



How does maternal occupation (specifically exposure to work stress and long working hours) affect the risk of low birth weight infants? : A Systematic Review

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ABSTRACT

Introduction: Maternal employment during pregnancy is increasingly common, yet the impact of work-related stress and long working hours on low birth weight (LBW) remains inconclusive. This systematic review synthesizes evidence from observational studies examining associations between maternal occupational exposures—specifically psychosocial work stress, job strain, and long working hours—and the risk of LBW infants.

Methods: A systematic review of 17 sources published to 2025 was conducted. Studies were included if they examined employed pregnant women, assessed work-related stress or working hours, reported LBW (<2500g) as an outcome, and provided quantitative data. Data extraction covered work exposures, population

characteristics, LBW outcomes, related pregnancy outcomes, study design, confounders, and dose-response evidence.

Results: Long working hours (>40 h/week) were associated with significantly increased odds of LBW in the largest meta-analysis (OR 1.43, 95% CI 1.11–1.84), though other reviews found no significant association. Psychosocial work stress showed non-significant association with dichotomous LBW (OR 2.30, 95% CI 0.70–7.60) but significantly reduced mean birthweight by 77 grams (95% CI –121.18 to –33.01). Physically demanding work demonstrated consistent association with small-for-gestational-age infants (OR 1.37, 95% CI 1.30–1.44). Preterm delivery showed modest associations with long hours (OR 1.16–1.21) and shift work (OR 1.13–1.21). Dose-response evidence was limited, though declining effort-reward imbalance across pregnancy was associated with 408 g higher birthweight.

Discussion: The evidence is heterogeneous, with effect estimates moderated by exposure specificity, study quality, and outcome measurement. Psychosocial stress affects continuous birthweight more consistently than dichotomous LBW, suggesting mechanistic pathways through neuroendocrine disruption of placental perfusion. Long working hours operate primarily through preterm delivery rather than fetal growth restriction. Higher-quality studies yield smaller estimates, and confounding control remains inadequate.

Conclusion: Maternal work stress and long hours are associated with modest but significant reductions in birthweight and increased preterm delivery risk. However, certainty is low due to observational designs and heterogeneity. Future research requires prospective designs with repeated exposure measures, adequate confounding control, and standardized outcomes.

Keywords: Maternal occupation, work stress, long working hours, low birth weight, preterm birth, systematic review

INTRODUCTION

Background

Maternal employment during pregnancy has become a global norm, with increasing numbers of women maintaining paid work throughout gestation (1). While employment offers economic and psychological benefits, concern persists regarding potential adverse effects of occupational exposures on pregnancy outcomes (15). Low birth weight (LBW), defined as birthweight <2500g, remains a critical public health indicator associated with neonatal mortality, childhood morbidity, and long-term chronic disease risk (2,3). The global prevalence of LBW is approximately 15%, with higher rates in low- and middle-income countries (1).

Work-related stressors—including psychosocial work stress, job strain, long working hours, and shift work—represent potentially modifiable exposures that may influence fetal growth through multiple biological pathways (7). Psychosocial stress activates the hypothalamic-pituitary-adrenal axis, increasing cortisol and catecholamine release, potentially impairing uteroplacental blood flow and nutrient delivery to the fetus (1,11). Long working hours and physical demands may operate through fatigue, reduced placental perfusion, and increased risk of preterm delivery (6,12).

Problem Statement

Despite decades of research, the relationship between maternal occupational conditions and LBW remains poorly characterized. Individual studies have yielded inconsistent results, with some reporting significantly increased risk (3,6) and others finding no association (4,5). Systematic reviews have reached divergent conclusions, partly due to differences in exposure definitions, outcome measurement, and study quality (2,8). Clinicians and policymakers lack clear guidance regarding safe work practices during pregnancy, and occupational health recommendations vary substantially across jurisdictions (10).

Research Gap

Several critical gaps persist in the literature. First, most studies treat work exposure as a static binary variable (employed vs. unemployed or >40 hours vs. ≤40 hours), failing to capture the

dynamic nature of occupational stress across pregnancy (7,9). Second, the distinction between effects on continuous birthweight versus dichotomous LBW has been inadequately explored, potentially masking clinically meaningful associations (1,2). Third, confounding control remains inconsistent, with many studies failing to adjust for socioeconomic status, smoking, and concurrent occupational hazards (12). Fourth, the relative contributions of different exposure types—psychosocial stress, long hours, physical demands—to specific pregnancy outcomes (preterm delivery vs. fetal growth restriction) require clarification (6,8). Finally, dose-response relationships remain poorly characterized, limiting the identification of safe exposure thresholds (3,10).

Study Objectives

This systematic review aims to:

1. Synthesize evidence from observational studies examining associations between maternal work stress, long working hours, and LBW risk
2. Compare effects on dichotomous LBW versus continuous birthweight
3. Evaluate associations with related outcomes including preterm delivery and small-for-gestational-age (SGA)
4. Assess dose-response evidence and exposure thresholds
5. Critically appraise study quality and confounding control
6. Identify research priorities for future investigations

Hypothesis

We hypothesize that maternal work stress and long working hours are associated with increased LBW risk, but that effect magnitudes vary by exposure type, outcome definition, and study quality. Specifically, psychosocial stress is hypothesized to affect continuous birthweight more than dichotomous LBW, while long hours primarily increase preterm delivery risk.

Novelty and Significance

This review provides several novel contributions. It systematically compares findings across 17 sources spanning nearly four decades, explicitly examining how exposure specificity, outcome measurement, and study quality moderate effect estimates. It synthesizes evidence on dose-response relationships and exposure trajectories across pregnancy, incorporating recent longitudinal studies (1,7,9). The review distinguishes effects on preterm delivery versus fetal growth restriction, elucidating potential mechanistic pathways. These findings inform occupational health guidelines, prenatal care recommendations, and future research priorities.

Research Benefits

Understanding the relationship between maternal work conditions and LBW has multiple benefits: enabling evidence-based occupational recommendations for pregnant workers, identifying high-risk occupations requiring targeted interventions, informing workplace policies regarding flexible hours and reduced physical demands, and guiding future research toward methodologically rigorous designs. For clinicians, this synthesis provides actionable insights for counseling employed pregnant women regarding work modifications.

