Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes: a systematic review

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OBJECTIVE: A decline in musculoskeletal health during pregnancy is an underappreciated adverse outcome of pregnancy that can have immediate and long-term health consequences. High physical job demands are known risk factors for nontraumatic musculoskeletal disorders in the general working population. Evidence from meta-analyses suggest that occupational lifting and prolonged standing during pregnancy may increase risk of adverse pregnancy outcomes. This systematic review examined associations between occupational lifting or postural load in pregnancy and associated musculoskeletal disorders and related sequalae.

DATA SOURCES: Five electronic databases (Medline, Embase, CINAHL, NIOSHTIC-2, and Ergonomic Abstracts) were searched from 1990 to July 2022 for studies in any language. A Web of Science snowball search was performed in December 2022. Reference lists were manually reviewed.

STUDY ELIGIBILITY CRITERIA: Eligible studies reported associations between occupational lifting or postural load and musculoskeletal health or sequelae (eg, employment outcomes) among pregnant and postpartum workers.

METHODS: Data were extracted using a customized form to document study and sample characteristics; and details of exposures, outcomes, covariates, and analyses. Investigators independently assessed study quality for 7 risk-of-bias domains and overall utility, with discrepant ratings resolved through discussion. A narrative synthesis was conducted due to heterogeneity.

RESULTS: Sixteen studies (11 cohort studies, 2 nested case-control studies, and 3 cross-sectional studies) from 8 countries were included (N=142,320 pregnant and N=1744 postpartum workers). Limited but consistent evidence with variable quality ratings, ranging from critical concern to high, suggests that pregnant workers exposed to heavy lifting (usually defined as ≥22 lbs or ≥10 kg) may be at increased risk of functionally limiting pelvic girdle pain and antenatal leave. Moreover, reports of dose-response relationships suggest graded risk levels according to lifting frequency, ranging from 21% to 45% for pelvic girdle pain and 58% to 202% for antenatal leave. Limited but consistent evidence also suggests that postural load increases the risk of employment cessation.

CONCLUSION: Limited but consistent evidence suggests that pregnant workers exposed to heavy lifting and postural load are at increased risk of pelvic girdle pain and employment cessation. Job accommodations to reduce exposure levels may promote safe sustainable employment for pregnant workers.

Key words: analgesics, antenatal leave, ergonomics, heavy lifting, labor market outcomes, low back pain, maternal health, musculoskeletal disorders, physical functioning, pelvic girdle pain, physical workload, postpartum period, postural load, work during pregnancy

Introduction

A decline in musculoskeletal health during pregnancy is an underappreciated adverse outcome of pregnancy that can have immediate and long-term maternal health consequences. Significant adaptations to the musculoskeletal system occur during pregnancy, and up to 70% of pregnant individuals experience at least mild musculoskeletal pain or discomfort that typically resolves after parturition.[1] It is estimated that the occurrence of severe and functionally limiting musculoskeletal pain affects up to 20% of pregnancies and persists into the postpartum period.[2–4] Physically demanding work is a known risk factor for musculoskeletal disorders in the general working population,[5,6] and a growing body of evidence from several systematic reviews with meta-analyses report associations between occupational lifting or postural load (eg, prolonged standing) in pregnancy and adverse pregnancy outcomes.[7–9] However, little is known about associations between these workplace exposures in pregnancy and musculoskeletal disorders or related sequelae, such as fatigue, analgesic use, and employment outcomes.

To evaluate what is known, we synthesized available evidence and identified knowledge gaps addressing the following: (1) the prevalence and incidence of musculoskeletal disorders among pregnant and postpartum workers occupationally exposed to lifting and postural load and (2) associations between exposure to occupational lifting or postural load and musculoskeletal disorders and related sequelae among pregnant and postpartum workers.

Methods

A protocol for this systematic review was registered a priori with PROSPERO, the International Prospective Register of Systematic Reviews (registration number CRD42021223685). This systematic review is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses-2 and Meta-Analysis of Observational

AJOG at a Glance

Why was this study conducted?

This study was conducted to identify and evaluate evidence reporting associations between specific physical job demands during pregnancy and risk of poor musculoskeletal health and related sequalae.

Key findings

Limited variable-quality evidence finds heavy lifting during pregnancy (usually defined as ≥22 lbs or ≥10 kg) may be associated with poor musculoskeletal health, which is consistent with a robust evidence base established for the general working population. The concentration of evidence between physical job demands in pregnancy and functionally limiting pelvic girdle pain is unique and suggestive of a distinct injury susceptibility coincident with gravidity.

What does this add to what is known?

Workers occupationally exposed to heavy lifting (≥22 lbs or ≥10 kg) during pregnancy may face increased risk of functionally limiting pelvic girdle pain. Heavy lifting and postural load, such as prolonged standing, were additionally associated with higher employment cessation (usually defined as antenatal leave).

Studies in Epidemiology reporting guidelines.[10,11]

Search strategy and information sources

Five electronic databases (Medline, Embase, the Cumulative Index to the Nursing and Allied Health Literature, the National Institute for Occupational Safety and Health Technical Information Center database, and Ergonomics Abstracts) were searched on July 1, 2022. Controlled-vocabulary terms and text words were used for the following concepts: population ("pregnancy" OR "postpartum"), occupational exposure ("lifting" OR "carrying" OR "postural load"), musculoskeletal disorders ("low back pain" OR "pelvic pain" OR "sacroiliac joint pain"), and sequelae ("fatigue" OR "analgesic use" OR "employment outcome" OR "work disability" OR "sickness absence" OR "employment withdrawal" OR "return to work"). The full search strategy is reported in Appendix A. We also used included studies as index articles for a snowball search using Web of Science on December 21, 2022, and we manually scanned the reference lists of included studies.

Eligibility criteria

For objectives 1 (prevalence and incidence) and 2 (associations), we considered nonrandomized comparative studies (cohort, case-control, and cross-sectional studies) of employed pregnant or postpartum workers in community, clinical, or industrial settings. For objective 1, we also considered single-group studies. For both objectives, we restricted to studies published since 1990 so that findings would reflect more modern working conditions and the contemporary work patterns of pregnant workers. Health and health behaviors during pregnancy can vary by employment status[12]; therefore, we excluded studies that did not restrict the sample to, or report subgroup analyses for, employed individuals. Included studies

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

Availability of Data

The protocol for this systematic review was registered with PROSPERO, the International prospective register of systematic reviews (registration number CRD42021223685), which is accessible at PROSPERO (york.ac.uk). Data extracted for this systematic review are archived in SRDR+ (ahrq.gov) and will be made publicly accessible online upon publication of this paper.

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assessed exposure to 1 or more specific types of physical job demands, namely lifting (or carrying) or postural load occurring at any anatomical site (eg, standing, bending or twisting, and shoulder flexion). We included studies examining relevant exposures occurring at any stage of pregnancy or up to 6 months postpartum, the period in which pregnancy-induced joint laxity is known to persist.[13] We excluded studies that only reported crude (eg, "manual work") or composite physical job demand measures where the effect of stressor components was obscured. Because growing evidence demonstrates that occupational and leisure-time physical activity are associated with differential health impacts,[14] including during pregnancy,[15] we excluded studies that did not distinguish between occupational and nonoccupational physical demands and studies that only assessed physical demands occurring outside of paid employment (eg, strength training, leisure-time physical activity, and domestic activity). Included studies measured musculoskeletal disorders occurring during pregnancy or postpartum, irrespective of anatomical site (studies addressing traumatic musculoskeletal injuries arising from blunt force, such as being struck by an object or falling, were not included). We also included studies measuring the following sequelae, regardless of whether the study authors explicitly stated these outcomes were attributed to musculoskeletal health: fatigue, analgesic use, and employment outcomes (eg, work disability, sickness absence that included antenatal or maternity leave, and employment outcomes that included quitting, being fired, delayed return to work). We excluded case studies, systematic reviews, editorials, commentaries, and conference proceedings.

Study selection

Records from electronic searches were de-duplicated in EndNote and imported into Abstrackr (http://abstrackr.cebm.brown.edu). After 2 rounds of pilot screening, 2 independent investigators (L.A.M. and C.Y.J.) conducted title and abstract screening of all remaining records. Potentially relevant articles were then retrieved for full-text screening by 2 of 5 independent investigators (L.A.M., C.Y.J., M-L.L., A.S-C., and I.J.S.). We translated potentially relevant non-English language articles using professional translators and Google Translate. We resolved screening discrepancies (at both abstract and full-text stages) by discussion between the screeners and by group consensus as needed.

Data extraction

We extracted data from each study into a customized data extraction form within the Systematic Review Data Repository Plus (SRDR+; http://srdrplus.ahrq.gov). One investigator (G.P.A. or H.J.K.) extracted all data that were then independently verified by a second investigator (H.J.K. or G.P.A.). We resolved discrepancies by discussion between the 2 investigators and by group consensus as needed. Extracted data included citation information, study name, study design, study years, funding source, country, research objectives, enrollment source, sample size, and sample population inclusion and exclusion criteria. Extracted occupational exposure characteristics included exposure definitions, assessment method, directionality of data collection (eg, prospective), number of assessments performed, and exposure period (ie, gestational or postpartum period). Extracted outcome characteristics included outcome definitions, assessment method, temporality of outcome assessment (eg, prospective), number of assessments performed, and outcome period (ie, gestational or postpartum). We extracted effect measures with confidence intervals or *P* values, the full lists of covariates, and the analytic treatment of covariates in reported models.

Risk of bias assessment

Risk of bias assessments were independently performed by 2 of 3 investigators (L.A.M., C.Y.J., and A.S-C). We developed a risk of bias form using items from the Risk of Bias in Nonrandomized Studies of Interventions tool and the National Toxicology Program Handbook for Preparing Report of Carcinogens Monographs, 2 methods used to assess risk of bias in nonrandomized studies.[16,17] Signaling criteria from these tools were adapted to account for known threats to the external and internal validity of nonrandomized studies involving worker populations and pregnant workers.[12,18–21] We assigned a rating (critical concern [0], low quality [+], medium quality [++], high quality [+++]) to each of 7 domains (selection, exposure, outcome, confounding, analysis, reporting, and sensitivity) and for overall utility. The rating for overall utility involved consideration of the individual domain ratings and the predicted degree of aggregate bias. We resolved discrepancies by discussion among L.A.M., C.Y.J., and A.S-C.

Data syntheses

The studies were grouped for synthesis into 4 exposure-outcome pairs: (1) lifting and musculoskeletal disorders, (2) postural load and musculoskeletal disorders, (3) lifting and employment outcomes, and (4) postural load and employment outcomes. Studies were further subgrouped based on a priori criteria related to exposure and outcome definitions, methods and timing of exposure and outcome assessments, and reported measures of association. Due to considerable heterogeneity in exposure and outcome definitions and in the measures of effect reported, a narrative synthesis was conducted. Conclusions about effect size, direction of effect, and generalizability of findings were drawn from effect estimates and confidence intervals within exposure-outcome pairs and subgroups, coupled with knowledge of the strengths and limitations of the underlying evidence, as reflected in our risk of bias ratings.[22]

Results

Study selection

In Figure, we illustrate the study selection process. The electronic database search identified 6387 records. Manual review of the reference lists of included studies and the snowball search identified an additional 288 articles. We screened a total of 117 articles in full text (including 16 articles that had been

FIGURE
PRISMA flow diagram

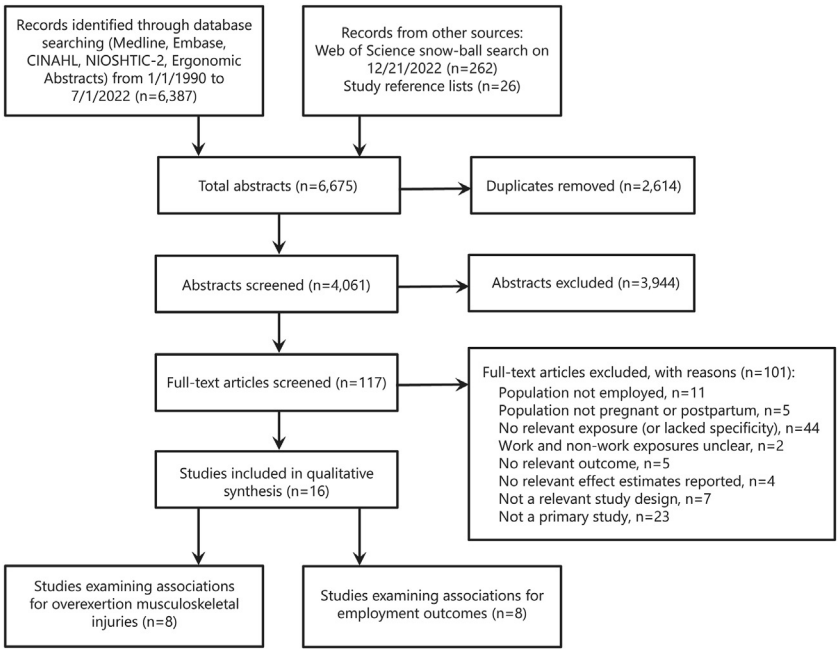

Figure is a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram. The diagram is a visual enumeration of studies identified through a systematic search process, followed by their disposition through each step of the screening process through to the final stage of determining those studies that meet eligibility criteria for inclusion in the systematic review.

PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-analysis.

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translated into English), of which we excluded 101 articles. The most frequent reasons for exclusion were lack of a relevant exposure (or exposure lacked specificity) (n=44) and the article not reporting a primary study (n=23). In Appendix B, we list references for all articles excluded during full-text screening, with reasons for exclusion. Sixteen studies met inclusion criteria.

Study and participant characteristics

In Table 1,[23–38] we summarize characteristics of the 16 included studies. Eleven studies (69%) employed a cohort design (8 were prospective), 2 (13%) were nested case-control design, and 3 (19%) a cross-sectional design. Half the studies were published since 2010. Most studies (69%) were conducted in northern Europe (Denmark, the Netherlands, and Norway), and 1 study each was conducted in Brazil, Canada, China, France, and the United States. All included studies were published in English. Three studies, including the 2 largest, used data from the Danish National Birth Cohort.[25,26,35] The other 13 studies involved unique study samples, ranging from 73[37] to 28,611 participants.[28] One industry-based study enrolled pregnant hospital workers employed in clinical, administrative, and support occupations,[32] whereas all remaining studies enrolled participants from clinical or community-based settings who were employed across a range of blue-collar and white-collar occupations.

Exposures assessed

All included studies assessed occupational exposure occurring during pregnancy and none assessed exposure postpartum. Nine studies (56%) measured exposure to both occupational lifting and postural load; however, none of these studies measured postures assumed during lifting activities. One study assessed only lifting,[26] and 6 studies assessed only postural load.[24,27–29,31,37] Whole-body postures (standing, walking, or sitting) were the postural load conditions measured most often. Postures of the back or torso (twisting or bending at the waist) were assessed in 4 studies.[28,33,34,38] Upper extremity posture (ie, working with hands above the shoulder) was assessed in 2 studies.[33,34] "Uncomfortable postures" and "static postures" (no anatomical regions specified) were assessed in 4 studies[27,29,30,32]

Outcomes assessed

Two studies assessed outcomes occurring postpartum: pelvic girdle pain (PGP)[27] and employment (return to work),[31] whereas most studies (88%) assessed musculoskeletal or employment outcomes occurring during pregnancy. Eight studies (50%) reported musculoskeletal

TABLE 1
Characteristics of all 16 included studies

Author, y	Study years	Country	Population	Sample Analyzed (total sample)	Exposures	Exposure assessment	Outcomes	Outcome assessment
Prospective cohort studies								
Pedersen et al,[23] 2021	2018–2018	Denmark	General population sample	910 (910)	Heavy lifting, standing, walking	Online questionnaire at 12 and 27 GW	Antenatal leave ≥14 d by 27 GW	Online questionnaire at 27 GW
Stafne et al,[24] 2019	2011–2015	Norway	General population sample	716 (855)	Standing/walking	Questionnaire at 18–22 GW	Antenatal leave due to lumbopelvic pain	Questionnaire at 32–36 GW
Hansen et al,[25] 2015	1996–2002	Denmark	Danish National Birth Cohort	49,195 (49,708)	Lifting, sitting, standing, walking, mixed (standing and other), kneeling	Telephone interview at 17 GW (median)	Onset of the first episode of antenatal leave lasting >15 d occurring between 10 and 29 GW	National sick leave registry
Larsen et al,[26] 2013	1996–2002	Denmark	Danish National Birth Cohort	47,935 (91,386)	Lifting	Interview at 12–16 GW and JEM	Functionally limiting pelvic pain during pregnancy	Interview at 6 mo postpartum
Stomp-van den Berg et al,[27] 2012	2004–2006	The Netherlands	Mom@Work Study	548 (548)	Standing or mixed standing/sitting, uncomfortable posture	Postal questionnaire at 30 GW (mean)	Pelvic girdle pain at 12 weeks postpartum	Postal questionnaire at 12 weeks postpartum with localized pain intensity registered on an 11-point scale, ranging from 0 (none) to 11 (much pain)
Kristensen et al,[28] 2008	1999–2005	Norway	Norwegian Mother and Child Cohort Study (MoBa)	28,611 (64 136)	Turning and bending	Questionnaire at 17 GW	Work absence >2 weeks between GW 17 and 30	Questionnaire at 30 GW
To et al,[29] 2003	NR	China	General population sample	254 (326)	Static posture, standing >4 h/day, walking >4 h/day	Questionnaire between 28 GW and delivery	Back pain symptoms in pregnancy	Questionnaire within 3 d postnatal
Larsen et al[30] 1999	NR	Denmark	General population sample	1516 (1516)	Lifting, uncomfortable posture	Questionnaire at 16 GW	Functionally limiting pelvic pain from 16 to 40 GW	Screening for functional pelvic pain at GW 16, 20, 30, 33, 38, and 40; when screening criteria met, rheumatologist exam performed
Retrospective cohort studies								
Wallace et al,[31] 2013	2003–2005	France	EDEN Mother-Child Cohort Study	1196 (1196)	Standing	Questionnaire during pregnancy (GW NR)	Return to work within 1 y after delivery	Questionnaires at 4, 8, and 12 mo postpartum

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(continued)

TABLE 1
Characteristics of all 16 included studies *(continued)*

Author, y	Study years	Country	Population	Sample Analyzed (total sample)	Exposures	Exposure assessment	Outcomes	Outcome assessment
Kaerlev et al,[32] 2004	1995–1999	Denmark	Healthcare sector	655 (773)	Heavy lifting, standing, walking, uncomfortable posture	Questionnaire at postpartum plus exposure imputation	Length and onset of antenatal leave >10% of work time	Hospital roster and linkage to the national birth registry for births during study period
Strand et al,[33] 1997	1989	Norway	Pregnancy and Work Survey	2693 (5438)	Lifting, hands above shoulder, bend and twist	Questionnaire at delivery	Certified sick leave occurring >3 or >8 weeks before delivery	Questionnaire at delivery
Nested case-control studies								
Guendelman et al,[34] 2016	2002–2003	United States	Juggling Work and Life During Pregnancy	1114 (1114)	Heavy lifting, bending at the waist, standing	Telephone interview a median of 4.5 mo postpartum	Employment withdrawal defined as a composite measure of antenatal leave, quitting work, or being fired while pregnant	Telephone interview a median 4.5 mo postpartum
Juhl et al,[35] 2005	2000–2001	Denmark	Danish National Birth Cohort	2758 (3589)	Lifting Sitting Standing, walking	Interview at 12 to 16 GW	Functional pelvic pain occurring during pregnancy or after delivery	Interview conducted 6 mo postpartum
Cross-sectional studies								
Caputo et al,[36] 2021	2015	Brazil	Pelotas Birth Cohort Study	2114 (3827)	Heavy lifting, standing	In-person interview at delivery	Low back pain during pregnancy	In-person interview at 12 mo postpartum
Cheng et al,[37] 2009	NR	Canada	General population sample	43 (73)	Sitting, standing	Interviewer-administered questionnaire at 20 and 34 GW	Functionally limiting back pain during pregnancy	Oswestry disability questionnaire at 20 and 34 GW
Endresen et al,[38] 1995	1989	Norway	General population sample	3789 (5215)	Lifting, standing, walking, bending forward Twist and bend, work above shoulder	Questionnaire at delivery	Low back pain during pregnancy; pelvic pain first onset during pregnancy and severity	Questionnaire at delivery

GW, gestational weeks; *JEM*, job exposure matrix; *NR*, not reported; *y*, year published.

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outcomes. Three of these studies assessed self-reported functionally limiting PGP during pregnancy[26,35,37] or self-reported functionally limiting PGP with a confirmatory clinical assessment of the pelvic girdle region by a rheumatologist.[30] In addition, 1 cross-sectional study assessed PGP and low back pain (LBP) during pregnancy, separately and combined (LBP/PGP),[38] whereas 3 studies assessed back pain[29,37] and LBP[36] during pregnancy. Among 8 studies that reported employment outcomes, 5 used participant self-reports of antenatal leave[23,24,28,33] or postpartum return to work,[31] 2 used national registry data to examine antenatal sick leave,[25,32] and 1 defined a composite measure of "employment withdrawal" based on participant self-reports of antenatal leave, quitting work, or being fired during pregnancy.[31]

Risk of bias assessment

Risk of bias ratings for all domains and overall utility among included studies are shown in Appendix C. We rated the overall utility of 2 studies as high, 4 as medium, 7 as low, and 3 as critical concern. The 6 studies rated high or medium utility were all published since 2012; the designs of these higher-rated studies included 4 prospective cohort studies (2 musculoskeletal and 2 employment outcomes),[23,25–27] 1 nested case-control (employment outcome),[34] and 1 cross-sectional study (musculoskeletal outcome).[36] The designs of studies rated as low utility included 2 prospective cohort studies (1 musculoskeletal and 1 employment outcome),[28,30] 3 retrospective cohorts (employment outcomes),[31–33] 1 nested case-control,[35] and 1 cross-sectional study (musculoskeletal outcomes).[38] The utility rating of critical concern was assigned to 3 smaller postural load studies reporting unadjusted measures of association (Spearman correlation coefficients[24,37] and crude odds ratios[29]). Appendix D includes a narrative summary of risk of bias-related concerns identified among included studies.

Synthesis of Results

Objective 1: prevalence or incidence of musculoskeletal disorders

No studies were identified reporting the prevalence or incidence of musculoskeletal disorders among occupationally exposed pregnant workers.

Objective 2: associations between occupational exposures and musculoskeletal disorders

Lifting or postural load and musculoskeletal disorders occurring in the extremities.

No studies were identified reporting associations between relevant occupational exposures and upper or lower extremity musculoskeletal disorders during pregnancy or postpartum.

Lifting and back pain or pelvic girdle pain during pregnancy.

