Maternal and Child Health Journal

Total Adverse Childhood Experiences and Preterm Birth: A Systematic Review

--Manuscript Draft--

Manuscript Number:	MACI-D-20-00190R2
Full Title:	Total Adverse Childhood Experiences and Preterm Birth: A Systematic Review
Article Type:	Original Research
Keywords:	AWMH-D-20-00019
Corresponding Author:	Shahirose Sadrudin Premji, Ph.D. York University School of Nursing Toronto, Ontario CANADA
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	York University School of Nursing
Corresponding Author's Secondary Institution:	
First Author:	Salima Sulaiman, MScN
First Author Secondary Information:	
Order of Authors:	Salima Sulaiman, MScN
	Shahirose Sadrudin Premji, Ph.D.
	Farideh Tavangar, MSc
	Ilona S Yim, Ph.D.
	Margaret Lebold, MScN
	Maternal-infant Global Health Team Collaborators in Research
Order of Authors Secondary Information:	
Funding Information:	Canadian Institutes of Health Research (CIHR) (376731) — Dr. Shahirose Sadrudin Premji
Abstract:	Introduction: Total adverse childhood experiences (ACEs) are gaining prominence as a risk factor for preterm birth (PTB). The emerging literature examining this relationship reports inconsistent findings. The purpose of this systematic review was to summarize the available evidence exploring whether total ACEs predict PTB. Methods: A total of 386 studies were returned from searches on PubMed, PsycINFO, and Cumulative Index to Nursing and Allied Health Literature (CINAHL). Nine studies were selected for final analysis and synthesis based on reporting of total ACEs and preterm birth gestational weeks or standard definition of birth before 37 weeks' gestational age. A systematic review rather than meta-analysis was selected to present the findings given the clinical and methodological (e.g., sample studied, measurement tools) heterogeneity of the retrieved studies and pregnancy outcomes measured. Results: The nine studies report on birth outcomes for 6,087 women from a range of sociodemographic and ethnic backgrounds. Despite a wide range of study designs, measurement tools, and timings of ACE exposure across studies, seven of the nine included studies showed significant relationships between ACEs and PTB. Conclusion: Systematic review of the literature suggests that total ACEs are associated with PTB and provides an overview on the known associations. However, to date only nine studies have assessed this link, and more studies are needed, to explore the associations between ACEs and PTB using appropriate and valid instruments and doing so among more diverse populations. Future research should also explore possible biological mechanisms (allostatic load), and moderating and mediating variables.

Powered by Editorial Manager® and ProduXion Manager® from Aries Systems Corporation

Author Details

Title Page

- **Authors Names:** Salima Sulaiman[1ǂ], Shahirose Sadrudin Premji[2ǂ], Farideh Tavangar[2ǂ], Ilona S Yim,[3] Margaret Lebold[2] and MiGHT

- **MiGHT members include:** Sharifa Lalani, Nicole Letourneau, Almina Pardhan, Kiran Shaikh, Aliyah Dosani, Imtiaz Jehan, Ayesha Mian, Syed Muzafar Ali, Heeramani Lohana, Suneeta Namdave, Nazia Shamim, Farooq Ghani, Rozina Shazad, Sidrah Nausheen, Ntonghanwah Forcheh, Christopher Naugler, Pauline Samia, Mohamoud Merali, Neelofur Babar, Arshia Javed, Erum Saleem, Qamarunissa Muhabat, Nigar Jabeen, Sana Siddiqui, Fouzia Hashmani and Kharah M. Ross

- **Title**: Total Adverse Childhood Experiences and Preterm Birth: A Systematic Review

- **The affiliation(s) of the author(s)**
- [1]University of Toronto, Lawrence S. Bloomberg Faculty of Nursing, Toronto, Ontario, CANADA
- [2]York University, Faculty of Health, School of Nursing, Toronto, Ontario, CANADA
- [3]University of California, Irvine, Department of Psychological Science, Irvine, California, USA

- **Author contributions**: SSP conceptualized the paper, SS, ISY, FT and ML independently searched the literature to ensure reliability, SS and ISY screened for eligibility; SS, SSP, ISY independently reviewed articles deemed eligible to determine relevance for the review, SS, SSP, ISY, and FT synthesized and analyzed the data for the original draft which was written by SS and significantly edited and updated by SSP and ISY. SSP, ISY and ML critically revised and contributed to the work. All authors reviewed and approved the final manuscript.

- **Corresponding Author**: Shahirose Sadrudin Premji
- **Email**: premjis@yorku.ca

If available, the 16-digit ORCID of the author(s)

- Shahirose Premji: 0000-0003-0423-4536
- Ilona S Yim: 0000-0002-2769-7253

- **Acknowledgements:** The authors would like to acknowledge the Maternal-infant Global Health Team (MiGHT) Collaborators in Research and support received through the Canadian Institutes of Health Research Grant (Application #376731).

Compliance with ethical standards:

- **Disclosure of potential conflicts of interest:** SS, FT, and ML were supported to work as research assistants through the Canadian Institutes of Health Research Project Grant (Application Number 376731). SSP and ISY have no conflict of interest.
- **Research involving Human Participants and/or Animals:** Not applicable. **(**This review does not contain any studies with human participants or animals performed by any of the authors.)
- **Informed consent:** Not applicable.

BLIND Manuscript -- without contact information
Click here to view linked References

Total Adverse Childhood Experiences and Preterm Birth: A Systematic Review

Abstract

Introduction

Total adverse childhood experiences (ACEs) are gaining prominence as a risk factor for preterm birth (PTB). The emerging literature examining this relationship reports inconsistent findings. The purpose of this systematic review was to summarize the available evidence exploring whether total ACEs predict PTB.

Methods

A total of 386 studies were returned from searches on PubMed, PsycINFO, and Cumulative Index to Nursing and Allied Health Literature (CINAHL). Nine studies were selected for final analysis and synthesis based on reporting of total ACEs and preterm birth gestational weeks or standard definition of birth before 37 weeks' gestational age. A systematic review rather than meta-analysis was selected to present the findings given the clinical and methodological (e.g., sample studied, measurement tools) heterogeneity of the retrieved studies and pregnancy outcomes measured.

Results

The nine studies report on birth outcomes for 6,087 women from a range of sociodemographic and ethnic backgrounds. Despite a wide range of study designs, measurement tools, and timings of ACE exposure across studies, seven of the nine included studies showed significant relationships between ACEs and PTB.

Conclusion

Systematic review of the literature suggests that total ACEs are associated with PTB and provides an overview on the known associations. However, to date only nine studies have

assessed this link, and more studies are needed, to explore the associations between ACEs and PTB using appropriate and valid instruments and doing so among more diverse populations. Future research should also explore possible biological mechanisms (allostatic load), and moderating and mediating variables.

Keywords

adverse childhood experiences, preterm birth, childhood maltreatment, childhood household dysfunction

Significance

What is already known on this subject? Adverse childhood experiences which includes various forms of negative, stressful and traumatic events that occur in early childhood can impact health and wellbeing across the lifespan. ***What this study adds?*** Our systematic review suggests that total ACEs are associated with PTB despite a wide range of study designs, measurement tools, and timings of ACE exposure across the seven of the nine studies showing a positive relationship.

