



The Prevalence of Maternal Depression and Anxiety Beyond 1 Year Postpartum: A Systematic Review

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Abstract

Background Maternal depression and anxiety occurring beyond the 1-year postpartum period can lead to significant suffering for both mother and child. This study aimed to systematically review and synthesize studies reporting the prevalence and incidence of maternal depression and anxiety beyond 1 year post-childbirth.

Methods A systematic literature review of the PsycINFO, Medline, and Embase databases identified studies reporting on the prevalence and/or incidence of depression and/or anxiety among mothers between 1 and 12 years post-childbirth. The quality of the included studies was assessed. Findings were synthesized qualitatively.

Results Twenty-one studies were identified that met the inclusion and exclusion criteria. All studies reported the prevalence of depression, with 31 estimates ranging from 6.6% at 3 to 11 years post-childbirth to 41.4% at 3 to 4 years post-childbirth. Five of these studies also reported the prevalence of depression in subgroups (e.g., ethnic origin, income, marital status). Four studies reported the prevalence of anxiety, with nine estimates ranging from 3.7% at 5 years post-childbirth to 37.0% at 3 to 4 years post-childbirth. Only one study reported incidence. The quality of the included studies was variable, with most studies scoring above 7/9.

Conclusion Maternal anxiety and depression remain prevalent beyond the first year postpartum, particularly in marginalized subgroups. Current observational studies lack consistency and produce highly variable prevalence rates, calling for more standardized measures of depression and anxiety. Clinical practice and research should consider the prevalence of maternal anxiety and depression beyond this period.

Significance

Maternal depression and anxiety that occur beyond the first postpartum year, a commonly overlooked period in research and practice, can lead to adverse outcomes for women and their children. There is no systematic review of the prevalence of depression and anxiety in women *after* the first postpartum year. We identified 21 studies that reported the prevalence of maternal depression between 6.6 and 41.4% between 1 and 12 years post-childbirth. Four studies reported the prevalence of anxiety between 3.7 and 37.0%. Estimates were higher in marginalized groups. Our results may assist in identifying high-risk women and inform appropriate prevention and treatment strategies.

Keywords Systematic review · Maternal depression · Maternal anxiety · Prevalence

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Introduction

It is widely recognized that postpartum mental health impacts women and their families alike. For the women, postpartum depression and anxiety can impede daily functioning and quality of life. In addition to affective symptoms, women may experience a reluctance to breastfeed (Hatton et al., 2005), anxiety attacks (Beck, 1992), and impaired parenting behaviours (Flynn et al., 2004; McLearn et al., 2006). Maternal depression and anxiety have been linked to poorer social engagement (Feldman et al., 2009), depressive symptoms and psychiatric disorders (Priel et al., 2020), and insecure attachment style (Campbell et al., 2004) in their children. Maternal postpartum depression is also the strongest predictor of paternal postpartum depression in part due to impaired spousal support and diminished relationship satisfaction (Don & Mickelson, 2012; Goodman, 2004; Paulson & Bazemore, 2010).

Clinical practice and research often define postpartum depression as major depressive disorder with an onset within 1 year of giving birth (Gaynes et al., 2005). The estimated prevalence of depression in the first year postpartum ranges from 5.0 to 26.3% (Liu et al., 2022; O'hara & Swain, 1996; Underwood et al., 2016; Woody et al., 2017). The DSM-IV does not recognize postpartum anxiety, despite being highly comorbid with depression and the high prevalence of anxiety symptoms in postpartum women (Fawcett et al., 2019; Ross & McLean, 2006; Wenzel et al., 2003). Accordingly, anxiety is less frequently screened for in primary care despite an estimated prevalence in the first year postpartum ranging from 8.5 to 9.9% (Dennis et al., 2017; Goodman et al., 2016).

From a primary care and public health perspective, maternal depression and anxiety that beyond the 1-year postpartum period can still lead to suffering and adverse outcomes for women and their families. A large systematic review found that the maternal consequences of long-term postpartum depression and anxiety included difficulty maintaining social and marital relationships, depression recurrence, and risky behaviours (Slomian et al., 2019). Mental health problems in mothers of young children have also been associated with poorer school performance, stunting and underweight, and higher psychological problems in their children (Bennett et al., 2016; Closa-Monasterolo et al., 2017; Shen et al., 2016). Furthermore, the influence of parental mental health on child health is most prominent during the formative, pre-adolescent years of child development (i.e., up to age 12), where significant cognitive, emotional and social transitions occur (Collins & Madsen, 2019). For instance, Agnafors et al. (2013) demonstrated that persistent depressive symptoms in mothers were the strongest predictor of behaviour problems in children at age 12.

Understanding when in the 12 years following delivery women experience depression and anxiety has important implications for screening, treatment, and allocation of mental health resources, especially given the profound impact of maternal affect on child development. Further, understanding subgroups of women according to demographic or socioeconomic factors that experience an increased burden of anxiety and depression beyond the first postpartum year can assist in identifying women for targeted preventative action.

Although there are single studies that have assessed anxiety and depression status in women beyond the first year postpartum, to our knowledge, no systematic review examining their prevalence and incidence exists. This review aims to systematically review and synthesize the studies on the prevalence and incidence of depression and anxiety in women 1 and 12 years after giving birth.

Methods

The systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The PRISMA 2020 checklist can be found in Online Resource 1. The study protocol was published in the PROSPERO international prospective register of systematic reviews (CRD42022325002).

Search Strategies

A literature review was performed in Medline, Embase, and PsycINFO databases from their inception to December 22, 2022. The search used terms related to three themes: (1) incidence and prevalence, (2) depression and anxiety, and (3) mothers 1 to 12 years post-childbirth. Full search strategies are included in Online Resource 2.

Inclusion and Exclusion Criteria

Studies measuring the prevalence and/or incidence of depression and/or anxiety in women after 12 months and before 12 years post-childbirth using diagnostic criteria (e.g., DSM) or validated screening scales to measure anxiety and depressive symptoms were included. The exclusion criteria were: (1) review papers, non-full-text papers, and non-English papers; (2) studies that assessed women at or before 1 year postpartum; (3) studies analyzing secondary data from the same original cohort. In the case of multiple studies that analyzed anxiety and depression from the same cohort, only one study was included in the review. That choice of inclusion was made in consensus by the authors based on the recentness of the study, number of time points analyzed, measurement of both anxiety and depression, and study quality. In this way, two studies were excluded

entirely (Barthel et al., 2017; Netsi et al., 2018), one study was excluded for one depression estimate (Woolhouse et al., 2015), and one study was excluded for one anxiety estimate (Woolhouse et al., 2019).

