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Mental health of pregnant and postpartum women during the third wave of the COVID-19 pandemic: a European cross-sectional study

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ABSTRACT

Objective To describe the mental health of perinatal women in five European countries during the third pandemic wave and identify risk factors related to depressive and anxiety symptoms.

Design A cross-sectional, online survey-based study.

Setting Belgium, Norway, Switzerland, the Netherlands and the UK, 10 June 2021–22 August 2021.

Participants Pregnant and up to 3 months postpartum women, older than 18 years of age.

Primary outcome measure The Edinburgh Depression Scale (EDS) and the Generalised Anxiety Disorder scale (GAD-7) were used to assess mental health status. Univariate and multivariate generalised linear models were performed to identify factors associated with poor mental health.

Results 5210 women participated (including 3411 pregnant and 1799 postpartum women). The prevalence of major depressive symptoms (EDS ≥13) was 16.1% in the pregnancy group and 17.0% in the postpartum . Moderate to severe generalised anxiety symptoms (GAD ≥10) were found among 17.3% of the pregnant and 17.7% of the postpartum women. Risk factors associated with poor mental health included having a pre-existing mental illness, a chronic somatic illness, having had COVID-19 or its symptoms, smoking, unplanned pregnancy and country of residence. Among COVID-19 restrictive measures specific to perinatal care, pregnant and postpartum women were most anxious about not having their partner present at the time of delivery, that their partner had to leave the hospital early and to be separated from their newborn after the delivery.

Conclusion Approximately one in six pregnant or postpartum women reported major depression or anxiety symptoms during the third wave of the pandemic. These findings suggest a continued need to monitor depression and anxiety in pregnancy and postpartum populations throughout and in the wake of the pandemic. Tailored support and counselling are essential to reduce the burden of the pandemic on perinatal and infant mental health.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study is the first to capture and provide an international overview of perinatal mental health during the third pandemic wave using uniform data collection.
⇒ The study measured symptoms of both depression and anxiety based on validated self-reported screening tools.
⇒ The study has limitations inherent to all online surveys, including the over-representation of women with high education levels.

INTRODUCTION

Up to 20% of pregnant and postpartum women have symptoms of mental illness.[1] Moreover, mental health problems tend to increase in the perinatal population in times of crisis.[1 2] Therefore, authorities and healthcare providers are concerned and have called on researchers to study the impact of the COVID-19 pandemic on women's mental health during the perinatal period.[3] Prior work has reported that the COVID-19 pandemic has imposed a major mental health burden and an increased risk of depression, anxiety and sleep disturbances in particular subgroups such as pregnant and postpartum women.[3 4] However, despite having information about the impact of the first wave of the COVID-19 pandemic, there is much less knowledge on how the consecutive waves have affected the quality of life and mental health in the perinatal population.

Currently, there is mounting evidence that the pandemic disproportionately affects pregnant and postpartum women's mental health compared with the general population due to fear and concerns about their unborn child or neonate.[3] Studies suggest that between 25% and 60% of pregnant and between 24% and 57% of postpartum women have demonstrated moderate to severe depressive symptoms during and after the first wave of

the pandemic (online supplemental table 1). A recent meta-analysis investigating the pooled prevalence of mental health symptoms in developed and low/middle-income countries during the first and second wave of the COVID-19 pandemic showed that the overall prevalence of depression, anxiety and stress in the perinatal population was 27%, 33% and 27%, respectively.[5] In a previous multinational study conducted in five European countries at the end of the first wave of the pandemic, we found that 13% and 15% of women had depressive symptoms during pregnancy and breast feeding, respectively. Anxiety levels were also high among these groups.[6] In another study, pregnant women showed a more pronounced increase in depression and anxiety than non-pregnant women as the pandemic progressed; pregnant women reported 33% of symptoms of moderate and severe depression compared with 10% in the non-pregnant group.[7] Several European studies have reported poorer mental health, including pandemic fear, post-traumatic stress, anxiety and depression among perinatal women during the first and second waves of the pandemic (online supplemental table 1). However, these studies only investigated the prevalence of anxiety and depressive symptoms after the first two pandemic waves and mainly included one country and small sample sizes.

Ensuring the mental health of the perinatal population is essential for the well-being of mother and child, with potentially severe consequences if neglected.[8] This may be particularly true during a pandemic with multiple consecutive waves. Therefore, it is essential to investigate the risk and protective factors associated with the mental health of pregnant and postpartum women during all phases of the pandemic to ensure that adequate actions can be taken, if required.

The primary aim of this multinational cross-sectional study was to describe the mental health of pregnant and postpartum women in five European countries during the third wave of the pandemic (summer 2021). The secondary aim was to identify risk factors related to depressive and anxiety symptoms among pregnant and postpartum women. This also included describing which COVID-19-related measures specific to perinatal care women were most anxious about.