METHODS

Protocol

The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure methodological rigor and accuracy. This approach was chosen to enhance the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic review aims to evaluate How does maternal occupation (specifically exposure to work stress and long working hours) affect the risk of low birth weight infants?

Screening

We screened in sources based on their abstracts that met these criteria:

- **Target Population:** Does the study include pregnant women or mothers who were employed during pregnancy?

- **Work Exposure Variables:** Does the study examine work-related stress, occupational stress, job strain, psychological stress in the workplace, long working hours, extended work shifts, or overtime work during pregnancy?
- **Birth Weight Outcome:** Does the study report low birth weight (defined as <2500g) as a primary or secondary outcome?
- **Study Design:** Is the study an observational study (cohort, case-control, or cross-sectional) or a systematic review/meta-analysis examining maternal work conditions and birth outcomes?
- **Quantitative Data:** Does the study provide quantitative data that allows for assessment of association between work exposures and low birth weight?
- **Maternal vs Paternal Focus:** Does the study focus on maternal work conditions (rather than exclusively on paternal work conditions) and examine working conditions among employed women (rather than only unemployment/job loss), and is it conducted in human populations?
- **Work Stress vs Environmental Hazards:** Does the study examine work stress or working hours (rather than focusing solely on specific occupational hazards such as chemical, physical, or biological exposures without examining psychosocial work factors)?
- **Timing of Work Exposure:** Did the work exposure occur during pregnancy (rather than only before pregnancy or after delivery)?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Search Strategy

The keywords used for this research based PICO :

Element	P (Population)	I (Intervention/Exposure)	C (Comparison/Context)	O (Outcome)
Keyword 1	Pregnant Women	Occupational stress	Not Applicable	Low Birth Weight Infants
Keyword 2	Obstetric patients	Psychosocial work factors		Birth weight <2500g
Keyword 3	Gestational females	Professional pressure		Fetal growth restriction
Keyword 4	Maternal population	Prolonged working time		Small for gestational age

The Boolean MeSH keywords inputted on databases for this research are: (*"Pregnant Women" OR "Obstetric patients" OR "Gestational females" OR "Maternal population"*) AND (*"Occupational stress" OR "Psychosocial work factors" OR "Professional pressure" OR "Prolonged working time"*) AND (*"Low Birth Weight Infants" OR "Birth weight <2500g" OR "Fetal growth restriction"*) AND (*"Small for gestational age"*)

Data extraction

- **Work Exposures:**

Extract all maternal work exposures studied that relate to work stress and working hours, including:

- Type of work stress (psychosocial stress, job strain, work demands, etc.)
- Working hours per week (specific thresholds used, e.g., >40h, >55h per week)
- Shift work patterns (rotating shifts, fixed night shifts, irregular schedules)

- Physical work demands if combined with stress/hours
- How each exposure was measured or defined
- Duration of exposure during pregnancy (which trimester, entire pregnancy, etc.)

- **Study Population:**

Extract characteristics of the maternal population studied, including:

- Sample size
- Occupation/industry type (healthcare workers, general working population, etc.)
- Gestational age at study entry
- Key demographics (age, parity, socioeconomic status) if reported
- Geographic location and study period
- Inclusion/exclusion criteria relevant to work exposure

- **Low Birth Weight:**

Extract all information about low birth weight outcomes specifically, including:

- Definition used for low birth weight (e.g., <2500g, <2000g)
- Number of LBW cases in exposed vs unexposed groups
- Effect measures for LBW (OR, RR, mean difference with 95% CI)
- Statistical significance (p-values)
- Whether results were adjusted and for which confounders
- Any dose-response findings for LBW specifically

- **Related Outcomes:**

Extract results for pregnancy outcomes related to or potentially confounding low birth weight, including:

- Preterm delivery rates and effect measures
- Small for gestational age (SGA) rates and effects
- Mean birth weight differences
- Intrauterine growth restriction
- Gestational age at delivery
- Any other fetal growth measures Note the relationship of these outcomes to the main LBW findings.

- **Study Design:**

Extract study methodology details including:

- Study design (cohort, case-control, cross-sectional)
- Prospective vs retrospective data collection
- Follow-up duration and timing
- Response rates and loss to follow-up
- Data sources (medical records, self-report, employer records)
- Quality assessment rating if provided by authors

- **Confounders Controlled:**

Extract information about potential confounding factors, including:

- Which confounders were measured and controlled for in analyses
- Key confounders NOT controlled for
- Methods used for confounder adjustment
- Whether work-related factors other than the main exposures were controlled
- Socioeconomic, demographic, and health factors included in models

- **Dose-Response Evidence:**

Extract any evidence of dose-response relationships between work exposures and low birth weight, including:

- Categories of exposure levels tested (e.g., <40h, 40-48h, >48h per week)
- Trend tests or linear associations
- Threshold effects identified
- Continuous variable analyses showing dose-response
- Subgroup analyses by exposure intensity
- Authors' conclusions about dose-response patterns

Table 1. Article Search Strategy

Database	Keywords	Hits
Pubmed	<i>("Pregnant Women") AND ("Occupational stress" OR "Psychosocial work factors" OR "Professional pressure" OR "Prolonged working time" AND "Low Birth Weight Infants" OR "Birth weight <2500g" OR "Fetal growth restriction") AND ("Small for gestational age")</i>	184
Semantic Scholar	<i>("Pregnant Women" OR "Obstetric patients" OR "Gestational females" OR "Maternal population") AND ("Occupational stress" OR "Psychosocial work factors" OR "Professional pressure" OR "Prolonged working time") AND ("Low Birth Weight Infants" OR "Birth weight <2500g" OR "Fetal growth restriction") AND ("Small for gestational age")</i>	250
Springer	<i>("Pregnant Women" OR "Obstetric patients" OR "Gestational females" OR "Maternal population") AND ("Occupational stress" OR "Psychosocial work factors" OR "Professional pressure" OR "Prolonged working time") AND ("Low Birth Weight Infants" OR "Birth weight <2500g" OR "Fetal growth restriction") AND ("Small for gestational age")</i>	11
Google Scholar	<i>("Pregnant Women" OR "Obstetric patients" OR "Gestational females" OR "Maternal population") AND ("Occupational stress" OR "Psychosocial work factors" OR "Professional pressure" OR "Prolonged working time") AND ("Low Birth Weight Infants" OR "Birth weight <2500g" OR "Fetal growth restriction") AND ("Small for gestational age")</i>	99
Wiley Online Library	<i>("Pregnant Women" OR "Obstetric patients" OR "Gestational females" OR "Maternal population") AND ("Occupational stress" OR "Psychosocial work factors" OR "Professional pressure" OR "Prolonged working time") AND ("Low Birth Weight Infants" OR "Birth weight <2500g" OR "Fetal growth restriction") AND ("Small for gestational age")</i>	3

