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Research paper

Rates of depressive and anxiety symptoms in the perinatal period during the COVID-19 pandemic: Comparisons between countries and with pre-pandemic data

Vera Mateus [a], Sara Cruz [b,c], Raquel Costa [d,e,f], Ana Mesquita [g], Andri Christoforou [h], Claire A. Wilson [i], Eleni Vousoura [j], Pelin Dikmen-Yildiz [k], Rena Bina [l], Sara Dominguez-Salas [m], Yolanda Contreras-García [n], Emma Motrico [m], Ana Osório [a,*]

[a] Developmental Disorders Program and Mackenzie Center for Research in Childhood and Adolescence, Center for Biological and Health Sciences, Mackenzie Presbyterian University, São Paulo, Brazil
[b] Instituto de Psicologia e de Ciências de Educação [Institute of Psychology and Education], Lusíada University of Porto, Porto, Portugal
[c] Centro de Investigação em Psicologia para o Desenvolvimento (CIPD) [The Psychology for Positive Development Research Center], Lusíada University of Porto, Porto, Portugal
[d] EPIUnit - Instituto de Saúde Pública, Universidade do Porto, Porto, Portugal
[e] Laboratório para a Investigação Integrativa e Translacional em Saúde Populacional (ITR), Porto, Portugal
[f] Lusófona University/HEI-Lab, Digital Human-environment Interaction Labs, Portugal
[g] School of Psychology, University of Minho, Portugal
[h] Department of Social and Behavioral Sciences, European University Cyprus, Cyprus
[i] Institute of Psychiatry, Psychology and Neuroscience, King's College London and South London and Maudsley NHS Foundation Trust, UK
[j] Department of Psychology, National and Kapodistrian University of Athens, Greece
[k] Department of Psychology, Kırklareli University, Kırklareli, Turkey
[l] School of Social Work, Bar Ilan University, Israel
[m] Psychology Department, Universidad Loyola Andalucia, Sevilla, Spain
[n] Departamento de Obstetricia y Puericultura, Facultad de Medicina, Universidad de Concepción, Chile

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ABSTRACT

Background: The COVID-19 pandemic was a significant threat to perinatal mental health. This study examined differences in clinically significant depression, anxiety, and co-morbid symptoms among pregnant and postpartum women across several countries and compared prevalence of perinatal depression and anxiety before and during the pandemic in each participating country.

Methods: Participants were 3326 pregnant and 3939 postpartum women (up to six months postpartum) living in Brazil, Chile, Cyprus, Greece, Israel, Portugal, Spain, Turkey, and the United Kingdom. An online survey was completed between June 7th and October 31st 2020, and included the Edinburgh Postnatal Depression Scale (EPDS) and the Generalized Anxiety Disorder Screener (GAD-7). The pre-pandemic studies were identified through literature review.

Results: Prevalence of clinically significant depression (EPDS≥13), anxiety (GAD-7 ≥ 10), and co-morbid (EPDS≥13 and GAD-7 ≥ 10) symptoms was 26.7 %, 20 % and 15.2 %, in pregnant women, and 32.7 %, 26.6 % and 20.3 %, in postpartum women, respectively. Significant between-country differences were found in all mental health indicators in both perinatal periods. Higher levels of symptoms were observed during (versus before) the pandemic, especially among postpartum women.

Limitations: Participants were mostly highly educated and cohabiting with a partner. The online nature of the survey may have limited the participation of women from vulnerable socio-economically backgrounds.

Conclusions: Our findings expand previous literature on the negative impact of the COVID-19 pandemic on perinatal mental health, by highlighting that this may be influenced by country of residence. Mental health care policies and interventions should consider the unique needs of perinatal women in different parts of the world.

* Corresponding author at: Developmental Disorders Program and Mackenzie Center for Research in Childhood and Adolescence, Center for Biological and Health Sciences, Mackenzie Presbyterian University, Rua da Consolação, 930, Prédio 28 (PPG-DD), São Paulo 01302-000, Brazil.
E-mail address: ana.osorio@mackenzie.br (A. Osório).

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1. Introduction

Perinatal mental disorders are the most common morbidity to affect women during pregnancy or in the first year after childbirth (O'Hara and Wisner, 2014); and they are particularly prevalent in low- and middle-income countries (Fisher et al., 2013; Gelaye et al., 2016). Perinatal depression (PND) is the most common mental disorder in the perinatal period (Rasmussen et al., 2017). Clinically, it is a major depressive disorder, with an onset in the peripartum period (American Psychiatric Association, 2013).

Systematic reviews and meta-analyses reported a prevalence of PND of 20.7 % during pregnancy (Yin et al., 2021), and 17.0 % in the postpartum period (Hahn-Holbrook et al., 2018; Shorey et al., 2018). Similarly, anxiety disorders are prevalent during the perinatal period, with approximately one in five women meeting diagnostic criteria for at least one anxiety disorder (Fawcett et al., 2019). Prevalence of self-reported anxiety symptoms is estimated at 22.9 % during pregnancy, 15 % up to 24 weeks postpartum, and 14.8 % beyond 24 weeks postpartum (Dennis et al., 2017). It is also estimated that around 6.3 % of women during pregnancy and 5.7 % up to 24 weeks postpartum, experience co-morbid anxiety and moderate/severe depression symptoms (Falah-Hassani et al., 2017). Left untreated, perinatal mental disorders have a significant negative impact on maternal outcomes and child development (Coussons-Read, 2013; Glover, 2014; Stein et al., 2014).

