Urinary incontinence increases risk of postpartum depression: systematic review and meta-analysis

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OBJECTIVE: Postpartum depression is one of the most common complications after childbearing. Urinary incontinence is a frequent symptom during pregnancy and the postnatal period, often being the first time that women experience it. This systematic review and meta-analysis aimed to synthesize the evidence on the association between urinary incontinence and postpartum depression and to assess whether this association becomes weaker at 6 months after childbirth.

DATA SOURCES: MEDLINE, Embase, Cochrane Library, Web of Science, and PsycINFO were searched from inception to December 26, 2023.

STUDY ELIGIBILITY CRITERIA: Cross-sectional and cohort studies addressing the association between urinary incontinence and postpartum depression were included.

METHODS: Pooled odds ratios and their 95% confidence intervals, and 95% prediction intervals were estimated using a DerSimonian and Laird random-effects model for the association between urinary incontinence and postpartum depression. Subgroup analyses were conducted on the basis of time after delivery (<6 or ≥6 months). The risk of bias was assessed with the National Institutes of Health Quality Assessment Tool for Observational Cohort Studies.

RESULTS: Eleven published studies were included in the systematic review and meta-analysis. Overall, the odds ratio for the association between urinary incontinence and postpartum depression was 1.45 (95% confidence interval, 1.11−1.79; 95% prediction interval, 0.49−2.40; I^2=65.9%; *P*=.001). For the 7 cohort studies, the odds ratio was 1.63 (95% confidence interval, 1.35−1.91; 95% prediction interval, 1.14−2.13; I^2=11.1%; *P*=.345). For the 4 cross-sectional studies, the odds ratio was 1.05 (95% confidence interval, 1.04−1.05; 95% prediction interval, 1.04−1.06; I^2=0.0%; *P*=.413). According to the time after delivery, the odds ratio estimates for cohort studies with a postpartum period <6 months were 1.44 (95% confidence interval, 1.07−1.81; prediction interval, 0.63−2.25; I^2=0.0%; *P*=.603) and 1.53 (95% confidence interval, 1.16−1.89; prediction interval, 0.41−2.65; I^2=50.7%; *P*=.087) for those with a postpartum period ≥6 months.

CONCLUSION: This systematic review and meta-analysis suggests that urinary incontinence may be a potential predictor of postpartum depression. Thus, it is important that health care professionals offer support and treatment options to women who experience these conditions.

Key words: cohort study, cross-sectional study, delivery type, depression, postpartum period, urinary incontinence

Introduction

Depression is one of the most common psychiatric conditions, with a high prevalence worldwide, affecting the quality of life of those who experience it.[1,2] It is estimated that at least 10% to 25% of women have experienced an episode of depression during their lifetime.[3] Postpartum depression (PPD) is one of the most common postpartum complications, and affects 14% of women after delivery, although this prevalence could be greater in developed countries.[4] PPD is characterized by a range of symptoms that occur during the first year after childbirth,[4,5] although they are most common between 6 and 8 weeks after delivery, when women experience physical changes, poorer sleep quality, and doubts or insecurities about caring for their newborn.[6] These could include, among others, decreased quality of life, depressed mood, anxiety, fatigue, hopelessness, irritability, guilt, and sleep deprivation.[3,7,8] Women with PPD are at increased risk of future episodes of depression.[7] In addition, PPD is a serious mental health condition that, if left untreated, can have negative effects on the mother−child relationship, such as poor cognitive functioning, behavioral inhibition, emotional disturbances,

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AJOG at a Glance

Why was this study conducted?

Urinary incontinence, along with other health problems, may contribute to the development of depressive symptoms, suggesting a possible association between urinary incontinence and the risk of postpartum depression. However, the available evidence remains inconclusive.

Key findings

Urinary incontinence increases the risk of postpartum depression.

What does this add to what is known?

Our study synthesized the available evidence about the association between urinary incontinence and postpartum depression. Our estimates support that urinary incontinence increases the risk of postpartum depression by 45%. In addition, estimates of increased risk of postpartum depression in women with postpartum urinary incontinence from follow-up studies do not differ significantly from those from cross-sectional studies. Finally, our analyses did not suggest that time after delivery reduces or increases the risk of postpartum depression in women with postpartum urinary incontinence.

violent behavior, and problems in adolescence.[8]

Urinary incontinence (UI) is defined as involuntary leakage of urine and is a common symptom during pregnancy and the postpartum period, often being the first time that women experience it,[9] producing adverse effects on their health and quality of life.[10] Previous evidence has shown that pregnancy and childbearing are factors associated with the onset of incontinence.[11–13] The overall mean prevalence of postpartum UI is high at approximately 31%, although during the first year after delivery these rates can range from 24% at 6 weeks to 32% at 12 weeks after delivery.[14] UI, along with other health problems such as fatigue, sexual problems, back pain, and relationship difficulties, may contribute to the development of depressive symptoms.[13] This suggests a possible association between UI and the risk of PPD, although the available evidence remains inconclusive. Therefore, this systematic review and meta-analysis aimed to: (1) synthesize and determine the association between UI and PPD, and (2) assess whether the time after delivery influences the strength of the association.

Methods

This systematic review and meta-analysis was conducted according to the MOOSE (Meta-analyses Of Observational Studies in Epidemiology) guidelines,[15] and was reported according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Supplemental Table S1)[16] and the MOOSE Reporting Guidelines for Meta-analyses of Observational Studies.[15] Previously, the protocol was registered in PROSPERO (International Prospective Register of Systematic Reviews; CRD42023427431).

Data sources and search strategy

Two reviewers (C.G.G. and E.R.G.) independently searched MEDLINE (via PubMed), Embase (via Scopus), the Cochrane database, Web of Science (WoS), and PsycINFO (via EBSCOhost) databases from inception to December 26, 2023, to identify cohort and cross-sectional studies aimed at determining the association between UI and PPD. Google Scholar was also searched, with the first 200 results screened under the assumption that the most applicable results would appear first. No language restrictions were applied. The "Find and Merge Duplicates" tool in Zotero Desktop (Corporation for Digital Scholarship, Vienna, VA) was used to search for duplicates. Any disagreements were resolved by consensus or by consulting a third researcher (A.T.C.). Further details of the search strategy used for each database are available in Supplemental Table S2. Email alerts were used to update the search. Study authors were contacted in case of missing data.

Study selection

The PI(E)COS (Populations, Interventions/Exposures, Comparators, Outcomes, and Study designs or Settings) strategy was followed to determine the inclusion criteria. Therefore, our inclusion criteria were as follows: (1) type of studies: cohort and cross-sectional studies; (2) participants: women in the postpartum period; (3) exposure: UI, defined as "involuntary loss of urine"[17]; thus, any type of UI determined through validated tests or objective measures was considered; and (4) outcomes: PPD assessed by validated questionnaires. Studies that did not report the information needed for the analyses were excluded.