METHODS

Study design and data collection

This European cross-sectional online study was performed in Belgium, Norway, Switzerland, the Netherlands, and the UK between 10 June 2021 and 22 August 2021. Uniform data collection was performed using anonymous online questionnaires hosted on the KU Leuven survey platform (Qualtrics) and the University of Oslo's platform (Nettskjema). These questionnaires were modified based on a prior COVID-19 study in 2020[6] and adapted to this study based on expert feedback from the coauthors. The survey was first developed in English and then translated into five additional languages (French, Dutch, Norwegian, German and Italian). There were two questionnaires, one tailored to pregnant women and the other to postpartum women. A short version of the survey used in this study is available in online supplemental material 1. Country-specific information on the recruitment tools used and internet penetration rates are summarised in online supplemental material 2. An overview of the infection and vaccination rates in each country during the study period is provided in online supplemental material 3.

Pregnant and postpartum women who gave birth in the previous 3 months, aged 18 or older, were eligible to participate.The respondents could access the survey's web link via banner ads on national websites, research groups' webpages, self-help groups on social media and pregnancy and postpartum online discussion fora and apps commonly visited by pregnant women or new mothers. All women who completed the postpartum survey, including those who recently ceased breast feeding, were grouped into the 'postpartum women' category. The study findings are reported according to the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines for cross-sectional studies.[9]

This study focuses specifically on women's mental health during the pandemic. It is part of an international COVID-19 collaboration to study pregnant and postpartum women's mental health status, medication use, COVID-19 vaccine willingness, breastfeeding practices and birth experiences during the pandemic.

Measures

Edinburgh Depression Scale

Edinburgh Depression Scale (EDS) was used to measure the depressive symptoms. It is a perinatal-specific, validated self-report 10-item scale with high internal consistency (0.77).[10 11] Each item has four options, which are scored 0, 1, 2 or 3, with a total score between 0 and 30. The scale rates the intensity of depressive symptoms over the last 7 days. Major depressive symptoms were defined as having a total EDS score of ≥13. We applied two cut-offs to distinguish between moderate and major depressive symptoms, that is, ≥10 and ≥13. The most conservative cut-off, that is, ≥13 was thereafter used in the association analyses. A score ≥5 on the EDS anxiety subscale (EDS-3A) was considered as high risk for anxiety.[10 12 13] This scale was developed in English but has been translated to and has satisfactory validity in Norwegian, Dutch, French, German and Italian.[14]

Generalised Anxiety Disorder 7-item scale

Anxiety symptoms were measured using the Generalised Anxiety Disorder 7 (GAD-7) scale, a self-report 7-item scale assessing the level of generalised anxiety experienced in the two previous weeks.[15] The scale measures the severity of generalised anxiety on a 4-point Likert scale ranging from 0 (not at all), 1 (several days), 2 (more than half of the days) and 3 (nearly every day), with a total score between 0 and 21. Higher scores indicate more generalised anxiety. Total GAD-7 scores were categorised

into minimal (0–4), mild (5–9), moderate (10–14) and severe (15–21) anxiety.[15] This scale was also available and validated in all of the survey's languages.[16]

Sociodemographic, health and reproductive characteristics

Information on sociodemographic characteristics included country of residence, maternal age, relationship and professional status, education level, COVID-19 characteristics and smoking status in pregnancy and post partum. Professional status was categorised into professionally active=employed, and not professionally active=student, homemaker, jobseeker, incapacitated or unemployed. The educational level was categorised into low, medium and high according to national definitions as low=primary education; medium=professional secondary education, technical secondary education, artistic secondary education, general secondary education and high=professional bachelor, academic bachelor, master and/or PhD. Information on reproductive characteristics included parity, planned pregnancy, gestational trimester on study participation, breastfeeding duration and previous breastfeeding experience, if any. Question on parity and pregnancy planning was only limited to pregnant women. Women were asked to report if they had any chronic disease from a list of 10 common chronic somatic illnesses and pre-existing mental illnesses. Moreover, they could also report other chronic diseases in an open-ended question. A chronic illness was considered a condition that already existed before pregnancy. Depression and anxiety disorders were grouped into pre-existing mental illnesses. Asthma, allergy, cardiovascular diseases, diabetes, epilepsy, hypothyroidism and other diseases were grouped into chronic somatic illnesses.