Screening

The review was conducted using Covidence systematic review software, which removed duplicate articles. Abstract screening was completed in duplicate by two independent reviewers with 93% agreement (TRH, BAC). Full-text articles were reviewed by a single author (TRH or BAC). A random selection of 20% of the reviewed full-text articles was reviewed by two authors (KA, SM) as a reliability check. Disagreements during abstract and full-text review were resolved in consensus by all authors. The included studies progressed to quality assessment and data extraction.

Quality Assessment

The quality of each study included was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Studies Reporting Prevalence Data (Joanna Briggs Institute, 2017). This tool was designed for systematic reviews and assesses the methodological quality of included studies with nine questions on the study design, conduct, and analysis. The questions were answered as Yes, No, or Unsure, and the total score was calculated. One reviewer (TRH) completed the critical appraisal of all studies, and 20% of the studies were assessed in pairs. Conflicts were resolved in consensus by all authors.

Data Extraction

We developed the data extraction tool, which was pilot tested with two studies by all authors. Extracted data included the country of study, publication year, journal of publication, objective, and study design. We also extracted information on the study setting, population characteristics, sampling technique, sample size, response rate, and reasons for non-response. For both mental health outcomes, we extracted details on the measurement tool, the data collection time point, and the prevalence estimates. When available, we extracted stratified prevalence estimates for demographic subgroups (e.g., parity, education status, income, race, age). One reviewer (TRH) completed the data extraction, with 20% of the studies done in pairs. Conflicts were resolved in consensus by all authors.

Analysis

Of the extracted data, information most relevant to the synthesis of prevalence data are presented in table. The

prevalence rates and time point of assessment are narratively synthesized in table and text. We also narratively synthesized the prevalence of anxiety and depression by demographic subgroups in table and text. If the prevalence was reported as a fraction, the percentage calculation was performed by the author (TRH). No studies were excluded from the analysis based on the quality assessment score. We were unable to conduct a meta-analysis due to heterogeneity across studies for prevalence estimates. Since only one study measured incidence during the time-period of interest (Kothari et al., 2016), we were unable to narratively synthesize or discuss trends in incidence rates. Therefore, our results are strictly focused on point and period prevalence data.

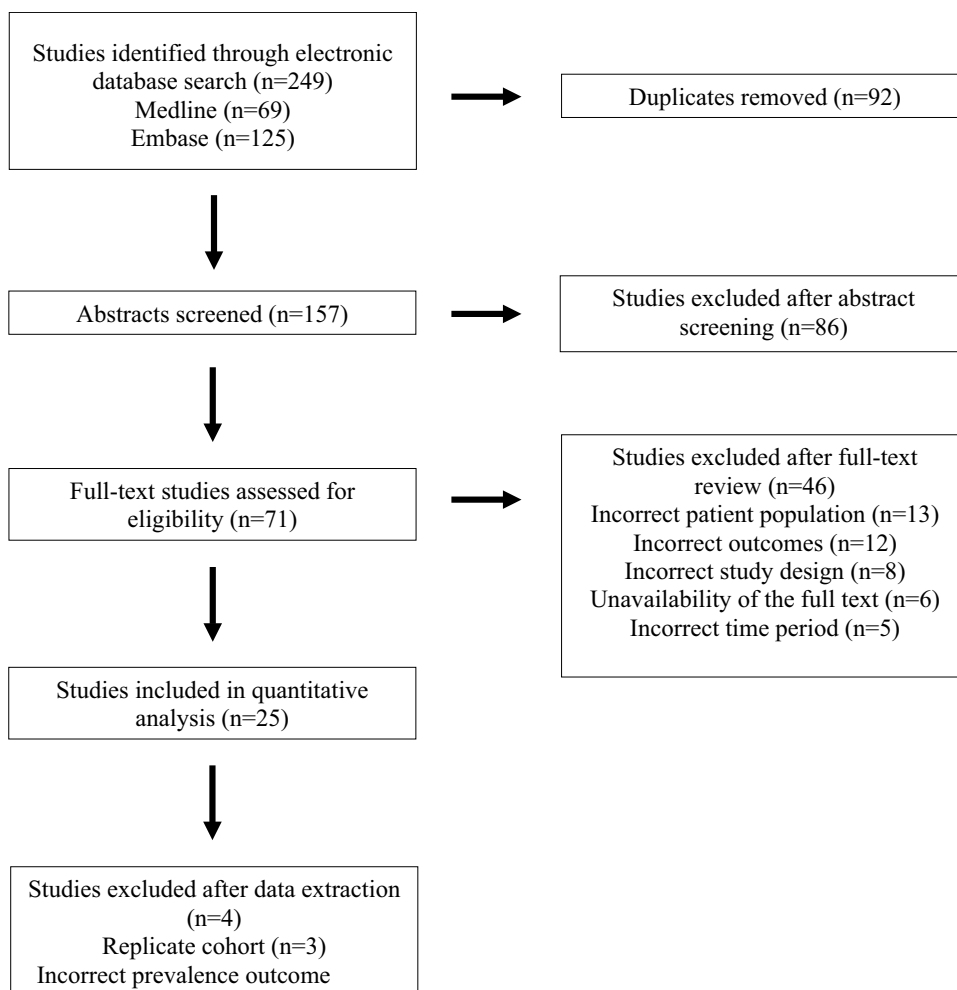
Results

Characteristics of Included Studies

Figure 1 shows the PRISMA diagram of included studies. The literature search yielded 249 citations. After duplicate removal, abstract review, and full-text review, 21 studies were included for analysis. The key characteristics of the 21 included studies are summarized in Table 1. This includes the country of origin, study design, study setting, methods, sample size, and prevalence and incidence outcomes.

