

## Women's perinatal depression: Anhedonia-related symptoms have increased in the COVID-19 pandemic

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### ABSTRACT

**Background:** The prevalence of perinatal depression increased during the COVID-19 pandemic, which may be due to changes in the profile of specific depressive symptoms.

**Aims:** To analyze the impact of the COVID-19 pandemic on the (1) prevalence and severity of specific depressive symptoms; and on the (2) prevalence of clinically significant symptoms of depression during pregnancy and postpartum.

**Methods:** Pregnant and postpartum women recruited before ( $n = 2395$ ) and during the COVID-19 pandemic ( $n = 1396$ ) completed a sociodemographic and obstetric questionnaire and the Edinburgh Postnatal Depression Scale (EPDS). For each item, scores  $\geq 1$  and  $\geq 2$  were used to calculate the prevalence and severity of depressive symptoms, respectively.

**Results:** The prevalence and severity of symptoms of depression were significantly higher during the COVID-19 pandemic. The prevalence of specific symptoms increased by  $>30\%$ , namely “being able to laugh and see the funny side of things” (pregnancy 32.6%, postpartum 40.6%), “looking forward with enjoyment to things” (pregnancy 37.2%, postpartum 47.2%); and “feelings of sadness/miserable” or “unhappiness leading to crying” during postpartum (34.2% and 30.2%, respectively). A substantial increase was observed in the severity of specific symptoms related to feelings that “things have been getting on top of me” during pregnancy and the postpartum period (19.4% and 31.6%, respectively); “feeling sad or miserable” during pregnancy (10.8%); and “feeling scared/panicky” during postpartum (21.4%).

**Conclusion:** Special attention should be paid to anhedonia-related symptoms of perinatal depression to ensure that they are adequately managed in present and future situations of crisis.

### 1. Introduction

Mental health problems emerged as a major public health concern during the COVID-19 pandemic [1] and were considered an integral component of COVID-19 response plans by the World Health Organization (WHO) [2]. Nonetheless, out of 130 WHO member states,  $<1$  in 5 countries allocated additional funding for mental health and psychosocial support, and  $>60\%$  of antenatal or postnatal mental health services

were disrupted [2]. At the same time, perinatal mental health problems increased, including clinically significant symptoms of depression [3].

#### 1.1. COVID-19 pandemic and perinatal symptoms of depression

Systematic reviews published two to three years before the COVID-19 outbreak consistently estimated the prevalence of depressive symptoms to be 9.2% for the prenatal and 9.5% for the postpartum period in

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high-income countries [4], regardless of the tools used (symptom severity scales or diagnostic tools). In Portuguese cohorts, about 20.0% of pregnant women [5,6] and 15.0%–22.4% of postpartum women had clinically significant symptoms of depression [7,8].

The prevalence of perinatal symptoms of depression increased during the COVID-19 pandemic [3,9,10]. About 30% of women living in European and South American countries scored  $\geq 13$  on the Edinburgh Postnatal Depression Scale (EPDS), which indicates the presence of clinically significant symptoms of depression [10]. Specifically in Europe, a study conducted in five countries with pregnant and postpartum women reported lower prevalence of EPDS  $\geq 13$  in Switzerland (10.5%/10.4%); the Netherlands (11.5%/9.1%); and Norway (12.0%/14.6%), as compared to the UK (42.1%/42.3%) or Ireland (26.3%/24.3%) [11]. The authors hypothesized that differences in prevalence rates could be explained at least partly by differences in social isolation; at the time of the study, social distancing restrictions were still in place in the UK and had recently been reduced in Ireland.

## 1.2. COVID-19 pandemic and specific symptoms of perinatal depression

The prevalence of clinically significant symptoms of depression during the COVID-19 pandemic is alarming. It is essential to gain knowledge on the increase in the prevalence and severity of specific symptoms of depression as a result of the COVID-19 pandemic. This would enhance the understanding of the presentation of symptoms which will ensure that adequate interventions are developed to meet the women's specific needs. Exploring the presentation of perinatal depression symptoms during the COVID-19 pandemic is especially relevant, as differences have been reported in the literature in relation to depressive symptoms in the perinatal period, as compared to other life periods [12,13,14]. The Edinburgh Postnatal Depression Scale [15] is a validated instrument for screening clinically significant symptoms of depression, both in pregnant and postpartum women [16]. The EPDS provides information on symptoms of depression, categorized as symptoms of anhedonia (items 1 and 2: able to laugh/looking forward); anxiety (items 3 to 5: self-blame, anxious/worried, scared panicky); and depression (items 6 to 10: overwhelmed, difficulty sleeping, sad or miserable, unhappy/crying, self-harm) [17,18]. This scale provides detailed information on the symptoms of perinatal depression, which prevalence and severity may have increased during the COVID-19 pandemic. The results obtained may help improve the readiness of health systems to meet the mental health needs of these women, according to their individual circumstances.

The aim of this study was to analyze the impact of the COVID-19 pandemic on the (1) prevalence and severity of specific symptoms of depression and on the (2) prevalence of clinically significant symptoms of depression during pregnancy and the postpartum period.

This study will contribute to the literature by providing comparative data on the prevalence and severity of specific symptoms of depression before and during the COVID-19 pandemic in a large sample of women in the perinatal period.

## 2. Method

### 2.1. Procedure

Data for the pre-pandemic period was collected from longitudinal cohorts of pregnant women recruited at public health centers in Northern Portugal (between 2004 and 2019). The aims and procedures of the study were explained to the participants. Written consent was obtained from pregnant women willing to participate. Data on expectant/postpartum women during the COVID-19 pandemic was collected through an online survey conducted between June 2020 and October 2020. All pregnant women (regardless of the stage of pregnancy) and mothers to infants younger than six months living in Portugal were eligible for inclusion. The aims and procedures of the study were

explained to participants. Written consent was obtained prior to access being granted to the questionnaire (detailed procedures are described elsewhere; [19]). All the studies were conducted according to the Declaration of Helsinki. The study was approved by the local Ethics Committees of the participating sites. The final sample included 3791 women from the cohorts described (prior to the COVID-19 pandemic,  $n = 2395$ ; during the COVID-19 pandemic,  $n = 1396$ ). Participants filled in a socio-demographic and obstetric questionnaire and completed the EPDS [15] either during pregnancy or postpartum.