Environmental conditions, such as extreme stress or emergencies, can increase the risk for developing mental disorders (World Health Organization, 2016), particularly in groups already vulnerable for psychological distress, such as women in the perinatal period (Motrico et al., 2020). Indeed, systematic reviews and meta-analyses conducted since the beginning of the ongoing pandemic reported an overall prevalence of depression and anxiety symptoms ranging from 17 % to 31 % and 30.5 % to 42 %, respectively, among women in the perinatal period (Demissie and Bitew, 2021; Fan et al., 2021; Shorey et al., 2021; Sun et al., 2021; Tomfohr-Madsen et al., 2021; Yan et al., 2020). In addition, the prevalence of co-morbid symptoms of depression and anxiety was estimated at 18 % (Sun et al., 2021). Changes in daily life experiences (e.g., social distancing and confinement) associated with altered perinatal healthcare practices (e.g., cancelled appointments or the absence of partners during face-to-face consultations or childbirth) and scarce information about the virus (e.g., the effect of infection on the fetus/newborn) may have contributed to the increased levels of perinatal mental distress (Salehi et al., 2020). However, the aforementioned systematic reviews and meta-analyses revealed large variation in the rates of symptoms across studies both during pregnancy and the postpartum. Along with specific methodological differences (e.g. assessment time point, instruments, etc.) that might explain this high variability, participants' country of residence appears to be an important factor to consider. Despite the global dimension of the COVID-19 pandemic, it is possible that perinatal mental health has been affected differently depending on the country of residence of women, government-imposed measures and restrictions, and how their prenatal and postnatal experiences and care were impacted during this period.

Therefore, this study's objectives are twofold: a) to report prevalence of clinically significant depressive, anxiety, and co-morbid symptoms among pregnant and postpartum women during the COVID-19 pandemic and compare them across several European and South American countries and b) to compare prevalence of clinically significant symptoms of perinatal depression and anxiety during the pandemic to their best estimate of pre-pandemic levels for each participating country.

2. Methods

2.1. Study design and population

The present work analyses baseline data from the Riseup-PPD-COVID-19 prospective cohort study (Motrico et al., 2021), which examines perinatal mental health during the COVID-19 pandemic in several European and South American countries – Albania, Brazil, Bulgaria, Chile, Cyprus, Greece, Israel, Malta, Portugal, Spain, Turkey, and the United Kingdom (UK). Eligible participants were adult pregnant and postpartum women (with an infant aged 6 months or younger) living in one of the countries involved in the study. Participant recruitment took place through social media advertising (e.g., Twitter, WhatsApp, Facebook), networks of organisations (e.g., universities, health care centers), policymakers, local organisations, as well as through colleagues and acquaintances of the research team members. By clicking on the study link, potential participants were provided with an overview of the main goals and ethical aspects of the study, as well as some questions on eligibility. If eligible, and after giving their informed electronic consent, women were given full access to the questionnaires. The study received approval by the Institutional Ethics Committees in each of the participating countries prior to data collection.

The survey data were collected online between June 7th and October 31st 2020 in the participating countries. From 15,611 clicks registered on the study link, 2058 respondents were excluded due to lack of response to the eligibility questions ($n = 1798$) and not meeting the inclusion criteria ($n = 260$). Of the remaining respondents consenting to participate in the study, 2965 women were excluded due to extremely incomplete questionnaires ($n = 2553$), incongruent data ($n = 300$), or duplicate responses ($n = 112$), thus resulting in 10,588 participants. In this analysis we included participants with complete data on depression and anxiety measures from countries with at least 300 participants (Motrico et al., 2021). Therefore, 2939 cases with missing data regarding the target measures and 384 respondents from three countries (Albania, $n = 37$; Bulgaria, $n = 84$; Malta, $n = 263$) were excluded from the analyses.

2.2. Measures

2.2.1. Socio-demographic information

The survey included socio-demographic questions such as age, country of residence, educational level, cohabitation with partner and previous pregnancies.

2.2.2. Depressive symptoms

The Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) was used to assess symptoms of depression during the perinatal period. The 10 items were scored using a 4-point Likert scale (0 to 3 points), with greater scores reflecting higher severity of symptoms of depression. The cutoff score of ≥13 was used to identify women with clinically significant levels of depressive symptoms (Levis et al., 2020). In our sample, the Cronbach alpha was 0.88. The EPDS has been widely adapted for use in the perinatal population across the countries involved in this study, mostly for screening of postpartum depression (Cox et al., 2014; Hahn-Holbrook et al., 2018). Although different EPDS cutoff scores have been validated in the participating countries (sometimes even within the same country), we opted for the EPDS cutoff score ≥ 13 as it has been suggested in previous systematic reviews and meta-analyses to show higher specificity in identifying clinically significant depressive symptoms during pregnancy and postpartum (Gibson et al., 2009; Levis et al., 2020; O'Connor et al., 2016). In addition, we also favored the EPDS ≥ 13 cutoff for research homogeneity purposes, as the majority of studies that assessed peripartum depression during the COVID-19 pandemic employed this cutoff score (Ceulemans et al., 2021; Durankuş and Aksu, 2022; Ho-Fung et al., 2022; Lebel et al., 2020; Matsushima and Horiguchi, 2022).

