Acta Obstetricia et Gynecologica Scandinavica

Received: 29 October 2020 | Revised: 11 January 2021 | Accepted: 16 January 2021

DOI: 10.1111/aogs.14092

ORIGINAL RESEARCH ARTICLE

# Mental health status of pregnant and breastfeeding women during the COVID-19 pandemic—A multinational cross-sectional study

Michael Ceulemans[1,2] | Veerle Foulon[1] | Elin Ngo[3] | Alice Panchaud[4,5] | Ursula Winterfeld[6] | Léo Pomar[7] | Valentine Lambelet[7] | Brian Cleary[8,9] | Fergal O'Shaughnessy[8,9] | Anneke Passier[2] | Jonathan L. Richardson[10] | Titia Hompes[11,12] | Hedvig Nordeng[3,13]

[1]Department of Pharmaceutical and Pharmacological Sciences, KU Leuven, Leuven, Belgium

[2]Teratology Information Service, Pharmacovigilance Centre Lareb, 's-Hertogenbosch, the Netherlands

[3]Pharmacoepidemiology and Drug Safety Research Group, Department of Pharmacy, PharmaTox Strategic Initiative, Faculty of Mathematics and Natural Sciences, University of Oslo, Oslo, Norway

[4]Service of Pharmacy, Lausanne University Hospital and University of Lausanne, Lausanne, Switzerland

[5]Institute of Primary Health Care (BIHAM), University of Bern, Bern, Switzerland

[6]Swiss Teratogen Information Service, Service de Pharmacologie Clinique, Lausanne University Hospital and University of Lausanne, Lausanne, Switzerland

[7]Materno-Fetal and Obstetrics Research Unit, Lausanne University Hospital, Lausanne, Switzerland

[8]Rotunda Hospital, Dublin, Ireland

[9]School of Pharmacy, Royal College of Surgeons Ireland, Dublin, Ireland

[10]UK Teratology Information Service, Newcastle upon Tyne Hospitals NHS Foundation Trust and Public Health England, Newcastle upon Tyne, UK

[11]Department of Neurosciences, KU Leuven, Leuven, Belgium

[12]Adult Psychiatry, UPC KU Leuven, Leuven, Belgium

[13]Department of Child Health and Development, Norwegian Institute of Public Health, Oslo, Norway

**Correspondence**
Michael Ceulemans, Department of Pharmaceutical and Pharmacological Sciences, KU Leuven, Campus Gasthuisberg, ON2, Herestraat 49 box 521, 3000 Leuven, Belgium.
Email: michael.ceulemans@kuleuven.be

**Funding information**
The research activities of Michael Ceulemans were supported by the Fund Maurange managed by the Royal Baudouin Foundation. Hedvig Nordeng is supported by a European Research Council Starting Grant DrugsInPregnancy (grant number 639377). Elin Ngo is supported by Dam Foundation.

## Abstract

**Introduction:** Evidence on perinatal mental health during the coronavirus disease 2019 (COVID-19) pandemic and its potential determinants is limited. Therefore, this multinational study aimed to assess the mental health status of pregnant and breastfeeding women during the pandemic, and to explore potential associations between depressive symptoms, anxiety, and stress and women's sociodemographic, health, and reproductive characteristics.

**Material and methods:** A cross-sectional, web-based study was performed in Ireland, Norway, Switzerland, the Netherlands, and the UK between 16 June and 14 July 2020. Pregnant and breastfeeding women up to 3 months postpartum who were older than 18 years of age were eligible. The online, anonymous survey was promoted

**Abbreviations:** CI, confidence interval; COVID-19, coronavirus disease 2019; EDS, Edinburgh Depression Scale; GAD-7, Generalized Anxiety Disorder seven-item scale; OR, odds ratio; PSS, Perceived Stress Scale; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

through social media and hospital websites. The Edinburgh Depression Scale (EDS), the Generalized Anxiety Disorder seven-item scale (GAD-7), and the Perceived Stress Scale (PSS) were used to assess mental health status. Regression model analysis was used to identify factors associated with poor mental health status.

**Results:** In total, 9041 women participated (including 3907 pregnant and 5134 breastfeeding women). The prevalence of major depressive symptoms (EDS ≥ 13) was 15% in the pregnancy cohort and and 13% the breastfeeding cohort. Moderate to severe generalized anxiety symptoms (GAD ≥ 10) were found among 11% and 10% of the pregnant and breastfeeding women. The mean (±SD) PSS scores for pregnant and breastfeeding women were 14.1 ± 6.6 and 13.7 ± 6.6, respectively. Risk factors associated with poor mental health included having a chronic mental illness, a chronic somatic illness in the postpartum period, smoking, having an unplanned pregnancy, professional status, and living in the UK or Ireland.

**Conclusions:** This multinational study found high levels of depressive symptoms and generalized anxiety among pregnant and breastfeeding women during the COVID-19 outbreak. The study findings underline the importance of monitoring perinatal mental health during pandemics and other societal crises to safeguard maternal and infant mental health.

**KEYWORDS**
anxiety, breastfeeding, coronavirus, COVID-19, depression, pregnancy, SARS-CoV-2, stress

## 1 | INTRODUCTION

Since December 2019, the new coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes coronavirus disease 2019 (COVID-19), has spread worldwide. To slow down the transmission of the virus and effectively control the pandemic, exceptional and unprecedented measures were taken by policy-makers across countries, such as the closure of workplaces, schools, shops, recreational facilities, bars, and restaurants.[1] These public health measures restricted individuals' liberty and affected every part of society.[2]

The potential impact of the COVID-19 pandemic on mental health should not be neglected, especially in vulnerable populations.[3,4] Pregnant and breastfeeding women are facing numerous life changes that make them particularly vulnerable to mental health disorders. According to the World Health Organization, about 10% of pregnant women and 13% of (recent) mothers experience a mental disorder, primarily depression.[5] A large multinational study on perinatal mental health conducted before the COVID-19 era showed that between 4% and 8% of women have moderate-to-very severe depressive symptoms during pregnancy and in the postnatal period.[6] In the context of the COVID-19 pandemic, maternal distress might be compounded by concerns and fears regarding the risk of infection or hospitalization due to COVID-19, especially as perinatal morbidity and mortality associated with COVID-19 have been described.[7-9] Maternal depressive symptoms, anxiety, and stress have been associated with adverse pregnancy, fetal, and (long-term) infant outcomes.[10-12] Therefore, it is critical that mental health disorders are detected and addressed in clinical practice.

