

RESEARCH ARTICLE

When the Bough Breaks: A systematic review and meta-analysis of mental health symptoms in mothers of young children during the COVID-19 pandemic

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Abstract

Parents have experienced considerable challenges and stress during the COVID-19 pandemic, which may impact their well-being. This meta-analysis sought to identify: (1) the prevalence of depression and anxiety in parents of young children (<age 5) during the COVID-19 pandemic, and (2) sociodemographic (e.g., parent age, being racially minoritized) and methodological moderators (e.g., study quality) that explain heterogeneity among studies. A systematic search was conducted across four databases from January 1, 2020 to March 3, 2021. A total of 18 non-overlapping studies (8981 participants), all focused on maternal mental health, met inclusion criteria. Random-effect meta-analyses were conducted. Pooled prevalence estimates for clinically significant depression and anxiety symptoms for mothers of young children during the COVID-19 pandemic were 26.9% (95% CI: 21.3–33.4) and 41.9% (95% CI: 26.7–58.8), respectively. Prevalence of clinically elevated depression and anxiety symptoms were higher in Europe and North America and among older mothers. Clinically elevated depressive symptoms were lower in studies with a higher percentage of individuals who were racially minoritized. In comparison, clinically elevated anxiety symptoms were higher among studies of low study quality and in samples with highly educated mothers. Policies and resources targeting improvements in maternal mental health are essential.

KEYWORDS

anxiety, COVID-19, depression, maternal mental health, young children

1 | BACKGROUND

1.1 | Maternal mental health during the COVID-19 pandemic

The COVID-19 pandemic and its associated consequences, including reduced social contact, economic hardship, and home confinement, have had a devastating global impact

on the mental well-being of individuals across the lifespan (Vindegaard & Benros, 2020). Indeed, longitudinal studies have demonstrated that there has been an increase in mental distress in the general population from before to during the COVID-19 pandemic (Pierce, Hope et al., 2020). However, not all groups of individuals are impacted equally, with some members of the population disproportionately shouldering high levels of stress and mental health burden

associated with the pandemic compared to others. One such group are women with infants and young children under the age of 5 years. In a large population-based study in the United Kingdom, some of the highest increases in mental distress during the early months of the pandemic were among mothers of young children (Pierce, Hope et al., 2020). Cross-sectional studies during the COVID-19 pandemic have also demonstrated high prevalence rates of mental health symptoms among pregnant women and mothers, including depression and anxiety, with rates well above those that existed before the COVID-19 pandemic (Cameron et al., 2020; Tomfohr-Madsen et al., 2021). Given that the health and well-being of infants and young child are inextricably linked to the well-being and functioning of their caregiver (Prime et al., 2020; Rogers et al., 2020; Schore, 2001), it is critical to understand the extent to which the COVID-19 has impacted maternal mental health as well as factors that may be exacerbating these effects. Particular attention to addressing the mental health needs of mothers of young children during and in the aftermath of the COVID-19 pandemic will be critical to rebuilding healthy citizens and communities.

1.2 | Maternal mental health and infant developmental health

Global estimates before the COVID-19 pandemic based on meta-analyses indicate that the prevalence rate of postpartum depression in mothers is approximately 17% (Shorey et al., 2018) and 15% for postnatal anxiety (Dennis et al., 2017). Research pre-pandemic has demonstrated that maternal mental illness, particularly maternal depression, and anxiety, are consequential for childhood and adolescent development (Goodman et al., 2011; Rogers et al., 2020). To optimally thrive, infants and young children are reliant on their caregivers to meet their basic needs (e.g., food, sleep, etc.), as well as their relational (e.g., sensitive parenting, conversational turns) and developmental needs (e.g., language input) (Anderson et al., 2021; De Wolff & van Ijzendoorn, 1997; Field, 2010). Maternal mental illness during these critical years can disrupt both the quality of the relational inputs the child receives (Bernard et al., 2018; Sohr-Preston & Scaramella, 2006) as well as the stability of the environment in which the child develops (Gelfand & Teti, 1990).

The postpartum period, including up to one year after the birth of a child, and early years of a child's life are developmental stages associated with increased vulnerability to mental health difficulties for mothers (Cameron et al., 2016; Shorey et al., 2018). Both maternal depression and anxiety in the postpartum period have been shown to be associated with a broad array of child development

Key findings and implications

- Pooled prevalence rates of clinically elevated depression and anxiety symptoms of mothers of young children (under age 5 years) during the COVID-19 pandemic were 26.9% and 41.9%, respectively, indicating an increase from pre-pandemic estimates.
- Estimates for depression symptoms were higher among studies from Europe and North America, with a higher proportion of older mothers and a lower proportion of individuals who are racially minoritized.
- Estimates of anxiety symptoms were higher among low-quality studies, studies conducted in Europe and North America, studies with older mothers, and studies of highly educated mothers.

Statement of relevance

As a result of the COVID-19 pandemic, mothers with young children have faced significant challenges, including loss of social support and child-care, loss of employment, and increased financial strain. Consequently, mental health difficulties in mothers have increased nearly two-fold for depression and three-fold for anxiety from pre-pandemic estimates. Given that infant mental health is inextricably linked to the mental well-being of the caregiver, policies that decrease familial stress, increase social and financial resources, and support the mental health of mothers during and after the COVID-19 pandemic are needed.

outcomes (Barker et al., 2011; Hentges et al., 2020). Indeed, research suggests that experiencing depression is associated with harsh or hostile parenting, less sensitive and responsive parenting, and increased challenges in the parent-child relationship (Badovinac et al., 2018; Barnes & Theule, 2019; Hentges et al., 2021; Lovejoy et al., 2000). The presence of maternal mental health difficulties in the early years are also associated with disruptive caregiving behaviors that have the potential to interfere with the attachment relationship (Lyons-Ruth et al., 2002). Similarly, anxious parenting, including overprotection and heightened communication about threat, have also been associated with increased post-traumatic stress

symptoms in children following natural disasters (Cobham & McDermott, 2014). Maternal anxiety has been shown to be particularly influenced by past and current life stressors and experiences (Agrati et al., 2015), making anxiety symptoms particularly vulnerable to a stressor like the COVID-19 pandemic.

1.3 | Unique experience of mothers of young children (0–5 years) during the COVID-19 pandemic

Experiencing the significant shifts and stressors associated with early parenthood during a global pandemic may have exacerbated maternal mental health difficulties, particularly for mothers dealing with social risks (e.g., poverty) or pre-existing mental health concerns. While increases in depressive and anxiety symptoms were experienced across the general population during the COVID-19 pandemic, mothers of young children were at increased risk for mental health difficulties for several potential reasons including loss of social support, loss of childcare, economic hardship, and the widening of social disparities.