2.2.3. Anxiety symptoms

The Generalized Anxiety Disorder Screener (GAD-7; Spitzer et al., 2006) is a 7-item scale, scored in a 4-point Likert scale (0 to 3 points), to assess the presence and severity of generalised anxiety symptoms. Total

scores range from 0 to 21 points, with higher scores reflecting more severe symptoms of anxiety. The questionnaire is suitable for use in the perinatal period (e.g., Simpson et al., 2014; Soto Balbuena et al., 2021; Zhong et al., 2015). The cutoff score of ≥10 was adopted to identify women with clinically significant symptoms of generalised anxiety (Spitzer et al., 2006). In our sample, the Cronbach alpha was 0.90. The cutoff score GAD-7 ≥10 was based on the original validation study in the general population as well as previous studies in the perinatal population prior to and during the pandemic (e.g., Ceulemans et al., 2021; Ho-Fung et al., 2022; Lamus et al., 2021; Pabon et al., 2020; Soto-Balbuena et al., 2018).

2.2.4. Selection of pre-pandemic studies

For the second objective of this study, the prevalence of prenatal and postpartum depression and generalised anxiety before the COVID-19 pandemic were identified through a search in PubMed database, targeting systematic reviews and meta-analyses published between 2011 and 2021. These systematic reviews and meta-analyses (n = 16) were then examined by two of the authors (VM and AO) and information on the individual studies conducted in each of the participating countries, with no restrictions to date of publication, was extracted. The following criteria were defined in order to select a best estimate of pre-pandemic levels of clinically significant depression and anxiety and symptoms: data collected before the COVID-19 pandemic, participants were pregnant and/or postpartum women (up to 1-year following delivery), participants recruited from the non-clinical perinatal population, levels of depression and anxiety reported separately for pregnant and postpartum women, and use of EPDS and GAD-7 to assess symptoms of depression and anxiety, respectively. In addition, studies using the same cutoff score for EPDS (≥13) and GAD-7 (≥10), with larger sample sizes, more recent publication and postpartum period up to six months following delivery, were given preference. Following this, research team members representing each of the countries involved in this analysis were contacted to confirm that the most appropriate studies have been selected or provide alternative suggestions if not. Details regarding characteristics of the selected pre-pandemic studies can be found in the Supplementary materials (Supplementary Table 1).

2.3. Data analysis

Data analysis was performed using IBM SPSS Statistics, version 21.0. Descriptive statistics of categorical variables were presented in terms of frequencies and percentages, and the mean and standard deviation reported for continuous variables. Co-morbid clinically significant symptoms were considered whenever women had both EPDS ≥13 and GAD-7 ≥10.

Chi-square tests were used to examine differences in levels of clinically significant symptoms of depression, anxiety and co-morbid symptoms across the participating countries. Any statistically significant association between country of residence and clinically significant symptoms (Yes vs. No) was investigated through post-hoc chi-square tests contrasting each pair of countries (e.g., Brazil vs. Chile, Brazil vs. Cyprus, etc.). The p-value was adjusted for multiple comparisons using the Bonferroni correction, therefore the threshold for corrected p-value was set to .0014. For the second objective of the study, we used chi-square tests to examine the association between clinically significant symptoms (Yes vs. No) and timing of data collection (pre-pandemic vs. during the pandemic) for each country. p-Values lower than .05 were considered significant. All statistical analyses were performed separately for pregnant and postpartum women, and for depression, anxiety, and co-morbid clinically significant symptoms.

3. Results

3.1. Participant characteristics

The final sample consisted of 7265 women (3326 pregnant and 3939 postpartum women), aged between 18 and 52 years (M = 31.84; SD = 4.97). Most participants had higher education (n = 5291, 72.8 %), were cohabiting with a partner (n = 6668; 91.8 %), and in 57.1 % of the cases (n = 4150), this was their first pregnancy. Pregnant women's gestational age was on average 27.24 weeks (SD = 8.55), with 6.1 % of the pregnant participants (n = 197) being in their first trimester, 27.1 % (n = 876) in their second trimester, and the majority of pregnant respondents (n = 2159, 66.8 %) in their third trimester. In turn, postpartum women were mostly mothers of a 2- (n = 739, 19.5 %) and 3-month-old (n = 713, 18.8 %) infant. Table 1 describes the participants' characteristics, both for the total sample and by perinatal period.

Table 1
Sample characteristics.

