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The association of adverse childhood experiences and its subtypes with adulthood sleep problems: A systematic review and meta-analysis of cohort studies

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ABSTRACT

Adverse childhood experience (ACE) is a powerful risk factor for long-term sleep health. However, the degree to which ACE and its subtypes contribute to adulthood sleep problems remains unknown. For this systematic review and meta-analysis, PubMed, Embase, Web of Sciences, Cochrane library, and CNKI (Chinese) were searched from inception to 1 December 2021. Cohort studies that examined the association between ACEs (aged <18 y) and adulthood sleep outcomes (aged ≥18 y) were included. The most fully adjusted odds ratios (ORs) were extracted and pooled using the random-effects model. A total of nine articles involving 108 330 participants from five high-income countries were identified. Individuals with at least one ACE subtype were more likely to report adulthood sleep problems (OR = 1.14, 1.09–1.20, $I^2 = 77.5\%$, $n = 9$ studies) compared with those without ACE. The pooled ORs were approximately 1.20 for sexual, physical, and emotional abuse with high heterogeneity ($I^2 > 80\%$), 1.09 (95% CI: 0.99–1.19, $I^2 = 0\%$, $n = 2$) for neglect, and 1.21 (95% CI: 1.14–1.30, $I^2 = 73.6\%$, $n = 3$) for family dysfunction. Individuals with multiple ACEs were associated with a higher magnitude of the risk for sleep problems (OR = 1.33, 95% CI: 1.18–1.49, $I^2 = 87.3\%$, $n = 3$). In conclusion, the magnitude of the risk for sleep problems was similar across ACE subtypes except for childhood neglect. ACE may have cumulative detrime ntal effects on sleep health. More longitudinal evidence regarding ACE-sleep relationships, particularly in low- and middle-income countries, is needed. Furthermore, more policy efforts and evidence-based preventions are warranted to address ACEs among children.

1. Introduction

Adverse childhood experiences (ACEs), or named as childhood adversities are typically defined as traumatic events that occur in childhood and adolescence (0–17 years), including abuse, neglect, and various forms of family dysfunction [1]. A systematic review that included 96 articles from 1990 to 2015 indicated that the prevalence of ACE in some countries has increased at an alarming rate worldwide [2]. It was reported that over 60% of American adults experienced at least one ACE subtype, and 16.7% experienced multiple ACEs [2]. In China, about 30% of children ever suffered child maltreatment [3]. A large body of researches have suggested that ACEs were strongly associated with a range of unfavorable health outcomes, including substance abuse, obesity, diabetes, cardiovascular diseases, cancers, depression, and suicide attempt [4–6].

Sleep health is essential for preventing some adverse health consequences, including cardiovascular diseases, psychological disorders, and neurodegenerative diseases [7]. Emerging studies have indicated that individuals who ever experienced ACEs tended to have sleep disorders and disturbances during adulthood [8,9]. The excessive psychological distresses resulting from ACEs place children in an unsafe and lonely growth environment and further exacerbate sleep problems via the dysfunction of circadian rhythm [10]. A previous systematic review including 28 cross-sectional and two prospective cohort studies gave a qualitative description that the majority of included studies documented a significant association between ACEs and sleep apnea, narcolepsy, nightmare

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distress, and sleep paralysis. However, the magnitude of sleep problems risk associated with ACEs remains unexplored, particularly based on longitudinal evidence [8]. Moreover, the included studies were published before 2013 [8], an updated systematic review and meta-analysis to quantify the association between ACEs and sleep problems was needed. Additionally, the association between ACE subtypes and sleep problems is still conflicting. A prebirth cohort recruiting young Australian pregnant women who attended their first obstetric visit reported that only physical abuse (0–14 years) was significantly related to sleep quality (21 years), while other subtypes of ACEs were not [11]. However, another large cohort study of US women indicated that all ACEs subtypes were significantly associated with insufficient sleep, sleep apnea, and restless sleep [12]. Therefore, this systematic review and meta-analysis was performed to quantify the association between ACEs and adulthood sleep problems and clarify the potential variation resulting from ACE subtypes.

2. Methods

This systematic review and meta-analysis was conducted following the updated PRISMA reporting guidelines (2020) [13] and registered with the PROSPERO (CRD42021293785).