A single medium-utility study examining the occurrence and severity of LBP[36] and a single low-utility study examining the occurrence of LBP and/or PGP[38] were consistent in reporting increased risk associated with frequent heavy lifting at work (Table 2[26,30,35,36,38]). Findings for functionally limiting PGP during pregnancy were inconsistent, with 1 high-utility study reporting elevated risk for any lifting ≥22 lbs (≥10kg) as well as a significant trend of proportionally higher risk as daily volume of lifting increased,[26] whereas findings were null for 1 low-utility study that was underpowered to detect small elevations in risk[35] and also for 1 low-utility study reporting crude effect estimates.[30] Consistency in positive findings among 3 studies were robust to the lifting threshold being defined qualitatively ("heavy lifting") or numerically (eg, ≥22 lbs or ≥10kg).[26,36,38] Notwithstanding sample size influencing precision in 1 study,[35] a key factor discriminating 3 studies reporting a positive from a null effect was the inclusion of lifting "frequency."[26,36,38]

Lifting and postpartum low back pain or pelvic girdle pain.

No studies were identified reporting associations between exposure to occupational lifting and postpartum LBP or PGP.

Postural load and back pain or pelvic girdle pain during pregnancy.

A consistent pattern of null findings was reported for associations between standing or standing and walking and back pain or LBP in 4 studies ranging from medium utility to critical concern,[29,36–38] and in a single low-utility study examining associations with PGP (Table 3[27,29,30,35–38]).[35] One small study rated as critical concern reported null findings between "static postures" (not otherwise specified) and back pain.[29] In contrast, findings from 2 single studies reported increased risks for other postural load conditions and LBP or PGP: 1 low-utility study reported an increased risk of functionally limiting PGP associated with work in "uncomfortable postures,"[30] and a second low-utility study reported an increased risk for LBP associated with bending forward at the waist and an increased risk of LBP and/or PGP associated with hourly twisting and, separately, for bending at the waist and working with hands above the shoulders.[38]

Postural load and postpartum low back pain or pelvic girdle pain.

A single medium-utility study reported varied associations between exposure to postural load at 30 weeks gestation and PGP occurring 12 weeks postpartum, with null findings reported for the association with prolonged standing and increased risk reported for associations with "uncomfortable work postures" (Table 3[27,29,30,35–38]).[27] No studies were identified reporting postural load and postpartum LBP.

Musculoskeletal sequelae

No studies were identified reporting associations between relevant physical job demands and fatigue, analgesic use, or work disability. Eight studies reported associations with diverse employment outcomes, ranging from employment withdrawal during pregnancy (ie, quitting work, being fired, and antenatal leave),[34] work absence,[28] sick or antenatal leave,[23–25,32,33] and return to work postpartum.[31]

TABLE 2
Occupational lifting and back and/or pelvic girdle pain during pregnancy

Author, y	Design	Overall utility	Exposure assessment		Lifting exposure		Effect measure	Effect size (95% CI)	Outcome
			Frequency	Timing	Reference	Categories			
Caputo et al,[36] 2021	Cross-sectional	++	1	Retrospective (at delivery)	Never have to lift heavy items	Heavy lifting: Rarely Sometimes Often Always Heavy lifting: Rarely Sometimes Often Always	Adj OR Adj MD	0.83 (0.54–1.27) 1.20 (0.93–1.55) 1.37 (0.94–2.00) 1.39 (1.01–1.93) 0.53 (−0.25 to 1.31) −0.19 (−0.63 to 0.25) 0.81 (0.18–1.44) 0.92 (0.39–1.44)	LBP during pregnancy (0, 1) LBP severity during pregnancy (0–10, no pain to highest pain)
Larsen et al,[26] 2013	Prospective cohort	+++	1	12–16 GW	Not defined; assumed no lifting and lifting ≤10 kg	Heavy lifting: any >11 kg cumulative[a] 15–100 kg 101–200 kg 201–500 kg 501–1k kg >1000 kg	Adj OR Adj OR	1.18 (1.12–1.25) 1.06 (0.99–1.13) 1.21 (1.09–1.34) 1.45 (1.31–1.60) 1.45 (1.23–1.72) 1.31 (1.02–1.69)	Functionally limiting PGP during pregnancy (0, 1)
Juhl et al,[35] 2005	Case-control	+	1	12–16 GW	Reported 'no,' but assumed ≤10 kg	Heavy lifting: 11–20 kg >20 kg	Adj OR	1.12 (0.88–1.44) 1.14 (0.86–1.50)	Functionally limiting PGP during pregnancy (0, 1)
Larsen et al,[30] 1999	Prospective cohort	+	1	16 GW	Not defined; assumed no lifting and lifting ≤10 kg	>10 kg	cOR Adj *P*-value	1.90 (1.41–2.56)[b] NS	Functionally limiting PGP during pregnancy (0, 1)
Endresen et al,[38] 1995	Cross-sectional	+	1	Retrospective (at delivery)	Not defined; assumed no lifting and lifting <10 kg	Frequent lifting 10–20 kg	Adj β	0.060 (2.18)[c]	LBP/PGP during pregnancy (0, 1)

Adj, adjusted; *CI*, confidence interval; *cOR*, crude odds ratio; *GW*, gestational weeks; *JEM*, Job Exposure Matrix; *kg*, kilograms; *LBP*, low back pain; *LBP/PGP*, low back and pelvic girdle pain combined; *MD*, mean difference; *NS*, not statistically significant; *OR*, odds ratio; *PGP*, pelvic girdle pain; *y*, year published; *(0, 1)*, binary outcome (no, yes).

[a] For self-reported cumulative total lifting per day, a positive exposure-response relationship was observed (*P* value for trend <.0001). For JEM-derived cumulative total lifting per day, an exposure-response relationship was not observed (*P* value for trend <.0918); [b] Effect size and 95% CI were computed from the proportion of exposed participants with and without pelvic girdle relaxation (Table 1).[30]; [c] Numeric value reported in parentheses, t (significance test).

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TABLE 3
Occupational postural load and back and/or pelvic girdle pain during pregnancy or postpartum

Author, y	Design	Overall utility	Exposure assessment		Postural definition		Effect measure	Effect size (95% CI)	Outcome
			Freq	Timing	Reference	Categories			
Caputo et al,[36] 2021	Cross-sectional	++	1	Retrospective (at delivery)	Not defined	Mean hours standing	Adj OR Adj MD	1.03 (0.99–1.06) 0.05 (−0.003 to 0.10)	LBP during pregnancy (0, 1) LBP severity during pregnancy (0–10)
Stomp-van den Berg et al,[27] 2012	Prospective cohort	++	1	30 GW	Mainly sitting Not defined	Standing or mixed standing/sitting Uncomfortable posture (NOS)	cOR Adj OR	1.14 (0.73–1.80) 1.31 (1.04–1.65)	Postpartum PGP 12 weeks after delivery
To et al,[29] 2003	Prospective cohort	0	1	Retrospective, within 3 d postnatal	Not defined Stand<4h/d walk<4 h/d	Static posture Standing >4 h/day Walking >4 h/day	cORs	1.47 (0.75–2.87) 2.40 (0.89–6.43) 3.47 (0.79–15.10)	Back pain during pregnancy
Cheng et al,[37] 2009	Cross-sectional	0	2	20 and 34 GW	Less time walking Less time standing	A lot of work time: Walking (1–7) Standing (1–7)	Correlation coefficient	−0.071 (20 GW) −0.235 (34 GW) 0.006 (20 GW) −0.108 (34 GW)	Functionally limiting back pain at 20 and at 34 GW (0–10)
Juhl et al,[35] 2005	Case-control	+	1	12–16 GW	Mostly sitting Mostly sitting	Predominantly standing or walking Mix of sitting, standing, and walking	Adj OR	1.04 (0.80–1.35) 1.02 (0.83–1.25)	Functionally limiting PGP during pregnancy (0, 1)
Larsen et al,[30] 1999	Prospective cohort	+	1	16 GW	Not defined	Uncomfortable posture (NOS)	Adj OR	1.65 (1.10–2.48)	Functionally limiting PGP during pregnancy (0, 1)
Endresen et al,[38] 1995	Cross-sectional	+	1	Retrospective (at delivery)	Not defined	Hourly twist and bend Work > shoulder Bending forward Standing, walking	Adj β	0.069 (2.13) 0.064 (3.23) 0.046 (3.09) NS (NR)	LBP/PGP during pregnancy (0, 1) LBP (0, 1)

Adj, adjusted; *CI*, confidence interval; *cOR*, crude odds ratio; *Freq*, frequency; *GW*, gestational weeks; *h*, hours; *LBP*, low back pain; *LBP/PGP*, low back and pelvic girdle pain combined; *NOS*, not otherwise specified; *NR*, not reported; *NS*, not statistically significant; *OR*, odds ratio; *PGP*, pelvic girdle pain; *y*, year published; *(0, 1)*, outcome (no, yes).

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Lifting and employment outcomes during pregnancy.

A consistent pattern of elevated risk was shown for associations between occupational lifting and employment outcomes occurring during pregnancy among all relevant studies having utility ratings of high (1 study),[23] medium (2 studies),[25,34] and low (2 studies)[32,33] (Table 4[23,25,32–34]). The consistency of findings was robust to the lifting threshold being defined qualitatively ("heavy lifting") or quantitatively (variable definitions ranging from >15 lbs [>6.8 kg] to ≥24 lbs [≥11 kg]), irrespective of lifting frequency. Findings from 1 high-utility prospective cohort study suggest that the timing or duration of exposure matters: persistent exposure to "heavy lifting" (not otherwise specified) through 27 weeks gestation was associated with more than a 3-fold increased risk of antenatal sick leave lasting ≥14 days, whereas risk was not elevated in those exposed only at 12 weeks gestation.[23] More than a 4-fold increased risk was reported in a medium-utility case-control study for the association between lifting >15 lbs (>6.8 kg) in both the first and second trimesters and employment withdrawal (antenatal leave, quitting, or being fired); this was the only lifting study that excluded those exposed to prolonged standing from the reference group.[34] The only employment outcome study that measured lifting frequency was a medium-utility prospective cohort study that reported a significant dose-response relationship, with graded risk estimates ranging from 58% to 202%, for exposure to progressively higher volumes of lifting per day and antenatal leave lasting >15 days.[25] In 2 separate low-quality retrospective cohort studies, lifting 22 to 44 lbs (10 to 20 kg) was associated with elevated risk of antenatal leave occurring both at 8 weeks or 3 weeks before delivery[33] and "heavy lifting" was associated with antenatal leave exceeding 10% of work time.[32]

Lifting and postpartum employment outcomes.

No studies were identified reporting associations between occupational lifting and postpartum employment outcomes.

Postural load and employment outcomes during pregnancy

Standing work. In contrast to null findings for associations with musculoskeletal disorders, a consistent pattern of elevated risk was shown for associations between standing (or standing and walking) and employment outcomes in 6 studies with utility ratings ranging from high[23] to medium[25,34] and low[31,32,33] to critical concern[24] (Table 5[23–25,28,31–34]). Findings from 1 high-utility prospective cohort study suggest that the timing or duration of exposure matters: persistent exposure to heavy lifting and prolonged standing through 27 weeks gestation was associated with increased risk of employment cessation, whereas risk was not elevated in those exposed only at 12 weeks gestation.[23] This finding is similar to findings from a medium-utility case-control study reporting associations between persistent exposure to prolonged standing ≥4 hours through the end of the second trimester and employment withdrawal (antenatal leave, quitting, or being fired); this was the only study that assessed risk of prolonged standing where the reference group excluded those exposed to prolonged standing and lifting >15 lbs (>6.8 kg).[34] A single medium-utility prospective cohort study assessed varying types of whole-body work exposure ("primarily standing," "primarily walking," "primarily standing and walking," "changeable" (ie, "I can change from sitting to standing to walking as I would like"), and "other" (ie, cycling, kneeling and standing combined with sitting) reporting elevated risk of sick leave lasting >15 days for each whole-body exposure, compared with "primarily sitting."[25]

Other postural load. Except for 1 low-utility study of turning and bending,[28] a consistent pattern of elevated risk was shown for associations between various non-whole-body postural load conditions (bending forward or twisting or bending at the waist, working with hands above the shoulders, or "uncomfortable postures") and employment outcomes in 3 studies with utility ratings ranging from medium[34] to low utility[32,33] (Table 5[23–25,28,31–34]). A medium-utility case-control study that examined persistent exposure to bending at the waist during the first and second trimesters reported significantly elevated risk (nearly 6-fold) for employment withdrawal (antenatal leave, quitting, or being fired), compared with a reference group not exposed to other physical job demands (bending at the waist, lifting >15 lbs [>6.8 kg] or prolonged standing).[34] A low-utility retrospective cohort study reported a positive association between "uncomfortable posture" and risk of sick leave lasting more than 10% of total work time,[32] whereas another low-utility retrospective cohort study reported elevated risk for sick leave (>8 weeks and >3 weeks before delivery) associated with bending at the waist and working with hands above the shoulders.[33]

Postural load and postpartum employment outcomes.

A low-utility retrospective cohort study reported associations between "always" standing at work during pregnancy (gestation period not reported) and postpartum employment defined as return-to-work status at 12 months after delivery.[31] No studies were identified reporting non-whole-body postural load and postpartum employment.

Comment

Principal findings

This systematic review finds that high physical job demands in pregnancy may be associated with a decline in musculoskeletal health and employment cessation. Specifically, occupational exposure to heavy lifting, usually defined as ≥22 lbs (≥10 kg), may increase the risk of functionally limiting PGP,[26,30,38] with graded effects for higher frequency lifting ranging from 21% to 45%.[26] Heavy lifting may additionally increase the risk of employment cessation (usually defined as antenatal leave),[23,25,32–34] with graded effects for higher frequency lifting ranging from 58% to 202%.[25] Limited but consistent evidence also indicates that employment cessation may increase ≥2-fold in association with prolonged standing and walking[23,25,32,34] and ≥30% for bending, twisting, and working with hands above the shoulders.[32–34]

TABLE 4
Occupational lifting and employment outcomes during pregnancy

Author, y	Design	Overall utility	Exposure assessment		Lifting exposure		Effect measure	Effect size (95% CI)	Outcome
			Freq	Timing	Reference	Categories			
Pedersen et al,[23] 2021	Prospective cohort	+++	2	12 and 27 GW	No heavy lifting	Heavy lifting any GW Heavy lifting at 12 GW but not 27 GW Heavy lifting at 27 GW but not 12 GW Heavy lifting at 12 and 27 GW	Adj OR	2.10 (1.30–3.50) 0.80 (0.20–2.80) 3.70 (1.80–7.60) 3.20 (1.80–5.40)	Sick leave ≥14 d ≤27 GW (0, 1)
Guendelman et al,[34] 2016	Case-control	++	1	Retrospective (4.5 mo postpartum), for each trimester	No lift >6.8 kg and no standing ≥4 h	Lift >6.8 kg in trimesters 1 & 2	Adj OR	4.20 (1.98–8.90)	Employment withdrawal during pregnancy (0, 1)
Hansen et al,[25] 2015	Prospective cohort	++	1	17 GW (median)	≤10 kg ≤20 kg 0–14 kg	Lifting 11-20 kg Lifting >20 kg Cumulative lifting: 15–100 kg 101–200 kg 201–500 kg 501–1000 kg >1000 kg Trend	Adj HR	1.77 (1.70–1.84) 1.83 (1.74–1.92) 1.58 (1.49–1.67) 2.01 (1.87–2.17) 2.18 (2.02–2.35) 2.26 (1.99–2.56) 3.02 (2.54–3.58) 1.29 (1.27–1.31)[a]	First sick leave onset lasting >15 d occurring 10-29 GW (0, 1)[b]
Kaerlev et al,[32] 2004	Retrospective cohort	+	1	Retrospective (after delivery)	No heavy lifting	Heavy lifting NOS	Adj OR	1.90 (1.30–2.90)	Length of antenatal leave >10% of work time (0, 1)
Strand et al,[33] 1997	Retrospective cohort	+	1	Retrospective (at delivery) for when pregnancy confirmed	Lift <10 kg	Heavy lifting 10–20 kg	Adj OR Adj OR	1.26 (1.01–1.57)[c] 1.48 (1.22–1.80)	Antenatal leave >8 wk before delivery (0, 1) >3 wk before delivery (0, 1)

Adj, adjusted; *CI*, confidence interval; *HR*, *Freq*, frequency; hazard ratio; *kg*, kilograms; *NOS*, not otherwise specified; *OR*, odds ratio; *RR*, relative risk; *y*, year published; *(0, 1)*, binary outcome (no, yes).

[a] For self-reported cumulative total lifting per day, a positive exposure-response relationship was observed; [b] See the source publication for reports time-dependent effects of the exposures measured by time-varying coefficients (Table 4).[25]; [c] The source publication reports a lower CI of 0.01 for "lifting heavy loads (10–20 kg)" believed to be an error based on the comparable sample size and effect estimate for exposure to "standing back bent forward" (Table 3).[33]

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TABLE 5
Occupational postural load and employment outcomes during pregnancy or postpartum

Author, y	Design	Overall utility	Exposure assessment		Postural load definition		Effect measure	Effect size (95% CI)	Outcome
			Freq	Timing	Reference	Categories			
Pedersen et al,[23] 2021	Prospective cohort	+++	2	12 and 27 GW	No standing or walking	Stand or walk any time Standing or walking at 12 GW but not 27 GW Stand or walk at 27 GW but not 12 GW Standing or walking at both timepoints	Adj OR	2.00 (1.20−3.00) 0.70 (0.20−2.00) 2.30 (1.10−4.70) 2.80 (1.70−4.60)	Antenatal leave ≥14 d ≤27 GW (0, 1)
Safne et al,[24] 2019	Prospective cohort	0	1	18−22 GW	Never/ seldom	Walking/standing: Periodically daily ≤50% time daily >50% time	r^s	0.144, $P<.05$	Antenatal leave due to LBP and/or PGP from 32−36 GW (0, 1)
Guendelman et al,[34] 2016	Case-control	++	1	Retrospective (4.5 mo postpartum), for each trimester	No lifting >6.8 kg and no standing ≥4 h	Frequent bending in trimesters 1 & 2 Standing ≥4 h in trimesters 1 and 2	Adj OR	5.89 (2.40−14.5) 2.91 (1.46−5.77)	Employment withdrawal during pregnancy (0, 1)
Hansen et al,[25] 2015	Prospective cohort	++	1	17 GW (median)	Primarily sitting	Primarily standing Primarily walking Primarily stand and walk Changeable Sit, cycle, kneel, stand	Adj HR	2.57 (2.34−2.82) 2.74 (2.54−2.96) 2.80 (2.62−2.99) 1.54 (1.46−1.64) 2.23 (1.77−2.82)	First antenatal leave onset lasting >15 d occurring 10 −29 GW (0, 1)
Wallace et al,[31] 2013	Retrospective cohort	+	NR	Retrospective (after delivery)	< always standing	Always standing at work	Adj OR	1.76 (1.07−2.90)[a]	Return to work ≤1 y after delivery (0, 1)
Kristensen et al,[28] 2008	Prospective cohort	+	1	~17 GW	≤ seldom	Turning/bending: Sometimes Daily, <50% Daily, >50%	Adj risk diff	−0.015 (−0.032 to 0.002) −0.022 (−0.39 to −0.006) 0.013 (−0.007 to 0.032)	Work absence >2 wks between GW 17 and 30 (0, 1)
Kaerlev et al,[32] 2004	Retrospective cohort	+	1	Retrospective (after delivery)	None Not defined	Walking or standing Uncomfortable posture (NOS)	Adj OR	3.40 (1.90−5.80) 1.60 (1.10−2.40)	Length of antenatal leave >10% of work time (0, 1)

MacDonald. Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes. Am J Obstet Gynecol 2024. *(continued)*

TABLE 5
Occupational postural load and employment outcomes during pregnancy or postpartum *(continued)*

Author, y	Design	Overall utility	Exposure assessment		Postural load definition		Effect measure	Effect size (95% CI)	Outcome
			Freq	Timing	Reference	Categories			
Strand et al,[33] 1997	Retrospective cohort	+	1	Retrospective (at delivery) for when pregnancy confirmed	No postural load	Stand and bend forward Hands > shoulder level Twisting/bending Hands > shoulder level Twisting/bending	Adj OR	1.30 (1.02–1.65) 1.36 (1.06–1.74) 1.32 (1.05–1.66) 1.55 (1.22–1.95) 1.46 (1.24–1.76)	Antenatal leave >8 wks before delivery (0, 1) Antenatal leave >3 wks < delivery (0, 1)

Adj, adjusted; *CI*, confidence interval; *Diff*, difference; *Freq*, frequency; *GW*, gestational weeks; *HR*, hazard ratio; *LBP*, low back pain; *LBP and/or PGP*, low back pain and/or pelvic girdle pain; *NR*, not reported; *NOS*, not otherwise specified; *OR*, odds ratio; *P*, significance value; r^s, Spearman correlation coefficient; *y*, year published; *(0, 1)*, binary outcome (no, yes).

[a] Estimate shown was computed from the reported proportion of exposed versus unexposed participants returning to work within 1 year postpartum, stratified by parity values 0 or 1, versus for parity ≥2, OR=8.06 (2.06–31.5).[31] d: July 1, 2022 (for all dates since January 1, 1990).

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PGP is a serious but poorly understood cause of morbidity during pregnancy, affecting about 20% of pregnant individuals and becoming chronic and persisting postpartum among 8% to 10%.[4,39,40] Unlike the more prevalent and generally mild musculoskeletal discomfort that coincides with advancing gravidity and resolves spontaneously after delivery, PGP is distinct in presenting earlier in pregnancy, invoking greater pain severity, impacting physical functioning (eg, pain in gait) and impeding activities of daily living (self-care, newborn care, and employment).[1,41–43] PGP refers to nongynecologic or nonurologic pain disorders of musculoskeletal origin affecting both the anterior (symphysis) and posterior (sacroiliac region).[39,40] Pain affecting both the anterior (symphysis) and posterior (sacroiliac region) or bilateral sacroiliac joints generally distinguishes more severe cases.[39] Somatic pain intensity progressing with activities of daily living is indicative of PGP and can aid in differential diagnoses.