Introduction

An estimated 15 million infants each year are born before thirty-seven weeks' gestational age (GA; WHO 2018) and are considered to be born preterm. Preterm birth (PTB) is associated with increased rates of morbidity, mortality, and long-term neurodevelopmental impairment (Ramachandrappa and Jain 2009; Ray et al. 2017), and these infants have significantly higher rates of neonatal mortality compared with term infants (22.9 per 1,000 PTB versus 0.6 per 1,000

term births) (Ray et al. 2017). Given the high prevalence of neonatal morbidity and mortality among PTB infants, preventing PTB remains a global priority (WHO 2012; WHO 2018).

Although maternal health before and during pregnancy is recognized as essential to birth outcomes, less is known about the exact causes and etiology of PTB (Dean et al. 2013). Maternal stress, distress, and many biopsychosocial processes occurring throughout women's lives, including throughout women's pregnancies, are thought to play significant roles and have multiplicative effects in the causal pathways to PTB, particularly for women living in low- and middle-income (LMI) countries (Premji et al. 2015; Wadhwa et al. 2011). The psychobiobehavioural model characterizes the interplay of individual stress reactivity, maladaptive patterns of biological responses because of wear and tear from acute and chronic stress-related physiological response over time (i.e., allostatic load), and maladaptive health behaviors (e.g., smoking, drinking) in the multisystem pathway to PTB (Premji et al. 2015).

Adverse childhood experiences (ACEs) are defined as traumatic experiences occurring prior to the age of eighteen (Felitti et al. 1998). Early definitions of ACEs have expanded over the past two decades and now include multiple types of early life trauma, categorized as: childhood maltreatment (i.e., sexual abuse, physical abuse, emotional abuse, physical neglect, and emotional neglect), household dysfunction (i.e., household substance use, partial separation or divorce, family member imprisonment, family member with mental illness, and domestic violence) and three additional stressful experiences [bullying, witnessing community violence, and collective violence (witnessing war)] for a total of thirteen ACE indicators (Felitti et al. 1998; WHO 2014). ACEs have been shown to have long-term and intergenerational consequences on both maternal health, and child health and behavioral outcomes (Gray et al. 2017; Madigan et al. 2017; McDonald et al. 2019).

Abuse, both as an individual ACE and as a condition of maternal health directly before and during pregnancy, is well-studied as a predictor of PTB (see Hillis et al. 2004; Nesari et al. 2018; Selk et al. 2016). In a meta-analysis of fourteen moderate-to-high quality studies, maternal history of abuse at any time-point before pregnancy, including during childhood, was found to be associated with PTB (OR= 1.28, 95% CI=1.12-1.47) (Nesari et al. 2018). While the meta-analysis found connections between prior maternal experiences of abuse (an individual ACE) and PTB (Nesari et al. 2018) of unquestionable importance, it is also the case that ACEs co-occur in children's lives. Felitti et al. (1998) conducted the foundational study demonstrating the importance of the combined effects of ACEs (total ACEs) on health outcomes. A few studies have begun to study the association between maternal total ACEs and PTB (Ben Salah et al. 2019; Christiaens et al. 2015; Dickerson 2017; Leeners et al. 2014; McDonnell and Valentino 2016; Shaikh et al. 2020; Smith et al. 2016), and therefore, the purpose of this systematic review was to compile and critically synthesize this literature guided by the following question: What is the association between total ACEs and preterm birth?

Methods

Search Strategy and Study Selection

Three databases [PubMed, PsychINFO, and Cumulative Index to Nursing and Allied Health Literature (CINAHL)] were searched using keywords that included the following four terms: (a) "premature birth"; (b) "infant, premature" (in PubMed, CINAHL) or "premature infant" (PsycINFO); (c) "preterm birth"; and (d) "birth outcome". Two of the terms (a and b) were listed as major search terms (Medical Subject Heading or MeSH in PubMed, major subject or mjsub in PsycINFO, and CINAHL heading word or MW in CINAHL) whereas the other two (c and d) were entered without this specification. These search terms were combined with the

search terms "adverse childhood experiences", "childhood trauma", "child abuse", and "child neglect" entered as regular search terms and the term “violence” entered as a major search term (see Appendix 1 for exact search box and results for each database). The final search was conducted in November 2020.

Only studies assessing total ACEs were considered, and studies reporting on single ACEs were excluded. ACEs was measured retrospectively in all studies while pregnancy was either followed prospectively or retrospectively. Studies were excluded if the outcome of interest was low birth weight which is reflective not only of prematurity but also of poor fetal growth resulting from maternal, fetal or placental health. Only studies published in English were considered given lack of resources (language expertise and translation costs) and time.

Data Extraction

From each of the nine selected studies, information was pulled together in a summary matrix table to highlight similarities and differences between studies (Table 1). Criteria included: year, author, country, participant demographics, study design, sample size, study methods (instrument), timing of data analysis, and findings related to PTB (i.e., odds ratio, confidence intervals, and p-values). Countries were classified based on income level. World Bank defines high-income countries as those with a gross national income (GNI) per capita of $12,536USD or more, upper middle-income countries as those with GNI per capita between $4,046USD and $12,535USD and low-income countries as those with a GNI per capita of US$1,035USD or less in 2019 (World Bank, 2021).

Study Quality and Bias

This study used a methodological quality checklist tool similar to the one developed by Shah (2010) and adapted by Staneva et al. (2015), a tool specifically designed for the assessment

Table 1

Characteristics of Included Studies

Author (year)	Country	Sample Description	Study Design	Sample size	Instrument	Time of measure of ACEs	Findings
Ben Salah et al. (2019)	Tunisia (LMI)	From Primary Health Care Centers; Region of Monastir (Tunisia); Avg age 29.1yr	Prospective longitudinal cohort study with exposure to violence assessed retrospectively using ACEs	593 women	Arabic version WHO ACE-IQ adapted for Tunisian context, version validated in Saudi Arabia; ACEs divided into intra-familial and social ACEs (i.e., peer violence, witnessing community violence, & exposure to war/collective violence	Within second trimester	Prematurity more prevalent among women with social ACEs history (P<0.0001). Gestational weeks reduced in presence of: peer violence [unadjusted] (β=-0.39; 95% CI: -0.69, -0.09, P < 0.01); collective violence [unadjusted] (β=-1.42; 95% CI: -1.9, -0.94, P < 0.001); collective violence [adjusted] (β=-1.15; 95% CI: -1.69, -0.62, P < 0.001) and witnessing community violence [adjusted] (β=0.42; 95% CI: 0.07, 0.77, P < 0.05). Relationship between total ACEs and pregnancy outcome mediated by depression
Bhengu et al. (2019)	South Africa (Upper middle-income)	From public sector district hospital; mostly Black African (92.4%); Avg age 27.7yr (all women enrolled)	Comparative cross-sectional study with retrospective reporting of ACEs	223 women (118 HIV negative, 105 HIV positive)	WHO ACE-IQ, using in-person interviews	Within first week postpartum	Mean ACE score (binary) of 3.28 (SD=2.76) and PTB rate of 8.97% (all participants). Greater ACE score was significantly associated with PTB birth (aOR=1.20; 95% CI: 1.02, 1.42) (all participants). When adjusted by HIV status, the odds of preterm birth were lower for HIV negative status