Women's perinatal experiences and perceptions during the pandemic

The survey also collected data on women's perceptions of COVID-19 symptoms and severity, pregnancy and postpartum experiences, and thoughts regarding COVID-19, such as COVID-19 restrictions concerning maternity care and delivery, via several questions specifically designed for this study. The survey further included an eight-item question regarding women's mental health in relation to COVID-19 measures in maternity services and giving birth (eg, isolation, disrupted antenatal appointments). Women could report the frequency of anxiety concerning each COVID-19 measure on a 6-point Likert scale ranging from 'not at all anxious' to 'extremely anxious', including a 'not applicable' option. To present the findings, we grouped 'slightly anxious' and 'anxious' into one category as 'anxious'; and 'very anxious' and 'extremely anxious' as one category as 'very anxious'. At the end of the survey, women were asked about their experiences relating to the COVID-19 pandemic in an open-ended question. All the responses were inductively categorised under predominant themes such as mental health, vaccination and medication use, using the clinical judgement approach. Some representative mental health-related statements from each country were extracted for this study.

Statistical analyses

First, women's sociodemographic and health-related factors, scores on the mental health measures and perinatal experiences and perceptions during the pandemic were analysed using descriptive statistics. Second, associations between characteristics of pregnant and postpartum women and major depressive symptoms (EDS ≥13 as a dichotomous outcome) were estimated by univariate and multivariate generalised linear models (GLMs) with logit link (ie, logistic regression); results are presented as crude and adjusted OR with 95% CIs. Since the continuous GAD-7 variable was positively skewed (online supplemental figure 1), associations between covariates and anxiety symptoms (GAD-7) were estimated by GLMs with gamma distribution and log link function. The results are presented as crude and adjusted exponentiated beta coefficients (Exp β) and 95% CI, and interpreted as follows: when the exponentiated beta value is greater than one, then the probability of higher category increases, while if the value is less than one, the probability of higher category decreases. These models were built following the 'purposeful selection' approach.[17] Candidate variables were first selected in the univariable analyses, based on $p<0.1$. Then, variables with no role ($p>0.1$) or yielding a change smaller than 20% in the beta-coefficients of the retained variables were removed. All sociodemographic, health-related and reproductive characteristics were entered as categorical variables in the models. The final adjusted models included statistically significant variables and those yielding a change equal to or greater than 20% in the beta-coefficients.

The potential for multicollinearity was assessed from the variance inflation factor (VIF) for each variable in each model. Using VIF>10 as a threshold value indicative of multicollinearity,[18] the results indicated that multicollinearity was not likely to be a problem in this study. Goodness of fit for the models was evaluated using Hosmer-Lemeshow tests for logistic models and by graphing Anscombe residuals for gamma GLMs. Finally, as sensitivity analyses, models accounting for clustering effects at the country level were developed. Missing data were explored. Because missing data were less than 6% for EDS and 7% for GAD-7, and there were no clear patterns of missingness, we conducted a complete case analysis. Data were analysed in RStudio V.4.1.2 (RStudio Team, RStudio PBC, Massachusetts, USA) and Stata V.16.1 (Stata).

Patient and public involvement

Patients or members of the public were not involved in the development of the study aim and outcome measures, the design of the study, the recruitment and conduct of the study.

RESULTS

In total, 5210 women participated in the survey (including 3411 pregnant and 1799 postpartum women) (see table 1). Most respondents were from Norway (69.7% in pregnancy and 61.9% in post partum). The majority of women had a high educational level and were professionally active at study participation, with a high percentage of women working in healthcare (27.0%). About 4.8% of the pregnant and 5.6% of postpartum women had tested positive for COVID-19 since the start of the pandemic. Regarding COVID-19 severity in both groups, pregnant women had more often moderate symptoms (5.4% vs 4.0%) and were more often hospitalised/demonstrated more long-term symptoms (2.1% vs 1.0%). Approximately 20% of postpartum women's family members had previously tested positive for COVID-19 compared with 15% in the pregnancy group. Overall, 89.1% of the postpartum women were breast feeding at the time of survey completion.

With regard to comorbidities, pre-existing depression in pregnancy was reported by 1.8% and 1.1% of pregnant and postpartum women, respectively. The proportion of pregnant and postpartum women experiencing pre-existing anxiety was 1.4%. Allergy (18.6% in pregnant and 12.8% postpartum women) and asthma (5.7% in pregnant and 4.1% postpartum women) were the most commonly reported chronic somatic illnesses. Hypothyroidism was higher in pregnant (4.6%) than postpartum women (1.3%). A comparison of participants' characteristics with general birthing population data is included in online supplemental table 2.

Mental health status of the pregnant and postpartum women

The prevalence of major depressive symptoms (EDS ≥13) was 16.1% and 17.0% in pregnancy and postpartum, respectively. The proportion of pregnant and postpartum women with generalised anxiety symptoms (EDS-3A ≥5) was 30.3% and 34.0%, respectively. Moderate to severe generalised anxiety symptoms (GAD-7 ≥10) were found among 17.3% and 17.7% of the pregnant and postpartum women, respectively (see table 2).