2.1. Search strategy and selection criteria

This review was a sub-project of a systematic review and meta-analysis regarding the association between ACEs and lifestyles. The search strategies were designed based on ACE and lifestyles (sleep, physical activity, diet, smoking, drinking) initially. Of which, sleep health was of particular research interest, and studies that related to sleep were selected for this meta-analysis separately. We designed search strategy based on the Medical subject headings (MeSH) and synonyms. The search terms for “adverse childhood experience” were Adverse Childhood Experiences [MeSH], Child Abuse [MeSH], child adversity, child trauma, child maltreatment, and child neglect; for “sleep” were Sleep [MeSH], Dyssomnias [Mesh], Sleep Hygiene [Mesh], insomnia, somnolence, sleep duration, and sleep quality; for “cohort study” were Cohort Studies [MeSH], cohort, longitudinal, and follow-up. PubMed, Embase, Web of Sciences, Cochrane library, and Chinese National Knowledge Infrastructure (CNKI) were searched from inception to 1 December 2021 without language restriction. Search strategies were tailored according to databases with the guidance of an experienced medical librarian. Search results excluded systematic review, meta-analysis, or other types of review and were filtered by human studies. Additionally, we supplemented search results with handed searching of references from selected studies and a previous related systematic review [8].

Cohort studies that reported the association between ACE (<18 years) and adulthood sleep outcomes (≥18 years) were included. Of which, studies that provided the odds ratios (ORs) or relative risks (RRs) and corresponding 95% confidence interval (CI) or provided the data that permitted OR calculation were included for meta-analysis. Articles that were not peer-reviewed were also excluded. Two authors (Yu HJ and Liu XX) independently screened the title and abstract, with definite or possible studies forwarded to full-text review to assess whether they met inclusion criteria. The discrepancy about inclusion was resolved by group discussion or consultation with the senior author. Final inclusion was determined based on the agreement from at least two authors.

2.2. Data extraction and synthesis

Study characteristics (first author, year, country, cohort name, study design), participants' characteristics (sample size, sex, age, and population source), ACEs (definition, subtypes, and measurement period and methods), and sleep outcomes (definition, subtypes, and measurement methods, ORs/RRs, and confounding factors) were extracted and checked by two authors (Yu HJ and Liu XX) using a customized form. Five main ACE subtypes, including sexual abuse, physical abuse, emotional abuse, neglect, and family dysfunction, were extracted. ACE measurement methods were categorized as prospective way including objective records and questionnaires during childhood and retrospective way including the recall of ACEs at adulthood. Multiple sleep outcomes were categorized into sleep deficiency focusing on short sleep duration and poor sleep quality including insomnia, difficulty to fall asleep, sleep apnea, waking too early, restless sleep, sleep snoring, etc.

We also conducted quality assessment using the Newcastle Ottawa Scale (NOS) independently [14]. NOS comprises three dimensions: 1) selection, four items (0–4 scores) assessing the representativeness of participants and exposure measurement; 2) comparability, one item (0–2 scores) assessing the comparability of cohorts based on study design and analysis; 3) outcome, there items (0–3 scores) assessing the outcome measurement and adequacy of follow-up. A study with NOS ≥5 was defined with moderate to good quality [15].

2.3. Statistical analysis

The most fully adjusted ORs and corresponding 95% CI were extracted for meta-analysis. The prevalence ratio was directly regarded as OR, the coefficient was converted to OR using *exp* (coefficient) [16]. RR was converted to OR when the incidence in the non-exposed group (P_{Ref}) was over 10% using the following formula: $RR = OR/(1-P_{Ref}+P_{Ref}*OR)$ [17]. A certain ACE subtype or sleep outcome itself also included multiple narrow dimensions that were pooled by the fix-effects model ahead. The pooled RR with 95% CI for the risk of sleep problems among individuals with at least one ACE, different ACE subtypes, accumulative ACEs were calculated using the random-effects model (DerSimonian and Laird). I^2 statistics of 25%, 50%, and 75% were used to determine low, medium, and high heterogeneity [18]. Publication bias was tested using *Egger's* test and funnel plots when at least ten ORs were available [19]. Subgroup analysis was conducted by ACE measurement methods (prospective/retrospective) and sleep outcomes (deficiency/poor-quality) when at least three ORs were available.

Sensitivity analysis was performed using the leave-one-out method or excluding studies with NOS <5. The leave-one-out method was conducted by recalculating the pooled ORs of remaining studies after omitting one study [20], which was commonly used to test the robustness of pooled estimates. All statistical analyses were used R software (Version 4.0.3) with “metafor” and “meta” packages. A two-tailed p-value < 0.05 was considered of statistical significance.

