Depression Among Portuguese Pregnant Women During Covid-19 Lockdown: A Cross Sectional Study

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Abstract

Introduction Coronavirus disease 2019 was declared as a pandemic on March 2020. Research on its psychological effects is still lacking. Perinatal depression is a medical complication of pregnancy, especially in situations of stress. In this study, we aimed to investigate the presence of symptoms of depression in pregnant women during the lockdown period in Portugal.
Methods This study consisted in a cross-sectional study among Portuguese pregnant women, who completed an online self-report questionnaire between 25th April and 30th April 2020. An anonymous online questionnaire was developed to assess depression and concerns related to COVID-19. This study was approved by the IRB of Hospital Dona Estefânia and performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. Eligibility criteria included pregnant women, ≥ 18 years and living in Portugal. The primary outcome was to evaluate the presence of depressive symptoms and its association to socio-demographic characteristics and to concerns related to COVID-19.
Results A total of 1698 pregnant women were enrolled. The mean age was 31.9 years. 82.4% felt a negative impact of the pandemic in the surveillance of pregnancy and 43% felt insufficient support. 26.3% showed "possible depression" according to the EPDS. A regression analysis revealed the possibility of depression increased as the concerns about COVID increased and was lower for women with support. The possibility of depression was higher for women with psychiatric medical history.
Conclusion This study demonstrated a significant increase in clinically significant depressive symptoms in pregnant women during the lockdown. It also revealed some of the socio-demographic characteristics of women at risk for depression. If left untreated, depression tends to persist, affecting the woman and also the child. Our findings suggest that COVID-19 represents a serious challenge for this population and reinforce the urgent need for early detection and intervention on mental health issues during pregnancy, especially during the pandemic.

Keywords COVID-19 · Lockdown · Pregnancy, depression

Significance

The impact of COVID-19 pandemic in the mental health of pregnant women is still unknown. However, it is known that situations of stress and social isolation may contribute to the development of depressive disorders. Perinatal mental health issues are associated with risks and complications for mother and fetus. Our findings suggest that COVID-19 represents a serious challenge for pregnant women (in terms of impact in mental health). This study gives us to have a more clear idea of mental health status of pregnant women in Portugal during COVID-19 lockdown, allowing us to define a more targeted approach to early detection and intervention.

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Introduction

Perinatal mood and anxiety disorders commonly affect women of reproductive age (CDC, 2018; Kendig et al., 2017; World Health Organization, n.d.). In addition, perinatal depression represents one of the most common complications of pregnancy, affecting about one in seven women (Kendig et al., 2017).

Research from high-income countries has revealed a point prevalence of around 3–5% of women suffering from antepartum major depressive disorder and around 11% if including minor depression (Howard et al., 2014; Woody et al., 2017). Some of the risk factors for prenatal depression are: stresfull life events, lack of support and social isolation, pre-natal anxiety and medical history of previous depression or post partum depression (Nicholas & Yung Peng, 2017). There is strong evidence that for women experiencing stressful or traumatic events before or during pregnancy the global prevalence of mental disorders is increased (Biaggi et al., 2016; Blackmore et al., 2017; Seng et al., 2008).

Coronavirus disease 2019 (COVID-19) is an infectious disease that was declared by the World Health Organization (WHO) as a pandemic on March 2020. At the moment (January 2021), more than 80 million cases are confirmed and the disease is spread beyond 220 countries around the world (World Health Organization, 2020b). In this context, several measures were adopted by national authorities of different countries to limit the global transmission of the disease. Specific recommendations were also created for risk groups and pregnant women were considered a risk group (CDC, 2019, 2020; World Health Organization, 2020a). At the beginnig of the pandemic, little information was known regarding the risks of the infection to pregnant women and to the fetus (CDC, 2019).

In Portugal, during COVID-19 state of emergency lockdown (active from March 18th to May 2nd 2020), local health authorities defined protective measures to this group. Healthcare resources were reorganized, implying the physical reallocation of services and the cancelation of routine and non-urgent diagnostic and treatment procedures (SNS, 2020). Pregnant women had prenatal appointments, routine exams and ultrasounds cancelled. Companions were no longer allowed at prenatal appointments and during labor (regardless of the woman or their partner's COVID-19 diagnosis) (Direção Geral da Saúde, 2020). These measures implied that women had to go through all perinatal experiences on their own, without support from a partner. Upon admission (when in labour), all all pregnant women were screened for SARS CoV. For women who tested positive to the virus, initial recommendations from health authorities included: no skin-to-skin contact between the mother and the baby, wastage of all breastmilk as well as possible separation between infected mothers and newborns (Direção Geral da Saúde, 2020).