**Key message**

Depressive and anxiety symptoms were often observed among pregnant and breastfeeding women during the COVID-19 pandemic. Poor mental health status was associated with a chronic mental or somatic illness, smoking, an unplanned pregnancy, professional status, and living in the UK or Ireland.

The extent to which pregnant and breastfeeding women have been emotionally affected by the pandemic remains under-explored. Previous publications have observed an increased likelihood of depressive symptoms and anxiety among pregnant and postpartum/breastfeeding cohorts during the early stages of the pandemic.[13-15] However, these studies were limited by relatively small sample sizes and/or individual settings or countries. This highlights the need for larger, multinational studies. In addition, it remains unclear which women are at risk of being emotionally affected. Identifying determinants associated with an increased risk of or protection from mental distress is vital to guide the development of effective prevention and intervention strategies. Therefore, the aim of this study was to assess the mental health status of pregnant and breastfeeding women living in several countries across Europe during the pandemic, and to

explore potential associations between depressive symptoms, anxiety, and stress, and women's sociodemographic, health, and reproductive characteristics.

## 2 | MATERIAL AND METHODS

A multinational, cross-sectional, web-based study was performed in Ireland, Norway, Switzerland, the Netherlands, and the UK between 16 June and 14 July 2020. Pregnant and breastfeeding women up to 3 months postpartum who were older than 18 years were eligible to participate. Data were collected through an anonymous online survey. The survey was promoted using banners on (hospital) websites, social media accounts, and pregnancy and breastfeeding forums commonly visited by pregnant women and/or new mothers. Information about recruitment tools used and internet penetration rates is summarized in the Supplementary material (Table S1). The study findings are reported according to STROBE guidelines.

The survey was part of a large, multinational COVID-19 research project aimed at studying pregnant and breastfeeding women's mental health status, medication use, breastfeeding practices, access to health services, and information needs during the pandemic. This manuscript focuses on women's mental health status (see Supplementary material, Figure S1).

The Edinburgh Depression Scale (EDS), the Generalized Anxiety Disorder seven-item scale (GAD-7), and the Perceived Stress Scale (PSS) were used to assess mental health status. Depressive symptoms were measured by the EDS, which is a self-report 10-item scale.[16,17] Each question has four different options which are scored 0, 1, 2, or 3. The scale rates the intensity of depressive symptoms over the last 7 days. Total score ranges between 0 and 30; major depressive symptoms were defined as women having a total EDS score of ≥13, while ≥5 on the EDS anxiety subscale (EDS-3A) was considered as high risk for anxiety.[16,18,19] The GAD-7 is a self-report scale that assesses the level of generalized anxiety experienced over the previous 2 weeks.[20] The scale consists of seven items measuring the frequency of being bothered by specific problems on a four-point Likert scale ranging from not at all, several days, more than half of the days, and nearly every day (scored from 0 to 3). Total scores range between 0 and 21 with higher scores indicating more generalized anxiety. Total GAD-7 scores were categorized into minimal (0-4), mild (5-9), moderate (10-14), and severe (15-21) anxiety. The PSS is a self-report scale of 10 items measuring the degree to which people perceive their lives as stressful.[21-23] Respondents are asked how often they have found their lives "unpredictable, uncontrollable, and overloaded" in the last month. The 10 items are assessed on a five-point Likert scale with response categories never, almost never, sometimes, fairly often, and very often (scored from 0 to 4). Total scores range between 0 and 40, with higher scores indicating larger perceived stress. The three mental health scales were available in all survey languages. The other questions were translated from English by the co-authors, including some open questions exploring the impact of SARS-CoV-2 on women's experiences and lives.

Information on sociodemographic characteristics was collected through the survey, including country, maternal age, relationship status, professional status, highest education level, smoking in pregnancy, and breastfeeding. Highest completed educational level was categorized into low, medium, and high according to national definitions. Information on health and reproductive characteristics was also collected, including having received a test for SARS-CoV-2 and the test result, chronic somatic and mental illness, parity, planned pregnancy, gestational trimester, pregnancy follow up, breastfeeding duration, and previous breastfeeding experience. All women who completed the breastfeeding survey, including those who recently ceased breastfeeding, were grouped into the category "breastfeeding women". A chronic illness was considered a condition that already existed before pregnancy. Depression, anxiety disorders, and bipolar disorder were grouped into chronic mental illness.

### 2.1 | Statistical analyses

Women's characteristics and scores on the mental health measures were analyzed using descriptive statistics. Associations between depressive symptoms (EDS ≥ 13) and characteristics of pregnant and breastfeeding women were estimated by univariable and multivariable logistic regression, and presented as crude (cOR) and adjusted (aOR) odds ratios and 95% CI. Associations between anxiety (GAD-7) and stress (PSS) were estimated by univariable and multivariable linear regression, and presented as unstandardized (B) regression coefficients and 95% CI. Logarithmic transformation of the dependent variable anxiety was performed to meet the required assumptions of linear regression; results of the latter regressions are presented on the natural logarithmic scale. All sociodemographic, health, and reproductive characteristics were entered as categorical variables in the models. Only significant covariates were retained in the final adjusted model, such as country, maternal age, professional status, smoking, chronic somatic and mental illness, planned pregnancy, and breastfeeding at the time of survey completion. Multicollinearity of the covariates included in the adjusted models was checked. Due to a technical error, item 7 of the EDS was lacking in the Norwegian survey. The EDS sum score for Norway was therefore calculated by multiple imputation. All statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS) version 26 (IBM® SPSS® Statistics).

### 2.2 | Ethical approval

Online informed consent was obtained from all participants before survey initiation. Ethical approval was waived in most countries, except for Ireland (Rotunda Hospital Research Ethics Committee, REC-2020-017, 23 June 2020). All data were stored and handled anonymously.