	Pregnant women (n = 3326)	Postpartum women (n = 3939)	Total sample (n = 7265)
Age (years), *mean* (SD)	31.44 (4.97)	32.18 (4.95)	31.84 (4.97)
Missing, *n* (%)	170 (5.1)	155 (3.9)	325 (4.5)
Education, *n* (%)			
Secondary school level or lower	861 (26.5)	963 (24.9)	1824 (25.6)
Higher education	2390 (73.5)	2901 (75.1)	5291 (74.4)
Missing	75 (2.3)	75 (1.9)	150 (2.1)
Living with a partner, *n* (%)			
Yes	3055 (94.1)	3613 (93.7)	6668 (93.9)
No	192 (5.9)	243 (6.3)	435 (6.1)
Missing	79 (2.4)	83 (2.1)	162 (2.2)
First pregnancy, *n* (%)			
Yes	1918 (57.7)	2232 (56.7)	4150 (57.1)
No	1407(42.3)	1705 (43.3)	3112 (42.8)
Missing	1 (0.0)	2 (0.1)	3 (0.0)
Infant age (days), *mean* (SD)		95.05 (51.06)	
<1 month, *n* (%)		463 (12.2)	
1 month, *n* (%)		639 (16.9)	
2 months, *n* (%)		739 (19.5)	
3 months, *n* (%)		713 (18.8)	
4 months, *n* (%)		581 (15.3)	
5 months, *n* (%)		475 (12.5)	
6 months, *n* (%)		177 (4.7)	
Missing, *n* (%)		152 (3.9)	
Weeks of gestation, *mean* (SD)	27.24 (8.55)		
1st trimester, *n* (%)	197 (6.1)		
2nd trimester, *n* (%)	876 (27.1)		
3rd trimester, *n* (%)	2159 (66.8)		
Missing, *n* (%)	94 (2.8)		
Country, *n* (%)			
Brazil	268 (8.1)	597 (15.2)	865 (11.9)
Chile	172 (5.2)	272 (6.9)	444 (6.1)
Cyprus	220 (6.6)	249 (6.3)	469 (6.5)
Greece	337 (10.1)	376 (9.5)	713 (9.8)
Israel	218 (6.6)	335 (8.5)	553 (7.6)
Portugal	753 (22.6)	669 (17.0)	1422 (19.6)
Spain	353 (10.6)	475 (12.1)	828 (11.4)
Turkey	806 (24.2)	620 (15.7)	1426 (19.6)
UK	199 (6.0)	346 (8.8)	545 (7.5)

Notes: Percentages excluding missing values. UK = United Kingdom. Weeks of gestation were calculated based on pregnant participants' expected date of childbirth and the date the questionnaire was completed.

3.2. Mental health indicators during the pandemic

Table 2 displays the overall multinational prevalence of clinically significant symptoms of depression, anxiety, and co-morbid anxiety and depression in pregnant and postpartum women during the COVID-19 pandemic. Clinically significant depressive symptoms were reported by 26.7 % (n = 889) of pregnant women and 32.7 % (n = 1288) of postpartum women. In turn, the prevalence of clinically significant symptoms of generalised anxiety was 20 % (n = 665) during pregnancy and 26.6 % (n = 1049) in postpartum women. Co-morbid clinically significant symptoms of depression and anxiety were observed in 15.2 % (n = 504) of the pregnant women and 20.3 % (n = 799) of the postpartum women. Overall, in pregnant women, the higher proportion of clinically significant symptoms was reported in Brazil and Chile, whereas the lowest was observed in Cyprus and Greece (and Turkey regarding anxiety symptoms only). In postpartum women, clinically significant symptoms prevalence was also higher in Brazil and Chile (and the UK regarding symptoms of depression only), whereas Cyprus and Israel were the countries presenting the lowest prevalences.

A significant association was found between country of residence and prevalence of clinically significant depressive symptoms in pregnant, $\chi^2(8) = 46.19$, $p < .001$, and postpartum women, $\chi^2(8) = 119.40$, $p < .001$ (see Table 3). Pregnant women living in Brazil, Chile and the UK reported significantly higher prevalence of clinically significant depressive symptoms than pregnant women living in Cyprus and Greece (all p-values $< .0014$). Furthermore, postpartum women living in Brazil were significantly more likely to experience clinically significant symptoms of depression than those living in any of the other participating countries (all p-values $< .001$), except the UK.

Considering clinically significant symptoms of generalised anxiety, a significant association with country of residence emerged for pregnant, $\chi^2(8) = 122.84$, $p < .001$, and postpartum women, $\chi^2(8) = 203.33$, $p < .001$ (see Table 4). Among pregnant women, those living in Brazil, Chile and Spain were more likely to report clinically significant symptoms of anxiety than those living in Cyprus, Greece, Israel, Portugal, and Turkey (all p-values $< .001$). In postpartum women, significantly higher prevalence of clinically significant symptoms of anxiety were observed in Brazil and Chile compared to the remaining countries (all p-values $< .001$), with the exception of Spain. Spain registered higher proportion of women with clinically significant anxiety symptoms than Cyprus, Israel, Portugal, and Turkey. A similar pattern was observed in the UK.

The prevalence of co-morbid clinically significant symptoms of depression and anxiety was significantly associated with country of residence in pregnant, $\chi^2(8) = 88.11$, $p < .001$, and postpartum women, $\chi^2(8) = 129.96$, $p < .001$ (see Table 5). Pregnant women living in Brazil and Chile had higher levels of co-morbid clinically significant symptoms during the pandemic, compared to their counterparts residing in most of the European participating countries (all p-values $< .001$), except Spain and the UK. In turn, pregnant women living in Spain and the UK reported higher prevalence of co-morbid clinically significant symptoms than those living in Cyprus, Greece, and Turkey (p-values $< .0014$). In postpartum women, Brazil differed significantly from most of the participating countries, registering higher prevalence of co-morbid clinically significant symptoms, except for Chile and the UK. Postpartum women residing in Chile, Spain and the UK reported higher levels of co-morbid clinically significant symptoms than those from Cyprus, Israel, and Turkey.