### 2.2. Measures

#### 2.2.1. Socio-demographic and obstetric characteristics

Information regarding age; country of birth (foreign vs. native); education ( $\leq 9$  years of education vs. 10–12 years of education vs. higher education [bachelor, master's degree or postgraduate diploma]); marital status (married/cohabiting vs. single/separated/divorced/widow); employment status (employed vs. unemployed/student/housewife); history of mental health problems (yes vs. no); parity (nulliparous/primiparous vs. multiparous); and risk pregnancy (Yes vs. No; with yes including maternal age over 40 or gestational diabetes or hypertension or short cervix or other clinical condition) was collected via a self-reported questionnaire.

#### 2.2.2. Symptoms of depression

Symptoms of depression were assessed using the EPDS [15]. EPDS is a 10-item self-report scale rated on a four-point Likert-type scale (0 to 3) aimed at assessing the severity of symptoms of depression within the previous seven days. Total scores range from 0 to 30, with higher scores indicating a higher severity of symptoms of depression. The items and scoring system are as follows: “Item 1. I have been able to laugh and see the funny side of things; 0. As much as I always could, 1. Not quite so much now, 2. Definitely not so much now, 3. Not at all”; “Item 2. I have looked forward with enjoyment to things; 0. As much as I ever did, 1. Rather less than I used to, 2. Definitely less than I used to, 3. Hardly at all”; “Item 3. I have blamed myself unnecessarily when things went wrong; 0. No, never, 1. Not very often, 2. Yes, some of the time, 3. Yes, most of the time”; “Item 4. I have been anxious or worried for no good reason; 0. No, not at all, 1. Hardly ever, 2. Yes, sometimes, 3. Yes, very often”; “Item 5. I have felt scared or panicky for no very good reason; 0. No, not at all, 1. No, not much, 2. Yes, sometimes, 3. Yes, quite a lot”; “Item 6. Things have been getting on top of me; 0. No, I have been coping as well as ever, 1. No, most of the time I have coped quite well, 2. Yes, sometimes I haven't been coping as well as usual, 3. Yes, most of the time I haven't been able to cope”; “Item 7. I have been so unhappy that I have had difficulty sleeping; 0. No, not at all, 1. Not very often, 2. Yes, sometimes, 3. Yes, most of the time”; “Item 8. I have felt sad or miserable; 0. No, not at all, 1. Not very often, 2. Yes, quite often, 3. Yes, most of the time”; “Item 9. I have been so unhappy that I have been crying; 0. No, never, 1. Only occasionally, 2. Yes, quite often, 3. Yes, most of the time”; “Item 10. The thought of harming myself has occurred to me; 0. Never, 1. Hardly ever, 2. Sometimes, 3. Yes, quite often”. Two categorization processes were conducted to calculate the prevalence (absent vs. present; score = 0 vs. scores  $\geq 1$ ) and severity (non-severe vs. severe; scores  $\leq 1$  vs. scores  $\geq 2$ ) of each item. The Portuguese version of EPDS has good internal consistency [20,21]. In the cohorts assessed prior to the COVID-19 pandemic, Cronbach's  $\alpha$  coefficient was 0.83 during pregnancy and 0.85 during the postpartum period. In the cohort assessed during the COVID-19 pandemic, Cronbach's  $\alpha$  coefficient was 0.90 during pregnancy and 0.91 during the postpartum period. As recommended, a cut-off of 13 was used to identify women with clinically significant symptoms of depression [16].

### 2.3. Statistical analyses

Descriptive statistics were calculated to analyze the socio-demographic and clinical characteristics of participants. The estimated

prevalence (scores  $\geq 1$ ) and severity (scores  $\geq 2$ ) of each depressive symptom were compared in the cohorts before and during the COVID-19 pandemic. Chi-square tests were performed to compare the prevalence of EPDS  $\geq 13$  in the cohorts before and during the COVID-19 pandemic. Two Multivariate Analyses of Covariance (MANCOVAs) and two Univariate Analyses of Covariance (UNIANCOVAs) were conducted to analyze the impact of the COVID-19 pandemic (before vs. during) on specific symptoms of depression during pregnancy and the postpartum period. As independent variables, the models included the period (before vs. during the COVID-19 pandemic) and the stage of pregnancy (early pregnancy –first and second trimester – vs. late pregnancy –third trimester) or stage of postpartum (early postpartum –until 12 weeks after childbirth– vs. late postpartum –>12 weeks after childbirth). The MANCOVA models included the 10 EPDS items as dependent variables, whereas the UNIANCOVA models included EPDS total score as the dependent variable. The models included potential sociodemographic, obstetric and health confounders (age, country of birth, education, marital status, employment status, history of mental health problems, parity, and risk pregnancy) as covariates.

Two-step logistic regressions were performed to analyze the impact of the COVID-19 pandemic on the prevalence of clinically significant symptoms of depression (EPDS  $\geq 13$ ) during pregnancy and the postpartum period. The first step (enter method) was performed to control potential sociodemographic, obstetric and health confounders. As independent variables, the second step included the variables of the first step, along with the period (before vs. during the COVID-19 pandemic), and stage of pregnancy (early pregnancy –first and second trimester – vs. late pregnancy –third trimester) or stage of postpartum (early postpartum –until 12 weeks after childbirth– vs. late postpartum –>12 weeks after childbirth) and clinically significant symptoms of depression (EPDS  $\geq 13$ ) as dependent variable.

Statistical significance was considered at  $p$  values  $< .05$ . Data were

analysed with IBM SPSS 26.0 version (SPSS Inc., Chicago).

### 3. Results

#### 3.1. Characteristics of participants

Table 1 shows the characteristics of participants by perinatal period: pregnancy vs. postpartum. Most pregnant women were 25 to 35 years old (63.0%); primiparous (78.3%); lived with their partner (85.3%); and about half had higher education (53.6%). Near one in four had experienced a mental health problem ever in life; 20.4% had a risk pregnancy; 28.5% were unemployed; and 8.7% were foreign-born. Most postpartum women were 25 to 35 years old (63.9%), primiparous (66.6%), and lived with their partner (88.0%), and about half had a higher education (57.6%). Near one in four had had a mental health problem ever in life, 21.2% had a risk pregnancy, 18.7% were unemployed, and 8.8% were foreign-born.

Both, pregnant and postpartum women assessed during the COVID-19 pandemic were more likely ( $p < 0.001$ ) to have clinically significant symptoms of depression (EPDS  $\geq 13$ ; 24.3% and 28.2%, respectively), as compared to women assessed prior to the COVID-19 pandemic (9.0% and 6.9%, respectively).