Data extraction

Two authors (C.G.G. and E.R.G.) independently extracted the following information from each included study: (1) first author name and publication year; (2) type of study, country, and cohort name; (3) sample characteristics: sample size, maternal age, time after delivery, delivery type and number of deliveries, depression history, educational level, and marital status; (4) PPD outcome; (5) purpose of the study; and (6) adjustment variables for the analyses (Supplemental Table S3). Sample characteristics were reported for participants with PPD when possible; otherwise, the data are presented for all cohort participants. Regarding outcomes, we considered the association between UI and PPD as the main outcome. A third researcher (A.T.C.) independently appraised the accuracy of the extracted information.

Quality assessment

Two authors (C.G.G. and E.R.G.) independently assessed the systematic risk of bias with the National Institutes of Health (NIH) Quality Assessment Tool for Observational Cohort Studies.[18] A total of 14 items determined the quality of the studies on the basis of the clarity of

the research question, participation rate, follow-up and dropouts, power analysis, and timing of exposure and outcome measurements. The items are scored as "yes," "no," "not reported," "cannot be determined," or "not applicable." Methodological quality was rated as "strong," "good," "fair," or "poor." A third author (A.T.C.) independently appraised the accuracy of the extracted information, and they were consulted when consensus could not be reached by the 2 authors alone.

Data synthesis

When at least 2 studies reported the effect estimate, a meta-analysis was conducted considering the most adjusted effect estimates and their 95% confidence intervals (CIs). The reported odds ratios (ORs) were considered equivalent to hazard ratios; moreover, because most studies provided ORs, the analyses were performed using this effect estimate.

A pooled OR and its 95% CI were estimated using the random-effects model of DerSimonian and Laird[19] to examine the association between UI and PPD according to the study design (cohort or cross-sectional studies). When studies analyzed the association at different time points, we considered the data recorded in the shortest time after delivery. Following the Cochrane Handbook recommendations, the Higgins I^2 (I-squared) statistic was used to quantify the proportion of total variation in study estimates due to heterogeneity and ranges between 0% and 100%.[20] Values of 0% to 40% were considered "not important" heterogeneity, 30% to 60% represented "moderate" heterogeneity, 50% to 90% represented "substantial" heterogeneity, and 75% to 100% represented "considerable" heterogeneity. Their corresponding *P* values, which indicate the probability that the observed differences can be attributed to chance, were also considered; a low *P* value provides evidence of heterogeneity (variation in effect estimates beyond chance). We also addressed heterogeneity by calculating 95% prediction intervals, estimating a range in which the results of future studies are expected to be found.[21] However, working with a limited number of studies may widen the interval to account for the unreliability of the estimates, potentially leading to a considerable overestimation of the true dispersion.[22]

When studies did not report the effect estimate, the OR was calculated indirectly from the percentage of participants with and without UI and the percentage of participants diagnosed with depression. For studies that reported data from logistic regression analysis and bivariate analysis, we used those from logistic regression because it is the best-fitting model.

Subgroup analyses were conducted on the basis of time after delivery (<6 or ≥6 months). For this subgroup analysis, only cohort studies were selected because this design is better for assessing causation over time. If the study provided data from different time points, these were analyzed in the corresponding subgroup. Meta-regression models were used to determine the potential influence of baseline maternal age, percentage of vaginal deliveries, and percentage of primiparous participants on the effect estimates (data from the complete cohort were considered when the data from our study population were not available).

A sensitivity analysis was performed to assess the robustness of the summary estimates using the leave-one-out method that helps to identify if any single study disproportionately influences the overall results.[23] In addition, we performed a sensitivity analysis by removing studies[13,24] that adjusted for depression history. Finally, we estimated publication bias using the Egger regression asymmetry test, where a *P* value of <.10 was considered statistically significant.[25]

All statistical analyses were performed using Stata/SE, Version 17 (StataCorp, College Station, TX).

Results

Literature search

The systematic searches identified a total of 465 studies, of which 141 duplicate records were removed. Finally, after full-text review of the 22 studies assessed for eligibility, 7 cohort studies[10,11,13,26–29] and 4 cross-sectional studies[24,30–32] with data on the outcome of interest were included in the systematic review and meta-analysis of PPD (Figure 1). The reasons for study exclusion after full-text review are available in the supplemental material (Supplemental Table S4).

Study characteristics

The main characteristics of the studies included are available in the Table.[10,11,13,24,26–32] All studies were published between 2000 and 2023. Two follow-up studies were conducted in Australia,[26,28] and 1 study each in France,[11] the Czech Republic,[13] South Korea,[10] the United States,[29] and Canada.[27] Regarding cross-sectional studies, 1 study each was from the United States,[24] Canada,[30] Turkey,[32] and China.[31] The total number of participants included in the cohort studies ranged from 204 to 83,066, and in the cross-sectional studies, it ranged from 102 to 519. A total of 92,974 participants were included: 91,544 in the cohort studies and 1430 in the cross-sectional studies. The maternal age range for the included participants was between 15 and 40 years. The time after delivery ranged from 25 days to 1 year. The most frequent type of delivery was spontaneous vaginal delivery. The number of deliveries ranged from 1 to 5. The inclusion of participants with UI during pregnancy was reported by Swenson et al[29] and Suar et al,[32] and 2 studies reported the percentage of prenatal depressive symptoms, with rates of 83%[13] and 37%.[29] Meanwhile, 2 studies[28,30] analyzed the OR for PPD, and only one[30] found a significant association. Between 4.5% and 16.4% of the women were single, divorced, or widowed. Conversely, between 18.6% and 97.5% had attained a university or professional school education.