Our findings have important implications for clinical practice. Because patients with the worst prognosis for chronic musculoskeletal conditions present with greater pain severity in early pregnancy,[4,29] antenatal providers play a critical role in early diagnosis and management. Moreover, work history and musculoskeletal symptom screenings in early pregnancy could be effective tools for identifying at-risk patients when education about work activity restrictions[44–46] and knowledge about safe and effective pain relief[47–49] may be preventative. Several guidelines exist to aid the diagnosis and treatment of PGP during gestation and postpartum periods.[39,40,50–54] Clinicians should consider referring patients to specialists (eg, physical therapy, acupuncturist) in light of evidence showing these modalities are safe and effective during pregnancy,[50–54] and may be more effective than standard obstetric care alone[55–57]

Comparison with existing literature

To our knowledge, this is the first systematic review examining specific physical job demands in pregnancy and associated

musculoskeletal health and employment outcomes. Our findings are consistent with other evidence reporting associations between these outcomes and broadly defined measures of job physical demands. For example, pregnant Norwegian workers exposed to "physically demanding" work experienced a 50% increase in severe PGP, compared with nonexposed pregnant workers[58]; whereas "unskilled" pregnant workers in Denmark were more likely to experience unresolved PGP pain 2 years postpartum, compared with skilled pregnant workers whose PGP resolved shortly after delivery.[59] Finally, Swedish workers employed in "manual" work in pregnancy experienced a 89% increased risk of musculoskeletal conditions (mainly LBP) and a 21% increased risk of sick leave, compared with pregnant workers not employed in manual work.[60]

Because heavy lifting and postural load are established risk factors for a range of musculoskeletal disorders in the general workforce,[5,6] we expected to identify studies reporting associations for musculoskeletal outcomes occurring in the upper (eg, carpal tunnel syndrome) or lower extremities among exposed pregnant workers. Moreover, PGP is not a recognized musculoskeletal condition attributed to physical job demands in the general workforce, thus the concentration of studies identified focusing on functionally limiting PGP is suggestive of a distinct injury susceptibility among exposed pregnant workers. Finally, the limited volume of evidence identified in our review stands in contrast to considerable evidence summarized in 5 systematic reviews with meta-analyses that synthesized the quality and strength of associations reported between physical job demands in pregnancy and other adverse pregnancy outcomes.[7−9,61,62] Therefore, our review contributes to the existing literature by identifying that exposed pregnant workers may additionally face unique musculoskeletal and employment risks warranting further clinical and research attention.

Strengths and limitations

Although our exclusion of studies that relied on broadly defined measures of exposure (job title or "manual work") resulted in a smaller evidence base, we believe this criterion strengthens our review by yielding more specific results that (1) better inform clinical decision making and workplace preventive actions and (2) better delineate critical knowledge gaps that can drive improvements in future research. Data were extracted into SRDR+; thus, data will be made freely available upon publication of this systematic review to encourage future updates as more relevant studies are published. Other notable strengths of this review include the application of rigorous standards in the search and identification of evidence without language restrictions, restricting evidence to only employed pregnant individuals due to known biases that may otherwise be introduced,[12] and the rigorous risk of bias evaluation performed for each study. In addition, our synthesis of the evidence considered the gestational timing and duration of exposure and dose-response relationships. Synthesis additionally addressed the quality of the analytic handling of the study variables, including adjustment for covarying coexposures and exposure proxies and the consideration of probable effect modifiers (Appendix D). This systematic review also has some limitations. Because we searched for evidence from 1990 onward, it is possible that relevant evidence was published prior to our date restriction. However, the findings of older studies may not apply as well to work conditions or work patterns of pregnant workers today. In addition, it is unlikely that inclusion of older studies would have changed our conclusions because the rigor of nonrandomized studies has generally improved with advances in epidemiologic methods and reporting standards. Due to the large number of exposure-outcome relationships considered in our review, some associations may have been statistically significant by chance. We restricted our search to full research articles published in the peer-reviewed literature; therefore, we risked not identifying relevant unpublished studies. Finally, all employment studies reviewed were conducted in countries (or jurisdictions) with statutory benefits that grant pregnant workers access to paid antenatal leave; thus, there may be limitations in the applicability of our findings from those studies to the experience of pregnant workers without such access.

Although half the studies identified in our review addressed employment outcomes, no studies were found examining other sequelae, namely analgesic use and fatigue. The absence of evidence on the use of analgesics to manage LBP and/or PGP during pregnancy has been reported previously.[63] Our findings, coupled with evidence linking prenatal analgesic use to birth defects,[64,65] suggests the need for future research examining the potential chain of associations linking physical job demands to musculoskeletal outcomes in pregnancy and corresponding analgesic use and adverse birth outcomes. In addition, further research is warranted to elucidate the potential mediating role of local and whole-body fatigue on employment outcomes to inform whether energy expenditure criteria used in existing workplace guidelines need revision for application to pregnant workers.[66]

Conclusions and implications

Limited but consistent evidence demonstrated that pregnant workers occupationally exposed to heavy lifting may be at increased risk of functionally limiting PGP. Clinicians can aid in the early identification of at-risk patients, prompting protections from modifiable workplace exposures and the timely initiation of treatments to prevent chronic disabling pain and attendant adverse impacts on daily living and quality of life.[1,41−43] Our findings are part of a larger pattern of evidence linking high physical job demands during pregnancy to other adverse health outcomes; therefore, public health interventions that reduce these exposures during pregnancy may provide additional health protection against adverse pregnancy outcomes.[7−9,67] Moreover, because racialized populations are disproportionately represented in physically demanding jobs, such interventions may improve racial or ethnic inequities in maternal and infant morbidity.[31,68]

Our review findings additionally suggest that heavy lifting and postural load may increase the risk of employment cessation during pregnancy. In recognition that reduced or suspended employment during pregnancy can cause economic hardship, recently enacted federal legislation in the United States (the Pregnant Workers Fairness Act) now requires that employers grant reasonable accommodations to pregnant workers, enabling them to keep working safely.[69] Clinician support can be critical in facilitating pregnant workers' access to needed work accommodations, which could be aided by an occupational medicine referral or a written order for work accomodations.[44] The American College of Obstetricians and Gynecologists Committee Opinion "Employment Considerations during Pregnancy and the Postpartum Period" addresses practical aspects of writing work accommodations and understanding the variable employment laws and leave programs relevant to pregnant workers, which now includes the federal Pregnant Workers Fairness Act in the United States.[69,70]

This systematic review finds limited but consistent evidence that pregnant workers occupationally exposed to lifting and postural load may be at increased risk of functionally-limiting PGP and employment cessation. Antenatal providers play an important role in early diagnosis and management, as well as patient education about work activity restrictions[44–46] and knowledge of safe and effective pain relief[47–49] that may be preventative. More prospective research is needed to inform: (1) whether the origins of musculoskeletal conditions identified in pregnancy predate gestation among female workers exposed to high physical job demands and (2) if the onset and resolution of gestation-induced joint laxity, which has been shown to occur between about 6 weeks gestation and at least 6 weeks postpartum,[13] coincide with periods of reduced load-bearing capacity that increase susceptibility to adverse musculoskeletal outcomes among exposed workers during pregnancy. Although 1 high-utility study reported that persistent exposure to heavy lifting and prolonged standing was associated with increased risk of employment cessation among those exposed through 27 weeks gestation, but not among those whose exposure was reduced after 12 weeks gestation,[23] insufficient data exist to inform the optimal timing of work activity restrictions to reduce risks. The emergence of guidelines addressing provisional recommendations for occupational lifting and other physical job demands during pregnancy[44–46] and guidelines for prescribing job accommodation requests[70] may be important tools to promote safe and sustainable employment in pregnancy. ■

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Appendix A Search strategy

TABLE A.1
Medline search strategy

#1	Population (pregnant or postpartum): Pregnancy/ OR exp Pregnancy Trimesters/ OR Pregnant Women/ OR Peripartum Period/ OR Postpartum Period/ OR Gravidity/ OR Parity/ OR pregnan$.ti,ab,kf. OR matern$.ti,ab,kf. OR gestation$.ti,ab,kf. OR antenat$.ti,ab,kf. OR ante-nat$.ti,ab,kf. OR prenat$.ti,ab,kf. OR pre-nat$.ti,ab,kf. OR perinat$.ti,ab,kf. OR peri-nat$.ti,ab,kf. OR postnat$.ti,ab,kf. OR post-nat$.ti,ab,kf. OR puerper$.ti,ab,kf. OR antepart$.ti,ab,kf. OR ante-part$.ti,ab,kf. OR prepart$.ti,ab,kf. OR pre-part$.ti,ab,kf. OR peripart$.ti,ab,kf. OR peri-part$.ti,ab,kf. OR postpart$.ti,ab,kf. OR post-part$.ti,ab,kf. OR trimester$.ti,ab,kf.
#2	Exposure to occupational lifting: exp Lifting/ OR exp "Moving and Lifting Patients"/ OR exp Weight Lifting/ OR exp Weight-Bearing/ OR lift$.ti,ab,kf. OR (carry$ adj3 heavy$).ti,ab,kf. OR (carry$ adj5 weight$).ti,ab,kf. OR (carry$ adj5 load$).ti,ab,kf. OR (carry$ adj5 object).ti,ab,kf. OR (carry$ adj5 objects).ti,ab,kf. OR Ergonomics/ OR ergonom$.ti,ab,kf. OR (biomechanic$ adj5 stressor$).ti,ab,kf. OR (biomechanic$ adj5 exposure$).ti,ab,kf. OR (mechanic$ adj stress$).ti,ab,kf. OR (manual$ adj3 handl$).ti,ab,kf. OR (material$ adj3 handl$).ti,ab,kf. OR (load$ adj3 handl$).ti,ab,kf. OR blue collar.ti,ab,kf. OR pink collar.ti,ab,kf. OR manual labor.ti,ab,kf. OR manual labour.ti,ab,kf. OR laborer$.ti,ab,kf. OR labourer$.ti,ab,kf. OR warehous$.ti,ab,kf. OR (order adj picker$).ti,ab,kf. OR (stock adj picker$).ti,ab,kf. OR (service adj work$).ti,ab,kf. OR exp Physical Exertion/ OR (occupational adj3 exertion).ti,ab,kf. OR (physical adj3 factor$).ti,ab,kf. OR (physical$ adj3 demand$).ti,ab,kf. OR (physical$ adj3 work$).ti,ab,kf. OR (physical$ adj5 load$).ti,ab,kf. OR (physical adj exertion).ti,ab,kf. OR physical job.ti,ab,kf. OR (physical adj stress$).ti,ab,kf. OR (occupation$ adj3 fatigu$).ti,ab,kf. OR (work$ adj3 fatigu$).ti,ab,kf. OR (job$ adj3 fatigu$).ti,ab,kf.
#3	Exposure to occupational postural load: Postural Balance/ OR (postur$ adj load$).ti,ab,kf. OR (postur$ adj angle$).ti,ab,kf. OR (awkward adj postur$).ti,ab,kf. OR (poor adj postur$).ti,ab,kf. OR (neutral adj postur$).ti,ab,kf. OR (non-neutral adj postur$).ti,ab,kf. OR (nonneutral adj postur$).ti,ab,kf. OR (non-standard adj postur$).ti,ab,kf. OR (nonstandard adj postur$).ti,ab,kf. OR (strenuous adj position$).ti,ab,kf. OR (strenuous adj postur$).ti,ab,kf. OR (demanding adj postur$).ti,ab,kf. OR (postural adj stress$).ti,ab,kf. OR (postural adj balance).ti,ab,kf. OR (postural adj stability).ti,ab,kf. OR (postural adj nstability).ti,ab,kf. OR (postural adj control).ti,ab,kf. OR (postural adj sway).ti,ab,kf. OR (postural adj perturbation$).ti,ab,kf. OR (postural adj equilibri$).ti,ab,kf. OR (postural adj adapt$).ti,ab,kf. OR (postural adj effect$).ti,ab,kf. OR (work$ adj3 postur$).ti,ab,kf. OR (work-related adj postur$).ti,ab,kf. OR (lift$ adj3 postur$).ti,ab,kf. OR (body adj3 postur$).ti,ab,kf. OR (dynamic adj postur$).ti,ab,kf. OR (spin$ adj3 postur$).ti,ab,kf. OR (trunk adj3 postur$).ti,ab,kf. OR (upright adj postur$).ti,ab,kf. OR (erect adj postur$).ti,ab,kf. OR (asymmetr$ adj postur$).ti,ab,kf. OR (shoulder$ adj3 postur$).ti,ab,kf. OR (limb$ adj3 postur$).ti,ab,kf. OR (upper-body adj3 postur$).ti,ab,kf. OR (arm$ adj3 postur$).ti,ab,kf. OR (lumbo-pelvic adj postur$).ti,ab,kf. OR (lumbopelvic adj postur$).ti,ab,kf. OR (hip$ adj3 postur$).ti,ab,kf. OR (extremit$ adj3 postur$).ti,ab,kf. OR (standing adj3 postur$).ti,ab,kf. OR (standing adj3 position$).ti,ab,kf. OR (static adj standing).ti,ab,kf. OR (prolonged adj standing).ti,ab,kf. OR (standing adj still).ti,ab,kf. OR (dynamic adj standing).ti,ab,kf. OR bending.ti,ab,kf. OR twisting.ti,ab,kf. OR stooping.ti,ab,kf. OR stooped.ti,ab,kf. OR squat$.ti,ab,kf. OR crouch$.ti,ab,kf. OR kneeling.ti,ab,kf. OR (trunk adj3 flexion).ti,ab,kf. OR (trunk adj3 twist$).ti,ab,kf. OR (trunk adj3 rotat$).ti,ab,kf. OR (back adj3 flexion).ti,ab,kf. OR (back adj bent).ti,ab,kf. OR (back adj3 angle$).ti,ab,kf. OR torsoflexion.ti,ab,kf. OR (spinal adj rotat$).ti,ab,kf. OR (shoulder adj3 flexion).ti,ab,kf. OR (shoulder adj3 extension$).ti,ab,kf. OR (hip adj3 flexion).ti,ab,kf. OR hands above shoulder.ti,ab,kf. OR hands above shoulders.ti,ab,kf. OR arms above shoulder.ti,ab,kf. OR arms above shoulders.ti,ab,kf. OR overhead.ti,ab,kf. OR elevated arms.ti,ab,kf. OR (bent adj knee$).ti,ab,kf.
#4	Exposure to occupational physical demands *(broader exposure search)*: [exp Work/ OR exp Workplace/ OR exp Employment/ OR exp Occupations/ OR exp Occupational Diseases/ OR exp Occupational Exposures/ OR exp Occupational Medicine/ OR work$.ti,ab,kf. OR employ$.ti,ab,kf. OR occupation$.ti,ab,kf. OR job$.ti,ab,kf.] AND [(physical$ adj ctive$).ti,ab,kf. OR (work$ adj activ$).ti,ab,kf. OR (occupation$ adj activ$).ti,ab,kf. OR (job$ adj activ$).ti,ab,kf.]
#5	Physical job demands: #2 OR #3 OR #4
#6	Outcome — musculoskeletal disorders: Sacroiliac Joint/ OR Pubic Symphysis/ OR Occupational Injuries/ OR Orthopedics/ OR exp Sprains/ and Strains/ OR exp Tendon Injuries/ OR Sciatica/ OR Carpal Tunnel Syndrome/ OR Relaxin/ OR exp Joint Dislocations/ OR Joint Instability/ OR Microtrauma, Physical/ OR musculoskelet$.ti,ab,kf. OR overexertion$.ti,ab,kf. OR kinesiophobi$.ti,ab,kf. OR sacroiliac.ti,ab,kf. OR (pubic adj symphys$).ti,ab,kf. OR pelvic girdle.ti,ab,kf. OR low back pain.ti,ab,kf. OR low back pain.ti,ab,kf. OR backache$.ti,ab,kf. OR (overuse adj injur$).ti,ab,kf. OR (overuse adj syndrome$).ti,ab,kf. OR (repetit$ adj strain$).ti,ab,kf. OR (repetit$ adj stress$).ti,ab,kf. OR (repetit$ adj motion$).ti,ab,kf. OR sciatica.ti,ab,kf. OR subluxation$.ti,ab,kf. OR sprain$.ti,ab,kf. OR tendinitis.ti,ab,kf. OR carpal tunnel.ti,ab,kf. OR relaxin.ti,ab,kf. OR laxity.ti,ab,kf. OR (spine adj instabilit$).ti,ab,kf. OR (spinal adj instabilit$).ti,ab,kf. OR (hernia$ and lumbar and disc).ti,ab,kf. OR (spinal$ adj5 hernia$).ti,ab,kf. OR intervertebral disc displacement.ti,ab,kf. OR (sacral adj insufficienc$).ti,ab,kf. OR (pelvic adj insufficienc$).ti,ab,kf. OR (symphyseal adj separat$).ti,ab,kf. OR (symphyseal adj dysfunct$).ti,ab,kf. OR (lumbopelvic adj instabilit$).ti,ab,kf. OR insufficient lumbopelvic stability.ti,ab,kf. OR (joint$ adj5 instabilit$).ti,ab,kf. OR (joint$ adj5 hypermobilit$).ti,ab,kf. OR (joint$ adj5 dislocation$).ti,ab,kf. OR (inferior adj dislocation$).ti,ab,kf. OR locomotor system.ti,ab,kf. OR hyperalgesi$.ti,ab,kf. OR (somatosensory adj system$).ti,ab,kf. OR cumulative trauma disorder.ti,ab,kf. OR cumulative trauma disorders.ti,ab,kf. OR (physical adj microtrauma$).ti,ab,kf. OR (musc$ adj strain$).ti,ab,kf. OR (tendon$ adj strain$).ti,ab,kf. OR (ligament$ adj strain$).ti,ab,kf. OR (musc$ adj spasm$).ti,ab,kf.

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TABLE A.1
Medline search strategy *(continued)*

#7	Outcome - sequelae (fatigue): exp Fatigue/ OR Muscle Fatigue/ OR Muscle Weakness/ OR Physical Endurance/ OR fatigu$.ti,ab,kf. OR exhaustion.ti,ab,kf. OR tiredness.ti,ab,kf. OR psychophysical.ti,ab,kf. OR (musc$ adj weak$).ti,ab,kf. OR (musc$ adj endurance).ti,ab,kf. OR (musc$ adj wear).ti,ab,kf.
#8	Outcome - sequelae (analgesic use): exp Analgesics/ OR Pain Management/ OR Cannabis/ OR diflunisal.ti,ab,kf. OR salsalate.ti,ab,kf. OR dexibuprofen.ti,ab,kf. OR fenoprofen.ti,ab,kf. OR ketoprofen.ti,ab,kf. OR dexketoprofen.ti,ab,kf. OR flurbiprofen.ti,ab,kf. OR oxaprozin.ti,ab,kf. OR loxoprofen.ti,ab,kf. OR indomethacin.ti,ab,kf. OR tolmetin.ti,ab,kf. OR sulindac.ti,ab,kf. OR etodolac.ti,ab,kf. OR ketorolac.ti,ab,kf. OR diclofenac.ti,ab,kf. OR aceclofenac.ti,ab,kf. OR nabumetone.ti,ab,kf. OR bromfenac.ti,ab,kf. OR piroxicam.ti,ab,kf. OR meloxicam.ti,ab,kf. OR tenoxicam.ti,ab,kf. OR droxicam.ti,ab,kf. OR lornoxicam.ti,ab,kf. OR phenylbutazone.ti,ab,kf. OR mefenamic acid.ti,ab,kf. OR meclofenamic acid.ti,ab,kf. OR flufenamic acid.ti,ab,kf. OR tolfenamic acid.ti,ab,kf. OR celecoxib.ti,ab,kf. OR rofecoxib.ti,ab,kf. OR valdecoxib.ti,ab,kf. OR arecoxib.ti,ab,kf. OR etoricoxib.ti,ab,kf. OR nimesulide.ti,ab,kf. OR clonixin.ti,ab,kf. OR licofelone.ti,ab,kf. OR hydrocodone.ti,ab,kf. OR oxymorphone.ti,ab,kf. OR morphine.ti,ab,kf. OR fentanyl.ti,ab,kf. OR fentanil.ti,ab,kf. OR thebaine.ti,ab,kf. OR heroin.ti,ab,kf. OR nicomorphine.ti,ab,kf. OR dihydrocodeine.ti,ab,kf. OR ethylmorphine.ti,ab,kf. OR eterocodeine.ti,ab,kf. OR buprenorphine.ti,ab,kf. OR hydromorphone.ti,ab,kf. OR pethidine.ti,ab,kf. OR meperidine.ti,ab,kf. OR ketobemidone.ti,ab,kf. OR prodine.ti,ab,kf. OR trimeperidine.ti,ab,kf. OR dextropropoxyphene.ti,ab,kf. OR bezitramide.ti,ab,kf. OR piritramide.ti,ab,kf. OR methadone.ti,ab,kf. OR dipipanone.ti,ab,kf. OR difenoxin.ti,ab,kf. OR diphenoxylate.ti,ab,kf. OR dezocine.ti,ab,kf. OR pentazocine.ti,ab,kf. OR phenazocine.ti,ab,kf. OR dihydroetorphine.ti,ab,kf. OR butorphanol.ti,ab,kf. OR nalbuphine.ti,ab,kf. OR levorphanol.ti,ab,kf. OR levomethorphan.ti,ab,kf. OR lefetamine.ti,ab,kf. OR meprazinol.ti,ab,kf. OR tilidine.ti,ab,kf. OR tramadol.ti,ab,kf. OR tapentadol.ti,ab,kf. OR (medic$ adj cannabis).ti,ab,kf. OR (medic$ adj mari?uana).ti,ab,kf. OR analgesic$.ti,ab,kf. OR painkiller$.ti,ab,kf. OR pain-killer$.ti,ab,kf. OR (pain adj medication$).ti,ab,kf. OR (pain$ adj3 pharmacotherap$).ti,ab,kf. OR acetaminophen.ti,ab,kf. OR paracetamol.ti,ab,kf. OR nsaid$.ti,ab,kf. OR (nonsteroidal adj anti-inflammatory).ti,ab,kf. OR (nonsteroidal adj antiinflammatory).ti,ab,kf. OR aspirin.ti,ab,kf. OR ibuprofen.ti,ab,kf. OR naproxen.ti,ab,kf. OR (cox-2 adj inhibitor$).ti,ab,kf. OR opioid$.ti,ab,kf. OR codeine.ti,ab,kf. OR oxycodone.ti,ab,kf.
#9	Outcome - sequelae, employment (work disability): Workers' Compensation/ OR exp "Activities of Daily Living"/ OR Mobility Limitation/ OR Work Performance/ OR exp Psychology, Industrial/ OR Quality of Life/ OR (worker$ adj compensation).ti,ab,kf. OR (workman$ adj compensation).ti,ab,kf. OR (functional adj disabilit$).ti,ab,kf. OR (work adj disabilit$).ti,ab,kf. OR (work adj abilit$).ti,ab,kf. OR workabilit$.ti,ab,kf. OR activities of daily living.ti,ab,kf. OR (activity adj level$).ti,ab,kf. OR (mobility adj impairment$).ti,ab,kf. OR (mobility adj limitation$).ti,ab,kf. OR (performance adj decrement$).ti,ab,kf. OR (pain adj interference$).ti,ab,kf. OR work performance.ti,ab,kf. OR productivity.ti,ab,kf. OR work capacity.ti,ab,kf. OR quality of life.ti,ab,kf.
#10	Outcome - sequelae, employment (sickness absence): Sick Leave/ OR Absenteeism/ OR exp Family Leave/ OR Bed Rest/ OR absenteeism.ti,ab,kf. OR (sick$ adj absence$).ti,ab,kf. OR (sick$ adj leave$).ti,ab,kf. OR (sick$ adj day$).ti,ab,kf. OR (antenatal adj leave).ti,ab,kf. OR (prenatal adj leave).ti,ab,kf. OR (postnatal adj leave).ti,ab,kf. OR (medical adj leave).ti,ab,kf. OR (pregnan* adj leave).ti,ab,kf. OR (bed adj rest).ti,ab,kf. OR bedrest.ti,ab,kf. OR (maternity adj leave).ti,ab,kf. OR (maternal adj leave).ti,ab,kf. OR (parental adj leave).ti,ab,kf. OR leave of absence.ti,ab,kf.
#11	Outcome - sequelae, employment (employment withdrawal): (work$ adj5 dismiss$).ti,ab,kf. OR (job adj5 dismiss$).ti,ab,kf. OR (employ$ adj5 dismiss$).ti,ab,kf. OR (work$ adj cessation).ti,ab,kf. OR (job adj cessation).ti,ab,kf. OR (employ$ adj cessation).ti,ab,kf. OR (work$ adj cease).ti,ab,kf. OR (employ$ adj cease).ti,ab,kf. OR (job adj cease).ti,ab,kf. OR (job adj loss$).ti,ab,kf. OR (work$ adj5 quit$).ti,ab,kf. OR (job adj5 quit$).ti,ab,kf. OR (employ$ adj5 quit$).ti,ab,kf. OR (work$ adj5 terminat$).ti,ab,kf. OR (job adj5 terminat$).ti,ab,kf. OR (employ$ adj5 terminat$).ti,ab,kf. OR (job adj5 fired).ti,ab,kf. OR (work$ adj5 fired).ti,ab,kf. OR (employ$ adj5 fired).ti,ab,kf. OR employment retention.ti,ab,kf. OR job retention.ti,ab,kf. OR Unemployment/ OR unemploy$.ti,ab,kf. OR employment.ti,ab,kf. OR workforce.ti,ab,kf. OR labor force.ti,ab,kf. OR labour force.ti,ab,kf. OR labor market.ti,ab,kf. OR labour market.ti,ab,kf. OR job market.ti,ab,kf. OR resignation.ti,ab,kf.
#12	Outcome - sequelae, employment (return to work): Return to Work/ OR (return$ adj3 work$).ti,ab,kf. OR (return$ adj3 employ$).ti,ab,kf. OR (return$ adj3 job).ti,ab,kf. OR return-to-work.ti,ab,kf. OR (back adj3 work$).ti,ab,kf. OR (back adj3 employ$).ti,ab,kf. OR (back adj3 job).ti,ab,kf. OR (work$ adj3 reentry).ti,ab,kf. OR (employ$ adj3 reentry).ti,ab,kf. OR (job adj3 reentry).ti,ab,kf. OR (work$ adj3 re-entry).ti,ab,kf. OR (employ$ adj3 re-entry).ti,ab,kf. OR (job adj3 re-entry).ti,ab,kf. OR (work$ adj3 reintegrat$).ti,ab,kf. OR (job adj3 reintegrat$).ti,ab,kf. OR (employ$ adj3 reintegrat$).ti,ab,kf. OR (work$ adj3 re-integrat$).ti,ab,kf. OR (job adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 retention).ti,ab,kf. OR (employ$ adj3 retention).ti,ab,kf. OR (job adj3 retention).ti,ab,kf. OR (work$ adj3 retain$).ti,ab,kf. OR (employ$ adj3 retain$).ti,ab,kf. OR (job adj3 retain$).ti,ab,kf. OR (work$ adj3 reacqui$).ti,ab,kf. OR (employ$ adj3 re-acqui$).ti,ab,kf. OR (job adj3 re-acqui$).ti,ab,kf. OR (work$ adj3 maint$).ti,ab,kf. OR (employ$ adj3 maint$).ti,ab,kf. OR (job adj3 maint$).ti,ab,kf. OR (work$ adj3 transition$).ti,ab,kf. OR (employ$ adj3 transition$).ti,ab,kf. OR (job adj3 transition$).ti,ab,kf. OR (work$ adj3 reengag$).ti,ab,kf. OR (employ$ adj3 reengag$).ti,ab,kf. OR (job adj3 reengag$).ti,ab,kf. OR (work$ adj3 re-engag$).ti,ab,kf. OR (employ$ adj3 re-ngag$).ti,ab,kf. OR (job adj3 re-engag$).ti,ab,kf. OR re-employ$.ti,ab,kf. OR reemploy$.ti,ab,kf. OR (employ$ adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 resum$).ti,ab,kf. OR (employ$ adj3 resum$).ti,ab,kf. OR (job adj3 resum$).ti,ab,kf.
#13	Outcomes — sequelae: #7 OR #8 OR #9 OR #10 OR #11 OR #12
#14	#1 (population) AND #5 (physical job demands) AND #6 (MSDs) AND #13 (sequelae)
#15	limit #14 to yr="1990 -Current"