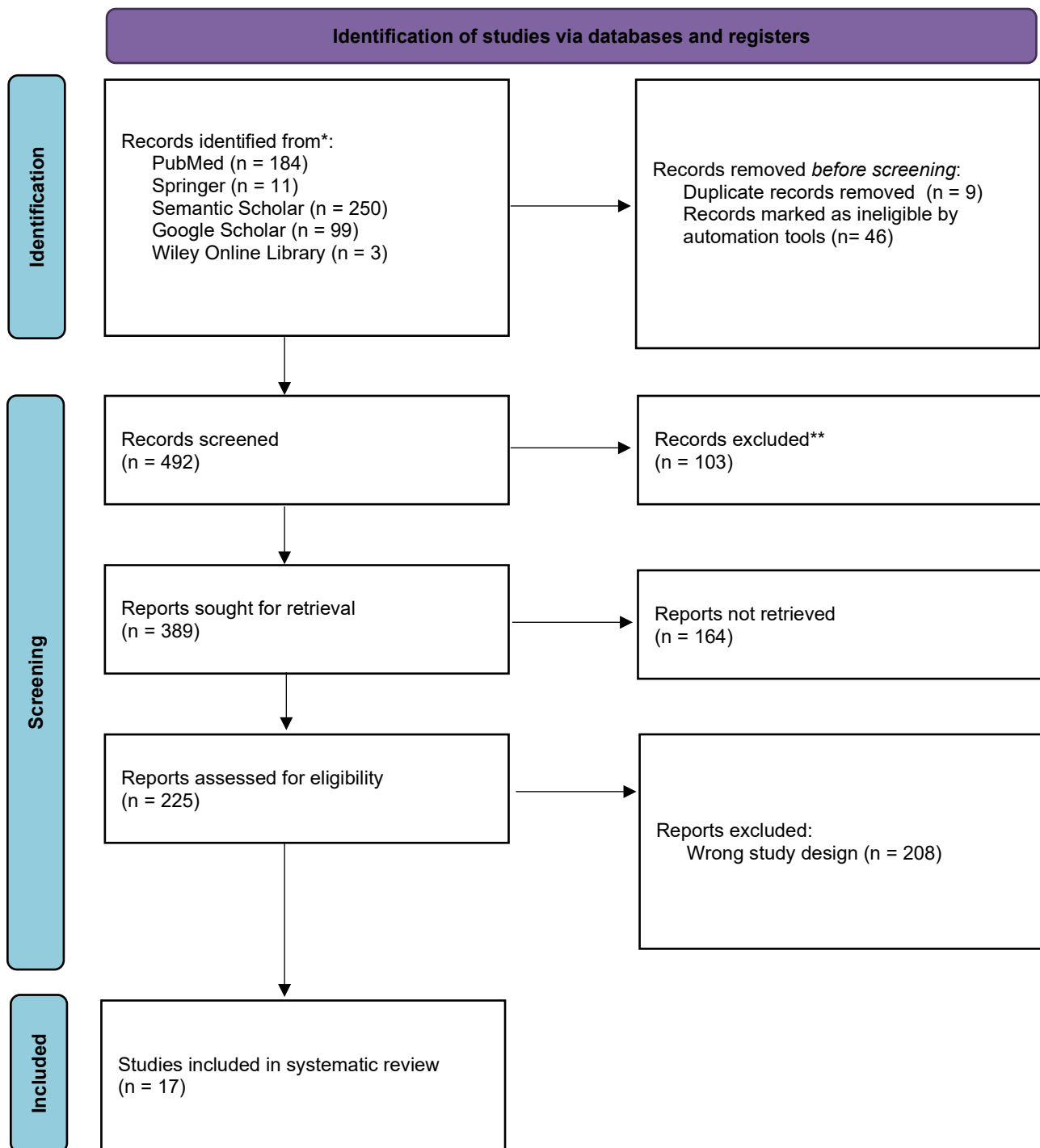


Figure 1. Article search flowchart

RESULTS

Characteristics of Included Studies

The 17 sources encompass systematic reviews with prospective cohort study, and retrospective cross-sectional study etc. The evidence base spans to 2025 and draws on populations from multiple continents.

Study	Exposures Studied	Population / Sample Size	Quality Assessment
C. Cai et al., 2019	Rotating shifts, fixed night shifts, long working hours (>40 h/wk) [3]	196,989 women across 62 observational studies [3]	Low to very low certainty (GRADE) [3]
Wubet Taklual Admas et al., 2025	Psychosocial work stress, job strain, high job demands, low decisional latitude [1]	1,346,686 women across 26 studies; 9 countries [1]	JBI tool and GRADE [1]
Margie H. Davenport et al., 2019	Long working hours (>40 h/wk) [4]	126,632 women; general working population [4]	GRADE framework [4]
M. Tartaglia et al., 2024	Psychosocial stress, postural constraints; 47 agents via job-exposure matrices [9]	12,851 women; France [9]	Not mentioned [9]