Pregnant women assessed during the COVID-19 pandemic were more likely to be older, live with their partner, have a high education, be primiparous, have a history of mental health problem, and have a risk pregnancy, as compared to pregnant women assessed prior to the COVID-19 pandemic. Postpartum women assessed during the COVID-19 pandemic were more likely to be older, live with their partner, have a higher education, be multiparous, and have a risk pregnancy. In addition, they were less likely to be unemployed, as compared to postpartum women assessed prior to the COVID-19 pandemic.

**Table 1**  
Participants' characteristics according to perinatal period, before and during the COVID-19 pandemic.

		Pregnancy			<i>p</i>	Postpartum			<i>p</i>
		COVID-19 pandemic				COVID-19 pandemic			
		Before	During	Total		Before	During	Total	
<i>n</i>	<i>n</i>	<i>N</i>	<i>n</i>	<i>n</i>	<i>N</i>	<i>n</i>	<i>N</i>		
		<i>n</i> (%)	<i>n</i> (%)	<i>N</i> (%)		<i>n</i> (%)	<i>n</i> (%)	<i>N</i> (%)	
Age	$\leq 24$	254 (18.5)	36 (5.1)	290 (14.0)	$< 0.001$	156 (15.9)	24 (3.9)	180 (11.2)	$< 0.001$
	25–35	870 (63.5)	438 (62.2)	1308 (63.0)		642 (65.2)	382 (61.8)	1024 (63.9)	
	$\geq 36$	247 (18.0)	230 (32.7)	477 (23.0)		186 (18.9)	212 (34.3)	398 (24.8)	
	Missing	1371	704	2075		984	618	1602	
Country of birth	Native	1252 (91.1)	590 (91.6)	1842 (91.3)	0.714	893 (90.8)	534 (92.1)	1427 (91.2)	0.374
	Foreign	122 (8.9)	54 (8.4)	176 (8.7)		91 (9.2)	46 (7.9)	137 (8.8)	
	Missing	28	104	132		984	580	1564	
Education	$\leq 9$ years of education	356(26.0)	7 (1.0)	363(17.3)	$< 0.001$	235(23.9)	8(1.3)	243(15.0)	$< 0.001$
	10–12 years of education	443 (32.4)	167 (22.8)	610 (29.1)		300 (30.5)	145 (22.7)	445 (27.5)	
	Higher education <sup>1</sup>	569 (41.6)	557 (76.2)	1126 (53.6)		447 (45.5)	486 (76.1)	933 (57.6)	
	Missing	1368	731	2099		982	639	1621	
Employment status	Unemployed or other <sup>2</sup>	371 (27.1)	232 (31.1)	603 (28.5)	0.051	231 (23.5)	74 (11.5)	305 (18.7)	$< 0.001$
	Employed	997 (72.9)	513 (68.9)	1510 (71.5)		752 (76.5)	572 (88.5)	1324 (81.3)	
	Missing	1368	745	2113		983	646	1629	
Marital status	Married/cohabiting	1100 (80.4)	690 (94.4)	1790 (85.3)	$< 0.001$	813 (82.9)	613 (95.9)	1426 (88.0)	$< 0.001$
	Other situation <sup>3</sup>	268 (19.6)	41 (5.6)	309 (14.7)		168 (17.1)	26 (4.1)	194 (12.0)	
	Missing	1368	731	2099		981	639	1620	
	Yes <sup>4</sup>	326 (23.9)	207 (28.0)	533 (25.3)		233 (23.7)	180 (27.9)	413 (25.4)	
History of mental health problems	No	1039 (76.1)	533 (72.0)	1572 (74.7)	0.039	750 (78.3)	466 (72.1)	1216 (74.6)	0.059
	Missing	1365	740	2105		983	646	1629	
Parity	Nulliparous/Primiparous	979 (70.3)	628 (88.1)	1607 (78.3)	$< 0.001$	723 (73.2)	360 (56.3)	1083 (66.6)	$< 0.001$
	Multiparous	413 (29.7)	85 (11.9)	498 (23.7)		265 (26.8)	279 (43.7)	544 (33.4)	
	Missing	1392	713	2105		988	639	1627	
	Yes	202(16.5)	199(27.0)	401(20.4)		156(15.9)	178(29.9)	334(21.2)	
Risk pregnancy <sup>5</sup>	No	1025(83.5)	538(73.0)	1563(79.6)	$< 0.001$	824(84.1)	417(70.1)	1241(78.8)	$< 0.001$
	Yes	175	11	186		13	53	66	
	Missing								

Notes. <sup>1</sup>bachelor, master's degree or postgraduate diploma<sup>2</sup>Other includes student/housewife<sup>3</sup>Other situation includes single/separated/divorced/widow<sup>4</sup>Any mental health problem ever in life<sup>5</sup>Risk pregnancy includes age over 40 or gestational diabetes or hypertension or short cervix or other clinical condition; COVID-19 = coronavirus disease.

### 3.2. Impact of the COVID-19 pandemic on specific symptoms of depression (EPDS items and total) during pregnancy and the postpartum period

Supplementary Fig. 1 displays the proportion of answer options selected per EPDS item by pregnant women assessed before vs. during the COVID-19 pandemic. The estimated prevalence of symptoms of depression in pregnant women (scores  $\geq 1$ ; see Fig. 1a) was higher during the COVID-19 pandemic for all items, except for items 3, 5, and 10, as compared to the pre-pandemic period. The items which prevalence increased the most ( $>30\%$ ) were item 1 (32.6%) and item 2 (37.2%) during the COVID-19 pandemic (49.9% and 53.3%, respectively), as compared to the pre-pandemic period (17.3% and 16.1%, respectively). The severity of symptoms of depression (scores  $\geq 2$ ; see Fig. 1b) was higher in all items except for item 10. The highest increases in severity were observed in items 6 (19.4%) and 8 (10.8%) during the COVID-19 pandemic (42.9% and 19.5%, respectively), as compared to the pre-pandemic period (23.5% and 8.7%, respectively).

Supplementary Fig. 2 displays the proportion of answer options selected per EPDS item by postpartum women before vs. during the COVID-19 pandemic. The estimated prevalence of symptoms of depression in postpartum women (scores  $\geq 1$ ; see Fig. 2a) was higher during the COVID-19 pandemic for all EPDS items, as compared to the pre-pandemic period. A  $> 40\%$  increase was observed in the estimated prevalence of items 1 (40.6%) and 2 (47.2%), followed by a  $> 30\%$  increase in items 8 (34.2%) and 9 (30.2%) during the pandemic (56.8%, 60.0%, 68.5%, and 56.6%, respectively), as compared to the pre-pandemic period (16.2%; 12.8%, 34.3%, and 26.4% respectively). The severity of symptoms of depression (scores  $\geq 2$ ; see Fig. 2b) was higher in all items during the COVID-19 pandemic. The highest increases in severity were observed in items 5 (21.4%) and 6 (31.6%) during the COVID-19 pandemic (41.5% and 56.0%, respectively), as compared to the pre-pandemic (20.1% and 24.4%, respectively).