First, because of public health requirements (i.e., social distancing, lockdown measures, and stay at home orders) many of the traditional mechanisms by which mothers of young children access and receive social support were suspended. For example, being able to gather with family or friends, socialize with other parents, or participate in playgroups or other activities were halted. Social support, particularly in the early years of parenting, has been identified as a critical ingredient for maternal mental health and wellbeing (Hetherington et al., 2018). Indeed, social support is a protective factor against depression and anxiety in mothers of young children (Mathiesen et al., 1999; Racine et al., 2019) and has been shown to moderate the association between perinatal stress and symptoms of depression and anxiety (Razurel & Kaiser, 2015). To date, a large population-based study has demonstrated that adults with low social support were at increased risk of elevated trajectories of depression during the COVID-19 pandemic as compared to those with adequate support (Iob et al., 2020). Thus, the direct loss of social support outside the immediate household during the COVID-19 pandemic, and the associated increased feelings of loneliness, isolation, and stress (Ollivier et al., 2021), particularly at a salient developmental juncture (i.e., transition to parenthood) when increases in social support are most needed, could have precipitated increased mental health difficulties in mothers of young children.

Second, when the COVID-19 pandemic was declared a global crisis, childcares and schools around the world closed their doors in order to mitigate virus spread

(Lee, 2020). In many jurisdictions, schools and childcares remained closed for several months leaving parents with the difficult task of balancing their employment and parenting responsibilities (Sevilla & Smith, 2020). Unlike older children, who can self-initiate and complete tasks independently, infants and young children require constant and consistent supervision. It is well known that when stressors mount and the availability of resources decrease, mental distress is a likely outcome (Selye, 1955). Thus, increased stress associated with balancing multiple roles may also have precipitated an increase in mental health difficulties for mothers (Calarco et al., 2020; Cheng et al., 2021). Notably, this may occur uniquely in mothers, not fathers, as research has shown that in heterosexual couples, mothers were more likely to care for children and be responsible for domestic labor during the COVID-19 pandemic (Zoch et al., 2021). Indeed, a study in the UK of dual working parents during the pandemic showed that women were responsible for 65.5% of the additional childcare required during the pandemic (Sevilla & Smith, 2020), which may have led to increased stress and subsequent mental health symptomatology in mothers.

Third, in many households, the loss of support from family as well as lack of childcare led to a reduction of work hours or loss of employment income. In families with young children, this was especially the case for mothers as compared to fathers (Carlson et al., 2020). The disparity in loss of employment and income for mothers during the COVID-19 pandemic has been referred to as the “motherhood penalty” (Dias et al., 2020). Loss of employment and income have been shown to be robust catalysts for increases in mental health symptomatology (Goldman-Mellor et al., 2014). For example, a study of mothers with school-aged children demonstrated that in households that had lost income or employment during the pandemic, rates of clinically significant anxiety and depression were 6% and 7% higher, respectively, than in families who had not lost income or employment (Racine, Hetherington et al., 2021). Additionally, economic data from Canada demonstrate that households with members under the age of 35 years experienced the greatest income declines in the early months of the pandemic (Statistics Canada, 2021), which is the demographic most likely to be parenting young children. Furthermore, evidence from countries around the globe, including both low-middle- and high-income countries indicate that the COVID-19 pandemic was associated with large decreases in family incomes as well as increased food insecurity (Hamadani et al., 2020; Patrick et al., 2020). Taken together, loss of employment, financial stress, and food insecurity during the COVID-19 pandemic, particularly among parents, may have created a context that was ripe for increases in maternal mental health difficulties.

As the COVID-19 pandemic has evolved, empirical evidence has demonstrated that social disparities that existed before the pandemic among mothers who are single, racially minoritized, and socially disadvantaged have been severely exacerbated (Etowa & Hyman, 2021; Hertz et al., 2021). Far from the great equalizer, the COVID-19 pandemic has increased pre-existing social and health inequalities among traditionally marginalized groups around the globe. For example, in a large, longitudinal survey in the United States, Black adults were three times more likely than Whites to report employment loss, food insecurity, or unemployment because of the COVID-19 pandemic (Perry et al., 2021). Food insecurity and economic hardship were also more severe among those without a university education and in women (Perry et al., 2021). Cross-sectional data on depressive symptoms in mothers of young children during the pandemic demonstrated that lower family income before the pandemic was associated with an increased likelihood of depressive symptoms during the pandemic (Cameron et al., 2020). Taken together, social inequalities with regards to health and mental health that existed prior to the pandemic for marginalized women, including reduced access to health and mental health care, racism, and poverty (Parker, 2021), have become even more entrenched (Hooper et al., 2020), leading to larger increases in mental health difficulties for mothers of young children who experience poverty, racism, and low education.

1.4 | Potential moderators associated with increases in maternal mental health symptoms during the COVID-19 pandemic

There are two important gaps in the literature with regards to understanding the mental health of mothers of young children during the COVID-19 pandemic. First, while preliminary studies have been conducted examining the prevalence of depression and anxiety symptoms of mothers during the pandemic, obtaining a pooled estimate of clinically significant mental health symptoms would help policymakers and mental health providers make decisions with regards to resource allocations and increases to address the increased rates of maternal mental health difficulties. Second, there is currently significant variability in effect size estimates across studies. Specifically, for depression, prevalence estimates range from 6.3% (Silverman et al., 2020) to 59% (Chaves et al., 2021) and for anxiety prevalence estimates range from 13.5% (Hamadani et al., 2020) to 61% (Fallon et al., 2021). When there is significant heterogeneity in prevalence estimates across studies, it suggests that a potential third variable (i.e., a moderator) may be at play. Thus, the current meta-analysis seeks to

identify the potential moderating variables that may play a role in explaining heterogeneity among study estimates. By examining moderator variables, we can identify whether prevalence rates of anxiety and depression are different for different subgroups of studies (Hall & Rosenthal, 1991). For example, whether mental health prevalence rates vary as a function of study quality or mean maternal age across included samples.

Several potential moderators may be playing a role in explaining between study heterogeneity for prevalence rates of maternal depression and anxiety during the COVID-19 pandemic including maternal age, infant age, being racially minoritized, maternal education level, and marital status. Specifically, prior to the pandemic, research has shown that younger mothers may be at increased risk for mental health symptomatology due to lower levels of social support and financial stability (Van Lieshout et al., 2020). Being the mother of a young infant is also a risk factor for mental health difficulties since the first months postpartum have been identified as a sensitive period for maternal mental health difficulties, particularly depression (Vesga-Lopez et al., 2008). Furthermore, as outlined in the previous section, in addition to experiences of interpersonal and systemic racism, mothers who are racially minoritized have experienced greater disparities in terms of employment loss and income during the COVID-19 pandemic, which may be contributing to increases in mental health symptomatology. Furthermore, other indicators of socioeconomic status such as level of education or marital status, may also be associated with increases in mental health symptomatology given that previous research has shown that financial strain and income loss are associated with increases in maternal mental health difficulties during the pandemic (Racine, Hetherington et al., 2021).