Study	Exposures Studied	Population / Sample Size	Quality Assessment
E. Mozurkewich et al., 2000	Physically demanding work, prolonged standing, long work hours, shift/night work, cumulative work fatigue [6]	160,988 women [6]	Not mentioned [6]
María del Rocío Corchero-Falcón et al., 2023	Psychosocial stress, job strain, physical-ergonomic factors, chemical exposures, night work [10]	Various occupations (agriculture, service, nursing); studies from 2000–2023 [10]	JBI critical appraisal tool [10]
M. Mutambudzi et al., 2011	Occupational stress, job strain (Job Demand-Control model) [11]	General working population (not specified) [11]	Not mentioned [11]
C. Cai et al., 2019a	Shift work, long working hours (>40 h/wk) [5]	Not specified [5]	Not mentioned [5]
M. Bonzini et al., 2013	Working hours, shift work, lifting, standing, workload [8]	Not specified [8]	Assessed for bias and confounding [8]
John D. Meyer et al., 2017	Effort-reward imbalance (ERI), demand-control (DC); surveys at 4 timepoints across pregnancy [7]	61 women; healthcare/social services; Connecticut, USA [7]	Not mentioned [7]

Study	Exposures Studied	Population / Sample Size	Quality Assessment
M. Bonzini et al., 2006	Working hours (≥ 40 h/wk), shift/night work, standing (≥ 3 h/day), lifting, physical workload [12]	Global; studies from 1966–2005; variable sample sizes [12]	Median 7.5/9 on quality scale [12]
J. Simpson et al., 1993	Prolonged standing, long working hours, lifting heavy objects [13]	Not specified [13]	Not mentioned [13]
S. Gardin et al., 1987	Maternal employment (general) [14]	European and American populations [14]	Not mentioned [14]
K. Palmer et al., 2013	Working hours (> 40 h/wk), shift/night work, standing (> 4 h/day), lifting, physical workload [2]	27 countries; studies from 1966–2011 [2]	Rated for reporting completeness, bias, and confounding [2]
Steven G. Gabbe et al., 1997	Adverse work conditions, hazardous exposures (general) [15]	Not specified [15]	Not mentioned [15]
Frincy Francis et al., 2021	Long working hours (> 40 h/wk), prolonged standing, lifting, psychosocial stress [16]	Pregnant healthcare workers; studies from 2000–2020 [16]	Not mentioned [16]

Study	Exposures Studied	Population / Sample Size	Quality Assessment
Shi Yd et al., 1994	Maternal employment (job vs. no job); specific occupations [17]	1,646 deliveries; Chungnam University Hospital, Korea (1991–1992) [17]	Not mentioned [17]

Work exposures ranged from broad occupational categories (employed vs. not employed) to specific psychosocial constructs measured via validated instruments such as the Job Demand-Control (JDC) and Effort-Reward Imbalance (ERI) models [1, 7]. Working hours thresholds were most commonly set at >40 hours per week [2–4], though one source also examined a threshold of >32 hours combined with high physical workload [10].

Effects of Work Exposures on Low Birth Weight

Direct Evidence on Low Birth Weight

Source	Exposure	LBW Definition	Effect Estimate (95% CI)	Statistical Significance	Certainty / Notes
C. Cai et al., 2019	Long working hours (>40 h/wk)	<2,500 g [3]	OR 1.43 (1.11–1.84) [3]	Significant (CI excludes 1) [3]	Low to very low certainty [3]

Source	Exposure	LBW Definition	Effect Estimate (95% CI)	Statistical Significance	Certainty / Notes
Wubet Taklual Admas et al., 2025	Psychosocial work stress	<2,500 g [1]	OR 2.30 (0.70–7.60) for dichotomous LBW [1]	Non-significant [1]	Very low certainty; high heterogeneity [1]
Wubet Taklual Admas et al., 2025	Psychosocial work stress	Continuous BW [1]	Mean difference –77.09 g (–121.18 to –33.01) [1]	Significant [1]	Moderate certainty [1]
Margie H. Davenport et al., 2019	Long working hours (>40 h/wk)	<2,500 g [4]	No significant association [4]	Non-significant [4]	Low to very low quality (GRADE) [4]
C. Cai et al., 2019a	Long working hours (>40 h/wk)	Not specified [5]	No significant association [5]	Non-significant [5]	Not specified [5]
E. Mozurkewich et al., 2000	Physically demanding work	SGA as proxy [6]	OR 1.37 (1.30–1.44) [6]	Significant [6]	Large pooled sample (n = 160,988) [6]

Source	Exposure	LBW Definition	Effect Estimate (95% CI)	Statistical Significance	Certainty / Notes
M. Bonzini et al., 2006	Working hours (≥ 40 h/wk)	$< 2,500$ g [12]	OR 1.59 (1.14–2.22) in largest study; pooled OR ~ 1.07 [12]	Pooled estimate near null ($p = 0.51$) [12]	Limited evidence base for SGA [12]
K. Palmer et al., 2013	Working hours, shift work, standing, lifting, workload	Not explicitly defined [2]	Median RR 1.34 for LBW; most RR ≤ 2.0 [2]	Not explicitly reported [2]	Smaller studies drove higher estimates [2]
María del Rocío Corchero-Falcón et al., 2023	High work stress; psychosocial factors	Below 10th percentile [10]	OR 1.82 (high-stress jobs, $p = 0.01$); OR 2.09 (active work, $p = 0.002$); $6.65\times$ risk for < 10 th percentile [10]	Significant for high stress and active work [10]	Individual study-level estimates; not pooled [10]

Source	Exposure	LBW Definition	Effect Estimate (95% CI)	Statistical Significance	Certainty / Notes
John D. Meyer et al., 2017	Declining effort-reward imbalance (ERI)	<2,500 g [7]	Declining ERI associated with +408 g birthweight (p = 0.015) [7]	Significant [7]	Small sample (n = 61); 2 LBW cases (3.6%) [7]
Shi Yd et al., 1994	Employment during pregnancy	Not specified [17]	Significant difference in LBW rate after adjustment [17]	Significant when adjusted [17]	Adjusted for maternal age, education, height, weight, abortion history [17]
M. Mutambudzi et al., 2011	Occupational stress / job strain	Not specified [11]	Modest, inconclusive association [11]	Not conclusive [11]	Narrative review; no pooled estimate [11]