**TABLE 1** Study characteristics of the women participating in the survey (n = 9041)

| | Pregnant women (n = 3907), % (n) | Breastfeeding women (n = 5134), % (n) |
|---|---|---|
| Sociodemographic characteristics | | |
| Country | | |
| Ireland | 17.7 (692) | 17.8 (912) |
| Norway | 34.4 (1344) | 28.9 (1485) |
| Switzerland | 14.4 (563) | 23.2 (1193) |
| The Netherlands | 30.0 (1173) | 28.2 (1447) |
| United Kingdom | 3.5 (135) | 1.9 (97) |
| Maternal age (y) | | |
| 18-25 | 8.5 (274) | 4.0 (164) |
| 26-30 | 33.1 (1069) | 25.8 (1062) |
| 31-35 | 40.0 (1290) | 45.4 (1864) |
| 36-40 | 16.5 (532) | 20.9 (858) |
| >40 | 2.0 (64) | 3.9 (161) |
| Relationship status | | |
| Partner | 98.4 (3195) | 98.5 (4076) |
| No partner | 1.6 (51) | 1.5 (62) |
| Professional status | | |
| Professionally active | 90.5 (2881) | 88.7 (3616) |
| Not professionally active | 9.5 (302) | 11.3 (461) |
| Highest education level | | |
| Low | 5.6 (176) | 7.3 (292) |
| Medium | 25.6 (808) | 24.7 (984) |
| High | 68.8 (2168) | 68.0 (2713) |
| Smoking in pregnancy/breastfeeding | | |
| Yes | 2.6 (85) | 3.4 (140) |
| No | 97.4 (3161) | 96.6 (3998) |
| Health and reproductive characteristics | | |
| SARS-CoV-2 | | |
| Tested | 8.8 (332) | 10.9 (520) |
| Tested positive | 0.6 (23) | 0.7 (33) |
| Chronic somatic illness[a] | | |
| Yes | 18.6 (602) | 15.8 (653) |
| No | 81.4 (2643) | 84.2 (3483) |
| Chronic mental illness[b] | | |
| Yes | 2.2 (70) | 1.1 (46) |
| No | 97.8 (3175) | 98.9 (4092) |
| Parity | | |
| Nulliparous | 53.8 (2090) | N/A |
| Multiparous | 46.2 (1796) | N/A |
| Planned pregnancy | | |
| Yes | 80.0 (3127) | N/A |
| No | 6.7 (262) | N/A |
| No, but it was not unexpected | 13.3 (518) | N/A |
| Gestational trimester | | |
| First trimester (0-12 wk) | 8.2 (314) | N/A |
| Second trimester (13-24 wk) | 25.8 (982) | N/A |
| Third trimester (25-40 wk) | 66.0 (2516) | N/A |
| Pregnancy follow-up mainly by | | |
| Obstetrician | 29.3 (1099) | N/A |
| Midwife | 53.7 (2015) | N/A |
| General practitioner | 14.9 (560) | N/A |
| Specialist | 2.2 (81) | N/A |
| Current breastfeeding duration | | |
| ≤6 wk | N/A | 15.8 (741) |
| Between 6 wk and 6 mo | N/A | 48.2 (2257) |
| >6 mo | N/A | 36.0 (1685) |
| Previous breastfeeding experience | | |
| Yes | N/A | 55.7 (2797) |
| No | N/A | 44.3 (2221) |

*Note:* Numbers may not add up due to missing values.

Abbreviations N/A, question was not applicable.

[a]Refers to nonmental illnesses.

[b]Refers to depression, anxiety disorders, and bipolar disorder.

## 3 | RESULTS

### 3.1 | Characteristics of the study participants

In total, 9041 women participated in the survey (ie, 3907 pregnant and 5134 breastfeeding women) (see Table 1). Most responses were collected from Norway (31%) and the Netherlands (29%), followed by Switzerland (19%), Ireland (18%), and the UK (3%). Overall, 91% of the postpartum women were still breastfeeding at the time of survey completion. A chronic somatic or mental illness was reported by 19% and 2% of the pregnant women, and by 16% and 1% of the breastfeeding women, respectively. Allergy (5%), asthma (5%), and depression (1%) were the most commonly reported chronic somatic and mental illnesses in the study population. About 10% of the respondents had been tested for SARS-CoV-2. Of those, 7% (n = 23) of the pregnant women and 6% (n = 33) of the breastfeeding women tested positive, corresponding to a prevalence of confirmed COVID-19 of <1% in this cohort. A comparison of participant characteristics with national

**TABLE 2** Mental health status of pregnant and breastfeeding women during the COVID-19 pandemic

| | | Pregnant women | | | Breastfeeding women | | |
|---|---|---|---|---|---|---|---|
| | | N | % | Mean (SD) | N | % | Mean (SD) |
| EDS | General | 3545 | 100.0 | 7.1 (5.1) | 4542 | 100.0 | 7.4 (4.6) |
| | Score ≥10 | 1006 | 28.4 | N/A) | 1287 | 28.3 | N/A |
| | Score ≥13 | 533 | 15.0 | N/A | 592 | 13.1 | N/A |
| | Country | | | | | | |
| | United Kingdom (≥13) | 48 | 42.1 | N/A | 33 | 42.3 | N/A |
| | Ireland (≥13) | 158 | 26.3 | N/A | 186 | 24.3 | N/A |
| | Norway (≥13) | 161 | 12.0 | N/A | 217 | 14.6 | N/A |
| | The Netherlands (≥13) | 115 | 11.5 | N/A | 113 | 9.1 | N/A |
| | Switzerland (≥13) | 51 | 10.5 | N/A | 102 | 10.4 | N/A |
| EDS-3A | Score ≥5 | 1749 | 49.3 | 5.8 (0.9) | 1749 | 38.5 | 5.8 (0.9) |
| GAD-7 | Total | 3467 | 100.0 | 4.8 (4.1) | 4455 | 100.0 | 4.4 (4.0) |
| | Minimal (0-4) | 1860 | 53.6 | N/A | 2594 | 58.2 | N/A |
| | Mild (5-9) | 1235 | 35.6 | N/A | 1492 | 32.1 | N/A |
| | Moderate (10-14) | 248 | 7.2 | N/A | 296 | 6.6 | N/A |
| | Severe (15-21) | 124 | 3.6 | N/A | 136 | 3.1 | N/A |
| | Country | | | | | | |
| | United Kingdom (10-21) | 31 | 28.2 | N/A | 18 | 23.7 | N/A |
| | Ireland (10-21) | 87 | 14.7 | N/A | 124 | 16.5 | N/A |
| | Norway (10-21) | 166 | 12.4 | N/A | 156 | 10.5 | N/A |
| | The Netherlands (10-21) | 61 | 6.4 | N/A | 57 | 4.8 | N/A |
| | Switzerland (10-21) | 27 | 5.8 | N/A | 77 | 8.1 | N/A |
| PSS | General | 3347 | 100.0 | 14.1 (6.6) | 4295 | 100.0 | 13.7 (6.6) |
| | Country | | | | | | |
| | United Kingdom | 108 | 3.2 | 19.5 (7.5) | 72 | 1.7 | 19.6 (7.5) |
| | Ireland | 567 | 16.9 | 16.4 (6.9) | 726 | 16.9 | 16.6 (6.6) |
| | Switzerland | 440 | 13.1 | 14.2 (5.5) | 891 | 20.7 | 14.6 (6.4) |
| | Norway | 1344 | 40.2 | 13.7 (6.3) | 1485 | 34.6 | 12.8 (6.3) |
| | The Netherlands | 888 | 26.5 | 12.4 (6.3) | 1121 | 26.1 | 12.1 (6.1) |