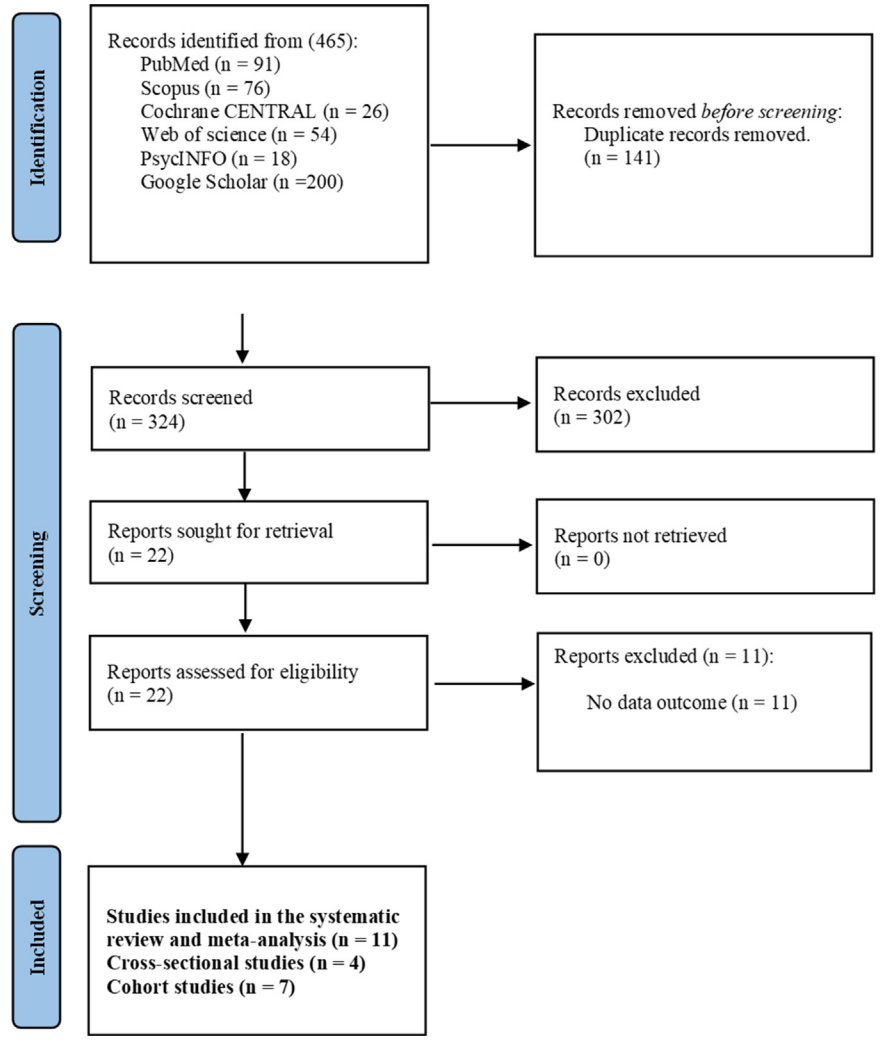
Exposure

Overall, the included studies did not report the type of UI, except for 1 study[13] that reported stress UI.

Outcomes and adjustments

All but one[10] of the studies included in our review used the Edinburgh Postnatal

FIGURE 1
Flow diagram



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Depression Scale (EPDS) to measure PPD. Six studies[11,13,24,29–31] reported data on the threshold score for the diagnosis of depression, considering a cutoff of 9 to 10 (strong diagnostic evidence) as indicative of depression (major and minor), whereas 4 studies[26–28,32] used a score of 12 to 13 (convincing diagnostic evidence) as indicative of this disorder.[33] The study by Nam et al[10] used diagnostic codes for depressive episodes associated with the puerperium to measure PPD, which was conceptualized as the patient needing a consultation at least once in the first 6 months postpartum, with a new diagnosis of the following depressive disorders, all coded: bipolar affective disorder, depressive episodes, recurrent depressive disorder, persistent mood disorders; other mood disorders; unspecified mood disorder; mixed anxiety and depressive disorder; or puerperium-associated mental disorder. There was heterogeneity among the adjustment variables, but most were related to maternal age, marital status, delivery type, number of deliveries, and depression history (Supplemental Table S3).

Risk of bias and certainty of evidence

Quality assessment using the NIH score showed that 8 studies were scored as "good" quality[11,13,27–32] and 3 as "fair" quality[10,24,26] (Supplemental Table S5).

Meta-analyses

First, the association between UI and PPD was analyzed by subgroups according to study type. In the 7 cohort studies,[10,11,13,26–29] with a total of 91,544 participants, the pooled OR was 1.63 (95% CI, 1.35−1.91; 95% prediction interval, 1.14−2.13; I^2=11.1%; *P*=.345). In the 4 cross-sectional studies,[24,30–32] with a total of 1430 participants, the pooled OR was 1.05 (95% CI, 1.04−1.05; 95% prediction interval, 1.04−1.06; I^2=0.0%; *P*=.413). Overall, the OR for the association between UI and PPD was 1.45 (95% CI, 1.11−1.79; 95% prediction interval, 0.49−2.40; I^2=65.9%; *P*=.001) (Figure 2).

Second, a subgroup analysis of the cohort studies according to the time after delivery was conducted. In the 4 studies[11,27–29] whose time after delivery was <6 months, with a total of 4573 participants, the pooled OR was 1.44 (95% CI, 1.07−1.81; I^2=0.0%; *P*=.603). In the 5 studies[10,11,13,26,28] whose time after delivery was ≥6 months, with a total of 89,502 participants, it was 1.53 (95% CI, 1.16−1.89; prediction interval, 0.41−2.65; I^2=50.7%; *P*=.087) (Figure 3).

Sensitivity analyses and meta-regression models

For cross-sectional studies, the pooled OR was significantly modified in magnitude when removing data from Doering et al[24] and Ganann et al.[30] For time after delivery <6 months, the pooled OR was significantly modified, although it was similar, when removing data from Sword et al[27] and Fritel et al.[11] The pooled OR estimate was not significantly modified for cohort studies (neither removing the retrospective cohort)[29] and time after delivery ≥6 months. In addition, removing studies that adjusted for depression history

TABLE
Characteristics of the included studies

Reference, y	Type of study (country)	n	Maternal age (y)	Time after delivery	Delivery type	Number of deliveries	UI during pregnancy	Depression history	Educational level	Marital status	Depression measurement	Purpose of study
Cohort studies												
Brown and Lumley,[26] 2000	Prospective cohort, Australia	204	<20 (1.7%); 20–24 (12.9%); 25–29 (34.9%); 30–34 (38.3%); >35 (12.3%)[a]	8 mo	Spontaneous vaginal (69.4%); forceps (11.6%); vacuum extraction (0.7%); emergency cesarean (8.2%); elective cesarean (8.8%)[a]	1 (38.4%); 2 (35.4%); 3 (17.4%); 4 (5.9%) ≥5 (2.9%)[a]	NR	NR	NR	NR	EPDS (≥13)	To investigate postnatal experiences, physical health, emotional well-being, and use of health services in the first months PP
Fritel et al,[11] 2016	Prospective cohort (EDEN), France	1226	<25 n=203; 25–29 n=530; 30–34 n=471; ≥35 n=209[a]	4 and 12 mo	Spontaneous vaginal n=1023; instrumental n=162; cesarean n=224[a]	1 n=686; 2 n=504; ≥3 n=221[a]	No	NR	<HSch diploma n=355; HSch diploma n=257; University, first Deg. n=319; >University, first Deg. n=460[a]	Married couple n=768; Unmarried couple n=65; Single n=72[a]	EPDS (≥10)	To test whether PP UI is related to altered mood or taking psychotropic drugs, and how this association evolves over time
Jurášková et al,[13] 2020	Prospective cohort (ELSPAC-CZ), Czech Republic	3701	<19 (11.3%); 20–24 (40%); 25–30 (33.2%); >30 (15.5%)	6 mo	Spontaneous vaginal (88.5%); instrumental vaginal (1.8%); cesarean-induction (3.9%); cesarean acute (3.7%); missing (2.1%)	1 (50.2%); 2 (39.6%); 3 (7.9%); ≥4 (2.3%)	NR	Yes (83.4%); No (13%); Missing (0.8%)	Primary (27%); Secondary (43.7%); University (18.6%); Missing (0.6%)	Married (88%); Divorced/ widowed (2.9%); Single (8%); Missing (1.1%)	EPDS (≥10)	To identify risk factors related to SUI and PPD after birth and investigate both possible directions of the association between SUI and PPD population-based sample

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(continued)