3.3. Comparison of mental health indicators pre- and during the pandemic

Table 6 compares prevalence of clinically significant symptoms of perinatal depression and anxiety before and during the pandemic for each of the participating countries. Almost all countries had a higher prevalence of clinically significant symptoms of depression among perinatal women during (vs. before) the COVID-19 pandemic, particularly in the postpartum period. Due to the lack of pre-pandemic studies assessing generalised anxiety through GAD-7 in the perinatal population, chi-square tests were run only for Brazil (pregnancy and postpartum) and Spain (pregnancy). Results showed greater prevalence of clinically significant symptoms of anxiety during (vs. before) the COVID-19 pandemic among postpartum women in Brazil and pregnant women in Spain ($p < .001$), but no significant differences were observed among pregnant women in Brazil ($p = .207$).

4. Discussion

The present study aimed to report and compare levels of clinically significant depressive, anxiety, and co-morbid symptoms in pregnant and postpartum women from nine European and South American countries during the COVID-19 pandemic and to compare these mental health indicators to pre-pandemic levels.

4.1. Main findings and comparison with previous studies

High levels of depressive, anxiety and co-morbid symptoms were reported by 26.7 %, 20 % and 15.2 % of pregnant women, respectively. In postpartum women, high levels of depressive, anxiety and co-morbid symptoms were reported by 32.7 %, 26.6 % and 20.3 %, respectively.

Similar prevalences (25.6 %) of depressive symptoms were reported in pregnant women during the pandemic in a recent systematic review and meta-analysis, which included 46 studies (Tomfohr-Madsen et al., 2021), but this review found higher levels of anxiety symptoms than in our sample (30.5 % vs. 20 %, respectively). Similar levels of co-

Table 2
Clinically significant symptoms of depression, anxiety, and co-morbid symptoms in pregnant and postpartum women during the COVID-19 pandemic.

	Pregnant women			Postpartum women		
	Depression	Anxiety	Co-morbid symptoms	Depression	Anxiety	Co-morbid symptoms
	EPDS ≥13 *n* (%)	GAD-7 ≥10 *n* (%)	EPDS ≥13 & GAD-7 ≥10 *n* (%)	EPDS ≥13 *n* (%)	GAD-7 ≥10 *n* (%)	EPDS ≥13 & GAD-7 ≥10 *n* (%)
Overall	889 (26.7)	665 (20.0)	504 (15.2)	1288 (32.7)	1049 (26.6)	799 (20.3)
Brazil	101 (37.7)	92 (34.3)	72 (26.9)	282 (47.2)	250 (41.9)	197 (33.0)
Chile	60 (34.9)	62 (36.0)	47 (27.3)	92 (33.8)	113 (41.5)	76 (27.9)
Cyprus	40 (18.2)	30 (13.6)	19 (8.6)	56 (22.5)	40 (16.1)	28 (11.2)
Greece	64 (19.0)	51 (15.1)	30 (8.9)	90 (23.9)	96 (25.5)	66 (17.6)
Israel	60 (27.5)	33 (15.2)	27 (12.4)	69 (20.6)	41 (12.3)	31 (9.3)
Portugal	183 (24.3)	149 (19.8)	115 (15.3)	188 (28.1)	151 (22.6)	116 (17.3)
Spain	93 (26.3)	104 (29.5)	69 (19.5)	159 (33.5)	160 (33.7)	113 (23.8)
Turkey	225 (27.9)	102 (12.7)	86 (10.7)	216 (34.8)	101 (16.3)	91 (14.7)
UK	63 (31.7)	42 (21.1)	39 (19.6)	136 (39.3)	97 (28.0)	81 (23.4)

EPDS = Edinburgh Postnatal Depression Scale; GAD-7 = Generalized Anxiety Disorder Screener; UK = United Kingdom. Sample sizes in the pregnant women group: EPDS valid data: n = 3326; GAD-7 valid data: n = 3325; sample sizes in the postpartum women group: EPDS valid data: n = 3939; GAD-7 valid data: n = 3937.

Table 3
Comparison of clinically significant symptoms of depression (EPDS ≥ 13) in pregnant and postpartum women across countries.

	1	2	3	4	5	6	7	8	9
Pregnant women: $\chi^2(8) = 46.19$, $p < .001$									
1. Brazil									
2. Chile	0.36								
3. Cyprus	22.37***	14.17***							
4. Greece	26.31***	15.61***	0.06						
5. Israel	5.61	2.45	5.42	5.55					
6. Portugal	17.63***	8.09	3.61	3.75	0.93				
7. Spain	9.12	4.08	5.07	5.31	0.10	0.54			
8. Turkey	9.08	3.33	8.55	10.02	0.01	2.63	0.30		
9. UK	1.82	0.43	10.24**	11.10***	0.86	4.44	1.77	1.09	
Postpartum women: $\chi^2(8) = 119.40$, $p < .001$									
1. Brazil									
2. Chile	13.71***								
3. Cyprus	44.85***	8.21							
4. Greece	53.04***	7.64	0.18						
5. Israel	64.86***	13.48***	0.30	1.14					
6. Portugal	49.48***	3.03	2.93	2.14	6.60				
7. Spain	20.69***	0.01	9.44	9.22	16.11***	3.79			
8. Turkey	19.34***	0.09	12.60***	13.07***	21.07***	6.79	0.22		
9. UK	5.58	1.97	18.74***	19.80***	28.32***	13.18***	2.96	1.91	

Notes: Bonferroni-corrected *p*-value (.05/36) = .0014. UK = United Kingdom.
** $p < .01$.
*** $p < .001$.