Author (year)	Country	Sample Description	Study Design	Sample size	Instrument	Time of measure of ACEs	Findings
							(aOR=0.04; 95% CI=0.01, 0.19) and HIV positive suppressed viral load (aOR=0.06, 95% CI: 0.01, 0.24) when compared to HIV unsuppressed status.
Christiaens et al. (2015)	Canada (High-income)	From three hospitals in Edmonton, mostly Caucasian (84% of cases; 83% of controls); Avg age 28.3yr (cases); 29.6yr (controls)	Case-Control (Retrospective) Mothers who delivered term and mothers who delivered preterm infants.	622 women (412 controls and 210 cases) recruited; 223 women (75 cases and 148 controls) in analysis (call rate 35%)	Wellbeing and pregnancy questionnaire (a grouping of checklists and validated research instruments including ACE score (Felitti et al. 1998)	Postnatal time period (3-months to 1-year)	High ACE score of 2+ ACEs significantly associated with increased PTB risk (aOR 2.09, 95% CI: 1.10, 3.98; P=0.024).
Gillespie et al. (2017)	USA (born and raised; High-income)	From obstetrics and gynecology clinics in two hospitals and community around Columbus, Ohio. African American, non-Hispanic; Avg age 26.5yr; primarily low SES	Prospective observational design	96 pregnant women (89 in analysis)	STRAIN (96 acute and chronic stressors); blood cortisol; days gestation at birth	28 – 32 6/7 weeks' GA	Cumulative childhood stress predicted birth timing (P=0.01): interpersonal loss (ab=0.02, 95% CI: 0.001, 0.045); physical danger (ab=0.02 95% CI: 0.001, 0.043); cortisol biological mediator. Note: stress in adulthood was controlled
Leeners et al. (2014)	Germany (High-income)	CSA group recruited from "Frauennotruf" support centers and control group recruited from local kindergartens, gynecological offices, or dental	Case-control (Retrospective) Sexually abused women and comparison group	375 (132 CSA and 243 comparison without CSA) recruited; 255 women (85 exposed to CSA and 170 comparison	CSA explored using questionnaire (Wyatt 1985); ACE explored through interview questions	Anytime during study period of 18 months (several years after birth)	Women who delivered PTB infants at greater likelihood of past exposure to either CSA (P=0.0239), physical abuse (P=0.0223) or other ACEs (P=0.0093)

Author (year)	Country	Sample Description	Study Design	Sample size	Instrument	Time of measure of ACEs	Findings
		offices. Nearly all Caucasian (98.8% in cohort; 99.4% in comparison); Avg age 26.6yr (cases); 27.5yr (controls)		without CSA[8]) in analysis			
McDonnell and Valentino (2016)	USA (High-income)	From local Women, Infants, and Children (WIC) offices located in a medium-sized Midwestern city; 53.3% Caucasian; 30.4% African American; 16.3% Other; Avg age 24.76yr	Prospective longitudinal	398 pregnant women recruited; 315 birth outcomes	FHHQ (commonly used in high-risk, low-income groups)	Prenatal time period (within 4.84 months (SD=2.14) of due date)	GA not correlated with ACE indicators
Mersky and Lee (2019)	USA (High-income)	Low income (98% $\leq$ 200% of federal poverty line/federal means-tested benefits; federal Maternal Infant & Early Childhood Home Visiting Program; 41.1% Caucasian; 24% African American; 23.2% Hispanic; Avg age 25.5yr	Secondary analysis of longitudinal study	1848 women (1823 in analysis)	Childhood Experiences Survey (19-item with 10 indicators summed for total ACE)	Within 90 days of starting home visiting program.	Total ACE score associated with PTB (OR=1.07; 95% CI: 1.01, 1.12; P<0.01) while controlling for maternal age, race/ethnicity, and education

Author (year)	Country	Sample Description	Study Design	Sample size	Instrument	Time of measure of ACEs	Findings
Shaikh et al. (2020)	Pakistan (LMI)	From four secondary hospital – 3 in Karachi, and one in Hyderabad; 29.6% Muhajir; 19.7% Sindhi, 15.2% Memon, 35.3% Other; Avg age 26.8yr	Secondary analysis of prospective longitudinal cohort study	300 women recruited; 263 birth outcomes	WHO ACE-IQ	12-19 weeks' GA	Mean PTB rate of 11.1% (95% CI: 7.7%, 15.4%). ACE-IQ (binary and frequency score) not significantly associated with PTB.
Smith et al. (2016)	USA (High-income)	From 137 obstetrical practices/hospital-based clinics around Connecticut and Western Massachusetts; 76% Caucasian; 17% Hispanic/other; Avg age 31yr	Prospective cohort	6438 (1905 eligible with depression and randomly selected 1612 of 4533 without depression); 2303 pregnant women (included women with and without depression)	ETI-SF (a shortened version of ETI-SR, a validated tool)	During second interview which was at 28(±2) weeks' GA	Direct effect: each unit increase of ACE was associated with a decrease in 0.063 weeks' GA (accounting for race/ethnicity). Indirect effect: each unit of ACE increase was associated with a decrease of 0.041 weeks (adjusted) (95% CI: -0.070, -0.018). Smoking accounted for most of the differential effect

Note: yr: year; ACE: Adverse Childhood Experiences; WHO: World Health Organization; IQ: International Questionnaire; CI: confidence interval; β: beta coefficient; HIV: human immunodeficiency virus; SD: standard deviation; PTB: preterm birth; aOR: adjusted odds ratio; USA: United States of America; SES: socio-economic status; STRAIN: Stress and Adversity Inventory; GA: gestational age; ab: indirect effect; CSA: childhood sexual abuse; FHHQ: Family Health History Questionnaire; ETI-SF: Early Trauma Inventory-Self-report Short Form; ETI-SR: Early Trauma Inventory-Self-report.

of quality and bias in studies exploring PTB and low birth weight as outcomes. Each single study was assessed against six categories—selection, exposure assessment, outcome assessment, confounding factor, analytical, and attrition—with preset definitions on which to determine bias as none, low, moderate or high detailed elsewhere (Shah 2010; Staneva 2015). Individual studies were given a score for each criteria that ranged from 'none' (no bias), 'little', 'moderate', and 'high'/'cannot tell' (extensive bias) (Shah 2010; Staneva et al. 2015). A final bias score for each study was calculated based on the score that was seen most frequently across the six areas of assessment for each study.

Study design

Although a meta-analytic review was originally considered, studies were not suitable for combination due to the diversity of individual study designs, sample characteristics, and the various screening tools used across the single studies. A systematic review of the literature was ultimately selected to look collectively at studies, comment methodologically on the quality of available studies, and to highlight participant demographics (e.g. geographies, ethnicities, ages) in which the outcome of interest (PTB) was, or was not, found (Ryan 2013). The narrative review also allowed for a comparison of studies, exploring whether similar or dissimilar intermediate outcomes and known confounders (for example, smoking) were assessed across individual study designs (Ryan 2013).