3. Results

3.1. Literature research

A total of nine articles [11,12,21–27] met the inclusion criteria (Fig. 1). All of them provided the OR of sleep problems for at least one ACE subtype, five for sexual abuse, five for physical abuse, three for emotional abuse, two for neglect, four for family dysfunction, and three for multiple ACE subtypes.

3.2. Study characteristics

Table 1 displays the study characteristics and participants'

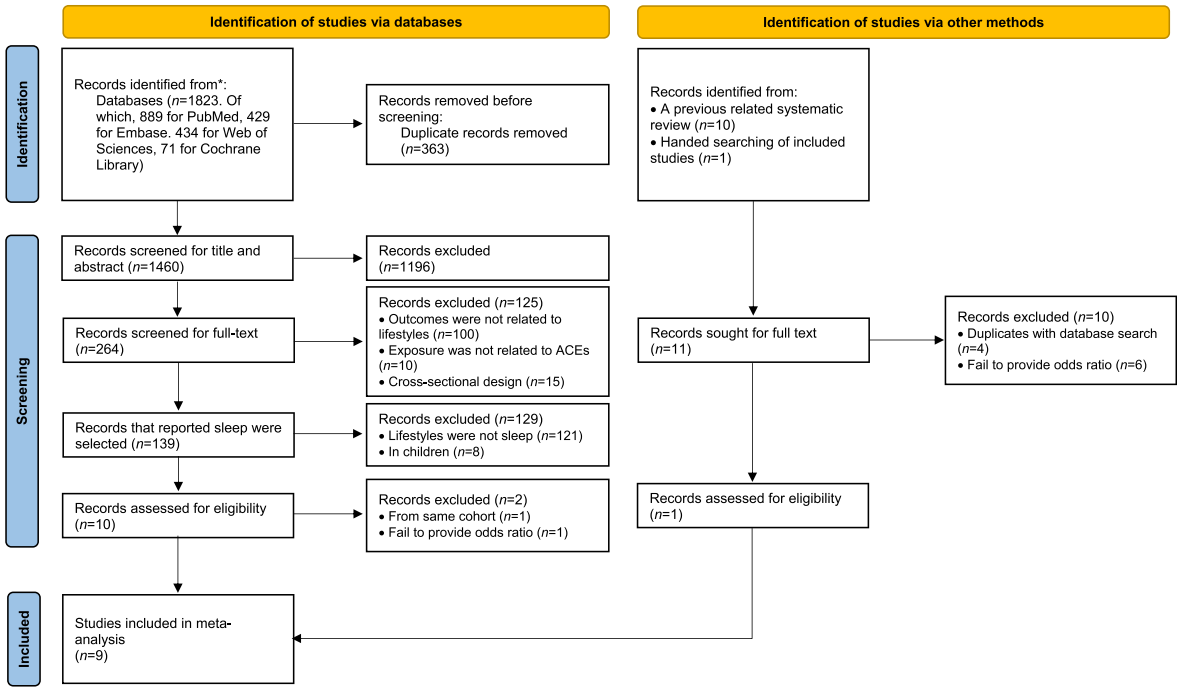


Fig. 1. Literature research and study selection.

Table 1
The study characteristics of included studies.