It is also possible that methodological characteristics of the studies may be associated with heterogeneity across studies. Specifically, studies of lower methodological quality from self-selected or non-probability samples may include individuals with higher mental health difficulties who self-selected to participate (Pierce, McManus et al., 2020). Thus, studies that involve non-probability sampling, non-representative samples, subjective measurement, or have not undergone peer review may be more likely to have over inflated mental health prevalence rates. Additionally, preliminary research evidence suggests that anxiety during the pandemic is decreasing over time, while suicidal ideation has been shown to increase over time, and depression has been shown to stay the same (O'Connor et al., 2020; Robinson et al., 2022). Lastly, geographical location may play a role in self-reports of mental health difficulties as previous research has shown that mental health stigma varies across cultural groups, with higher

levels of mental health stigma being observed in Asian Americans than other cultural groups (Abdullah & Brown, 2011). In summary identifying the sociodemographic and methodological factors that are associated with variability in prevalence rates across studies may help inform the development of and investment in programs, policies, or governmental support that could improve mental health symptoms among mothers of young children.

1.5 | Rationale for review

An important step to inform resource allocation and program planning is to understand the magnitude of the impact of COVID-19 on the mental health of mothers with young children as well as associated factors that may amplify or attenuate elevations in mental health difficulties. To address this research gap, as well as inform policy and practice, the current systematic review and meta-analysis examines the prevalence of mental health difficulties, specifically depression and anxiety, among mothers of children under the age of 5 years during the COVID-19 pandemic. To our knowledge, a synthesis on the mental health difficulties of mothers of infants and young children has not been conducted to date. Additionally, to inform for whom and under what circumstances maternal mental health may be most at risk, we must examine candidate moderator variables. Thus, in the current meta-analysis we also examine sociodemographic (i.e., maternal age, child age, being racially minoritized, education, and marital status) and methodological (i.e., study quality, month of the year, and geographic region) moderating variables that may account for variability in prevalence rates across studies. Based on previous literature, we hypothesized that samples with a higher proportion of mothers who were young, had younger children, were minoritized from a racial/ethnic standpoint, had lower education, and were less likely to be married would have higher prevalence rates of anxiety and depressive symptoms. It has been suggested that lower quality studies, such as those that use convenience sampling, may be associated with an inflation in mental health prevalence estimates during the COVID-19 pandemic (Pierce, McManus et al., 2020). Thus, we also hypothesized that lower quality studies would also have higher prevalence rates. We also hypothesized that mental illness prevalence rates would be higher in North American and Europe than in East Asia, as pre-pandemic estimates of mental health difficulties were lowest in Asian countries prior to the pandemic (Baxter et al., 2013), which may be attributable to higher levels of mental health stigma that has been identified in Asian countries (Kudva et al., 2020).

2 | METHOD

2.1 | Search strategy and study identification

The review is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (Moher et al., 2009) and the protocol was pre-registered in PROSPERO [CRD42021240457]. Searches were conducted in Ovid MEDLINE, Embase, Cochrane Central Register of Controlled Trials (CENTRAL), and APA PsycINFO up to March 3, 2021, by a health sciences librarian. A date restriction was applied to capture studies from the beginning of the COVID-19 pandemic onwards. No language restrictions were applied, and search strategies combined search terms falling under three themes: (1) mental health and illness (including, but not limited to, anxiety, depression, and post-traumatic stress); (2) COVID-19; and (3) parents (see Table S1 for example of search strategy in Ovid MEDLINE). Terms were searched as both keywords and database subject headings as appropriate. Both adjacency operators and truncation were used to capture phrasing variations in keyword searching. A hand search, which involved using the terms “parent”, “mental health”, and “COVID-19” in google scholar was also conducted on March 1, 2021 and one additional study was added to the search results.

2.2 | Inclusion and exclusion criteria

The inclusion criteria for the current review are detailed as follows: (1) data were collected during the COVID-19 pandemic, (2) the study sample represented a general population of biological parents with children with a mean age of 5 years or younger; (3) the proportion of parents meeting clinical cut-off scores or falling in the moderate-to-severe symptom range of depression or anxiety using a validated self-report measures was reported in the study (i.e., number of parents meeting the cut-off divided by the total number of parents in the sample); (4) the study was empirical; and (5) written in English. Studies with a broad age range of children that reported on maternal mental health difficulties separately for mothers of children under and over 5 years of age were included. We did not include samples of parents who had chronic health conditions, parents who had contracted COVID-19, or who identified as having a psychiatric condition or having received psychiatric treatment prior to the pandemic. Studies that were not empirical in nature, such as case studies or qualitative syntheses, were also excluded. Studies of samples with participants with psychiatric conditions (e.g., schizophrenia,

severe postpartum depression, eating disorders, mania) or receiving treatment prior to the pandemic (i.e., on an inpatient psychiatric unit) were not included as the baseline prevalence of mental health concerns for these individuals may have already had elevated mental health difficulties prior to the pandemic. Only one study from a given sample was included in the meta-analysis. As such, if more than one study was retrieved using the same sample, the study with the largest sample size and most comprehensive information was retained. All studies included in the current review were published. Although the review set out to examine mental illness in parents during the COVID-19 pandemic, only studies including data on mothers met inclusion criteria. As such, the review focuses on the mental health of mothers.

Using Covidence software, five coders reviewed 1627 titles and abstracts that were obtained from the search and evaluated them against eligibility criteria, of which 133 full texts were retrieved. To establish reliability for the abstract review, 20% of the 18 non-overlapping included studies abstracts were double coded and random agreement probability ranged from .851 to .871. Once the full texts were retrieved from the abstract that met inclusion criteria, the full texts were reviewed by three study authors to ensure the full texts should be included. All full texts were reviewed by two study authors and disagreements were resolved via consensus.

2.3 | Data extraction: coding

Once studies were established as meeting inclusion criteria, five coders extracted information on study characteristics, prevalence rates for anxiety and depression, as well as potential moderators. Coders used a comprehensive coding manual developed by the first and last authors. All studies were extracted by two coders and discrepancies were discussed and final consensus was reached. If a study had more than one data point, the most recent data collection point was retained. Additionally, in a study where findings were reported separately for more than one child age group under the age of 5 years, a pooled prevalence rate for children under the age of 5 years was calculated.

The following moderators were extracted: (1) parent age at the time the mental health measure was administered (continuously as a mean); (2) child age at the time of data collection, (3) country in which the study was conducted, (4) month of the 2020 calendar year when data was collected (ranging from 1 to 12), (5) percentage of the sample that was female, (6) the percentage of the sample that was racially minoritized (i.e., percentage of individuals who were of a different race or ethnicity than the dominant

group), (7) the percentage of parents who had a university education, and (8) the percentage of parents who were married. Education and marital status were extracted as proxies for socio-economic status as few studies reported on the income of participants or the nature of the reporting was too heterogenous to extract. Study quality was also coded for each study and is described below.