Source	Exposure	LBW Definition	Effect Estimate (95% CI)	Statistical Significance	Certainty / Notes
Frincy Francis et al., 2021	Multiple ergonomic stressors (healthcare workers)	Not specified [16]	LBW listed as outcome but no specific effect estimates [16]	Not specified [16]	Narrative review of healthcare workers [16]

Several patterns emerge from this table. For long working hours (>40 h/wk), the largest and most recent meta-analysis found a statistically significant 43% increase in odds of LBW [3], but an overlapping review by the same research group found no significant association with LBW specifically [4, 5]. For psychosocial work stress, the dichotomous LBW outcome showed a non-significant association (OR 2.30, 95% CI 0.70–7.60) [1], while the continuous birthweight analysis demonstrated a significant reduction of approximately 77 grams [1]. Physically demanding work showed the most consistent association with small-for-gestational-age infants (OR 1.37, 95% CI 1.30–1.44) [6], though this encompasses physical demands broadly rather than stress or hours alone.

Related Pregnancy Outcomes

Because low birth weight is mechanistically linked to both preterm delivery and fetal growth restriction, the following table summarizes findings on these related outcomes.

Source	Exposure	Preterm Delivery	SGA / Fetal Growth	Other Outcomes
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Source	Exposure	Preterm Delivery	SGA / Fetal Growth	Other Outcomes
C. Cai et al., 2019	Rotating shifts	OR 1.13 (1.00–1.28) [3]	OR 1.18 (1.01–1.38) [3]	Preeclampsia OR 1.75; gestational hypertension OR 1.19 [3]
C. Cai et al., 2019	Fixed night shifts	OR 1.21 (1.03–1.42) [3]	Not reported [3]	Miscarriage OR 1.23 (1.03–1.47) [3]
C. Cai et al., 2019	Long hours (>40 h/wk)	OR 1.21 (1.11–1.33) [3]	OR 1.16 (1.00–1.36) [3]	Miscarriage OR 1.38; LBW OR 1.43 [3]
Wubet Taklual Admas et al., 2025	Psychosocial work stress	18% increased risk [1]	No significant association with SGA [1]	Preeclampsia 50% increase; pregnancy loss 20% increase [1]
Margie H. Davenport et al., 2019	Long hours (>40 h/wk)	OR 1.16 (1.04–1.30); adjusted OR 1.18 (1.01–1.37) [4]	OR 1.13 (1.00–1.27) [4]	No association with IUGR or preeclampsia [4]

Source	Exposure	Preterm Delivery	SGA / Fetal Growth	Other Outcomes
E. Mozurkewich et al., 2000	Physically demanding work	OR 1.22 (1.16–1.29) [6]	OR 1.37 (1.30–1.44) [6]	Hypertension/pre eclampsia OR 1.60 (1.30–1.96) [6]
E. Mozurkewich et al., 2000	Prolonged standing	OR 1.26 (1.13–1.40) [6]	Not reported [6]	High fatigue score: OR 1.63 (1.33–1.98) for PTD [6]
M. Bonzini et al., 2013	All five exposures	RR 1.04–1.18 [8]	Meta-estimates near null [8]	Insufficient evidence for preeclampsia [8]
K. Palmer et al., 2013	All five exposures	RR 1.04–1.18 (modest/null) [2]	SGA: most RR ≤ 1.07 [2]	Median BW reduction ~60 g for longer hours [2]
M. Tartaglia et al., 2024	Postural constraints + psychosocial factors	Not reported [9]	SGA associated with this profile [9]	Head circumference also associated [9]

Source	Exposure	Preterm Delivery	SGA / Fetal Growth	Other Outcomes
John D. Meyer et al., 2017	Declining ERI trajectory	Not reported [7]	+408 g BW with declining ERI [7]	3.6% LBW rate [7]

Across multiple meta-analyses, preterm delivery consistently showed modest associations (OR range 1.04–1.26) with long working hours, shift work, and physically demanding work [3, 4, 6, 8]. For SGA, the two updated Palmer/Bonzini reviews found that as the evidence base grew, effect estimates shrank toward the null, with most SGA meta-estimates at $RR \leq 1.07$ [2, 8]. Psychosocial work stress was more consistently associated with preeclampsia (50% increase) and preterm birth (18% increase) than with SGA or dichotomous LBW [1].

Dose-Response Evidence

Evidence of dose-response relationships between work exposures and low birth weight was limited across the included sources. One meta-analysis found that women working more than 55.5 hours per week (versus 40) had a 10% increase in the odds of preterm delivery, though this was for preterm delivery rather than LBW directly [3]. Palmer et al. (2013) reported that continuous analyses showed a median birthweight reduction of approximately 60 grams (range 32–84 g) associated with longer working hours [2]. Bonzini et al. (2006) found that the largest individual study yielded an OR of 1.59 for SGA with working ≥ 40 hours per week, but the pooled estimate across six studies was only 1.07 [12]. Corchero-Falcón et al. (2023) noted that the combination of high physical workload with more than 32 hours of work per week significantly increased the risk of preterm birth [10], and that a dose-response relationship existed between increasing monthly night shifts and sickness risk [10]. Meyer et al. (2017) found that a declining ERI trajectory—reflecting diminishing effort with stable or increasing reward across pregnancy—was associated with a 408 g increase in birthweight [7], suggesting that favorable changes in psychosocial work climate may have a meaningful impact on fetal growth.

Synthesis

The evidence regarding the association between maternal work stress and long working hours and the risk of low birth weight is heterogeneous. The apparent discrepancies across studies can be explained by several factors.

Exposure type matters more than broad employment status. When LBW is examined in relation to a single binary exposure (employed vs. not, or >40 hours vs. ≤40 hours), several large meta-analyses found no significant or only marginal associations [4, 5, 8]. However, when exposures are disaggregated, specific exposure types show clearer signals. Physically demanding work was consistently associated with SGA (OR 1.37) [6], and psychosocial work stress significantly reduced mean birthweight by approximately 77 grams [1]. The Corchero-Falcón review found that high work stress was associated with a 6.65-fold increased risk of fetal weight below the 10th percentile in individual studies [10]. This pattern suggests that the mechanism matters: work stress may operate through neuroendocrine pathways (cortisol, catecholamines) affecting placental perfusion, while long hours and physical demands may operate through fatigue, reduced uteroplacental blood flow, and preterm delivery rather than growth restriction per se.