*Note:* Due to a technical error, item 7 of the EDS was lacking in the Norwegian survey. The EDS sum score for Norway was therefore calculated by multiple imputation.

Abbreviations: EDS, Edinburgh Depression Scale (16); EDS-3A, Edinburgh Depression Anxiety Subscale; GAD-7, Generalized Anxiety Disorder Seven-item Scale (20); N/A, not applicable; PSS, Perceived Stress Scale (21).

birthing population data is included in the Supplementary material (Table S2).

## 3.2 | Mental health status of the pregnant and breastfeeding women

The observed prevalence of major depressive symptoms (EDS ≥ 13) was 15% and 13% in the pregnancy and breastfeeding cohorts, respectively. Moderate to severe generalized anxiety symptoms (GAD-7 ≥ 10) were found among 11% and 10% of the pregnant and breastfeeding women, respectively. The mean ± SD) PSS scores for pregnant and breastfeeding women were 14.1 ± 6.6 and 13.7 ± 6.6, respectively. The findings for major depressive symptoms, generalized anxiety, and stress were worse among women residing in the UK and Ireland (see Table 2). A visual representation of the distribution of the scale scores is included in the Supplementary material (Figures S2-S4). Illustrative responses to the open-ended questions are presented in the Supplementary material (Table S3). Women answered, for example, that their partners were often not allowed during prenatal visits, at the delivery and/or during the postnatal period in the hospital during the pandemic, and that they had fear of the impact of COVID-19 on the unborn child and their own health.

**TABLE 3** Factors associated with major depressive symptoms (EDS ≥ 13) among pregnant and breastfeeding women

| | Pregnant women | | | | Breastfeeding women | | | |
|---|---|---|---|---|---|---|---|---|
| | cOR | 95% CI | aOR[a] | 95% CI | cOR | 95% CI | aOR[b] | 95% CI |
| Country | | | | | | | | |
| Norway | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Ireland | 2.63 | 2.06-3.36 | 2.55 | **1.97-3.31** | 2.64 | 2.08-3.34 | 2.70 | **2.10-3.46** |
| Switzerland | 0.86 | 0.62-1.20 | 0.82 | 0.57-1.19 | 0.95 | 0.73-1.24 | 1.03 | 0.77-1.37 |
| The Netherlands | 0.96 | 0.74-1.23 | 0.85 | 0.78-1.36 | 0.83 | 0.64-1.07 | 0.90 | 0.69-1.18 |
| United Kingdom | 5.34 | 3.56-8.03 | 4.64 | **2.96-7.26** | 6.02 | 3.72-9.72 | 5.78 | **3.45-9.68** |
| Professional status | | | | | | | | |
| Active, but not in health care | Ref | Ref | Ref | Ref | Ref | Ref | — | — |
| Active in health care | 0.77 | 0.61-0.97 | 0.80 | 0.63-1.01 | 0.90 | 0.73-1.11 | — | — |
| Not professionally active | 1.87 | 1.40-2.50 | 1.35 | 0.98-1.85 | 1.32 | 0.99-1.74 | — | — |
| Smoking in pregnancy/breastfeeding | | | | | | | | |
| Yes | 2.47 | 1.53-3.97 | 2.12 | **1.26-3.56** | 1.86 | 1.23-2.81 | 1.72 | **1.10-2.67** |
| Chronic somatic illness | | | | | | | | |
| Yes | 1.20 | 0.95-1.53 | — | — | 1.59 | 1.27-1.99 | 1.51 | **1.18-1.92** |
| Chronic mental illness | | | | | | | | |
| Yes | 5.43 | 3.36-8.77 | 4.35 | **2.55-7.41** | 6.88 | 3.83-12.35 | 5.76 | **3.09-10.74** |
| Planned pregnancy | | | | | | | | |
| No | 2.11 | 1.54-2.89 | 1.65 | **1.15-2.38** | N/A | N/A | N/A | N/A |
| No, but it was not unexpected | 1.74 | 1.36-2.23 | 1.60 | **1.21-2.10** | N/A | N/A | N/A | N/A |
| Breastfeeding at the time of survey completion | | | | | | | | |
| No | N/A | N/A | N/A | N/A | 1.85 | 1.42-2.42 | 1.69 | **1.26-2.27** |

*Note:* The bold numbers indicate adjusted odds ratios where the 95% confidence interval does not include 1.

Abbreviations: CI, confidence interval, cOR, crude odds ratio, aOR, adjusted odds ratio; N/A, not available.

[a]Adjusted for country, professional status, smoking in pregnancy, chronic mental illness, and planned pregnancy.

[b]Adjusted for country, smoking in breastfeeding, chronic somatic and mental illness, and breastfeeding at the time of survey completion.

### 3.3 | Factors associated with mental health status of pregnant and breastfeeding women

Overall, a higher likelihood of major depressive symptoms (EDS ≥ 13) was observed among pregnant and breastfeeding women who reported a chronic mental illness, smoking, and living in the UK or Ireland. Major depressive symptoms were also associated with no breastfeeding at the time of survey completion, having an unplanned pregnancy, and having a chronic somatic illness in the postpartum period (see Table 3).