TABLE
Characteristics of the included studies *(continued)*

Reference, y	Type of study (country)	n	Maternal age (y)	Time after delivery	Delivery type	Number of deliveries	UI during pregnancy	Depression history	Educational level	Marital status	Depression measurement	Purpose of study
Nam et al,[10] 2021	Prospective cohort (NHIS-NSC), Korea	83066	15−24 (4.67%); 25−29 (30.14%); 30−34 (47.70%); 35−39 (15.39%); ≥40 (2.09%)	6 mo	Spontaneous vaginal (56.53%); instrumental (6.33%); cesarean delivery (37.14%)	1 (nulliparous) (63.76%); 2 (32.07%); 3 (4.17%)	NR	NR	NR	NR	Diagnostic codes for depressive episodes	To investigate the association between UI and PPD 6 mo after childbirth and analyze the effect of other risk factors
Swenson et al,[29] 2018	Retrospective cohort (USA)	284	30.6±4.8	25 d	All vaginal delivery (forceps, n=12 and vacuum, n=30)[a]	Nulliparous women 79.6%[a]	UI during pregnancy and PP. 28.9% of those with PPD and 10.1% of those without PPD [b]	Depression/ anxiety (37%)[a]	NR	NR	EPDS (≥10)	To determine the prevalence of a positive PPD screen in a specialty PP perineal clinic and identify risk factors
Sword et al,[27] 2011	Prospective cohort (The Ontario Mother and Infant Study [TOMIS] III), Canada	1758	31.3±5.3	6 wk	Vaginal delivery (n=1733); cesarean delivery (n=827)[a]	Not first pregnancy (OR, 1.22 [1.01−1.47])[a]	NR	NR	Less than HSch (5.9%); HSch (9.1%); Some community college/technical Sch (7.4%); Completed community college/technical Sch (22.7%); Some university (6.3%); Completed university (48.7%)[a]	Married (77.5%); Common-law/ living with partner (16.2%); Separated/ widowed/ divorced (1.1%); Never married (5.2%)[a]	EPDS (≥12)	To determine whether PPD at 6 wk following childbirth is associated with mode of delivery

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(continued)

TABLE
Characteristics of the included studies *(continued)*

Reference, y	Type of study (country)	n	Maternal age (y)	Time after delivery	Delivery type	Number of deliveries	UI during pregnancy	Depression history	Educational level	Marital status	Depression measurement	Purpose of study
Woolhouse et al,[28] 2014	Prospective cohort (the Maternal Health Study), Australia	1305	18–24 (11.3%); 25–29 (28.8%) 30–34 (40.5%) ≥35 (19.3%)	3 and 9 mo	NR	Nulliparous women	NR	Any previous depression (OR, 1.66 [0.97–2.84])	Tertiary qualifications (73.9%); Year ≤12 (26.1%)	Married (61.9%); Living with partner (34.0%); Single/ divorced/ separated (4.1%)	EPDS (≥13)	To investigate the relationship between maternal physical health problems and depressive symptoms in PP
Cross-sectional studies												
Doering et al,[24] 2019	Cross-sectional (USA)	102	<30 (51.0%); ≥30 (46.2%)	6 wk	Vaginal (72.1%); cesarean (26.9%)[a]	1 (32.7%); 2 (26.0%); ≥3 (39.4%)[a]	NR	NR	HSch or less (27.9%); Some college (18.3%); College graduate (31.7%); Graduate or professional Sch (15.4%)	Married (54.8%); Single, with partner (28.9%); Single, alone (16.4%)	EPDS (≥10)	To examine the link between UI and PPD using validated questionnaire with focus on physical symptoms and the antidepressant use
Ganann et al,[30] 2016	Prospective cohort (The Ontario Mother and Infant Study [TOMIS] III), Canada	519	32.69	6 wk, 6 mo, and 1 y	NR	NR	NR	Previous depression (OR, 1.52 [1.45–1.59])	Less than HSch (2.5%); Completed HSch (7.7%); Some community college/technical Sch or completed diploma (16.5%); Some university (7.2%); Completed bachelor's Deg./graduate Deg. (66.1%)	Married/ common-law/ living with a partner (96.5%); Single (never married)/ widowed/ separated/ divorced (3.5%)	EPDS (9–10)	To identify individual- and community-level factors predictive of PPD among immigrant women in PP

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(continued)

TABLE
Characteristics of the included studies *(continued)*

Reference, y	Type of study (country)	n	Maternal age (y)	Time after delivery	Delivery type	Number of deliveries	UI during pregnancy	Depression history	Educational level	Marital status	Depression measurement	Purpose of study
Suar et al,[32] 2023	Cross-sectional (Turkey)	406	18–34 (84.2%); ≥35 (15.8%)	8 wk to 4 mo; 5–8 mo; 9–12 mo	Vaginal delivery (53.9%); cesarean delivery (46.1%)	1 (41.1%); 2 (30.6%); ≥3 (28.3%)	74.2% of women with UI during PP	NR	Primary Sch (6.8%); Secondary Sch (32.1%); HSch (34.5%); Associate Deg. (9.1%); Undergraduate (15.5%); Graduate (1.7%)	Duration of marriage: 1–9 y, n=302 (74.4%); ≥10 y, n=104 (25.6%)	EPDS (≥13) and Nottingham Health Profile	To determine the prevalence and effect of UI in the PP on psychosocial status of women
Zhang et al, 2023[31]	Cross-sectional (China)	403	<30 (32.3%); ≥30–34 (48.1%); ≥35 (19.6%)	6 wk	Vaginal delivery n=309 (76.7%); cesarean delivery n=94 (23.3%)	Primiparous (67.5%); multiparous (32.5%)	NR	NR	Lower than college diploma (2.5%); College and above (97.5%)[a]	Marriage or relationship length duration: ≤2 y (40.9%); >2, <5 y (33.7%); ≥5 y (25.3%)	EPDS (≥10)	To examine the effect of the PP rehabilitation program on PPD and investigate possible influencing factors

Deg., degree; *ELSPAC-CZ*, European Longitudinal Study of Pregnancy and Childhood in the Czech Republic; *EPDS*, Edinburgh Postnatal Depression Scale; *HSch*, high school; *NHIS-NSC*, Korean National Health Insurance Service—National Sample Cohort; *NR*, not reported; *OR*, odds ratio; *PP*, postpartum period; *PPD*, postpartum depression; *Sch*, school; *SUI*, stress urinary incontinence; *UI*, urinary incontinence.

[a] Data of all study participants.