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TABLE A.2
Embase search strategy

#1	Population (pregnant or postpartum): exp pregnancy/ OR pregnant Woman/ OR perinatal period/ OR parity/ OR pregnan$.ti,ab,kf. OR matern$.ti,ab,kf. OR gestation$.ti,ab,kf. OR antenat$.ti,ab,kf. OR ante-nat$.ti,ab,kf. OR prenat$.ti,ab,kf. OR pre-nat$.ti,ab,kf. OR perinat$.ti,ab,kf. OR peri-nat$.ti,ab,kf. OR postnat$.ti,ab,kf. OR post-nat$.ti,ab,kf. OR puerper$.ti,ab,kf. OR antepart$.ti,ab,kf. OR ante-part$.ti,ab,kf. OR prepart$.ti,ab,kf. OR pre-part$.ti,ab,kf. OR peripart$.ti,ab,kf. OR peri-part$.ti,ab,kf. OR postpart$.ti,ab,kf. OR post-part$.ti,ab,kf. OR trimester$.ti,ab,kf.
#2	Exposure to occupational lifting: biomechanics/ OR lifting effort/ OR weight lifting/ OR weight bearing/ OR ergonomics/ OR blue collar worker/ OR manual labor/ OR lift$.ti,ab,kf. OR (carry$ adj3 heavy).ti,ab,kf. OR (carry$ adj5 weight$).ti,ab,kf. OR (carry$ adj5 load$).ti,ab,kf. OR (carry$ adj5 object).ti,ab,kf. OR (carry$ adj5 objects).ti,ab,kf. OR ergonom$.ti,ab,kf. OR (biomechanic$ adj5 stressor$).ti,ab,kf. OR pink collar.ti,ab,kf. OR manual labor.ti,ab,kf. OR manual labour.ti,ab,kf. OR laborer$.ti,ab,kf. OR labourer$.ti,ab,kf. OR warehous$.ti,ab,kf. OR (order adj picker$).ti,ab,kf. OR (stock adj picker$).ti,ab,kf. OR (service adj work$).ti,ab,kf. OR exp Physical Exertion/ OR (occupational adj3 exertion).ti,ab,kf. OR (physical adj3 factor$).ti,ab,kf. OR (physical$ adj3 demand$).ti,ab,kf. OR (physical$ adj3 work$).ti,ab,kf. OR (physical$ adj5 load$).ti,ab,kf. OR (physical adj exertion).ti,ab,kf. OR physical job.ti,ab,kf. OR (physical adj stress$).ti,ab,kf. OR (occupation$ adj3 fatigu$).ti,ab,kf. OR (work$ adj3 fatigu$).ti,ab,kf. OR (job$ adj3 fatigu$).ti,ab,kf.
#3	Exposure to occupational postural load: Postural Balance/ OR (postur$ adj load$).ti,ab,kf. OR (postur$ adj angle$).ti,ab,kf. OR (awkward adj postur$).ti,ab,kf. OR (poor adj postur$).ti,ab,kf. OR (neutral adj postur$).ti,ab,kf. OR (non-neutral adj postur$).ti,ab,kf. OR (nonneutral adj postur$).ti,ab,kf. OR (non-standard adj postur$).ti,ab,kf. OR (nonstandard adj postur$).ti,ab,kf. OR (strenuous adj position$).ti,ab,kf. OR (strenuous adj postur$).ti,ab,kf. OR (demanding adj postur$).ti,ab,kf. OR (postural adj stress$).ti,ab,kf. OR (postural adj balance).ti,ab,kf. OR (postural adj stability).ti,ab,kf. OR (postural adj nstability).ti,ab,kf. OR (postural adj control).ti,ab,kf. OR (postural adj sway).ti,ab,kf. OR (postural adj perturbation$).ti,ab,kf. OR (postural adj equilibri$).ti,ab,kf. OR (postural adj adapt$).ti,ab,kf. OR (postural adj effect$).ti,ab,kf. OR (work$ adj3 postur$).ti,ab,kf. OR (work-related adj postur$).ti,ab,kf. OR (lift$ adj3 postur$).ti,ab,kf. OR (body adj3 postur$).ti,ab,kf. OR (dynamic adj postur$).ti,ab,kf. OR (spin$ adj3 postur$).ti,ab,kf. OR (trunk adj3 postur$).ti,ab,kf. OR (upright adj postur$).ti,ab,kf. OR (erect adj postur$).ti,ab,kf. OR (asymmetr$ adj postur$).ti,ab,kf. OR (shoulder$ adj3 postur$).ti,ab,kf. OR (limb$ adj3 postur$).ti,ab,kf. OR (upper-body adj3 postur$).ti,ab,kf. OR (arm$ adj3 postur$).ti,ab,kf. OR (lumbo-pelvic adj postur$).ti,ab,kf. OR (lumbopelvic adj postur$).ti,ab,kf. OR (hip$ adj3 postur$).ti,ab,kf. OR (extremit$ adj3 postur$).ti,ab,kf. OR (standing adj3 postur$).ti,ab,kf. OR (standing adj3 position$).ti,ab,kf. OR (static adj standing).ti,ab,kf. OR (prolonged adj standing).ti,ab,kf. OR (standing adj still).ti,ab,kf. OR (dynamic adj standing).ti,ab,kf. OR bending.ti,ab,kf. OR twisting.ti,ab,kf. OR stooping.ti,ab,kf. OR stooped.ti,ab,kf. OR squat$.ti,ab,kf. OR crouch$.ti,ab,kf. OR kneeling.ti,ab,kf. OR (trunk adj3 flexion).ti,ab,kf. OR (trunk adj3 twist$).ti,ab,kf. OR (trunk adj3 rotat$).ti,ab,kf. OR (back adj3 flexion).ti,ab,kf. OR (back adj bent).ti,ab,kf. OR (back adj3 angle$).ti,ab,kf. OR torsoflexion.ti,ab,kf. OR (spinal adj rotat$).ti,ab,kf. OR (shoulder adj3 flexion).ti,ab,kf. OR (shoulder adj3 extension$).ti,ab,kf. OR (hip adj3 flexion).ti,ab,kf. OR hands above shoulder.ti,ab,kf. OR hands above shoulders.ti,ab,kf. OR arms above shoulder.ti,ab,kf. OR arms above shoulders.ti,ab,kf. OR overhead.ti,ab,kf. OR elevated arms.ti,ab,kf. OR (bent adj knee$).ti,ab,kf.
#4	Exposure to occupational physical demands *(broader exposure search)*: [exp Work/ OR exp Workplace/ OR exp Employment/ OR exp Occupations/ OR exp Occupational Diseases/ OR exp Occupational Exposures/ OR exp Occupational Medicine/ OR work$.ti,ab,kf. OR employ$.ti,ab,kf. OR occupation$.ti,ab,kf. OR job$.ti,ab,kf.] AND [(physical$ adj ctive$).ti,ab,kf. OR (work$ adj activ$).ti,ab,kf. OR (occupation$ adj activ$).ti,ab,kf. OR (job$ adj activ$).ti,ab,kf.]
#5	Physical job demands: #2 OR #3 OR #4
#6	Outcome — musculoskeletal disorders: Sacroiliac Joint/ OR Pubic Symphysis/ OR Occupational Injuries/ OR Orthopedics/ OR exp Sprains/ and Strains/ OR exp Tendon Injuries/ OR Sciatica/ OR Carpal Tunnel Syndrome/ OR Relaxin/ OR exp Joint Dislocations/ OR Joint Instability/ OR Microtrauma, Physical/ OR musculoskelet$.ti,ab,kf. OR overexertion$.ti,ab,kf. OR kinesiophobi$.ti,ab,kf. OR sacroiliac.ti,ab,kf. OR (pubic adj symphys$).ti,ab,kf. OR pelvic girdle.ti,ab,kf. OR low back pain.ti,ab,kf. OR low back pain.ti,ab,kf. OR backache$.ti,ab,kf. OR (overuse adj injur$).ti,ab,kf. OR (overuse adj syndrome$).ti,ab,kf. OR (repetit$ adj strain$).ti,ab,kf. OR (repetit$ adj stress$).ti,ab,kf. OR (repetit$ adj motion$).ti,ab,kf. OR sciatica.ti,ab,kf. OR subluxation$.ti,ab,kf. OR sprain$.ti,ab,kf. OR tendinitis.ti,ab,kf. OR carpal tunnel.ti,ab,kf. OR relaxin.ti,ab,kf. OR laxity.ti,ab,kf. OR (spine adj instabilit$).ti,ab,kf. OR (spinal adj instabilit$).ti,ab,kf. OR (hernia$ and lumbar and disc).ti,ab,kf. OR (spinal$ adj5 hernia$).ti,ab,kf. OR intervertebral disc displacement.ti,ab,kf. OR (sacral adj insufficienc$).ti,ab,kf. OR (pelvic adj insufficienc$).ti,ab,kf. OR (symphyseal adj separat$).ti,ab,kf. OR (symphyseal adj dysfunct$).ti,ab,kf. OR (lumbopelvic adj instabilit$).ti,ab,kf. OR insufficient lumbopelvic stability.ti,ab,kf. OR (joint$ adj5 instabilit$).ti,ab,kf. OR (joint$ adj5 hypermobilit$).ti,ab,kf. OR (joint$ adj5 dislocation$).ti,ab,kf. OR (inferior adj dislocation$).ti,ab,kf. OR locomotor system.ti,ab,kf. OR hyperalgesi$.ti,ab,kf. OR (somatosensory adj system$).ti,ab,kf. OR cumulative trauma disorder.ti,ab,kf. OR cumulative trauma disorders.ti,ab,kf. OR (physical adj microtrauma$).ti,ab,kf. OR (musc$ adj strain$).ti,ab,kf. OR (tendon$ adj strain$).ti,ab,kf. OR (ligament$ adj strain$).ti,ab,kf. OR (musc$ adj spasm$).ti,ab,kf.
#7	Outcome - sequelae (fatigue): exp Fatigue/ OR Muscle Fatigue/ OR Muscle Weakness/ OR Physical Endurance/ OR fatigu$.ti,ab,kf. OR exhaustion.ti,ab,kf. OR tiredness.ti,ab,kf. OR psychophysical.ti,ab,kf. OR (musc$ adj weak$).ti,ab,kf. OR (musc$ adj endurance).ti,ab,kf. OR (musc$ adj wear).ti,ab,kf.

MacDonald. Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes. Am J Obstet Gynecol 2024. *(continued)*

TABLE A.2
Embase search strategy *(continued)*

#8	Outcome - sequelae (analgesic use): exp Analgesics/ OR Pain Management/ OR Cannabis/ OR diflunisal.ti,ab,kf. OR salsalate.ti,ab,kf. OR dexibuprofen.ti,ab,kf. OR fenoprofen.ti,ab,kf. OR ketoprofen.ti,ab,kf. OR dexketoprofen.ti,ab,kf. OR flurbiprofen.ti,ab,kf. OR oxaprozin.ti,ab,kf. OR loxoprofen.ti,ab,kf. OR indomethacin.ti,ab,kf. OR tolmetin.ti,ab,kf. OR sulindac.ti,ab,kf. OR etodolac.ti,ab,kf. OR ketorolac.ti,ab,kf. OR diclofenac.ti,ab,kf. OR aceclofenac.ti,ab,kf. OR nabumetone.ti,ab,kf. OR bromfenac.ti,ab,kf. OR piroxicam.ti,ab,kf. OR meloxicam.ti,ab,kf. OR tenoxicam.ti,ab,kf. OR droxicam.ti,ab,kf. OR lornoxicam.ti,ab,kf. OR phenylbutazone.ti,ab,kf. OR mefenamic acid.ti,ab,kf. OR meclofenamic acid.ti,ab,kf. OR flufenamic acid.ti,ab,kf. OR tolfenamic acid.ti,ab,kf. OR celecoxib.ti,ab,kf. OR rofecoxib.ti,ab,kf. OR valdecoxib.ti,ab,kf. OR arecoxib.ti,ab,kf. OR etoricoxib.ti,ab,kf. OR nimesulide.ti,ab,kf. OR clonixin.ti,ab,kf. OR licofelone.ti,ab,kf. OR hydrocodone.ti,ab,kf. OR oxymorphone.ti,ab,kf. OR morphine.ti,ab,kf. OR fentanyl.ti,ab,kf. OR fentanil.ti,ab,kf. OR thebaine.ti,ab,kf. OR heroin.ti,ab,kf. OR nicomorphine.ti,ab,kf. OR dihydrocodeine.ti,ab,kf. OR ethylmorphine.ti,ab,kf. OR eterocodeine.ti,ab,kf. OR buprenorphine.ti,ab,kf. OR hydromorphone.ti,ab,kf. OR pethidine.ti,ab,kf. OR meperidine.ti,ab,kf. OR ketobemidone.ti,ab,kf. OR prodine.ti,ab,kf. OR trimeperidine.ti,ab,kf. OR dextropropoxyphene.ti,ab,kf. OR bezitramide.ti,ab,kf. OR piritramide.ti,ab,kf. OR methadone.ti,ab,kf. OR dipipanone.ti,ab,kf. OR difenoxin.ti,ab,kf. OR diphenoxylate.ti,ab,kf. OR dezocine.ti,ab,kf. OR pentazocine.ti,ab,kf. OR phenazocine.ti,ab,kf. OR dihydroetorphine.ti,ab,kf. OR butorphanol.ti,ab,kf. OR nalbuphine.ti,ab,kf. OR levorphanol.ti,ab,kf. OR levomethorphan.ti,ab,kf. OR lefetamine.ti,ab,kf. OR meprazinol.ti,ab,kf. OR tilidine.ti,ab,kf. OR tramadol.ti,ab,kf. OR tapentadol.ti,ab,kf. OR (medic$ adj cannabis).ti,ab,kf. OR (medic$ adj mari?uana).ti,ab,kf. OR analgesic$.ti,ab,kf. OR painkiller$.ti,ab,kf. OR pain-killer$.ti,ab,kf. OR (pain adj medication$).ti,ab,kf. OR (pain$ adj3 pharmacotherap$).ti,ab,kf. OR acetaminophen.ti,ab,kf. OR paracetamol.ti,ab,kf. OR nsaid$.ti,ab,kf. OR (nonsteroidal adj anti-inflammatory).ti,ab,kf. OR (nonsteroidal adj antiinflammatory).ti,ab,kf. OR aspirin.ti,ab,kf. OR ibuprofen.ti,ab,kf. OR naproxen.ti,ab,kf. OR (cox-2 adj inhibitor$).ti,ab,kf. OR opioid$.ti,ab,kf. OR codeine.ti,ab,kf. OR oxycodone.ti,ab,kf.
#9	Outcome - sequelae, employment (work disability): Workers' Compensation/ OR exp "Activities of Daily Living"/ OR Mobility Limitation/ OR Work Performance/ OR exp Psychology, Industrial/ OR Quality of Life/ OR (worker$ adj compensation).ti,ab,kf. OR (workman$ adj compensation).ti,ab,kf. OR (functional adj disabilit$).ti,ab,kf. OR (work adj disabilit$).ti,ab,kf. OR (work adj abilit$).ti,ab,kf. OR workabilit$.ti,ab,kf. OR activities of daily living.ti,ab,kf. OR (activity adj level$).ti,ab,kf. OR (mobility adj impairment$).ti,ab,kf. OR (mobility adj limitation$).ti,ab,kf. OR (performance adj decrement$).ti,ab,kf. OR (pain adj interference$).ti,ab,kf. OR work performance.ti,ab,kf. OR productivity.ti,ab,kf. OR work capacity.ti,ab,kf. OR quality of life.ti,ab,kf.
#10	Outcome - sequelae, employment (sickness absence): Sick Leave/ OR Absenteeism/ OR exp Family Leave/ OR Bed Rest/ OR absenteeism.ti,ab,kf. OR (sick$ adj absence$).ti,ab,kf. OR (sick$ adj leave$).ti,ab,kf. OR (sick$ adj day$).ti,ab,kf. OR (antenatal adj leave).ti,ab,kf. OR (prenatal adj leave).ti,ab,kf. OR (postnatal adj leave).ti,ab,kf. OR (medical adj leave).ti,ab,kf. OR (pregnan* adj leave).ti,ab,kf. OR (bed adj rest).ti,ab,kf. OR bedrest.ti,ab,kf. OR (maternity adj leave).ti,ab,kf. OR (maternal adj leave).ti,ab,kf. OR (parental adj leave).ti,ab,kf. OR leave of absence.ti,ab,kf.
#11	Outcome - sequelae, employment (employment withdrawal): (work$ adj5 dismiss$).ti,ab,kf. OR (job adj5 dismiss$).ti,ab,kf. OR (employ$ adj5 dismiss$).ti,ab,kf. OR (work$ adj cessation).ti,ab,kf. OR (job adj cessation).ti,ab,kf. OR (employ$ adj cessation).ti,ab,kf. OR (work$ adj cease).ti,ab,kf. OR (employ$ adj cease).ti,ab,kf. OR (job adj cease).ti,ab,kf. OR (job adj loss$).ti,ab,kf. OR (work$ adj5 quit$).ti,ab,kf. OR (job adj5 quit$).ti,ab,kf. OR (employ$ adj5 quit$).ti,ab,kf. OR (work$ adj5 terminat$).ti,ab,kf. OR (job adj5 terminat$).ti,ab,kf. OR (employ$ adj5 terminat$).ti,ab,kf. OR (job adj5 fired).ti,ab,kf. OR (work$ adj5 fired).ti,ab,kf. OR (employ$ adj5 fired).ti,ab,kf. OR employment retention.ti,ab,kf. OR job retention.ti,ab,kf. OR unemployment/ OR unemploy$.ti,ab,kf. OR employment.ti,ab,kf. OR workforce.ti,ab,kf. OR labor force.ti,ab,kf. OR labour force.ti,ab,kf. OR labor market.ti,ab,kf. OR labour market.ti,ab,kf. OR job market.ti,ab,kf. OR resignation.ti,ab,kf.
#12	Outcome - sequelae, employment (return to work): Return to Work/ OR (return$ adj3 work$).ti,ab,kf. OR (return$ adj3 employ$).ti,ab,kf. OR (return$ adj3 job).ti,ab,kf. OR return-to-work.ti,ab,kf. OR (back adj3 work$).ti,ab,kf. OR (back adj3 employ$).ti,ab,kf. OR (back adj3 job).ti,ab,kf. OR (work$ adj3 reentry).ti,ab,kf. OR (employ$ adj3 reentry).ti,ab,kf. OR (job adj3 reentry).ti,ab,kf. OR (work$ adj3 re-entry).ti,ab,kf. OR (employ$ adj3 re-entry).ti,ab,kf. OR (job adj3 re-entry).ti,ab,kf. OR (work$ adj3 reintegrat$).ti,ab,kf. OR (job adj3 reintegrat$).ti,ab,kf. OR (employ$ adj3 reintegrat$).ti,ab,kf. OR (work$ adj3 re-integrat$).ti,ab,kf. OR (job adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 retention).ti,ab,kf. OR (employ$ adj3 retention).ti,ab,kf. OR (job adj3 retention).ti,ab,kf. OR (work$ adj3 retain$).ti,ab,kf. OR (employ$ adj3 retain$).ti,ab,kf. OR (job adj3 retain$).ti,ab,kf. OR (work$ adj3 reacqui$).ti,ab,kf. OR (employ$ adj3 re-acqui$).ti,ab,kf. OR (job adj3 re-acqui$).ti,ab,kf. OR (work$ adj3 maint$).ti,ab,kf. OR (employ$ adj3 maint$).ti,ab,kf. OR (job adj3 maint$).ti,ab,kf. OR (work$ adj3 transition$).ti,ab,kf. OR (employ$ adj3 transition$).ti,ab,kf. OR (job adj3 transition$).ti,ab,kf. OR (work$ adj3 reengag$).ti,ab,kf. OR (employ$ adj3 reengag$).ti,ab,kf. OR (job adj3 reengag$).ti,ab,kf. OR (work$ adj3 re-engag$).ti,ab,kf. OR (employ$ adj3 re-ngag$).ti,ab,kf. OR (job adj3 re-engag$).ti,ab,kf. OR re-employ$.ti,ab,kf. OR reemploy$.ti,ab,kf. OR (employ$ adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 resum$).ti,ab,kf. OR (employ$ adj3 resum$).ti,ab,kf. OR (job adj3 resum$).ti,ab,kf.
#13	Outcomes — sequelae: #7 OR #8 OR #9 OR #10 OR #11 OR #12
#14	#1 (population) AND #5 (physical job demands) AND #6 (MSDs) AND #13 (sequelae)
#15	limit #14 to yr="1990 -Current"

MacDonald. Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes. Am J Obstet Gynecol 2024.

