Associations of Unintended Pregnancy With Maternal and Infant Health Outcomes
A Systematic Review and Meta-analysis

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IMPORTANCE Unintended pregnancy is common in the US and is associated with adverse maternal and infant health outcomes; however, estimates of these associations specific to current US populations are lacking.

OBJECTIVE To evaluate associations of unintended pregnancy with maternal and infant health outcomes during pregnancy and post partum with studies relevant to current clinical practice and public health in the US.

DATA SOURCES Cochrane Central Register of Controlled Trials and Database of Systematic Reviews, PsycINFO, SocINDEX, and MEDLINE databases (January 1, 2000, to June 15, 2022) and manual review of reference lists.

STUDY SELECTION Epidemiologic studies relevant to US populations that compared key maternal and infant health outcomes for unintended vs intended pregnancies and met prespecified eligibility criteria were included after investigators' independent dual review of abstracts and full-text articles.

DATA EXTRACTION AND SYNTHESIS Investigators abstracted data from publications on study methods, participant characteristics, settings, pregnancy intention, comparators, confounders, and outcomes; data were validated by a second investigator. Risk of bias was independently dual rated by investigators using criteria developed by the US Preventive Services Task Force. Results of studies controlling for confounders were combined by using a profile likelihood random-effects model.

MAIN OUTCOMES AND MEASURES Prenatal depression, postpartum depression, maternal experience of interpersonal violence, preterm birth, and infant low birth weight.

RESULTS Thirty-six studies (N = 524 522 participants) were included (14 cohort studies rated good or fair quality; 22 cross-sectional studies); 12 studies used large population-based data sources. Compared with intended pregnancy, unintended pregnancy was significantly associated with higher odds of depression during pregnancy (23.3% vs 13.9%; adjusted odds ratio [aOR], 1.59 [95% CI, 1.35-1.92]; I^2 = 85.0%; 15 studies [n = 41 054]) and post partum (15.7% vs 9.6%; aOR, 1.51 [95% CI, 1.40-1.70]; I^2 = 7.1%; 10 studies [n = 82 673]), interpersonal violence (14.6% vs 5.5%; aOR, 2.22 [95% CI, 1.41-2.91]; I^2 = 64.1%; 5 studies [n = 42 306]), preterm birth (9.4% vs 7.7%; aOR, 1.21 [95% CI, 1.12-1.31]; I^2 = 1.7%; 10 studies [n = 94 351]), and infant low birth weight (7.3% vs 5.2%; aOR, 1.09 [95% CI, 1.02-1.21]; I^2 = 0.0%; 8 studies [n = 87 547]). Results were similar in sensitivity analyses based on controlling for history of depression for prenatal and postpartum depression and on study design and definition of unintended pregnancy for relevant outcomes. Studies provided limited sociodemographic data and measurement of confounders and outcomes varied.

CONCLUSIONS AND RELEVANCE In this systematic review and meta-analysis of epidemiologic observational studies relevant to US populations, unintended pregnancy, compared with intended pregnancy, was significantly associated with adverse maternal and infant outcomes.

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n the US, 45% of pregnancies from 2008 to 2011[1] and 38% of births from 2017 to 2019[2] were unintended. While overall rates of unintended pregnancy have declined across previous decades, rates have remained highest among those with low incomes, at younger ages, and among racial or ethnic minority groups.[1] Unintended pregnancy has been associated with worse measures of health and welfare for parents, infants, and children.[3,4]

Reducing unintended pregnancy is a Healthy People 2030 public health priority.[5] While multiple factors contribute to unintended pregnancies, contraception provides an effective preventive health strategy and is included under provisions of the Patient Protection and Affordable Care Act of 2010.[6] The safety and effectiveness of contraceptive methods have been well-established,[7,8] and clinical recommendations from medical and public health organizations have provided guidance to patients and clinicians.[4,9,10] However, access to and coverage for contraceptive services have faced ongoing obstacles in the US.[11,12] In addition, many states have or will restrict or prohibit terminating an unintended pregnancy following the recent Supreme Court decision in *Dobbs v Jackson Women's Health*.[13]

Understanding relationships between unintended pregnancy and health can inform clinical practice and health policy; however, estimates of these associations specific to current US populations are lacking. The aim of this systematic review and meta-analysis was to estimate associations of unintended pregnancy with key maternal and infant health outcomes during pregnancy and post partum in epidemiologic observational studies relevant to clinical practice and public health in the US.

Methods

This meta-analysis was part of a larger systematic review on the effectiveness of contraceptive counseling and provision interventions that was used to update national clinical practice recommendations.[10,14] A research protocol (PROSPERO CRD42020192981)[15] was developed in collaboration with methodological and content experts convened for this review that incorporates standard methods of systematic review and meta-analysis[16] and adheres to the Meta-analysis of Observational Studies in Epidemiology guidelines.[17] Institutional review board approval and participant informed consent were not required for this review because it included only previously published research.

Data Sources

A research librarian conducted searches of the Cochrane Central Register of Controlled Trials and Database of Systematic Reviews, PsycINFO, SocINDEX, and Ovid MEDLINE (January 1, 2000, to June 15, 2022) databases for relevant English-language articles published since 2000 (eMethods in Supplement). Investigators manually reviewed reference lists of key studies and systematic reviews.

Study Selection

Investigators independently dual reviewed abstracts and full-text articles to identify studies meeting prespecified eligibil-

Key Points

Question Is unintended pregnancy associated with adverse maternal and infant health conditions during pregnancy and post partum in the US?

Findings In this systematic review and meta-analysis, 36 studies (N = 524 522 participants) that controlled for multiple confounders compared health outcomes for intended vs unintended pregnancies. Unintended pregnancy was significantly associated with higher odds of maternal depression during pregnancy and post partum, maternal experience of interpersonal violence, preterm birth, and infant low birth weight.

Meaning Unintended pregnancy, compared with intended pregnancy, was significantly associated with adverse maternal and infant outcomes.

ity criteria. Discrepancies were resolved by discussion and consensus. Published studies were eligible for the meta-analysis if they evaluated associations of unintended pregnancy with maternal and infant health outcomes occurring during pregnancy and post partum by comparing participants with unintended vs intended pregnancies and reported estimates that adjusted for confounders. Unintended pregnancy was determined by maternal self-report. To optimize applicability to US practice, eligible studies included populations in countries considered very high on the 2018 Human Development Index. While the search and eligibility criteria used an inclusive definition of women (ie, pregnant and postpartum populations that included all gender identities), studies referred to their populations as women. Investigators managed references in an EndNote database (Thomson Reuters).

Outcomes

Eligibility criteria for studies in the systematic review included a wide range of maternal and infant health outcomes occurring during pregnancy and post partum. However, studies of most outcomes could not be combined in meta-analysis because they were reported in single or a small number of studies, outcome measures were heterogeneous, or results were not controlled for confounders. Studies not eligible for the meta-analysis were not included in this article.

Studies provided adequate data for meta-analysis for 5 outcome measures including prenatal depression, postpartum depression, maternal experience of interpersonal violence, preterm birth (<37 weeks' completed gestation), and infant low birth weight (<2500 g).

Data Extraction and Risk of Bias Assessment

Investigators (B.G.D., K.A., A.B.) abstracted data from included studies into tables including study design, methods, participant characteristics, settings, measure of pregnancy intention, comparators, confounders, and outcomes. Additional investigators (H.D.N., R.F.) reviewed data for accuracy. All data were extracted directly from publications, and contacting authors for additional information was not necessary. Risk of bias (quality) of cohort studies was independently dual rated as good, fair, or poor by investigators using criteria

developed by the US Preventive Services Task Force (eMethods in Supplement).[18] While these criteria are frequently used for systematic reviews for clinical guidelines, they do not apply to cross-sectional studies. Discrepancies were resolved through consensus with a third reviewer.

Data Synthesis

Results of included studies rated good or fair quality were combined using meta-analysis to obtain summary estimates of associations with the 5 maternal and infant health outcomes. Studies compared outcomes between 2 groups based on their definitions of unintended pregnancy and selection of comparison groups (unintended/intended; unplanned/planned; unwanted/wanted). For the primary meta-analysis, studies were combined using categories that most closely represented unintended pregnancy and were most consistent with definitions used across studies.

Adjusted odds ratios (aORs) from studies that adjusted for key confounding variables were included in the meta-analysis and no crude estimates were included. Adjusted risk ratios (aRRs) were reported in 2 studies[19,20] and converted to aORs. The aORs were combined by using a profile likelihood random-effects model to account for variation among studies.[21] The presence of statistical heterogeneity among studies was assessed using Cochran χ^2 tests, and the magnitude of heterogeneity using the I^2 statistic.[21] Heterogeneity was explored with sensitivity analyses based on study design (cross-sectional; cohort), whether the study controlled for history of depression for prenatal depression and postpartum depression outcomes, defined pregnancy as unwanted rather than unintended or unplanned, and provided separate outcomes for mistimed pregnancy. Unadjusted absolute risks were expressed as the proportions of participants in each group experiencing the outcome of interest for studies providing data. Overall absolute risks were calculated by combining proportions for individual studies. Studies not reporting data for absolute risks were not included in the overall estimates. Tests of small study effects were evaluated using the Egger test[22] and funnel plots for outcomes with at least 10 studies. Analyses were performed using Stata/SE version 16.1 (StataCorp). All significance testing was 2-sided, and results were considered statistically significant if $P < .05$. Because of the potential for type I error due to multiple comparisons in the observational studies, findings for the meta-analysis should be interpreted as exploratory.