2.4 | Study quality

Given the rapidly evolving nature of the COVID-19 pandemic and the need to abbreviate the amount of time taken to conduct the meta-analysis, a brief five-item study quality measure was adapted based on the National Institute of Health Quality Assessment Tool for Observation Cohort and Cross-Sectional Studies (National Heart, Lung & Blood Institute, 2014). The brief study quality measure had five items which included: (1) outcome was assessed with a validated measure; (2) study was peer-reviewed versus unpublished at the time the review was conducted; (3) study had a response rate of at least 50%; (4) depression or anxiety was assessed objectively (i.e., diagnostic interview); and (5) the study had sufficient exposure time to COVID-19 (i.e., at least one week since the first case of COVID-19 in the specific country where the study was conducted). Each item of the study quality score received a score of 0 (no) or 1 (yes) with total potential scores ranging between 0 and 5. If information was not clear, not reported, or missing within the study, the study quality item was marked as 0. The criteria for the study quality scoring measure as well as the detailed scores are provided in Tables S2 and S3 of the Supplemental material.

2.5 | Statistical analyses

2.5.1 | Pooled effect sizes

Random effects models were used in the current meta-analysis as heterogeneity is assumed across studies and is the most conservative analytic strategy (Borenstein et al., 2010). Separate meta-analyses were conducted for each of the maternal mental health outcomes: depression and anxiety. All analyses were conducted using Comprehensive Meta-analysis (CMA version 3.0), a well-established software for conducting meta-analyses (Borenstein et al., 2013). Pooled prevalence estimates with associated 95% confidence intervals (CIs) around the estimate were computed for both depression and anxiety symptoms and estimates were weighted by the inverse of their variance, which prioritizes larger samples.

2.5.2 | Heterogeneity and moderator analyses

Between study heterogeneity was evaluated using the Q and I^2 statistics. Using guidelines established by Borenstein et al. (2009), a significant Q statistic suggests moderator analyses should be explored, while the degree of variability across studies is indicated by the I^2 statistic. When an I^2 value exceeds 75%, moderator analyses should also be explored. Given that only eight studies were retrieved for the anxiety meta-analysis, we examined categorical moderators when the number of studies in each category exceeded two. Random-effects meta-regressions were calculated in CMA to explore the effect of continuous moderators. To explore publication bias, we used the Egger test, which is a linear regression of the effect sizes on the standard errors weighted by their inverse variance (Egger et al., 1997). We also examined funnel plots for asymmetry, which are scatter plots of the effect sizes from individual studies plotted against their standard error. A significant Egger test and an asymmetrical funnel plot suggest there is publication bias. We also used Duval and Tweedie's trim-and-fill method (Duval & Tweedie, 2004) to examine whether the pooled effect size needed to be adjusted based on publication bias. The trim-and-fill technique identifies significant publication bias and provides an adjusted pooled effect size if studies were imputed to correct the bias (Shi & Lin, 2019).

3 | RESULTS

As reported in the PRISMA flow diagram (see Figure 1), our search yielded 1627 non-duplicate records, of which 133 full-text articles were retrieved and evaluated against inclusion criteria. A total of 18 non-overlapping studies met full inclusion criteria (Cameron et al., 2020; Chaves et al., 2021; Fallon et al., 2021; Hamadani et al., 2020; Harrison et al., 2021; Loret de Mola et al., 2021; Molgora & Accordini, 2020; Oskovi-Kaplan et al., 2020; Ostacoli et al., 2020; Pariente et al., 2020; Silverman et al., 2020; Spinola et al., 2020; Stojanov et al., 2020; Suhariati et al., 2020; Sun et al., 2020; Suzuki, 2020; Zanardo et al., 2020; Zanardo et al., 2021).

3.1 | Study characteristics

Study characteristics for all 18 included studies are presented in Table 1. There were 16 studies that provided data for clinically elevated depressive symptoms and eight studies that provided data for clinically elevated anxiety symp-

toms. Across all included studies, 8981 participants were included, all of whom were female. The mean age of mothers was 30.68 years (age range 24.1–34.77) and the mean age of children was 10.47 months (age range 0.07–60 months). On average, 26.73% of the women across samples were identified as belonging to racially minoritized groups. Of the samples included, on average, 52.80% of women had at least a university education and 62.76% were married. With regards to geographic region, nine studies were from Europe (50.0%), two from East Asia (11.1%), two from North America (11.1%), two from the Middle East (11.1%), one from South Asia (5.6%), one from Southeast Asia (5.6%), and one from South America (5.6%). The average study quality score was 3.33 (range 3–4).

3.2 | Pooled prevalence of clinically elevated maternal depressive symptoms during COVID-19

The random-effects meta-analysis of 16 studies yielded a pooled prevalence rate of .269 (95% CI: .213, .334; Figure 2) or 26.9% for clinically elevated depressive symptoms. The funnel plot was symmetrical (see Figure S1), and the Egger test was statistically significant ($p = .03$). No studies were identified to trim or impute using Duval and Tweedie's trim and fill technique.

3.2.1 | Moderator analyses for pooled prevalence of clinically elevated depressive symptoms

Significant between study heterogeneity was identified ($Q = 430.445$, $p < .001$, $I^2 = 96.52$); thus, potential moderators were explored based on all included studies (see Table 2). Three moderators were significant for maternal depressive symptoms: geographical region, maternal age, and being racially minoritized. The prevalence of clinically significant depression was higher in studies from Europe and North America ($k = 11$; rate = .313, 95% CI: .238, .400; $p < .001$) compared to studies from South America, the Middle East, or Asia ($k = 5$; rate = .185, 95% CI: .114, .285; $p < .001$). Prevalence rates varied as a function of maternal age ($b = .182$, 95%CI: .04, .32) with depressive symptoms being higher in studies with older mothers. Lastly, being racially minoritized was a significant moderator whereby studies that had higher percentages of individuals who were racially minoritized had lower depressive symptom prevalence rates ($b = -.03$, 95%CI: $-.04$, $-.02$). No other significant moderators were detected.