Generalized anxiety among pregnant and breastfeeding women was positively associated with having a chronic mental illness and negatively associated with being professionally active in health care (see Table 4). Anxiety symptoms were also more likely among pregnant women living in the UK, smoking in pregnancy, and having an unplanned pregnancy, as well as among unemployed breastfeeding women and women suffering from a chronic somatic illness in the postpartum period.

Stress among pregnant and breastfeeding women was positively associated with having a chronic mental illness, having a chronic somatic illness, and living in the UK or Ireland (see Table 5). Likewise, stress symptoms were more likely among women smoking in pregnancy and having an unplanned pregnancy, as well as among breastfeeding women who reported being unemployed and women who were no longer breastfeeding when completing the survey. Stress among pregnant women decreased with increasing age.

With regard to COVID-19, pregnant and breastfeeding women who had tested positive for SARS-CoV-2 were not more likely to have major depressive symptoms, generalized anxiety, or stress at the time of survey completion compared with women without a positive test result. Reproductive characteristics such as parity and gestational trimester were also not associated with women's mental health status.

## 4 | DISCUSSION

This cross-sectional, web-based study aimed to assess the mental health status of pregnant and breastfeeding women faced with an unprecedented pandemic, and to identify factors associated with mental health status. To our knowledge, this is the first multinational study across several European countries using a broad range of internationally recognized mental health measures and uniform data

**TABLE 4** Factors associated with generalized anxiety (GAD-7) among pregnant and breastfeeding women

| | Pregnant women | | | | Breastfeeding women | | | |
|---|---|---|---|---|---|---|---|---|
| | Crude | | Adjusted[a] | | Crude | | Adjusted[b] | |
| | B | 95% CI | B | 95% CI | B | 95% CI | B | 95% CI |
| Country | | | | | | | | |
| Norway | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Ireland | −0.00 | −0.07 to 0.07 | 0.02 | −0.05 to 0.10 | 0.01 | −0.06 to 0.08 | 0.07 | −0.01 to 0.14 |
| Switzerland | −0.24 | −0.32 to −0.16 | −0.21 | **−0.30 to −0.13** | −0.21 | −0.28 to −0.15 | −0.15 | **−0.22 to −0.08** |
| The Netherlands | −0.42 | −0.48 to −0.36 | −0.39 | **−0.45 to −0.32** | −0.43 | −0.49 to −0.37 | −0.40 | **−0.46 to −0.34** |
| United Kingdom | 0.31 | 0.16-0.45 | 0.29 | **0.13-0.44** | 0.20 | 0.02-0.38 | 0.17 | −0.02 to 0.36 |
| Maternal age (y) | | | | | | | | |
| 18-25 | 0.27 | 0.17-0.37 | 0.19 | **0.09-0.29** | 0.21 | 0.09-0.34 | 0.07 | −0.05 to 0.20 |
| 26-30 | 0.03 | −0.03 to 0.09 | 0.03 | −0.04 to 0.09 | 0.05 | −0.02 to 0.11 | 0.04 | −0.02 to 0.10 |
| 31-35 | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| 36-40 | −0.01 | −0.09 to 0.06 | −0.03 | −0.11 to 0.04 | −0.03 | −0.10 to 0.03 | −0.08 | **−0.14 to −0.02** |
| >40 | −0.03 | −0.23 to 0.16 | −0.15 | −0.34 to 0.04 | −0.02 | −0.15 to 0.11 | −0.10 | −0.23 to 0.02 |
| Professional status | | | | | | | | |
| Active, but not in health care | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Active in health care | −0.10 | −0.16 to −0.04 | −0.08 | **−0.14 to −0.02** | −0.10 | −0.16 to −0.05 | −0.07 | **−0.13 to −0.02** |
| Not professionally active | 0.16 | 0.07-0.26 | 0.02 | −0.08 to 0.11 | 0.14 | 0.06-0.22 | 0.10 | **0.02-0.18** |
| Smoking in pregnancy/breastfeeding | | | | | | | | |
| Yes | 0.21 | 0.04-0.38 | 0.21 | **0.04-0.37** | 0.12 | −0.01 to 0.25 | — | — |
| Chronic somatic illness | | | | | | | | |
| Yes | 0.15 | 0.08-0.22 | 0.06 | −0.01 to 0.13 | 0.21 | 0.15-0.28 | 0.15 | **0.09-0.22** |
| Chronic mental illness | | | | | | | | |
| Yes | 0.78 | 0.60-0.96 | 0.59 | **0.40-0.78** | 0.77 | 0.54-1.00 | 0.58 | **0.35-0.81** |
| Planned pregnancy | | | | | | | | |
| No | 0.26 | 0.16-0.37 | 0.17 | **0.07-0.28** | N/A | N/A | N/A | N/A |
| No, but it was not unexpected | 0.19 | 0.11-0.26 | 0.10 | **0.03-0.18** | N/A | N/A | N/A | N/A |
| Breastfeeding at the time of survey completion | | | | | | | | |
| No | N/A | N/A | N/A | N/A | 0.09 | 0.01-0.18 | 0.09 | −0.00 to 0.17 |

*Note:* The results were obtained after natural logarithmic transformation of the dependent variable and are presented on this scale. The bold numbers indicate the 95% CI of the unstandardized regression coefficients of the adjusted analyses that do not include the null.

Abbreviations: B, unstandardized regression coefficient; CI, confidence interval; N/A, not available.

[a]Adjusted for country, maternal age, professional status, smoking in pregnancy, chronic somatic and mental illness, and planned pregnancy.

[b]Adjusted for country, maternal age, professional status, chronic somatic and mental illness, and breastfeeding at the time of survey completion.

collection among pregnant and breastfeeding women. Moreover, the "women's voices" included in this study through the open-ended quotations shed important light on the mental health challenges these women face in their everyday lives.