Author	Year	Country	Cohort name	Study design	Sample size	Sex	Age	Population
Abajobir, A. A.	2017	Australia	Mater-University of Queensland Study of Pregnancy (MUSP), birth cohort	Prospective (From birth to 21 y)	3778	56.2% Female	21 y	A consecutive sample of all women presenting and first obstetric visit
Boynton-Jarrett, R.	2021	America	Black Women's Health Study (BWHS)	Prospective (2005–2009)	29 988	100% Female	21-69 y	Black women recruited largely through the Essence magazine subscriber list and friends and relatives of early respondents
Chapman, D. P.	2013	America	Behavioral Risk Factor Surveillance Survey (BRFSS)	Retrospective	25 810	63.8% Female	over 18 y	Non-institutionalized U.S. adults aged 18 years and older.
Deschênes, S·S.	2021	England	Whitehall II cohort study	Prospective (2001–2012–2013)	5610	28.3% Female	mean 55.5 y	British civil servants without coronary heart disease at wave 5 (1997–1999)
Gregory, A. M.	2006	New Zealand	Dunedin Multidisciplinary Health and Development Study	Prospective (From birth to 18 y)	1037	48% Female	18 y	Children at age 3 y from cohort families that are primarily white and represent the full range of socioeconomic level in the general population.
Javakhishvili, M.	2021	America	NA	Prospective (1967–1971 to 2009–2010)	649	46.1% Female	mean 47.0 y	Children with documented cases of maltreatment (physical and sexual abuse and neglect) and a comparison group of children matched on the basis of age, sex, race/ethnicity, and approximate family social class.
Lin, H. H. S.	2018	America	The Study of Women's Health Across the Nation (SWAN)	Prospective (2002–2003 to 2004–2005)	338	100% Female	mean 52.4 y	Women with at least one menstrual period in the previous 3 months, not currently using exogenous hormones, no surgical removal of the uterus and/or both ovaries, not pregnant, and not breastfeeding.
McWhorter, K. L.	2019	America	The Sister Study	Prospective (2003–2009)	40 082	100% Female	35-74 y	Women never diagnosed with breast cancer but who had a sister (full or half) diagnosed with breast cancer.
Talvitie, E.	2019	Finland	Young Finns Study	Prospective (1980–2007)	1038	57.4% Female	mean 37.2 y	Children were randomly selected from the national social security register

characteristics. The nine included articles were published between 2013 and 2021, involving 108 330 participants from five high-income countries: America ($n = 5$), Australia ($n = 1$), England ($n = 1$), Finland ($n = 1$), and New Zealand ($n = 1$). Of which, one [22] was the retrospective design and eight [11,12,21,23–26,28] were the prospective design, respectively. Four articles only included females or had a stratified analysis of sex. The mean age of five included articles was over 45 years. For ACE assessment (Table S1), two [11,25] used the court or state-wide child protection records, two [24,28] adopted questionnaires completed by one parent, the other five collected questionnaires completed by participants themselves [12,21–23,26]. For sleep problems assessment (Table S1), one [11] used the Pittsburgh Sleep Quality Index (PSQI), two [24,25] adopted the Diagnostic Interview Schedule (DIS), one [28] used the Jenkins sleep scale (JSS), the other five articles [12,21–23,26] used the self-administrated questions completed by self-report. Three articles [22,23,25] reported sleep deficiency, three [11,24,26] reported poor sleep quality, and the other three

[12,21,28] reported both as sleep outcomes. Seven of nine articles were assessed with moderate to high quality (NOS ≥5) (Table S2). The Cronbach's Alpha between two authors was 0.84.

3.3. ACE and risk of sleep problems

Individuals with at least one ACE subtype were likely to report a higher risk of sleep problems (pooled OR = 1.14, 95% CI: 1.09–1.20, I^2 = 77.5%, *p*-value<0.001, *k* = 12 ORs from nine articles) compared with those without ACE (Fig. 2A). The pooled ORs of sleep problems associated with childhood sexual, physical, and emotional abuse were approximately 1.20 with high heterogeneity (I^2>80%). Likewise, the magnitude of pooled OR for family dysfunction was the same but with a medium heterogeneity (I^2 = 73.6%), while it was lower for neglect (1.09, 95% CI: 0.99–1.19, *p*-value = 0.969, *k* = 3 from two articles) (Fig. 2B). For multiple ACEs (Fig. 2C), individuals with at least two ACE subtypes tended to have a higher magnitude of pooled OR of sleep problems (1.33, 95% CI: 1.18–1.49, I^2 = 87.3%, *p*-value<0.001, *k* = 5 ORs from three articles).

The subgroup analysis (Table 2) by ACE measurement methods (prospective/retrospective) for at least one ACE subtype indicated that the magnitude of the pooled OR between prospective (OR = 1.11) and retrospective (or = 1.15) ACEs was similar (*p*-value = 0.684), while it was non-significant for the association between prospectively assessed ACEs and sleep problems (OR = 1.11, 95% CI: 0.96–1.30). The subgroup analysis of sleep problems (deficiency/poor quality) for at least one ACE subtype indicated individuals with at least one ACE subtype had a higher magnitude for the risk of sleep quality (pooled OR = 1.21, 95% CI: 1.12–1.31, I^2 = 78.5%, *p*-value<0.001, *k* = 6 ORs from five articles) than sleep deficiency (pooled OR = 1.09, 95% CI: 1.04–1.15, I^2 = 47.6%, *p*-value = 0.089, *k* = 6 ORs from six articles). For sexual and physical abuse, the magnitude of pooled ORs between different ACE measurement methods and between different sleep outcomes was similar. The pooled ORs for emotional abuse, neglect, and family dysfunction were not calculated because the number of ORs (*k*) was <3.