Strength of Evidence

The strength of evidence was assessed by using modified GRADE criteria (eMethods in Supplement).[23] Ratings were based on study limitations (low, medium, or high level), consistency (consistent, inconsistent, or unknown/not applicable), directness (direct or indirect), precision (precise or imprecise), and reporting bias (suspected or undetected). The strength of evidence was assigned an overall grade of high, moderate, low, or insufficient by evaluating and weighing the combined results of the above domains. Grades were initially assessed by 1 investigator and then reviewed by all investigators for consensus.
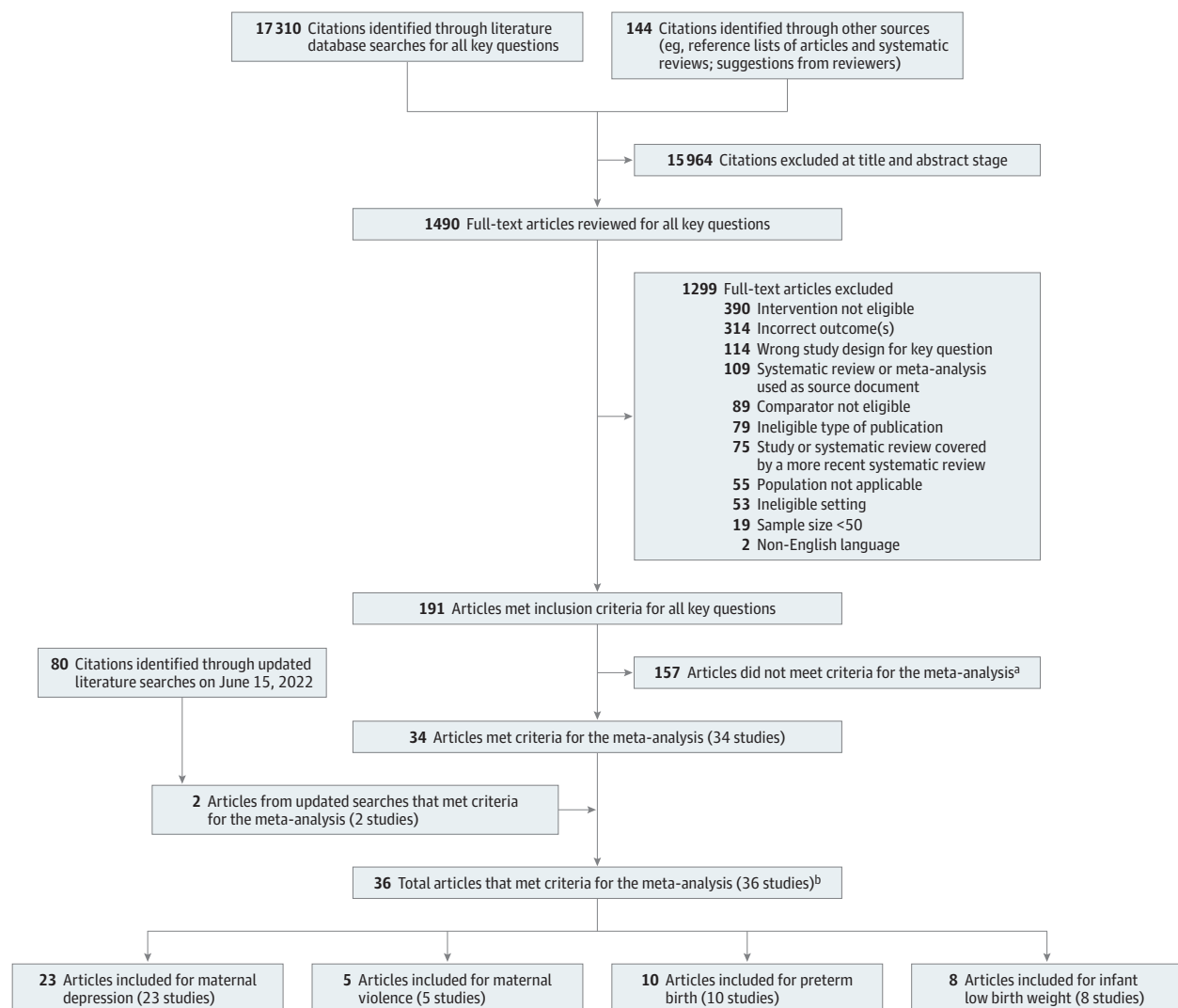
Results

A total of 36 observational studies (14 cohort and 22 cross-sectional studies; N = 524 522 participants) met inclusion criteria and provided adjusted estimates of associations between unintended pregnancy and maternal and infant outcomes for the meta-analysis. These studies represented a subset of the complete search of 17 534 abstracts for the full systematic review; no relevant gray literature was found (**Figure 1**). Of 14 cohort studies, 3 met criteria for good quality[24-26] and 11 for fair.[27-37] Most cohort studies used both prospectively and retrospectively collected data depending on predictors, confounders, and outcomes. The main limitations of rated cohort studies included high loss to follow-up, no sociodemographic data, and variations in selection of confounders. Cross-sectional studies also had limited sociodemographic data and variations in selection of confounders.

Studies were mostly conducted in North America, with additional studies in Europe and Asia. Most studies were based on analysis of more than 1000 observations, and 12 studies were based on more than 10 000 observations from population-based data sources.[19,20,24,26,38-45] Examples include the California Maternal and Infant Health Assessment,[38] UK Millennium Cohort Study,[40] and the Pregnancy Risk Assessment Monitoring System (PRAMS),[20,41,43,45] an ongoing maternal and infant health surveillance system in the US.[46] Participants in studies using population-based data sources reflected the age, racial and ethnic, and sociodemographic characteristics of the community, while smaller studies focused on specific populations.

Studies determined pregnancy intention by maternal self-report using measures from the PRAMS[20,26,41-43,45,47,48] or measures modeled on the PRAMS[27,34,35,38,49,50]; direct questions[19,24,30,33,36,37,39,40,51-54]; and other approaches.[25] Studies used various terms to elicit pregnancy intention from participants including whether the pregnancy was intended, wanted, planned, or mistimed. For example, in the PRAMS, women were asked, "Thinking back to just before you got pregnant with your new baby, how did you feel about becoming pregnant?" Responses included, "I wanted to be pregnant then," "I wanted to be pregnant later," and "I didn't want to be pregnant then or at any time in the future." These responses have been modified over time. Studies using responses indicating mistiming of pregnancy often combined categories. Most studies considered a pregnancy unintended or unplanned when a woman wanted to become pregnant in the future but not at the time she became pregnant (wanted later) or when she did not want to become pregnant then or at any time in the future (unwanted). Intended or planned pregnancies included those that were desired at the time they occurred or sooner than they occurred (then or sooner). Several studies did not describe how pregnancy intention was determined.[28,29,31,55-58]

Studies collected outcome measures either during pregnancy or post partum depending on the outcome. Postpartum depression, preterm birth, and infant low birth weight only

Figure 1. Literature Search Flow Diagram

| 17 310 Citations identified through literature database searches for all key questions | 144 Citations identified through other sources (eg, reference lists of articles and systematic reviews; suggestions from reviewers) |

15 964 Citations excluded at title and abstract stage

1490 Full-text articles reviewed for all key questions

1299 Full-text articles excluded
- 390 Intervention not eligible
- 314 Incorrect outcome(s)
- 114 Wrong study design for key question
- 109 Systematic review or meta-analysis used as source document
- 89 Comparator not eligible
- 79 Ineligible type of publication
- 75 Study or systematic review covered by a more recent systematic review
- 55 Population not applicable
- 53 Ineligible setting
- 19 Sample size <50
- 2 Non-English language

191 Articles met inclusion criteria for all key questions

80 Citations identified through updated literature searches on June 15, 2022

157 Articles did not meet criteria for the meta-analysis[a]

34 Articles met criteria for the meta-analysis (34 studies)

2 Articles from updated searches that met criteria for the meta-analysis (2 studies)

36 Total articles that met criteria for the meta-analysis (36 studies)[b]

| 23 Articles included for maternal depression (23 studies) | 5 Articles included for maternal violence (5 studies) | 10 Articles included for preterm birth (10 studies) | 8 Articles included for infant low birth weight (8 studies) |

[a] Excluded studies addressed other key questions of the systematic review.　　[b] Some studies included more than 1 outcome.

occurred at or after birth and all women included in studies with these outcomes completed a pregnancy. Prenatal depression and interpersonal violence during pregnancy occurred before birth and studies varied in timing of the outcome measurement. In studies collecting outcome measures during pregnancy, women did not have to complete a pregnancy to be included.

While the extent of adjustment for confounders varied across studies, adjustments generally included key demographic variables, such as maternal age, race and ethnicity, education, marital status, and income or poverty level; parity; and smoking and alcohol use. Several studies of prenatal or postpartum depression also adjusted for history of depression. Most studies reported results for the overall population, precluding analysis by specific populations based on demographic or other characteristics.

Maternal Depression

Twenty-three studies reported adjusted estimates of the association between unintended pregnancy and maternal depression including 15 studies of depression during pregnancy (7 cohort[24,28,29,31,32,34,37] and 8 cross-sectional[39,44,49-51,55,56,58] studies) and 10 studies of depression post partum (4 cohort[24,27,30,37] and 6 cross-sectional[19,41-43,47,48] studies) (Table 1). For prenatal depression, 12 studies collected depression measures during pregnancy[28,29,31,32,34,37,49-51,55,56,58] and 3 collected measures post partum.[24,39,44] Maternal depression was defined by dichotomizing responses based on standardized depression instruments, including the Edinburgh Postnatal Depression Scale, Patient Health Questionnaire, Center for Epidemiological Studies Depression Scale, 6-item Kessler Psychological Distress Scale, Hopkins Symptom Checklist-Depression Scale, and World Mental Health

Table 1. Studies of Unintended Pregnancy and Maternal Outcomes

Source	Study type (No. of patients); country; age; race and ethnicity	Measure	Confounders included in adjusted analysis	Comparison	Outcome	Results (unintended vs intended pregnancy)	Quality rating[a]
Depression							
Gross et al,[42] 2002	Cross-sectional (14 609); US; <20 to >35 y; race and ethnicity NR	PRAMS: self-report of being very depressed[b] collected post partum	Demographics,[c] stressors, infant health, physical abuse, parity	Unwanted vs wanted; mistimed (too soon) vs wanted	Postpartum depression	Unwanted: aOR, 1.5 (95% CI, 1.0-2.2); mistimed: aOR, 1.3 (95% CI, 1.0-1.7)	NA
Chee et al,[31] 2005	Prospective cohort (559); Singapore; <20 to >35 y; 53% Chinese; 47% non-Chinese	English or Mandarin EPDS ≥7 followed by the Structured Clinical Interview for DSM-IV, nonpatient version collected at a prenatal clinic visit and 6 wk post partum	Demographics, female infant, employed, ≥2 living children, living arrangements, marital dissatisfaction, support, history of abortion or depression, family history of mental disorder	Unplanned vs planned	Prenatal depression; postpartum depression	Prenatal: aOR, 2.56 (95% CI, 1.18-5.52); post partum: OR, 1.77 (95% CI, 0.67-4.66)	Fair
Rich-Edwards et al,[37] 2006	Prospective cohort (1662 midpregnancy, 1278 post partum); US; <23 to >40 y; race and ethnicity NR	EPDS ≥12 at midpregnancy and 6 mo post partum	Demographics, immigrant status, parity, family/friends support, partner support	Unwanted vs wanted	Prenatal depression; postpartum depression	Midpregnancy: aOR, 2.05 (95% CI, 1.12-3.75); 6 mo post partum: aOR, 1.55 (95% CI, 0.68-3.53)	Fair
Blake et al,[50] 2007	Cross-sectional (1007); US; mean, 25.1 y; 100% Black	Hopkins Symptom Checklist-Depression Scale score ≥0.75 collected at >32 wk gestation	Demographics, gestational age, employment status	Unwanted vs intended; mistimed (too soon) vs intended	Prenatal depression in the past month	Unwanted: aOR, 1.35 (95% CI, 0.95-1.90); mistimed: aOR, 1.38 (95% CI, 1.02-1.86)	NA
Escribè-Agüir et al,[56] 2008	Cross-sectional (685); Spain; <30 to >34 y; race and ethnicity NR	EPDS ≥13 collected at the third trimester	Demographics, depression history, clinical factors	Unplanned vs planned	Prenatal depression	aOR, 0.87 (95% CI, 0.37-2.05)	NA
Bunevicius et al,[29] 2009	Prospective cohort (230); Lithuania; mean, 29 y; race and ethnicity NR	Depression responses collected at 12-16, 22-26, and 32-36 wk gestation[d]	Education, history of depression, neuroticism, psychosocial stressors	Unwanted + unplanned vs intended	Prenatal depression	12-16 wk: aOR, 6.07 (95% CI, 1.64-22.46); 22-26 wk: aOR, 15.35 (95% CI, 3.18-74.24); 32-36 wk: aOR, 7.30 (95% CI, 1.79-29.74)	Fair
Cheng et al,[47] 2009	Cross-sectional (9048); US; <20 to >40 y; race and ethnicity NR	PRAMS: self-report of symptoms, dichotomized and collected at 2-9 mo post partum	Demographics, Medicaid insured, parity	Unwanted vs intended; mistimed (too soon) vs intended	Postpartum depression	Unwanted: aOR, 1.98 (95% CI, 1.48-2.64); mistimed: aOR, 1.34 (95% CI, 1.08-1.68)	NA
Dhillon and Macarthur,[55] 2010	Cross-sectional (300); United Kingdom; mean, 28 y; 7% Bangladeshi, 27% Indian, 65% Pakistani	EPDS ≥12 collected at prenatal visits	Multiparous, satisfied with pregnancy, previous depression, anxiety, support, family preference for a male	Unplanned vs planned	Prenatal depression	aOR, 2.2 (95% CI, 1.1-4.3)	NA
Maxson and Miranda,[34] 2011	Prospective cohort (1321); US; <20 to >35 y; 23% Black, 77% White	20-Item CES-D, continuous and dichotomized (unspecified threshold) collected between 18-28 wk gestation	Demographics, >3 children, self-efficacy, perceived stress, social support	Unwanted vs wanted; mistimed (too soon) vs wanted	Prenatal depression	Unwanted: aOR, 0.90 (95% CI, 0.64-1.40); mistimed: aOR, 0.90 (95% CI, 0.68-1.30)	Fair
Dudas et al,[51] 2012	Cross-sectional (1719); Hungary; mean, 27.7 y; race and ethnicity NR	Leverton Questionnaire ≥12 collected at 14-24 wk gestation	Primiparity, lack of support, previous sterility or adverse obstetric outcome, history of depression, major life events in past year	Unplanned vs planned	Prenatal depression	aOR, 1.12 (95% CI, 1.03-1.20)	NA
Abbasi et al,[27] 2013	Prospective cohort (2972); US; 18-36 y; 2% Asian, 7% Black, 5% Hispanic, 83% White, 2% other	EPDS ≥12 collected at 1 mo post partum	Demographics, prepregnancy depression/anxiety	Unintended vs intended	Postpartum depression	aOR, 1.41 (95% CI, 0.91-2.18)	Fair
McCrory and McNally,[19] 2013	Cross-sectional (10 140); Ireland; mean, 31 y; 3% Asian, 3% Black, 94% White	8-Item CES-D ≥7 collected at 9 mo post partum	Demographics, parity, folic acid use, smoking and alcohol use	Unintended vs Intended	Postpartum depression	aRR, 1.36 (95% CI, 1.19-1.54)	NA