Included studies were from 14 countries, with eight from the USA. According to The World Bank Group (2021), four cohorts were identified from lower-middle-income countries, two from upper-middle-income countries, and 15 from high-income countries. Sixteen studies used a prospective cohort design and five studies were cross-sectional surveys. Regarding study setting, seven studies were conducted in a clinical setting (e.g., recruitment from hospitals or primary care centers), five were population-based, three were conducted online, three involved birth cohorts, and three were conducted in both community and clinical settings. All 21 studies assessed depression and four assessed both depression and anxiety (Table 1).

The most common measurement tool used to assess depression was the Edinburgh Postnatal Depression Scale (EPDS; $n = 8$), followed by the Center for Epidemiologic Studies Depression Scale (CESD; $n = 5$), Patient Health Questionnaire (PHQ; $n = 3$), Beck Depression Inventory-II (BDI-II; $n = 2$), Hopkins Symptom Checklist-25 (HSCL-25; $n = 1$), Composite International Diagnostic Interview (CIDI; $n = 1$), and International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM; $n = 1$). Regarding anxiety, measurement tools included the Generalized Anxiety Disorder-7 (GAD-7; $n = 2$) and the Spielberger State Anxiety Inventory (SSAI; $n = 1$). One study used a condensed version of the HSCL

Fig. 1 PRISMA diagram of included studies

(SCL-8), which assesses anxiety and depression. Regarding the method of survey administration, 13 studies administered these tools as self-reported questionnaires and six studies administered these tools via interviews. One study evaluated two separate cohorts with the EPDS; however, the EPDS was administered as an interview in the first cohort and as a self-reported measure in the second cohort (Matijasevich et al., 2009). Finally, one study diagnosed depression by board-certified psychiatrists (Chen et al., 2020) (Table 1).

The quality assessment of included studies using the JBI Critical Appraisal Checklist is summarized in Table 2. The quality ratings ranged from three to nine (out of nine). Most studies had scores equal to or greater than seven ($n = 14$). The most common reasons for failing to meet the checklist criteria included a lack of drop-out analysis (Q5), limited sample frame (Q1), and lack of reported denominator values or confidence intervals for prevalence estimates (Q8).

Prevalence of Depression 1 to 12 Years Post-childbirth

Twenty-one studies assessed the prevalence of depression and include 31 total time points of measurement beyond the first postpartum year. The prevalence of depression ranged from 6.6% measured at 3 to 11 years post-childbirth (Chen et al., 2020) to 41.4% measured at 3 to 4 years post-childbirth (Leiferman et al., 2021).

There were 14 estimates of depression prevalence within or including the second postpartum year, ranging from 7.0 to 30.8% (Adhikari et al., 2022; Chi et al., 2016; Guo et al., 2014; Hahn-Holbrook et al., 2013; Horwitz et al., 2007; Kothari et al., 2016; Matijasevich et al., 2009; Mayberry et al., 2007; Reay et al., 2011; Schmidt et al., 2006; Woolhouse et al., 2015; Ystrom et al., 2014). The prevalence within or including the third year was reported five times, ranging from 12.4 to 31.8% (Adhikari et al., 2022; Chi et al., 2016; Civic & Holt, 2000; Manuel et al., 2012; Ystrom et al.,