3.4. Sensitivity analysis

The leave-one-out analysis (Table S3) indicated the OR of sleep quality from the study of McWhorter, K. L. et al. [12] contributed the highest heterogeneity in the association of at least one ACE subtype, physical abuse, sexual and abuse with sleep problems. The OR of sleep deficiency from the study of McWhorter, K. L. et al. [12] showed a dominance of heterogeneity for emotional abuse with I^2 decreased from 81.0% to 0%, pooled OR (95% CI) increased from 1.20 (1.08–1.33) to 1.27 (1.23–1.31), and family dysfunction with I^2 decreased from 73.6% to 19.4%, the pooled OR (95% CI) increased slightly from 1.21 (1.14–1.30) to 1.24 (1.91–1.30). Additionally, we also conducted a sensitivity analysis that excluded studies with NOS <5 for the association between at least one ACE subtype and sleep problems, the pooled OR was similar and I^2 increased from 77.5% to 81.0%.

3.5. Publication bias

The assessment of publication bias was only conducted for the association between at least one ACE subtype and sleep problems due to the limitation of No. of ORs. *Egger's* test shows no evidence of substantial publication bias (*p*-value = 0.953). The funnel plot indicates that three studies [11,23,26] have a small-study effect.

4. Discussion

This is the first meta-analysis to summarize the association of ACE and its subtypes with sleep problems. The findings indicated that individuals with at least one ACE subtype and multiple ACE subtypes were associated with a 14% and 33% elevated risk of adulthood sleep problems, respectively. Furthermore, no evidence indicates that the risk of sleep problems varied across ACE subtypes except for neglect.

Compared with the previous related systematic review [8], although we confirmed similar findings that ACEs were associated with adulthood sleep problems, our study with a more comprehensive search strategy extended the prior work to quantify their associations using the meta-analysis method. This meta-analysis further found that the magnitude of the association between different ACE subtypes and sleep problems was similar and identified a cumulative effect of multiple ACEs on sleep problems.

Our meta-analysis observed that individuals with a single sexual abuse, physical abuse, emotional abuse, or family dysfunction were similarly associated with about 20% of increased risk of sleep problems compared with those without any ACE. The pooled OR of sleep problems related to a single ACE subtype (OR >1.2) was similar to some other adulthood health outcomes, including obesity [29], diabetes [5], and cancers [6]. Aligned with these studies, there is no apparent difference in the magnitude of the pooled OR across ACE subtypes regardless of health outcomes. Of which, neglect was an outlier. Both our study and the review of Danes et al. found that the association between neglect and multiple health outcomes was non-significant [29], while the review of Huang et al. indicated that the influence of neglect was the most prominent ACE subtype [5]. However, existing meta-analyses on the influence of neglect on sleep and other health outcomes were based on a small number of included studies. Given that neglect is the most prevalent ACE subtype [3,30], more investigations focusing on the relationship between childhood neglect and sleep problems are required.

The finding of our meta-analysis also indicated that individuals with multiple ACEs were associated with a 33% of elevated risk of sleep problems. Likewise, the cumulative effect of ACEs has been also observed in its association with other health outcomes, including asthma, cardiovascular diseases, and mental health problems [31,32]. The potential reason might be that the ACE subtypes were interrelated with each other. A retrospective cohort study involving over 17 thousand participants reported that childhood sexual abuse was strongly associated with multiple ACE subtypes [33]. Similarly, another large cross-sectional study involving over eight thousand participants reported that the co-occurrence among ACE subtypes was evident with 87% of individuals experiencing two or more ACEs [34]. These findings suggest that work to emphasize a certain single ACE subtype among children who suffered multiple ACEs might achieve less effect [4]. Therefore, multidisciplinary prevention might be one promising strategy to promote early intervention among parents and children.