Table 1. Studies of Unintended Pregnancy and Maternal Outcomes (continued)

Source	Study type (No. of patients); country; age; race and ethnicity	Measure	Confounders included in adjusted analysis	Comparison	Outcome	Results (unintended vs intended pregnancy)	Quality rating[a]
Redshaw and Henderson,[58] 2013	Cross-sectional (5332); England; 19 to >40 y; 13% Asian, 8% Black, 2% Chinese, 75% White, 2% mixed[e]	Response to question about experiencing depression[f] collected at 3 mo post partum	Demographics, single parenthood, long-term physical problem/disability	Unplanned but not overjoyed/pleased vs planned	Prenatal depression	aOR, 1.66 (95% CI, 1.25-2.20)	NA
Fellenzer and Cibula,[39] 2014	Cross-sectional (18 394); US; <17 to >35 y; 7% Black, 5% Hispanic, 81% White, 7% other	PRAMS: 5-levels collapsed into none, mild, moderate, and severe symptoms collected within 72 h of delivery	Demographics, smoking during first trimester, drug use, medical insurance	Unintended vs intended; mistimed (too soon) vs intended	Prenatal depression	Mild depression symptoms: unintended, aOR, 1.75 (95% CI, 1.54-1.99); mistimed, aOR, 1.75 (95% CI, 1.61-1.90). Moderate symptoms: unintended, aOR, 1.99 (95% CI, 1.62-2.46); mistimed, aOR, 1.74 (95% CI, 1.50-2.02). Severe symptoms: unintended, aOR, 3.61 (95% CI, 2.56-5.10); mistimed, aOR, 2.67 (95% CI, 2.02-3.51)	NA
Bahk et al,[24] 2015	Prospective cohort (first wave, 2078; second wave, 1904; third wave, 1802); South Korea; mean, 31.3 y; race and ethnicity NR	Kessler 6 Scale ≥14 collected at birth and post partum	Demographics, birth order, infant sex, parental smoking and alcohol, parental occupation	Unintended vs intended	Prenatal and postpartum depression	Prenatal: aOR, 1.32 (95% CI, 1.01-1.72); 1 mo post partum: aOR, 1.59 (95% CI, 1.06-2.40); 4 mo post partum: aOR, 1.30 (95% CI, 0.98-1.71); 1 y post partum: aOR, 1.19 (95% CI, 0.90-1.56); 2 y post partum: aOR, 0.95 (95% CI, 0.71-1.28); overall: aOR, 1.22 (95% CI, 1.02-1.46)	Good
Bayrampour et al,[28] 2015	Prospective cohort (2998); Canada; <25 to >35 y; 80% White; 20% other	EPDS ≥13 collected at the second and third trimesters	Demographics, history of mental health issues, stress, social support, reproductive history	Unplanned vs planned	Prenatal depression in both second and third trimesters	aOR, 3.05 (95% CI, 1.61-5.79)	Fair
Gariepy et al,[32] 2016	Prospective cohort (2651); US; mean, 31 y; 3% Asian, 7% Black, 14% Hispanic, 74% White, 1% mixed[e]	WMH-CIDI version 2.1, standard algorithm for MDE collected at <18 wk gestation and repeated twice during pregnancy	Demographics, alcohol use, benzodiazepine use, panic disorder, sexual abuse, PTSD	Unplanned vs planned	MDE during pregnancy	Unplanned: aOR, 1.69 (95% CI, 1.23-2.32)	Fair
Suh et al,[48] 2016	Cross-sectional (5549); US; <18 to >35 y; 39% Black, 61% White	PRAMS: 5 levels collapsed into none, mild, severe symptoms collected 9 mo post partum	Demographics, maternal factors, stress before pregnancy, physical abuse, smoking and drinking habits	Unwanted vs wanted; mistimed (too soon) vs wanted	Postpartum depression	Mild depression symptoms: unwanted: aOR, 1.19 (95% CI, 0.95-1.49); mistimed: aOR, 1.19 (95% CI, 1.01-1.41). Severe depression symptoms: unwanted: aOR, 1.76 (95% CI, 1.23-2.53); mistimed: aOR, 1.23 (95% CI, 0.91-1.66)	NA
Gauthreaux et al,[41] 2017	Cross-sectional (110 231); US; <20 to >35 y; 9% Black, 77% White, 14% other; 20% Hispanic, 80% non-Hispanic	PRAMS: self-report of symptoms collected post partum	Demographics, gestational age, history of depression, abuse, number of stressors	Unwanted vs wanted; mistimed (too soon) vs wanted	Postpartum depression	Unwanted: aOR, 1.51 (95% CI, 1.34-1.71); mistimed, desired sooner: aOR, 1.15 (95% CI, 1.05-1.25); mistimed, desired later: aOR, 1.30 (95% CI, 1.20-1.41)	NA
Cruz-Bendezú et al,[49] 2020	Cross-sectional (870); US; mean, 29.3 y; 10% Black, 51% Hispanic, 28% White, 11% other	Current depression: PHQ-2 ≥3 or EDPS ≥12 collected at prenatal visits	Demographics, country of birth, gravidity, insurance status	Unintended vs intended	Prenatal depression	aOR, 1.83 (95% CI, 1.04-3.20)	NA

(continued)

Research **Original Investigation**

Associations of Unintended Pregnancy With Maternal and Infant Health Outcomes

Table 1. Studies of Unintended Pregnancy and Maternal Outcomes (continued)

Source	Study type (No. of patients); country; age; race and ethnicity	Measure	Confounders included in adjusted analysis	Comparison	Outcome	Results (unintended vs intended pregnancy)	Quality rating[a]
Chan,[30] 2021	Prospective cohort (1083); Hong Kong; mean, 31.3 y; race and ethnicity NR	Chinese EPDS ≥10 collected at <24 wk gestation and 1 mo post partum	Demographics, IPV during pregnancy, depression during pregnancy, father involvement, social support	Unintended vs intended	Postpartum depression	aOR, 1.95 (95% CI, 1.15-3.28)	Fair
Mark and Cowan,[43] 2022	Cross-sectional (144 017); US; age and race and ethnicity NR	PRAMS: self-report of symptoms, dichotomized and collected post partum	Demographics, state, birth order, Medicaid status	Unwanted vs wanted	Postpartum depression	aOR, 2.42 (t statistic, 3.23)	NA
Moreau et al,[44] 2022	Cross-sectional (10 339); France; 18 to >40 y; race and ethnicity NR	Presence of sadness and loss of interest for at least 2 consecutive wk during pregnancy collected at delivery	Demographics, parity, health insurance, high-risk maternal conditions	Unplanned/unwanted vs planned/wanted	Prenatal depression	aOR, 1.75 (95% CI, 1.51-2.02)	NA
Experience of violence							
Goodwin et al,[20] 2000	Cross-sectional (34 835); US; 86% >20 y; 19% Black, 77% White, 4% other	PRAMS item: physical abuse in the 12 mo preceding or during pregnancy collected post partum	Demographics, behaviors, prenatal care entry	Unintended (mistimed [too soon] + unwanted) vs intended	IPV before or during pregnancy	aRR, 2.5 (95% CI, 2.2-2.8)	NA
Martin and Garcia,[57] 2011	Cross-sectional[9] (313); US; 30% < 21 y; 100% Latina	Physical and emotional interpersonal violence (validated 12-item scale[59]) collected second or third trimester	Demographics, acculturation	Unintended vs intended	IPV during pregnancy	aOR, 2.80 (95% CI, 1.01-7.73)	NA
Lukasse et al,[52] 2015	Cross-sectional (7102); Europe; <25 to >35 y; race and ethnicity NR	Abuse in the past 12 mo (emotional, physical, sexual) on the NorVold Abuse Questionnaire collected at prenatal visits	Demographics, weeks of gestation	Unintended vs intended	IPV during pregnancy	aOR, 2.03 (95% CI, 1.54-2.68)	NA
Narayan et al,[53] 2019	Cross-sectional[9] (236); US; mean, 30.9 y; 13% Black, 50% Latina, 17% White, 17% multiracial	Interview: IPV during pregnancy (experience any of 10 types of physical violence during pregnancy) collected post partum	Demographics, victimization in middle childhood and adolescence, depressive symptoms	Unplanned vs planned	IPV during pregnancy	aOR, 0.84 (95% CI, 0.37-1.96)	NA
Mark and Cowan,[43] 2022	Cross-sectional (126 474); US; age and race and ethnicity NR	PRAMS item: physical abuse in the 12 mo preceding or during most recent pregnancy collected post partum	Demographics, state, birth order, Medicaid status	Unwanted vs wanted	IPV during pregnancy	aOR, 2.05 (t statistic, 2.27)	NA

Abbreviations: aOR, adjusted odds ratio; aRR, adjusted relative risk; CES-D, Center for Epidemiological Studies Depression Scale; EPDS, Edinburgh Postnatal Depression Scale; IPV, intimate partner violence; MDE, major depressive episode; NA, not applicable; NR, not reported; PHQ, Patient Health Questionnaire; PRAMS, Pregnancy Risk Assessment Monitoring System; PTSD, posttraumatic stress disorder; WMH-CIDI, World Mental Health Composite International Diagnostic Interview.