Table 4
Comparison of clinically significant symptoms of anxiety (GAD-7 ≥ 10) in pregnant and postpartum women across countries.

	1	2	3	4	5	6	7	8	9
Pregnant women: $\chi^2(8) = 122.84$, $p < .001$									
1. Brazil									
2. Chile	0.14								
3. Cyprus	27.59***	26.99***							
4. Greece	30.47***	28.84***	0.24						
5. Israel	22.92***	22.58***	0.22	0.00					
6. Portugal	23.18***	21.02***	4.29	3.37	2.32				
7. Spain	1.67	2.32	18.95***	20.32***	14.96***	12.75***			
8. Turkey	63.83***	55.57***	0.15	1.26	0.97	14.66***	47.45***		
9. UK	9.76	10.21	4.10	3.11	2.44	0.17	4.57	9.28	
Postpartum women: $\chi^2(8) = 203.33$, $p < .001$									
1. Brazil									
2. Chile	0.01								
3. Cyprus	51.97***	40.69***							
4. Greece	26.89***	18.52***	7.89						
5. Israel	86.90***	67.42***	1.67	19.80***					
6. Portugal	54.33***	34.49***	4.66	1.17	15.11***				
7. Spain	7.52	4.61	25.37***	6.63	47.85***	17.33***			
8. Turkey	97.01***	66.12***	0.01	12.60***	2.70	8.07	44.82***		
9. UK	18.04***	12.39***	11.71***	0.58	25.90***	3.69	2.97	18.80***	

Notes: Bonferroni-corrected *p*-value (.05/36) = .0014. UK = United Kingdom.
*** $p < .001$.

morbidity were observed in our study (15.2 %) to that of another recent systematic review (18 %; Sun et al., 2021).

In contrast, in our study, the prevalence of clinically significant postpartum depressive symptoms (32.7 %) was higher compared to those reported in systematic reviews conducted during the pandemic (Shorey et al., 2021 – 17 %; Yan et al., 2020 – 22 %; depressive symptom data assessed with multiple questionnaires). Although there are no specific data regarding postpartum anxiety in the aforementioned systematic reviews, we observed a higher prevalence of clinically significant symptoms of anxiety (26.6 %) compared to a previous multinational study conducted in several European countries and using the same instrument, with mothers up to 3 months following delivery (10 %; Ceulemans et al., 2021). Similarly, prevalence of co-morbid symptoms was higher in postpartum women in our sample (20.3 %) compared to the prevalence reported in earlier investigations with perinatal women during the pandemic (Luo et al., 2021 – 6.3 %; Sun et al., 2021 – [pregnant only] 18 %). In our multinational sample, higher levels of clinically significant symptoms were observed among postpartum than pregnant women, which may reflect mounting psychological demands experienced by women dealing with changes/restrictions/limited access to their postnatal health care, transitioning to motherhood during a pandemic, worrying about the risk of infection to them and their baby, alongside constraints to daily living associated with the pandemic (Diamond et al., 2020; Gildner and Thayer, 2020).

The prevalence of clinically significant depressive, anxiety and co-morbid symptoms varied considerably across the nine participating countries. The highest levels of symptoms were reported in Brazil and Chile, followed by Spain and the UK. Cyprus, Greece, and Israel had the lowest prevalences of clinically significant symptoms. Indeed, Brazil, Chile, Spain and the UK had high numbers of confirmed cases and

Table 5
Comparison of co-morbid clinically significant symptoms (EPDS ≥13 & GAD-7 ≥10) in pregnant and postpartum women across countries.

	1	2	3	4	5	6	7	8	9
Pregnant women: $\chi^2(8) = 88.11$, $p < .001$									
1. Brazil									
2. Chile	0.01								
3. Cyprus	26.47***	24.08***							
4. Greece	34.37***	30.11***	0.01						
5. Israel	15.36***	13.80***	1.68	1.79					
6. Portugal	17.76***	14.08***	6.31	8.19	1.08				
7. Spain	4.65	4.07	12.41***	15.90***	4.84	3.17			
8. Turkey	42.05***	33.47***	0.78	0.82	0.55	7.34	16.70***		
9. UK	3.33	3.09	10.53**	12.76***	3.98	2.17	0.00	11.68***	
Postpartum women: $\chi^2(8) = 129.96$, $p < .001$									
1. Brazil									
2. Chile	2.22								
3. Cyprus	42.59***	22.68***							
4. Greece	27.90***	9.95	4.67						
5. Israel	64.82***	35.70***	0.59	10.16					
6. Portugal	41.57***	13.38***	5.10	0.01	11.45***				
7. Spain	10.91***	1.58	16.39***	4.91	28.03***	7.22			
8. Turkey	56.51***	21.86***	1.77	1.46	5.59	1.69	14.73***		
9. UK	9.69	1.65	14.32***	3.81	24.50***	5.37	0.02	11.57***	

Notes: Bonferroni-corrected *p*-value (.05/36) = .0014. UK = United Kingdom.
** $p < .01$.
*** $p < .001$.