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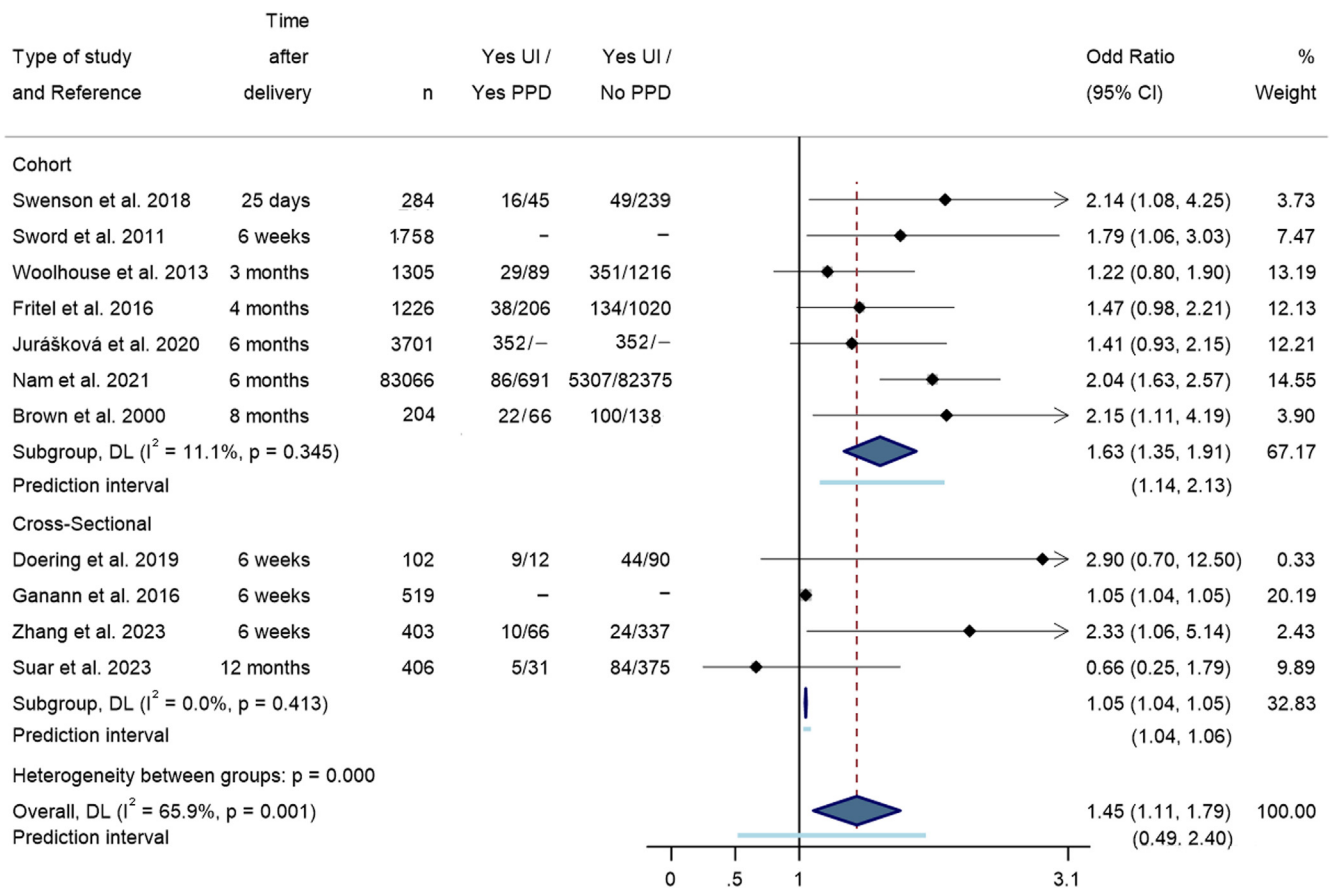
FIGURE 2
Subgroup analysis according to the type of study



"Yes UI/Yes PPD" and "Yes UI/No PPD" are the proportions of participants with UI out of the total number of participants with and without a diagnosis of PPD, respectively.

CI, confidence interval; *DL*, DerSimonian-Laird; *PPD*, postpartum depression; *UI*, urinary incontinence.

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significantly modified the pooled OR estimate for the cross-sectional studies, but not for the cohort studies or for the overall OR estimate (Supplemental Table S6).

When meta-regression models were conducted according to maternal age, percentage of vaginal deliveries, and percentage of primiparous women, no significant results were found, except for the percentage of primiparous women (Supplemental Table S7). Finally, because of the small number of studies (n<10), it was not possible to assess publication bias for any subgroup.

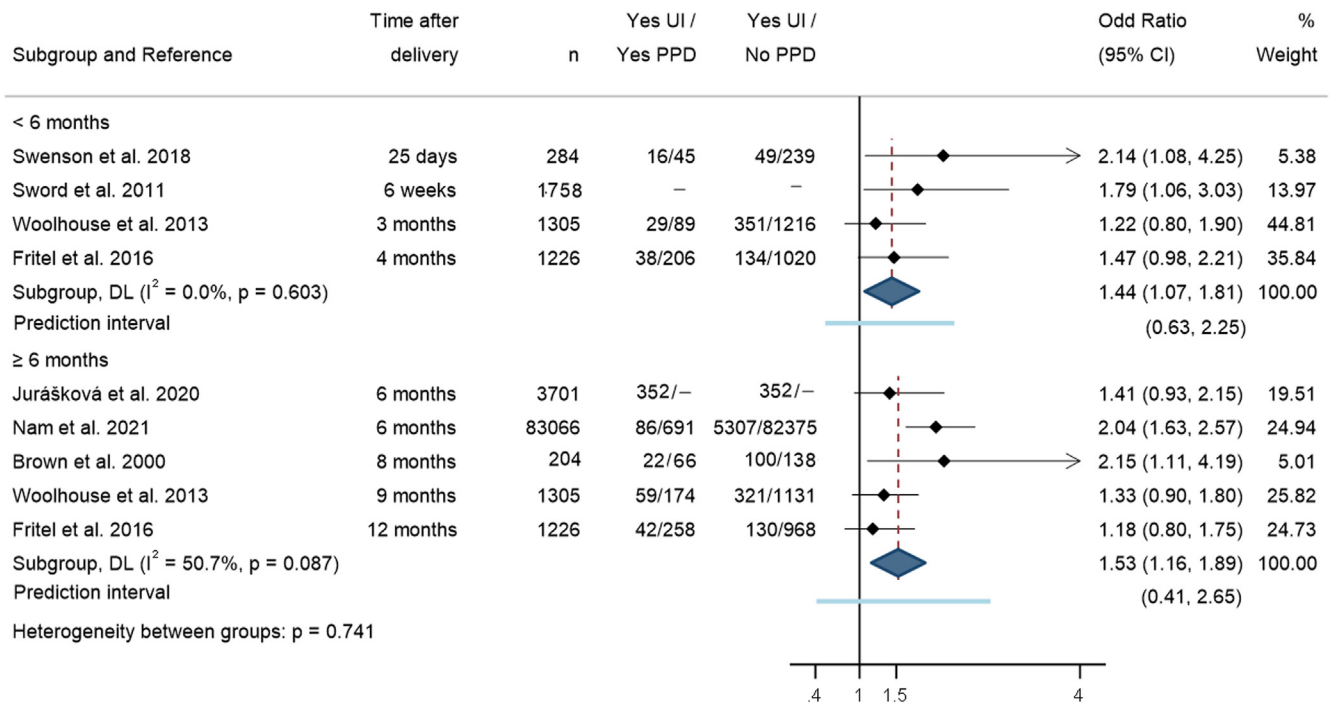
Discussion

This study synthesizes the available evidence on the association between UI and PPD. Our estimates suggest that UI may increase the risk of PPD on average by 45%. In addition, estimates of the increased risk of PPD in women with postpartum UI from follow-up studies did not differ significantly from those from cross-sectional studies, and both 95% prediction intervals excluded the null effect and maintained the same direction as the 95% CI. Finally, our analyses did not suggest that time after delivery reduced or increased the risk of PPD in women with postpartum UI.

