatric primary care to help prevent child maltreatment: The safe environment for every kid (SEEK) model. *Pediatrics*, 123(3), 858–864.
- Duke, N. N., Pettingell, S. L., McMorris, B. J., & Borowsky, I. W. (2010). Adolescent violence perpetration: Associations with multiple types of adverse childhood experiences. *Pediatrics*, 125(4), e778–e786.
- Ellis, W. R., & Dietz, W. H. (2017). A new framework for addressing adverse childhood and community experiences: The building community resilience model. *Academic Pediatrics*, 17(7, Supplement), S86–93.
- Exley, D., Norman, A., & Hyland, M. (2015). Adverse childhood experience and asthma onset: A systematic review. *European Respiratory*, 24(136), 299–305.
- Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., et al. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. *American Journal of Preventive Medicine*, 14(4), 245–258.
- Ford, E. S., Anda, R. F., Edwards, V. J., Petty, G. S., Zhao, G., & Li, C. (2011). Adverse childhood experiences and smoking status in five states. *Preventive Medicine*, 53(3), 188–193.
- Frankenberger, D., Clements-Nolle, K., & Yang, W. (2015). The association between adverse childhood experiences and alcohol use during pregnancy in a representative sample of adult women. *Women's Health Issues*, 25(6), 688–695.
- Gilbert, L. K., Breiding, M. J., Merrick, M. T., Thompson, W. W., Ford, D. C., & Dhingra, S. S. (2015). Childhood adversity and adult chronic disease: an update from ten states and the District of Columbia, 2010. *American Journal of Preventive Medicine*, 48(3), 345–349.
- Hillis, S. D., Anda, R. F., Felitti, V. J., Nordenberg, D., & Marchbanks, P. A. (2000). Adverse childhood experiences and sexually transmitted diseases in men and women: A retrospective study. *Pediatrics*, 106(1), E11.
- Hillis, S. D., Anda, R. F., Felitti, V. J., & Marchbanks, P. A. (2001). Adverse childhood experiences and sexual risk behaviors in women: A retrospective cohort study. *Family Planning Perspectives*, 33(5), 206–211.
- Hostinar, C. E., Lachman, M. E., Mroczek, D. K., Seeman, T. E., & Miller, G. E. (2015). Additive contributions of childhood adversity and recent stressor to inflammation at midlife: Findings from the MIDUS study. *Developmental Psychology*, 51(11), 1630–1644.
- Huang, H., Yan, P., Shan, Z., Chen, S., Li, M., & Luo, C. (2015). Adverse childhood experiences and risk of type 2 diabetes: A systematic review and meta-analysis. *Metabolism*, 64(11), 1408–1418.
- Jacobs, M. B., Boynton-Jarrett, R. D., & Harville, E. W. (2015). Adverse childhood experiences, fertility difficulties, and menstrual cycle characteristics. *Journal of Psychosomatic Obstetrics and Gynaecology*, 36(2), 46–57.
- Jimenez, M. E., Wade, R., Lin, Y., Morrow, L. M., & Reichman, N. E. (2016). Adverse experiences in early childhood and kindergarten outcomes. *Pediatrics*, 137(2), e20151839.
- Jones, J., Reidy, M. C., Hargreaves, M., & Rog, D. (2017). Translating brain science research into community-level change. *Academic Pediatrics*, 17(7, Supplement), S24–25.
- Kajepeta, S., Gelaye, B., Jackson, C. L., & Williams, M. A. (2015). Adverse childhood experiences are associated with adult sleep disorders: A systematic review. *Sleep Medicine*, 16(3), 320–330.
- 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.
- Kalmakis, K. A., Meyer, J. S., Chiodo, L., & Leung, K. (2015). Adverse childhood experiences and chronic hypothalamic-pituitary-adrenal activity. *Stress*, 18(4), 446–450.
- Kochanek, K. D., Murphy, S. L., Xu, J., & Arias, E. (2017). *Mortality in the United States, 2016. NCHS data brief*. 293.