TABLE A.3
The Cumulative Index to the Nursing and Allied Health Literature (CINAHL) search strategy

#1	Population (pregnant or postpartum): Pregnancy/ OR exp Pregnancy Trimesters/ OR Pregnant Women/ OR Peripartum Period/ OR Postpartum Period/ OR Gravidity/ OR Parity/ OR pregnan$.ti,ab,kf. OR matern$.ti,ab,kf. OR gestation$.ti,ab,kf. OR antenat$.ti,ab,kf. OR ante-nat$.ti,ab,kf. OR prenat$.ti,ab,kf. OR pre-nat$.ti,ab,kf. OR perinat$.ti,ab,kf. OR peri-nat$.ti,ab,kf. OR postnat$.ti,ab,kf. OR post-nat$.ti,ab,kf. OR puerper$.ti,ab,kf. OR antepart$.ti,ab,kf. OR ante-part$.ti,ab,kf. OR prepart$.ti,ab,kf. OR pre-part$.ti,ab,kf. OR peripart$.ti,ab,kf. OR peri-part$.ti,ab,kf. OR postpart$.ti,ab,kf. OR post-part$.ti,ab,kf. OR trimester$.ti,ab,kf.
#2	Exposure to occupational lifting: exp Lifting/ OR exp "Moving and Lifting Patients"/ OR exp Weight Lifting/ OR exp Weight-Bearing/ OR lift$.ti,ab,kf. OR (carry$ adj3 heavy$).ti,ab,kf. OR (carry$ adj5 weight$).ti,ab,kf. OR (carry$ adj5 load$).ti,ab,kf. OR (carry$ adj5 object).ti,ab,kf. OR (carry$ adj5 objects).ti,ab,kf. OR Ergonomics/ OR ergonom$.ti,ab,kf. OR (biomechanic$ adj5 stressor$).ti,ab,kf. OR (biomechanic$ adj5 exposure$).ti,ab,kf. OR (mechanic$ adj stress$).ti,ab,kf. OR (manual$ adj3 handl$).ti,ab,kf. OR (material$ adj3 handl$).ti,ab,kf. OR (load$ adj3 handl$).ti,ab,kf. OR blue collar.ti,ab,kf. OR pink collar.ti,ab,kf. OR manual labor.ti,ab,kf. OR manual labour.ti,ab,kf. OR laborer$.ti,ab,kf. OR labourer$.ti,ab,kf. OR warehous$.ti,ab,kf. OR (order adj picker$).ti,ab,kf. OR (stock adj picker$).ti,ab,kf. OR (service adj work$).ti,ab,kf. OR exp Physical Exertion/ OR (occupational adj3 exertion).ti,ab,kf. OR (physical adj3 factor$).ti,ab,kf. OR (physical$ adj3 demand$).ti,ab,kf. OR (physical$ adj3 work$).ti,ab,kf. OR (physical$ adj5 load$).ti,ab,kf. OR (physical adj exertion).ti,ab,kf. OR physical job.ti,ab,kf. OR (physical adj stress$).ti,ab,kf. OR (occupation$ adj3 fatigu$).ti,ab,kf. OR (work$ adj3 fatigu$).ti,ab,kf. OR (job$ adj3 fatigu$).ti,ab,kf.
#3	Exposure to occupational postural load: Postural Balance/ OR (postur$ adj load$).ti,ab,kf. OR (postur$ adj angle$).ti,ab,kf. OR (awkward adj postur$).ti,ab,kf. OR (poor adj postur$).ti,ab,kf. OR (neutral adj postur$).ti,ab,kf. OR (non-neutral adj postur$).ti,ab,kf. OR (nonneutral adj postur$).ti,ab,kf. OR (non-standard adj postur$).ti,ab,kf. OR (nonstandard adj postur$).ti,ab,kf. OR (strenuous adj position$).ti,ab,kf. OR (strenuous adj postur$).ti,ab,kf. OR (demanding adj postur$).ti,ab,kf. OR (postural adj stress$).ti,ab,kf. OR (postural adj balance).ti,ab,kf. OR (postural adj stability).ti,ab,kf. OR (postural adj nstability).ti,ab,kf. OR (postural adj control).ti,ab,kf. OR (postural adj sway).ti,ab,kf. OR (postural adj perturbation$).ti,ab,kf. OR (postural adj equilibri$).ti,ab,kf. OR (postural adj adapt$).ti,ab,kf. OR (postural adj effect$).ti,ab,kf. OR (work$ adj3 postur$).ti,ab,kf. OR (work-related adj postur$).ti,ab,kf. OR (lift$ adj3 postur$).ti,ab,kf. OR (body adj3 postur$).ti,ab,kf. OR (dynamic adj postur$).ti,ab,kf. OR (spin$ adj3 postur$).ti,ab,kf. OR (trunk adj3 postur$).ti,ab,kf. OR (upright adj postur$).ti,ab,kf. OR (erect adj postur$).ti,ab,kf. OR (asymmetr$ adj postur$).ti,ab,kf. OR (shoulder$ adj3 postur$).ti,ab,kf. OR (limb$ adj3 postur$).ti,ab,kf. OR (upper-body adj3 postur$).ti,ab,kf. OR (arm$ adj3 postur$).ti,ab,kf. OR (lumbo-pelvic adj postur$).ti,ab,kf. OR (lumbopelvic adj postur$).ti,ab,kf. OR (hip$ adj3 postur$).ti,ab,kf. OR (extremit$ adj3 postur$).ti,ab,kf. OR (standing adj3 postur$).ti,ab,kf. OR (standing adj3 position$).ti,ab,kf. OR (static adj standing).ti,ab,kf. OR (prolonged adj standing).ti,ab,kf. OR (standing adj still).ti,ab,kf. OR (dynamic adj standing).ti,ab,kf. OR bending.ti,ab,kf. OR twisting.ti,ab,kf. OR stooping.ti,ab,kf. OR stooped.ti,ab,kf. OR squat$.ti,ab,kf. OR crouch$.ti,ab,kf. OR kneeling.ti,ab,kf. OR (trunk adj3 flexion).ti,ab,kf. OR (trunk adj3 twist$).ti,ab,kf. OR (trunk adj3 rotat$).ti,ab,kf. OR (back adj3 flexion).ti,ab,kf. OR (back adj bent).ti,ab,kf. OR (back adj3 angle$).ti,ab,kf. OR torsoflexion.ti,ab,kf. OR (spinal adj rotat$).ti,ab,kf. OR (shoulder adj3 flexion).ti,ab,kf. OR (shoulder adj3 extension$).ti,ab,kf. OR (hip adj3 flexion).ti,ab,kf. OR hands above shoulder.ti,ab,kf. OR hands above shoulders.ti,ab,kf. OR arms above shoulder.ti,ab,kf. OR arms above shoulders.ti,ab,kf. OR overhead.ti,ab,kf. OR elevated arms.ti,ab,kf. OR (bent adj knee$).ti,ab,kf.
#4	Exposure to occupational physical demands *(broader exposure search)*: [exp Work/ OR exp Workplace/ OR exp Employment/ OR exp Occupations/ OR exp Occupational Diseases/ OR exp Occupational Exposures/ OR exp Occupational Medicine/ OR work$.ti,ab,kf. OR employ$.ti,ab,kf. OR occupation$.ti,ab,kf. OR job$.ti,ab,kf.] AND [(physical$ adj ctive$).ti,ab,kf. OR (work$ adj activ$).ti,ab,kf. OR (occupation$ adj activ$).ti,ab,kf. OR (job$ adj activ$).ti,ab,kf.]
#5	Physical job demands: #2 OR #3 OR #4
#6	Outcome — musculoskeletal disorders: Sacroiliac Joint/ OR Pubic Symphysis/ OR Occupational Injuries/ OR Orthopedics/ OR exp Sprains/ and Strains/ OR exp Tendon Injuries/ OR Sciatica/ OR Carpal Tunnel Syndrome/ OR Relaxin/ OR exp Joint Dislocations/ OR Joint Instability/ OR Microtrauma, Physical/ OR musculoskelet$.ti,ab,kf. OR overexertion$.ti,ab,kf. OR kinesiophobi$.ti,ab,kf. OR sacroiliac.ti,ab,kf. OR (pubic adj symphys$).ti,ab,kf. OR pelvic girdle.ti,ab,kf. OR low back pain.ti,ab,kf. OR low back pain.ti,ab,kf. OR backache$.ti,ab,kf. OR (overuse adj injur$).ti,ab,kf. OR (overuse adj syndrome$).ti,ab,kf. OR (repetit$ adj strain$).ti,ab,kf. OR (repetit$ adj stress$).ti,ab,kf. OR (repetit$ adj motion$).ti,ab,kf. OR sciatica.ti,ab,kf. OR subluxation$.ti,ab,kf. OR sprain$.ti,ab,kf. OR tendinitis.ti,ab,kf. OR carpal tunnel.ti,ab,kf. OR relaxin.ti,ab,kf. OR laxity.ti,ab,kf. OR (spine adj instabilit$).ti,ab,kf. OR (spinal adj instabilit$).ti,ab,kf. OR (hernia$ and lumbar and disc).ti,ab,kf. OR (spinal$ adj5 hernia$).ti,ab,kf. OR intervertebral disc displacement.ti,ab,kf. OR (sacral adj insufficienc$).ti,ab,kf. OR (pelvic adj insufficienc$).ti,ab,kf. OR (symphyseal adj separat$).ti,ab,kf. OR (symphyseal adj dysfunct$).ti,ab,kf. OR (lumbopelvic adj instabilit$).ti,ab,kf. OR insufficient lumbopelvic stability.ti,ab,kf. OR (joint$ adj5 instabilit$).ti,ab,kf. OR (joint$ adj5 hypermobilit$).ti,ab,kf. OR (joint$ adj5 dislocation$).ti,ab,kf. OR (inferior adj dislocation$).ti,ab,kf. OR locomotor system.ti,ab,kf. OR hyperalgesi$.ti,ab,kf. OR (somatosensory adj system$).ti,ab,kf. OR cumulative trauma disorder.ti,ab,kf. OR cumulative trauma disorders.ti,ab,kf. OR (physical adj microtrauma$).ti,ab,kf. OR (musc$ adj strain$).ti,ab,kf. OR (tendon$ adj strain$).ti,ab,kf. OR (ligament$ adj strain$).ti,ab,kf. OR (musc$ adj spasm$).ti,ab,kf.
#7	Outcome - sequelae (fatigue): exp Fatigue/ OR Muscle Fatigue/ OR Muscle Weakness/ OR Physical Endurance/ OR fatigu$.ti,ab,kf. OR exhaustion.ti,ab,kf. OR tiredness.ti,ab,kf. OR psychophysical.ti,ab,kf. OR (musc$ adj weak$).ti,ab,kf. OR (musc$ adj endurance).ti,ab,kf. OR (musc$ adj wear).ti,ab,kf.

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TABLE A.3
The Cumulative Index to the Nursing and Allied Health Literature (CINAHL) search strategy *(continued)*

#8	Outcome - sequelae (analgesic use): exp Analgesics/ OR Pain Management/ OR Cannabis/ OR diflunisal.ti,ab,kf. OR salsalate.ti,ab,kf. OR dexibuprofen.ti,ab,kf. OR fenoprofen.ti,ab,kf. OR ketoprofen.ti,ab,kf. OR dexketoprofen.ti,ab,kf. OR flurbiprofen.ti,ab,kf. OR oxaprozin.ti,ab,kf. OR loxoprofen.ti,ab,kf. OR indomethacin.ti,ab,kf. OR tolmetin.ti,ab,kf. OR sulindac.ti,ab,kf. OR etodolac.ti,ab,kf. OR ketorolac.ti,ab,kf. OR diclofenac.ti,ab,kf. OR aceclofenac.ti,ab,kf. OR nabumetone.ti,ab,kf. OR bromfenac.ti,ab,kf. OR piroxicam.ti,ab,kf. OR meloxicam.ti,ab,kf. OR tenoxicam.ti,ab,kf. OR droxicam.ti,ab,kf. OR lornoxicam.ti,ab,kf. OR phenylbutazone.ti,ab,kf. OR mefenamic acid.ti,ab,kf. OR meclofenamic acid.ti,ab,kf. OR flufenamic acid.ti,ab,kf. OR tolfenamic acid.ti,ab,kf. OR celecoxib.ti,ab,kf. OR rofecoxib.ti,ab,kf. OR valdecoxib.ti,ab,kf. OR arecoxib.ti,ab,kf. OR etoricoxib.ti,ab,kf. OR nimesulide.ti,ab,kf. OR clonixin.ti,ab,kf. OR licofelone.ti,ab,kf. OR hydrocodone.ti,ab,kf. OR oxymorphone.ti,ab,kf. OR morphine.ti,ab,kf. OR fentanyl.ti,ab,kf. OR fentanil.ti,ab,kf. OR thebaine.ti,ab,kf. OR heroin.ti,ab,kf. OR nicomorphine.ti,ab,kf. OR dihydrocodeine.ti,ab,kf. OR ethylmorphine.ti,ab,kf. OR eterocodeine.ti,ab,kf. OR buprenorphine.ti,ab,kf. OR hydromorphone.ti,ab,kf. OR pethidine.ti,ab,kf. OR meperidine.ti,ab,kf. OR ketobemidone.ti,ab,kf. OR prodine.ti,ab,kf. OR trimeperidine.ti,ab,kf. OR dextropropoxyphene.ti,ab,kf. OR bezitramide.ti,ab,kf. OR piritramide.ti,ab,kf. OR methadone.ti,ab,kf. OR dipipanone.ti,ab,kf. OR difenoxin.ti,ab,kf. OR diphenoxylate.ti,ab,kf. OR dezocine.ti,ab,kf. OR pentazocine.ti,ab,kf. OR phenazocine.ti,ab,kf. OR dihydroetorphine.ti,ab,kf. OR butorphanol.ti,ab,kf. OR nalbuphine.ti,ab,kf. OR levorphanol.ti,ab,kf. OR levomethorphan.ti,ab,kf. OR lefetamine.ti,ab,kf. OR meprazinol.ti,ab,kf. OR tilidine.ti,ab,kf. OR tramadol.ti,ab,kf. OR tapentadol.ti,ab,kf. OR (medic$ adj cannabis).ti,ab,kf. OR (medic$ adj mari?uana).ti,ab,kf. OR analgesic$.ti,ab,kf. OR painkiller$.ti,ab,kf. OR pain-killer$.ti,ab,kf. OR (pain adj medication$).ti,ab,kf. OR (pain$ adj3 pharmacotherap$).ti,ab,kf. OR acetaminophen.ti,ab,kf. OR paracetamol.ti,ab,kf. OR nsaid$.ti,ab,kf. OR (nonsteroidal adj anti-inflammatory).ti,ab,kf. OR (nonsteroidal adj antiinflammatory).ti,ab,kf. OR aspirin.ti,ab,kf. OR ibuprofen.ti,ab,kf. OR naproxen.ti,ab,kf. OR (cox-2 adj inhibitor$).ti,ab,kf. OR opioid$.ti,ab,kf. OR codeine.ti,ab,kf. OR oxycodone.ti,ab,kf.
#9	Outcome - sequelae, employment (work disability): Workers' Compensation/ OR exp "Activities of Daily Living"/ OR Mobility Limitation/ OR Work Performance/ OR exp Psychology, Industrial/ OR Quality of Life/ OR (worker$ adj compensation).ti,ab,kf. OR (workman$ adj compensation).ti,ab,kf. OR (functional adj disabilit$).ti,ab,kf. OR (work adj disabilit$).ti,ab,kf. OR (work adj abilit$).ti,ab,kf. OR workabilit$.ti,ab,kf. OR activities of daily living.ti,ab,kf. OR (activity adj level$).ti,ab,kf. OR (mobility adj impairment$).ti,ab,kf. OR (mobility adj limitation$).ti,ab,kf. OR (performance adj decrement$).ti,ab,kf. OR (pain adj interference$).ti,ab,kf. OR work performance.ti,ab,kf. OR productivity.ti,ab,kf. OR work capacity.ti,ab,kf. OR quality of life.ti,ab,kf.
#10	Outcome - sequelae, employment (sickness absence): Sick Leave/ OR Absenteeism/ OR exp Family Leave/ OR Bed Rest/ OR absenteeism.ti,ab,kf. OR (sick$ adj absence$).ti,ab,kf. OR (sick$ adj leave$).ti,ab,kf. OR (sick$ adj day$).ti,ab,kf. OR (antenatal adj leave).ti,ab,kf. OR (prenatal adj leave).ti,ab,kf. OR (postnatal adj leave).ti,ab,kf. OR (medical adj leave).ti,ab,kf. OR (pregnan* adj leave).ti,ab,kf. OR (bed adj rest).ti,ab,kf. OR bedrest.ti,ab,kf. OR (maternity adj leave).ti,ab,kf. OR (maternal adj leave).ti,ab,kf. OR (parental adj leave).ti,ab,kf. OR leave of absence.ti,ab,kf.
#11	Outcome - sequelae, employment (employment withdrawal): (work$ adj5 dismiss$).ti,ab,kf. OR (job adj5 dismiss$).ti,ab,kf. OR (employ$ adj5 dismiss$).ti,ab,kf. OR (work$ adj cessation).ti,ab,kf. OR (job adj cessation).ti,ab,kf. OR (employ$ adj cessation).ti,ab,kf. OR (work$ adj cease).ti,ab,kf. OR (employ$ adj cease).ti,ab,kf. OR (job adj cease).ti,ab,kf. OR (job adj loss$).ti,ab,kf. OR (work$ adj5 quit$).ti,ab,kf. OR (job adj5 quit$).ti,ab,kf. OR (employ$ adj5 quit$).ti,ab,kf. OR (work$ adj5 terminat$).ti,ab,kf. OR (job adj5 terminat$).ti,ab,kf. OR (employ$ adj5 terminat$).ti,ab,kf. OR (job adj5 fired).ti,ab,kf. OR (work$ adj5 fired).ti,ab,kf. OR (employ$ adj5 fired).ti,ab,kf. OR employment retention.ti,ab,kf. OR job retention.ti,ab,kf. OR unemployment/ OR unemploy$.ti,ab,kf. OR employment.ti,ab,kf. OR workforce.ti,ab,kf. OR labor force.ti,ab,kf. OR labour force.ti,ab,kf. OR labor market.ti,ab,kf. OR labour market.ti,ab,kf. OR job market.ti,ab,kf. OR resignation.ti,ab,kf.
#12	Outcome - sequelae, employment (return to work): Return to Work/ OR (return$ adj3 work$).ti,ab,kf. OR (return$ adj3 employ$).ti,ab,kf. OR (return$ adj3 job).ti,ab,kf. OR return-to-work.ti,ab,kf. OR (back adj3 work$).ti,ab,kf. OR (back adj3 employ$).ti,ab,kf. OR (back adj3 job).ti,ab,kf. OR (work$ adj3 reentry).ti,ab,kf. OR (employ$ adj3 reentry).ti,ab,kf. OR (job adj3 reentry).ti,ab,kf. OR (work$ adj3 re-entry).ti,ab,kf. OR (employ$ adj3 re-entry).ti,ab,kf. OR (job adj3 re-entry).ti,ab,kf. OR (work$ adj3 reintegrat$).ti,ab,kf. OR (job adj3 reintegrat$).ti,ab,kf. OR (employ$ adj3 reintegrat$).ti,ab,kf. OR (work$ adj3 re-integrat$).ti,ab,kf. OR (job adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 retention).ti,ab,kf. OR (employ$ adj3 retention).ti,ab,kf. OR (job adj3 retention).ti,ab,kf. OR (work$ adj3 retain$).ti,ab,kf. OR (employ$ adj3 retain$).ti,ab,kf. OR (job adj3 retain$).ti,ab,kf. OR (work$ adj3 reacqui$).ti,ab,kf. OR (employ$ adj3 re-acqui$).ti,ab,kf. OR (job adj3 re-acqui$).ti,ab,kf. OR (work$ adj3 maint$).ti,ab,kf. OR (employ$ adj3 maint$).ti,ab,kf. OR (job adj3 maint$).ti,ab,kf. OR (work$ adj3 transition$).ti,ab,kf. OR (employ$ adj3 transition$).ti,ab,kf. OR (job adj3 transition$).ti,ab,kf. OR (work$ adj3 reengag$).ti,ab,kf. OR (employ$ adj3 reengag$).ti,ab,kf. OR (job adj3 reengag$).ti,ab,kf. OR (work$ adj3 re-engag$).ti,ab,kf. OR (employ$ adj3 re-ngag$).ti,ab,kf. OR (job adj3 re-engag$).ti,ab,kf. OR re-employ$.ti,ab,kf. OR reemploy$.ti,ab,kf. OR (employ$ adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 resum$).ti,ab,kf. OR (employ$ adj3 resum$).ti,ab,kf. OR (job adj3 resum$).ti,ab,kf.
#13	Outcomes — sequelae: #7 OR #8 OR #9 OR #10 OR #11 OR #12
#14	#1 (population) AND #5 (physical job demands) AND #6 (MSDs) AND #13 (sequelae)
#15	limit #14 to yr="1990 -Current"