TABLE 1 Characteristics of studies included

First author, year, reference	N ^a	Maternal age (years)	Child age (months)	% Minoritized	% University educated	% Married	Country	Mental health measured	Name of mental health measures	Data collection date
Cameron 2020	475	34.27	0–60	16.17	71.4	91.5	Canada	Anx, Dep	PASS, EPDS, GAD-7, CESD/CESD-R	Apr 14–28, 2020
Chaves 2021	724	33.36		–	76.4	91.4	Spain	Anx, Dep	EPDS; items 3,4,5, EPDS	Apr 7th–May 8th, 2020
Fallon 2021	614	30.9	1.75	4.1	21.50	57	United Kingdom	Anx, Dep	STAI-S, EPDS	Apr 16–May 15, 2020
Hamadani 2020	2410	24.1	18.2		3.6		Bangladesh	Anx	GAD-7	May 19–June 18, 2020
Harrison 2021	251	32.2	6.29	5.2	72.1	97.2	UK	Anx, Dep	PASS, EPDS	May–June, 2020
LoretteMola 2021	591		<12	–			Brazil	Anx, Dep	GAD-7, EPDS	July–Dec 2020
Molgora 2020	170 (anx), 186 (dep)	33.01	<6	–	66.6	58.6	Italy	Anx, Dep	STAI, EPDS	Mar 1–May 3, 2020
Oskovi-Kaplan 2020	223	26.15	.07		10.3		Turkey	Dep	EPDS	June 2020
Ostacoli 2020	163	34.77	<4	4.9	61.3	93.30	Italy	Dep	EPDS	June 15–29, 2020
Pariente 2020	223	29.1	.07	46.6		90.60	Israel	Dep	EPDS	Mar 18–April 29, 2020
Silverman 2020	252	27	<12	90			United States	Dep	EPDS	Jan 2–June 30, 2020
Spinola 2020	243	34.01	3.78	–	80.94	93.44	Italy	Dep	EPDS	May 11–June 6, 2020
Stojanov 2020	108	32	<12	–	70.9	87	Serbia	Dep	EPDS	Mar 29 th –Apr 4th, 2020
Suhariati 2020	51	20–34	60	–	19.6	–	Indonesia	Anx	Zung SAS	Sept 2020
Sun 2020	2092	41.42% aged 25–29		2.8	79.01	–	China	Dep	EPDS	Dec 31, 2019–Mar 22, 2020
Suzuki, 2020	132	79.6% aged 19–40	1	–	–	–	Japan	Dep	EPDS	Mar 11–April 13, 2020
Zanardo 2020	91	33.73	<1	–	–	57.1	Italy	Dep	EPDS	Mar 8–May 3, 2020
Zanardo 2021	152	33.47	.07	44.08	–	55.26	Italy	Dep	EPDS	Mar 8–May 18, 2020

Abbreviations: Anx, Anxiety; CESD, Centre for Epidemiologic Studies Depression Scale; CESD-R, Centre for Epidemiologic Studies Depression Scale Revised; Dep, Depression; EPDS, Edinburgh Postnatal Depression Scale; GAD-7, Generalized Anxiety Disorder 7-Item; PASS, Perinatal Anxiety Screening Scale; STAI, Spielberger State Trait Anxiety Inventory; STAI, Spielberger State Trait Anxiety Inventory, State Scale; Zung SAS, Zung Self-Rating Anxiety Scale.

^aSample size entered into the meta-analysis.

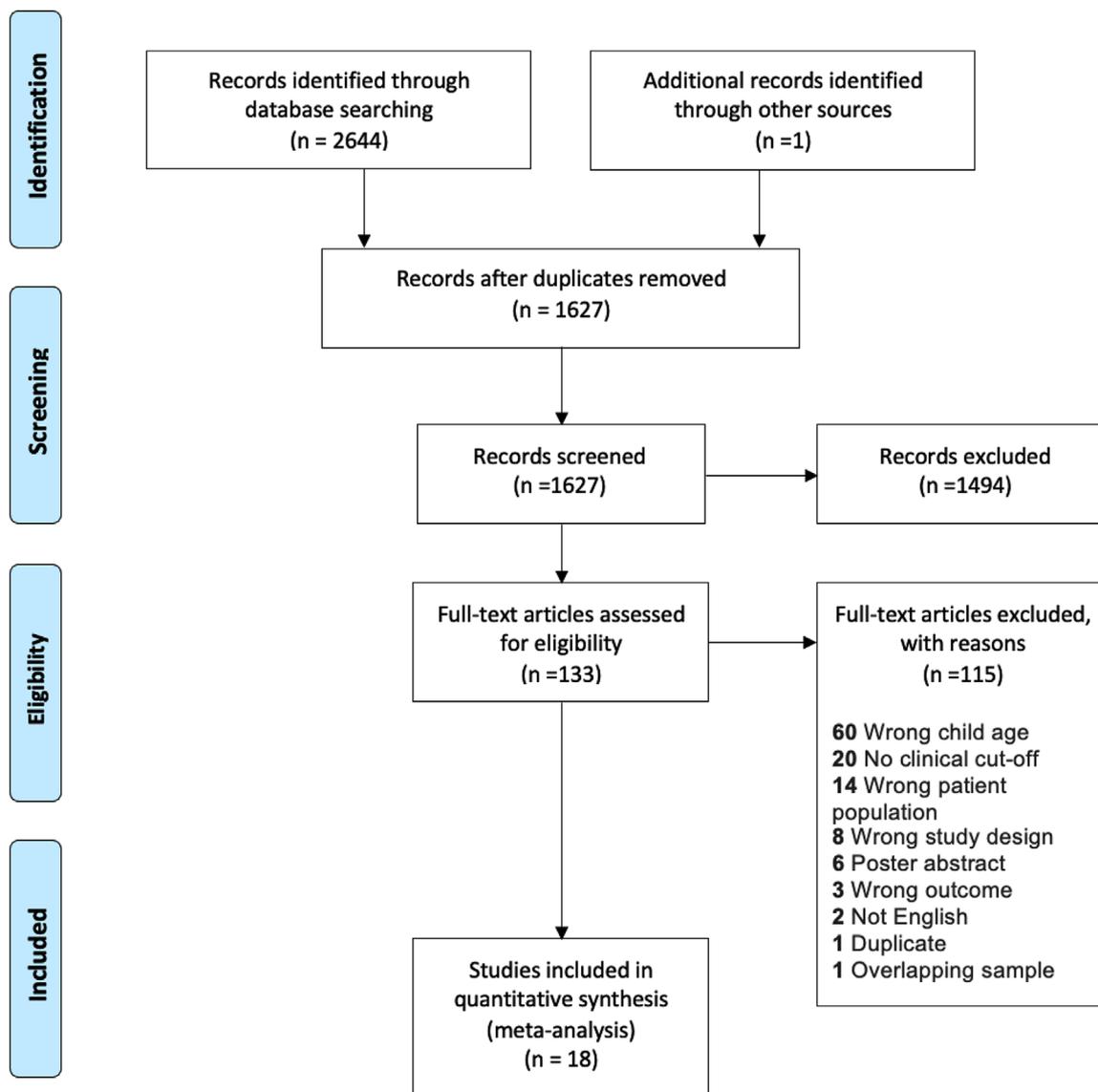


FIGURE 1 PRISMA flow diagram

3.3 | Pooled prevalence of clinically elevated maternal anxiety symptoms during COVID-19

The overall pooled prevalence of clinically elevated anxiety symptoms across eight studies was .419 (95% CI: .267, .588; Figure 2) or 41.9%. The funnel plot was somewhat asymmetrical (see Figure S2), and the Egger test was not significant ($p = .24$). When Duval and Tweedie's trim-and-fill method was applied to account for publication bias, two imputed studies were identified (See Figure S2). This indicates that after adjusting for publication bias and imputing two studies, the adjusted pooled effect size is .364 (95% CI: .241, .507; Figure 2) or 36.4%.