Differ from the previous related systematic review [8], our meta-analysis only included cohort studies, which eliminated the possibility of causation reversion. Among included studies, four assessed ACEs using prospective methods, including records from courts or state-wide child protection authorities [11,25], or consecutive questionnaires in childhood and adolescence completed by one parent [24,28], the other five included studies assessed ACEs by self-report. The subgroup analysis by study design indicated that the relationship between ACEs and sleep problems was significant in prospective cohort studies but non-significant in retrospective cohort studies. A review reported that the agreement

of ACE assessment between retrospective and prospective was unoptimistic (*Cohen* $\kappa = 0.19$), about 52% of individuals with childhood maltreatment observed prospectively failed to report it retrospectively [35]. That means individuals with ACEs identified by prospective and retrospective measurements may be substantially different [35]. Therefore, it was recommended that assess the ACE using more objective methods, including childhood records or consecutive surveys to improve its reliability.

The findings of this review have some important implications for clinical practice and public health issues. Accumulative studies have proposed that trauma-associated sleep disorder (TSD) was a unique parasomnia [36,37]. The trauma in initial clinical TSD includes war, maritime disasters, sexual trauma, and burn and does not limit the period of trauma occurrence [37], ACEs may have some overlapped trauma subtypes to clinical TSD symptoms. Our review provides more evidence on the classification of TSD, but further investigations are required to examine whether the consideration of ACEs during the therapy process of sleep disorders will achieve more favorable effects. Some economic and diseases burden analyses reported that estimated economic costs accounted for 1.1%–6.0% of nations' gross domestic products in European countries [38], a 10% reduction in ACE prevalence approximately saved 3 million disability-adjusted life-years (DALYs) or 105 billion [39]. ACE is an early driver of poor physical and mental health, which links sleep problems via some pathways, including the cortisol regulation and stress coping ability [4]. Currently, the prevention of non-communicable diseases predominantly addressed many "proximal" factors, including lifestyles modification, advertisement, and pricing [4]. These findings suggested that the prevention strategies considering multiple ACEs and intervention pathways linking ACEs to reduce disease risk might be a priority to achieve more health and finical benefits for public health.

Several limitations of this meta-analysis should be noted. In general, the high heterogeneity and a small number of included studies reduce the reliability of the findings of our meta-analysis, and no definite definition of sleep problems leads to the finding being difficult to apply in the clinical prevention of specific sleep disorders. The inclusion criterion of peer-reviewed cohort studies might miss some unpublished data related to the ACE-sleep association, which was also likely to cause publication bias. However, given the high prevalence of ACEs [2,3], more evidence was required to improve sleep health among children/adolescents with trauma experiences. As for included studies, i) the assessments of ACEs and sleep problems were almost based on self-report, recall bias was thereby inevitable [35]. Moreover, the assessment questionnaires for ACEs were diverse, including Childhood Trauma Questionnaire (CTQ), Conflict Tactics Scale (CTS), and some self-administrated questions. Additionally, although all studies assessed ACE during childhood and/or adolescence, which however did not consider the exposure length. It was observed that intermittent ACEs were associated with a higher risk of behavior problems that chronic ACEs [40]. For sleep outcomes, although sleep deficiency was mainly defined by sleep duration, some studies reported ≤6 h/day, ≤7 h/day, and 14 days of feeling not get enough sleep in one month. Similarly, poor sleep quality was diverse, including sleep restlessness, difficulty to fall asleep, and waking up too early. The questionnaires for assessing sleep outcomes were also different, including the PSQI, DIS, JSS, and some self-administrated questions. In view of measurement methods of ACEs and sleep outcomes varied a lot by study, a greater standardization in future investigations for assessing the longitudinal association between ACEs and sleep problems is needed [4]. ii) Participants' socioeconomic characteristics, environmental risk, and genetic variation across different studies are likely to cause bias in the association between ACEs and sleep problems. Additionally, the included studies were conducted in high-income countries. Many youths in low- and middle-income countries are of higher possibility of exposure to privation and war-related violence [41]. Hence, the generalizability of our findings to the global context is limited and the evidence from low-income countries is warranted.

In summary, this review indicates ACEs are associated with a significantly elevated risk of sleep problems, and exposure to multiple ACEs is associated with accumulative harmful effects on sleep health. However, there are similar effects of sexual, physical, and emotional abuse and family dysfunction on sleep problems. More longitudinal evidence regarding the association between ACE and sleep problems, particularly in low- and middle-income countries is needed. These findings highlight that more policy efforts and evidence-based prevention are warranted to address ACEs among children to promote their sleep health.