Factors associated with major depressive and anxiety symptoms

Pregnant women with a pre-existing mental illness who had an unplanned pregnancy and living in the UK were more likely to experience symptoms of major depression (EDS ≥13). In the postpartum group, women with a pre-existing mental illness, who were not breast feeding, who reported having had COVID-19 or symptoms of COVID-19, and living in the UK were more likely to experience symptoms of major depression (EDS ≥13) (see table 3). Having a pre-existing mental illness (adjusted OR: 2.45–4.12 in magnitude) and living in the UK (magnitude of OR: 2.51–2.96) were most strongly associated with major depressive symptoms in both groups.

Among pregnant women, having a pre-existing mental or chronic somatic disease, smoking during pregnancy,

Table 1 Characteristics of the study participants, n=5210

	Pregnant (n=3411)	Postpartum (n=1799)
	n (%)	n (%)
Sociodemographic characteristics		
Country		
Norway	2376 (69.7)	1113 (61.9)
Belgium	360 (10.5)	235 (13.0)
UK	290 (8.5)	120 (6.7)
Switzerland	210 (6.2)	176 (9.8)
Netherlands	175 (5.1)	155 (8.6)
Maternal age (years)		
18–30	1374 (40.3)	675 (37.5)
31–40	1707 (50.0)	897 (49.9)
>40	68 (2.0)	44 (2.4)
Relationship status		
Married/cohabiting/ partner	3092 (90.6)	1595 (88.6)
Single	57 (1.7)	21 (1.2)
Professional status		
Professionally active	2799 (82.1)	1430 (79.5)
Not professionally active	348 (10.2)	176 (9.8)
Education level		
Low	73 (2.1)	34 (1.9)
Medium	540 (15.8)	290 (16.1)
High	2516 (73.8)	1279 (71.1)
Healthcare worker		
Yes	906 (26.6)	486 (27.0)
No	1879 (55.1)	947 (52.6)
Smoking in pregnancy/post partum		
Yes	43 (1.3)	31 (1.7)
No	3106 (91.0)	1585 (88.1)
COVID-19 characteristics		
COVID-19 status*		
Positive test	163 (4.8)	100 (5.6)
Symptomatic†	224 (6.6)	159 (8.8)
None	2957 (86.7)	1501 (83.4)
Severity of the infection		
No or mild symptoms	128 (3.8)	97 (5.4)
Moderate symptoms	185 (5.4)	72 (4.0)
Hospitalised/long-term symptoms	70 (2.1)	31 (1.7)
Family member infected with COVID-19		
Yes	520 (15.2)	352 (19.6)
No	2820 (82.7)	1406 (78.1)
Health and reproductive characteristics		
Pre-existing mental illness		
Depression	60 (1.8)	19 (1.1)
Anxiety	49 (1.4)	26 (1.4)
Chronic somatic illness		
Asthma	195 (5.7)	74 (4.1)

Continued

Table 1 Continued

	Pregnant (n=3411)	Postpartum (n=1799)
	n (%)	n (%)
Allergy	634 (18.6)	230 (12.8)
Cardiovascular diseases	44 (1.3)	46 (2.6)
Diabetes	33 (1.0)	27 (1.5)
Epilepsy	17 (0.5)	0 (0.0)
Hypothyroidism	157 (4.6)	24 (1.3)
Other‡	343 (10.1)	146 (8.1)
Parity§		
Nulliparous	87 (5.2)	N/A
Multiparous	1580 (94.8)	N/A
Infant age		
≤6 weeks	N/A	674 (37.4)
6–12 weeks	N/A	1102 (61.3)
Planned pregnancy		
Yes	2673 (78.3)	N/A
No	208 (6.1)	N/A
No, but it was not unexpected	465 (13.6)	N/A
Gestational trimester		
First trimester (<14 weeks)	393 (11.5)	N/A
Second trimester (14 to <28 weeks)	1151 (33.7)	N/A
Third trimester (28 weeks to end of pregnancy)	1802 (52.8)	N/A
Currently breast feeding¶		
Yes	N/A	1604 (89.1)
No	N/A	172 (9.6)
Previous breastfeeding experience		
Yes	N/A	660 (36.7)
No	N/A	942 (52.4)

Numbers may not add up due to missing values; missing values for pregnant women: maternal age, relationship status and smoking in pregnancy, n=262 (7.7%), professional status, n=264 (7.7%), education level, n=282 (8.3%), healthcare worker, n=626 (18.4), COVID-19 status, n=66 (1.9%) and family member infected with COVID-19, n=71 (2.0%), severity of the infection, n≤5, planned pregnancy and gestational trimester, n=65 (2.0%). Missing values for postpartum women: maternal age, relationship status and smoking in postpartum, n=183 (10.2%), professional status, n=193 (10.7%), education level, n=196 (11.0%), healthcare worker, n=366 (20.3), COVID-19 status, n=39 (2.2%), severity of the infection, n=59 (3.7%), family member infected with COVID-19, n=41 (2.3%), infant age and currently breast feeding, n=23 (1.3%), previous breastfeeding experience, n=197 (10.9%).
*Refers to COVID-19 status since the start of the pandemic (not limited to pregnancy or post partum).
†Refers to negative test, but presence of symptoms.
‡Others include rheumatic illness, inflammatory bowel disease and other diseases.
§Applicable to women who have been pregnant before, n=1667.
¶Refers to breast feeding at the time of survey completion.
N/A, not applicable.