[a] Cohort studies were independently dual-rated by investigators. Cross-sectional studies were not rated because US Preventive Services Task Force criteria were not available for this study design.

[b] Self-report of being very depressed based on women's responses to the PRAMS question, "In the month after your delivery, would you say that you were not depressed at all, a little depressed, moderately depressed, very depressed, or very depressed and had to get help?" The very depressed group included the last 2 responses.

[c] Demographic variables, such as maternal age, race and ethnicity, education, marital status, income, and/or poverty level, vary by study.

[d] WMH-CIDI Short Form (CIDI-SF) screener and Structured Clinical Interview for *DSM-III-R* for psychiatric diagnostic assessment. Women who gave at least 1 positive answer to the CIDI-SF depression screening question were evaluated for depressive disorder using the nonpatient version of the Structured Clinical Interview for *DSM-III-R* (SCID-NP).

[e] "Mixed" was the term used during data collection.

[f] Response to question, "Did you experience depression or seek help for depression from a midwife or a doctor?" Postnatal "blues" was combined with postnatal depression.

[g] Studies used cross-sectional data collection; analysis was designed as case-control.

Composite International Diagnostic Interview; relevant responses from the PRAMS; and direct questions about depression. These measures varied in their ability to identify symptoms of depression, screening thresholds for depression, or depression diagnosis.

In a meta-analysis, unintended compared with intended pregnancy was significantly associated with depression during pregnancy (23.3% vs 13.9%; adjusted odds ratio [aOR], 1.59 [95% CI, 1.35-1.92]; I^2 = 85.0%; 15 studies [n = 41 054][24, 28, 29, 31, 32, 34, 37, 39, 44, 49-51, 55, 56, 58]) and post partum (15.7% vs 9.6%; aOR, 1.51 [95% CI, 1.40-1.70]; I^2 = 7.1%; 10 studies [n = 82 673][19,24,27,30,37,41-43,47,48]) (**Figure 2**). In a sensitivity analysis, results were similar regardless of controlling for a history of depression, cross-sectional or cohort study design (eFigure 1 in Supplement), or whether the exposure of interest was defined by the study as an unwanted pregnancy rather than an unintended or unplanned pregnancy (eFigure 2 in Supplement). For studies comparing pregnancies occurring sooner than wanted,[34,39,41,42,47,48,50] point estimates were consistent with the main findings, although not statistically significant for prenatal depression[34,39,50] (eFigure 3 in Supplement).

Maternal Experience of Interpersonal Violence

Five cross-sectional studies[20,43,52,53,57] reported estimates of the relationship of unintended pregnancy and experience of interpersonal violence during pregnancy that adjusted for sociodemographic and other confounders. Two studies collected measures during pregnancy[52,57] and 3 post partum.[20,43,53] Violence was defined by dichotomizing responses based on standardized scales including the Life Stressor Checklist–Revised and NorVold Abuse Questionnaire; relevant items in the PRAMS; or a screening instrument validated for the study population.[59] Some measures included emotional or sexual abuse and used composite measures. In a meta-analysis, unintended compared with intended pregnancy was significantly associated with interpersonal violence during pregnancy (14.6% vs 5.5%; aOR, 2.22 [95% CI, 1.41-2.91]; I^2 = 64.1%; 5 studies [n = 42 306][20,43,52,53,57]) (Figure 2). No sensitivity analysis was performed because all studies used a cross-sectional study design and defined the exposure of interest as a pregnancy that was unintended or unplanned.

Preterm Birth and Infant Low Birth Weight

Ten studies reported adjusted estimates of associations between unintended pregnancy and preterm birth, defined as less than 37 weeks' completed gestation (4 cohort[26,33,35,36] and 6 cross-sectional[19,38,40,43,45,54] studies). Eight studies reported infant low birth weight, measured as less than 2500 g (3 cohort[25,26,36] and 5 cross-sectional[19,40,43,45,54] studies) (**Table 2**). Outcome measures were obtained from medical records, birth certificates, and parent self-report.

In a meta-analysis, unintended compared with intended pregnancy was significantly associated with preterm birth (9.4% vs 7.7%; aOR, 1.21 [95% CI, 1.12-1.31]; I^2 = 1.7%; 10 studies [n = 94 351][19,26,33,35,36,38,40,43,45,54]) and infant low birth weight (7.3% vs 5.2%; aOR, 1.09 [95% CI, 1.02-1.21]; I^2 = 0.0%; 8 studies [n = 87 547][19,25,26,36,40,43,45,54]) (**Figure 3**). In a sensitivity analysis, results for preterm birth were similar regardless of cross-sectional or cohort study design or whether the exposure of interest was defined by the study as a pregnancy that was unwanted rather than unintended or unplanned (eFigure 4 in Supplement). For infant low birth weight, point estimates were consistent with the main findings but were not statistically significant for cohort studies, or for pregnancies defined as unwanted, based on fewer studies (eFigure 5 in Supplement). For studies comparing pregnancies occurring sooner than wanted,[26,38,45] point estimates indicated that mistimed pregnancies compared with intended pregnancies were associated with lower odds of preterm birth and infant low birth weight, although few studies were included in these estimates (eFigure 4 and eFigure 5 in Supplement).

Publication Bias and Strength of Evidence

An assessment of publication bias indicated no small study effects for depression during pregnancy and post partum and for preterm birth (eFigure 6 in Supplement). There were too few studies to evaluate small study effects for interpersonal violence and low birth weight.

Studies met modified GRADE criteria for moderate to high strength of evidence of associations of unintended pregnancy with higher rates of maternal depression during pregnancy and post partum, maternal experience of interpersonal violence, preterm birth, and infant low birth weight (eTable in Supplement). These grades were supported by evidence that included data from large population-based sources with high applicability to clinical practices serving similar patient populations in the US, consistency and precision of findings, and unlikely reporting bias.

Discussion

Compared with intended pregnancy, unintended pregnancy was significantly associated with adverse maternal and infant outcomes in this systematic review and meta-analysis of 36 epidemiologic observational studies.

Strengths of this systematic review and meta-analysis included the comprehensive literature search; focused eligibility criteria; inclusion of studies from contemporary cohorts relevant to the US population; assessment of individual study quality and overall strength of evidence for each outcome; and use of adjusted estimates from individual studies to estimate overall associations. In addition, heterogeneity was explored through sensitivity analysis based on controlling for history of depression for depression outcomes; study design; and definitions of pregnancy as unintended, unwanted, and mistimed. This review addressed health issues with timely policy and practice implications following the recent Supreme Court decision limiting abortion.

Results of the meta-analysis were generally consistent with previous reviews. Published narrative reviews without

Figure 2. Maternal Outcomes[a]

A Prenatal depression
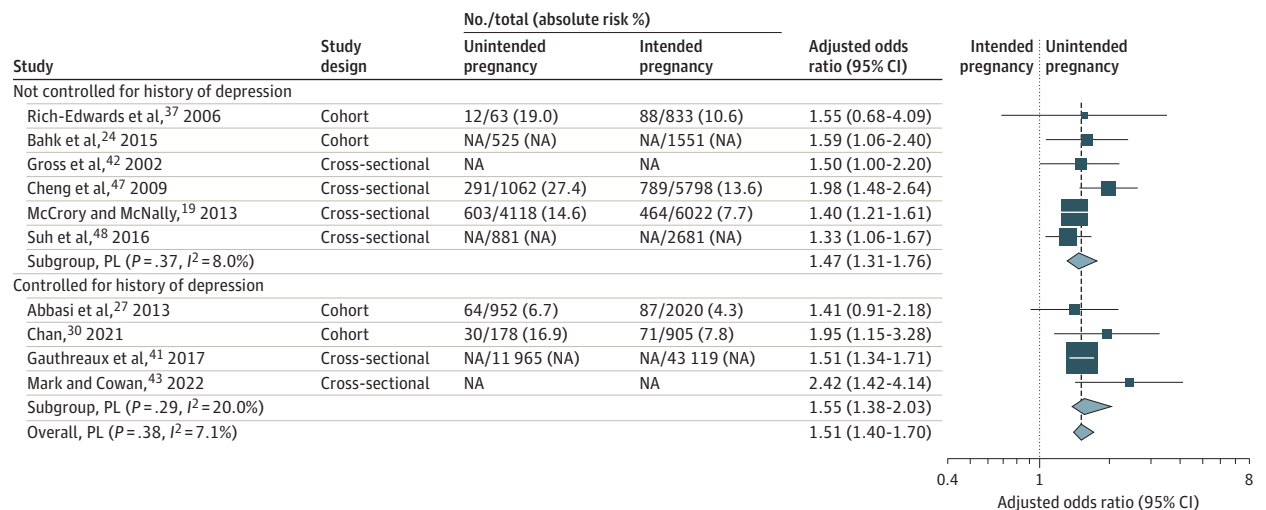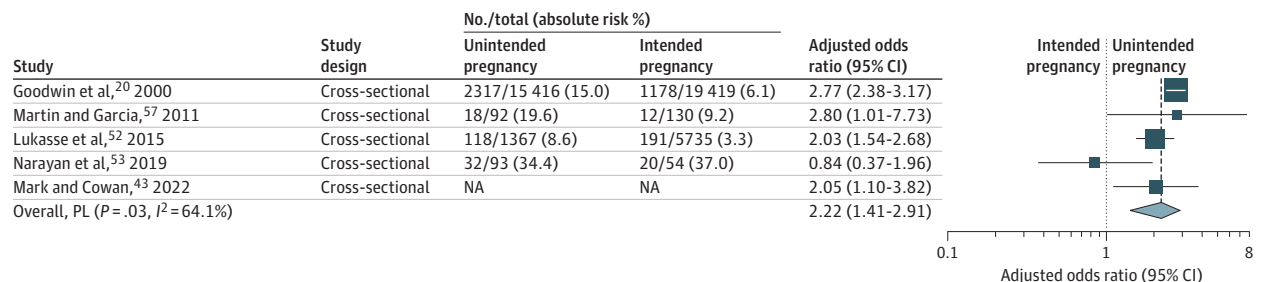
Study	Study design	No./total (absolute risk %) Unintended pregnancy	Intended pregnancy	Adjusted odds ratio (95% CI)
Not controlled for history of depression				
Maxson and Miranda,[34] 2011	Cohort	NA/245 (NA)	NA/498 (NA)	0.90 (0.64-1.40)
Bahk et al,[24] 2015	Cohort	NA/525 (NA)	NA/1551 (NA)	1.32 (1.01-1.72)
Bayrampour et al,[28] 2015	Cohort	37/653 (5.7)	35/2335 (1.5)	3.05 (1.61-5.79)
Gariepy et al,[32] 2016	Cohort	131/987 (13.3)	91/1664 (5.5)	1.69 (1.23-2.32)
Blake et al,[50] 2007	Cross-sectional	109/237 (46.0)	135/347 (38.9)	1.35 (0.95-1.90)
Redshaw and Henderson,[58] 2013	Cross-sectional	130/829 (15.7)	294/3970 (7.4)	1.66 (1.25-2.20)
Fellenzer and Cibula,[39] 2014	Cross-sectional	646/1551 (41.7)	2542/11 249 (22.6)	1.93 (1.71-2.18)
Cruz-Bendezú et al,[49] 2020	Cross-sectional	36/341 (10.6)	27/529 (5.1)	1.83 (1.04-3.20)
Moreau et al,[44] 2022	Cross-sectional	279/1245 (22.4)	792/7685 (10.3)	1.75 (1.51-2.02)
Subgroup, PL (P = .003, I^2 = 65.3%)				1.61 (1.35-1.91)
Controlled for history of depression				
Chee et al,[31] 2005	Cohort	35/195 (17.9)	33/364 (9.1)	2.56 (1.18-5.52)
Rich-Edwards et al,[37] 2006	Cohort	22/84 (26.2)	73/1036 (7.0)	1.89 (0.88-4.09)
Bunevicius et al,[29] 2009	Cohort	NA/25 (NA)	NA/205 (NA)	8.79 (2.11-36.58)
Escribè-Agüir et al,[56] 2008	Cross-sectional	NA/73 (NA)	NA/612 (NA)	0.87 (0.37-2.05)
Dhillon and Macarthur,[55] 2010	Cross-sectional	58/218 (26.6)	34/82 (41.5)	2.20 (1.10-4.30)
Dudas et al,[51] 2012	Cross-sectional	92/407 (22.6)	203/1312 (15.5)	1.13 (1.03-1.20)
Subgroup, PL (P = .003, I^2 = 71.6%)				1.72 (1.11-3.22)
Overall, PL (P <.001, I^2 = 85.0%)				1.59 (1.35-1.92)