The survey was distributed in June-July 2020, beyond the peak of the first wave of the pandemic in all study countries (except for the UK), at a time when the strictest containment measures had been lifted (except for the UK and Ireland). The overall prevalence of major depressive symptoms was about 14%, with higher scores observed among women living in the UK and Ireland. The overall percentage is somewhat higher than the prevalence estimates reported among pregnant and postpartum women living in high-income countries before COVID-19 (10%-13%),[5,24] but substantially lower than estimates observed in other countries during the early stages of the pandemic when strict containment measures were in place (24%-37%).[14,18] As postnatal depression is often a continuation of symptoms that already manifested during pregnancy,[25] these findings should encourage detection and appropriate management of mental distress in clinical practice. With regard to generalized anxiety, a similar pattern was found, with a slightly higher prevalence (10%-11%) compared with the non-COVID-19 era (2%-9%),[26] but lower than rates reported in Belgium during severe restrictions

**TABLE 5** Factors associated with perceived stress (PSS) among pregnant and breastfeeding women

| | Pregnant women | | | | Breastfeeding women | | | |
|---|---|---|---|---|---|---|---|---|
| | Crude | | Adjusted[a] | | Crude | | Adjusted[b] | |
| | B | 95% CI | B | 95% CI | B | 95% CI | B | 95% CI |
| Country | | | | | | | | |
| Norway | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Ireland | 2.72 | 2.10-3.35 | 3.04 | **2.38-3.69** | 3.87 | 3.30-4.43 | 4.17 | **3.58-4.76** |
| Switzerland | 0.56 | −0.13 to 1.24 | 0.99 | **0.29-1.70** | 1.80 | 1.27-2.32 | 1.87 | **1.32-2.42** |
| The Netherlands | −1.23 | −1.77 to −0.69 | −0.93 | **−1.48 to −0.38** | −0.72 | −1.21 to −0.23 | −0.48 | −0.99 to 0.02 |
| United Kingdom | 5.84 | 4.59-7.08 | 5.53 | **4.23-6.83** | 6.82 | 5.32-8.32 | 6.40 | **4.88-7.92** |
| Maternal age (y) | | | | | | | | |
| 18-25 | 2.08 | 1.23-2.94 | 1.63 | **0.77-2.50** | 0.87 | −0.18 to 1.92 | 0.74 | −0.30-1.77 |
| 26-30 | 0.18 | −0.35-0.72 | 0.54 | **0.03-1.06** | −0.19 | −0.68 to 0.31 | 0.31 | −0.17 to 0.79 |
| 31-35 | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| 36-40 | 0.37 | −0.29 to 1.04 | −0.20 | −0.83 to 0.44 | 0.77 | 0.24-1.30 | 0.17 | −0.35 to 0.68 |
| >40 | −0.35 | −2.00 to 1.29 | −1.93 | **−3.52 to −0.33** | 0.98 | −0.08 to 2.04 | −0.14 | −1.16 to 0.88 |
| Professional status | | | | | | | | |
| Active, but not in health care | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Active in health care | −0.92 | −1.42 to −0.42 | −0.83 | **−1.31 to −0.35** | −0.54 | −0.99 to −0.08 | −0.40 | −0.83 to 0.04 |
| Not professionally active | 2.00 | 1.21-2.80 | 0.53 | −0.27 to 1.33 | 1.70 | 1.05-2.35 | 1.22 | **0.58-1.85** |
| Smoking in pregnancy/breastfeeding | | | | | | | | |
| Yes | 2.70 | 1.28-4.11 | 1.59 | **0.20-2.98** | 1.73 | 0.63-2.84 | 0.89 | −0.19 to 1.97 |
| Chronic somatic illness | | | | | | | | |
| Yes | 1.15 | 0.57-1.73 | 0.68 | **0.11-1.26** | 1.34 | 0.79-1.89 | 1.17 | **0.62-1.71** |
| Chronic mental illness | | | | | | | | |
| Yes | 7.90 | 6.36-9.43 | 6.37 | **4.79-7.95** | 7.99 | 6.09-9.88 | 7.00 | **5.10-8.89** |
| Planned pregnancy | | | | | | | | |
| No | 3.20 | 2.32-4.08 | 2.31 | **1.40-3.21** | N/A | N/A | N/A | N/A |
| No, but it was not unexpected | 1.65 | 1.00-2.30 | 1.05 | **0.40-1.71** | N/A | N/A | N/A | N/A |
| Breastfeeding at the time of survey completion | | | | | | | | |
| No | N/A | N/A | N/A | N/A | 1.19 | 0.47-1.91 | 0.81 | **0.10-1.52** |

*Note:* The bold numbers indicate the 95% CI of the unstandardized regression coefficients of the adjusted analyses that do not include the null.

Abbreviations: B, unstandardized regression coefficient; CI, confidence interval; N/A, not available.

[a]Adjusted for country, maternal age, professional status, smoking in pregnancy, chronic somatic and mental illness, and planned pregnancy.

[b]Adjusted for country, maternal age, professional status, smoking in breastfeeding, chronic somatic and mental illness, and breastfeeding at the time of survey completion.

(14%).[14] This finding is in line with a recent Chinese study suggesting that prenatal anxiety increases with the severity of the measures imposed.[13] As illustrated by the respondents' quotations, partners were often not allowed to attend perinatal checks and the delivery. As shown previously, women described considerable psychological suffering due to the exclusion of their partners from antenatal visits and around the time of birth.[27] A recent review concluded that a lack of social and/or partner support is a risk factor for antenatal depression,[28] so future policy decisions should carefully consider the impact of infection-reducing measures on the supporting role of the partner in the perinatal period.

As poor mental health can lead to adverse maternal and infant outcomes, insight into potential influencing factors is critical. Identified risk factors associated with poor mental health included: a chronic mental illness, a somatic illness in the postpartum period, smoking, an unplanned pregnancy, professional status, and living in the UK or Ireland. Having a chronic physical condition has previously been identified as a risk factor for perinatal mental illness.[29] Limited

access to health services during the pandemic may have prevented women with chronic illnesses from seeing clinicians, potentially contributing to an increased psychological burden.[30,31] Professional status also appeared to have an impact on anxiety and stress levels. While working in health care may have protected women to some extent, being unemployed placed women at higher risk of experiencing mental distress. As the first wave of the pandemic was almost over in most countries at the time of study completion, this might have led to some careful optimism, reduced workload, or (slightly) more pleasant working conditions among healthcare professionals. Healthcare personnel might also be the best informed about COVID-19 and pregnancy or lactation. In contrast, given the high rates of job losses and substantial job insecurity associated with the ongoing health crisis,[2] clinicians should be vigilant for the emotional well-being of the growing group of unemployed women. Furthermore, women living in the UK and Ireland were more likely to report higher levels of mental distress. This may be explained by the fact that the social distancing restrictions were still in place in the UK and had only recently eased in Ireland at the time of the study (see Supplementary material, Table S4).[32] These findings contribute to the growing evidence of the potential deleterious effect of strict lockdown measures on women's mental health.[13,14] Interestingly, a UK cohort study performed in April 2020 observed the largest increase in mental distress under the conditions of the pandemic among women aged 18-34 years and living with young children, which is reflective of our study population.[4] On the other hand, a higher prevalence of perinatal depressive symptoms among UK residents, compared with their Norwegian counterparts, was already previously reported before the COVID-19 outbreak.[6]