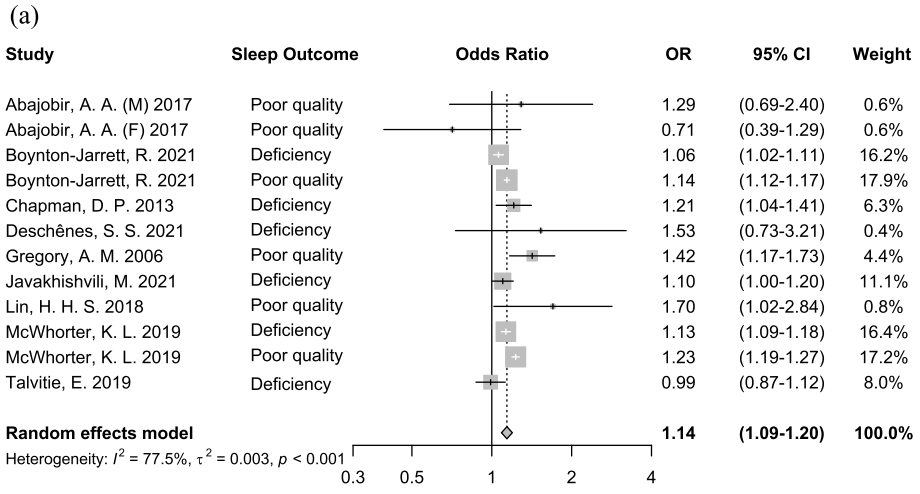
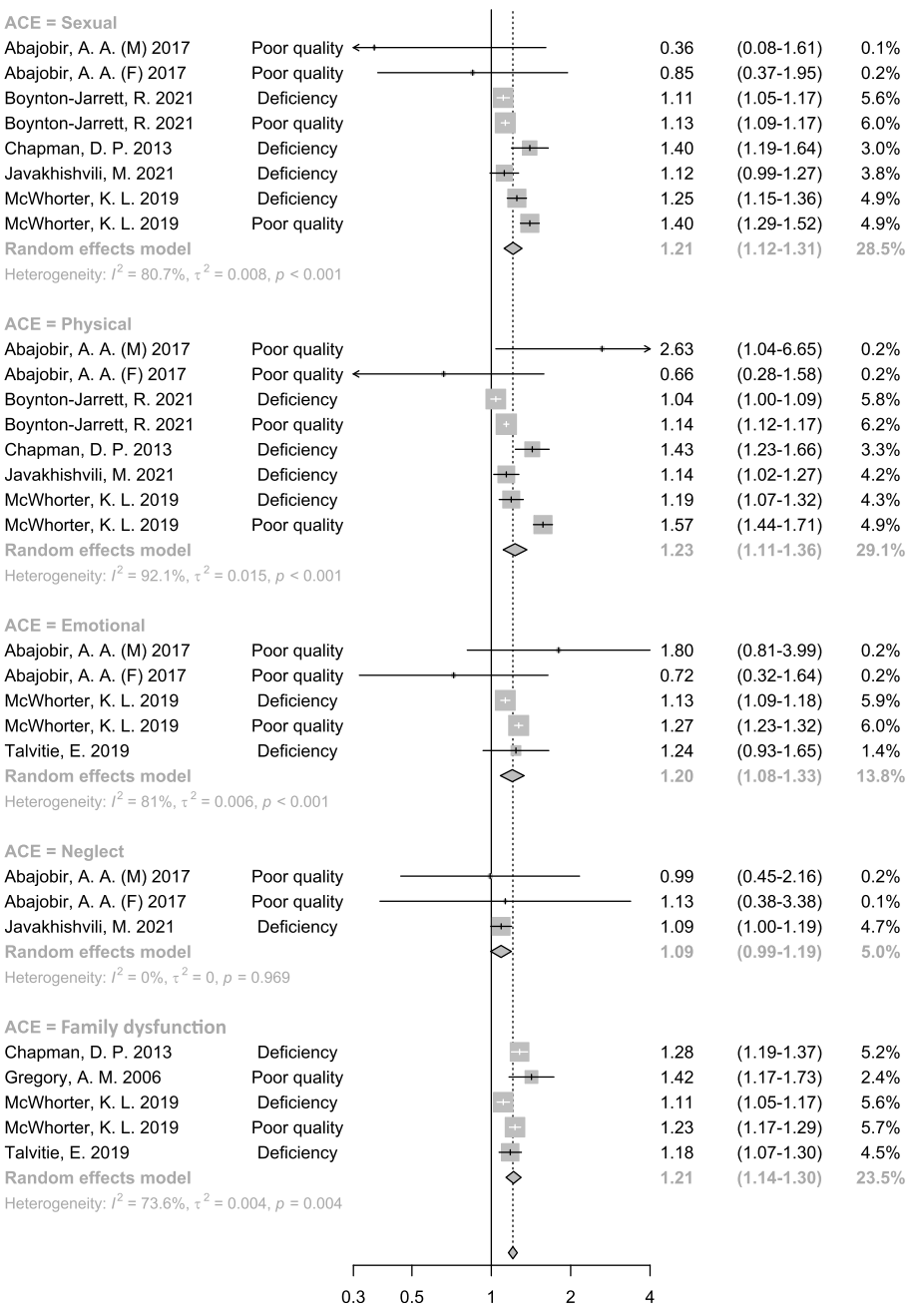