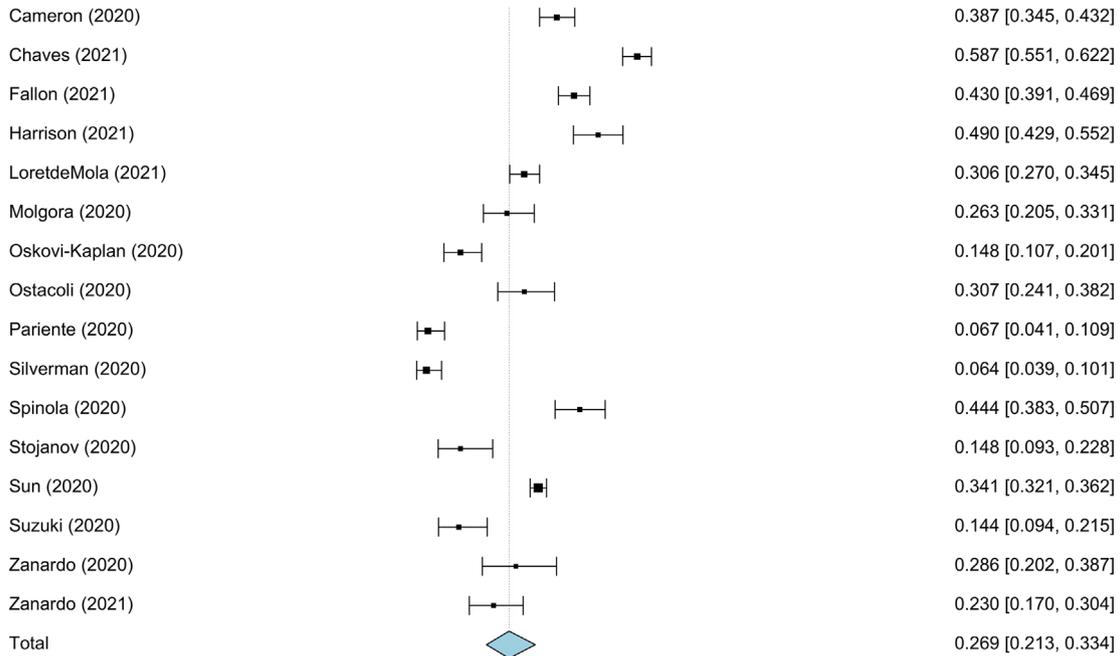
3.3.1 | Moderator analyses for pooled prevalence of clinically elevated anxiety symptoms

For the eight studies reporting on anxiety, there was significant between-study heterogeneity ($Q = 749.218, p < .001, I^2 = 99.07$) and thus, potential moderators were examined (see Table 3). There were four significant moderators that emerged for symptoms of anxiety: study quality, geographical region, maternal age, and maternal education. The prevalence of clinically significant anxiety was higher in studies deemed to be of poorer study quality ($k = 6$; rate = .508, 95% CI: .404, .611; $p = .884$) compared to studies with better study quality scores ($k = 2$; rate = .200, 95% CI: .110, .336; $p < .001$). The second significant moderator

Study

Rate [95% CI]

Depression



Anxiety

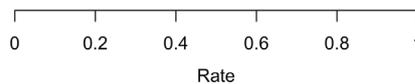
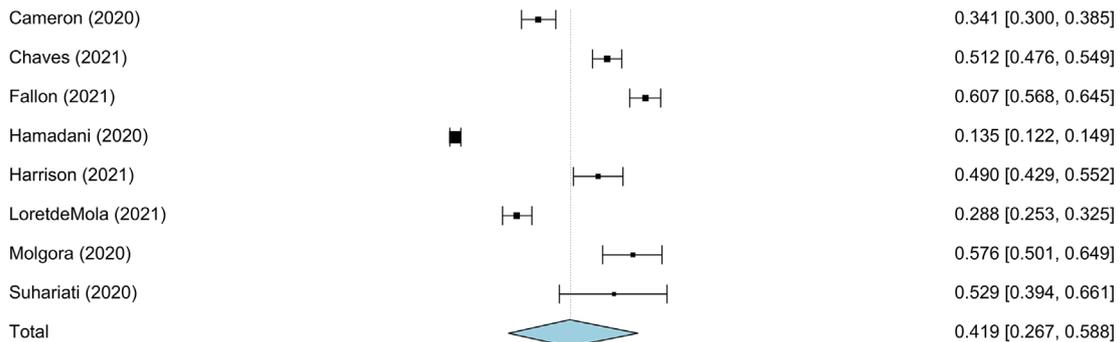


FIGURE 2 Forest plots of the pooled prevalence of clinically elevated depressive and anxiety symptoms in mothers of young children during the COVID-19 pandemic

was geographical region, the prevalence of clinically significant anxiety was higher in studies from Europe and North America ($k = 5$; rate = .504, 95% CI: .382, .626; $p = .944$) compared to studies from South America, the Middle East, or Asia ($k = 3$; rate = .279, 95% CI: .167, .427; $p = .005$). Third, prevalence rates varied as a function of maternal age ($b = .17$, 95% CI: .008, .34) with anxiety symptoms being higher in studies with older mothers. Lastly, maternal education was a significant moderator of anxiety prevalence

rates with more highly educated mothers exhibiting higher clinically significant symptoms of anxiety ($b = .02$, 95%CI: .003, .03).

4 | DISCUSSION

The current meta-analysis and systematic review of cross-sectional studies during COVID-19 found a pooled

TABLE 2 Results of moderator analyses for the prevalence of clinically elevated depressive symptoms in mothers of young children during COVID-19

Categorical moderators	k	Prevalence	95% CI	Homogeneity	
				Q	p
Study quality score				.539	.463
Low (2–3)	10	.287**	.212, .376		
High (4)	6	.239***	.157, .346		
Geographical region				4.05	.04
South America, Middle East, Asia	5	.185***	.114, .285		
Europe/North America	11	.313***	.238, .400		
Continuous moderators	k	Estimate	95% CI	Z	p
Maternal age	14	.182	.04, .32	2.55	.01
Child age	13	.02	−.03, .08	.85	.40
Month of data collection in 2020	16	.08	−.13, .29	.73	.47
Maternal education	10	.01	−.004, .03	1.41	.16
Racially minoritized status	8	−.03	−.04, −.02	−5.71	<.001
Marital status	9	.02	−.004, .04	1.57	.12

Note: k = number of studies; CI = confidence interval. * $p < .05$; ** $p < .01$; *** $p < .001$.