Results

Study Selection

The search strategy yielded 287 studies in PubMed, 75 studies in PsycINFO, and 111 studies in CINAHL, resulting in 386 studies after removal of 87 duplicate and triplicate records (see Fig. 1). Non-human animal studies were considered beyond the scope of this manuscript. In

an initial step, the title and abstract of each article were screened, and 335 articles were excluded because they were clearly irrelevant.

A full-text review of 51 articles by two independent reviewers was undertaken against predetermined inclusion and exclusion criteria (Fig. 1). Discrepancies and uncertainties about whether studies met the inclusion criteria were discussed between two reviewers, and consensus was reached. Of the 51 articles, 42 were excluded because they had no or no adequate measure of total ACEs, two studies because PTB was treated as the predictor variable of offspring total ACEs, two because low birth weight, not PTB, was the outcome, one because menarche and the contribution of age of menarche to birth outcomes was studied, and two manuscripts because they were systematic or meta-analytic reviews.

Description of Studies

Birth outcomes for 6,087 individual women were studied across the nine studies (Table 1). Two studies (Ben Salah et al. 2019; Shaikh et al. 2020) were conducted in the LMI country of Pakistan (Shaikh et al. 2020) and another in Tunisia (Ben Salah et al. 2019). Seven studies were conducted in high or upper-middle income countries, including four studies from the USA (Gillespie et al. 2017; McDonnell and Valentino 2016; Mersky and Lee 2019; Smith et al. 2016), one study from Canada (Christiaens et al. 2015), one study from Germany (Leeners et al. 2014), and one study from South Africa (Bhengu et al. 2019).

Recruitment settings and procedures, and the nature of study designs varied across studies. Participants were recruited from primary health care centers (Ben Salah et al. 2019), hospitals (Bhengu et al. 2019; Christiaens et al. 2015), or offices of federal programs for high-risk women such as Women, Infants, and Children (McDonnell and Valentino 2016), and a Maternal Infant and Early Childhood Home Visiting Program (Mersky and Lee 2019). Study

samples varied widely between 89 African-American women in a small, prospective study (Gillespie et al. 2017) to a large, prospective cohort study of 2,303 mostly Caucasian women (Smith et al. 2016). All were observational studies but varied in the temporal nature of the study designs: five studies used prospective designs with women being assessed for ACEs during pregnancy and followed for pregnancy outcome (Ben Salah et al. 2019; Bhengu et al. 2019; Gillespie et al. 2017; McDonnell and Valentino 2016; Shaikh et al. 2020; Smith et al. 2016) and two studies used retrospective designs (Christiaens et al. 2015; Leeners et al. 2014). Two studies conducted secondary analysis of a longitudinal study (Mersky and Lee 2019; Shaikh et al. 2020). The studies utilized varied types of design, including cohort (Ben Salah et al. 2019; Gillespie et al. 2017; McDonnell and Valentino 2016; Mersky and Lee 2019; Shaikh et al. 2020; Smith et al. 2016), comparative cross-sectional (Bhengu et al. 2019) and case-control (Christiaens et al. 2015; Leeners et al. 2014).

The majority of studies included women of varying ethnicities. In five studies, women were predominantly Caucasian (Christiaens et al. 2015; Leeners et al. 2014; McDonnell and Valentino 2016; Mersky and Lee 2019; Smith et al. 2016). The other three studies (Bhengu et al. 2019; Gillespie et al. 2017; Shaikh et al. 2020) included participants with a diverse range of ethnicities, including one study in which nearly all women were Black African (Bhengu et al. 2019), in another study (Shaikh et al. 2020) women were Pakistani with various ethnicities (Muhajir, Sindhi, Memon, or other), while in another study women were African American, born and raised in the USA (Gillespie et al. 2017). The Tunisian study (Ben Salah et al. 2019) did not describe the ethnic origins of the participants. All studies employed purposive or convenience sampling. All study data was collected in clinical-type settings, or over the phone. The pregnancy outcome of weeks' or days' GA was collected from pre-existing data, medical records

(e.g., prenatal and labor and delivery forms) or from interviews with women and checked against medical chart data. Studies that categorized pregnancy outcome by type of delivery (i.e., preterm birth or term birth) used the standard definition of less than 37 weeks' GA.

Study Quality and Bias

Seven studies (Ben Salah et al. 2019; Bhengu et al. 2019; Christiaens et al. 2015; Gillespie et al. 2017; Leeners et al. 2014; Shaikh et al. 2020; Smith et al. 2016) were assessed as having no or low bias overall notwithstanding high selection bias (Gillespie et al. 2017), moderate risk of analysis bias (Bhengu et al. 2019; Gillespie et al. 2017), and moderate attrition bias (Christiaens et al. 2015; Leeners et al. 2014; Smith et al. 2016). Two studies (McDonnell and Valentino 2016; Mersky and Lee 2019) were assessed as having moderate overall bias based on the high selection bias (Mersky and Lee 2019), attrition bias (McDonnell and Valentino 2016), moderate risk of bias in outcome assessment (Mersky and Lee 2019), and our inability to tell whether the study had risk of bias in analysis and controlled appropriately for confounding factors (McDonnell and Valentino 2016) (Table 2).

Table 2

Risk of bias (Shah 2010; Staneva et al. 2015)

Studies	Selection	Exposure assessment	Outcome assessment	Confounding factor	Analytical	Attrition	Overall bias assessment
Ben Salah et al. (2019)	None	None	None	Low	Low	None	None
Bhengu et al. (2019)	Low	Low	None	None	Moderate	None	Low
Christiaens et al. (2015)	None	Low	None	None	None	Moderate	None
Gillespie et al. (2017)	High	None	None	None	Moderate	Low	Low

Leeners et al. (2014)	None	None	None	None	None	Moderate	None
McDonnell and Valentino (2016)	None	Low	None	Cannot tell	Cannot tell	High	Moderate
Mersky and Lee (2019)	High	Low	Moderate	None	Low	None	Moderate
Shaikh et al. (2020)	None	None	None	None	Low	Low	None
Smith et al. (2016)	None	Low	None	None	None	Moderate	None

Exposure Assessment: ACEs

The nine studies each collected information about total ACEs at various times during prenatal or postpartum period and used various measurement tools (see Table 1 for details). Five studies measured ACEs during pregnancy (Ben Salah et al. 2019; Gillespie et al. 2017; McDonnell and Valentino 2016; Shaikh et al. 2020; Smith et al. 2016), one study explored ACEs and PTB at the same time within the first week postpartum (Bhengu et al. 2019), and three studies assessed ACEs at various times in the postpartum period (Christiaens et al. 2015; Leeners et al. 2014; Mersky and Lee 2019) and did not always specify the exact time (Mersky and Lee 2019). Of note, the Wellbeing and Pregnancy Questionnaire (Christiaens et al. 2015) used the 10-items from the original ACE study (Felitti et al. 1998), the WHO ACE-IQ (Ben Salah et al. 2019; Bhengu et al. 2019; Shaikh et al. 2020), which is intended for use in all countries, was recently validated for use in Nigeria, a lower middle-income country (Kazeem 2015) and Malawi, a low-income country (Kidman et al. 2019) and the FHHQ (McDonnell and Valentino 2016) has been previously validated for use with low-income high-risk populations. Most studies controlled for known confounding factors of PTB, including maternal smoking and alcohol use in pregnancy. Notably, Bhengu et al. (2019) adjusted for socio-economic status, finding no

change to ACE totals when adjusted, while Gillespie et al. (2017) controlled for stress in adulthood, finding that stress occurring in childhood predicted birth timing. Some studies also examined mediators (direct/indirect) of the relationship between ACE and preterm birth including depression (Ben Salah et al. 2019), race/ethnicity (Smith et al. 2016), and cortisol (Gillespie et al. 2017).