Table 6
Comparison of clinically significant symptoms of depression and anxiety in perinatal women during the COVID-19 pandemic versus pre-pandemic studies.

	Depression								
	Pregnant women				Postpartum women				
	Pre-pandemic		Pandemic	χ^2	Pre-pandemic		Pandemic	χ^2
	Study	EPDS ≥13 *n* (%)	EPDS ≥13 *n* (%)		Study	EPDS ≥13 *n* (%)	EPDS ≥13 *n* (%)	
Brazil	Jacques et al., 2021	504 (16.1)	101 (37.7)	78.70***	Filha et al., 2016	3065 (25.7)	282 (47.2)	134.61***
Chile	Jadresic et al., 1992	8 (7.4)[a]	85 (49.4)	52.79***	Rojas et al., 2018	121 (39.7)[a]	150 (55.1)	13.82***
Cyprus	n.a.	n.a.	40 (18.2)		n.a.	n.a.	56 (22.5)	
Greece	Koutra et al., 2014	73 (16.7)	64 (19.0)	0.71	Chatzi et al., 2011	74 (14.0)	90 (23.9)	14.66***
Israel	Polachek et al., 2014	22 (24.7)[b]	75 (34.4)	2.74	Simhi et al., 2019	84 (8.4)[a]	128 (38.2)	166.92***
Portugal	Figueiredo and Conde, 2011	49 (19.0)[a]	298 (39.6)	36.87***	Costa et al., 2007	27 (13.7)	188 (28.1)	16.90***
Spain	Vázquez and Míguez, 2019	133 (23.4)[a]	153 (43.3)	40.60***	Escriba-Aguir and Artazcoz, 2011	48 (11.4)	159 (33.5)	60.93***
Turkey	Dikmen-Yildiz et al., 2017	262 (27.5)[c]	261 (32.4)	4.81*	Dikmen-Yildiz et al., 2017	219 (25.5)	216 (34.8)	15.03***
UK	Howard et al., 2018	143 (26.2)	63 (31.7)	2.14	Matijasevich et al., 2009	1393 (10.1)	136 (39.3)	298.71***

	Anxiety							
	Pregnant women				Postpartum women			
	Pre-pandemic		Pandemic	χ^2	Pre-pandemic		Pandemic	χ^2
	Study	GAD-7 ≥10 (%)	GAD-7 ≥10 (%)		Study	GAD-7 ≥10 (%)	GAD-7 ≥10 (%)	
Brazil	Pabon et al., 2020	159 (29.9)	92 (34.3)	1.59	Lamus et al., 2021	101 (19.6)	250 (41.9)	63.45***
Chile	n.a.	n.a.	62 (36.0)		n.a.	n.a.	113 (41.5)	
Cyprus	n.a.	n.a.	30 (13.6)		n.a.	n.a.	40 (16.1)	
Greece	n.a.	n.a.	51 (15.1)		n.a.	n.a.	96 (25.5)	
Israel	n.a.	n.a.	33 (15.2)		n.a.	n.a.	41 (12.3)	
Portugal	n.a.	n.a.	149 (19.8)		n.a.	n.a.	151 (22.6)	
Spain	Soto-Balbuena et al., 2018	31 (8.2)	104 (29.5)	56.48***	n.a.	n.a.	160 (33.7)	
Turkey	n.a.	n.a.	102 (12.7)		n.a.	n.a.	101 (16.3)	
United Kingdom	n.a.	n.a.	42 (21.1)		n.a.	n.a.	97 (28.0)	

Notes: n.a. = no study available using this instrument; UK = United Kingdom. EPDS = Edinburgh Postnatal Depression Scale; GAD-7 = Generalized Anxiety Disorder Screener. In cases where the pre-pandemic studies used an EPDS cutoff score different than 13, and to enable comparisons with our own data, we recalculated the frequencies and percentages for our pandemic data according to the specific cutoff score used by each of those pre-pandemic studies.
* $p < .05$.
*** $p < .001$.
[a] EPDS ≥10.
[b] EPDS ≥11.
[c] EPDS ≥12.

COVID-19 related deaths throughout the study period: a known risk factor for greater psychological distress (Sun et al., 2020; Wu et al., 2020). The increased strain on healthcare systems from managing high numbers of COVID-19 cases may have resulted in limited access to health services by women in the perinatal period (Lazzerini et al., 2022), with potential detrimental effects on their emotional wellbeing. In addition, in countries with less well-developed healthcare systems, already struggling to cope with pre-existing clinical needs (Cimerman et al., 2020; Rodriguez-Morales et al., 2020), such as Brazil and Chile, the pandemic is very likely to have exacerbated pre-existing vulnerabilities. Brazil in particular experienced a high number of COVID-19 related deaths among pregnant and postpartum women (compared to other countries worldwide) (Francisco et al., 2021; Gurzenda and Castro, 2021; Nakamura-Pereira et al., 2020), which likely represented an additional mental health stressor. Another possible explanation for our findings may reside in the specific measures implemented by each government to contain the virus and to mitigate the economic and societal impacts of the pandemic, especially those affecting perinatal care practices and mental health. For example, previous studies showed that stringency of governmental restriction policies (Lee et al., 2021; Usmani et al., 2021), changes in daily routines (Alzueta et al., 2021) and in perinatal experiences and plans (Iyengar et al., 2021; Usmani et al., 2021) are associated with mental health outcomes during this period. Further research on the mental health impact of such measures for the perinatal population is required. Certainly, in our study population more stringent policies and measures of containment were associated with lower levels of symptomatology (Mesquita et al., submitted).