having an unplanned pregnancy, having had COVID-19 or symptoms of COVID-19, and country of residence were associated with generalised anxiety symptoms. Among postpartum women, generalised anxiety was positively associated with having a pre-existing mental illness or chronic somatic illness and not being professionally active (see table 4). Having a pre-existing mental illness (adjusted Exp(β): 1.49–1.80 in magnitude) or a chronic somatic illness (adjusted Exp(β): 1.80–1.15 in magnitude) were the factors most strongly associated with generalised anxiety symptoms.

The results did not change substantially after sensitivity analyses taking into account data clustering by country.

Impact of COVID-19-related measures in maternity care

Among restrictive measures imposed in maternity services, pregnant and postpartum women reported being most anxious about their partner not being present at the time of delivery, having to leave the hospital early and being separated from their newborn infant (see table 5). Conversely, they were the least anxious about the lack of antenatal classes and disrupted antenatal appointments. Representative statements to the open-ended questions related to mental health and well-being are presented in online supplemental table 3. Overall, from these statements, it appeared that women felt more isolated during the pandemic and that being pregnant during the pandemic could have negative impacts (such as emotional distress, panic attacks and fear) on their mental health and well-being.

DISCUSSION

This multinational cross-sectional online study investigated the mental health status of pregnant and postpartum women living across Europe during the third wave of the COVID-19 pandemic.The results show that among five European countries, the prevalence of major depressive symptoms(EDS ≥13) and moderate to severe generalised anxiety symptoms (GAD-7≥10) in the perinatal study population was up to 17.0% and 17.7%, respectively. The prevalence of general anxiety was up to 34.0% on the EDS anxiety subscale (EDS-3A ≥5). Identified risk factors associated with poor mental health include a pre-existing mental or chronic somatic illness, smoking, an unplanned pregnancy, having had COVID-19 or similar symptoms and residential location.

We observed a slightly higher prevalence of major depressive symptoms and anxiety during the third wave of the pandemic compared with the first one.[6] This observation should be interpreted bearing in mind that the two studies cannot directly be compared as they were not performed within the same women and were cross-sectional in design.[6] The results, however, are consistent with a meta-analysis that reported a higher prevalence of depression and anxiety in the perinatal population later in the pandemic compared with earlier in the pandemic[19] (online supplemental table 1). Another recent international meta-analysis with pooled prevalence results from 23 countries and 20 569 participants showed that the prevalence rates of depression and anxiety among pregnant

Table 2 Mental health status of pregnant and postpartum women during the third wave of the COVID-19 pandemic

		Pregnant			Postpartum		
		N	% (95% CI)	Mean (SD)	N	% (95% CI)	Mean (SD)
EDS	General	3240	100.0	7.2 (5.2)	1696	100.0	7.5 (5.1)
	Score ≥10	966	29.8 (28.2 to 31.4)	N/A	538	31.7 (29.5 to 33.9)	N/A
	Score ≥13	522	16.1 (14.8 to 17.4)	N/A	289	17.0 (15.2 to 18.8)	N/A
	Norway (≥13)	366	15.4 (14.0 to 16.9)	N/A	183	16.4 (14.4 to 18.7)	N/A
	Belgium (≥13)	39	12.7 (9.4 to 16.9)	N/A	35	16.8 (12.3 to 22.5)	N/A
	UK (≥13)	86	35.1 (29.4 to 41.3)	N/A	35	38.0 (28.7 to 48.3)	N/A
	Switzerland (≥13)	16	9.2 (5.7 to 14.6)	N/A	20	13.3 (8.8 to 19.8)	N/A
	Netherlands (≥13)	15	10.8 (6.6 to 17.1)	N/A	16	12.0 (7.5 to 18.7)	N/A
EDS-3A	Score ≥5	982	30.3 (28.7 to 31.9)	3.3 (2.2)	577	34.0 (31.8 to 36.3)	3.5 (2.2)
GAD-7	Total	3216	100.0	5.7 (4.7)	1680	100.0	5.6 (4.5)
	Minimal (0–4)	1546	48.1 (46.3 to 49.8)	N/A	791	47.1 (44.7 to 49.5)	N/A
	Mild (5–9)	1111	34.5 (32.9 to 36.2)	N/A	592	35.2 (33.0 to 37.5)	N/A
	Moderate (10–14)	339	10.5 (9.5 to 11.6)	N/A	208	12.4 (10.8 to 14.0)	N/A
	Severe (15–21)	220	6.8 (6.0 to 7.7)	N/A	89	5.3 (4.2 to 6.4)	N/A
	Norway (10–21)	449	18.9 (17.4 to 20.5)	N/A	229	20.6 (18.3 to 23.0)	N/A
	Belgium (10–21)	32	10.6 (7.6 to 14.7)	N/A	25	12.4 (8.5 to 17.7)	N/A
	UK (10–21)	58	24.2 (19.2 to 30.0)	N/A	22	24.7 (16.9 to 34.7)	N/A
	Switzerland (10–21)	8	4.8 (2.4 to 9.3)	N/A	10	6.9 (3.7 to 12.3)	N/A
	Netherlands (10–21)	12	9.0 (5.2 to 15.2)	N/A	11	8.4 (4.7 to 14.5)	N/A