TABLE 3 Results of moderator analyses for the prevalence of clinically elevated anxiety symptoms in mothers of young children during COVID-19

Categorical moderators	k	Prevalence	95% CI	Homogeneity	
				Q	p
Study quality score				11.502	.001
Low (scores of 2–3)	6	.508**	.404, .61		
High (score of 4)	2	.200***	.110, .336		
Geographical region				5.319	.02
South America, Middle East, Asia	3	.279***	.167, .427		
Europe/North America	5	.504***	.382, .626		
Continuous moderators^a	k	Estimate	95% CI	Z	p
Maternal age	6	.17	.008, .34	2.06	.04
Child age	7	.008	−.04, .05	.37	.71
Month of data collection in 2020	8	−.08	−.41, .25	−.47	.64
Maternal education	6	.02	.003, .03	2.33	.02
Marital status	5	−.02	−.03, .003	−1.69	.09

Note: k = number of studies; CI = confidence interval. * $p < .05$; ** $p < .01$; *** $p < .001$.

^aThere were insufficient studies to examine racially minoritized status as a moderator.

prevalence of 26.9% for maternal depression and 41.9% (36.4% after adjusting for publication bias) for maternal anxiety symptoms. Thus, approximately one in four mothers of young children are experiencing clinically significant depression during COVID-19, while one in two are experiencing anxiety. When comparing these rates to pre-pandemic estimates of 17% for clinically elevated depression and 15% for anxiety (Dennis et al., 2017; Horwitz et al., 2007; Shorey et al., 2018), the current study suggests a doubling and tripling of depression and anxiety symptoms, respectively, has been observed for

mothers of young children early in the pandemic. These findings are consistent with longitudinal studies demonstrating a substantive increase in maternal depression and anxiety during the COVID-19 pandemic, compared to pre-pandemic estimates (Racine, Hetherington et al., 2021). Public health measures implemented for managing the spread of COVID-19 have left some families grappling with job losses, financial hardship, and a loss of social and childcare supports. These substantive changes likely have downstream consequences for maternal mental health, as women take on more household duties to fill the void

of uprooted household and childcare supports and face uncertainty about when supports will be re-established (Carlson et al., 2020).

There are several explanations for why maternal mental distress may be so impacted by COVID-19. First, past research has identified social support as being an important factor in the wellbeing of mothers, such that a lack of social support has been associated with mental health concerns (Bullock et al., 2002; Howard et al., 2014). Given the COVID-19 pandemic has required populations to reduce and limit social contacts, mothers may represent a population that is particularly harmed by a reduction in social support. Second, mothers of young children may also be at greater risk for depression and anxiety during the COVID-19 pandemic due to the stress associated with balancing multiple roles (e.g., childcare, homeschooling, work, domestic tasks). Closures of schools and daycare facilities have forced many parents to balance paid work and childcare and previous literature has suggested that women tend to take on a greater portion of childcare and household labor (Horne et al., 2018). Existing research has found that mothers, particularly those with younger children, were more likely to reduce paid work compared to fathers during the COVID-19 pandemic to accommodate for childcare and homeschooling (Collins et al., 2020). Further, research has found that the increased demands of household work mothers face has been associated with stress and frustration (Hjalmsdottir & Bjarnadottir, 2021), which may have exacerbated maternal mental health difficulties during this global crisis. Third, the COVID-19 pandemic has been associated with significant job loss and associated financial strain, which may contribute to increased rates of anxiety and depression, particularly among mothers of young children. Indeed, past research has found that financial strain was a significant predictor of reduced mental health among mothers (Black et al., 2009; Crosier et al., 2007). Taken together, increased maternal mental health difficulties during the pandemic may be largely attributable to decreases in support at the family level and increased stress due to financial strain.

Across meta-analyses, we found that the prevalence of maternal depression and anxiety increased with age, whereby older mothers reported the greatest symptom burden. In addition, reports of clinically elevated anxiety were higher among mothers with versus without a university education. Although maternal maturity and education may be protective in the context of the family environment (e.g., parenting skills; Bornstein et al., 2006), researchers have emphasized that delayed parenting may come with time-associated biological costs for maternal mental health (McMahon et al., 2015). For example, maternal age is associated with increased risk for adverse pregnancy outcomes (Lean et al., 2017) and, in turn, older mothers may

experience greater anxiety and depression in the perinatal period (Garcia-Blanco et al., 2017). With the added physical threat of COVID-19 infection and the pandemic's associated impact on maternal access to social supports, it is likely that mental health difficulties among older mothers may have been triggered or exacerbated by COVID-19-related stressors. For example, older mothers may have been more concerned about poor health-related outcomes for themselves and be more likely to have elderly family members who are at highest risk of poor outcomes due to COVID-19, which could have also contributed to elevated mental distress (Segel-Karpas & Ayalon, 2021).

Additionally, studies have indicated that older versus younger mothers often have higher levels of education, consequently, hold job positions with greater levels of responsibility and income (Bouchard et al., 2008; McMahon et al., 2015). At the same time, older versus younger mothers also balance greater levels of family responsibility (Garcia-Blanco et al., 2017). Thus, closure of schools and daycares, shifts to at-home work, and loss of income may have significantly affected older and more educated mothers who provide incomes for their families. Future research on the impact of work status on maternal mental health during the pandemic is needed to clarify the relation between maternal age, education level, and anxiety and depression. Nonetheless, efforts to alleviate mental health concerns among older and highly educated mothers should focus on enhancing natural social supports (e.g., partner support) and providing tangible supports (e.g., increased paid time off, flexible work schedules) to offset the demands exacerbated by COVID-19.

Counter to our hypotheses that mothers who are racially minoritized would experience higher levels of mental health difficulties during the COVID-19 pandemic, we found that studies with a higher proportion racially minoritized mothers had lower reported prevalence rates of depressive symptoms. These findings are counter to previous studies documenting the disproportionate medical impact of COVID-19 on marginalized communities (Hooper et al., 2020), particularly as it relates to elevated mortality rates as well as reduced access to social determinants of health during the COVID-19 pandemic (e.g., access to safe housing, health care, food insecurity) (Brown et al., 2020; Hooper et al., 2020; McKnight-Eily et al., 2021). As limited research has been conducted with racially minoritized mothers of young children, specifically, during the COVID-19 pandemic, we can only speculate about why studies with a higher proportion of racially minoritized mothers had lower depression prevalence rates. One possibility is that racially minoritized women may have been more likely to be employed as essential workers during the pandemic. A large population-based study in the UK found that participants who were essential workers were less

likely to experience severe depressive symptoms during the pandemic (Job et al., 2020). Research in mothers of middle school children during the COVID-19 pandemic has also shown a protective effect among racially minoritized mothers as compared to white mothers for anxiety symptoms (Racine, Hetherington et al., 2021). Another possibility, which is in line with challenge models of resilience, is that previous exposure to adversity for racially minoritized women served to inoculate or prepare them for future stressors, such as those associated with the COVID-19 pandemic (Zimmerman, 2013). It may be that women who are racially minoritized have developed coping skills and supports from earlier hardship they have experienced in their communities (e.g., systemic disparities, oppression, and racism), which prepared them to deal with the stressors associated with the COVID-19 pandemic, while White or highly educated women were less prepared to deal with these stressors. Indeed, research in the United States documented increased emphasis on social support, communal interaction, and increased volunteerism in Black communities during COVID-19 (Stamps et al., 2021), all factors that could promote individual and community resilience. Additionally, Black (57%) and Latin American (35%) children in the United States are more likely to reside in multigenerational households than white children (20%) (Cross, 2018), which may also have conferred resilience due to the additional support and childcare available in the home. Taken together, more research is needed to disentangle what might be contributing to the potential resilience among mother who are racially minoritized with regards to mental health difficulties during the pandemic.