Outcome Measurement: Preterm birth

All nine studies examined the association between total ACEs and the pregnancy outcome of PTB, and just two (McDonnell and Valentino 2016; Shaikh et al. 2020) showed no significant association. Two studies (Christiaens et al. 2015; Smith et al. 2016) reported decreases in GA with increasing exposure to the number of ACEs. In the prospective cohort study by Smith et al. (2016), for each unit increase in ACE, GA decreased by 0.063 weeks when accounting for race/ethnicity and 0.041 weeks (corrected for bias) when considering indirect effects through mediators, with smoking accounting for just under half of the effect. Similarly, in their case-controlled study, Christiaens et al. (2015) found that for every additional ACE, the risk of PTB increased by eighteen percent (aOR 1.18; 95% CI: 0.99, 1.40). Moreover, women with two or more ACEs had a two-fold increased risk of PTB (aOR 2.09; 95% CI: 1.10, 3.98; P=0.024) (Christiaens et al. 2015). These studies highlight the importance of cumulative ACE exposure in increasing PTB risk. Mersky and Lee (2019), while controlling for maternal age, race/ethnicity, and education, found the total ACE score was associated with PTB (OR=1.07; 95% CI: 1.01, 1.12; P<0.01). In a cross-sectional study, Bhengu et al. (2019) found that greater ACE scores were significantly associated with PTB (aOR=1.20; 95% CI 1.02-1.42). However, the odds of preterm birth were lower for HIV-negative women when adjusted for HIV status (see Table 1).

Leeners et al. (2014) also found that childhood sexual abuse, itself an ACE, was associated with an increased risk for premature delivery compared to an unexposed group (18.8% compared to 8.2%, P= 0.024). PTB was also more likely to occur in women who had experienced other ACEs (e.g., emotional abuse, substance abuse in family members, mentally handicapped family members, family members at risk for suicide, and family members in prison) (P=0.009) or physical abuse in childhood (P=0.022) (Leeners et al. 2014, p. 173). While controlling for stress in adulthood, Gillespie et al. (2017) noted that childhood stress, specifically interpersonal loss (ab = 0.02, 95% CI: 0.001, 0.045) and physical danger (ab = 0.02 95% CI: 0.001, 0.043) predicted birth timing with cortisol serving as a biological mediator.

In contrast to these associations, McDonnell and Valentino (2016) found no correlation between ACE indicators (childhood household maltreatment and childhood household dysfunction) and GA in women, in a majority never-married and racially diverse sample of women, recruited from local Women, Infants, and Children offices located in a Midwestern city in the USA. Moreover, McDonnell and Valentino (2016) found no significant differences between infant GA and several predictor variables (i.e., age of first pregnancy, infant birth weight, child 6-month Ages and Stages Questionnaire (ASQ) score, and Beck Depression Inventory scores). The authors of that study note that based on these findings of non-significance, they did not consider any further analysis of GA (McDonnell and Valentino 2016). Similarly, Shaikh et al. (2020) found no association between ACE and preterm birth using both the binary and frequency score of the ACE-IQ.

Discussion and Conclusion

The intent of this systematic review was to provide an overview of the associations between maternal total ACEs and PTB, based in the current research literature. While our initial

goal was to conduct a meta-analytic review, the nine studies we identified could not be combined meaningfully due to the heterogeneity of the sample characteristics, inclusion and exclusion criteria, timing of the exposure measurement, and measurement tools. Three studies (Gillespie et al. 2017; McDonnell and Valentino 2016; Mersky and Lee 2019) recruited women with very specific characteristics (see Table 1) and were thus not comparable to women in the other studies. Substantial variability existed in the participant demographics across studies, including variability in the proportions of races and ethnicities, education levels, employment status, marital status, parity, illicit drug use, and age. Bhengu et al. (2019) enrolled mostly Black South African women (92.4%) who were single, divorced or widowed, while Shaikh enrolled Pakistani low-risk women (i.e., no high-risk health or obstetric complications) who were married, and Ben Salah at al. (2019) enrolled Tunisian who also had high-risk pregnancies (i.e., had diabetes or high blood pressure). Only Bhengu et al. (2019) and Shaikh et al. (2020) included family or household income. Two of the studies excluded participants with histories of PTBs, multifetal pregnancies, and complications during pregnancy from the control group (Smith et al. 2016; Christiaens et al. 2015). Smith et al. (2016) recruited pregnant women who used antidepressant medication, experienced symptoms of trauma (i.e., general trauma and physical, emotional and sexual abuse) or post-traumatic stress, or were clinically diagnosed as depressed, alongside a healthy comparison group; whereas, McDonnell and Valentino (2016) recruited pregnant women and followed them until after six months postpartum, irrespective of their depression status. In contrast, Christiaens et al. (2015) and Bhengu et al. (2019) recruited postpartum women who had delivered term and preterm infants. Lastly, Leeners et al. (2014) recruited participants who had delivered a live baby anytime in past five years, who were not currently pregnant, and who had a

history of sexual abuse, alongside a healthy comparison group, with the age at first delivery and number of children matched between groups.

While the studies employed diverse methods and strategies to study ACEs and PTB, overall, the findings from seven of the nine studies identified suggest an increased risk for PTB when women were exposed to ACEs. Two studies (McDonnell and Valentino 2016; Shaikh et al. 2020) did not and it is possible that the specific limitations in the study (McDonnell and Valentino 2016) or socio-cultural context (Shaikh et al. 2020) may explain differences in findings. McDonnell and Valentino (2016) report high attrition rates in their study which may misrepresent the actual occurrence of PTB and warrants further consideration. Of the many risk factors for PTB, some risk factors have been considered as mediators between ACEs and pregnancy outcomes, for example, smoking, history of a psychiatric disorder, and substance use (Smith et al. 2016). Whereas the majority of the studies in this review considered many of these risk factors, McDonnell and Valentino (2016) did not do so to the same degree, limiting the possible analyses and interpretations of the roles and extent of PTB mediators in that study. Shaikh et al. (2020) used a different tool (ACE-IQ: binary and frequency scores) to measure ACEs when compared to studies that showed an association (e.g., Christiaens et al., 2015; Smith et al., 2016). A low report of ACEs was evident among Pakistani women enrolled in the study by Shaikh et al. (2020) and neither the number of ACEs nor ongoing exposure to ACEs was associated with preterm birth. The appraisal of ACEs and the lack of impact of ACEs on pregnancy outcomes (i.e., reactivity to stress) may have been influenced by shared or acceptable sociocultural norms, and environmental context of the women who resided in a LMI country (Bright et al. 2018; Shaikh et al. 2020).