Significant multivariate effects of the COVID-19 pandemic were found on symptoms of depression (EPDS items) during pregnancy, *Wilk's Lambda* = 0.86,  $F(10, 1789) = 28.89$ ,  $p < .001$ ,  $\eta^2 = 0.14$ . Significant univariate effects of the COVID-19 pandemic were found on EPDS total score and all items, except for items 3 and 10. Pregnant women assessed during the COVID-19 pandemic reported more symptoms of depression, as compared to pregnant women assessed prior to the COVID-19 pandemic (see Table 2). Significant multivariate effects of the COVID-19 pandemic were found on symptoms of depression (EPDS items) during postpartum, *Wilk's Lambda* = 0.77,  $F(10, 1455) = 44.66$ ,  $p < .001$ ,  $\eta^2 = 0.24$ . Results revealed significant univariate effects of the COVID-19 pandemic on all EPDS items and the total score. Postpartum women assessed during the COVID-19 pandemic reported more symptoms of depression compared to postpartum women assessed prior to the COVID-19 pandemic (see Table 2).

### 3.3. Impact of the COVID-19 pandemic on the prevalence of clinically significant symptoms of depression (EPDS $\geq 13$ ) during pregnancy and the postpartum period

The first step of the regression model for the prevalence of clinically significant symptoms of depression (EPDS  $\geq 13$ ) during pregnancy included potential sociodemographic, obstetric and health confounders. The model was statistically significant ( $\chi^2(9) = 61.79$ ,  $p < .001$ ), explained 3% to 6% of the variance in the prevalence of clinically significant symptoms of depression during pregnancy (Cox & Snell  $R^2 = 0.03$ , Nagelkerke  $R^2 = 0.06$ ), and correctly classified 86.2% of cases. The period (before vs. during the COVID-19 pandemic) and stage of pregnancy (early vs. late) were added in the second step of the model. The second step of the regression model was statistically significant ( $\chi^2(11) = 154.33$ ,  $p < .001$ ), explained 8% to 15% of the variance in the prevalence of clinically significant symptoms of depression during pregnancy (Cox & Snell  $R^2 = 0.08$ , Nagelkerke  $R^2 = 0.15$ ), and correctly classified

86.6% of cases. Pregnant women assessed during the COVID-19 pandemic had higher odds of reporting clinically significant symptoms of depression, as compared to pregnant women assessed prior to the COVID-19 pandemic. Being foreign or having a low education level or a history of mental health problems increased the odds of reporting clinically significant symptoms of depression during pregnancy (see Table 3).

The first step of the regression model for the prevalence of clinically significant symptoms of depression (EPDS  $\geq 13$ ) during the postpartum period included potential sociodemographic, obstetric and health confounders. The model was statistically significant ( $\chi^2(9) = 54.02$ ,  $p < .001$ ), explained 4% to 7% of the variance in the prevalence of clinically significant symptoms of depression during the postpartum period (Cox & Snell  $R^2 = 0.04$ , Nagelkerke  $R^2 = 0.07$ ) and correctly classified 86.2% of cases. The period (before vs. during the COVID-19 pandemic) and stage of postpartum (early vs. late) were added in the second step. The second step was statistically significant ( $\chi^2(11) = 165.58$ ,  $p < .001$ ), explained 11% to 19% of the variance in the prevalence of clinically significant symptoms of depression during the postpartum period (Cox & Snell  $R^2 = 0.11$ , Nagelkerke  $R^2 = 0.19$ ), and correctly classified 86.1% of cases. Postpartum women assessed during the COVID-19 pandemic had higher odds of reporting clinically significant symptoms of depression, as compared to postpartum women assessed prior to the COVID-19 pandemic. A foreign nationality, a history of mental health problems, and a young age increased the odds of reporting clinically significant symptoms of depression during the postpartum period (see Table 3).

## 4. Discussion

### 4.1. Main findings

This study provides evidence that pregnant/postpartum women during the COVID-19 pandemic had higher odds of reporting clinically significant symptoms of depression, as compared to pregnant/postpartum women assessed prior to the COVID-19 pandemic. The increased prevalence of clinically significant symptoms of depression during the COVID-19 pandemic can be due to a significantly higher prevalence and severity of specific core depressive and anhedonia-related symptoms, as assessed on the EPDS.

Additionally, being foreign or having a history of mental health problems increased the odds of having clinically significant symptoms of depression during pregnancy/postpartum. A low education only increased the odds of having clinically significant depressive symptoms during pregnancy, whereas a young age only increased the odds during the postpartum period.