B Postpartum depression

Study	Study design	No./total (absolute risk %) Unintended pregnancy	Intended pregnancy	Adjusted odds ratio (95% CI)
Not controlled for history of depression				
Rich-Edwards et al,[37] 2006	Cohort	12/63 (19.0)	88/833 (10.6)	1.55 (0.68-4.09)
Bahk et al,[24] 2015	Cohort	NA/525 (NA)	NA/1551 (NA)	1.59 (1.06-2.40)
Gross et al,[42] 2002	Cross-sectional	NA	NA	1.50 (1.00-2.20)
Cheng et al,[47] 2009	Cross-sectional	291/1062 (27.4)	789/5798 (13.6)	1.98 (1.48-2.64)
McCrory and McNally,[19] 2013	Cross-sectional	603/4118 (14.6)	464/6022 (7.7)	1.40 (1.21-1.61)
Suh et al,[48] 2016	Cross-sectional	NA/881 (NA)	NA/2681 (NA)	1.33 (1.06-1.67)
Subgroup, PL (P = .37, I^2 = 8.0%)				1.47 (1.31-1.76)
Controlled for history of depression				
Abbasi et al,[27] 2013	Cohort	64/952 (6.7)	87/2020 (4.3)	1.41 (0.91-2.18)
Chan,[30] 2021	Cohort	30/178 (16.9)	71/905 (7.8)	1.95 (1.15-3.28)
Gauthreaux et al,[41] 2017	Cross-sectional	NA/11 965 (NA)	NA/43 119 (NA)	1.51 (1.34-1.71)
Mark and Cowan,[43] 2022	Cross-sectional	NA	NA	2.42 (1.42-4.14)
Subgroup, PL (P = .29, I^2 = 20.0%)				1.55 (1.38-2.03)
Overall, PL (P = .38, I^2 = 7.1%)				1.51 (1.40-1.70)

C Maternal violence

Study	Study design	No./total (absolute risk %) Unintended pregnancy	Intended pregnancy	Adjusted odds ratio (95% CI)
Goodwin et al,[20] 2000	Cross-sectional	2317/15 416 (15.0)	1178/19 419 (6.1)	2.77 (2.38-3.17)
Martin and Garcia,[57] 2011	Cross-sectional	18/92 (19.6)	12/130 (9.2)	2.80 (1.01-7.73)
Lukasse et al,[52] 2015	Cross-sectional	118/1367 (8.6)	191/5735 (3.3)	2.03 (1.54-2.68)
Narayan et al,[53] 2019	Cross-sectional	32/93 (34.4)	20/54 (37.0)	0.84 (0.37-1.96)
Mark and Cowan,[43] 2022	Cross-sectional	NA	NA	2.05 (1.10-3.82)
Overall, PL (P = .03, I^2 = 64.1%)				2.22 (1.41-2.91)

The sizes of the boxes represent numbers of participants in each study. The vertical dashed lines indicate the location of the adjusted odds ratio of the overall estimate. NA indicates data were not available; PL, profile likelihood.

[a] Totals do not include all participants because some studies did not report data.

Table 2. Studies of Unintended Pregnancy and Preterm Birth and Infant Low Birth Weight

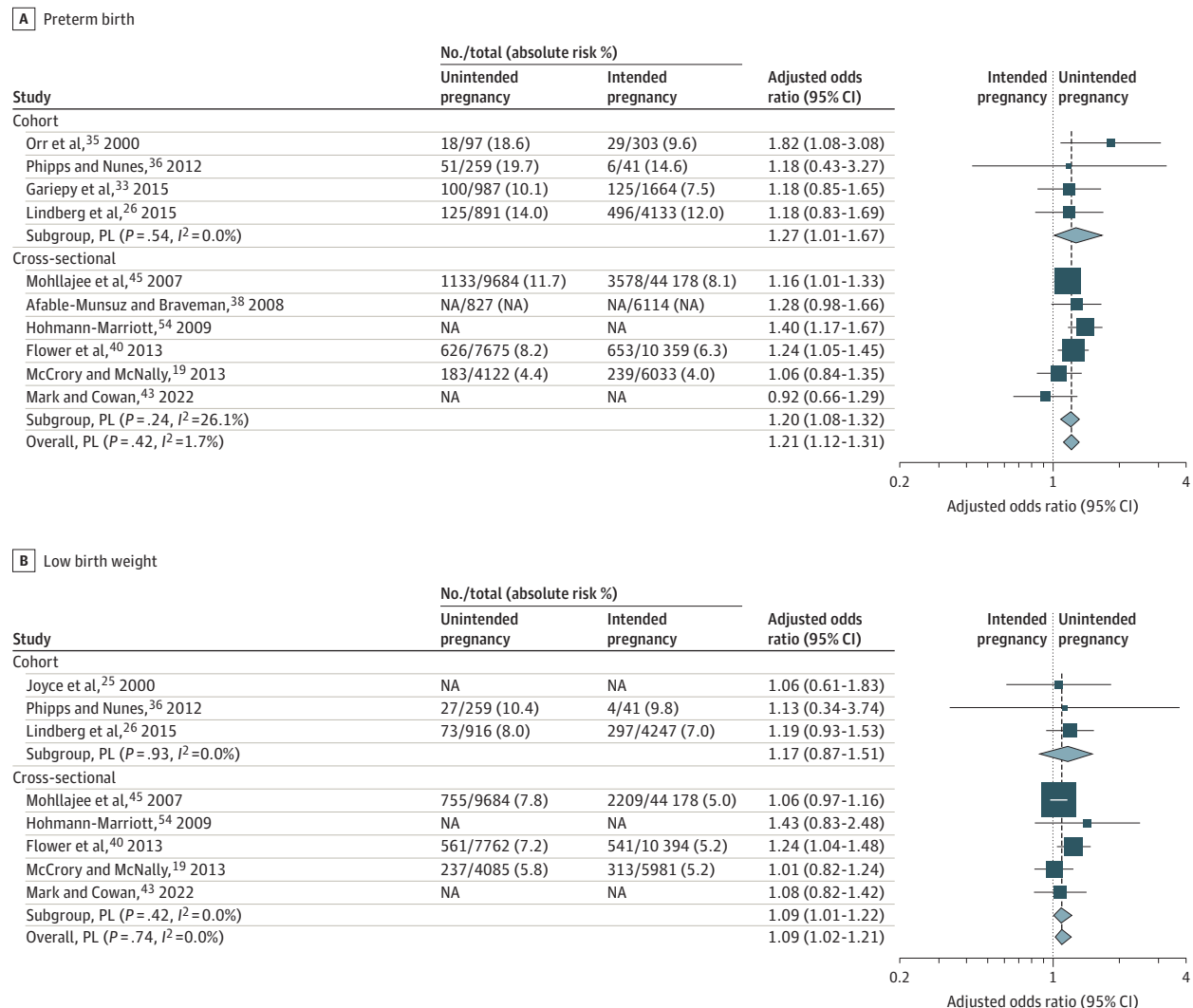| Source	Study type (No. of patients); country; age; race and ethnicity	Measures	Confounders included in adjusted analysis	Comparison	Outcome	Results (unintended vs intended pregnancy)	Quality rating[a]
Joyce et al,[25] 2000	Prospective cohort; (7751); US; age and race and ethnicity not reported	<2500 g; maternal report	Demographics,[b] family characteristics, mother's Aid to Families with Dependent Children participation; Armed Forces Qualification Test score, self-efficacy score, self-esteem score	Unwanted vs intended; mistimed vs intended	Low birth weight	Unwanted: aOR, 1.06 (95% CI, not reported); mistimed: aOR, 0.85 (95% CI, not reported)	Good
Orr et al,[35] 2000	Prospective cohort; (913); US; age and race and ethnicity not reported	<37 wk; medical records	Alcohol use, drug use, smoking, clinical factors	Unintended vs intended	Preterm	aOR, 1.82 (95% CI, 1.08-3.08)	Fair
Mohllajee et al,[45] 2007	Cross-sectional; (87 087); US; 18 to >35 y; 2% Asian, 20% Black, 77% White, 1% other; 13% Hispanic, 87% non-Hispanic	<2500 g; <37 wk; birth certificate (Pregnancy Risk Assessment Monitoring System)	Demographics, parity, prenatal care, smoking, alcohol use, previous low birth weight or preterm	Unwanted vs intended; mistimed (too soon) vs intended	Preterm; low birth weight	Preterm: unwanted: aOR, 1.16 (95% CI, 1.01-1.33); mistimed: aOR, 0.91 (95% CI, 0.83-1.00). Low birth weight: unwanted: aOR, 1.06 (95% CI, 0.97-1.16); mistimed: aOR, 0.92 (95% CI, 0.86-0.97)	Not applicable
Afable-Munsuz and Braveman,[38] 2008	Cross-sectional (5763); US; 15 to >35 y; 100% White	<37 wk; birth certificates	Demographics, parity, paternal education	Unwanted vs intended; mistimed (too soon) vs intended	Preterm	Unwanted: aOR, 1.31 (95% CI, 0.89-1.91); mistimed: aOR, 1.08 (95% CI, 0.83-1.41)	Not applicable
Hohmann-Marriott,[54] 2009	Cross-sectional; (5788); US; mean, 29.6 y; 4% Asian, 8% Black, 22% Hispanic, 1% Native American, 64% White, 2% multiracial or multiethnic	<37 wk; <2500 g; birth certificates	Demographics, relationship problems, birth order, smoking	Unintended vs intended	Preterm; low birth weight	Preterm: aOR, 1.36; $P < .001$; low birth weight: aOR, 0.02 (not statistically significant[c])	Not applicable
Phipps and Nunes,[36] 2012	Prospective cohort; (300); US; 12 to 19 y; 35% Black, 47% Hispanic, 19% White, 8% other	<37 wk; <2500 g; medical records	Demographics, pregnancy readiness, and sexually transmitted disease history (for preterm)	Unplanned vs planned	Preterm; low birth weight	Preterm: aOR, 1.18 (95% CI, 0.43-3.27); low birth weight: aOR, 1.13 (95% CI, 0.34-3.74)	Fair
Flower et al,[40] 2013	Cross-sectional (18 178); UK; age and race and ethnicity not reported	<37 wk; <2500 g; parental report	Demographics, relationship status, fertility treatment, smoking, body mass index (for preterm)	Unintended vs intended	Preterm; low birth weight	Preterm: aOR, 1.24 (95% CI 1.05-1.45); low birth weight: aOR, 1.24 (95% CI 1.04-1.48)	Not applicable
McCrory and McNally,[19] 2013	Cross-sectional; (low birth weight = 10 066; preterm = 10 155); Ireland; mean, 31 y; 3% Asian, 3% Black, 94% White	<37 wk; <2500 g; maternal report	Demographics, parity, folic acid use, smoking, alcohol use, antenatal visit	Unintended vs intended	Preterm; low birth weight	Preterm: aRR, 1.06 (95% CI, 0.85-1.33); low birth weight: aRR, 1.01 (95% CI, 0.83-1.22)	Not applicable
Gariepy et al,[33] 2015	Prospective cohort; (2654); US; mean, 31 y; 3% Asian, 7% Black, 14% Hispanic, 74% White, 1% multiracial or multiethnic	<37 wk; medical records	Demographics, clinical factors	Unplanned vs planned	Preterm	aOR, 1.18 (95% CI, 0.85-1.65)	Fair