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TABLE A.4
National Institute for Occupational Safety and Health Technical Information Center (NIOSHTIC-2) search strategy

#1	Population (pregnant or postpartum): Pregnancy/ OR exp Pregnancy Trimesters/ OR Pregnant Women/ OR Peripartum Period/ OR Postpartum Period/ OR Gravidity/ OR Parity/ OR pregnan$.ti,ab,kf. OR matern$.ti,ab,kf. OR gestation$.ti,ab,kf. OR antenat$.ti,ab,kf. OR ante-nat$.ti,ab,kf. OR prenat$.ti,ab,kf. OR pre-nat$.ti,ab,kf. OR perinat$.ti,ab,kf. OR peri-nat$.ti,ab,kf. OR postnat$.ti,ab,kf. OR post-nat$.ti,ab,kf. OR puerper$.ti,ab,kf. OR antepart$.ti,ab,kf. OR ante-part$.ti,ab,kf. OR prepart$.ti,ab,kf. OR pre-part$.ti,ab,kf. OR peripart$.ti,ab,kf. OR peri-part$.ti,ab,kf. OR postpart$.ti,ab,kf. OR post-part$.ti,ab,kf. OR trimester$.ti,ab,kf.
#2	Exposure to occupational lifting: exp Lifting/ OR exp "Moving and Lifting Patients"/ OR exp Weight Lifting/ OR exp Weight-Bearing/ OR lift$.ti,ab,kf. OR (carry$ adj3 heavy$).ti,ab,kf. OR (carry$ adj5 weight$).ti,ab,kf. OR (carry$ adj5 load$).ti,ab,kf. OR (carry$ adj5 object).ti,ab,kf. OR (carry$ adj5 objects).ti,ab,kf. OR Ergonomics/ OR ergonom$.ti,ab,kf. OR (biomechanic$ adj5 stressor$).ti,ab,kf. OR (biomechanic$ adj5 exposure$).ti,ab,kf. OR (mechanic$ adj stress$).ti,ab,kf. OR (manual$ adj3 handl$).ti,ab,kf. OR (material$ adj3 handl$).ti,ab,kf. OR (load$ adj3 handl$).ti,ab,kf. OR blue collar.ti,ab,kf. OR pink collar.ti,ab,kf. OR manual labor.ti,ab,kf. OR manual labour.ti,ab,kf. OR laborer$.ti,ab,kf. OR labourer$.ti,ab,kf. OR warehous$.ti,ab,kf. OR (order adj picker$).ti,ab,kf. OR (stock adj picker$).ti,ab,kf. OR (service adj work$).ti,ab,kf. OR exp Physical Exertion/ OR (occupational adj3 exertion).ti,ab,kf. OR (physical adj3 factor$).ti,ab,kf. OR (physical$ adj3 demand$).ti,ab,kf. OR (physical$ adj3 work$).ti,ab,kf. OR (physical$ adj5 load$).ti,ab,kf. OR (physical adj exertion).ti,ab,kf. OR physical job.ti,ab,kf. OR (physical adj stress$).ti,ab,kf. OR (occupation$ adj3 fatigu$).ti,ab,kf. OR (work$ adj3 fatigu$).ti,ab,kf. OR (job$ adj3 fatigu$).ti,ab,kf.
#3	Exposure to occupational postural load: Postural Balance/ OR (postur$ adj load$).ti,ab,kf. OR (postur$ adj angle$).ti,ab,kf. OR (awkward adj postur$).ti,ab,kf. OR (poor adj postur$).ti,ab,kf. OR (neutral adj postur$).ti,ab,kf. OR (non-neutral adj postur$).ti,ab,kf. OR (nonneutral adj postur$).ti,ab,kf. OR (non-standard adj postur$).ti,ab,kf. OR (nonstandard adj postur$).ti,ab,kf. OR (strenuous adj position$).ti,ab,kf. OR (strenuous adj postur$).ti,ab,kf. OR (demanding adj postur$).ti,ab,kf. OR (postural adj stress$).ti,ab,kf. OR (postural adj balance).ti,ab,kf. OR (postural adj stability).ti,ab,kf. OR (postural adj nstability).ti,ab,kf. OR (postural adj control).ti,ab,kf. OR (postural adj sway).ti,ab,kf. OR (postural adj perturbation$).ti,ab,kf. OR (postural adj equilibri$).ti,ab,kf. OR (postural adj adapt$).ti,ab,kf. OR (postural adj effect$).ti,ab,kf. OR (work$ adj3 postur$).ti,ab,kf. OR (work-related adj postur$).ti,ab,kf. OR (lift$ adj3 postur$).ti,ab,kf. OR (body adj3 postur$).ti,ab,kf. OR (dynamic adj postur$).ti,ab,kf. OR (spin$ adj3 postur$).ti,ab,kf. OR (trunk adj3 postur$).ti,ab,kf. OR (upright adj postur$).ti,ab,kf. OR (erect adj postur$).ti,ab,kf. OR (asymmetr$ adj postur$).ti,ab,kf. OR (shoulder$ adj3 postur$).ti,ab,kf. OR (limb$ adj3 postur$).ti,ab,kf. OR (upper-body adj3 postur$).ti,ab,kf. OR (arm$ adj3 postur$).ti,ab,kf. OR (lumbo-pelvic adj postur$).ti,ab,kf. OR (lumbopelvic adj postur$).ti,ab,kf. OR (hip$ adj3 postur$).ti,ab,kf. OR (extremit$ adj3 postur$).ti,ab,kf. OR (standing adj3 postur$).ti,ab,kf. OR (standing adj3 position$).ti,ab,kf. OR (static adj standing).ti,ab,kf. OR (prolonged adj standing).ti,ab,kf. OR (standing adj still).ti,ab,kf. OR (dynamic adj standing).ti,ab,kf. OR bending.ti,ab,kf. OR twisting.ti,ab,kf. OR stooping.ti,ab,kf. OR stooped.ti,ab,kf. OR squat$.ti,ab,kf. OR crouch$.ti,ab,kf. OR kneeling.ti,ab,kf. OR (trunk adj3 flexion).ti,ab,kf. OR (trunk adj3 twist$).ti,ab,kf. OR (trunk adj3 rotat$).ti,ab,kf. OR (back adj3 flexion).ti,ab,kf. OR (back adj bent).ti,ab,kf. OR (back adj3 angle$).ti,ab,kf. OR torsoflexion.ti,ab,kf. OR (spinal adj rotat$).ti,ab,kf. OR (shoulder adj3 flexion).ti,ab,kf. OR (shoulder adj3 extension$).ti,ab,kf. OR (hip adj3 flexion).ti,ab,kf. OR hands above shoulder.ti,ab,kf. OR hands above shoulders.ti,ab,kf. OR arms above shoulder.ti,ab,kf. OR arms above shoulders.ti,ab,kf. OR overhead.ti,ab,kf. OR elevated arms.ti,ab,kf. OR (bent adj knee$).ti,ab,kf.
#4	Exposure to occupational physical demands *(broader exposure search)*: [exp Work/ OR exp Workplace/ OR exp Employment/ OR exp Occupations/ OR exp Occupational Diseases/ OR exp Occupational Exposures/ OR exp Occupational Medicine/ OR work$.ti,ab,kf. OR employ$.ti,ab,kf. OR occupation$.ti,ab,kf. OR job$.ti,ab,kf.] AND [(physical$ adj ctive$).ti,ab,kf. OR (work$ adj activ$).ti,ab,kf. OR (occupation$ adj activ$).ti,ab,kf. OR (job$ adj activ$).ti,ab,kf.]
#5	Physical job demands: #2 OR #3 OR #4
#6	Outcome — musculoskeletal disorders: Sacroiliac Joint/ OR Pubic Symphysis/ OR Occupational Injuries/ OR Orthopedics/ OR exp Sprains/ and Strains/ OR exp Tendon Injuries/ OR Sciatica/ OR Carpal Tunnel Syndrome/ OR Relaxin/ OR exp Joint Dislocations/ OR Joint Instability/ OR Microtrauma, Physical/ OR musculoskelet$.ti,ab,kf. OR overexertion$.ti,ab,kf. OR kinesiophobi$.ti,ab,kf. OR sacroiliac.ti,ab,kf. OR (pubic adj symphys$).ti,ab,kf. OR pelvic girdle.ti,ab,kf. OR low back pain.ti,ab,kf. OR low back pain.ti,ab,kf. OR backache$.ti,ab,kf. OR (overuse adj injur$).ti,ab,kf. OR (overuse adj syndrome$).ti,ab,kf. OR (repetit$ adj strain$).ti,ab,kf. OR (repetit$ adj stress$).ti,ab,kf. OR (repetit$ adj motion$).ti,ab,kf. OR sciatica.ti,ab,kf. OR subluxation$.ti,ab,kf. OR sprain$.ti,ab,kf. OR tendinitis.ti,ab,kf. OR carpal tunnel.ti,ab,kf. OR relaxin.ti,ab,kf. OR laxity.ti,ab,kf. OR (spine adj instabilit$).ti,ab,kf. OR (spinal adj instabilit$).ti,ab,kf. OR (hernia$ and lumbar and disc).ti,ab,kf. OR (spinal$ adj5 hernia$).ti,ab,kf. OR intervertebral disc displacement.ti,ab,kf. OR (sacral adj insufficienc$).ti,ab,kf. OR (pelvic adj insufficienc$).ti,ab,kf. OR (symphyseal adj separat$).ti,ab,kf. OR (symphyseal adj dysfunct$).ti,ab,kf. OR (lumbopelvic adj instabilit$).ti,ab,kf. OR insufficient lumbopelvic stability.ti,ab,kf. OR (joint$ adj5 instabilit$).ti,ab,kf. OR (joint$ adj5 hypermobilit$).ti,ab,kf. OR (joint$ adj5 dislocation$).ti,ab,kf. OR (inferior adj dislocation$).ti,ab,kf. OR locomotor system.ti,ab,kf. OR hyperalgesi$.ti,ab,kf. OR (somatosensory adj system$).ti,ab,kf. OR cumulative trauma disorder.ti,ab,kf. OR cumulative trauma disorders.ti,ab,kf. OR (physical adj microtrauma$).ti,ab,kf. OR (musc$ adj strain$).ti,ab,kf. OR (tendon$ adj strain$).ti,ab,kf. OR (ligament$ adj strain$).ti,ab,kf. OR (musc$ adj spasm$).ti,ab,kf.
#7	Outcome - sequelae (fatigue): exp Fatigue/ OR Muscle Fatigue/ OR Muscle Weakness/ OR Physical Endurance/ OR fatigu$.ti,ab,kf. OR exhaustion.ti,ab,kf. OR tiredness.ti,ab,kf. OR psychophysical.ti,ab,kf. OR (musc$ adj weak$).ti,ab,kf. OR (musc$ adj endurance).ti,ab,kf. OR (musc$ adj wear).ti,ab,kf.

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TABLE A.4
National Institute for Occupational Safety and Health Technical Information Center (NIOSHTIC-2) search strategy
(continued)

#8	Outcome - sequelae (analgesic use): exp Analgesics/ OR Pain Management/ OR Cannabis/ OR diflunisal.ti,ab,kf. OR salsalate.ti,ab,kf. OR dexibuprofen.ti,ab,kf. OR fenoprofen.ti,ab,kf. OR ketoprofen.ti,ab,kf. OR dexketoprofen.ti,ab,kf. OR flurbiprofen.ti,ab,kf. OR oxaprozin.ti,ab,kf. OR loxoprofen.ti,ab,kf. OR indomethacin.ti,ab,kf. OR tolmetin.ti,ab,kf. OR sulindac.ti,ab,kf. OR etodolac.ti,ab,kf. OR ketorolac.ti,ab,kf. OR diclofenac.ti,ab,kf. OR aceclofenac.ti,ab,kf. OR nabumetone.ti,ab,kf. OR bromfenac.ti,ab,kf. OR piroxicam.ti,ab,kf. OR meloxicam.ti,ab,kf. OR tenoxicam.ti,ab,kf. OR droxicam.ti,ab,kf. OR lornoxicam.ti,ab,kf. OR phenylbutazone.ti,ab,kf. OR mefenamic acid.ti,ab,kf. OR meclofenamic acid.ti,ab,kf. OR flufenamic acid.ti,ab,kf. OR tolfenamic acid.ti,ab,kf. OR celecoxib.ti,ab,kf. OR rofecoxib.ti,ab,kf. OR valdecoxib.ti,ab,kf. OR arecoxib.ti,ab,kf. OR etoricoxib.ti,ab,kf. OR nimesulide.ti,ab,kf. OR clonixin.ti,ab,kf. OR licofelone.ti,ab,kf. OR hydrocodone.ti,ab,kf. OR oxymorphone.ti,ab,kf. OR morphine.ti,ab,kf. OR fentanyl.ti,ab,kf. OR fentanil.ti,ab,kf. OR thebaine.ti,ab,kf. OR heroin.ti,ab,kf. OR nicomorphine.ti,ab,kf. OR dihydrocodeine.ti,ab,kf. OR ethylmorphine.ti,ab,kf. OR eterocodeine.ti,ab,kf. OR buprenorphine.ti,ab,kf. OR hydromorphone.ti,ab,kf. OR pethidine.ti,ab,kf. OR meperidine.ti,ab,kf. OR ketobemidone.ti,ab,kf. OR prodine.ti,ab,kf. OR trimeperidine.ti,ab,kf. OR dextropropoxyphene.ti,ab,kf. OR bezitramide.ti,ab,kf. OR piritramide.ti,ab,kf. OR methadone.ti,ab,kf. OR dipipanone.ti,ab,kf. OR difenoxin.ti,ab,kf. OR diphenoxylate.ti,ab,kf. OR dezocine.ti,ab,kf. OR pentazocine.ti,ab,kf. OR phenazocine.ti,ab,kf. OR dihydroetorphine.ti,ab,kf. OR butorphanol.ti,ab,kf. OR nalbuphine.ti,ab,kf. OR levorphanol.ti,ab,kf. OR levomethorphan.ti,ab,kf. OR lefetamine.ti,ab,kf. OR meprazinol.ti,ab,kf. OR tilidine.ti,ab,kf. OR tramadol.ti,ab,kf. OR tapentadol.ti,ab,kf. OR (medic$ adj cannabis).ti,ab,kf. OR (medic$ adj mari?uana).ti,ab,kf. OR analgesic$.ti,ab,kf. OR painkiller$.ti,ab,kf. OR pain-killer$.ti,ab,kf. OR (pain adj medication$).ti,ab,kf. OR (pain$ adj3 pharmacotherap$).ti,ab,kf. OR acetaminophen.ti,ab,kf. OR paracetamol.ti,ab,kf. OR nsaid$.ti,ab,kf. OR (nonsteroidal adj anti-inflammatory).ti,ab,kf. OR (nonsteroidal adj antiinflammatory).ti,ab,kf. OR aspirin.ti,ab,kf. OR ibuprofen.ti,ab,kf. OR naproxen.ti,ab,kf. OR (cox-2 adj inhibitor$).ti,ab,kf. OR opioid$.ti,ab,kf. OR codeine.ti,ab,kf. OR oxycodone.ti,ab,kf.
#9	Outcome - sequelae, employment (work disability): Workers' Compensation/ OR exp "Activities of Daily Living"/ OR Mobility Limitation/ OR Work Performance/ OR exp Psychology, Industrial/ OR Quality of Life/ OR (worker$ adj compensation).ti,ab,kf. OR (workman$ adj compensation).ti,ab,kf. OR (functional adj disabilit$).ti,ab,kf. OR (work adj disabilit$).ti,ab,kf. OR (work adj abilit$).ti,ab,kf. OR workabilit$.ti,ab,kf. OR activities of daily living.ti,ab,kf. OR (activity adj level$).ti,ab,kf. OR (mobility adj impairment$).ti,ab,kf. OR (mobility adj limitation$).ti,ab,kf. OR (performance adj decrement$).ti,ab,kf. OR (pain adj interference$).ti,ab,kf. OR work performance.ti,ab,kf. OR productivity.ti,ab,kf. OR work capacity.ti,ab,kf. OR quality of life.ti,ab,kf.
#10	Outcome - sequelae, employment (sickness absence): Sick Leave/ OR Absenteeism/ OR exp Family Leave/ OR Bed Rest/ OR absenteeism.ti,ab,kf. OR (sick$ adj absence$).ti,ab,kf. OR (sick$ adj leave$).ti,ab,kf. OR (sick$ adj day$).ti,ab,kf. OR (antenatal adj leave).ti,ab,kf. OR (prenatal adj leave).ti,ab,kf. OR (postnatal adj leave).ti,ab,kf. OR (medical adj leave).ti,ab,kf. OR (pregnan* adj leave).ti,ab,kf. OR (bed adj rest).ti,ab,kf. OR bedrest.ti,ab,kf. OR (maternity adj leave).ti,ab,kf. OR (maternal adj leave).ti,ab,kf. OR (parental adj leave).ti,ab,kf. OR leave of absence.ti,ab,kf.
#11	Outcome - sequelae, employment (employment withdrawal): (work$ adj5 dismiss$).ti,ab,kf. OR (job adj5 dismiss$).ti,ab,kf. OR (employ$ adj5 dismiss$).ti,ab,kf. OR (work$ adj cessation).ti,ab,kf. OR (job adj cessation).ti,ab,kf. OR (employ$ adj cessation).ti,ab,kf. OR (work$ adj cease).ti,ab,kf. OR (employ$ adj cease).ti,ab,kf. OR (job adj cease).ti,ab,kf. OR (job adj loss$).ti,ab,kf. OR (work$ adj5 quit$).ti,ab,kf. OR (job adj5 quit$).ti,ab,kf. OR (employ$ adj5 quit$).ti,ab,kf. OR (work$ adj5 terminat$).ti,ab,kf. OR (job adj5 terminat$).ti,ab,kf. OR (employ$ adj5 terminat$).ti,ab,kf. OR (job adj5 fired).ti,ab,kf. OR (work$ adj5 fired).ti,ab,kf. OR (employ$ adj5 fired).ti,ab,kf. OR employment retention.ti,ab,kf. OR job retention.ti,ab,kf. OR unemployment/ OR unemploy$.ti,ab,kf. OR employment.ti,ab,kf. OR workforce.ti,ab,kf. OR labor force.ti,ab,kf. OR labour force.ti,ab,kf. OR labor market.ti,ab,kf. OR labour market.ti,ab,kf. OR job market.ti,ab,kf. OR resignation.ti,ab,kf.
#12	Outcome - sequelae, employment (return to work): Return to Work/ OR (return$ adj3 work$).ti,ab,kf. OR (return$ adj3 employ$).ti,ab,kf. OR (return$ adj3 job).ti,ab,kf. OR return-to-work.ti,ab,kf. OR (back adj3 work$).ti,ab,kf. OR (back adj3 employ$).ti,ab,kf. OR (back adj3 job).ti,ab,kf. OR (work$ adj3 reentry).ti,ab,kf. OR (employ$ adj3 reentry).ti,ab,kf. OR (job adj3 reentry).ti,ab,kf. OR (work$ adj3 re-entry).ti,ab,kf. OR (employ$ adj3 re-entry).ti,ab,kf. OR (job adj3 re-entry).ti,ab,kf. OR (work$ adj3 reintegrat$).ti,ab,kf. OR (job adj3 reintegrat$).ti,ab,kf. OR (employ$ adj3 reintegrat$).ti,ab,kf. OR (work$ adj3 re-integrat$).ti,ab,kf. OR (job adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 retention).ti,ab,kf. OR (employ$ adj3 retention).ti,ab,kf. OR (job adj3 retention).ti,ab,kf. OR (work$ adj3 retain$).ti,ab,kf. OR (employ$ adj3 retain$).ti,ab,kf. OR (job adj3 retain$).ti,ab,kf. OR (work$ adj3 reacqui$).ti,ab,kf. OR (employ$ adj3 re-acqui$).ti,ab,kf. OR (job adj3 re-acqui$).ti,ab,kf. OR (work$ adj3 maint$).ti,ab,kf. OR (employ$ adj3 maint$).ti,ab,kf. OR (job adj3 maint$).ti,ab,kf. OR (work$ adj3 transition$).ti,ab,kf. OR (employ$ adj3 transition$).ti,ab,kf. OR (job adj3 transition$).ti,ab,kf. OR (work$ adj3 reengag$).ti,ab,kf. OR (employ$ adj3 reengag$).ti,ab,kf. OR (job adj3 reengag$).ti,ab,kf. OR (work$ adj3 re-engag$).ti,ab,kf. OR (employ$ adj3 re-ngag$).ti,ab,kf. OR (job adj3 re-engag$).ti,ab,kf. OR re-employ$.ti,ab,kf. OR reemploy$.ti,ab,kf. OR (employ$ adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 resum$).ti,ab,kf. OR (employ$ adj3 resum$).ti,ab,kf. OR (job adj3 resum$).ti,ab,kf.
#13	Outcomes — sequelae: #7 OR #8 OR #9 OR #10 OR #11 OR #12
#14	#1 (population) AND #5 (physical job demands) AND #6 (MSDs) AND #13 (sequelae)
#15	limit #14 to yr="1990 -Current"

MacDonald. Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes. Am J Obstet Gynecol 2024.