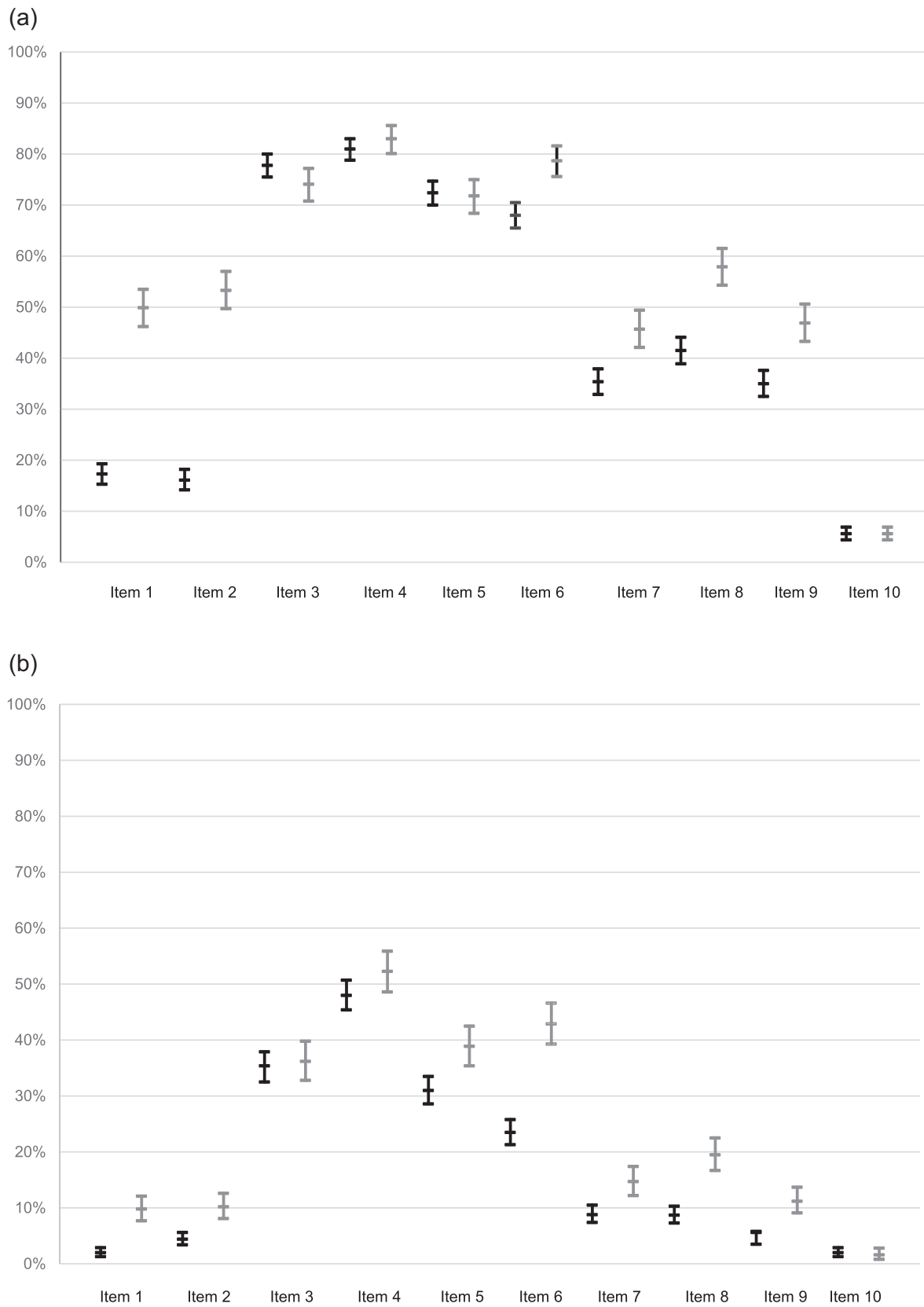
During the COVID-19 pandemic, the number and severity of symptoms of depression during pregnancy and the postpartum period was considerably higher, as compared to the pre-pandemic period.

### 4.2. Prevalence of clinically significant symptoms of depression

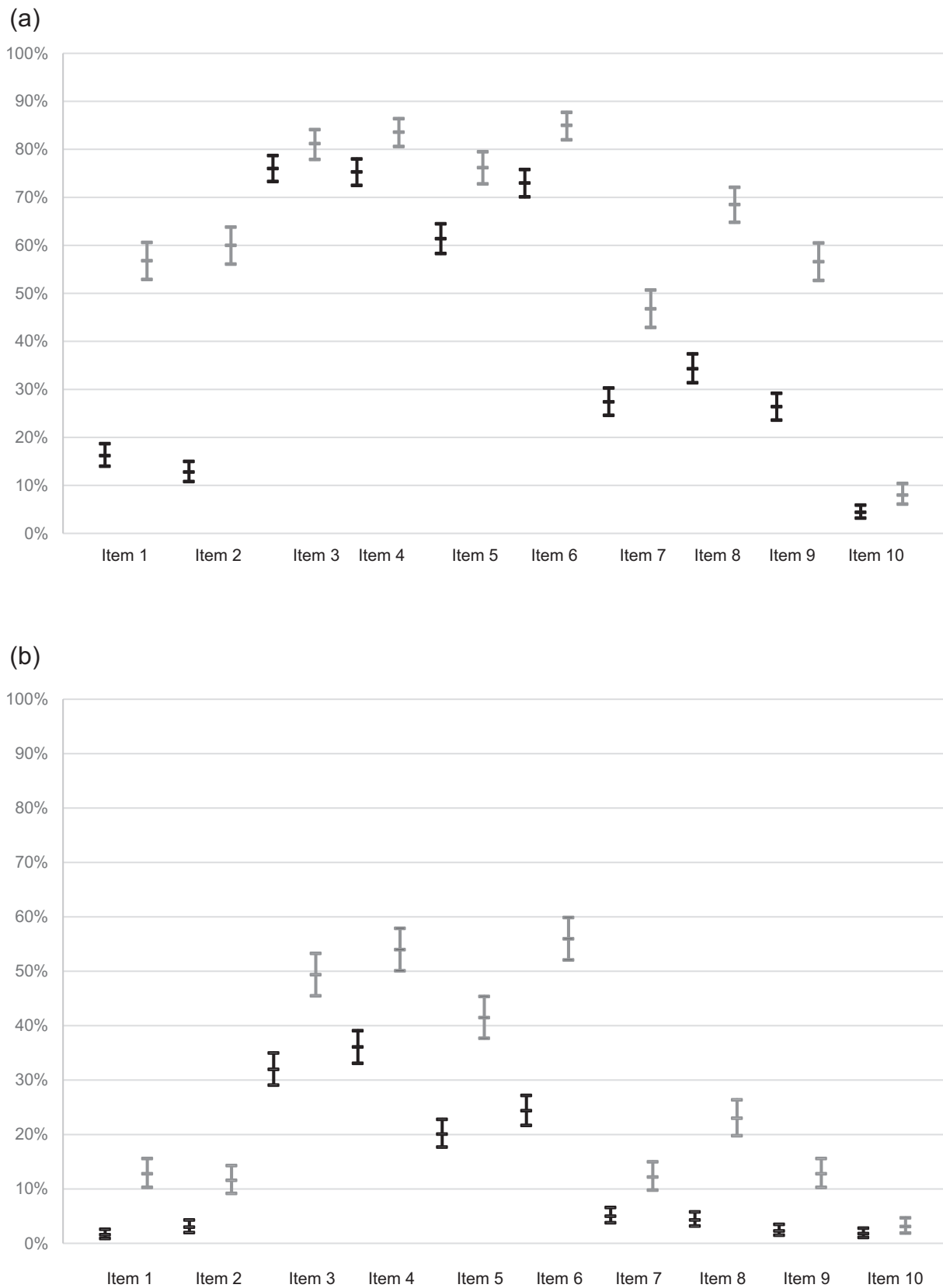
Our data show that about one in four pregnant women obtained a score  $\geq 13$  on the EPDS and this prevalence was even higher in the postpartum period. Lower prevalence rates have been reported in Switzerland and the Netherlands, whereas higher prevalence rates have been reported in the UK, and similar in Ireland [11]. Importantly, the increase observed in the prevalence and severity of depressive symptoms during the pandemic was more remarkable during postpartum, as compared to the pregnancy period (21.3% vs. 15.3%, respectively). This finding suggests a higher burden of the COVID-19 pandemic on the mental health of women during the postpartum period.