Table 1 Characteristics of included studies and study findings

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Abdollahi and Zarghami (2018)	Iran	Prospective cohort	Women who attended primary health care centers were evaluated for depression during pregnancy. Women without depression were reassessed at 12 weeks and 4 years post-childbirth. Participants assessed with self-reported questionnaires.	During pregnancy, 1801 women reported no depressive symptoms. 1546 of these women were evaluated at 12 weeks postpartum. Women with depression at 12 weeks (n = 254) formed the case group and women without depression at 12 weeks (n = 1292) formed the control group. Four years later, all eligible cases (n = 216) and randomly selected controls (n = 475) were assessed. Overall, 98.8% completed the 4-year follow up, that is 204 cases (94.4%) and 467 controls (98.3%). The rate of primiparity was 62.3% (n = 418) at the 4-year follow up.	Depression: EPDS (> 12/30)	20.7% (139/671) at 4 years ^a	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Adhikari et al. (2022)	Canada	Secondary analysis of the All Our Families (AOF) longitudinal cohort	AOF recruited pregnant women from city-wide medical laboratory offices, maternity clinics, and community outlets. Participants self-reported depressive symptoms during pregnancy, and at 4 months, 1, 2, 3, 5, and 8 years post-childbirth.	AOF recruited 3387 women in pregnancy. The longitudinal response rate over time was over 70%. 2398 participants with relevant data up to 8 years post-childbirth were included in analysis.	Depression: CES-D ($\geq 16/60$) Anxiety: SSAI-20 ($\geq 40/80$) at 2- and 3- years SSAI-6 (1 standard deviation above the mean) at 5- and 8-years	12.5% (2) CI 11.0, 14.3) at 2 years ^b 12.4% (95% CI 11.0, 13.9) at 3 years ^b 16.1% (95% CI 14.5, 17.8) at 5 years ^b 18.6% (95% CI 17.0, 20.4) at 8 years ^b	15.4% (95% CI 13.6, 17.2) at 2 years ^b 15.2% (95% CI 13.7, 16.9) at 3 years ^b 16.4% (95% CI 14.8, 18.1) at 5 years ^b 17.4% (95% CI 15.7, 19.1) at 8 years ^b
Agnafors et al. (2013)	Sweden	Prospective birth cohort	All mothers of children from a birth cohort of 5 municipalities were asked to participate. Baseline data completed at Child Welfare Centers at the routine 3-month check-up. Follow-up was completed via self-reported questionnaires at home.	A birth cohort was identified, and 1723 mothers agreed to participate. At the 3-month baseline study, mothers completed self-reported questionnaires. At the 12-year follow-up, 1707 mothers were eligible and 893 (52.3%) participated.	Depression: HSCLI-25 ($> 1.75/4$)	21.5% (192/893) at 12 years ^a	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Chen et al. (2020)	Taiwan	Nationwide birth cohort	Population based. Children born between 01/2001 and 12/2008 were identified from the Taiwan National Health Insurance Research Database (NHIRD). Mothers and fathers of enrolled children were assessed for depression by board-certified psychiatrists pre-pregnancy, during pregnancy, and < 1 year, 1–3 years, and > 3 years post-childbirth.	The NHIRD contains data from 3,000,000 individuals. 708,515 eligible father-mother-child triads were identified and included.	Depression: ICD-9-CM (diagnostic codes 296.2x, 296.3x, 300.4, and 311)	6.6% (46,629/708,515) at 3–11 years ^a	Not measured
Chi et al. (2016)	China	Cross-sectional survey	Online community. The online survey was distributed via multiple chat platforms popular with women after delivery.	5500 mothers participated in the survey and 506 (92%) completed the survey. At the time of survey, 400 women (79.1%) had 1 child.	Depression: CES-D (≥ 16/60)	30.8% (54/175) at 1–2 years (not including at 1 year) ^a 31.8% (44/138) at 2–3 years ^a	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Civic and Holt (2000)	USA	Secondary data analysis of a cross-sectional survey and longitudinal study	Stratified random sample of women who gave birth in the USA in 1998. Secondary data analysis of the 1998 National Maternal and Infant Health Survey and the 1991 Longitudinal Follow-up Survey, which measured depressive symptoms at a mean of 17 and 36 months postpartum, respectively. Surveys were conducted via telephone or in-person interview by the National Center for Health Statistics. Survey results were linked to vital records and information from hospitals and health care providers.	9953 (74%) of the intended cohort participate in the 1998 survey. In 1991, 9440 women whose infants were living at the time were contacted and 8285 (88%) participated in the 36-month follow-up survey. After exclusion, the final sample size included 5303 eligible women.	Depression: CES-D ($\geq 16/60$)	19.9% (1053/5303) at a mean of 36 months (minimum of 2 years) ^a	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Guo et al. (2014)	Ghana and Côte d'Ivoire	Prospective birth cohort (Child Development Study)	Women in their last trimester were recruited from the Aboho Community Hospital in Côte d'Ivoire (CDI) and the Komfo Anokye Teaching Hospital in Ghana (GHA) during antenatal care visits. Women were screened for depressive and anxiety symptoms via interviews at 3 months antepartum, and 3, 12, and 24 months postpartum.	1030 women participated at baseline and 659 were eligible for follow-up analysis 285 total completed both the PHQ-9 and the GAD-7 at the 2-year follow up (i.e., 43.3% of those who completed the baseline visit)	Depression: PHQ-9 ($\geq 10/27$) Anxiety: GAD-7 ($\geq 10/21$)	6.1% (13/215) in GHA at 2 years ^a 10.0% (7/70) in CDI at 2 years ^a In total: 7.0% (20/285) at 2 years	4.7% (10/215) in GHA at 2 years ^a 1.4% (1/70) in CDI at 2 years ^a In total: 3.9% (11/285) at 2 years
Hahn-Holbrook et al. (2013)	USA	Secondary data analysis of a longitudinal study (Multi-Site Behaviour in Pregnancy Study)	Recruitment of women in their first trimester occurred at two obstetric clinics in southern California by research nurses. During pregnancy, demographic information and measures of depressive symptomatology were collected by interviewers. Participants self-reported their depressive symptoms and breastfeeding behaviour at 3, 6, 12, and 24 months postpartum.	Participants included 254 women who were enrolled in the larger longitudinal study. The present study included 205 eligible women with relevant data (80.7% included).	Depression: EPDS ($\geq 10/30$)	15% (24/160) at 24 months ^a	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Hall (1990)	USA	Cross-sectional study	Reviewed birth certificates in a North Carolina County to identify eligible children. Names of these children were matched with the kindergarten enrollment rosters for the school system. Data on everyday stressors, depressive symptoms, and sociodemographic characteristics were collected by structured questionnaires via in-home interviews. Participants were mothers of 5–6-year-old children who weighed <2500 g at birth.	Of the 612 matches made from birth certificates and kindergarten registrations, 200 mothers (33%) were contacted and agreed to participate. The study sample included 196 mothers (98%) with complete sets of data.	Depression: CES-D ($\geq 16/60$)	32.6% (64/196) at 5–6 years ^a Note: The authors report “Sixty-four mothers (49%) had scores of 16 or greater”	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Horwitz et al. (2007)	USA	Prospective pregnancy cohort (secondary analysis of birth cohort)	<p>Birth cohort (born between July 1995 and September 1997) from the Yale-New Haven Hospital was identified from birth records. Families of these children were randomly selected. The mothers were mailed a questionnaire to complete at two time points—between June to September 1998 and approximately 1 year later.</p>	<p>A sample of 1788 families was randomly selected from 7433 eligible families identified from the birth cohort. Of those sampled, 1605 were eligible and 1278 (79.8%) participated in the initial assessment. The current study only included biological mothers (n = 1208). In total, 1095 (90.6%) participated in the 1-year follow-up and 1053 were included in the final analysis. The average number of children at home was 2.08 ± 0.97 at initial assessment.</p>	<p>Depression: CES-D (≥ 16/60)</p>	<p>18.5% (188/1053) at a mean of 12.2 months after initial assessment, which was 11.5–42.1 months post-childbirth^a</p>	<p>Not measured</p>
Kothari et al. (2016)	Netherlands	Prospective longitudinal survey	<p>Women were recruited from two delivery hospitals during their postpartum stay, where baseline information was collected. They completed a telephone interview at 2 weeks, and 2, 6, and 18 months after delivery. Demographic and health-related information was collected through medical records.</p>	<p>In total, 332 women agreed to participate in the study. The final study sample included 249 (75%) women who completed all follow-ups.</p>	<p>Depression: EPDS (≥ 12/30)</p>	<p>8.4% (37/249) at 18 months^{a†}</p>	<p>Not measured</p>