- Liu, Y., Croft, J. B., Chapman, D. P., et al. (2013). Relationship between adverse childhood experiences and unemployment among adults from five US states. *Social Psychiatry and Psychiatric Epidemiology*, 48(3), 357–369.
- Logan-Greene, P., Green, S., Nurius, P. S., & Longhu, D. (2014). Distinct contributions of adverse childhood experiences and resilience resources: A cohort analysis of adult physical and mental health. *Social Work in Health Care*, 53(8), 776–797.
- Mair, C., Cunradi, C. B., & Todd, M. (2012). Adverse childhood experiences and intimate partner violence: Testing psychosocial mediational pathways among couples. *Annals of Epidemiology*, 22(12), 832–839.
- Mantel, N., & Haenzel, W. (1959). Statistical aspects of the analysis of data from retrospective studies of disease. *Journal of the National Cancer Institute*, 22(4), 719–748.
- McCall-Hosenfeld, J., Winter, M., Heeren, T., & Liebschutz, J. M. (2014). The association of interpersonal trauma with somatic symptom severity in a primary care population with chronic pain: Exploring the role of gender and the mental health sequelae of trauma. *Journal of Psychosomatic Research*, 77(3), 196–204.
- McCauley, H. L., Blossnich, J. R., & Dichter, M. E. (2015). Adverse childhood experiences and adult health outcomes among veteran and non-veteran women. *Journal of Women's Health*, 24(9), 723–729.
- Messersmith, A. (2013). *Smoking mediates the relationship between adverse childhood experiences and chronic obstructive pulmonary disease in the BRFSS data*. Thesis. Available at: http://jdc.jefferson.edu/cgi/viewcontent.cgi?article=1089&context=mpchapstone_presentation.
- Mills, V., Van Hoof, M., Baur, J., & McFarlane, A. C. (2012). Predictors of mental health service utilization in a non-treatment seeking epidemiological sample of Australian adults. *Community Mental Health Journal*, 48(4), 511–521.
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, 151(4), W65–94.
- Montgomery, A. E., Cutliff, J. J., Evans-Chase, M., Treglia, D., & Culhane, D. P. (2013). Relationship among adverse childhood experiences, history of active military service, and adult outcomes: Homelessness, mental health, and physical health. *American Journal of Public Health*, 103(Suppl 2), S262–S268.
- Murphy, A., Steele, M., Dube, S. R., Bate, J., Bonuck, K., & Meissner, P. (2014). Adverse Childhood Experiences (ACEs) questionnaire and Adult Attachment Interview (AAI): Implication for parent-child relationships. *Child Abuse & Neglect*, 38(2), 224–233.
- Nurius, P. S., Logan-Greene, P., & Green, S. (2012). ACEs within a social disadvantage framework: Distinguishing unique, cumulative, and moderate contributions to adult mental health. *Journal of Prevention & Intervention in the Community*, 40(4), 278–290.
- Nurius, P. S., Green, S., Logan-Greene, P., & Borja, S. (2015). Life course pathways of adverse childhood experiences toward adult psychological well-being: A stress process analysis. *Child Abuse & Neglect*, 45, 143–153.
- O'Malley, D. M., Randell, K. A., & Dowd, M. D. (2016). Family adversity and resilience measures in pediatric acute care settings. *Public Health Nursing*, 33(1), 3–10.
- Ockene, I. S., & Miller, N. H. (1997). Cigarette smoking, cardiovascular disease, and stroke: A statement for healthcare professionals from the American Heart Association. American Heart Association Task Force on Risk Reduction. *Circulation*, 96(9), 3243–3247.
- Ortiz, R., & Sibinga, E. M. (2017). The role of mindfulness in reducing the adverse effects of childhood stress and trauma. McClafferty H, ed. *Children*, 4(3), 16.
- Pinto, R., Correia, L., & Maia, A. (2014). Assessing the reliability of retrospective reports of adverse childhood experiences among adolescents with documented

- childhood maltreatment. *Journal of Family Violence*, 29(4), 431–438.