Most studies did not explore in great detail the mechanism of action and biopsychosocial pathways whereby ACEs are believed to influence health outcomes. A notable exception is a study by Gillespie et al. (2017) who explored a stress-related biological pathway whereby indirect effects of childhood stress on birth timing were estimated by maternal cortisol level. Their secondary analyses were guided by the "placental clock" theory in which cumulative childhood stress alters the hypothalamic-pituitary-adrenal (HPA) reactivity leading to rapid rise in cortisol which when detected by the fetal/placental unit alters the rate of production of placental corticotropin-releasing hormone which controls the timing of birth (Gillespie et al. 2017). The biopsychosocial pathways whereby ACEs are believed to influence pregnancy outcome such as preterm birth is a promising area of research. For example, several studies have explored the effects of allostatic load, a measure of the combined effects of physiological stress, and how, over time (with advanced age), accumulated allostatic load can affect the body's normal regulation mechanisms (Chyu and Upchurch 2011; Ribeiro et al. 2018), including birth outcomes (Wallace and Harville 2013). In our systematic review, although McDonnell and Valentino (2016) did not find an association between PTB and ACEs, their study sample represented the youngest average participant age of the nine studies, suggesting this sample of younger women may have experienced less accumulation of allostatic load which potentially could have offered some age-related protection against PTB outcomes.

Allostatic load biomarkers have been studied across various sociodemographic categories to demonstrate the physiological effects arising out of social living conditions (i.e., education and racialization) (Chyu and Upchurch 2011; Geronimus et al. 2006). For example, in a large US national survey, Chyu and Upchurch (2011) found greater allostatic load scores and faster allostatic load accumulation (by age) among black women compared to white or Mexican

women. Moreover, Chyu and Upchurch (2011) found that women with lower family income levels, and women with only a high school education, had higher mean allostatic load scores. Looking specifically at allostatic measures and PTB, Wallace and Harville (2013) explored PTB among white and Black women in the United States, finding that across both races GA decreased as allostatic load increased.

It should be noted seven of the nine studies included in this synthesis were conducted in high and upper-middle income countries and the majority of participants were Caucasian. As evidence mounts showing disparities among more socially-disadvantaged women (and connections to biological markers) there will be a need for future research exploring the possible connections between ACEs and PTB to include diversely-situated women, including women of diverse races, ethnicities, and socio-economic classes. Some of the studies included here exemplify the integration of local context in studying ACEs and PTB outcome, for example: a high HIV endemic area with concerns about adherence to anti-retroviral therapy, and substance use (Bhengu et al. 2019); low-income women enrolled in a federal Maternal Infant & Early Childhood Home Visiting Program (Mersky and Lee, 2019); and more recently, women specifically from specific regions in LMIC, including the region of Monastir, Tunisia (Ben Salah et al. 2019) and cities of Karachi and Hyderabad, Pakistan (Shaikh et al. 2020). Still, we argue there is a need for additional contextualized primary studies in LMI countries where PTB is known to have especially high incidence rates (Premji et al. 2015; Shaikh et al. 2020). To more fully understand the longstanding and far-reaching health effects of ACEs globally, more research using the ACE-IQ scale in middle and particularly in low-income countries is needed (Kidman et al. 2019; World Health Organization 2009/2011). Such scholarship could build on

recent research that has newly validated the use of ACE-IQ tool in populations in Nigeria and Malawi, respectively (Kazeem 2015; Kidman et al. 2019).

Limitations

This systematic review is limited insofar as there have been few studies on total ACEs and PTB from which to draw. In our comprehensive search, we retrieved only nine studies that matched our search criteria. It remains a possibility that studies that reinforce the null hypothesis of no association between ACEs and PTB, may be less often published than studies showing a positive relationship (Joober et al. 2012). This possibility may partially explain why we found only two studies that did not show a relationship between ACEs and PTB. In addition, we found only two recently published studies conducted on the relationship between ACEs and PTB in LMI countries, suggesting that much of the wider global health implications of ACEs on PTB are still to be studied. Our systematic review also relied on English-language studies thus may not represent all of the studies in the field thus introducing risk of bias.

A limitation across all of the primary studies looking at childhood experiences through ACE indicators, and therefore also our review, is the strong measurement bias of ACE as data was collected retrospectively (i.e., recall bias), the possibility of participant self-reporting bias, and social desirability bias (Althubaiti 2016). Similarly, disease status of the sample, for example, participants screened for ACEs while experiencing depression, may have influenced the degree to which women reported ACEs (Wright et al. 2012). Nonetheless, the use of validated screening tools employed in each of the primary studies likely decreased such risks (Althubaiti 2016).

Moreover, while the included primary studies touched on the negative health trajectories often seen with ACEs, we found limited discussion of measures that might prevent ACEs and

PTB outcomes. Social support, for example, has been studied as a promising mediator of many of the pregnancy risks associated with ACEs (Racine et al. 2018). More studies are needed, to explore the associations between ACEs and PTB including the possible biological mechanisms (allostatic load), and moderating and mediating variables.

Conclusion and Implications

The results of this narrative synthesis summarize the current literature exploring connections between ACEs and PTB with seven of the nine studies included in our review demonstrating connections between these measures. However, further research is needed to explore the associations between ACEs and PTB using appropriate and valid instruments and doing so among more diverse populations. Moreover, it will be necessary to explore the associations between ACEs and PTB alongside ongoing research about allostatic load and the mechanisms related to how the body is able to remember traumatic early childhood events and how exactly these phenomena can lead to adverse adult outcomes. Future research should also explore possible moderating and mediating variables in the pathway linking ACEs to PTB.