Although only a few women with confirmed COVID-19 were enrolled, no association was found between a positive test result and mental health status. It should be acknowledged, however, that the EDS and GAD-7 only collect information on depressive symptoms and anxiety experienced over the last 1-2 weeks.[16,21] As data on the exact timing of the infection were unavailable, it is possible that the positive test occurred weeks or months ago and that mental distress had already improved or resolved.

The study was performed in collaboration with several members of the European Network of Teratology Information Services. The multinational approach resulted in a large sample of over 9000 women living across Europe, allowing a comparison between countries. To maximize data uniformity, the same data collection instrument consisting of validated scales commonly used in the perinatal setting was used across all countries, which is a clear advantage over previous smaller and single-country studies. Healthcare professionals will in turn benefit from the insight generated by the quotations on women's personal experiences during the pandemic.

Some limitations should also be considered. First, the survey was promoted through social media, a sampling technique with an inherent risk of selection (sampling) bias. However, web-based studies have been considered a reasonable recruitment method for epidemiological studies, and the internet penetration rate is high among European women of childbearing age.[33,34] Compared with national birthing population data, participants were more often first-time mothers, more highly educated, professionally active and nonsmokers, and more often had a partner. This might indicate a selection bias toward more healthy study participants. As women with higher education attainment and with a partner tend to have fewer antenatal depressive symptoms and anxiety,[35,36] the high prevalence observed in our sample might reflect the impact of the pandemic. Furthermore, a lower proportion of women reported a chronic mental illness when compared with the general birthing population. Consequently, we cannot exclude the possibility that the more severely depressed or anxious women did not participate in the online survey. Hence, it might be possible that the high level of mental distress observed in our cohort is still an underestimation of the actual situation in the general perinatal population. Second, the lack of a nonpregnant comparison group and the cross-sectional study design generally prevented us from drawing conclusions on the (long-term) impact of the pandemic, and whether the observed mental distress quickly resolved or persisted for a longer period of time. The pre-pandemic mental health status of individual respondents as well as the extent of partner support and media usage during the pandemic was unknown. Third, women's self-reported symptoms were not specific for SARS-CoV-2 infection, and were therefore not used in the analyses to avoid unjustified conclusions. Fourth, only 232 UK residents participated; this necessitates careful interpretation of the UK findings. Fifth, due to the lack of validated and clinically relevant cut-off values, the anxiety and stress scale scores were considered as continuous variables in the analysis. Finally, the regression models only explored associations between mental health status and sociodemographic, health, and reproductive characteristics. Future studies should investigate which other variables, including the impact of ongoing/severe COVID-19, affect women's psychological well-being.

## 5 | CONCLUSION

This cross-sectional study performed across five European countries in June-July 2020 found high levels of depressive symptoms and generalized anxiety among pregnant and breastfeeding women during the COVID-19 pandemic. Risk factors associated with poor mental health status included a chronic mental illness, a chronic somatic illness in the postpartum period, smoking, an unplanned pregnancy, professional status, and living in the UK or Ireland. The study findings underline the importance of monitoring perinatal mental health during pandemics and other societal crises to safeguard maternal and infant mental health.

### ACKNOWLEDGMENTS

The authors are grateful to the following individuals for their help with this study: Jennifer Donnelly (Ireland), Nicola Maher (Ireland), Richard Duffy (Ireland), Ursula Nagle (Ireland), Julia Daly (Ireland), Marina Cullen (Ireland), Geraldine Gibney (Ireland), Mike Geary (Ireland), Fiona O'Toole (Ireland), Fátimah Alaya (Ireland), Cormac

McAdam (Ireland), Laila Torstveit (Norway), Leiry Cornejo Chavez (Norway), Elias Refstie (Norway), Milos Stojanov (Switzerland), Annerose van der Mijle (the Netherlands), Alison Oliver (UK), and Alexandra Richardson (UK). They thank especially Prof. Thomas Neyens (KU Leuven & UHasselt, Belgium) for his help with the data analysis. They are also grateful to the Board and the Scientific Committee of the European Network of Teratology Information Services for encouraging teratology information centers to participating in the study.

## CONFLICT OF INTEREST

None.