(continued)

Table 2. Studies of Unintended Pregnancy and Preterm Birth and Infant Low Birth Weight (continued)

Source	Study type (No. of patients); country; age; race and ethnicity	Measures	Confounders included in adjusted analysis	Comparison	Outcome	Results (unintended vs intended pregnancy)	Quality rating[a]
Lindberg et al,[26] 2015	Prospective cohort; (8444); US; 15 to 44 y; 8% Black, 10% Hispanic, 69% White; 12% other	<37 wk; <2500 g; birth certificate (Pregnancy Risk Assessment Monitoring System)	Demographics, clinical and lifestyle factors	Unwanted vs wanted; mistimed vs wanted	Preterm; low birth weight	Preterm: unwanted: aOR, 1.18 (95% CI, 0.83-1.69); mistimed <2 y: aOR, 0.89 (95% CI, 0.67-1.19); mistimed ≥2 y: aOR, 0.93 (95% CI, 0.67-1.28). Low birth weight: unwanted: aOR, 1.19 (95% CI, 0.93-1.53); mistimed <2 y: aOR, 0.95 (95% CI, 0.80-1.12); mistimed ≥2 y: aOR, 0.85 (95% CI, 0.70-1.02)	Good
Mark and Cowan,[43] 2022	Cross-sectional (144 017); US; age and race and ethnicity not reported	<37 wk; <2500 g; birth certificate (Pregnancy Risk Assessment Monitoring System)	Demographics, state, birth order, Medicaid status	Unwanted vs wanted	Preterm; low birth weight	Preterm: aOR, 0.92 (t statistic, −0.47); low birth weight: aOR, 1.08 (t statistic, 0.53)	Not applicable

Abbreviation: aOR, adjusted odds ratio.

[a] Cohort studies were independently dual-rated by investigators. Cross-sectional studies were not rated because US Preventive Services Task Force criteria were not available for this study design.

[b] Demographic variables, such as maternal age, race and ethnicity, education, marital status, income, and/or poverty level, vary by study.

[c] P value not provided by study; unless otherwise stated, cutoff P > .05.

Figure 3. Infant Outcomes[a]

A Preterm birth

Study	No./total (absolute risk %)		Adjusted odds ratio (95% CI)
	Unintended pregnancy	Intended pregnancy	
Cohort			
Orr et al,[35] 2000	18/97 (18.6)	29/303 (9.6)	1.82 (1.08-3.08)
Phipps and Nunes,[36] 2012	51/259 (19.7)	6/41 (14.6)	1.18 (0.43-3.27)
Gariepy et al,[33] 2015	100/987 (10.1)	125/1664 (7.5)	1.18 (0.85-1.65)
Lindberg et al,[26] 2015	125/891 (14.0)	496/4133 (12.0)	1.18 (0.83-1.69)
Subgroup, PL (P = .54, I² = 0.0%)			1.27 (1.01-1.67)
Cross-sectional			
Mohllajee et al,[45] 2007	1133/9684 (11.7)	3578/44 178 (8.1)	1.16 (1.01-1.33)
Afable-Munsuz and Braveman,[38] 2008	NA/827 (NA)	NA/6114 (NA)	1.28 (0.98-1.66)
Hohmann-Marriott,[54] 2009	NA	NA	1.40 (1.17-1.67)
Flower et al,[40] 2013	626/7675 (8.2)	653/10 359 (6.3)	1.24 (1.05-1.45)
McCrory and McNally,[19] 2013	183/4122 (4.4)	239/6033 (4.0)	1.06 (0.84-1.35)
Mark and Cowan,[43] 2022	NA	NA	0.92 (0.66-1.29)
Subgroup, PL (P = .24, I² = 26.1%)			1.20 (1.08-1.32)
Overall, PL (P = .42, I² = 1.7%)			1.21 (1.12-1.31)

B Low birth weight

Study	No./total (absolute risk %)		Adjusted odds ratio (95% CI)
	Unintended pregnancy	Intended pregnancy	
Cohort			
Joyce et al,[25] 2000	NA	NA	1.06 (0.61-1.83)
Phipps and Nunes,[36] 2012	27/259 (10.4)	4/41 (9.8)	1.13 (0.34-3.74)
Lindberg et al,[26] 2015	73/916 (8.0)	297/4247 (7.0)	1.19 (0.93-1.53)
Subgroup, PL (P = .93, I² = 0.0%)			1.17 (0.87-1.51)
Cross-sectional			
Mohllajee et al,[45] 2007	755/9684 (7.8)	2209/44 178 (5.0)	1.06 (0.97-1.16)
Hohmann-Marriott,[54] 2009	NA	NA	1.43 (0.83-2.48)
Flower et al,[40] 2013	561/7762 (7.2)	541/10 394 (5.2)	1.24 (1.04-1.48)
McCrory and McNally,[19] 2013	237/4085 (5.8)	313/5981 (5.2)	1.01 (0.82-1.24)
Mark and Cowan,[43] 2022	NA	NA	1.08 (0.82-1.42)
Subgroup, PL (P = .42, I² = 0.0%)			1.09 (1.01-1.22)
Overall, PL (P = .74, I² = 0.0%)			1.09 (1.02-1.21)

The sizes of the boxes represent numbers of participants in each study. The vertical dashed lines indicate the location of the adjusted odds ratio of the overall estimate. NA indicates data were not available; PL, profile likelihood.

[a] Totals do not include all participants because some studies did not report data.

quantitative estimates of associations described higher rates of perinatal depression with unintended pregnancy.[3,60] A narrative review of unintended pregnancy and interpersonal violence or abuse also described higher rates with unintended pregnancy.[3] Most previous reviews evaluated maternal health behaviors rather than health outcomes and concluded that few studies were available to determine relationships between unintended pregnancy and psychosocial health or psychological outcomes.[60]

Results of the meta-analysis were also consistent with previous meta-analyses of unintended pregnancy and preterm birth and infant low birth weight. However, point estimates reported in previous meta-analyses were higher than in the current review.[61,62] These differences may be attributed to previous reviews' inclusion of older studies from a wider range of populations including low-income countries, variations in definitions of unintended pregnancy, and use of estimates that were not adjusted for confounders.[61,62]

The health outcomes highlighted in this review serve as markers of health and well-being during pregnancy and post partum, and their higher incidence with unintended pregnancy is important to clinical practice and public health. Reducing preterm birth, increasing depression screening in pregnancy, and reducing different types of violence are objectives of Healthy People 2030.[5] Prevention of unintended pregnancy, also an objective of Healthy People 2030, may play a role in improving these national health indicators.

While depression and interpersonal violence are commonly experienced during pregnancy and post partum, they

are often undetected despite clinical guidelines recommending routine screening and management.[63-65] Perinatal depression, defined as episodes of depression during pregnancy or the first 12 months post partum, affects between 9% and 37% of pregnancies,[66] regardless of pregnancy intention. Its harmful effects are well known including chronic depression, suicide, adverse birth outcomes, impaired infant bonding and caretaking, and child developmental disorders, among others.[67-72] Interpersonal violence is experienced by approximately 36% of women in the US during their lifetimes[73] and may increase during the perinatal period as additional stress and partner conflict escalate under the demands of pregnancy and parenthood. Violence during pregnancy is associated with multiple adverse maternal and infant health outcomes, including increased hospitalization during infancy.[74-76]

Infant low birth weight and preterm birth are indicators of maternal health, nutrition, health care, and poverty.[77,78] Based on international standards, these measures are routinely collected and reported, allowing comparisons over time and across populations. Infant low birth weight is associated with higher mortality, neurologic disabilities, impaired language development, lower academic achievement, and increased risk of chronic disease.[79] Preterm birth is associated with increased mortality and multiple health problems related to immaturity.[80]

Areas for further research include studies specifically designed to identify associations of unintended pregnancy with maternal and infant health outcomes. Most studies in this review used existing data sources that were not primarily designed to answer this question. Studies are needed that minimize bias, for example, studies with prospective measurement of pregnancy intention[81] that adequately control for a range of confounders. Appropriate adjustment for confounding could help identify factors relating to unintended pregnancy as a marker of social risk[82,83] as well as a health condition.

Limitations

This study has several limitations. First, only English-language articles and studies applicable to the US were included, although this focus improved its relevance to US clinical practice and public health. Compared with other high-income countries, the US has a higher rate of unintended pregnancy,[84] and health care financing and delivery differ greatly.

Second, this review was subject to publication bias in which studies with negative or null findings were not included because they were never published. While no small study effects were detected for depression during pregnancy and post partum and for preterm birth, publication bias remains a possibility.