Fig. 1

Comprehensive search strategy and inclusion of studies in the narrative synthesis using the PRISMA model (Moher et al. 2009)

References

Althubaiti, A. (2016). Information bias in health research: Definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare*, *2016*(9), 211-217. https://doi.org/10.2147/JMDH.S104807

Ben Salah, A., Lemieux, A., Mlouki, I., Amor, I., Bouanene, I., Ben Salem, K., al'Absi, M., & El Mhamdi, S. (2019). Impact of social violence and childhood adversities on pregnancy outcomes: A longitudinal study in Tunisia. *Journal of Global Health*, *9*(2), 020435. https://doi.org/10.7189/jogh.09.020435

Bhengu, B.S., Tomita, A., Mashaphu, S., & Paruk, S. (2019). The role of adverse childhood experiences on perinatal substance use behavior in KwaZulu-Natal Province, South Africa. *AIDS and Behavior*, *24*, 1643-1652. https://doi.org/10.1007/s10461-019-02661-y

Bright, K., Norris, J., Letourneau, N., King-Rosario, M., & Premji, S. S. (2018). Prenatal maternal anxiety in South Asia: A rapid best-fit framework synthesis. *Frontiers in Psychiatry*, *9*, 467. https://doi.org/10.3389/fpsyt.2018.00467

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. https://doi.org/10.1186/s12916-015-0353-0

Chyu, L., & Upchurch, D. M. (2011). Racial and ethnic patterns of allostatic load among adult women in the United States: Findings from the National Health and Nutrition Examination Survey 1999-2004. *Journal of Women's Health*, *20*(4), 575-583. https://doi.org/10.1089/jwh.2010.2170

Dean, S., Mason, E., Howson, C., Lassi, Z., Imam, A., & Bhutta, Z. (2013). Born too soon: Care before and between pregnancy to prevent preterm births: from evidence to action. *Reproductive Health, 10,* S3. https://doi.org/10.1186/1742-4755-10-S1-S3

Dickerson, K. (2017). *Impact of adverse childhood experiences on maternal and birth weight in Appalachia*. [Doctoral dissertation, Warden University]. Walden Dissertations and Doctoral Studies.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., & Koss, D. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The adverse childhood experiences (ACE) study. *American Journal of Preventative Medicine, 14*(4), 245-258

Geronimus, A. T., Hicken, M., Keene, D., & Bound, J. (2006). "Weathering" and age pattern of allostatic load scores among blacks and whites in the United States. *American Journal of Public Health*, *96*, 826-833.

Gillespie, S. L., Christian, L. M., Alston, A.D., & Salsberry, P.J. (2017). Childhood stress and timing among African American women: Cortisol as biological mediator. *Psychoneuroendocrinology*, *84*, 32-41. https://doi.org/10.1016/j.psyneuen.2017.06.009

Gray S. A. O., Jones, C. W., Theall, K.P., Glackin, E., & Drury, S. S. (2017). Thinking across generations: Unique contributions of maternal early life and prenatal stress to infant physiology. *Journal of the American Academy of Child & Adolescent Psychiatry*, *56*(11), 922-929. https://doi.org/10.1016/j.jaac.2017.09.001

Hillis, S. D., Anda, R. F., Dube, S. R., Felitti, V. J., Marchbanks, P. A., & Marks, J. S. (2004). The association between adverse childhood experiences and adolescent pregnancy, long-

term psychosocial consequences, and fetal death. *Pediatrics*, *113*(3), 320-327. https://doi.org/10.1542/peds.113.2.320

Joober, R., Schmitz, N., Annable, L., & Boksa, P. (2012). Publication bias: What are the challenges and can they be overcome? *Journal of Psychiatry & Neuroscience*, *37*(3),149-152. http://doi.org/10.1503/jpn.120065

Kazeem, O. T. (2015). A validation of the adverse childhood experiences scale in Nigeria. *Research on Humanities and Social Sciences*, *5*, 18-23.

Kidman, R., Smith, D., Riccolo, L. R., & Kohler, H-P. (2019). Psychometric evaluation of the Adverse Childhood Experience International Questionnaire (ACE-IQ) in Malawian adolescents. *Child Abuse & Neglect*, *92*, 139-145. http://doi.org/10.1016/j.chiabu.2019.03.015

Leeners, B., Rath, W., Block, E., Görres, G., & Tschudin, S. (2014). Risk factors for unfavorable pregnancy outcome in women with adverse childhood experiences. *Journal of Perinatal Medicine*, *42*, 171-178. http://doi.org/10.1515/jpm-2013-0003

Madigan, S., Wade, M., Plamondon, A., Maguire, J. L., & Jenkins, J. M. (2017). Maternal adverse childhood experience and infant health: Biomedical and psychosocial risks as intermediary mechanisms. *Journal of Pediatrics*, *187*, 282-289. http://doi.org/10.1016/j.jpeds.2017.04.052

McDonald, S. W., Madigan, S., Racine, N., Benzies, K., Tomfohr, L., & Tough, S. (2019). Maternal adverse childhood experiences, mental health, and child behaviour at age 3: The all our families community cohort study. *Preventative Medicine*, *118*, 286-294. https://doi.org/10.1016/j.ypmed.2018.11.013

McDonnell, C. G., & Valentino, K. (2016). Intergenerational effects of childhood trauma: Evaluating pathways among maternal ACEs, perinatal depressive symptoms, and infant outcomes. *Child Maltreatment, 21*, 317-326. http://doi.org/10.1177/1077559516659556

Mersky, J. P., & Lee, C. P. (2019). Adverse childhood experiences and poor birth outcomes in a diverse, low-income sample. *BMC Pregnancy and Childbirth, 19*, 387. http://doi.org/10.1186/s12884-019-2560-8

Moher ,D., Liberati, A., Tetzlaff, J., Altman, D. G., & PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine, 6*, e1000097. https://doi.org/10.1371/journal.pmed.1000097

Nesari, M., Olson, J. K., Vandermeer, B., Slater, L., & Olson, D. M. (2018). Does a maternal history of abuse before pregnancy affect pregnancy outcomes? A systematic review with meta-analysis. *BMC Pregnancy and Childbirth, 18*, 404. https://doi.org/10.1186/s12884-018-2030-8

Premji, S. S., Yim, I. S., Dosani Mawji, A., Kanji, Z., Sulaiman, S., Musana, J. W., Samia, P., Shaikh, K., Letourneau, N., & MiGHT Group. (2015). Psychobiobehavioral model for preterm birth in pregnant women in low- and middle-income countries. *BioMed Research International, 2015*, 450309. https://doi.org/10.1155/2015/450309

Racine, N., Madigan, S., Plamondon, A., Hetherington, E., McDonald, S., & Tough, S. (2018). Maternal adverse childhood experiences and antepartum risks: The moderating role of social support. *Archives of Women's Mental Health, 21*, 663-670. https://doi.org/10.1007/s00737-018-0826-1

Ramachandrappa, A., & Jain, L. (2009). Health issues of the late preterm infant. *Pediatric Clinics of North America, 56*(3), 565-577. http://doi.org/10.1016/j.pcl.2009.03.009

Ray, J. G., Park, A. L., & Fell, D. B. (2017). Mortality in infants affected by preterm birth and severe small-for-gestational age birth weight. *Pediatrics*, *140*(6), e20171881. https://doi.org/10.1542/peds.2017-1881

Ribeiro, A. I., Amaro, J., Lisi, C., & Fraga, S. (2018). Neighborhood socioeconomic deprivation and allostatic load: A scoping review. *International Journal of Environmental Research and. Public Health*, *15*(6), 1-15. https://doi.org/10.3390/ijerph15061092

Ryan, R. (2013). Cochrane Consumers and Communication Review Group: Data synthesis and analysis. *Cochrane Consumers and Communication Review Group*. https://cccrg.cochrane.org/sites/cccrg.cochrane.org/files/public/uploads/Analysis.pdf

Selk, S. C., Rich-Edwards, J. W., Koenen, K., & Kubzansky, L. D. (2016). An observational study of type, timing, and severity of childhood maltreatment and preterm birth. *Journal of Epidemiology and Community Health*, *70*, 589-595. https://doi.org/10.1136/jech-2015-206304