Although the primary original studies included in the present review do not address what type of professional should treat UI-related PPD, it is very likely that the woman will initially see a primary care professional, especially if the process extends beyond the first 6 weeks when obstetrician-gynecologists routinely evaluate postpartum women for a general health examination.[34] In many cases, a multidisciplinary approach involving different health professionals may be beneficial for addressing all aspects of this situation.[35]

It is well known that UI is associated with a decline in psychological well-

FIGURE 3
Subgroup analysis of cohort studies according to time after delivery



"Yes UI/Yes PPD" and "Yes UI/No PPD" are the proportions of participants with UI out of the total number of participants with and without a diagnosis of PPD, respectively.

CI, confidence interval; *DL*, DerSimonian-Laird; *PPD*, postpartum depression; *UI*, urinary incontinence.

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being.[36] Current evidence suggests that UI may contribute to the onset of depressive symptoms in the postpartum period.[37,38] The relationship between UI and PPD is complex and multifaceted. UI can lead to changes in social relationships and the development of anxiety, mood problems, and depressive symptoms.[32] Women with UI often feel anger, shame, and low self-esteem, which negatively affect their quality of life, facilitate the development of PPD, and may be the cause of more frequent future depressive episodes.[12] Moreover, hormonal changes[39] and other factors, such as sleep disturbance[40] and a history of depression,[4] may increase the risk of not only PPD but also UI.[41,42] Our synthesis of evidence, in accordance with these previous findings, suggests a possible association between UI and PPD.

Our sensitivity analyses showed that the pooled OR changed significantly when data from some studies were removed. These changes in pooled estimates could be due to sample characteristics (such as small sample size,[24] samples that included women with less severe disease [EPDS 9−10],[30] or samples in which participants were older women with lower incomes than those who did not agree to participate[27]) or be related to the timing of the postpartum period (eg, due to a lack of data soon after delivery).[11]

Time after delivery may be an important factor in understanding the relationship between UI and PPD. However, our data showed a wide variability ranging from 25 days to 12 months, and pooled analyses did not show conclusive results, probably because cohort studies assessing the evolution of PPD over time included women with different characteristics in terms of the number of pregnancies, mode of delivery, and severity of PPD. Despite this, the trend seems to indicate an effect that does not attenuate over time, especially when considering primiparous women with severe PPD (EPDS ≥13).[28] However, this trend may change, and the association may attenuate over time when including multiparous women or women with less severe disease (EPDS ≥10).[11]

In summary, further cohort studies assessing the evolution of this association over time from the immediate postpartum period, controlling for women's prepartum characteristics (eg, history of depression or UI during pregnancy) or other postpartum-related factors (eg, age, marital status, educational level, feeding mode, parity) are needed to have a clear measure of the effect and to draw robust conclusions.

Limitations

This systematic review and meta-analysis of cohort and cross-sectional studies has several limitations that need

to be acknowledged to fully appreciate the extent of the estimates presented. First, because of the design of the included studies, temporal ambiguity prevents us from making causal inferences. Second, some circumstances that might influence the relationship between UI and PPD, such as a history of depression, sexual problems, or income level, could not be examined because of insufficient data available for analysis. Third, PPD is influenced by many confounding factors such as depression history, UI during pregnancy, breastfeeding, hypoestrogenic status, and pain. However, most studies provided only crude data, and the number of studies reporting adjusted data was limited. Fourth, it is known that stress UI is the most common UI reported by women during the postpartum period.[32,43,44] However, it cannot be concluded on the basis of our data which type of UI is most strongly associated with PPD because most studies did not report this information. Fifth, some of the studies do not include UI or depression as a primary exposure or outcome. However, to truly understand the association between these variables, a representative population of women with both conditions is needed and participants should be preselected. Finally, most studies used the EPDS scale to assess PPD. However, the score for detecting depressive episodes was not the same in all of the studies, which could be important because the cutoff value of the EPDS determines the sensitivity and specificity of the results.[45] In addition, this scale is useful for screening because it is quick to administer, sensitive to a wider range of emotional and physical symptoms commonly experienced after childbirth, and has moderate accuracy.[46] However, a definitive clinical diagnosis by a health professional is required.

Conclusion

This systematic review and meta-analysis suggests that UI may increase the risk of PPD. It is important for health care providers to be aware of this relationship and provide support and treatment options to women who experience these disorders during the postpartum period. Both conditions are treatable, and early intervention can lead to better outcomes for the mother's physical and mental well-being. ■

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Supplemental Material

Supplemental Table S1 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Guide

Supplemental Table S2 Database search strategy

Supplemental Table S3 Adjustment variables for the analysis of the included studies

Supplemental Table S4 Excluded studies with reasons for exclusion

Supplemental National Institutes of Health quality assessment for cohort and cross-sectional studies

Supplemental Table S6 Sensitivity analyses

Supplemental Table S7 Meta-regression models for the association between urinary incontinence and postpartum depression by maternal age, percentage of vaginal delivery, and percentage of primiparous women

SUPPLEMENTAL TABLE S1

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Guide PRISMA 2020 checklist

		Reporting item	Page number
Title			
Title	#1	Identify the report as a systematic review	1
Abstract			
Abstract	#2	Report an abstract addressing each item in the PRISMA 2020 for Abstracts checklist	4 and 5
Introduction			
Background/rationale	#3	Describe the rationale for the review in the context of existing knowledge	6 and 7
Objectives	#4	Provide an explicit statement of the objective(s) or question(s) the review addresses	7
Methods			
Eligibility criteria	#5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses	8
Information sources	#6	Specify all databases, registers, websites, organizations, reference lists, and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	7 and 8
Search strategy	#7	Present the full search strategies for all databases, registers, and websites, including any filters and limits used	Table S2
Selection process	#8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and, if applicable, details of automation tools used in the process	7 and 8
Data collection process	#9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and, if applicable, details of automation tools used in the process	8
Data items	#10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (for example, for all measures, time points, analyses), and, if not, the methods used to decide which results to collect	9 and 10
Study risk of bias assessment	#11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and, if applicable, details of automation tools used in the process	8 and 9
Effect measures	#12	Specify for each outcome the effect measure(s) (such as risk ratio, mean difference) used in the synthesis or presentation of results	9 and 10
Synthesis methods	#13a	Describe the processes used to decide which studies were eligible for each synthesis (such as tabulating the study intervention characteristics and comparing against the planned groups for each synthesis [item #5])	8
Synthesis methods	#13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics or data conversions	8
Synthesis methods	#13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses	8

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SUPPLEMENTAL TABLE S1

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Guide PRISMA 2020 checklist

(continued)