- Ports, K. A., Ford, D. C., & Merrick, M. T. (2016). Adverse childhood experiences and sexual victimization in adulthood. *Child Abuse & Neglect*, 51, 313–322.
- Raine, R., Haines, A., Sensky, T., et al. (2002). Systematic review of mental health interventions for patients with common somatic symptoms: can research evidence from secondary care be extrapolated to primary care? *BMJ*, 325, 1082.
- Ramiro, L. S., Madrid, B. J., & Brown, D. W. (2010). Adverse childhood experiences (ACE) and health-risk behaviors among adults in a developing country setting. *Child Abuse & Neglect*, 34(11), 842–855.
- Raposo, S., Mackenzie, C. S., Henriksen, C. A., & Affif, T. O. (2014). Time does not heal all wounds: Older adults who experienced childhood adversities have higher odds of mood, anxiety, and personality disorders. *The American Journal of Geriatric Psychiatry*, 22(11), 1241–1250.
- Reiser, S. J., McMillan, K. A., Wright, K. D., & Asmundson, G. J. G. (2014). Adverse childhood experiences and health anxiety in adulthood. *Child Abuse & Neglect*, 38(3), 407–413.
- Remigo-Baker, R. A., Hayes, D. K., & Reyes-Salvail, F. (2014). Adverse childhood events and current depressive symptoms among women in Hawaii: 2010 BRFFSS, Hawaii. *Maternal and Child Health Journal*, 18(10), 2300–2308.
- Remigo-Baker, R. A., Hayes, D. K., & Reyes-Salvail, F. (2015). Adverse childhood events are related to the prevalence of asthma and chronic obstructive pulmonary disorder among adult women in Hawaii. *Lung*, 193(6), 885–891.
- Resilience Trumps ACEs (2017). Resilience trumps ACEs. Community resilience initiative. Updated 2017. Accessed October 10, 2017** <https://resiliencetrumpsaces.org>.
- Ronksley, P. E., Brien, S. E., Turner, B. J., Mukamal, K. J., & Ghali, W. A. (2011). Association of alcohol consumption with selected cardiovascular disease outcomes: A systematic review and meta-analysis. *BMJ*, 342, d671.
- Rytälä-Manninen, M., Lindberg, N., Haravuori, H., Kettunen, K., Marttunen, M., & Joukama, M. (2014). Adverse childhood experiences as risk factors for serious mental disorders and inpatient hospitalization among adolescents. *Child Abuse & Neglect*, 38(12), 2021–2032.
- Sacco, K. A., George, T. P., Vessicchio, J. C., Easton, C. J., & Prigerson, H. G. (2007). Adverse childhood experiences, smoking and mental illness in adulthood: A preliminary study. *Annals of Clinical Psychiatry*, 19(2), 88–97.
- Salinas-Miranda, A. A., Salemi, J. L., King, L. M., Baldwin, J. A., Berry, E., & Austin, D. A. (2015). Adverse childhood experiences and health-related quality of life in adulthood: Revelations from a community needs assessment. *Health and Quality of Life Outcomes*, 13, 123.
- Sanders, B., & Becker-Lausen, E. (1995). The measurement of psychosocial maltreatment: Early data on the child abuse and trauma scale. *Child Abuse & Neglect*, 19(3), 315–323.
- Schüssler-Fiorenza Rose, S. M., Xie, D., & Stineman, M. (2014). Adverse childhood experiences and disability in US adults. *P M R*, 6(8), 670–680.
- Sege, R. D., & Harper Browne, C. (2017). Responding to ACEs with HOPE: Health outcomes from positive experiences. *Academic Pediatrics*, 17(7, Supplement), S79–S85.
- Sinnot, C., McHugh, S., Fitzgerald, A. P., Bradley, C. P., & Kearney, P. M. (2015). Psychosocial complexity in multimorbidity: the legacy of adverse childhood experiences. *Family Practice*, 32(3), 269–275.