Fig. 2. The pooled odds ratios of sleep problems according to ACE numbers and subtypes. **A**: At least one ACE subtype vs. none ACE; **B**: ACE subtypes vs. none ACE; **C**: multiple ACEs vs. none ACE
Note: ACE, adverse childhood experience; OR: odds ratio; (F), female; (M), male.

(b)



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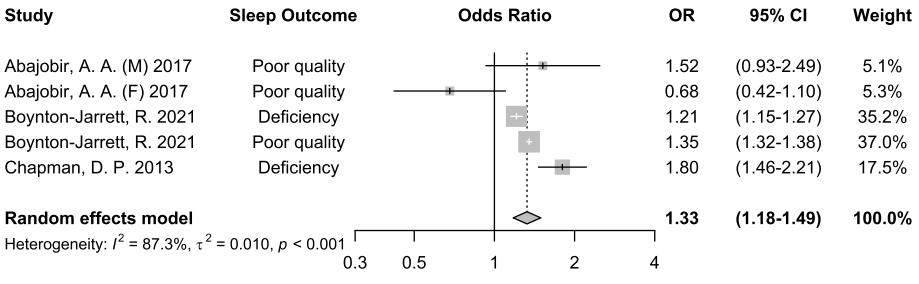

Fig. 2. (*continued*).

Table 2
The subgroup analysis of pooled odds ratio regarding the association between ACE and sleep problems by ACE measurement methods and sleep outcomes.

By ACE measurement	k^a	n^b	OR (95% CI)	I^2, p-value[c]	p-value[d]	By sleep outcomes	k^a	n^b	OR (95% CI)	I^2, p-value[c]	p-value[d]
At least one ACE subtype											
Prospective	5	4	1.11 (0.96–1.30)	65.4%, 0.021	0.684	Poor sleep quality	6	5	1.21 (1.12–1.31)	78.5%, <0.001	**0.029**
Retrospective	7	5	1.15 (1.09–1.21)	83.1%, <0.001		Sleep deficiency	6	6	1.09 (1.04–1.15)	47.6%, 0.089	
Sexual abuse											
Prospective	3	2	1.01 (0.70–1.45)	22.6%, 0.275	0.286	Poor sleep quality	4	3	1.20 (0.98–1.47)	88.0%, <0.001	0.985
Retrospective	5	3	1.23 (1.13–1.35)	87.8%, <0.001		Sleep deficiency	4	4	1.20 (1.09–1.31)	73.2%, 0.011	
Physical abuse											
Prospective	3	2	1.20 (0.69–2.09)	56.7%, 0.099	0.900	Poor sleep quality	4	3	1.32 (0.99–1.77)	94.8%, <0.001	0.465
Retrospective	5	3	1.25 (1.11–1.40)	95.2%, <0.001		Sleep deficiency	4	4	1.18 (1.04–1.33)	85.7%, <0.001	

Note.
ACE, adverse childhood experience; OR: odds ratio.
[a] The number of ORs provided by included studies.
[b] The number of included studies.
[c] Indicating the statistical significance of heterogeneity calculated by the Cochran's Q test.
[d] Indicating the statistical difference between subgroups; the bold front of p-value indicates a statistical difference (<0.05). ACE, adverse childhood experience; OR: odds ratio.

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None.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.sleep.2022.06.006.

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