### 4.3. Prevalence of symptoms of depression

Important increases were observed in the prevalence of difficulties in being able to laugh and see the funny side of things (item 1, pregnancy



**Fig. 1.** Estimates and 95% CI around the probability of having a depressive symptom (score  $\geq 1$ ) before (black) and after (grey) or a severe depressive symptom (score  $\geq 2$ ) before (black) and after (grey) the COVID-19 pandemic - Pregnancy.



**Fig. 2.** Estimates and 95% CI around the probability of having a depressive symptom (score  $\geq 1$ ) before (black) and after (grey) or a severe depressive symptom (score  $\geq 2$ ) before (black) and after (grey) the COVID-19 pandemic - Postpartum.



**Table 2**

The impact of COVID-19 pandemic on specific symptoms of depression (EPDS items and total) during pregnancy and the postpartum period, adjusting for socio-demographic and health confounders.

EPDS	Pregnancy					Postpartum				
	COVID-19 pandemic				F	COVID-19 pandemic				F
	Before n = 1402		During n = 748			Before n = 962		During n = 513		
M	SD	M	SD	M	SD	M	SD	M	SD	
Item 1. I have been able to laugh and see the funny side of things	0.19	0.44	0.54	0.66	187.72***	0.17	0.42	0.71	0.71	211.28***
Item 2. I have looked forward with enjoyment to things	0.20	0.52	0.63	0.69	185.08***	0.15	0.44	0.74	0.70	337.06***
Item 3. I have blamed myself unnecessarily when things go wrong	1.15	0.82	1.15	0.88	1.47	1.10	0.80	1.40	0.92	32.55***
Item 4. I have been anxious or worried for no good reason	1.35	0.88	1.42	0.86	11.55**	1.14	0.83	1.48	0.88	40.01***
Item 5. I have felt scared or panicky for no very good reason	1.06	0.85	1.13	0.91	7.21**	0.83	0.78	1.26	0.91	63.40***
Item 6. Things have been getting on top of me	0.92	0.79	1.26	0.90	54.25***	0.99	0.76	1.51	0.87	77.98***
Item 7. I have been so unhappy that I have had difficulty sleeping	0.45	0.69	0.60	0.77	27.18***	0.32	0.58	0.59	0.74	50.95***
Item 8. I have felt sad or miserable	0.51	0.69	0.77	0.81	54.32***	0.39	0.58	0.94	0.80	175.05***
Item 9. I have been so unhappy that I have been crying	0.40	0.61	0.59	0.74	38.88***	0.29	0.52	0.71	0.73	128.17***
Item 10. The thought of harming myself has occurred to me	0.08	0.35	0.07	0.34	2.81	0.06	0.32	0.11	0.44	6.49*
Total	6.30	4.28	8.20	5.74	75.62***	5.72	4.18	9.44	5.61	159.38***

*Notes.* Response options, Item 1. 0. As much as I always could, 1. Not quite so much now, 2. Definitely not so much now, 3. Not at all; Item 2. 0. As much as I ever did, 1. Rather less than I used to, 2. Definitely less than I used to, 3. Hardly at all; Item 3. 0. No, never, 1. Not very often, 2. Yes, some of the time, 3. Yes, most of the time; Item 4. 0. No, not at all, 1. Hardly ever, 2. Yes, sometimes, 3. Yes, very often; Item 5. 0. No, not at all, 1. No, not much, 2. Yes, sometimes, 3. Yes, quite a lot; Item 6. 0. No, I have been coping as well as ever, 1. No, most of the time I have coped quite well, 2. Yes, sometimes I haven't been coping as well as usual, 3. Yes, most of the time I haven't been able to cope; Item 7. 0. No, not at all, 1. Not very often, 2. Yes, sometimes, 3. Yes, most of the time; Item 8. 0. No, not at all, 1. Not very often, 2. Yes, quite often, 3. Yes, most of the time; Item 9. 0. No, never, 1. Only occasionally, 2. Yes, quite often, 3. Yes, most of the time; Item 10. 0. Never, 1. Hardly ever, 2. Sometimes, 3. Yes, quite often.

Models adjusted for age, country of birth, education, marital status, employment status, history of mental health problems, parity, and risk pregnancy.

32.6%, postpartum 40.6%); looking forward with enjoyment to things (item 2, pregnancy 37.2%, postpartum 47.2%); feeling sad/miserable in the postpartum period (item 8, 34.2%); and unhappiness leading to crying in the postpartum period (item 9, 30.2%). The last two symptoms are core symptoms of depression, whereas the first two symptoms have been previously classified as anhedonia-related symptoms [17,18,22] and refer to the inability to feel pleasure in normally pleasurable activities. The increases in the prevalence of core symptoms of depression and anhedonia-related symptoms may be related to non-pharmaceutical interventions (including containment and closure policies) implemented by governments to contain the COVID-19 outbreak [23,24]. These measures had a huge impact on daily routines and prevented engagement in pleasurable activities, particularly those that involved social contact, which resulted in social isolation. In Portugal, within the study period, the Portuguese “lockdown style” was quite strict, with a high median stringency index (index varies from 0 to 100; 100 = strictest [23]) (71.30; P<sub>25</sub>-P<sub>75</sub>: 71.30–72.69; Min-Max: 63.43–74.54). This high stringency index indicates that social contact was substantially restricted in the population. Preventive measures included containment and closure policies such as school and workplace closure, cancellation of public events, restrictions on gatherings, closure of public transport, stay-at-home measures, restrictions on internal movements, or border restriction [23], which led to increased social isolation.

The prevalence of anxiety-related symptoms (items 3 to 5: self-blame, anxious/worried, scared panicky) remained steadily. Those symptoms were the most prevalent in the pre-pandemic. During the COVID-19 pandemic, these symptoms remained the most prevalent along with the core depression symptom of overwhelmed (item 6), both during pregnancy and the postpartum period. This finding suggests that the symptoms that were already the most prevalent in women assessed prior to the COVID-19 pandemic may be less prone to variability resulting from contextual changes.