TABLE A.5
Ergonomics abstracts search strategy

#1	Population (pregnant or postpartum): Pregnancy/ OR exp Pregnancy Trimesters/ OR Pregnant Women/ OR Peripartum Period/ OR Postpartum Period/ OR Gravidity/ OR Parity/ OR pregnan$.ti,ab,kf. OR matern$.ti,ab,kf. OR gestation$.ti,ab,kf. OR antenat$.ti,ab,kf. OR ante-nat$.ti,ab,kf. OR prenat$.ti,ab,kf. OR pre-nat$.ti,ab,kf. OR perinat$.ti,ab,kf. OR peri-nat$.ti,ab,kf. OR postnat$.ti,ab,kf. OR post-nat$.ti,ab,kf. OR puerper$.ti,ab,kf. OR antepart$.ti,ab,kf. OR ante-part$.ti,ab,kf. OR prepart$.ti,ab,kf. OR pre-part$.ti,ab,kf. OR peripart$.ti,ab,kf. OR peri-part$.ti,ab,kf. OR postpart$.ti,ab,kf. OR post-part$.ti,ab,kf. OR trimester$.ti,ab,kf.
#2	Exposure to occupational lifting: exp Lifting/ OR exp "Moving and Lifting Patients"/ OR exp Weight Lifting/ OR exp Weight-Bearing/ OR lift$.ti,ab,kf. OR (carry$ adj3 heavy$).ti,ab,kf. OR (carry$ adj5 weight$).ti,ab,kf. OR (carry$ adj5 load$).ti,ab,kf. OR (carry$ adj5 object).ti,ab,kf. OR (carry$ adj5 objects).ti,ab,kf. OR Ergonomics/ OR ergonom$.ti,ab,kf. OR (biomechanic$ adj5 stressor$).ti,ab,kf. OR (biomechanic$ adj5 exposure$).ti,ab,kf. OR (mechanic$ adj stress$).ti,ab,kf. OR (manual$ adj3 handl$).ti,ab,kf. OR (material$ adj3 handl$).ti,ab,kf. OR (load$ adj3 handl$).ti,ab,kf. OR blue collar.ti,ab,kf. OR pink collar.ti,ab,kf. OR manual labor.ti,ab,kf. OR manual labour.ti,ab,kf. OR laborer$.ti,ab,kf. OR labourer$.ti,ab,kf. OR warehous$.ti,ab,kf. OR (order adj picker$).ti,ab,kf. OR (stock adj picker$).ti,ab,kf. OR (service adj work$).ti,ab,kf. OR exp Physical Exertion/ OR (occupational adj3 exertion).ti,ab,kf. OR (physical adj3 factor$).ti,ab,kf. OR (physical$ adj3 demand$).ti,ab,kf. OR (physical$ adj3 work$).ti,ab,kf. OR (physical$ adj5 load$).ti,ab,kf. OR (physical adj exertion).ti,ab,kf. OR physical job.ti,ab,kf. OR (physical adj stress$).ti,ab,kf. OR (occupation$ adj3 fatigu$).ti,ab,kf. OR (work$ adj3 fatigu$).ti,ab,kf. OR (job$ adj3 fatigu$).ti,ab,kf.
#3	Exposure to occupational postural load: Postural Balance/ OR (postur$ adj load$).ti,ab,kf. OR (postur$ adj angle$).ti,ab,kf. OR (awkward adj postur$).ti,ab,kf. OR (poor adj postur$).ti,ab,kf. OR (neutral adj postur$).ti,ab,kf. OR (non-neutral adj postur$).ti,ab,kf. OR (nonneutral adj postur$).ti,ab,kf. OR (non-standard adj postur$).ti,ab,kf. OR (nonstandard adj postur$).ti,ab,kf. OR (strenuous adj position$).ti,ab,kf. OR (strenuous adj postur$).ti,ab,kf. OR (demanding adj postur$).ti,ab,kf. OR (postural adj stress$).ti,ab,kf. OR (postural adj balance).ti,ab,kf. OR (postural adj stability).ti,ab,kf. OR (postural adj nstability).ti,ab,kf. OR (postural adj control).ti,ab,kf. OR (postural adj sway).ti,ab,kf. OR (postural adj perturbation$).ti,ab,kf. OR (postural adj equilibri$).ti,ab,kf. OR (postural adj adapt$).ti,ab,kf. OR (postural adj effect$).ti,ab,kf. OR (work$ adj3 postur$).ti,ab,kf. OR (work-related adj postur$).ti,ab,kf. OR (lift$ adj3 postur$).ti,ab,kf. OR (body adj3 postur$).ti,ab,kf. OR (dynamic adj postur$).ti,ab,kf. OR (spin$ adj3 postur$).ti,ab,kf. OR (trunk adj3 postur$).ti,ab,kf. OR (upright adj postur$).ti,ab,kf. OR (erect adj postur$).ti,ab,kf. OR (asymmetr$ adj postur$).ti,ab,kf. OR (shoulder$ adj3 postur$).ti,ab,kf. OR (limb$ adj3 postur$).ti,ab,kf. OR (upper-body adj3 postur$).ti,ab,kf. OR (arm$ adj3 postur$).ti,ab,kf. OR (lumbo-pelvic adj postur$).ti,ab,kf. OR (lumbopelvic adj postur$).ti,ab,kf. OR (hip$ adj3 postur$).ti,ab,kf. OR (extremit$ adj3 postur$).ti,ab,kf. OR (standing adj3 postur$).ti,ab,kf. OR (standing adj3 position$).ti,ab,kf. OR (static adj standing).ti,ab,kf. OR (prolonged adj standing).ti,ab,kf. OR (standing adj still).ti,ab,kf. OR (dynamic adj standing).ti,ab,kf. OR bending.ti,ab,kf. OR twisting.ti,ab,kf. OR stooping.ti,ab,kf. OR stooped.ti,ab,kf. OR squat$.ti,ab,kf. OR crouch$.ti,ab,kf. OR kneeling.ti,ab,kf. OR (trunk adj3 flexion).ti,ab,kf. OR (trunk adj3 twist$).ti,ab,kf. OR (trunk adj3 rotat$).ti,ab,kf. OR (back adj3 flexion).ti,ab,kf. OR (back adj bent).ti,ab,kf. OR (back adj3 angle$).ti,ab,kf. OR torsoflexion.ti,ab,kf. OR (spinal adj rotat$).ti,ab,kf. OR (shoulder adj3 flexion).ti,ab,kf. OR (shoulder adj3 extension$).ti,ab,kf. OR (hip adj3 flexion).ti,ab,kf. OR hands above shoulder.ti,ab,kf. OR hands above shoulders.ti,ab,kf. OR arms above shoulder.ti,ab,kf. OR arms above shoulders.ti,ab,kf. OR overhead.ti,ab,kf. OR elevated arms.ti,ab,kf. OR (bent adj knee$).ti,ab,kf.
#4	Exposure to occupational physical demands *(broader exposure search)*: [exp Work/ OR exp Workplace/ OR exp Employment/ OR exp Occupations/ OR exp Occupational Diseases/ OR exp Occupational Exposures/ OR exp Occupational Medicine/ OR work$.ti,ab,kf. OR employ$.ti,ab,kf. OR occupation$.ti,ab,kf. OR job$.ti,ab,kf.] AND [(physical$ adj ctive$).ti,ab,kf. OR (work$ adj activ$).ti,ab,kf. OR (occupation$ adj activ$).ti,ab,kf. OR (job$ adj activ$).ti,ab,kf.]
#5	Physical job demands: #2 OR #3 OR #4
#6	Outcome — musculoskeletal disorders: Sacroiliac Joint/ OR Pubic Symphysis/ OR Occupational Injuries/ OR Orthopedics/ OR exp Sprains/ and Strains/ OR exp Tendon Injuries/ OR Sciatica/ OR Carpal Tunnel Syndrome/ OR Relaxin/ OR exp Joint Dislocations/ OR Joint Instability/ OR Microtrauma, Physical/ OR musculoskelet$.ti,ab,kf. OR overexertion$.ti,ab,kf. OR kinesiophobi$.ti,ab,kf. OR sacroiliac.ti,ab,kf. OR (pubic adj symphys$).ti,ab,kf. OR pelvic girdle.ti,ab,kf. OR low back pain.ti,ab,kf. OR low back pain.ti,ab,kf. OR backache$.ti,ab,kf. OR (overuse adj injur$).ti,ab,kf. OR (overuse adj syndrome$).ti,ab,kf. OR (repetit$ adj strain$).ti,ab,kf. OR (repetit$ adj stress$).ti,ab,kf. OR (repetit$ adj motion$).ti,ab,kf. OR sciatica.ti,ab,kf. OR subluxation$.ti,ab,kf. OR sprain$.ti,ab,kf. OR tendinitis.ti,ab,kf. OR carpal tunnel.ti,ab,kf. OR relaxin.ti,ab,kf. OR laxity.ti,ab,kf. OR (spine adj instabilit$).ti,ab,kf. OR (spinal adj instabilit$).ti,ab,kf. OR (hernia$ and lumbar and disc).ti,ab,kf. OR (spinal$ adj5 hernia$).ti,ab,kf. OR intervertebral disc displacement.ti,ab,kf. OR (sacral adj insufficienc$).ti,ab,kf. OR (pelvic adj insufficienc$).ti,ab,kf. OR (symphyseal adj separat$).ti,ab,kf. OR (symphyseal adj dysfunct$).ti,ab,kf. OR (lumbopelvic adj instabilit$).ti,ab,kf. OR insufficient lumbopelvic stability.ti,ab,kf. OR (joint$ adj5 instabilit$).ti,ab,kf. OR (joint$ adj5 hypermobilit$).ti,ab,kf. OR (joint$ adj5 dislocation$).ti,ab,kf. OR (inferior adj dislocation$).ti,ab,kf. OR locomotor system.ti,ab,kf. OR hyperalgesi$.ti,ab,kf. OR (somatosensory adj system$).ti,ab,kf. OR cumulative trauma disorder.ti,ab,kf. OR cumulative trauma disorders.ti,ab,kf. OR (physical adj microtrauma$).ti,ab,kf. OR (musc$ adj strain$).ti,ab,kf. OR (tendon$ adj strain$).ti,ab,kf. OR (ligament$ adj strain$).ti,ab,kf. OR (musc$ adj spasm$).ti,ab,kf.
#7	Outcome - sequelae (fatigue): exp Fatigue/ OR Muscle Fatigue/ OR Muscle Weakness/ OR Physical Endurance/ OR fatigu$.ti,ab,kf. OR exhaustion.ti,ab,kf. OR tiredness.ti,ab,kf. OR psychophysical.ti,ab,kf. OR (musc$ adj weak$).ti,ab,kf. OR (musc$ adj endurance).ti,ab,kf. OR (musc$ adj wear).ti,ab,kf.

MacDonald. Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes. Am J Obstet Gynecol 2024. *(continued)*

TABLE A.5
Ergonomics abstracts search strategy *(continued)*

#8	Outcome - sequelae (analgesic use): exp Analgesics/ OR Pain Management/ OR Cannabis/ OR diflunisal.ti,ab,kf. OR salsalate.ti,ab,kf. OR dexibuprofen.ti,ab,kf. OR fenoprofen.ti,ab,kf. OR ketoprofen.ti,ab,kf. OR dexketoprofen.ti,ab,kf. OR flurbiprofen.ti,ab,kf. OR oxaprozin.ti,ab,kf. OR loxoprofen.ti,ab,kf. OR indomethacin.ti,ab,kf. OR tolmetin.ti,ab,kf. OR sulindac.ti,ab,kf. OR etodolac.ti,ab,kf. OR ketorolac.ti,ab,kf. OR diclofenac.ti,ab,kf. OR aceclofenac.ti,ab,kf. OR nabumetone.ti,ab,kf. OR bromfenac.ti,ab,kf. OR piroxicam.ti,ab,kf. OR meloxicam.ti,ab,kf. OR tenoxicam.ti,ab,kf. OR droxicam.ti,ab,kf. OR lornoxicam.ti,ab,kf. OR phenylbutazone.ti,ab,kf. OR mefenamic acid.ti,ab,kf. OR meclofenamic acid.ti,ab,kf. OR flufenamic acid.ti,ab,kf. OR tolfenamic acid.ti,ab,kf. OR celecoxib.ti,ab,kf. OR rofecoxib.ti,ab,kf. OR valdecoxib.ti,ab,kf. OR arecoxib.ti,ab,kf. OR etoricoxib.ti,ab,kf. OR nimesulide.ti,ab,kf. OR clonixin.ti,ab,kf. OR licofelone.ti,ab,kf. OR hydrocodone.ti,ab,kf. OR oxymorphone.ti,ab,kf. OR morphine.ti,ab,kf. OR fentanyl.ti,ab,kf. OR fentanil.ti,ab,kf. OR thebaine.ti,ab,kf. OR heroin.ti,ab,kf. OR nicomorphine.ti,ab,kf. OR dihydrocodeine.ti,ab,kf. OR ethylmorphine.ti,ab,kf. OR eterocodeine.ti,ab,kf. OR buprenorphine.ti,ab,kf. OR hydromorphone.ti,ab,kf. OR pethidine.ti,ab,kf. OR meperidine.ti,ab,kf. OR ketobemidone.ti,ab,kf. OR prodine.ti,ab,kf. OR trimeperidine.ti,ab,kf. OR dextropropoxyphene.ti,ab,kf. OR bezitramide.ti,ab,kf. OR piritramide.ti,ab,kf. OR methadone.ti,ab,kf. OR dipipanone.ti,ab,kf. OR difenoxin.ti,ab,kf. OR diphenoxylate.ti,ab,kf. OR dezocine.ti,ab,kf. OR pentazocine.ti,ab,kf. OR phenazocine.ti,ab,kf. OR dihydroetorphine.ti,ab,kf. OR butorphanol.ti,ab,kf. OR nalbuphine.ti,ab,kf. OR levorphanol.ti,ab,kf. OR levomethorphan.ti,ab,kf. OR lefetamine.ti,ab,kf. OR meprazinol.ti,ab,kf. OR tilidine.ti,ab,kf. OR tramadol.ti,ab,kf. OR tapentadol.ti,ab,kf. OR (medic$ adj cannabis).ti,ab,kf. OR (medic$ adj mari?uana).ti,ab,kf. OR analgesic$.ti,ab,kf. OR painkiller$.ti,ab,kf. OR pain-killer$.ti,ab,kf. OR (pain adj medication$).ti,ab,kf. OR (pain$ adj3 pharmacotherap$).ti,ab,kf. OR acetaminophen.ti,ab,kf. OR paracetamol.ti,ab,kf. OR nsaid$.ti,ab,kf. OR (nonsteroidal adj anti-inflammatory).ti,ab,kf. OR (nonsteroidal adj antiinflammatory).ti,ab,kf. OR aspirin.ti,ab,kf. OR ibuprofen.ti,ab,kf. OR naproxen.ti,ab,kf. OR (cox-2 adj inhibitor$).ti,ab,kf. OR opioid$.ti,ab,kf. OR codeine.ti,ab,kf. OR oxycodone.ti,ab,kf.
#9	Outcome - sequelae, employment (work disability): Workers' Compensation/ OR exp "Activities of Daily Living"/ OR Mobility Limitation/ OR Work Performance/ OR exp Psychology, Industrial/ OR Quality of Life/ OR (worker$ adj compensation).ti,ab,kf. OR (workman$ adj compensation).ti,ab,kf. OR (functional adj disabilit$).ti,ab,kf. OR (work adj disabilit$).ti,ab,kf. OR (work adj abilit$).ti,ab,kf. OR workabilit$.ti,ab,kf. OR activities of daily living.ti,ab,kf. OR (activity adj level$).ti,ab,kf. OR (mobility adj impairment$).ti,ab,kf. OR (mobility adj limitation$).ti,ab,kf. OR (performance adj decrement$).ti,ab,kf. OR (pain adj interference$).ti,ab,kf. OR work performance.ti,ab,kf. OR productivity.ti,ab,kf. OR work capacity.ti,ab,kf. OR quality of life.ti,ab,kf.
#10	Outcome - sequelae, employment (sickness absence): Sick Leave/ OR Absenteeism/ OR exp Family Leave/ OR Bed Rest/ OR absenteeism.ti,ab,kf. OR (sick$ adj absence$).ti,ab,kf. OR (sick$ adj leave$).ti,ab,kf. OR (sick$ adj day$).ti,ab,kf. OR (antenatal adj leave).ti,ab,kf. OR (prenatal adj leave).ti,ab,kf. OR (postnatal adj leave).ti,ab,kf. OR (medical adj leave).ti,ab,kf. OR (pregnan* adj leave).ti,ab,kf. OR (bed adj rest).ti,ab,kf. OR bedrest.ti,ab,kf. OR (maternity adj leave).ti,ab,kf. OR (maternal adj leave).ti,ab,kf. OR (parental adj leave).ti,ab,kf. OR leave of absence.ti,ab,kf.
#11	Outcome - sequelae, employment (employment withdrawal): (work$ adj5 dismiss$).ti,ab,kf. OR (job adj5 dismiss$).ti,ab,kf. OR (employ$ adj5 dismiss$).ti,ab,kf. OR (work$ adj cessation).ti,ab,kf. OR (job adj cessation).ti,ab,kf. OR (employ$ adj cessation).ti,ab,kf. OR (work$ adj cease).ti,ab,kf. OR (employ$ adj cease).ti,ab,kf. OR (job adj cease).ti,ab,kf. OR (job adj loss$).ti,ab,kf. OR (work$ adj5 quit$).ti,ab,kf. OR (job adj5 quit$).ti,ab,kf. OR (employ$ adj5 quit$).ti,ab,kf. OR (work$ adj5 terminat$).ti,ab,kf. OR (job adj5 terminat$).ti,ab,kf. OR (employ$ adj5 terminat$).ti,ab,kf. OR (job adj5 fired).ti,ab,kf. OR (work$ adj5 fired).ti,ab,kf. OR (employ$ adj5 fired).ti,ab,kf. OR employment retention.ti,ab,kf. OR job retention.ti,ab,kf. OR unemployment/ OR unemploy$.ti,ab,kf. OR employment.ti,ab,kf. OR workforce.ti,ab,kf. OR labor force.ti,ab,kf. OR labour force.ti,ab,kf. OR labor market.ti,ab,kf. OR labour market.ti,ab,kf. OR job market.ti,ab,kf. OR resignation.ti,ab,kf.
#12	Outcome - sequelae, employment (return to work): Return to Work/ OR (return$ adj3 work$).ti,ab,kf. OR (return$ adj3 employ$).ti,ab,kf. OR (return$ adj3 job).ti,ab,kf. OR return-to-work.ti,ab,kf. OR (back adj3 work$).ti,ab,kf. OR (back adj3 employ$).ti,ab,kf. OR (back adj3 job).ti,ab,kf. OR (work$ adj3 reentry).ti,ab,kf. OR (employ$ adj3 reentry).ti,ab,kf. OR (job adj3 reentry).ti,ab,kf. OR (work$ adj3 re-entry).ti,ab,kf. OR (employ$ adj3 re-entry).ti,ab,kf. OR (job adj3 re-entry).ti,ab,kf. OR (work$ adj3 reintegrat$).ti,ab,kf. OR (job adj3 reintegrat$).ti,ab,kf. OR (employ$ adj3 reintegrat$).ti,ab,kf. OR (work$ adj3 re-integrat$).ti,ab,kf. OR (job adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 retention).ti,ab,kf. OR (employ$ adj3 retention).ti,ab,kf. OR (job adj3 retention).ti,ab,kf. OR (work$ adj3 retain$).ti,ab,kf. OR (employ$ adj3 retain$).ti,ab,kf. OR (job adj3 retain$).ti,ab,kf. OR (work$ adj3 reacqui$).ti,ab,kf. OR (employ$ adj3 re-acqui$).ti,ab,kf. OR (job adj3 re-acqui$).ti,ab,kf. OR (work$ adj3 maint$).ti,ab,kf. OR (employ$ adj3 maint$).ti,ab,kf. OR (job adj3 maint$).ti,ab,kf. OR (work$ adj3 transition$).ti,ab,kf. OR (employ$ adj3 transition$).ti,ab,kf. OR (job adj3 transition$).ti,ab,kf. OR (work$ adj3 reengag$).ti,ab,kf. OR (employ$ adj3 reengag$).ti,ab,kf. OR (job adj3 reengag$).ti,ab,kf. OR (work$ adj3 re-engag$).ti,ab,kf. OR (employ$ adj3 re-ngag$).ti,ab,kf. OR (job adj3 re-engag$).ti,ab,kf. OR re-employ$.ti,ab,kf. OR reemploy$.ti,ab,kf. OR (employ$ adj3 re-integrat$).ti,ab,kf. OR (work$ adj3 resum$).ti,ab,kf. OR (employ$ adj3 resum$).ti,ab,kf. OR (job adj3 resum$).ti,ab,kf.
#13	Outcomes — sequelae: #7 OR #8 OR #9 OR #10 OR #11 OR #12
#14	#1 (population) AND #5 (physical job demands) AND #6 (MSDs) AND #13 (sequelae)
#15	limit #14 to yr="1990 -Current"

MacDonald. Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes. Am J Obstet Gynecol 2024.

APPENDIX B Reasons for exclusion

TABLE B.1
Full-text articles excluded with reasons

Population not employed or no results reported for an employed sub-sample (n=11)

1. Charpentier K, Leboucher J, Lawani M, et al. Back pain during pregnancy and living conditions: a comparison between Beninese and Canadian women. Annals of physical and rehabilitation medicine. 2012;55(3):148-159.
2. de Andrade CH, Bitencourt RC, de Freitas RK, da Cunha LF, Matos DC, Lira PI, Barbosa L, Lemos A. Factors associated with pain in the pelvic girdle in pregnant adolescents: A case-control study. Musculoskeletal Science and Practice. 2018 Dec 1;38:106-12.
3. Franklin MM and Lybarger CK. An analysis of posture and back pain in the first and third trimester of pregnancy. Physical Therapy. 1997;77(5):S36.
4. Kiymaz N, Yilmaz N, Zeteroğlu Ş, Yazici T. Does pregnancy induce or enhances low back pain? The Pain Clinic. 2006;18(3):247-249.
5. Manyozo S. Low back pain during pregnancy: Prevalence, risk factors and association with daily activities among pregnant women in urban Blantyre, Malawi. Malawi Medical Journal. 2019;31(1):71-76.
6. Morino S, Ishihara M, Umezaki F, Hatanaka H, Iijima H, Yamashita M, Aoyama T, Takahashi M. Low back pain and causative movements in pregnancy: A prospective cohort study. BMC Musculoskeletal Disorders. 2017 Dec;18(1):1-8.
7. Östgaard HC, Zetherström G, Roos-Hansson E. Back pain in relation to pregnancy: A 6-year follow-up. Spine. 1997 Dec 15;22(24):2945-50.
8. Shijagurumayum Acharya R, Tveter AT, Grotle M, Eberhard-Gran M, Stuge B. Prevalence and severity of low back-and pelvic girdle pain in pregnant Nepalese women. BMC pregnancy and childbirth. 2019 Dec;19:1-1.
9. Starzec-Proserpio M, Węgrzynowska M, Sys D, Kajdy A, Rongies W, Baranowska B. Prevalence and factors associated with postpartum pelvic girdle pain among women in Poland: A prospective, observational study. BMC Musculoskeletal Disorders. 2022 Dec;23(1):1-0.
10. Torres-Arreola L, Constantino-Casas P, Villa-Barragan JP et al. Health and working conditions of pregnant women working inside and outside the home in Mexico City. BMC public health. 2007;7(100968562):25.
11. Yetişgin A, Cinakli A, Nergiz AR, Mahmut KU, Satis S. Risk factors for pregnancy related low back pain. Konuralp Medical Journal. 2019;11(2):302-7.

Population not pregnant or postpartum (n=5)

1. Chavalitsakulchai P and Shahnavaz H. Problems of ergonomics in five different industries of Thailand. Paper presented at the Designing for Everyone: Proceedings of the 11th Congress of the International Ergonomics Association, Paris, 1991, Volume 2.
2. Kesztyus D, Wirt T, Kobel S et al. Is central obesity associated with poorer health and health-related quality of life in primary school children? Cross-sectional results from the Baden-Wurttemberg Study. BMC public health. 2013;13(100968562):260.
3. Pichayapinyo P, Saslow LR, Aikens JE et al. Feasibility study of automated interactive voice response telephone calls with community health nurse follow-up to improve glycaemic control in patients with type 2 diabetes. International Journal of Nursing Practice. 2019;25(6).
4. Steinhardt M, Greenhow L, Stewart J. The relationship of physical activity and cardiovascular fitness to absenteeism and medical care claims among law enforcement officers. American journal of health promotion. 1991;5(6):455-460.
5. Worku, Z. Prevalence of low-back pain in Lesotho mothers. Journal of manipulative and physiological therapeutics. 2000;23(3):147-154.