- Skjothaug, T., Smith, L., Wentzel-Larsen, T., & Moe, V. (2015). Prospective fathers' adverse childhood experiences, pregnancy-related anxiety, and depression during pregnancy. *Infant Mental Health Journal*, 36(1), 104–113.
- Strine, T. W., Dube, S. R., Edwards, V. J., Witt Prehn, A., Rasmussen, S., & Wagenfeld, M. (2012). Associations between adverse childhood experiences, psychological distress, and adult alcohol problems. *American Journal of Health Behavior*, 36(3), 408–423.
- Strine, T. W., Edwards, V. J., Dube, S. R., Wagenfeld, M., Dhingra, S., & Witt Prehn, A. (2012). The mediating sex-specific effect of psychological distress on the relationship between adverse childhood experiences and current smoking among adults. *Substance Abuse Treatment, Prevention, and Policy*, 7, 30.
- Su, S., Wang, X., Kapuku, G. K., Treiber, F. A., Pollock, D. M., & Harshfield, G. A. (2014). Adverse childhood experiences are associated with detrimental hemodynamics and elevated circulating endothelin-1 in adolescents and young adults RR. *Hypertension*, 64(1), 201–207.
- Su, S., Wang, X., Polluck, D. M., Treiber, F. A., Xu, X., & Snieder, H. (2015). Adverse childhood experiences and blood pressure trajectories from childhood to young adulthood: The Georgia Stress and Heart Study. *Circulation*, 131(19), 1674–1681.
- Teicher, M. H., Anderson, C. M., & Polcari, A. (2012). Childhood maltreatment is associated with reduced volume in the hippocampal subfields CA3, dentate gyrus, and subiculum. *PNAS*, 109(9), e563–572.
- Thompson, P., & Jaque, S. V. (2015). Posttraumatic stress disorder and psychopathology in dancers. *Medical Problems of Performing Artists*, 30(3), 157–162.
- Tietjen, G. E., Khubchandani, J., Herial, N. A., & Shah, K. (2012). Adverse childhood experiences are associated with migraine and vascular biomarkers. *Headache*, 52(6), 920–929.
- Vander Weg, M. W. (2011). Adverse childhood experiences and cigarette smoking: The 2009 Arkansas and Louisiana behavioral risk factor surveillance systems. *Nicotine & Tobacco Research*, 13(7), 616–622.
- Walsh, E. G., & Cawthon, S. W. (2014). The mediating role of depressive symptoms in the relationship between adverse childhood experiences and smoking. *Addictive Behaviors*, 39(10), 1471–1476.
- Wells, G. A., Shea, B., O'Connell, D., Peterson, J., Welch, V., & Losos, M. (2009). *The Newcastle-Ottawa Scale (NOS) for assessing the quality if nonrandomized studies in meta-analyses*. Published October 19, 2009. Accessed October 10, 2017 http://www.ohri.ca/programs/clinical_epidemiology/oxford.html.
- Whitaker, R. C., Dearth-Wesley, T., Gooze, R. A., Becker, B. D., Gallagher, K. C., & McEwen, B. S. (2014). Adverse childhood experiences, dispositional mindfulness, and adult health. *Preventive Medicine*, 67, 147–153.
- Whitfield, C. L., Dube, S. R., Felitti, V. J., & Anda, R. F. (2005). Adverse childhood experiences and hallucinations. *Child Abuse & Neglect*, 29(7), 797–810.
- Ye, D., & Reyes-Salvail, F. (2014). Adverse childhood experiences among Hawaii adults: Findings from the 2010 Behavioral Risk Factor Survey. *Hawai'i Journal of Medicine & Public Health*, 73(6), 181–190 June.
- Yeoman, K., Safraneck, T., Buss, B., Cadwell, B. L., & Mannino, D. (2013). Adverse childhood experiences and adult smoking, Nebraska 2011. *Preventing Chronic Disease*, 10, 130009.