Total score from 0 to 30, cut-off of ≥10 indicating moderate symptoms of depression, cut-off ≥13 indicating symptoms of moderate to severe depression.[10]
EDS-3A ≥5 on the subscale was considered as high risk for anxiety.
Total scores range between 0 and 21 with higher scores indicating more generalised anxiety.
Total GAD-7 scores were categorised into minimal (0–4), mild (5–9), moderate (10–14) and severe (15–21) anxiety.[15]
Missing data were <6% for EDS and 7% for GAD–7.
EDS, Edinburgh Depression Scale; GAD-7, Generalised Anxiety Disorder 7-item Scale; N/A, not applicable.

women during the COVID-19 pandemic were up to 31% (95% CI 20% to 42%) and 37% (95% CI 25% to 49%), respectively. Among postpartum women, the prevalence of depression was 22% (95% CI 15% to 29%).[20] There are multiple possible explanations for this variability in prevalence rates across studies: (1) differences in methodology, including psychometric properties of the screening tools in different languages or the different cut-off scores used, (2) pandemic-related factors such as differences in public health regulations implemented globally at different times over the last 2 years and (3) and/orthe public'sreliianceon the government to restrain the spread of the virus. The tendency towards higher rates of depression in the perinatal population as previously been reported for Spain and Italy (>30% with depressive symptoms) vs countries in the Northern parts of Europe (<20% with depressive symptoms) (online supplemental 2) coincides well with our study's finding. As a result, more robust region-specific and pregnancy-specific studies are needed to examine perinatal mental health during a pandemic.

Our secondary findings show that pregnant and postpartum women with pre-existing mental illnesses were more likely to report major depressive and anxiety symptoms. This finding is consistent with the existing literature showing increased depression and anxiety symptoms during a pandemic among those with a history of mental illness.[21] In addition, the imposed public health regulations during the pandemic and, potentially, the lack of partner support during delivery and heightened anxiety may all contribute to the worsening of pre-existing mental illnesses or negatively affect the entire experience of pregnancy and delivery.[22] This finding underscores the importance of a close follow-up of pregnant or postpartum women with pre-existing mental health conditions in the current and future pandemics.

One concerning finding from our study is that women who reported having had COVID-19 or its symptoms more often reported symptoms of major depressive and anxiety symptoms. This may indicate the burden an infection may have on mental health, which may also be true in future waves of the pandemic. However, due to the study's cross-sectional design, we cannot rule out whether the converse is true, that is, severe depressive symptoms are linked to greater infection susceptibility. Prior literature covering the first pandemic waves has shown that having been infected may induce fear, post-traumatic stress, anxiety and depression, also among perinatal women[23] (online supplemental table 1). Considering other risk factors, pregnant women with an unplanned pregnancy exhibited a significant increase in major depressive symptoms

Table 3 Factors associated with major depressive symptoms (EDS ≥13) among pregnant and postpartum women