No relevant exposure or occupational physical demand measure lacked specificity (n=44)

1. Alexanderson K, Hensing G, Carstensen J et al. Pregnancy-related sickness absence among employed women in a Swedish county. Scandinavian journal of work, environment & health. 1995;191-198.
2. Andersen LK, Backhausen M, Hegaard HK, Juhl M. Physical exercise and pelvic girdle pain in pregnancy: A nested case—control study within the Danish National Birth Cohort. Sexual & Reproductive Healthcare. 2015 Dec 1;6(4):198-203.
3. Ariansen AM. Age, occupational class and sickness absence during pregnancy: a retrospective analysis study of the Norwegian population registry. BMJ open. 2014 May 1;4(5):e004381. IAN
4. Backhausen MG, Bendix JM, Damm P, Tabor A, Hegaard HK. Low back pain intensity among childbearing women and associated predictors. A cohort study. Women and Birth. 2019 Aug 1;32(4):e467-76.
5. Brady S. and Monaghan K. Working through pregnancy: The experiences of Irish hospital-based physiotherapists. Physiotherapy Ireland. 2007;28(2):11-20.
6. Bryndal A, Majchrzycki M, Grochulska A, Glowinski S, Seremak-Mrozikiewicz A. Risk factors associated with low back pain among a group of 1510 pregnant women. Journal of personalized medicine. 2020 Jun 15;10(2):51.
7. Cohen-Rosenblum AR, Varady NH, Leonovicz O et al. Repetitive musculoskeletal injuries: A survey of female adult reconstruction surgeons. The Journal of Arthroplasty. 2022.
8. Dørheim SK, Bjorvatn B, Eberhard-Gran M. Sick leave during pregnancy: A longitudinal study of rates and risk factors in a Norwegian population. BJOG: An International Journal of Obstetrics & Gynaecology. 2013 Apr;120(5):521-30.
9. Duarte VM, Meucci RD, Cesar JA. Severe low back pain among pregnant women in Southern Brazil. Ciência & Saúde Coletiva. 2018;23(8).
10. Elden H, Gutke A, Kjellby-Wendt G, Fagevik-Olsen M, Ostgaard HC. Predictors and consequences of long-term pregnancy-related pelvic girdle pain: A longitudinal follow-up study. BMC musculoskeletal disorders. 2016 Dec;17:1-3.
11. Estryn-Béhar M, Amar É, Choudat D. Regular sick leave during pregnancy: An analysis in AP-HP hospitals from 2005 to 2008 shows its major importance for demanding jobs. Nursing Care Research. 2013;113(2):51-60.
12. Estryn-Béhar M, Amar É, Choudat D. Ordinary sick leave during pregnancy: an analysis at the AP-HP from 2005 To 2008 shows their major importance for arduous jobs. Recherche en soins infirmiers. 2013;(2):51-60.

MacDonald. Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes. Am J Obstet Gynecol 2024. *(continued)*

TABLE B.1
Full-text articles excluded with reasons *(continued)*

13. Gashaw M, Yitayal MM, Zemed A, et al. Level of activity limitations and predictors in women with pregnancy-related pelvic girdle pain: Prospective cross-sectional study. Annals of Medicine and Surgery. 2022;1;78:103754.
14. Guimarães SF, Santos PC, Couto SM. Standing up, sitting or lying down: Patient position and non-specific pregnancy-related low back pain. International Journal of Therapy & Rehabilitation. 2015;22.
15. Gumy JM, Plagnol AC, Piasna A. Job satisfaction and women's timing of return to work after childbirth in the uk. work and occupations. 2022 Aug;49(3):345-75.
16. Günal A and Demirtürk F. Occupational hazards, sleep quality and musculoskeletal problems of pregnant workers. Journal of Obstetrics and Gynaecology. 2022;42(2):215-219.
17. Gutke A, Olsson CB, Vollestad N, Öberg B, Nilsson Wikmar L, Stendal Robinson H. Association between lumbopelvic pain, disability and sick leave during pregnancy - a comparison of three Scandinavian cohorts. Journal of Rehabilitation Medicine. 2014;46(5):468-474.
18. Hansen ML, Thulstrup AM, Juhl M, Kristensen JK, Ramlau-Hansen CH. Predictors of sickness absence in pregnancy: A Danish cohort study. Scandinavian journal of work, environment & health. 2015 Mar 1:184-193.
19. Hakansson A. Equality in health and health care during pregnancy: A prospective population-based study from southern Sweden. Acta obstetricia et gynecologica Scandinavica. 1994;73(9):674-9.
20. Henrotin JB, Vaissière M, Etaix M, Dziurla M, Malard S, Lafon D. Exposure to occupational hazards for pregnancy and sick leave in pregnant workers: A cross-sectional study. Annals of occupational and environmental medicine. 2017 Dec;29:1-1.
21. Henrotin JB, Vaissière M, Etaix M, Dziurla M, Malard S, Lafon D. Exposure to occupational risks during pregnancy: Return of inter-company medical services [Exposition aux risques professionnels pendant la grossesse: retour de services médicaux interentreprises]. Gynecology Obstetrics Fertility & Senology, 2018, 46 (1):20-27.
22. Henrotin JB and Béringuier H. Working at the hospital during pregnancy: A descriptive national cross-sectional study in France. Sante Publique. 2019;31(5):611-21. Translated to English
23. Kierkegaard O, Kristiansen JL. Sick-leave during pregnancy - focusing on textile workers. Ugeskrift for Laeger. 1992;154(34):2306-2308.
24. Krzepota J, Sadowska D, Biernat E. Relationships between physical activity and quality of life in pregnant women in the second and third trimester. International journal of environmental research and public health. 2018;15(12).
25. Long G, Yaoyao Z, Na Y, et al. Generalized joint laxity as a predictor of recovering from low back pain during pregnancy—a prospective study. Journal of Orthopaedic Science. 2022;27(2):342-347.
26. Malmqvist S, Kjaermann I, Andersen K et al. The association between pelvic girdle pain and sick leave during pregnancy: A retrospective study of a Norwegian population. BMC pregnancy and childbirth. 2015;15(1):1-8.
27. McGovern P, Dowd B, Gjerdingen D et al. Time off work and the postpartum health of employed women. Medical care. 1997;507-521.
28. Miranda LA, Moura AC, Kasawara KT, et al. Exercise and physical activity levels and associated factors among high-risk pregnant women. Revista Brasileira de Ginecologia e Obstetrícia. 2022;44:360-368.
29. Mogren IM. Previous physical activity decreases the risk of low back pain and pelvic pain during pregnancy. Scandinavian journal of public health. 2005;33(4):300-306.
30. Mukkannavar P, Desai BR, Mohanty U, Kulkarni S, Parvatikar V, Daiwajna S. Pelvic girdle pain in Indian postpartum women: A cross-sectional study. Physiotherapy theory and practice. 2014 Feb 1;30(2):123-130.
31. Nakamura Y, Tsuno YS, Wada A, Nagasaka K, Kawajiri M, Takeishi Y, Yoshida M, Yoshizawa T. Occupational stress is associated with job performance among pregnant women in Japan: Comparison with similar age group of women. BMC Pregnancy and Childbirth. 2022 Oct 5;22(1):749.
32. Ng BK, Kipli M, Abdul Karim AK, Shohaimi S, Abdul Ghani NA, Lim PS. Back pain in pregnancy among office workers: Risk factors and its impact on quality of life. Hormone molecular biology and clinical investigation. 2017 Sep 4;32(3):20170037.
33. Osipov VG and Efremov MM. The dynamics of the physical work capacity of women during pregnancy. Voprosy kurortologii, fizioterapii, i lechebnoi fizicheskoi kultury. 1995;(3):33-34.
34. Östgaard HC, Andersson GB, Schultz AB et al. Influence of biomechanical factors on low-back pain in pregnancy. Acta Orthop Scand. 1991;62 (Suppl 246).
35. Östgaard HC, Andersson GB. Postpartum low-back pain. Spine. 1992;17(1):53-55.
36. Pellegrini M, Panzone I, Genovese P et al. Ten years of protection of the maternity leave of women working in Pistoia. Giornale Italiano di Medicina del Lavoro ed Ergonomia. 2007;29(3): 381-382.
37. Pons RM, Agüir VE, Revuelta CC. The expectations of a woman's return to work after childbirth. Gaceta sanitaria. 1994;8(45):280-5.
38. Robinson HS, Mengshoel AM, Veierød MB, Vøllestad N. Pelvic girdle pain: Potential risk factors in pregnancy in relation to disability and pain intensity three months postpartum. Manual therapy. 2010 Dec 1;15(6):522-528.
39. Sejbaek CS, Pedersen J, Schlünssen V et al. The influence of multiple occupational exposures on absence from work in pregnancy: A prospective cohort study. Scandinavian Journal of Work, Environment & Health. 2020;46(1):60-68.
40. Shafi P, Khan R, Ahmad T, et al. Prevalence of lower back pain in pregnant women with pre-eclampsia. Pakistan Journal of Medical & Health Sciences. 2021;33(7.41):32-47.
41. Stapleton DB, MacLennan AH, Kristiansson P. The prevalence of recalled low back pain during and after pregnancy: A South Australian population survey. Australian and New Zealand journal of obstetrics and gynaecology. 2002 Oct;42(5):482-5.
42. Villar Vinuesa R, Benavides FG, Serra Saurina L, Serra C. Prestación por riesgo durante el embarazo e incapacidad temporal en una cohorte de trabajadoras del Parc de Salut Mar (Barcelona, España). Gaceta Sanitaria. 2019 Sep-Oct; 33 (5): 455-61. 2019.
43. Villar R, Serra L, Serra C, et al. Working conditions and absence from work during pregnancy in a cohort of healthcare workers. Occupational and Environmental Medicine. 2019;76(4):236-242.
44. Wada S, Matsubara S. Kinematic changes of pregnant gait during pregnancy and post-partum. Gait & Posture. 2018;65:327-328.

TABLE B.1
Full-text articles excluded with reasons *(continued)*

Work and non-work physical exposures — unclear distinctions (n=2)

1. Beaucage-Gauvreau E, Dumas G, Lawani M. Trunk postural demands of occupational activities of some merchant pregnant women in Benin, West Africa. Ergonomics. 2012;55(10):1218-1228.
2. Ceprnja D, Chipchase L, Fahey P, et al. Prevalence and factors associated with pelvic girdle pain during pregnancy in Australian women: A cross-sectional study. Spine. 2021 Jul 7;46(14):944.

No relevant outcome (n=5)

1. Bonzini MM. Study of physical activity at work and pregnancy. Occupational Health; 2019;61(11):32-34.
2. Daga AS. Occupation of women and maternal and child health. Indian journal of maternal and child health. 1991;2(1):23-4.
3. Paul JA and Frings-Dresen MHW. Changes in working posture and perceived effort due to pregnancy. Paper presented at the Designing for Everyone: Proceedings of the 11th Congress of the International Ergonomics Association, Paris, 1991, Volume 2.
4. Paul JA and Frings-Dresen MHW. The standing working posture, hip load, and comfort during pregnancy: A longitudinal study. Paper presented at the Proceedings of the 12th Triennial Congress of the International Ergonomics Association, Toronto, Canada, 1994, Volume 2.
5. Makowiec-Dabrowska T, Hanke W, Radwan-Wlodarczyk Z, et al. [Working condition of pregnant women. Departures from regulation on occupations especially noxious or hazardous to women]. Wjakich warunkach pracuja kobiety bedace w ciazy? Zakres odstepstw od przepisow o pracach szczegolnie uciazliwych lub szkodliwych dla kobiet. 2003;54(1):33-43.

No relevant effect estimates reported (n=4)

1. Da Rosa PC, Sperandio FF, Sacomori C. [Analysis of occupational tasks in pregnant brazilian women with low back pain] Análisis de las actividades ocupacionales en gestantes con dolor lumbar de brasil. Rev.int.med.cienc.act.fís.deporte- vol.12 - número 48 - ISSN: 1577-0354.
2. Fanello S, Ripault B, Druker S et al. Hospital staff and their pregnancies: Changes over the past twenty years. Archives des Maladies Professionnelles et de l'Environnement. 2005;66(3):244-251.
3. Koemeester AP, Leegwater A, Broersen JP, Hoekstra EJ. Physical work load and the onset of maternity leave. Journal of Occupational Rehabilitation. 1997 Jun 1;7(2):75-82.
4. Östgaard HC, Andersson GB, Karlsson K. Prevalence of back pain in pregnancy. Spine. 1991;16(5):549-52.

Not a relevant study design for addressing research question (eg, case study) (n=7)

1. Brynhildsen J, Hansson A, Persson A et al. Follow-up of patients with low back pain during pregnancy. Obstetrics and Gynecology. 1998;91(2):182-186.
2. Kalboussi H, Bannour D, Kacem I, Debbabi F, Salah HH, Mrizak N. Influence of occupational factors on pregnant women's absenteeism in central Tunisia. Archives des Maladies Professionnelles et de l'Environnement. 2015;76(5):468-77.
3. Norén L, Östgaard S, Nielsen TF, Östgaard HC. Reduction of sick leave for lumbar back and posterior pelvic pain in pregnancy. Spine. 1997 Sep 15;22(18):2157-60.
4. Tarchi M, Bartoli D, Demi A et al. Emerging problems in enforcement of safe maternity and feeding protection at work: A public prevention service experience. Giornale Italiano di Medicina del Lavoro ed Ergonomia. 2007;29(3):385-386.
5. Thanatsis N, Kollia G, Gkliatis J, et al. Bilateral transient osteoporosis of the hip in pregnancy. Journal of Obstetrics and Gynaecology. 2018;38(3):415-416.
6. Tophoj A and Mortensen JT. Pregnancy-related and work-related sick leave of pregnant women. Ugeskrift for laeger. 1999;161(36):5009-5013.
7. Vinuesa RV, Serra C, Serra L, et al. Absence due to illness, medical and working conditions during pregnancy in a cohort of health professionals. Archivos de Prevención de Riesgos Laborales. 2022;25(2):101-18.

Not a primary study (n=23)

1. Alex MR. Occupational hazards for pregnant nurses: Finding a balance between service and safety. American Journal of Nursing. 2011;111(1):28-39.
2. Around the states. American Journal of Nursing. 2008; 108(4):20.
3. Banerjee B. Physical hazards in employment and pregnancy outcome. Indian Journal of Community Medicine; 2009;34(2):89-93.
4. Bisch C, Telliez F, Delanaud S, et al. Risk factors of distal upper-limb cumulative trauma disorders at work during pregnancy. XXIXeme Congres de la Societe de Biomecanique, Creteil, 2004. [conference proceedings]
5. Bonzini MM, Coggon D, Godfrey K et al. Risk factors of distal upper-limb cumulative trauma disorders at work during pregnancy. Occupational Health. 2009;61,11:32.
6. Borden ME. Smooth moves. American Baby. 1995;57(10):A14-72.
7. Czyzo S. Proactive pregnancy. Alive: Canada's Natural Health & Wellness Magazine. 2018;(427): 33-36.
8. Gilmour D. Risks for the new or expectant mother: Working in the perioperative environment. British Journal of Perioperative Nursing. 2000;10(6):299-304.
9. Goodwin E and Aston G. Pregnant clauses - limiting the occupational risks of heavy work and postural stress in pregnancy. Nursing Times. 1994;90(43):54-58.
10. Guidotti TL. Demystifying reproductive hazards in the workplace. Archives of Environmental and Occupational Health. 2014;69(2):125-126.
11. Katonis P, Kampouroglou A, Aggelopoulos A, Kakavelakis K, Lykoudis S, Makrigiannakis A, Alpantaki K. Pregnancy-related low back pain. Hippokratia. 2011 Jul;15(3):205.
12. Mander R. Manual handling and the immobile mother. British Journal of Midwifery. 1999;7(8): 485-487.

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TABLE B.1
Full-text articles excluded with reasons *(continued)*

13. Merry AHH & Bastiaenen CHG. Etiological determinants of pregnancy-related pelvic girdle pain. European Journal of Epidemiology. 2015;30(8):924.
14. Ogg, MJ and Anderson MA. Clinical issues. AORN Journal. 2019; 110(2):195-203.
15. Phelan ST. Oh, by the way... When do I have to quit working? Contemporary OB/GYN. 2006;51(7):33-36.
16. Pongpramorn SP. Factors associated with return to work 6 months after delivery. Occupational and environmental medicine. 2013;70(S1).
17. Pope RE. The common compensatory pattern: Its origin and relationship to the postural model. AAO Journal. 2003;13(4):19-40.
18. Prine L, Morris L, de Fiebre G et al. Helping pregnant women keep their jobs. American Family Physician. 2016;94(6):494-496.
19. Ray GG and Atreya V. A Documentation on different modes of load carrying by Indian women. Paper presented at the Proceedings of the 10th Anniversary of M.Sc. Ergonomics International Conference, 1999.
20. Russell R and Reynolds F. Back pain, pregnancy, and childbirth. British Medical Journal. 1997;314(7087):1062-1063.
21. Sneag DB, Bendo JA. Pregnancy-related low back pain. Orthopedics. 2007 Oct 1;30(10):839-845.
22. Uzelpasaci E, Topuz S, Orhan C, et al. The comparison of physical activity level in pregnant women with and without low back pain. Annals of the Rheumatic Diseases. 2018;77(S2):469.
23. Walking 2.0. Nature. 2015;520:6.

MacDonald. Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes. Am J Obstet Gynecol 2024.

APPENDIX C

TABLE C.1
Risk of bias ratings for all included articles[a]

Article	Outcome	Selection	Lifting / Postural Load[b]	Outcomes	Confounding	Analysis	Reporting	Sensitivity	Utility
Caputo 2021[36]	Low back pain during pregnancy	++	+ / ++	++	+	+	++	+	++
Larsen 2013[26]	Functionally-limiting pelvic pain during pregnancy	+++	++ / –	++	+	+++	++	+++	+++
Stomp-van den Berg 2012[27]	Pelvic girdle pain at 12 weeks postpartum	+	– / 0	++	+++	++	++	++	++
Cheng 2009[37]	Functionally-limiting back pain during pregnancy	+	– / +++	+++	0	0	+	+	0
Juhl 2005[35]	Functionally-limiting pelvic pain during pregnancy	+++	++ / +	++	+	++	++	+++	+
To 2003[29]	Back pain during pregnancy and 2 years postpartum	+	– / ++	+	0	0	0	0	0
Larsen 1999[30]	Functionally limiting pelvic pain during pregnancy	+	+ / +	+++	+	+	+	++	+
Endresen 1995[38]	Low back pain during pregnancy	+++	+ / ++	+	+	+	+	+	+
Pedersen 2021[23]	Sick leave ≥14 days occurring ≤27 GWs	++	++ / +++	++	+++	++	+++	++	+++
Stafne 2019[24]	Sick leave due to LBP and/or PGP during pregnancy	++	– / +	++	+	+	0	++	0
Guendelman 2016[34]	Employment withdrawal during pregnancy	++	++ / ++	++	++	+++	++	++	++
Hansen 2015[25]	First onset sick leave >15 days from 10 −29 GWs	+++	++ / +	+++	+	+++	+++	+++	++
Wallace 2013[31]	Return to work one year after delivery	++	– / +	+++	+	++	+	++	+
Kaerlev 2004[32]	Antenatal sick leave >10% working time	++	0 / 0	++	+	++	+++	++	+
Kristensen 2008[28]	Absence from work ≥2 weeks from 13 −28 GWs	++	– / +	+++	0	+	+++	++	+
Strand 1997[33]	Sick leave occurring >8 or >3 weeks before delivery	++	+ / ++	++	+	++	+++	+++	+

LBP and/or PGP, low back pain and/or pelvic girdle pain; *GW*, gestational weeks.

[a] Rating classification: critical concern (0), low quality (+), medium quality (++), high quality (+++); [b] Rating classification shown when exposure to lifting (left) or postural load (right) was measured, whereas a dash (–) indicates exposure was not measured.

MacDonald. Physical job demands in pregnancy and associated musculoskeletal health and employment outcomes. Am J Obstet Gynecol 2024.

APPENDIX D. Summary of risk of bias issues identified among included studies

All included studies collected exposure to lifting and postural load from participant self-reports. Differential exposure misclassification can occur if individuals who experience the outcome are more likely to report inflated exposure values; this risk is greatest when exposure is reported retrospectively (after outcome onset). Three studies examining associations for musculoskeletal outcomes[29,36,38] and 3 studies examining associations with employment outcomes used participants' retrospective reports of exposure.[32–34] Most included studies (62%) collected prospective self-reports of exposure, which makes it unlikely that differential recall alone explains the findings. Nonetheless, no studies reported the use of validated self-reported physical job exposures.

One study examining factors associated with return to work 12 months postpartum only reported that exposure data were collected "during pregnancy", with no gestational period specified.[31] Two studies examining associations with musculoskeletal outcomes prospectively collected exposure data during the second half of pregnancy,[27,36] when healthy worker selection effects are more likely, which can bias effect estimates toward the null.[20] All remaining studies with prospective assessments collected exposure data at or by onset of the second trimester.[23,25,26,30,35]

Three studies assessed exposure more than once.[23,34,37] Evidence from these studies indicated that exposure to lifting and postural load generally declined as pregnancy progressed. Among the remaining 13 studies that collected exposure data once, only 1 study acknowledged that effect estimates could be biased toward the null if higher levels of exposure collected earlier in pregnancy were incorrectly assumed to apply to the entire pregnancy.[25]

Reasons for lower risk of bias ratings included not performing multivariable regression analyses,[24,37] not reporting adjusted risk estimates,[29,30] and poor analytic treatment of covariates in multivariable regression analyses. Covariate treatment was judged as poor when there was risk of over-adjust, as in studies that statistically adjusted for coexposures associated with, conceptually linked to, or were surrogates for occupational lifting or postural load, such as "physical exertion,"[27] "physically strenuous work,"[35] "heavy workloads,"[28,30] and "occupational status" or "occupation group,"[25,26,31] or studies that statistically adjusted for comorbid conditions that may be associated with the exposures of interest, such as "prior sick leave,"[27] "musculoskeletal pain history,"[27,30,35] and "number of maternal morbidities."[34] Only 1 study conducted a stratified analysis to examine the influence of musculoskeletal pain history on effect estimates.[26] With limited exceptions,[26,34] few studies considered the influence of potential moderators that may attenuate or exacerbate risk in subpopulations of pregnant workers. For example, better quality studies considered the possible moderating effects of covariates, such as parity, leisure-time physical activity, and part-time work hours.[26,34] Included studies more often statistically adjusted for these and other potential moderating factors, increasing the likelihood of bias that can occur when risk is incorrectly assumed to be uniform across subgroups of pregnant workers.