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Leiferman et al. (2021)	USA	Cross-sectional study	Online community. Used convenience sampling to recruit mothers through unpaid social media posts over the course of 4 months. Mothers with children aged 1–4 years completed a 20-min online survey.	The survey was opened by 186 women and completed by 146 (78.5%) women.	Depression: PHQ-8 ($\geq 10/24$) Anxiety: GAD-7 ($\geq 10/21$)	41.4% (12/29) at 3–4 years ^a 31% (9/29) also stated they had a current clinical depression diagnosis ^a	37% (10/29) at 3–4 years ^a 10.3% (3/29) also stated they had a current clinical anxiety diagnosis ^a
Manuel et al. (2012)	USA	Secondary data analysis of the Fragile Families and Child Wellbeing Study (FFCWS), a national longitudinal study	The FFCWS was a stratified random sample of all cities with a population over 2000,000. The study examined 5000 births between 02/1998 and 09/2000 across 20 cities in the USA. Mothers and fathers were interviewed at birth (baseline), and at 1, 3, and 5 years post-childbirth.	In the FFCWS, baseline data were collected on 4898 births. For the follow-up assessments, 86% completed year 3 and 85% completed year 5. In the present study, a total of 3675 mothers had available depression ratings across all follow-up assessments were included in the study sample. 1412 women had 1 child at the 3-year assessment and 1411 had 1 child at the 5-year assessment.	Depression: CIDI-SF 1.0 (must answer affirmatively to ≥ 3 symptoms)	21% (767/3675) at 3 years ^a 17% (620/3675) at 5 years ^a	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Matijasevič et al. (2009)	Brazil and UK	Secondary data analysis of two population-based birth longitudinal cohort studies	<p>Avon Longitudinal Study of Parents and Children (ALSPAC) cohort: Recruitment of all women who resided in 3 Bristol-based health districts of the Avon County. The study enrolled women in the study area who had an expected delivery date between April 1, 1991, and December 31, 1992. Participants completed self-reported questionnaires and clinical records at 18 and 32 weeks gestation, 8-weeks postpartum, and 8-, 21-, and 33-months postpartum.</p> <p>Pelotas cohort: Recruited mothers who gave birth in Pelotas in 2004 at 5 maternity hospitals. Mothers completed questionnaires via interview shortly after delivery and completed in-home interviews at 3, 12, and 24 months after birth.</p>	<p>ALSPAC cohort: Includes 14,541 pregnancies. In total, 13,798 women were eligible and included for analysis. Response rate was 74.0% at the 21-month follow-up. At initial assessment, 5672 women (45.1%) were first time mothers, 4388 (34.8%) had 1 previous child, and 2536 (20.1%) had 2 or more previous children.</p> <p>Pelotas cohort: Includes 4287 births. 4109 mothers were eligible and included for analysis. A subsample of 965 women were chosen to complete the EPDS at 3-months and 880 responded (91.2%). Response rate was 93.5% at the 24-month follow-up. At initial assessment, 1624 (39.6%) were first time mothers, 1082 (26.3%) had 1 previous child, and 1402 (34.1%) had 2 or more previous children.</p>	<p>Depression: EPDS ($\geq 13/30$)</p>	<p>16% in ALSPAC cohort at 21 months^{a,b} 9.9% in Pelotas cohort at 24 months^{a,b}</p>	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Mayberry et al. (2007)	USA	Cross-sectional survey	Online community. Participants were recruited from the registration website. Participant's child-bearing experiences were assessed in a national survey (Listening to Mothers survey) via telephone interview or online questionnaire. A subset of mothers who completed the survey by internet were approached to complete the EPDS online.	The initial survey was completed by 1583 mothers. A subset of 1447 mothers who completed the survey online completed the EPDS. Of the 374 women who were 13–18 months postpartum, 166 (37.2%) had 1 child, 111 (21.9%) had 2 children, and 97 (23.9%) had 3 or more children. Of the 389 women who were 19–24 postpartum, 150 (33.6%) had 1 child, 129 (25.4%) had 2 children, and 110 (28.6%) had 3 or more children.	Depression: EPDS ($\geq 13/30$)	17.1% at 13–18 months ^{a,b} 20.4% at 19–24 months ^{a,b}	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Reay et al. (2011)	Australia	Prospective cohort study. Follow-up of participants in the Australian Capital Territory (ACT), one of seven pilot sites for the beyond-blue program	Participants in the beyondblue study were recruited from hospitals in the ACT. Women were screened during pregnancy and 6–8 weeks postpartum. Women were either “screened negative” or “screened positive” for depression Two years later, the current study evaluated all participants who screened positive as the case group and an equal number who screened negative as the control group. Participants were mailed a self-report questionnaire.	The ACT included 984 women from 3 hospitals. In the current study, 159 cases and 147 controls were recruited. In total, 98 cases (61.6%) and 101 controls (68.7%) completed the questionnaires. At baseline, 35.4% of cases and 31.7% of controls were primiparous. At the 2-year follow up, the average number of children in the case and control groups was 2.0 and 1.9, respectively.	Depression: EPDS (≥ 13) and BDI-II ($\geq 20/63$ indicates moderate to severe depression)	EPDS: 42.9% (42/98) of cases at 2 years ^a 11.9% (12/101) of controls at 2 years ^a Total: 27.1% (54/199) BDI-II 35.7% of cases at 2 years ^{a,b} 9.9% of controls at 2 years ^{a,b}	Not measured
Schmidt et al. (2006)	USA	Prospective cohort	Adolescent mothers who delivered at the University of Texas Medical Branch were interviewed by research assistants within 48 h of delivery. Mothers completed self-reported surveys at 3, 6, 12, 18, 24, and 48 months postpartum.	In total, 1053 mothers were eligible to participate. 26 were not asked and 95 refused, leaving 932 who completed the baseline interview. The current sample consisted of 623 mothers who completed at least 5 out of 6 follow-up surveys (66.8% response rate).	Depression: BDI ($\geq 8/39$)	23.6% (95% CI 20.2, 27.0) at 24 months ^b 21.1% (95% CI 17.7, 24.5) at 48 months ^b	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Woolhouse et al. (2019)	Australia	Prospective cohort	Women who were registered to give birth at six public hospitals in Melbourne were recruited for the Maternal Health Study by hospital staff. Participants completed self-reported questionnaires at 3 months, 12 months, and 4 years postpartum.	The final analyzed sample included 1507 eligible women. In total, 1431 (95%), 1357 (90%), and 1102 (73.1%) returned the 3-month, 12-month, and 4-year follow-ups, respectively.	Depression: EPDS ($\geq 13/30$)	13.5% at 4 years ^{a,b}	Excluded
Woolhouse et al. (2015)	Australia	Prospective cohort	Women who were registered to give birth at six public hospitals in Melbourne were recruited for the Maternal Health Study by hospital staff. Participants completed self-reported questionnaires at 3 months, 12 months, and 4 years postpartum.	The final analyzed sample included 1507 eligible nulliparous women. In total, 1431 (95%), 1400 (93%), 1357 (90%), and 1327 (88.1%) returned 3-, 6-, 12-, and 18-month follow-ups, respectively. 1102 (83.4%) returned the 4-year follow-up.	Depression: EPDS ($\geq 13/30$)	11.3% at 18 months ^{a,b}	Not measured
Wulsin et al. (2010)	Honduras	Cross-sectional	Mothers of children between 1 and 10 years of age were recruited from the waiting rooms at two primary care clinics and their surrounding neighbourhoods. Data on participants' demographics and depressive symptoms were collected by structured interviews.	The final sample included 415 women, 216 from the urban site and 199 from the rural site. The mean number of children per woman at the point of assessment was 3.59.	Depression: modified Spanish version of PHQ-9 (used the DSM-IV algorithm to classify respondents with major and minor depressive symptoms)	Major depression: 17.6% at 1–10 years ^{a,b} Minor depression: 52% at 1–10 years ^{a,b}	Not measured