Regarding the second objective of the study, results revealed a significant increase in symptoms of depression and anxiety during (vs. before) the COVID-19 pandemic, especially for women in the postpartum period, corroborating evidence of a recent systematic review examining perinatal mental health before versus during the COVID-19 pandemic (Iyengar et al., 2021). Nevertheless, a few exceptions were found among pregnant women, with some countries showing no significant differences in levels of depressive symptoms (Greece, Israel, and the UK) or anxiety (Brazil). Some studies have also reported no change (Sade et al., 2020) or even decreased depressive symptoms in pregnant women assessed following the onset of the pandemic compared to women assessed before (Pariente et al., 2020; Silverman et al., 2020). Nonetheless, additional investigation is needed in order to better understand this varied pattern of results, especially which perinatal health practices were implemented in these countries that may have buffered the impact of the pandemic on perinatal women's mental health.

4.2. Strengths and limitations

One strength of the present study is that data collection was carried out in several countries at the same time, and using the same instruments, allowing us to directly compare perinatal mental health indicators between countries. Furthermore, the instruments used to assess clinically significant symptoms are considered gold standard for the screening of probable depression (EPDS) and anxiety (GAD-7). Despite the expected elevation in psychological distress during the ongoing public health crisis, this study also explored the extent of the increase in depression and anxiety symptoms compared to pre-pandemic levels.

However, there are noteworthy limitations to this study. Firstly, not all countries involved in the present study have validated the EPDS in pregnant women, whereas validation studies for use of GAD-7 in the perinatal population is lacking for most of these countries. Therefore, further research is needed to ascertain the validity and reliability of these instruments, both in pregnant and postpartum women across different populations/cultures, and to establish cutoff scores that may better estimate probable cases in each specific perinatal period. Additionally, most participants were highly educated and living with a partner: characteristics that are considered protective against perinatal mental disorders (Biaggi et al., 2016; Norhayati et al., 2015). Since the survey was conducted online it may also have limited the participation of more vulnerable women, such as those without internet access, with lower education, or immigrants with difficulties in understanding the language of the country of residence. Furthermore, women younger than 18 years – another vulnerable group – were not included in this sample due to ethical reasons. Thus, considering the characteristics of our sample, levels of clinically significant symptoms reported here may be an underestimation and may limit the generalisability of our findings. Further research is needed involving perinatal women from more social-economically vulnerable backgrounds.

Another limitation regards the lack of data on mental health outcomes before the pandemic in this sample. Although stringent inclusion criteria were used to select the best estimate of pre-pandemic studies, variability in rates of depression can be observed within the same country depending on the cutoff score used, sample size and timing of assessment (Hahn-Holbrook et al., 2018). For example, some of the selected pre-pandemic studies used cutoff points different from the one used in our study (EPDS $\geq$13). In those cases, we adjusted our own cutoff to enable comparisons. However, this change precludes us from drawing definite conclusions regarding changes in levels of probable depression from before to during the pandemic in those countries. In addition, studies using GAD-7 to assess generalised anxiety in the perinatal population were only found in Brazil and Spain, limiting the generalisation of the findings regarding changes in perinatal generalised anxiety before and during the pandemic. The selected pre-pandemic studies were also heterogeneous in terms of sample size, setting of recruitment, and perinatal period assessed, thus likely to impact the methodological quality of the study. Therefore, it is important to conduct more high-quality studies on women's depression and anxiety symptoms throughout pregnancy and in the first year postpartum, especially in countries where this topic is understudied.

Finally, the timing of the survey is also important to consider, since for many countries, until October 2020, the numbers of cases and COVID-19 related deaths were relatively low, which may be reflected in the lower levels of anxiety/depression in early meta-analyses. Therefore, examining these prevalence rates over time will be enlightening to better understand the impact of the pandemic on perinatal mental health.

5. Conclusions

Our findings confirm previous literature showing the negative effects of the COVID-19 pandemic on perinatal mental health and further show variations of those effects across the women's countries of residence. In future studies, it will be important to examine potential protective and risk factors at the country level, especially those regarding specific perinatal healthcare practices implemented during the pandemic. In this way, national evidence-based perinatal mental health care policies and intervention programs may be designed to accurately meet the unique needs of perinatal women in each country. Future research may also usefully focus on the longer-term maternal mental health outcomes and the impact of the pandemic on child development. A unified approach from health professionals, researchers, policymakers, and wider society will be required to mitigate the negative impacts and to foster recovery in perinatal mental health during the pandemic and in its aftermath.

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CRediT authorship contribution statement

EM is principal investigator on the survey from which data for this analysis are drawn. EM and AM conceived and designed the larger multinational study, while all authors collaborated in the design of the study. All authors were involved in recruitment of participants. VM and AO conceived the research question of the study presented here and developed the analysis plan. VM conducted the data analyses. AO and SC supervised the data analyses. VM, AO and SC wrote the first draft of the manuscript. All authors critically revised the manuscript and approved the final version.

Conflict of interest

The authors declare that they have no conflict of interest.

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