#### 4.4. Severity of symptoms of depression

The severity of symptoms of depression also increased significantly during the COVID-19 pandemic, especially concerning core-symptoms of depression of feeling overwhelmed –“things have been getting on top of me”– during pregnancy and the postpartum period (item 6,

pregnancy 19.4%, postpartum 31.6%), and sadness during pregnancy –“I have felt sad or miserable” (item 8, 10.8%)–, as well as the anxiety-related symptom of feeling scared/panicky in the postpartum period (item 5, 21.4%). During pregnancy, severity increased most significantly in two core symptoms of depression (items 6 and 8), whereas in the postpartum period, the highest increases were observed in a core-depressive symptom and an anxiety-related symptom (items 5 and 6).

The feeling of overwhelm during pregnancy and the postpartum might be associated with the significant proportion of Portuguese women reporting difficulties in accessing routine antenatal care (49.2%) and the reduced overall quality of maternal and neonatal care during the COVID-19 pandemic (47.3%) [25]. These concerns added to worries about the lack of social support (e.g., restrictions on visits) [26] resulting from non-pharmaceutical interventions (movement restrictions and stay-at-home requirements). These restrictions may have resulted in isolation and deprivation from the social support that is usually provided to women by relatives and friends around the postpartum period. A previous study showed that support from healthcare providers is associated with lower symptoms of depression [27]. Feeling scared in the postpartum period might be driven by increased worries about the infant and medical care, including the possibility that the infant will be infected with SARS-CoV-2.

The proportion of pregnant women that had feelings of scariness or panic without a reason and of pregnant or postpartum women that had feelings of unnecessary blame or self-harm did not increase in the COVID-19 pandemic compared to before. The first two symptoms are anxiety-related components of depression [17,18,22]. These results suggest that the COVID-19 pandemic had a higher impact on symptoms of depression, as compared to anxiety-related symptoms in the perinatal period.

Finally, the severity of anxiety-related symptoms did not increase during the COVID-19 pandemic. Those symptoms (e.g., self-blame, anxious/worried, scared panicky) were the most severe both before and during the COVID-19 pandemic, along with the core depressive symptom of feeling overwhelmed, both in pregnant and postpartum women.

**Table 3**

The impact of timing (before vs during COVID-19 pandemic) on the prevalence of clinically significant symptoms of depression (EPDS  $\geq 13$ ) during pregnancy and the postpartum period, adjusting for sociodemographic, obstetric, and health confounders.

Pregnancy	$\beta$	Wald	p	OR	95% CI
<i>Step 1</i>					
Not married/cohabiting <sup>1</sup> (ref. married/cohabiting)	0.01	0.01	0.948	0.99	0.67–1.46
Risk pregnancy <sup>2</sup> (ref. normal pregnancy)	0.25	2.10	0.147	0.78	0.56–1.09
Foreign (ref. native)	0.66	9.70	0.002	1.93	1.28–2.92
Unemployed or other <sup>3</sup> (ref. employed)	0.48	10.12	0.001	1.62	1.20–2.18
$\leq 9$ years of education (ref. higher education <sup>4</sup> )	0.21	0.94	0.332	0.81	0.53–1.24
10–12 years of education (ref. higher education <sup>4</sup> )	0.22	1.69	0.193	1.24	0.90–1.72
Any mental health problem ever in life (ref. no)	0.81	30.38	<	0.45	0.34–0.60
$\leq 24$ years old (ref. >33 years old)	0.16	0.37	0.541	1.17	0.71–1.93
25–33 years old (ref. >33 years old)	–0.18	1.10	0.294	0.84	0.60–1.17
<i>Step 2</i>					
Not married/cohabiting <sup>1</sup> (ref. married/cohabiting)	0.29	1.76	0.185	1.33	0.87–2.03
Risk pregnancy <sup>2</sup> (ref. normal pregnancy)	0.04	0.06	0.814	0.96	0.68–1.36
Foreign (ref. native)	0.81	13.06	<	2.25	1.45–3.48
Unemployed or other <sup>3</sup> (ref. employed)	0.28	3.22	0.073	1.33	0.97–1.81
$\leq 9$ years of education (ref. higher education <sup>4</sup> )	0.82	10.30	<	2.27	1.38–3.75
10–12 years of education (ref. higher education <sup>4</sup> )	0.55	9.77	0.002	1.74	1.23–2.46
Any mental health problem ever in life (ref. no)	0.73	22.82	<	0.48	0.36–0.65
$\leq 24$ years old (ref. >33 years old)	0.32	1.45	0.228	1.38	0.82–2.34
25–33 years old (ref. >33 years old)	–0.06	0.12	0.725	0.94	0.67–1.33
During COVID-19 pandemic (ref. before)	1.60	81.35	<	0.20	0.14–0.29
Early pregnancy <sup>5</sup> (ref. late pregnancy <sup>6</sup> )	0.36	4.91	0.027	0.70	0.51–0.96
<i>Postpartum</i>					
<i>Step 1</i>					
Not married/cohabiting <sup>1</sup> (ref. married/cohabiting)	0.06	0.06	0.807	0.94	0.57–1.56
Risk pregnancy <sup>2</sup> (ref. normal pregnancy)	0.42	5.54	0.019	1.52	1.07–2.16
Foreign (ref. native)	0.54	4.84	0.028	1.71	1.06–2.77
Unemployed or other <sup>3</sup> (ref. employed)	0.26	1.38	0.240	0.77	0.50–1.19
$\leq 9$ years of education (ref. higher education <sup>4</sup> )	0.95	12.13	<	0.39	0.23–0.66
10–12 years of education (ref. higher education <sup>4</sup> )	0.43	4.99	0.026	0.65	0.44–0.95
Any mental health problem ever in life (ref. no)	0.95	33.28	<	0.39	0.28–0.53
$\leq 24$ years old (ref. >33 years old)	0.54	2.70	0.100	1.72	0.90–3.27
25–33 years old (ref. >33 years old)	0.19	1.00	0.317	1.21	0.84–1.74
<i>Step 2</i>					
Not married/cohabiting <sup>1</sup> (ref. married/cohabiting)	0.35	1.56	0.212	1.42	0.82–2.44
Risk pregnancy <sup>2</sup> (ref. normal pregnancy)	0.18	0.94	0.332	1.20	0.83–1.74
Foreign (ref. native)	0.70	7.03	0.008	2.01	1.20–3.36