Table 1 (continued)

Study citation	Country	Study design	Methods	Sample	Measurement tool (cut-off)	Depression prevalence and time point of assessment	Anxiety prevalence and time point of assessment
Ystrom et al. (2014)	Norway	Secondary data analysis of the Mother and Child Cohort study (MoBa), a population-based prospective cohort study	The MoBa study recruitment was population-based. Mothers completed self-report questionnaires during pregnancy and at 0.5, 1.5, 3, and 5 years postpartum.	The MoBa study included 95,200 mothers. The current study had 94,499 pregnancies with valid follow up data on depression and anxiety. Response rates 72.4% at 1.5 years, 58.5% at 3 years, and 53.4% at 5 years. At the time of initiating birth, the rate of primiparity among women with a single birth (n = 85,248) was 52.7%. Among women with multiple birth (n = 1842), 48.7% were primiparous.	Depression and anxiety: SCL-8 (> 1.75/4)	12.1% at 1.5 years ^{a,b} 12.5% at 3 years ^{a,b} 8.5% at 5 years ^{a,b}	5.1% at 1.5 years ^{a,b} 5.8% at 3 years ^{a,b} 3.7% at 5 years ^{a,b}

^aNo reported confidence interval (CI)

^bNo reported numerator/denominator

BDI-II Beck Depression Inventory-II, *CES-D* Center for Epidemiologic Studies Depression Scale, *CIDI* Composite International Diagnostic Interview, *EPDS* Edinburgh Postnatal Depression Scale, *GAD* Generalized Anxiety Disorder, *HSL-25* Hopkins Symptom Checklist-25, *PHQ* Patient Health Questionnaire, *SSAI* Spielberger State Anxiety Inventory

Table 2 Quality assessment of included studies using the JBI Critical Appraisal Checklist

Study citation	Quality assessment questions ^a									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Total
Abdollahi and Zarghami (2018)	Y	Y	Y	Y	N	Y	Y	N	Y	7
Adhikari et al., (2022)	Y	Y	Y	Y	U	Y	Y	Y	Y	8
Agnafors et al. (2013)	Y	Y	Y	Y	N	Y	Y	N	U	6
Chen et al., (2020)	Y	Y	Y	Y	Y	Y	Y	N	Y	8
Chi et al., (2016)	N	N	Y	Y	N	Y	Y	N	Y	5
Civic and Holt (2000)	Y	Y	Y	Y	Y	Y	Y	N	Y	8
Guo et al., (2014)	Y	Y	Y	Y	U	Y	Y	N	Y	7
Hahn-Holbrook et al., (2013)	U	U	Y	Y	U	Y	Y	N	U	4
Hall (1990)	N	Y	Y	Y	Y	Y	Y	N	Y	7
Horwitz et al., (2007)	Y	Y	Y	Y	Y	Y	Y	N	Y	8
Kothari et al., (2016)	Y	Y	Y	Y	N	Y	Y	N	Y	7
Leiferman et al., (2021)	N	N	Y	Y	N	Y	Y	N	Y	5
Manuel et al., (2012)	Y	Y	Y	Y	U	Y	Y	N	Y	7
Matijasevich et al., (2009)	Y	Y	Y	Y	N	Y	Y	N	Y	7
Mayberry et al., (2007)	N	N	Y	Y	N	Y	Y	N	N	4
Reay et al., (2011)	Y	Y	Y	Y	Y	Y	Y	N	Y	8
Schmidt et al., (2006)	U	Y	Y	Y	Y	Y	Y	N	Y	7
Woolhouse et al., (2019)	U	Y	Y	Y	Y	Y	Y	N	Y	7
Woolhouse et al., (2015)	U	Y	Y	Y	Y	Y	Y	N	Y	7
Wulsin et al., (2010)	U	N	Y	Y	N	N	Y	N	N	3
Ystrom et al., (2014)	Y	Y	Y	Y	U	Y	Y	N	U	6

Y Yes, N No, U Unsure

^aQuality assessment questions:

Q1: Was the sample frame appropriate to address the target population?

Q2: Were study participants sampled in an appropriate way?

Q3: Was the sample size adequate?

Q4: Were the study subjects and the setting described in detail?

Q5: Was the data analysis conducted with sufficient coverage of the identified sample?

Q6: Were valid methods used for the identification of the condition?

Q7: Was the condition measured in a standard, reliable way for all participants?

Q8: Was there appropriate statistical analysis?

Q9: Was the response rate adequate, and if not, was the low response rate managed appropriately?

2014). In the fourth postpartum year, depression prevalence was reported four times, ranging from 13.5 to 41.4% (Abdollahi & Zarghami, 2018; Leiferman et al., 2021; Schmidt et al., 2006; Woolhouse et al., 2019). There were four estimates of depression prevalence within or including the fifth postpartum year, ranging from 8.5 to 32.6% (Adhikari et al., 2022; Hall, 1990; Manuel et al., 2012; Ystrom et al., 2014). The prevalence at 8 years was reported once at 18.6% (Adhikari et al., 2022). Other prevalence measurements included 6.6% between 3 and 11 years (Chen et al., 2020) and 17.6% between 1 and 10 years (Wulsin et al., 2010). Finally, one study of women with children 12 years of age reported the prevalence of depression as 21.5% (Agnafors et al., 2013). These results are summarized in Table 1.

Seven studies analyzed the prevalence of depression at multiple time points beyond the first-year post-childbirth.