Shah, P. S. (2010). Parity and low birth weight and preterm birth: A systematic review and meta- analyses. *Acta Obstetetricia et Gynecologica Scandinavica*, *89*(7), 862-875. https://doi.org/10.3109/00016349.2010.486827

Shaikh, K., Premji, S. S, Lalani, S., Forcheh, N., Dosani, A., Yim, I. S., Samia, P., Naugler, C., Letourneau, N., & The Maternal Infant Global Health Team (MiGHT) Collaborators in Research. (2020). Ethnic disparity and exposure to supplements rather than adverse childhood experiences linked to preterm birth in Pakistani women. *Journal of Affective Disorders*, *267*, 49-56. https://doi.org/10.1016/j.jad.2020.01.180

Smith, M.V., Gotman, N., & Yonkers, K. A. (2016). Early childhood adversity and pregnancy outcomes. *Maternal and Child Health Journal, 20,* 790-798. https://doi.org/10.1007/s10995-015-1909-5

Staneva, A., Bogossian, F., Pritchard, M., & Wittkowski, A. (2015). The effects of maternal depression, anxiety, and perceived stress during pregnancy on preterm birth: A systematic review. *Women and Birth*, *28*(3), 179-193. https://doi.org/10.1016/j.wombi.2015.02.003

Wadhwa, P. D., Entringer, S., Buss, C., & Lu, M. C. (2011). The contribution of maternal stress to preterm birth: Issues and considerations. *Clinics in Perinatology*, *38*(3), 351-384. https://doi.org/10.1016/j.clp.2011.06.007

Wallace, M. E., & Harville, E. W. (2013). Allostatic load and birth outcomes among white and Black women in New Orleans. *Maternal and Child Health Journal*, *17*, 1025-1029. https://doi.org/10.1007/s10995-012-1083-y

World Bank. (2021, January). *World Bank country and lending groups*. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

World Health Organization. (2009, May/2011, May). *ACE global research network.* https://www.who.int/violence_injury_prevention/violence/activities/adverse_childhood_experiences/global_research_network/en/

World Health Organization. (2012). *Born too soon: The global action report on preterm birth.* https://www.who.int/pmnch/media/news/2012/201204_borntoosoon-report.pdf

World Health Organization. (2014) *Adverse childhood experiences international questionnaire (ACE-IQ).*

http://www.who.int/violence_injury_prevention/violence/activities/adverse_childhood_experiences/en/.

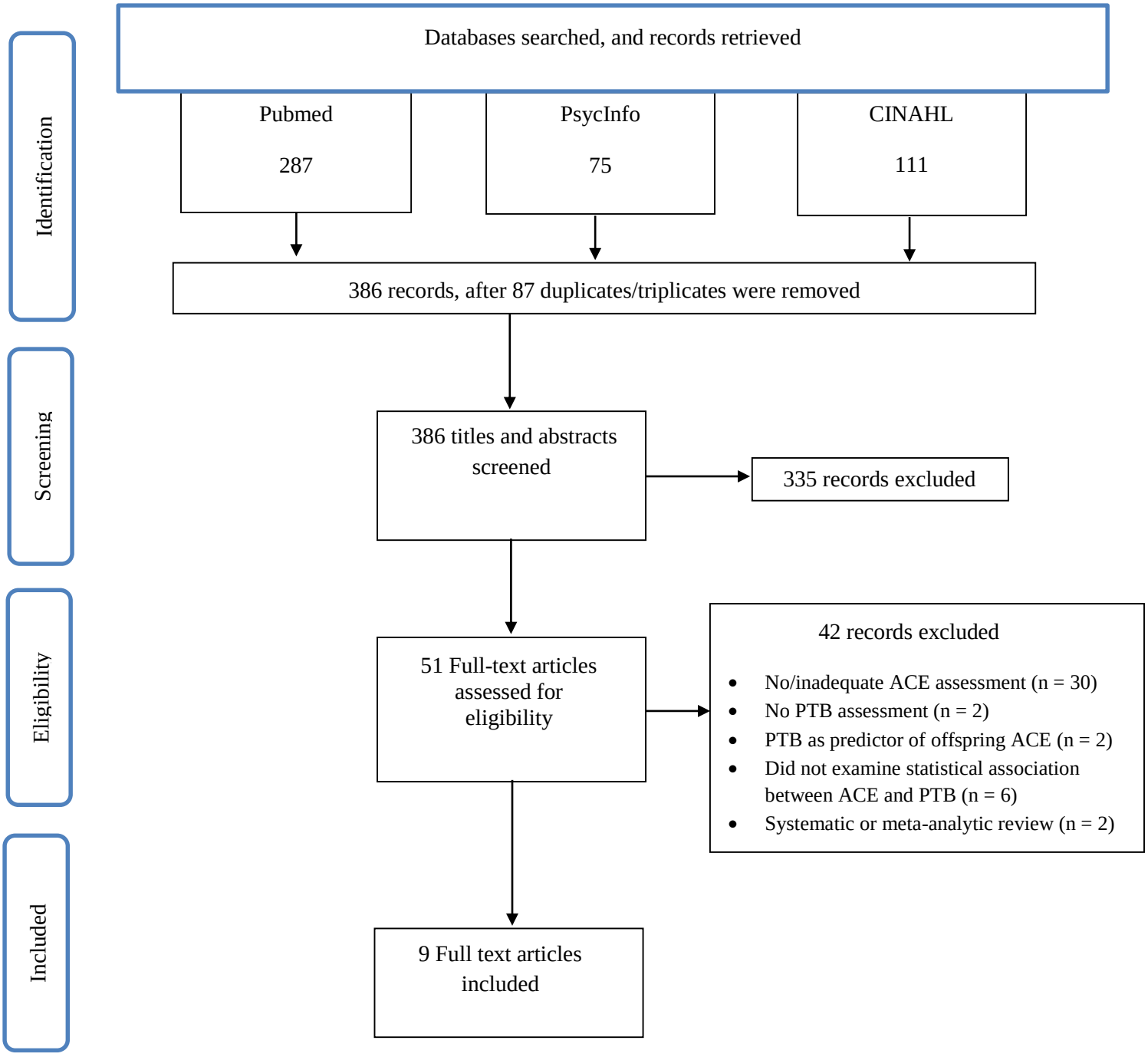
World Health Organization. (2018). *Preterm birth*. https://www.who.int/en/news-room/fact-sheets/detail/preterm-birth.

Wright, P., Stern, J., & Phelan, M. (2012). *Core Psychiatry* (3rd ed.). Elsevier. https://www.elsevier.com/books/core-psychiatry/9780702033971

Wyatt, G. E. (1985). The sexual abuse of Afro-Americans and white-American women in childhood. *Child Abuse & Neglect*, *9*(4), 507-519. https://doi.org/10.1016/0145-2134(85)90060-2

Figure 1

Fig. 1 Flowchart



Click here to access/download

Supplementary Material

Appendix 1 Exact Search Box and Results for Each Database.docx