**Table 3 (continued)**

Pregnancy	$\beta$	Wald	p	OR	95% CI
Unemployed or other <sup>3</sup> (ref. employed)	0.14	0.36	0.547	0.87	0.55–1.38
$\leq 9$ years of education (ref. higher education <sup>4</sup> )	0.11	0.12	0.734	1.12	0.60–2.09
10–12 years of education (ref. higher education <sup>4</sup> )	0.13	0.43	0.513	0.87	0.59–1.31
Any mental health problem (ref. no)	0.85	24.04	<	0.43	0.30–0.60
$\leq 24$ years old (ref. >33 years old)	0.84	5.71	0.017	2.32	1.16–4.61
25–33 years old (ref. >33 years old)	0.41	4.34	0.037	1.50	1.03–2.21
During COVID-19 pandemic (ref. before)	1.97	89.76	<	7.14	4.75–10.72
Early postpartum <sup>7</sup> (ref. late postpartum <sup>8</sup> )	0.09	0.25	0.616	0.92	0.65–1.29

Notes. COVID-19, coronavirus disease; EPDS, Edinburgh Postnatal Depression Scale; OR, odds ratio; CI, Confidence interval<sup>1</sup>; Includes single/separated/divorced/widow<sup>2</sup>; Risk pregnancy includes age over 40 or gestational diabetes or hypertension or short cervix or other clinical condition<sup>3</sup>; Other includes student/housewife; <sup>4</sup>bachelor, master’s degree or postgraduate diploma; <sup>5</sup>first and second pregnancy trimester; <sup>6</sup>third pregnancy trimester; <sup>7</sup>until 12 weeks after childbirth<sup>8</sup>; >12 weeks after childbirth.

Models adjusted for age, country of birth, education, marital status, employment status, history of mental health problems, parity, and risk pregnancy.

**4.5. Factors associated with the prevalence of clinically significant symptoms of perinatal depression during the COVID-19 pandemic**

Overall, pregnant/postpartum women assessed during the COVID-19 pandemic had higher odds of reporting clinically significant symptoms of depression, as compared to those assessed prior to the COVID-19 pandemic, which is consistent with previous evidence [3,9]. This is a major and serious public health concern, in the light that 60% of antenatal or postnatal mental health services were disrupted during the COVID-19 pandemic [2]. Untreated perinatal mental health problems have adverse consequences for children [28]. The finding that a young age, being foreign, a low education level or a history of mental health problems increase the risk for reporting clinically significant symptoms of depression during pregnancy and/or the postpartum period during the COVID-19 pandemic is consistent with previous reports [29]. Awareness should be raised about the mental health needs of the most vulnerable groups of women during the perinatal period. This would greatly contribute to the implementation of priority policies and promote the readiness of mental health services during the perinatal period in a context of crisis.

**4.6. Strengths and limitations**

The EPDS was used to assess symptoms of depression during pregnancy and the postpartum period. Since it is one of the most widely used self-reported measures to assess perinatal symptoms of depression [16], it allows comparison with other studies. Considering the normative sociodemographic characteristics of the sample, generalization of findings to other populations should be dealt with caution.

Significant differences were found between the cohort of women assessed during the COVID-19 pandemic and the cohort women assessed prior to the COVID-19 pandemic. However, these differences were controlled in the statistical analysis to examine the impact of the COVID-19 pandemic on perinatal symptoms of depression.

**4.7. Implications for clinical practice and research**

A variety of reliable short versions of the EPDS have been developed [e.g. [30,31]] in order to increase the cost-effectiveness of mental health screening plans. The significant increase in the prevalence and severity



of specific depressive symptoms during the COVID-19 pandemic raises concerns on the adequacy of using shortened EPDS versions during future contexts of crisis. For instance, items 5 and 6 were removed in some validated shortened versions of the EPDS [e.g. [31,32]]. However, these items represent symptoms which severity increases in situations of crisis, especially in the postpartum period. Clinicians should be aware that the use of shortened versions of the EPDS may lead to the underestimation of perinatal mental health problems. This may occur as short versions of the EPDS do not assess the symptoms which prevalence and severity increase the most during situations of crisis or when social isolation is required for any reason. Additionally, the administration of shortened versions prevents perinatal mental healthcare services from becoming aware of the occurrence of symptoms of depression in contexts of crisis or social isolation. This limitation results in health services failing to provide adequate screening, monitoring, and health care services, including strategies for reducing social isolation and improving social support, according to the specific needs of women during pregnancy or the postpartum period. We identified vulnerable groups that need the clinicians' special attention in terms of perinatal mental health. Maternal and neonatal health care services should be aware that women who are young, foreign or have a history of mental health problems or a low education level, have higher odds of developing mental health problems. Therefore, screening for mental health problems is of foremost importance to overcome inequities in health care. Funding for mental health and psychosocial support is scarce and antenatal or postnatal mental health services were disrupted during the COVID-19 pandemic [2]. At the same time our study showed that perinatal mental health worsened. If used wisely, the evidence provided in this study may contribute to improving the quality of mental healthcare by targeting and monitoring vulnerable groups using cost-effective tools.

## 5. Conclusion

The COVID-19 pandemic had an impact on the prevalence and severity of specific symptoms of depression, as well as on the prevalence of clinically significant symptoms of depression during the perinatal period. These deleterious effects were mainly due to the significantly higher prevalence and severity of core depressive and anhedonia-related symptoms. Our results suggest that clinical attention should be focused on the specific symptoms of depression that these women experience, in order to improve screening and treatment in this and future pandemics. The use of appropriate tools that assess a broad range of symptoms and address vulnerable groups is key to improving mental health care during current and future situations of crisis.

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The authors have no financial relationships relevant to this article to disclose.

## Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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## Author statement

I declare that I participated in the design, execution, and analysis of the paper by Costa and colleagues entitled "Women's perinatal depression: Anhedonia-related symptoms have increased in the COVID-19 pandemic"; that I have seen and approved the final version and that it has neither been published nor submitted elsewhere. I also declare that I have no conflict of interest, other than any noted in the covering letter to the editor.

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## Author contributions

Costa and Pinto had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Concept and design: RC TP AC BF; Acquisition, analysis, or interpretation of data: RC TP AC BF AM EM; Drafting of the manuscript: RC TP AC; Critical revision of the manuscript for important intellectual content: RC TP AC BF AM EM; Statistical analysis: RC TP; Obtained funding: RC AC BF AM.

## Declaration of Competing Interest

None.

## Data availability

Data will be made available on request.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.genhosppsy.2023.06.007>.

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