Chi et al. (2016) reported a slight increase in depression prevalence from the second to third year post-childbirth from 30.8 to 31.8%. Mayberry et al. (2007) found an increase between 13–18 months and 19–24 months from 17.1 to 20.4%. Adhikari et al. (2022) also demonstrated an increase between 2 and 8 years post-childbirth from 12.5 to 18.6%. Two studies reported a decrease in depression prevalence: (1) 23.6 to 21.1% from 2 to 4 years (Schmidt et al., 2006); and (2) 21 to 17% from 3 to 5 years (Manuel et al., 2012).

Prevalence of Depression in Socio-demographic Subgroups

The prevalence of depression in multiple socio-demographic subgroups is reported in Table 3. Four studies reported the prevalence of depression in ethnic subgroups.

Table 3 Prevalence of depression in demographic subgroups

Study citation	Subgroup	Prevalence of depression	
Matijasevich et al., (2009)	Race:		
	Black/Mixed	18.4% at 21 months 19.1% at 24 months	
	White	9.5% at 21 months 14.9% at 24 months	
	Income:		
	1st family income quintile	15.6% at 21 months 22.7% at 24 months	
	2nd family income quintile	11.1% at 21 months 19.7% at 24 months	
	3rd family income quintile	8.8% at 21 months 16.1% at 24 months	
	4th family income quintile	5.9% at 21 months 12.7% at 24 months	
	5th family income quintile	6.7% at 21 months 8.9% at 24 months	
	Marital status:		
	Married	9.3% at 21 months 15.6% at 24 months	
	Single	19.5% at 21 months 18.4% at 24 months	
	Schmidt et al., (2006)	Race:	
		Mexican American	24.5% at 24 months 21.3% at 48 months
African American		16.9% at 24 months 20.0% at 48 months	
Caucasian		30.1% at 24 months 22.2% at 48 months	

Table 3 (continued)

Study citation	Subgroup	Prevalence of depression	
Manuel et al., (2012)	Race:		
	Non-Hispanic Black	22.8% at 3 years 17.6% at 5 years	
	Hispanic	17.8% at 3 years 13.6% at 5 years	
	Non-Hispanic White	20.8% at 3 years 19.7% at 5 years	
	Other	17.3% at 3 years 14.3% at 5 years	
	Income:		
	< 100% of poverty threshold	24.8% at 3 years 20.3% at 5 years	
	100–199% of poverty threshold	21.6% at 3 years 16.4% at 5 years	
	200–299% of poverty threshold	17.4% at 3 years 15.2% at 5 years	
	> 300% of poverty threshold	14.3% at 3 years 11.9% at 5 years	
	Marital status:		
	Married	15.7% at 3 years 13.5% at 5 years	
	Divorced/Separated	29.1% at 3 years 24.8% at 5 years	
	Single	26.0% at 3 years 18.1% at 5 years	
	Education level:		
	> 12 years	19.9% at 3 years 16.6% at 5 years	
	Hall (1990)	Race:	
		Black	41.2% at 5–6 years
		White	21.4% at 5–6 years
		Marital status:	
Married		24.8% at 5–6 years	
Divorced/Separated		31.1% at 5–6 years	
Never-Married		33.3% at 5–6 years	
Education level:			
> 12 years	15.2% at 5–6 years		
Wulsin et al., (2010)	Employment status:		
	Employed	30.4% at 5–6 years	
	Unemployed	33.8% at 5–6 years	
	Place of residence:		
Rural	16.2% at 1–10 years		
Urban	18.8% at 1–10 years		

The greatest difference in depression prevalence between ethnic subgroups was reported by Hall (1990), with 41.2% of Black women and 21.4% of white women reporting depressive symptoms at 5 to 6 years post-childbirth (Table 3).

Three studies reported the prevalence of depression in income subgroups. The greatest difference in depression prevalence between the highest and lowest recorded income subgroups was found in a Brazilian cohort. At 24 months post-childbirth, 22.7% of women in the first family income quintile reported depressive symptoms, compared to 8.9% of women in the fifth family income quintile (Matijasevich et al., 2009). In all studies that reported the prevalence of depression in subgroups based on income, a higher prevalence was found in women of lower income compared to higher income (Table 3).

Three studies reported the prevalence of depression in subgroups based on marital status. Consistently, the prevalence of depression was lower in married women compared to single or divorced women. For instance, Hall (1990) found at 5 to 6 years post-childbirth, depressive symptoms were reported by 33.3% of never married women, 31.1% of divorced or separated women, and 24.8% of married women. The prevalence of depression in women with > 12 years of education ranged from 15.2% (measured at 5 to 6 years) (Hall, 1990) to 19.9% (measured at 3 years) (Manuel et al., 2012). In women 1 to 10 years post-childbirth, 16.2% of those living in a rural area and 18.8% of those living in an urban area reported depressive symptoms (Wulsin et al., 2010). Furthermore, Hall (1990) found that at 5 to 6 years post-childbirth, 33.8% of unemployed and 30.4% of employed women reported depressive symptoms (Table 3).

Finally, no association could be found between the income level of the country and depression prevalence. Both the highest and lowest prevalence estimates (6.6 to 41.4%) were found in high-income countries. Only six prevalence estimates came from low-income countries, ranging from 7.0 and 31.8%.

Prevalence of Anxiety 1 to 12 Years Post-childbirth

As shown in Table 1, four studies assessed the prevalence of anxiety and included nine total time points of measurement beyond 1 year post-childbirth. The prevalence of anxiety ranged from 3.7%, measured at 5 years (Ystrom et al., 2014), to 37%, measured at 3 to 4 years (Leiferman et al., 2021). Other prevalence estimates were 3.9% at 2 years (Guo et al., 2014), 5.1% at 1.5 years (Ystrom et al., 2014), and 5.8% at 3 years (Ystrom et al., 2014). None of the included studies reported the prevalence of anxiety by population subgroups.

Adhikari et al. reported an increasing prevalence of anxiety at four time points post-childbirth. The prevalence at 2, 3, 5, and 8 years post-childbirth was 15.4%, 15.2%, 16.4%, and 17.4%, respectively.