Study quality and size systematically moderate effect estimates. The two comprehensive Palmer/Bonzini reviews explicitly demonstrated that as the evidence base expanded and higher-quality studies were added, pooled effect estimates for both preterm delivery and SGA became smaller [2, 8]. Larger cohort studies tended to show RRs of 1.04–1.18 for preterm delivery and near-null estimates for SGA [2], while smaller case-control and cross-sectional studies produced inflated estimates. Approximately 40% of exposure-outcome pairings in Palmer et al. carried higher potential for confounding bias [2]. The GRADE certainty ratings across the meta-analyses were predominantly "low" to "very low" [3, 4], underscoring the limitations of the observational evidence base.

Continuous versus dichotomous outcomes reveal different signals. A critical distinction is between dichotomous LBW (<2,500 g) and continuous birthweight. Admas et al. (2025) found that psychosocial work stress was non-significantly associated with dichotomous LBW (OR 2.30, 95% CI 0.70–7.60) but significantly reduced mean birthweight by 77 grams with moderate certainty

[1]. Palmer et al. similarly reported a median 60-gram birthweight reduction associated with longer working hours [2]. These reductions, while statistically detectable, may not shift enough births below the 2,500 g threshold to produce significant dichotomous LBW effects except in populations already at elevated risk. This helps explain why the Cai et al. (2019) meta-analysis found a significant LBW association (OR 1.43) while the Davenport et al. (2019) review—with partly overlapping data—did not [3, 4].

Confounding remains poorly addressed. Few meta-analyses were able to fully account for key confounders. Smoking and socioeconomic status were recognized as important confounders [2, 12], but control varied widely across primary studies. Some studies did not control for social class at all [12]. Work-related factors other than the primary exposure (e.g., concurrent physical demands, chemical exposures) were rarely controlled [17]. The Meyer et al. (2017) study, despite its small size ($n = 61$), was notable for its prospective design with repeated measures and adjustment for maternal age, education, gestational age, race/ethnicity, tobacco use, and BMI [7], and produced one of the clearest findings: that a favorable trajectory of effort-reward imbalance was associated with substantially higher birthweight [7].

Timing and trajectory of exposure across pregnancy may be critical. Most studies treated work exposure as a fixed characteristic, yet Meyer et al. showed that the trajectory of psychosocial work stress mattered more than baseline levels [7]. Tartaglia et al. found that associations between the occupational exposome and SGA were present only among women who stopped working during the third trimester [9], suggesting that both the type and duration of exposure influence outcomes. Bonzini et al. (2006) noted that exposures in the first two trimesters were the most commonly assessed [12], but whether continued exposure into late pregnancy confers additional risk remains insufficiently characterized.

In summary, the balance of evidence suggests that psychosocial work stress is associated with a modest but significant reduction in mean birthweight (approximately 60–77 grams) [1, 2], while associations with dichotomous LBW ($<2,500$ g) are inconsistent and appear to be driven by study size, quality, and exposure specificity. Long working hours (>40 h/wk) show a more consistent association with preterm delivery (OR ~ 1.16 – 1.21) [3, 4] than with fetal growth

restriction. Physically demanding work demonstrates the most robust association with SGA (OR 1.37) [6]. The psychosocial work environment—particularly the balance of effort and reward—may have a clinically meaningful effect on birthweight when assessed longitudinally [7], though this evidence rests on a single small study. Higher-quality studies with larger samples consistently yield smaller effect estimates, and all reviews rate the certainty of evidence as low to very low [1, 3, 4].

DISCUSSION

This systematic review synthesizes evidence from 17 sources examining associations between maternal work stress, long working hours, and LBW risk. The findings reveal a complex picture characterized by heterogeneous effect estimates, important distinctions between exposure types, and significant methodological considerations that moderate conclusions.

Exposure Specificity Determines Effect Magnitude

A central finding is that the type and specificity of occupational exposure critically influence observed associations with LBW. When work exposure is treated as a broad binary variable (employed vs. unemployed or >40 hours vs. ≤40 hours), several large meta-analyses found no significant or only marginal associations with LBW (4,5,8). However, disaggregating exposures reveals clearer signals. Psychosocial work stress, measured using validated instruments such as the Job Demand-Control and Effort-Reward Imbalance models, demonstrated distinct effects depending on outcome definition (1,7). The comprehensive meta-analysis by Admas et al. (2025) found that psychosocial stress was non-significantly associated with dichotomous LBW (OR 2.30, 95% CI 0.70–7.60) but significantly reduced mean birthweight by 77 grams (95% CI –121.18 to –33.01) with moderate certainty (1). This pattern suggests that work stress shifts the entire birthweight distribution downward without necessarily increasing the proportion of infants below the 2500g threshold, except in populations already at elevated risk.

Physically demanding work showed the most consistent associations with fetal growth restriction. Mozurkewich et al. (2000) reported a pooled OR of 1.37 (95% CI 1.30–1.44) for SGA associated with physical work demands, based on 160,988 women across multiple studies (6). This finding aligns with mechanistic hypotheses linking sustained physical exertion to reduced

uteroplacental blood flow and nutrient delivery (13). Importantly, this association persisted across diverse occupational groups and geographic settings, suggesting robustness.

Long working hours (>40 h/week) presented the most inconsistent evidence. The largest and most recent meta-analysis by Cai et al. (2019) found a statistically significant 43% increase in LBW odds (OR 1.43, 95% CI 1.11–1.84) (3). However, an overlapping review by the same research group found no significant association with LBW specifically (4,5). This discrepancy likely reflects differences in included studies, analytic approaches, and outcome definitions. The Palmer et al. (2013) updated review explicitly demonstrated that as higher-quality studies were added over time, pooled effect estimates for both preterm delivery and SGA became smaller, with larger cohort studies yielding RRs of 1.04–1.18 for preterm delivery and near-null estimates for SGA (2).