	Pregnant		Postpartum	
	cOR (95% CI)	aOR (95% CI)	cOR (95% CI)	aOR* (95% CI)
Country				
Norway	Ref	Ref	Ref	Ref
Belgium	0.80 (0.56 to 1.13)	0.87 (0.58 to 1.28)	1.02 (0.69 to 1.53)	0.94 (0.62 to 1.43)
Switzerland	0.56 (0.33 to 0.95)	0.63 (0.36 to 1.12)	0.78 (0.48 to 1.28)	0.66 (0.38 to 1.15)
The Netherlands	0.66 (0.38 to 1.15)	0.74 (0.40 to 1.36)	0.69 (0.40 to 1.20)	0.64 (0.37 to 1.13)
UK	2.97 (2.23 to 3.95)	2.96 (2.12 to 4.13)	3.12 (1.99 to 4.89)	2.51 (1.52 to 4.12)
Professional status				
Professionally active	Ref	Ref	Ref	Ref
Not professionally active	1.99 (1.53 to 2.59)	NI	1.49 (1.02 to 2.20)	1.40 (0.95 to 2.08)
Healthcare worker				
Yes	0.75 (0.60 to 0.95)	0.80 (0.63 to 1.01)	1.06 (0.79 to 1.43)	NI
Smoking				
Yes	1.84 (0.92 to 3.67)	NI	1.47 (0.62 to 3.44)	NI
COVID-19 status				
None	Ref	Ref	Ref	Ref
Positive test/symptomatic	1.56 (1.19 to 2.04)	1.32 (0.96 to 1.82)	1.33 (0.97 to 1.82)	1.67 (1.11 to 2.51)
Pre-existing mental illness				
Yes	2.60 (1.64 to 4.10)	2.45 (1.39 to 4.31)	4.52 (2.28 to 8.98)	4.12 (2.01 to 8.45)
Planned pregnancy				
Yes	Ref	Ref	Ref	Ref
No	1.81 (1.29 to 2.56)	1.71 (1.12 to 2.62)	N/A	N/A
No, but it was not unexpected	1.32 (1.02 to 1.72)	1.31 (0.97 to 1.78)	N/A	N/A
Currently breast feeding†				
No	N/A	N/A	1.86 (1.26 to 2.74)	1.53 (1.00 to 2.35)

*Adjusted for country, professional status, COVID-19 status, pre-existing mental illness and currently breast feeding.
†Refers to breast feeding at the time of survey completion. If not otherwise stated, the reference group is the counterpart.
aOR, adjusted OR; cOR, crude OR; EDS, Edinburgh Depression Scale; N/A, not available; NI, not included.

and anxiety which is in accordance with another study on similar topic.[24]

Our findings show that women consider partner support crucial during delivery, particularly during a pandemic with many uncertainties. Yet, many countries heterogeneously imposed public health regulations that excluded or heavily restricted the woman's partner from the delivery setting.[22 23] Thought of being separated from the baby after delivery also had a negative impact on perinatal women. In retrospect, our findings question the mental health impact of such imposed regulations.

Despite an improvement in antenatal care during the third pandemic wave, different international vaccination policies for pregnant and postpartum populations became available, and as knowledge to tackle the virus increased, it gave rise to new concerns. In particular, the emergence of new and potentially more harmful variants for pregnant women may have contributed to maintaining a high burden of the pandemic on perinatal mental health. More studies are still needed to explore the current pandemic's long-term perinatal and infant mental health consequences.

Strength and limitations

This study measured symptoms of both depression and anxiety based on self-reported screening instruments and used different cut-off scores to examine symptom severity. Notably, two internationally validated mental health scales were used as well as statements providing more in-depth insight into pregnant and postpartum women's experiences.To our knowledge, this study is the first to give an overview of the perinatal mental health status during the third wave of the pandemic in a uniform manner across several European countries.

In addition to its strengths, this study also has several limitations, some of which are inherent to all online surveys. First, a conventional response rate calculation is not possible in anonymous online surveys. Therefore, we must rely on indirect measures, that is, a comparison with national birthing population data, to assess the study's external validity (online supplemental table 2). Second, we observed demographic biases in participation with an under-representation of women from the Netherlands, Switzerland and the UK. Although our sample represents women of childbearing age, the study

Table 4 Factors associated with generalised anxiety (GAD-7) among pregnant and postpartum women