Discussion

The current systematic review identified 21 studies reporting the prevalence of depression and/or anxiety in women between 1 and 12 years post-childbirth. Only one study reported the incidence of depression. Prevalence estimates of depression were much more abundant, with 31 total estimates across 21 studies. The prevalence of depression ranged from 6.6 to 41.4%. There were nine prevalence estimates of anxiety across four studies, ranging from 3.7 to 37%. Overall, our results indicate a vast range of anxiety and depression prevalence estimates.

Five studies reported the prevalence of depression in demographic subgroups. The prevalence of depression varied in subgroups based on ethnic origin, but was as high as 41.2% in Black women and as low as 9.5% in white women. The prevalence of depression was consistently higher in women of lower income compared to higher income, ranging from 6.7% in women in the top family income quintile in England to 41.7% in American women with the lowest annual family income. The prevalence of depression was also consistently higher in unmarried women than in married women, ranging from 9.3% in married women to 33.3% in never married women.

Overall, the review findings show that maternal depression and anxiety remain prevalent years beyond the immediate postpartum period. It is essential for healthcare professionals, researchers, and policy makers to be aware of the chronicity of maternal anxiety and depression and its high prevalence in select subgroups, as this may assist in identifying high-risk women and inform prevention and intervention strategies. Current clinical practice focuses on the screening and treatment of women within the first postpartum year, highlighting a gap and opportunity to address maternal mental health beyond this period. Given our results, the extension of maternal mental health assessments and screening to beyond this period should be considered by those in primary care, especially since early management of maternal mental health problems can significantly improve child outcomes (Weissman et al., 2015). Moreover, stronger coordination between prenatal care and long-term mental health care is essential to ensure continuity of care for affected women into the late post-childbirth period.

It is also evident the lack of studies on the prevalence and incidence of anxiety beyond the first post-partum year. Since anxiety and depression are typically comorbid, a holistic understanding of maternal mental health is incomplete without additional studies about anxiety (Ross et al., 2003). We also identified a lack of studies assessing the incidence of depression and anxiety. Incidence is a stronger indicator than prevalence, since incidence indicates in which post-childbirth year women are most

vulnerable to develop anxiety and depression symptoms, further informing targeted screening and prevention strategies. Future studies that assess depression and anxiety at multiple time points should likewise include documentation of incidence rates. Furthermore, there remains a lack of studies on women with older children. Older childhood is a unique developmental period also highly influenced by present and previous exposure to parental depression and anxiety. For instance, adolescents who were exposed to postnatal depression in infancy may have impaired cognitive and psychosocial outcomes (Sanger et al., 2015) and adolescent depression is linked to concurrent exposure to maternal depression (Hammen et al., 2008).

Study population recruitment approaches may influence prevalence rates. The highest prevalence of anxiety and depression were both reported by Leiferman et al. Participants were recruited through social media such as Facebook, Momforum.com, and Mothering.com. Similarly high results were reported by Chi et al. (2016), who distributed a questionnaire on multiple chat platforms popular among women after delivery. In the second and third postpartum years, they reported the prevalence of depression to be upwards of 30%. Women with depression or anxiety seeking help online may be more likely to participate in studies with online recruitment strategies. Alternatively, women who are social media users may be at higher risk of adverse mental health outcomes. The recruitment strategy should be carefully considered in future prevalence and incidence studies.

The method of questionnaire administration may influence prevalence rates. Generally, the studies that collected data via interview reported lower depression and anxiety estimates than those that used self-reported questionnaires. The Matijasevich et al. (2009) study evaluated two cohorts that used different administration methods— the ALSPAC cohort was administered a self-reported EPDS and the Pelotas cohort was administered the EPDS via in-home interviews. The lower prevalence of depression in Pelotas (9.9%) than ALSPAC (16%) may be partly explained by the difference in questionnaire delivery. Participants may be less likely to disclose socially undesirable mental health information in an interview environment (Locke & Gilbert, 1995; Richman et al., 1999). The method of questionnaire administration should be addressed by future studies.

A lack of or ineffective treatment of depression and anxiety after childbirth may explain its persistence through the early and middle childbearing years. Furthermore, psychotherapy in depressed women may improve parenting distress and child mental health, but may not improve maternal perceptions of or responsiveness to their child (Cuijpers et al., 2015; Forman et al., 2007). Information on whether women were receiving treatment for depression and anxiety would contextualize the prevalence rates and symptom persistence in future studies. While most

of our included studies did not provide this information, Reay et al. (2011) found that the majority (63%) of women who were depressed prenatally or immediately postpartum received some type of treatment within the following 2 years. Additionally, Woolhouse et al. (2019) found that at 4 years post-childbirth, 13.9% of all women and 32.5% of women with depressive symptoms answered positively to psychotropic medication use within the past month.

A strength of this paper is that we systematically reviewed studies on the prevalence of anxiety and depression beyond 1 year post-childbirth, which, to our knowledge, is the first review in this regard. This paper offers extensive information on this topic, as previous systematic reviews in the field are focused on either anxiety or depression, prevalence or incidence, or the first postpartum year only (Dennis et al., 2017; Goodman, 2004; Goodman et al., 2016; Woody et al., 2017). The search strategies we used were comprehensive, as we consulted with librarians and other experts in the field. We further synthesized the findings with respect to the social determinants of health (e.g., race, income, education, urban/rural), which furthers our understanding of the women at higher risk for mental health problems.

A limitation of this review is that we limited studies to those published in English. The full-text review, study quality assessment, and data extraction were not done in pairs by the authors. This should not impact the quality of the review process because a portion of studies was reviewed by a second author, and consensus was made by all authors. Finally, we were unable to quantitatively summarize or provide a pooled estimate of the prevalence of depression and anxiety using meta-analysis due to data limitations.

Conclusion

The current systematic review identified 21 studies reporting the prevalence of depression and anxiety in women between 1 and 12 years post-childbirth. We concluded that maternal anxiety and depression remain prevalent beyond the first postpartum year, particularly in marginalized demographic subgroups. These results may assist in identifying high-risk women and inform targeted prevention and intervention strategies. There remains a lack of research analyzing the incidence and prevalence of anxiety and depression. Future directions include more longitudinal and cross-sectional studies addressing this lack of studies. Moreover, current clinical practice, which is focused on the first postpartum year, should expand the scope of maternal mental health screening, prevention, and treatment beyond this period.

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