Differential Effects on Preterm Delivery versus Fetal Growth Restriction

The evidence consistently supports distinct pathways through which different occupational exposures affect pregnancy outcomes. Long working hours and shift work demonstrate more consistent associations with preterm delivery than with fetal growth restriction. Cai et al. (2019) reported that long hours (>40 h/week) were associated with significantly increased preterm delivery risk (OR 1.21, 95% CI 1.11–1.33), while the association with SGA was marginally significant (OR 1.16, 95% CI 1.00–1.36) (3). Similarly, rotating shifts (OR 1.13 for preterm delivery) and fixed night shifts (OR 1.21 for preterm delivery) showed stronger associations with preterm birth than with SGA (3). Davenport et al. (2019) confirmed these findings, reporting adjusted ORs of 1.18 (95% CI 1.01–1.37) for preterm delivery with long hours, with no association with intrauterine growth restriction (4).

This pattern suggests mechanistic specificity: work-related fatigue, circadian disruption, and physical exhaustion may trigger preterm labor pathways through inflammatory cascades or premature cervical changes (8,11). In contrast, psychosocial stress may more directly affect fetal growth through sustained neuroendocrine alterations affecting placental function (7). The Corchero-Falcón et al. (2023) review found that high work stress was associated with a 6.65-fold increased risk of fetal weight below the 10th percentile in individual studies, though these estimates derived from smaller, potentially higher-risk populations (10).

Continuous versus Dichotomous Outcomes Reveal Different Signals

The distinction between continuous birthweight and dichotomous LBW represents a critical methodological consideration with substantive implications. Admas et al. (2025) demonstrated this most clearly: psychosocial work stress showed no significant association with LBW as a binary outcome but significantly reduced mean birthweight (1). Palmer et al. (2013) similarly reported a median birthweight reduction of approximately 60 grams (range 32–84 g) associated with longer working hours (2). These reductions, while statistically detectable, may not shift enough births below the 2500g threshold to produce significant dichotomous effects except in populations with elevated baseline risk.

This finding has important implications for research and practice. Studies relying solely on dichotomous LBW may underestimate true occupational effects, particularly in high-income countries with good nutritional status and healthcare access where most births occur above 2500g. Continuous birthweight analysis provides greater statistical power to detect modest but potentially clinically meaningful shifts that could have population-level significance. Meyer et al. (2017) provided the most compelling evidence for clinically meaningful effects, demonstrating that a favorable trajectory of declining effort-reward imbalance across pregnancy was associated with 408 g higher birthweight ($p = 0.015$) (7). Although this study was small ($n = 61$), its prospective design with repeated measures and comprehensive confounding control strengthens confidence in the finding.

Dose-Response Evidence and Exposure Thresholds

Evidence for dose-response relationships between work exposures and LBW remains limited but suggestive. Cai et al. (2019) found that women working more than 55.5 hours per week (compared to 40 hours) had a 10% increase in preterm delivery odds, suggesting a possible threshold effect above 55 hours (3). However, this finding pertained to preterm delivery rather than LBW directly. Corchero-Falcón et al. (2023) noted that the combination of high physical workload with more than 32 hours of work per week significantly increased preterm birth risk, and that increasing monthly night shifts showed dose-response relationships with sickness risk (10). Palmer

et al. (2013) reported that continuous analyses demonstrated linear associations between working hours and birthweight reduction, with no clear threshold below which effects were absent (2).

The most compelling dose-response evidence comes from longitudinal trajectory analyses. Meyer et al. (2017) found that the pattern of effort-reward imbalance across pregnancy—not simply baseline levels—determined birthweight outcomes (7). Women whose effort-reward imbalance declined (indicating improving work conditions) had substantially higher birthweights than those with stable or increasing imbalance. This finding suggests that both the intensity and duration of exposure, as well as changes over time, influence fetal growth. Tartaglia et al. (2024) similarly found that associations between occupational exposome profiles and SGA were present only among women who stopped working during the third trimester, suggesting that cumulative exposure across pregnancy may be critical (9).

Study Quality Systematically Moderates Effect Estimates

A consistent theme across multiple reviews is that study quality systematically influences effect estimates. The Palmer/Bonzini collaborations explicitly demonstrated that as the evidence base expanded and higher-quality studies were added, pooled effect estimates for both preterm delivery and SGA became smaller (2,8). Larger cohort studies with prospective design, adequate sample sizes, and comprehensive confounding control consistently yielded effect estimates in the range of RR 1.04–1.18 for preterm delivery, with near-null estimates for SGA (2). In contrast, smaller case-control and cross-sectional studies produced inflated estimates, likely reflecting selection bias, recall bias, and inadequate confounding control.

The GRADE certainty ratings across meta-analyses were predominantly "low" to "very low" (1,3,4), underscoring limitations of the observational evidence base. Approximately 40% of exposure-outcome pairings in Palmer et al. carried high potential for confounding bias (2). Bonzini et al. (2006) noted that the largest individual study in their review yielded an OR of 1.59 for SGA with working ≥ 40 hours per week, but the pooled estimate across six studies was only 1.07 (12), illustrating how single large studies can be misleading without appropriate context.

Timing and Trajectory of Exposure Across Pregnancy

Most studies treated work exposure as a fixed characteristic, yet emerging evidence suggests that timing and trajectory matter critically. Meyer et al. (2017) showed that the trajectory of psychosocial work stress across pregnancy predicted birthweight more strongly than baseline levels (7). Women whose effort-reward imbalance declined (indicating improving work conditions) had 408 g higher birthweights than those with stable or worsening imbalance. This finding has important implications for intervention: modifying work conditions during pregnancy may have meaningful effects on fetal growth.

Tartaglia et al. (2024) found that associations between occupational exposome and SGA were present only among women who stopped working during the third trimester (9). This paradoxical finding may reflect that women with the most demanding jobs selectively stopped working, introducing selection bias, or that continued exposure into late pregnancy confers additional risk that becomes apparent only when comparing those who worked throughout versus those who stopped. Bonzini et al. (2006) noted that exposures in the first two trimesters were most commonly assessed (12), but whether continued exposure into late pregnancy confers additional risk remains insufficiently characterized.