All these measures intended to diminish the number of people circulating in hospitals and maternities. However, they certainly had an impact on the mental health of this population (Buekens et al., 2020a, b; Thapa et al., 2020).

Not only the rapid increase in number of COVID-19 cases, but also the uncertainty of the possible risks for women and fetus infected and the implementation of these measures may have lead to increased level of stress and anxiety among pregnant women (Fakari & Simbar, 2020; Luo & Yin, 2020).

Other aspects related to the pandemic and the period of lockdown, such as social distancing, may also have contributed to changes in mental health in this population (Buekens et al., 2020a, b). Restricted access to mental health services due to the pandemic may also have been more intense during Covid-19 pandemic, limiting early detection and intervention (Buekens et al., 2020a, b).

The mental health repercussion of the COVID-19 pandemic on childbearing women is a major public health challenge (Buekens et al., 2020a, b). Inadequate screening and referral systems of antenatal depression often results in women with perinatal mental health issues going undiagnosed and untreated. Perinatal mental health issues are associated with preterm delivery, low birth weight, impaired postnatal infant growth, insecure infant-mother attachments and suboptimal breastfeeding practices, as well as with increased risk of psychological and developmental disturbances in children (Brockington et al., 2001; Fisher et al., 2012).

Depressive disorders are treatable and preventable. Antenatal identification of women with mental illness is important to protect both the health of the mother and of the neonate (Kendig et al., 2017; Stein et al., 2014). Very little is known on the impact of a global pandemic like COVID-19 on the mental health of pregnant women. In the present study, we aimed to asess the presence of clinical significant depressive symptoms among a Portuguese sample of pregnant women during the national state of emergency lockdown due to COVID-19 pandemic. We also aimed to assess the relationship of these symptoms with socio-demographic characteristics and with concerns related to COVID-19.

Materials and Methods

Study Design and Sample

We performed a cross-sectional study among Portuguese pregnant women, who completed an online self-report questionnaire between 25th April and 30th April 2020.

Eligibility criteria included pregnant women who were aged ≥ 18 years and living in Portugal during the first lockdown period. The lockdown period in Porugal had been decreted on March 18th, so all of these women were in lock-down for about 5–6 weeks when they participated in the study. All participants agreed to take part on the study, completing an informed consent.

The online questionnaire was developed by the research team members and was stored in Google Forms. It took approximately 10 min to complete. Those who did not fully complete the questionnaire or refused to give consent were automatically excluded. Women not living in Portugal during the lockdown period were also excluded.

This questionnaire was available online and was sent in different platforms (such as social media, e-mail, center of labour preparation).

The questionnaire addressed different topics, such as socio-demographic data, background on mental health, pregnancy follow-up data, implications of COVID-19 pandemic in pregnancy, emotional state of the mother in terms of symptoms of depression (using a validated scale).

The primary outcome of this study was to evaluate the presence of clinically significant depressive symptoms in pregnant women during the COVID-19 lockdown and its relationship to socio-demographic characteristics and to concerns related to the virus.

This study followed the ethical principles for medical research involving human subjects and was aligned by recommendations of the Declaration of Helsinki. It was submitted and approved by the IRB of the Hospital Dona Estefânia, CHULC, were the investigators work.

Study Measures

Edinburgh Postnatal Depression Scale (EPDS)

This is a 10 items Likert type scale, with four possible answers for each item (coded 0–3). The items 3, 5, 6, 7, 8, 9 and 10 are coded reversibly. It is a self-completed screening tool, extensively used as a screening scale for perinatal depression (Cox et al., 1987), well validated for Portuguese population and specifically used to screen depression in pregnancy and post-partum (Areias et al., 1996). Despite the fact that this scale does not make a clinical diagnose, it investigates the number of symptoms experienced by each participant and gives us an idea of women at risk for depressive disorders.

To determine a sum score, each item is added up giving a minimum score of 0 and a maximum score of 30. A cut-off of 13 is generally used, with individuals whose results are ≥ than 13 being considered at risk for depression. This cut-off was applied in this study.