		Reporting item	Page number
Synthesis methods	#13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s) and method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	9 and 10
Synthesis methods	#13e	Describe any methods used to explore possible causes of heterogeneity among study results (such as subgroup analysis, meta-regression)	8
Synthesis methods	#13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results	10
Reporting bias assessment	#14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases)	8 and 9
Certainty assessment	#15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome	NR
Data items	#10b	List and define all other variables for which data were sought (such as participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	8
Results			
Study selection	#16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram (http://www.prisma-statement.org/PRISMAStatement/FlowDiagram)	10 and 11 Figure 1
Study selection	#16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded	Table S4
Study characteristics	#17	Cite each included study and present its characteristics	10 and 11 Table 1
Risk of bias in studies	#18	Present assessments of risk of bias for each included study	12 and Table S5
Results of individual studies	#19	For all outcomes, present for each study: (1) summary statistics for each group (where appropriate), and (2) an effect estimate and its precision (such as confidence/credible interval), ideally using structured tables or plots	Figures 2 and 3
Results of syntheses	#20a	For each synthesis, briefly summarize the characteristics and risk of bias among contributing studies	12 and Table S5
Results of syntheses	#20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (such as confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	12 and 13 Figures 2 and 3
Results of syntheses	#20c	Present results of all investigations of possible causes of heterogeneity among study results	NR
Results of syntheses	#20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results	13
Risk of reporting biases in syntheses	#21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed	12
Certainty of evidence	#22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed	NR
Discussion			
Results in context	#23a	Provide a general interpretation of the results in the context of other evidence	13 and 14

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SUPPLEMENTAL TABLE S1

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Guide PRISMA 2020 checklist

(continued)

		Reporting item	Page number
Limitations of included studies	#23b	Discuss any limitations of the evidence included in the review	14 and 15
Limitations of the review methods	#23c	Discuss any limitations of the review processes used	14 and 15
Implications	#23d	Discuss implications of the results for practice, policy, and future research	11 and 15
Other information			
Registration and protocol	#24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered	7
Registration and protocol	#24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared	NR
Registration and protocol	#24c	Describe and explain any amendments to information provided at registration or in the protocol	NR
Support	#25	Describe sources of financial or nonfinancial support for the review, and the role of the funders or sponsors in the review	1
Competing interests	#26	Declare any competing interests of review authors	1
Availability of data, code, and other materials	#27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytical code; any other materials used in the review	NR

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SUPPLEMENTAL TABLE S2

Database search strategy

Search set for Medline (via PubMed)
("Depression, Postpartum"[Mesh] OR "postnatal depression" OR "postpartum depression" OR "postpartum blahs" OR "maternity blues" OR "postpartum depress*" OR "puerperal depressive symptom" OR "after birth depression" OR "prenatal depression" OR "depression after childbirth") AND ("urinary Incontinence" OR "Urinary disorders" OR "Reflex Urinary Incontinence" OR "Urge Urinary Incontinence" OR "Stress Urinary Incontinence" OR "Mixed Urinary Incontinence" OR "urine loss" OR "leaking urine" OR "incontinence" OR "lower urinary tract symptoms" OR "Pelvic Floor Disorders" OR "Urinary Incontinence"[Mesh] OR "Urinary Incontinence, Urge"[Mesh] OR "Urinary Incontinence, Stress"[Mesh]OR "Lower Urinary Tract Symptoms"[Mesh]OR "Pelvic Floor Disorders"[Mesh])
Total results: 91
Search set for Scopus
("postnatal depression" OR "postpartum depression" OR "postpartum blahs" OR "maternity blues" OR "postpartum depress*" OR "puerperal depressive symptom" OR "after birth depression" OR "prenatal depression" OR "depression after childbirth") AND ("urinary Incontinence" OR "Urinary disorders" OR "Reflex Urinary Incontinence" OR "Urge Urinary Incontinence" OR "Stress Urinary Incontinence" OR "Mixed Urinary Incontinence" OR "urine loss" OR "leaking urine" OR "incontinence" OR "lower urinary tract symptoms")
Total results: 76
Search set for Cochrane CENTRAL
("postnatal depression" OR "postpartum depression" OR "postpartum blahs" OR "maternity blues" OR "postpartum depress*" OR "puerperal depressive symptom" OR "after birth depression" OR "prenatal depression" OR "depression after childbirth") AND ("urinary Incontinence" OR "Urinary disorders" OR "Reflex Urinary Incontinence" OR "Urge Urinary Incontinence" OR "Stress Urinary Incontinence" OR "Mixed Urinary Incontinence" OR "urine loss" OR "leaking urine" OR "incontinence" OR "lower urinary tract symptoms")
Total results: 26
Search set for Web of Science
("postnatal depression" OR "postpartum depression" OR "postpartum blahs" OR "maternity blues" OR "postpartum depress*" OR "puerperal depressive symptom" OR "after birth depression" OR "prenatal depression" OR "depression after childbirth") AND ("urinary Incontinence" OR "Urinary disorders" OR "Reflex Urinary Incontinence" OR "Urge Urinary Incontinence" OR "Stress Urinary Incontinence" OR "Mixed Urinary Incontinence" OR "urine loss" OR "leaking urine" OR "incontinence" OR "lower urinary tract symptoms")
Total results: 54
Search set for PsycINFO
("postnatal depression" OR "postpartum depression" OR "postpartum blahs" OR "maternity blues" OR "postpartum depress*" OR "puerperal depressive symptom" OR "after birth depression" OR "prenatal depression" OR "depression after childbirth") AND ("urinary Incontinence" OR "Urinary disorders" OR "Reflex Urinary Incontinence" OR "Urge Urinary Incontinence" OR "Stress Urinary Incontinence" OR "Mixed Urinary Incontinence" OR "urine loss" OR "leaking urine" OR "incontinence" OR "lower urinary tract symptoms")
Total results: 18
Search set for Google Scholar (the first 200 results)
“postpartum depression” AND “urinary incontinence”
Total results: 200

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SUPPLEMENTAL TABLE S3

Adjustment variables for the analysis of the included studies

References	Adjustment
Brown and Lumley,[26] 2000	No adjustment
Fritel et al,[11] 2016	Age, occupational group, marital status, parity, and center
Jurášková et al,[13] 2020	Maternal age in y, maternal education, marital status, parity, smoking status, prepregnancy body mass index, back pain, prepregnancy self-reported health, prenatal depressive symptoms, mother wetting in later childhood, depression in mother family history, birthweight, mode of delivery
Nam et al,[10] 2021	Year
Swenson et al,[29] 2018	No adjustment
Sword et al,[27] 2011	Correlation among patients within site
Woolhouse et al,[28] 2014	No adjustment
Doering et al,[24] 2019	History of depression
Ganann et al,[30] 2016	OR adjusted (adjustment variables not reported)
Suar et al,[32] 2023	No adjustment
Zhang et al,[31] 2023	Parity, expected sex of the neonate, and feeding mode

OR, odds ratio.