Mechanistic Pathways

The observed patterns suggest distinct mechanistic pathways linking different occupational exposures to pregnancy outcomes. Psychosocial work stress likely operates through neuroendocrine pathways, with chronic stress activating the HPA axis and increasing cortisol and catecholamine release (1,11). Elevated cortisol may impair placental function, reduce uteroplacental blood flow, and restrict fetal nutrient delivery, leading to reduced birthweight without necessarily triggering preterm delivery. This mechanism aligns with the finding that psychosocial stress affects continuous birthweight more consistently than dichotomous LBW or preterm delivery.

Long working hours and physical demands may operate through different pathways. Sustained physical exertion and prolonged standing can reduce uteroplacental blood flow through mechanical compression of pelvic vessels and increased maternal catecholamines (6,13). Fatigue and circadian disruption from shift work may trigger inflammatory responses or premature cervical

changes, increasing preterm delivery risk (3,8). The stronger associations of these exposures with preterm delivery than with fetal growth restriction support this mechanistic distinction.

Implications for Clinical Practice and Policy

These findings have several implications for clinical practice and occupational health policy. First, healthcare providers should assess occupational exposures comprehensively when caring for pregnant workers, including not only work hours but also psychosocial stress, physical demands, and shift schedules. Second, interventions should be tailored to specific exposure types: reducing physical demands and providing adequate rest breaks for physically demanding occupations, addressing psychosocial stressors through workplace modifications or support services, and limiting extended work hours and night shifts (10).

Third, the finding that improving work conditions across pregnancy (declining effort-reward imbalance) is associated with substantially higher birthweight suggests that workplace accommodations initiated after pregnancy recognition may be effective (7). This supports policies enabling work modifications during pregnancy rather than requiring women to stop working entirely. Fourth, the modest effect sizes and low certainty of evidence suggest that occupational factors are one of many determinants of birthweight, and interventions should be implemented within broader strategies addressing smoking, nutrition, and socioeconomic disadvantage.

Research Priorities

This review identifies several priorities for future research. First, prospective cohort studies with repeated exposure measures across pregnancy are needed to characterize exposure trajectories and critical windows of susceptibility (7,9). Second, studies should assess both continuous birthweight and dichotomous LBW to detect modest but potentially meaningful effects (1,2). Third, comprehensive confounding control must include socioeconomic status, smoking, nutrition, and concurrent occupational exposures (12,17). Fourth, validated instruments for psychosocial stress (Job Demand-Control, Effort-Reward Imbalance) should be used to enable comparability across studies (1,7). Fifth, dose-response analyses with multiple exposure categories or continuous measures are needed to identify potential thresholds for intervention (3,10). Sixth, studies should examine effect modification by individual characteristics (parity, age, health status) and

occupational factors (industry type, job control, social support) (11). Seventh, intervention studies evaluating the effectiveness of workplace accommodations on pregnancy outcomes are urgently needed (10).

CONCLUSION

Summary of Findings

This systematic review of 17 sources examining associations between maternal work stress, long working hours, and LBW risk yields several key conclusions. The evidence is heterogeneous, with effect estimates systematically moderated by exposure specificity, outcome measurement, study quality, and confounding control. Psychosocial work stress is associated with a modest but significant reduction in mean birthweight of approximately 60–77 grams, though associations with dichotomous LBW (<2500g) are inconsistent. Long working hours (>40 h/week) demonstrate more consistent associations with preterm delivery (OR ~1.16–1.21) than with fetal growth restriction. Physically demanding work shows the most robust association with SGA (OR 1.37). The psychosocial work environment—particularly the balance of effort and reward—may have clinically meaningful effects on birthweight when assessed longitudinally, with improving work conditions across pregnancy associated with substantially higher birthweight.

Certainty of Evidence

The certainty of evidence across all outcomes is low to very low according to GRADE assessments. Larger, higher-quality cohort studies consistently yield smaller effect estimates than smaller studies with weaker designs. Approximately 40% of exposure-outcome pairings carry high potential for confounding bias. Confounding control remains inadequate across most studies, with variable adjustment for smoking, socioeconomic status, and concurrent occupational hazards. These limitations preclude strong causal inferences and suggest that true effect sizes may be smaller than reported in some individual studies.

Clinical and Policy Implications

Despite these limitations, the evidence supports several practical recommendations. Healthcare providers should assess occupational exposures comprehensively during prenatal care

and consider work modifications for women in high-risk occupations. Reducing physical demands, providing adequate rest breaks, addressing psychosocial stressors, and limiting extended work hours may reduce adverse pregnancy outcomes. Workplace policies enabling flexible hours, job modifications, and paid leave during pregnancy warrant implementation. However, interventions should be implemented within comprehensive strategies addressing multiple determinants of birthweight, as occupational factors are one of many contributing influences.

Future Research Directions

Future research requires prospective cohort designs with repeated exposure measures across pregnancy, validated instruments for psychosocial stress, comprehensive confounding control, and assessment of both continuous and dichotomous outcomes. Studies should characterize dose-response relationships and identify critical windows of susceptibility. Intervention studies evaluating workplace accommodations are urgently needed. Research in low- and middle-income countries is essential to understand context-specific risks and inform global recommendations. Collaboration across occupational health, obstetrics, and epidemiology disciplines will be necessary to advance this field.

Final Conclusion

In conclusion, maternal work stress and long working hours are associated with modest but significant reductions in birthweight and increased preterm delivery risk. The evidence suggests that these associations operate through distinct pathways: psychosocial stress affecting fetal growth through neuroendocrine mechanisms, and long hours/physical demands increasing preterm delivery risk through fatigue and physiological stress. However, the low certainty of evidence, heterogeneity across studies, and modest effect sizes indicate that occupational factors are one of many determinants of birthweight. Until higher-quality evidence emerges, a precautionary approach supporting work modifications for pregnant women in high-risk occupations appears warranted, balanced against the recognized benefits of employment for maternal and child health.

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