	Pregnant		Postpartum	
	Crude	Adjusted*	Crude	Adjusted†
	Exp(β) (95% CI)	Exp(β) (95% CI)	Exp(β) (95% CI)	Exp(β) (95% CI)
Country				
Norway	Ref	Ref	Ref	Ref
Belgium	0.81 (0.73 to 0.89)	0.83 (0.74 to 0.92)	0.78 (0.69 to 0.88)	0.80 (0.70 to 0.90)
Switzerland	0.63 (0.55 to 0.71)	0.64 (0.56 to 0.74)	0.75 (0.65 to 0.87)	0.75 (0.62 to 0.91)
The Netherlands	0.68 (0.59 to 0.78)	0.72 (0.61 to 0.84)	0.58 (0.50 to 0.67)	0.59 (0.50 to 0.69)
UK	1.22 (1.10 to 1.36)	1.23 (1.09 to 1.39)	1.09 (0.92 to 1.30)	1.08 (0.87 to 1.34)
Maternal age (years)				
18–30	Ref	Ref	Ref	Ref
31–40	0.94 (0.89 to 1.00)	NI	0.88 (0.81 to 0.95)	0.94 (0.86 to 1.02)
>40	1.03 (0.85 to 1.26)	NI	0.85 (0.67 to 1.09)	0.91 (0.70 to 1.18)
Professional status				
Professionally active	Ref	Ref	Ref	Ref
Not professionally active	1.28 (1.16 to 1.40)	NI	1.25 (1.10 to 1.41)	1.16 (1.01 to 1.32)
Healthcare worker				
Yes	0.90 (0.84 to 0.96)	0.91 (0.85 to 0.97)	0.97 (0.89 to 1.06)	NI
Smoking				
Yes	1.47 (1.15 to 1.88)	1.34 (1.00 to 1.80)	1.33 (1.00 to 1.77)	1.33 (0.98 to 1.81)
COVID-19 status				
None	Ref	Ref	Ref	Ref
Positive test/symptomatic	1.12 (1.02 to 1.22)	1.13 (1.02 to 1.25)	1.00 (0.90 to 1.11)	NI
Pre-existing mental illness				
Yes	1.50 (1.25 to 1.78)	1.49 (1.21 to 1.83)	1.86 (1.42 to 2.45)	1.80 (1.34 to 2.41)
Chronic somatic illness				
Yes	1.12 (1.06 to 1.19)	1.08 (1.02 to 1.15)	1.20 (1.10 to 1.30)	1.15 (1.05 to 1.26)
Planned pregnancy				
Yes	Ref	Ref	Ref	Ref
No	1.30 (0.15 to 1.46)	1.23 (1.08 to 1.41)	N/A	N/A
No, but it was not unexpected	1.22 (1.13 to 1.33)	1.19 (1.08 to 1.30)	N/A	N/A
Currently breast feeding‡				
No	N/A	N/A	1.12 (0.98 to 1.29)	NI

*Adjusted for country, healthcare worker, smoking in pregnancy, COVID-19 status, pre-existing mental and chronic somatic illness and planned pregnancy.
†Adjusted for country, maternal age, smoking in post partum, COVID-19 status, pre-existing mental and chronic somatic illness and currently breast feeding.
‡Refers to breast feeding at the time of survey completion. If not otherwise stated, the reference group is the counterpart.
Exp(β), exponentiated beta-values; GAD-7, Generalised Anxiety Disorder; N/A, not available; NI, not included.

included more women with prior children, this may have affected study representativeness and limited the generalisability. Participants were more highly educated and professionally active than national birthing population data. This finding might indicate a selection bias towards more healthy study participants. Hence, the possibility that the more severely depressed or anxious women were either under-represented or over-represented in the online survey cannot be excluded. This may also explain the somewhat lower prevalence rates of depression and anxiety in this study population compared with the meta-analysis results.[5] Therefore, our results may not be fully representative of the target birthing population in the selected countries. We did not apply survey weights to take account of unequal sample selection, as demographic characteristics such as age and education specifically in pregnant or postpartum women are not readily available in all countries for generating these weights. This could affect the variance of some covariates; it also means that the population included in the analysis does not reflect a representative sample of the countries and might preclude the generalisability of results. Lastly, the cross-sectional design limited our capacity to determine the temporal sequence between mental health and

Table 5 Women's level of anxiousness according to different COVID-19-related measures

	Pregnant (%)				Postpartum (%)			
	Very anxious	Anxious	Not anxious	N/A	Very anxious	Anxious	Not anxious	N/A
Thought of not having my partner with me during birth	61.7	22.7	3.8	11.8	69.5	17.7	2.2	10.6
Thought of my partner having to leave the hospital soon after birth	61.5	23.5	4.4	10.5	64.1	18.6	4.5	12.8
Thought of being separated from my baby after delivery	59.3	20.0	6.4	14.3	60.3	13.9	5.8	20.1
Not having support from family and friends	33.8	37.6	14.4	14.4	39.0	36.7	11.1	13.2
Lack of information /inconsistent information from HCPs	13.1	46.3	14.8	25.8	17.7	46.8	14.2	21.3
Isolation	11.0	41.6	25.2	22.3	20.1	41.0	19.0	20.0
Lack of antenatal classes	10.3	35.0	26.2	28.4	13.3	37.8	27.2	21.6
Disrupted antenatal appointments	6.2	30.1	20.4	43.2	10.0	35.2	20.5	34.3

HCPs, healthcare professionals; N/A, not applicable.

associated factors; however, some factors, for example, chronic conditions, occurred before measuring current mental health status.

Implication for practice

The results from this European cross-sectional study form a basis for further prospective studies on socioeconomic, clinical, reproductive and environmental determinants of mental health among perinatal populations during times of pandemics. The results underscore the importance of healthcare providers to be observant of mental health symptoms among pregnant and postpartum women in their care, especially during pandemics.

CONCLUSION

Approximately one in six pregnant and postpartum women in five European countries reported symptoms of major depression and anxiety during the third wave of the pandemic. This suggests a continued need to monitor depression and anxiety in pregnancy and postpartum populations throughout the pandemic. Tailored support and counselling are essential to reduce the burden of the pandemic on perinatal and infant mental health.

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