Third, this review had a narrow scope and the meta-analysis included only 5 maternal and infant health outcomes. Several additional adverse pregnancy outcomes are associated with unintended pregnancy, such as higher rates of miscarriage,[85] premature rupture of membranes,[45] and complications during delivery,[19] although fewer studies of these outcomes have been published. Other outcomes outside the scope of this review included long-term health, child development, and socioeconomic effects that can provide a more complete picture of adverse outcomes related to unintended pregnancy. However, previous reviews with broader scopes have noted a lack of research on additional maternal, infant, and child outcomes, particularly long-term outcomes.[3,60,86]

Fourth, included studies were limited by the inconsistency and imprecision of their measures. Studies used several measures of unintended pregnancy including unwanted, unintended, mistimed, and attitudes about pregnancy, among others, and most studies relied on recall of pregnancy intention, introducing bias. Studies of maternal depression and violence used different outcome measures and time points. While some studies used validated scales for outcomes, others used investigator-generated measures. Despite these differences, results of studies were generally consistent regardless of measures used and supported results of previous systematic and narrative reviews.

Fifth, the inherent biases of observational studies that constitute the evidence base for this topic limit interpretations. Although inclusion criteria for this review required adjustment for confounders, studies varied in how well they accomplished this.

Conclusions

In this systematic review and meta-analysis of epidemiologic observational studies relevant to US populations, unintended pregnancy, compared with intended pregnancy, was significantly associated with adverse maternal and infant outcomes.

REFERENCES

1. Finer LB, Zolna MR. Declines in unintended pregnancy in the United States, 2008-2011. *N Engl J Med*. 2016;374(9):843-852. doi:10.1056/NEJMsa1506575

2. National Center for Health Statistics, Centers for Disease Control and Prevention. Key statistics from the National Survey of Family Growth – I listing. Accessed September 15, 2022. https://www.cdc.gov/nchs/nsfg/key_statistics/i-keystat.htm#intendbirthbywomen

3. Gipson JD, Koenig MA, Hindin MJ. The effects of unintended pregnancy on infant, child, and parental health: a review of the literature. *Stud Fam Plann*. 2008;39(1):18-38. doi:10.1111/j.1728-4465.2008.00148.x

4. American College of Obstetricians and Gynecologists. Committee opinion no. 615: access to contraception. *Obstet Gynecol*. 2015;125(1):250-255. doi:10.1097/01.AOG.0000459866.14114.33

5. US Department of Health and Human Services. Healthy People 2030: pregnancy and childbirth. Accessed September 15, 2022. https://health.gov/healthypeople/objectives-and-data/browse-objectives/pregnancy-and-childbirth

6. Centers for Medicare & Medicaid Services. Birth control benefits. Accessed September 15, 2022. https://www.healthcare.gov/coverage/birth-control-benefits/

7. Curtis KM, Jatlaoui TC, Tepper NK, et al. US selected practice recommendations for contraceptive use, 2016 (US SPR). *MMWR Recomm Rep*. 2016;65(4):1-66. doi:10.15585/mmwr.rr6504a1

8. Centers for Disease Control Prevention. US medical eligibility criteria for contraceptive use, 2010: practice guideline. *MMWR Morb Mortal Wkly Rep*. 2010;59(RR-4):1-86.

9. Gavin L, Pazol K. Update: providing quality family planning services: recommendations from CDC and the US Office of Population Affairs, 2015: practice guideline. *MMWR Morb Mortal Wkly Rep*. 2016;65(9):231-234. doi:10.15585/mmwr.mm6509a3

10. Women's Preventive Services Initiative. Contraception. Accessed September 15, 2022. https://www.womenspreventivehealth.org/recommendations/contraception

11. Frederiksen B, Ranji U, Salganicoff A, Long M. Women's sexual and reproductive health services: key findings from the 2020 KFF Women's Health Survey. Kaiser Family Foundation. Accessed September 15, 2022. https://www.kff.org/womens-health-policy/issue-brief/womens-sexual-and-reproductive-health-services-key-findings-from-the-2020-kff-womens-health-survey/

12. Sonfield A. Seeing the whole pattern: coordinated federal attacks on birth control coverage and access. Guttmacher Institute. Accessed September 15, 2022. https://www.guttmacher.org/article/2020/06/seeing-whole-pattern-coordinated-federal-attacks-birth-control-coverage-and-access

13. Guttmacher Institute. An overview of abortion laws. Accessed September 15, 2022. https://www.guttmacher.org/state-policy/explore/overview-abortion-laws

14. Nelson HD, Cantor A, Jungbauer RM, et al. Effectiveness and harms of contraceptive counseling and provision interventions for women. *Ann Intern Med*. 2022;175(7):980-993. doi:10.7326/M21-4380

15. National Institute for Health Research. PROSPERO: international prospective register of systematic reviews. Accessed September 15, 2021. https://www.crd.york.ac.uk/prospero/

16. Effective Health Care Program, Agency for Healthcare Research and Quality. Methods guide for effectiveness and comparative effectiveness reviews. February 23, 2018. Accessed September 15, 2022. https://effectivehealthcare.ahrq.gov/products/collections/cer-methods-guide

17. Stroup DF, Berlin JA, Morton SC, et al. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis of Observational Studies in Epidemiology (MOOSE) group. *JAMA*. 2000;283(15):2008-2012. doi:10.1001/jama.283.15.2008

18. US Preventive Services Task Force. Methods and processes. Accessed September 15, 2022. https://www.uspreventiveservicestaskforce.org/uspstf/about-uspstf/methods-and-processes

19. McCrory C, McNally S. The effect of pregnancy intention on maternal prenatal behaviours and parent and child health: results of an Irish cohort study. *Paediatr Perinat Epidemiol*. 2013;27(2):208-215. doi:10.1111/ppe.12027

20. Goodwin MM, Gazmararian JA, Johnson CH, Gilbert BC, Saltzman LE. Pregnancy intendedness and physical abuse around the time of pregnancy: findings from the pregnancy risk assessment monitoring system, 1996-1997: PRAMS Working Group: Pregnancy Risk Assessment Monitoring System. *Matern Child Health J*. 2000;4(2):85-92. doi:10.1023/A:1009566103493

21. Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Stat Med*. 2002;21(11):1539-1558. doi:10.1002/sim.1186

22. Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ*. 1997;315(7109):629-634. doi:10.1136/bmj.315.7109.629

23. Berkman ND, Lohr KN, Ansari MT, et al. Grading the strength of a body of evidence when assessing health care interventions: an EPC update. *J Clin Epidemiol*. 2015;68(11):1312-1324. doi:10.1016/j.jclinepi.2014.11.023

24. Bahk J, Yun SC, Kim YM, Khang YH. Impact of unintended pregnancy on maternal mental health: a causal follow up data of the Panel Study on Korean Children (PSKC). *BMC Pregnancy Childbirth*. 2015;15:85. doi:10.1186/s12884-015-0505-4

25. Joyce TJ, Kaestner R, Korenman S. The effect of pregnancy intention on child development. *Demography*. 2000;37(1):83-94. doi:10.2307/2648098

26. Lindberg L, Maddow-Zimet I, Kost K, Lincoln A. Pregnancy intentions and maternal and child health: an analysis of longitudinal data in Oklahoma. *Matern Child Health J*. 2015;19(5):1087-1096. doi:10.1007/s10995-014-1609-6

27. Abbasi S, Chuang CH, Dagher R, Zhu J, Kjerulff K. Unintended pregnancy and postpartum depression among first-time mothers. *J Womens Health (Larchmt)*. 2013;22(5):412-416. doi:10.1089/jwh.2012.3926

28. Bayrampour H, McDonald S, Tough S. Risk factors of transient and persistent anxiety during pregnancy. *Midwifery*. 2015;31(6):582-589. doi:10.1016/j.midw.2015.02.009

29. Bunevicius R, Kusminskas L, Bunevicius A, Nadisauskiene RJ, Jureniene K, Pop VJ. Psychosocial risk factors for depression during pregnancy. *Acta Obstet Gynecol Scand*. 2009;88(5):599-605. doi:10.1080/00016340902846049

30. Chan KL. The role of father involvement and intimate partner violence on postnatal depression among women with unintended pregnancy. *J Interpers Violence*. 2021;36(17-18):NP9864-NP9884. doi:10.1177/0886260519862274

31. Chee CY, Lee DT, Chong YS, Tan LK, Ng TP, Fones CS. Confinement and other psychosocial factors in perinatal depression: a transcultural study in Singapore. *J Affect Disord*. 2005;89(1-3):157-166. doi:10.1016/j.jad.2005.09.004

32. Gariepy AM, Lundsberg LS, Miller D, Stanwood NL, Yonkers KA. Are pregnancy planning and pregnancy timing associated with maternal psychiatric illness, psychological distress and support during pregnancy? *J Affect Disord*. 2016;205:87-94. doi:10.1016/j.jad.2016.06.058

33. Gariepy AM, Lundsberg LS, Stolar M, Stanwood NL, Yonkers KA. Are pregnancy planning and timing associated with preterm or small for gestational age births? *Fertil Steril*. 2015;104(6):1484-1492. doi:10.1016/j.fertnstert.2015.08.012

34. Maxson P, Miranda ML. Pregnancy intention, demographic differences, and psychosocial health. *J Womens Health (Larchmt)*. 2011;20(8):1215-1223. doi:10.1089/jwh.2010.2379

35. Orr ST, Miller CA, James SA, Babones S. Unintended pregnancy and preterm birth. *Paediatr Perinat Epidemiol*. 2000;14(4):309-313. doi:10.1046/j.1365-3016.2000.00289.x

36. Phipps MG, Nunes AP. Assessing pregnancy intention and associated risks in pregnant adolescents. *Matern Child Health J*. 2012;16(9):1820-1827. doi:10.1007/s10995-011-0928-0

37. Rich-Edwards JW, Kleinman K, Abrams A, et al. Sociodemographic predictors of antenatal and postpartum depressive symptoms among women in a medical group practice. *J Epidemiol Community Health*. 2006;60(3):221-227. doi:10.1136/jech.2005.039370

38. Afable-Munsuz A, Braveman P. Pregnancy intention and preterm birth: differential associations among a diverse population of women. *Perspect Sex Reprod Health*. 2008;40(2):66-73. doi:10.1363/4006608

39. Fellenzer JL, Cibula DA. Intendedness of pregnancy and other predictive factors for symptoms of prenatal depression in a population-based study. *Matern Child Health J*. 2014;18(10):2426-2436. doi:10.1007/s10995-014-1481-4

40. Flower A, Shawe J, Stephenson J, Doyle P. Pregnancy planning, smoking behaviour during pregnancy, and neonatal outcome: UK Millennium Cohort Study. *BMC Pregnancy Childbirth*. 2013;13:238. doi:10.1186/1471-2393-13-238

41. Gauthreaux C, Negron J, Castellanos D, et al. The association between pregnancy intendedness and experiencing symptoms of postpartum depression among new mothers in the United States, 2009 to 2011: a secondary analysis of PRAMS data. *Medicine (Baltimore)*. 2017;96(6):e5851. doi:10.1097/MD.0000000000005851

42. Gross KH, Wells CS, Radigan-Garcia A, Dietz PM. Correlates of self-reports of being very depressed in the months after delivery: results from the Pregnancy Risk Assessment Monitoring System. *Matern Child Health J*. 2002;6(4):247-253. doi:10.1023/A:1021110100339