## ORCID

*Michael Ceulemans* https://orcid.org/0000-0002-4130-5869

## REFERENCES

1. Flaxman S, Mishra S, Gandy A, et al. Estimating the effects of non-pharmaceutical interventions on COVID-19 in Europe. *Nature*. 2020;584:257-261.
2. Fitzgerald DA, Nunn K, Isaacs D. Consequences of physical distancing emanating from the COVID-19 pandemic: an Australian perspective. *Paediatr Respir Rev*. 2020;35:25-30.
3. Thapa SB, Mainali A, Schwank SE, Acharya G. Maternal mental health in the time of the COVID-19 pandemic. *Acta Obstet Gynecol Scand*. 2020;99:817-818.
4. Pierce M, Hope H, Ford T, et al. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *Lancet Psychiatry*. 2020;7:883-892.
5. World Health Organization. Maternal mental health. https://www.who.int/mental_health/maternal-child/maternal_mental_health/en/. Accessed December 4, 2020.
6. Lupattelli A, Twigg MJ, Zagorodnikova K, et al. Self-reported perinatal depressive symptoms and postnatal symptom severity after treatment with antidepressants in pregnancy: a cross-sectional study across 12 European countries using the Edinburgh Postnatal Depression Scale. *Clin Epidemiol*. 2018;10:655-669.
7. Allotey J, Stallings E, Bonet M, et al. Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis. *BMJ*. 2020;370:m3320.
8. Westgren M, Pettersson K, Hagberg H, Acharya G. Severe maternal morbidity and mortality associated with COVID-19: the risk should not be downplayed. *Acta Obstet Gynecol Scand*. 2020;99:815-816.
9. Favre G, Pomar L, Baud D. Coronavirus disease 2019 during pregnancy: do not underestimate the risk of maternal adverse outcomes. *Am J Obstet Gynecol MFM*. 2020;2:100160.
10. Jarde A, Morais M, Kingston D, et al. Neonatal outcomes in women with untreated antenatal depression compared with women without depression: a systematic review and meta-analysis. *JAMA Psychiatry*. 2016;73:826-837.
11. Grigoriadis S, Graves L, Peer M, et al. Maternal anxiety during pregnancy and the association with adverse perinatal outcomes: systematic review and meta-analysis. *J Clin Psychiatry*. 2018;79:17r12011.
12. Witt WP, Litzelman K, Cheng ER, Wakeel F, Barker ES. Measuring stress before and during pregnancy: a review of population-based studies of obstetric outcomes. *Matern Child Health J*. 2014;18:52-63.
13. Liu X, Chen M, Wang Y, et al. Prenatal anxiety and obstetric decisions among pregnant women in Wuhan and Chongqing during the COVID-19 outbreak: a cross-sectional study. *BJOG*. 2020;127:1229-1240.
14. Ceulemans M, Hompes T, Foulon V. Mental health status of pregnant and breastfeeding women during the COVID-19 pandemic: a call for action. *Int J Gynecol Obstet*. 2020;151(1):146-147.
15. Davenport MH, Meyer S, Meah VL, Strynadka MC, Khurana R. Moms are not OK: COVID-19 and maternal mental health. *Front Glob Women's Health*. 2020;1. https://doi.org/10.3389/fgwh.2020.00001.
16. Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry*. 1987;150:782-786.
17. Bergink V, Kooistra L, Lambregtse-van den Berg MP, et al. Validation of the Edinburgh Depression Scale during pregnancy. *J Psychosom Res*. 2011;70:385-389.
18. Lebel C, MacKinnon A, Bagshawe M, Tomfohr-Madsen L, Giesbrecht G. Elevated depression and anxiety symptoms among pregnant individuals during the COVID-19 pandemic. *J Affect Disord*. 2020;277:5-13.
19. Levis B, Negeri Z, Sun Y, Benedetti A, Thombs BD. Accuracy of the Edinburgh Postnatal Depression Scale (EPDS) for screening to detect major depression among pregnant and postpartum women: systematic review and meta-analysis of individual participant data. *BMJ*. 2020;371:m4022.
20. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166:1092-1097.
21. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24:385-396.
22. Korten NC, Comijs HC, Penninx BW, Deeg DJ. Perceived stress and cognitive function in older adults: which aspect of perceived stress is important? *Int J Geriatr Psychiatry*. 2017;32:439-445.
23. van Eck M, Berkhof H, Nicolson N, Sulon J. The effects of perceived stress, traits, mood states, and stressful daily events on salivary cortisol. *Psychosom Med*. 1996;58:447-458.
24. Woody CA, Ferrari AJ, Siskind DJ, Whiteford HA, Harris MG. A systematic review and meta-regression of the prevalence and incidence of perinatal depression. *J Affect Disord*. 2017;219:86-92.
25. Underwood L, Waldie K, D'Souza S, Peterson ER, Morton S. A review of longitudinal studies on antenatal and postnatal depression. *Arch Womens Ment Health*. 2016;19:711-720.
26. Dennis CL, Falah-Hassani K, Shiri R. Prevalence of antenatal and postnatal anxiety: systematic review and meta-analysis. *Br J Psychiatry*. 2017;210:315-323.
27. Naurin E, Markstedt E, Stolle D, et al. Pregnant under the pressure of a pandemic: a large-scale longitudinal survey before and during the COVID-19 outbreak. *Eur J Publ Health*. 2020. https://academic.oup.com/eurpub/advance-article/doi/10.1093/eurpub/ckaa223/5999799.
28. Dadi AF, Miller ER, Bisetegn TA, Mwanri L. Global burden of antenatal depression and its association with adverse birth outcomes: an umbrella review. *BMC Public Health*. 2020;20:173.
29. Brown HK, Wilton AS, Ray JG, Dennis C-L, Guttmann A, Vigod SN. Chronic physical conditions and risk for perinatal mental illness: a population-based retrospective cohort study. *PLoS Med*. 2019;16:e1002864.
30. Ceulemans M, Verbakel JY, Van Calsteren K, Eerdekens A, Allegaert K, Foulon V. SARS-CoV-2 infections and impact of the COVID-19 pandemic in pregnancy and breastfeeding: results from an observational study in primary care in Belgium. *Int J Environ Res Public Health*. 2020;17:6766.
31. Vazquez-Vazquez A, Dib S, Rougeaux E, Wells JC, Fewtrell M. The impact of the Covid-19 lockdown on the experiences and feeding practices of new mothers in the UK: preliminary data from the COVID-19 New Mum Study. *Appetite*. 2020;156:104985.
32. European Centre for Disease Prevention and Control. Baseline projections of COVID-19 in the EU/EEA and the UK: an update.

https://www.ecdc.europa.eu/en/publications-data/baseline-projections-covid-19-eueea-and-uk-update. Accessed October 2, 2020.

33. van Gelder MM, Bretveld RW, Roeleveld N. Web-based questionnaires: the future in epidemiology? *Am J Epidemiol*. 2010;172:1292-1298.
34. Eurostat. Households with broadband access. https://ec.europa.eu/eurostat/en/web/products-datasets/-/TIN00073. Accessed December 4, 2020.
35. Biaggi A, Conroy S, Pawlby S, Pariante CM. Identifying the women at risk of antenatal anxiety and depression: a systematic review. *J Affect Disord*. 2016;191:62-77.
36. Matsumura K, Hamazaki K, Tsuchida A, Kasamatsu H, Inadera H. Education level and risk of postpartum depression: results from the Japan Environment and Children's Study (JECS). *BMC Psychiatry*. 2019;19:419.

## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

**How to cite this article:** Ceulemans M, Foulon V, Ngo E, et al. Mental health status of pregnant and breastfeeding women during the COVID-19 pandemic – A multinational cross-sectional study. *Acta Obstet Gynecol Scand*. 2021;00:1–11. https://doi.org/10.1111/aogs.14092