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SUPPLEMENTAL TABLE S4

Excluded studies with reasons for exclusion

Study	Reason for exclusion
Martínez-Galiano JM, Hernández-Martínez A, Rodríguez-Almagro J, Delgado-Rodríguez M, Rubio-Alvarez A, Gómez-Salgado J. Women's Quality of Life at 6 Weeks Postpartum: Influence of the Discomfort Present in the Puerperium. Int J Environ Res Public Health. 17 de enero de 2019;16(2):253.	No data outcome
Thompson JF, Roberts CL, Currie M, Ellwood DA. Prevalence and persistence of health problems after childbirth: associations with parity and method of birth. Birth. junio de 2002;29(2):83-94.	No data outcome
Cooklin AR, Amir LH, Nguyen CD, Buck ML, Cullinane M, Fisher JRW, et al. Physical health, breastfeeding problems and maternal mood in the early postpartum: a prospective cohort study. Arch Womens Ment Health. junio de 2018;21(3):365-74.	No data outcome
Badreddine J, Pope R, Sheyn D. Impact of Urinary Incontinence on Postpartum Sexual Function. Urogynecology (Phila). 1 de noviembre de 2022;28(11):753-62.	No data outcome
Navodani T, Gartland D, Brown SJ, Riggs E, Yelland J. Common maternal health problems among Australian-born and migrant women: A prospective cohort study. PLoS One. 2019;14(2):e0211685.	No data outcome
Hullfish KL, Fenner DE, Sorser SA, Visger J, Clayton A, Steers WD. Postpartum depression, urge urinary incontinence, and overactive bladder syndrome: is there an association? Int Urogynecol J Pelvic Floor Dysfunct. octubre de 2007;18(10):1121-6.	No data outcome
van de Pol G, van Brummen HJ, Bruinse HW, Heintz APM, van der Vaart CH. Is there an association between depressive and urinary symptoms during and after pregnancy? Int Urogynecol J Pelvic Floor Dysfunct. diciembre de 2007;18(12):1409-15.	No data outcome
Jingran Du, Juntong Ye, Hui Fei, Mengxiong Li, Yun Liu and Tian Li. Effect of epidural analgesia on pelvic floor dysfunction at 6 months postpartum in primiparous women: a prospective cohort study. Sex Med 2021 Oct;9(5):100417.	No data outcome
Mori E, Iwata H, Sakajo A, Maehara K, Tamakoshi K. Association between physical and depressive symptoms during the first 6 months postpartum. *Int J of Nursing Practice*. 2017;23(S1):e12545. https://doi.org/10.1111/ijn.12545	No data outcome
Webb DA, Bloch JR, Coyne JC, Chung EK, Bennett IM, Culhane JF. Postpartum Physical Symptoms in New Mothers: Their Relationship to Functional Limitations and Emotional Well-being. *Birth*. 2008;35(3):179-187. https://doi.org/10.1111/j.1523-536X.2008.00238.x	No data outcome
Lal M, Pattison HM, Allan TF, Callender R. Postcesarean pelvic floor dysfunction contributes to undisclosed psychosocial morbidity. *J Reprod Med*. 2009;54(2):53-60	No data outcome

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SUPPLEMENTAL TABLE S5

National Institutes of Health quality assessment for cohort and cross-sectional studies

Criteria	Brown and Lumley,[26] 2000	Fritel et al,[11] 2016	Jurášková et al,[13] 2020	Nam et al,[10] 2021	Swenson et al,[29] 2018	Sword et al.[27] 2011	Woolhouse et al,[28] 2014	Doering et al,[24] 2019	Ganann et al[30] 2016	Zhang et al,[31] 2023	Suar et al,[32] 2023
1. Was the research question or objective in this article clearly stated?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2. Was the study population clearly specified and defined?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3. Was the participation rate of eligible persons at least 50%?	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y
4. Were all the participants selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5. Was a sample size justification, power description, or variance and effect estimates provided?	Y	NR	NR	NR	NR	Y	Y	N	Y	Y	Y
6. For the analyses in this article, were the exposure(s) of interest measured before the outcome(s) being measured?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7. Was the time frame sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (eg, categories of exposure or exposure measured as a continuous variable)?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
10. Was the exposure(s) assessed more than once over time?	N	Y	Y	N	Y	N	Y	N	Y	N	Y
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

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(continued)

SUPPLEMENTAL TABLE S5

National Institutes of Health quality assessment for cohort and cross-sectional studies *(continued)*

Criteria	Brown and Lumley,[26] 2000	Fritel et al,[11] 2016	Jurášková et al,[13] 2020	Nam et al,[10] 2021	Swenson et al,[29] 2018	Sword et al.[27] 2011	Woolhouse et al,[28] 2014	Doering et al,[24] 2019	Ganann et al[30] 2016	Zhang et al,[31] 2023	Suar et al,[32] 2023
12. Were the outcome assessors blinded to the exposure status of participants?	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
13. Was loss to follow-up after baseline ≤20%?	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Quality rating (Good, Fair, or Poor)	Fair	Good	Good	Fair	Good	Good	Good	Fair	Good	Good	Good

N, no; *NR*, not reported; *Y*, yes.

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SUPPLEMENTAL TABLE S6

Sensitivity analyses

Sensitivity analyses of the cohort studies according to the time after delivery

Cohort studies <6 mo			
Study omitted	OR	LL	UL
Swenson et al,[29] 2018	1.40	1.02	1.78
Sword et al,[27] 2011	1.38	0.98	1.78
Woolhouse et al,[28] 2014	1.62	1.12	2.11
Fritel et al,[11] 2016	1.42	0.96	1.88
Cohort studies ≥6 mo			
Study omitted	OR	LL	UL
Jurášková et al,[13] 2020	1.56	1.09	2.04
Nam et al,[10] 2021	1.32	1.04	1.60
Brown and Lumley,[26] 2000	1.49	1.10	1.88
Woolhouse et al,[28] 2014	1.60	1.11	2.09
Fritel et al,[11] 2016	1.64	1.22	2.06
Sensitivity analyses according to the type of study			
Cohort studies			
Study omitted	OR	LL	UL
Swenson et al[29]	1.61	1.31	1.92
Sword et al[27,34]	1.62	1.29	1.94
Woolhouse et al,[28] 2014	1.74	1.46	2.04
Fritel et al,[11] 2016	1.67	1.32	2.01
Jurášková et al,[13] 2020	1.68	1.35	2.02
Nam et al,[10] 2021	1.46	1.15	1.77
Brown and Lumley,[26] 2000	1.61	1.31	1.92
Cross-sectional studies			
Study omitted	OR	LL	UL
Doering et al,[24] 2019	1.02	0.70	1.35
Ganann et al[30] 2016	1.18	−0.02	2.39
Zhang et al,[31] 2023	1.05	1.04	1.05
Suar et al,[32] 2023	1.05	1.05	1.06
Sensitivity analyses removing studies that adjusted for history of depression[13,24,33,35]			
Subgroup	OR	LL	UL
Cohort	1.68	1.35	2.02
Cross-sectional	1.02	0.70	1.35
Overall	1.46	1.07	1.85

LL, lower limit; *OR*, odds ratio; *UL*, upper limit.

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SUPPLEMENTAL TABLE S7

Meta-regression models for the association between urinary incontinence and postpartum depression by maternal age, percentage of vaginal delivery, and percentage of primiparous women

Outcome	n	ß (95% CI)	*P* value
Maternal age	9	0.02 (−0.22 to 0.26)	.875
Vaginal delivery, %	7	1.20 (−2.20 to 4.60)	.407
Primiparous, %	8	1.67 (0.17−3.18)	.034[a]

CI, confidence interval.

[a] Statistically significant.

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