43. Mark NDE, Cowan SK. Do pregnancy intentions matter? a research note revisiting relationships among pregnancy, birth, and maternal outcomes. *Demography*. 2022;59(1):37-49. doi:10.1215/00703370-9710311

44. Moreau C, Bonnet C, Beuzelin M, Blondel B. Pregnancy planning and acceptance and maternal psychological distress during pregnancy: results from the National Perinatal Survey, France, 2016. *BMC Pregnancy Childbirth*. 2022;22(1):162. doi:10.1186/s12884-022-04496-3

45. Mohllajee AP, Curtis KM, Morrow B, Marchbanks PA. Pregnancy intention and its relationship to birth and maternal outcomes. *Obstet Gynecol*. 2007;109(3):678-686. doi:10.1097/01.AOG.0000255666.78427.c5

46. Centers for Disease Control and Prevention. Participating PRAMS sites. Accessed September 15, 2022. https://www.cdc.gov/prams/states.htm

47. Cheng D, Schwarz EB, Douglas E, Horon I. Unintended pregnancy and associated maternal preconception, prenatal and postpartum behaviors. *Contraception*. 2009;79(3):194-198. doi:10.1016/j.contraception.2008.09.009

48. Suh EY, Ma P, Dunaway LF, Theall KP. Pregnancy intention and post-partum depressive affect in Louisiana pregnancy risk assessment monitoring system. *Matern Child Health J*. 2016;20(5):1001-1013. doi:10.1007/s10995-015-1885-9

49. Cruz-Bendezú AM, Lovell GV, Roche B, et al. Psychosocial status and prenatal care of unintended pregnancies among low-income women. *BMC Pregnancy Childbirth*. 2020;20(1):615. doi:10.1186/s12884-020-03302-2

50. Blake SM, Kiely M, Gard CC, El-Mohandes AA, El-Khorazaty MN; NIH-DC Initiative. Pregnancy intentions and happiness among pregnant black women at high risk for adverse infant health outcomes. *Perspect Sex Reprod Health*. 2007;39(4):194-205. doi:10.1363/3919407

51. Dudas RB, Csatordai S, Devosa I, et al. Obstetric and psychosocial risk factors for depressive symptoms during pregnancy. *Psychiatry Res*. 2012;200(2-3):323-328. doi:10.1016/j.psychres.2012.04.017

52. Lukasse M, Laanpere M, Karro H, et al; Bidens Study Group. Pregnancy intendedness and the association with physical, sexual and emotional abuse: a European multi-country cross-sectional study. *BMC Pregnancy Childbirth*. 2015;15:120. doi:10.1186/s12884-015-0558-4

53. Narayan AJ, Hagan MJ, Cohodes E, Rivera LM, Lieberman AF. Early childhood victimization and physical intimate partner violence during pregnancy: a developmental and person-oriented approach. *J Interpers Violence*. 2019;34(1):3-26. doi:10.1177/0886260516639261

54. Hohmann-Marriott B. The couple context of pregnancy and its effects on prenatal care and birth outcomes. *Matern Child Health J*. 2009;13(6):745-754. doi:10.1007/s10995-009-0467-0

55. Dhillon N, Macarthur C. Antenatal depression and male gender preference in Asian women in the UK. *Midwifery*. 2010;26(3):286-293. doi:10.1016/j.midw.2008.09.001

56. Escribè-Agüir V, Gonzalez-Galarzo MC, Barona-Vilar C, Artazcoz L. Factors related to depression during pregnancy: are there gender differences? *J Epidemiol Community Health*. 2008;62(5):410-414. doi:10.1136/jech.2007.063016

57. Martin KR, Garcia L. Unintended pregnancy and intimate partner violence before and during pregnancy among Latina women in Los Angeles, California. *J Interpers Violence*. 2011;26(6):1157-1175. doi:10.1177/0886260510368154

58. Redshaw M, Henderson J. From antenatal to postnatal depression: associated factors and mitigating influences. *J Womens Health (Larchmt)*. 2013;22(6):518-525. doi:10.1089/jwh.2012.4152

59. Peek-Asa C, Garcia L, McArthur D, Castro R. Severity of intimate partner abuse indicators as perceived by women in Mexico and the United States. *Women and Health*. 2002;35:165-180.

60. Hill B, Kothe EJ, Currie S, et al. A systematic mapping review of the associations between pregnancy intentions and health-related lifestyle behaviours or psychological wellbeing. *Prev Med Rep*. 2019;14:100869. doi:10.1016/j.pmedr.2019.100869

61. Shah PS, Balkhair T, Ohlsson A, Beyene J, Scott F, Frick C. Intention to become pregnant and low birth weight and preterm birth: a systematic review. *Matern Child Health J*. 2011;15(2):205-216. doi:10.1007/s10995-009-0546-2

62. Hall JA, Benton L, Copas A, Stephenson J. Pregnancy intention and pregnancy outcome: systematic review and meta-analysis. *Matern Child Health J*. 2017;21(3):670-704. doi:10.1007/s10995-016-2237-0

63. Curry SJ, Krist AH, Owens DK, et al; US Preventive Services Task Force. Interventions to prevent perinatal depression: US Preventive Services Task Force recommendation statement. *JAMA*. 2019;321(6):580-587. doi:10.1001/jama.2019.0007

64. Curry SJ, Krist AH, Owens DK, et al; US Preventive Services Task Force. Screening for intimate partner violence, elder abuse, and abuse of vulnerable adults: US Preventive Services Task Force final recommendation statement. *JAMA*. 2018;320(16):1678-1687. doi:10.1001/jama.2018.14741

65. Women's Preventive Services Initiative. Screening for interpersonal and domestic violence. Accessed September 15, 2022. https://www.womenspreventivehealth.org/recommendations/screening-for-interpersonal-and-domestic-violence/

66. Norhayati MN, Hazlina NH, Asrenee AR, Emilin WM. Magnitude and risk factors for postpartum symptoms: a literature review. *J Affect Disord*. 2015;175:34-52. doi:10.1016/j.jad.2014.12.041

67. Lovejoy MC, Graczyk PA, O'Hare E, Neuman G. Maternal depression and parenting behavior: a meta-analytic review. *Clin Psychol Rev*. 2000;20(5):561-592. doi:10.1016/S0272-7358(98)00100-7

68. Szegda K, Markenson G, Bertone-Johnson ER, Chasan-Taber L. Depression during pregnancy: a risk factor for adverse neonatal outcomes? a critical review of the literature. *J Matern Fetal Neonatal Med*. 2014;27(9):960-967. doi:10.3109/14767058.2013.845157

69. Wouk K, Stuebe AM, Meltzer-Brody S. Postpartum mental health and breastfeeding practices: an analysis using the 2010-2011 Pregnancy Risk Assessment Monitoring System. *Matern Child Health J*. 2017;21(3):636-647. doi:10.1007/s10995-016-2150-6

70. Beck CT. The effects of postpartum depression on child development: a meta-analysis. *Arch Psychiatr Nurs*. 1998;12(1):12-20. doi:10.1016/S0883-9417(98)80004-6

71. Minkovitz CS, Strobino D, Scharfstein D, et al. Maternal depressive symptoms and children's receipt of health care in the first 3 years of life. *Pediatrics*. 2005;115(2):306-314. doi:10.1542/peds.2004-0341

72. Santos IS, Matijasevich A, Barros AJ, Barros FC. Antenatal and postnatal maternal mood symptoms and psychiatric disorders in pre-school children from the 2004 Pelotas Birth Cohort. *J Affect Disord*. 2014;164(100):112-117. doi:10.1016/j.jad.2014.04.033

73. Smith SG, Zhang X, Basile KC, et al. The National Intimate Partner and Sexual Violence Survey: 2015 data brief: updated release. November 2018. Accessed September 15, 2022. https://stacks.cdc.gov/view/cdc/60893

74. Shah PS, Shah J; Knowledge Synthesis Group on Determinants of Preterm/LBW Births. Maternal exposure to domestic violence and pregnancy and birth outcomes: a systematic review and meta-analyses. *J Womens Health (Larchmt)*. 2010;19(11):2017-2031. doi:10.1089/jwh.2010.2051

75. Desmarais SL, Pritchard A, Lowder EM, Janssen PA. Intimate partner abuse before and

during pregnancy as risk factors for postpartum mental health problems. *BMC Pregnancy Childbirth*. 2014;14:132. doi:10.1186/1471-2393-14-132

76. Pavey AR, Gorman GH, Kuehn D, Stokes TA, Hisle-Gorman E. Intimate partner violence increases adverse outcomes at birth and in early infancy. *J Pediatr*. 2014;165(5):1034-1039. doi:10.1016/j.jpeds.2014.06.060

77. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins—Obstetrics. Prediction and prevention of spontaneous preterm birth: ACOG Practice Bulletin, Number 234. *Obstet Gynecol*. 2021;138(2):e65-e90. doi:10.1097/AOG.0000000000004479

78. Manuck TA. Racial and ethnic differences in preterm birth: a complex, multifactorial problem. *Semin Perinatol*. 2017;41(8):511-518. doi:10.1053/j.semperi.2017.08.010

79. Campbell DE, Imaizumi SO. Health and developmental outcomes of very preterm and very low-birth-weight infants. In: McInerny TK, Adam

HM, Campbell DE, DeWitt TG, Meschan Foy J, Kamat DM, eds. *American Academy of Pediatrics Textbook of Pediatric Care*. American Academy of Pediatrics; 2016.

80. Stewart DL, Barfield WD; Committee on Fetus and Newborn. Updates on an at-risk population: late-preterm and early-term infants. *Pediatrics*. 2019;144(5):e20192760. doi:10.1542/peds.2019-2760

81. Rocca CH, Ralph LJ, Wilson M, Gould H, Foster DG. Psychometric evaluation of an instrument to measure prospective pregnancy preferences: the desire to avoid pregnancy scale. *Med Care*. 2019;57(2):152-158. doi:10.1097/MLR.0000000000001048

82. Kost K, Zolna M. Challenging unintended pregnancy as an indicator of reproductive autonomy: a response. *Contraception*. 2019;100(1):5-9. doi:10.1016/j.contraception.2019.04.010

83. Potter JE, Stevenson AJ, Coleman-Minahan K, et al. Challenging unintended pregnancy as an

indicator of reproductive autonomy. *Contraception*. 2019;100(1):1-4. doi:10.1016/j.contraception.2019.02.005

84. Singh S, Sedgh G, Hussain R. Unintended pregnancy: worldwide levels, trends, and outcomes. *Stud Fam Plann*. 2010;41(4):241-250. doi:10.1111/j.1728-4465.2010.00250.x

85. Nguyen BT, Chang EJ, Bendikson KA. Advanced paternal age and the risk of spontaneous abortion: an analysis of the combined 2011-2013 and 2013-2015 National Survey of Family Growth. *Am J Obstet Gynecol*. 2019;221(5):476.e1-476.e7. doi:10.1016/j.ajog.2019.05.028

86. Logan C, Holcombe E, Manlove J, Ryan S. The consequences of unintended childbearing: a white paper. Child Trends. May 1, 2007. Accessed October 5, 2022. https://www.childtrends.org/publications/the-consequences-of-unintended-childbearing-a-white-paper