Moderator analyses identified that rates of anxiety and depression were highest among mothers in North American and European countries, in comparison to South American, Middle Eastern, Southeast Asian, and South Asian counties. These findings may reflect the relatively higher rates of COVID-19 cases and deaths found in North America and Europe at the outset of the pandemic (World Health Organization, 2021). Lower reported prevalence rates in countries outside Europe and North America may also reflect reporting differences across geographic regions. For example, pre-pandemic reports of mental health difficulties in Asia were lower than other countries (Baxter et al., 2013), which may be attributable to a collectivism or higher stigma related to mental illness (Kudva et al., 2020). In addition, the prevalence of anxiety was higher in studies of lower versus higher methodological quality, a finding that has been shown in other meta-analysis on child (Racine, McArthur et al., 2021) and adult mental health during COVID-19 (e.g., Cooke et al., 2020). Lower quality studies typically use methods of sampling that may over represent individuals with mental health difficulties as they may self-select to respond to

surveys about mental health. Studies that use less rigorous forms of measurement may also be more likely to provide inflated estimates. During the COVID-19 pandemic, it may be that methodological quality was sacrificed due to the need to rapidly conduct research at the beginning of the pandemic. Future studies with greater methodological rigor are needed to ensure prevalence rates of maternal anxiety are not overestimated.

4.1 | Limitations

The findings of the current meta-analysis should be considered with certain limitations in mind. The first and most important limitation of this study was the lack of reports on fathers' mental health during COVID-19. The involvement of fathers has increased considerably over the past few decades (Yogman et al., 2016). Therefore, it cannot be understated how crucial it is to also assess how fathers are coping during and beyond the pandemic. Several studies have also failed to report on and include ethnic and socioeconomic diverse participants in their studies. With less than 30% of participants identifying as racially minoritized and most mothers having good education and marital partners, the results from the current study may not generalize outside of populations with low social risks. Thus, we are also limited in our ability to make similar conclusions about mothers in higher risk samples who may be more susceptible to higher rates of anxiety and depression (Alonzo et al., 2021). Given that the average age of children in the study was less than 1 year old, future work is needed to understand the mental health impact of the COVID-19 pandemic on mothers of older children and adolescents. A previous study has demonstrated the decline of parenting stress across early childhood (Williford et al., 2007). However, with the closures of schools and other support programs, dealing with school-aged child during COVID presents its own unique challenges which may exacerbate the distress that mothers experience (see Racine, Hetherington et al., 2021). A further limitation of the study was the lack of representative and population-representative samples, which should be prioritized in future research (Pierce, McManus et al., 2020).

Additionally, in the current meta-analysis, we were unable to disentangle the potential role of varying case rates as well as different public health restrictions and closures, both of which could influence mental health symptomatology. Recent research has demonstrated that mental distress during COVID-19 has waxed and waned with restrictions, specifically with lower levels of mental distress when restrictions are eased (Daly & Robinson, 2021). Future research examining the pattern of mental illness across longitudinal studies will be able to infer the role

of public health related restrictions on mental health and well-being. Lastly, the current meta-analysis was limited in its ability to examine how specific experiences during COVID-19, such as income loss, fear of illness, exposure to COVID-19, or loss of loved ones, may have influenced mental health difficulties in mothers as it was not always systematically reported across studies. Understanding the mechanisms by which maternal mental health difficulties were exacerbated during the pandemic will be important for planning recovery efforts.

5 | CONCLUSION, IMPLICATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Findings from the current study highlight pressing concerns about the mental wellbeing of mothers of young children during the COVID-19 pandemic. Mental health concerns were greatest among mothers who were older, highly educated, from a racial or ethnic majority group, and living in North American or European regions. Results underscore the need to dedicate significant resources toward addressing mental health concerns among mothers. At the individual level, the rapid implementation of brief, psychometrically-sound screening instruments (e.g., PHQ-2, GAD-2; Staples et al., 2019) in perinatal and pediatric primary care settings may serve as a feasible avenue to identify mothers at risk of depression and anxiety. Moreover, the development of brief, evidence-based interventions for parental distress that can be delivered via telemental health and in group contexts may help to reach a wider audience of mothers and reduce potential barriers to care. At the familial level, resources must also be dedicated to mitigating the potential negative effects of maternal depression and anxiety on child developmental outcomes. This may include mobilizing evidence-based parenting programs to mothers with identified mental health concerns and providing early intervention for offspring with identified concerns. Finally, at the systemic level, researchers have emphasized the need for government bodies and policymakers to invest in and expand social services (e.g., stable housing, childcare, availability or expansion of parental leave), map and coordinate existing social and mental health services for families, provide targeted outreach to populations at greatest risk, and change policies that sustain and promote discrimination (Fontanesi et al., 2020; Goldman et al., 2020; Shim, 2020). Altogether, these efforts may help to address the concerning prevalence of depression and anxiety among mothers during COVID-19.

In terms of areas for future research, studies are needed on the mental health implications of COVID-19 for fathers. Emerging studies have indicated a shift in the division

of family and household responsibilities at the onset of the pandemic, whereby fathers' level of involvement has increased (Mangiavacchi et al., 2020; Shafer et al., 2020). However, it is unclear whether this shift in labor has had implications for fathers' parenting stress or other areas of mental health. In line with this aim, investigations on the role of partner support and marital conflict with respect to parent mental health may help shed light on the relationship characteristics that may buffer or worsen depression and anxiety in the context of COVID-19. Further research is also needed on mothers with pre-existing physical and mental health conditions, as well as mothers of children with mental, developmental, or physical concerns, where parenting stress and mental illness may be heightened. Finally, multigenerational, longitudinal research is greatly needed to determine if the high rates of maternal depression and anxiety identified are reflective of an acute period of distress or are sustained effects of COVID-19, and if there are enduring consequences on child wellbeing.

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CONFLICTS OF INTEREST

The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

Data were extracted from published studies. Extracted data, study protocols, and analyses will be shared as requested from the corresponding author.

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