Sociodemographic Characteristics

Data were collected on age, place of residency, marital status, household, highest academic qualification and current employment status.

Pregnancy Data

Participants were asked to give information regarding the gestational age, impact of COVID-19 on medical vigilance and family support.

Medical History

Medically relevant issues were requested and were obtained from the subjects, such as past and/or current psychiatric disorders.

Concerns About COVID-19 Scale

We created a scale to evaluate concerns related to the pandemic. Women were asked to rate the fear of: contamination and/or transmission of the disease to the newborn, early separation from the baby after birth and not being permitted to breastfeed. This scale consisted of a six items Likert type scale, with four possible answers for the first five items (coded 1–4) and five possible answer for the last item (coded 1–5).

Statistical Analysis

For baseline characteristics quantitative variables were described using the mean, median and standard deviation and qualitative and categorical variables were described in percentages and proportions.

To compare the variables between the two groups (with and without clinically significant depressive symptoms measured by the EPDS) the following the adequate tests were applied (Chi-square test, Fisher's exact test or two sample t-test).

The relationship of the presence of clinically significant depressive symptoms (scores on EPDS—qualitative dependent variable) with baseline clinical and demographic characteristics and with COVID-19 related stressors and concerns was done using a binary logistic regression model.

For the logistic regression model, the dependent variable was EPDS categories (No depression = 0, Possible depression = 1) and the independent variables were: Sociodemographic data (Age, Education level, Household, Work/occupation); Pregnancy Data (Poor support, Pregnancy complications, Trimester of pregnancy, Number of pregnancies), Medical and Psychiatric Background (Previous history of mental health disorders), Concerns about COVID Scale.

A p-value < 0.05 was considered statistically significant. Statistical analysis was performed with Stata package version 15.

Results

Group Baseline Characteristics

The sample integrated 1698 female elements accordingly to the eligibility criteria. By using electronic data capture that required participants to provide responses, there was very little missing data in the analysis variables.

The distribution of sociodemographic data, pregnancy data and of the impact of the pandemic in the pregnancy surveillance is described in Table 1.

In what concerns medical and psychiatric background, 30.3% had psychiatric and/or psychological history in the past, 6.6% at the moment and 14.0% felt the need of mental health support at the moment.

The issues related to the COVID-19 pandemic are analysed in Table 2, showing that 7.4% of the pregnant women were tested to COVID 19 infection during pregnancy, resulting in 0.3% confirmed as infected. 4.1% of the pregnant women who responded to the questionnaire reported having a family member who was confirmed as infected in the last month. For the questions related to the scale analysing the concerns about COVID, the vast majority showed very high levels of concern with the various issues (Table 2).

Scales Reliability

Concerns About COVID

The value of Cronbach's alpha is 0.843, so we can consider that the variables measure adequately the concerns about COVID, additional tests indicate that items are highly correlated with the scale (0.517–0.766) and that individual items elimination does not increases the alpha value, showing large effects (Hinkle et al., 2003).

EPDS Scale

The value of Cronbach's alpha is 0.894, so the variables measure adequately the EPDS, and additional tests indicate that items are highly correlated with the scale (0.307–0.789) and that individual items elimination does not increases the alpha value.

Scales Analysis: Concerns About COVID Scale and EPDS Scale

The Concerns about COVID Scale scores were determined by calculating the sum of the score for each item, varying between a possible minimum of 6 and a possible maximum of 25, the mean value ($M = 22.57 \pm 3.14$) was very high, close to the possible maximum value. The EPDS Scale scores also calculated from the sum of the score for each item, varying between a possible minimum of 0 and a possible maximum of 30, the mean value ($M = 8.90 \pm 5.40$) was relatively low, below the scale middle-point.

The EPDS Scale scores were then converted in two categories, with scores below 13 indicating "no depression" and of 13 or higher indicating "possible depression". In our sample, 26.3% showed "possible depression" and the remaining 73.7% showed "no depression".

The Relationship Between EPDS Scale and Selected Socio-Demographic Variables

The relations are presented in Table 3 and Figs. 1 and 2. Regarding the education level, the percentage of "possible depression" was higher for elementary school or less (44.6%), intermediate for high school (33.9%) and lower for college degree (23.4%), so it decreased with an increase in the education level, and the differences were statistically significant ($\chi^2_2 = 25.839$, $p < 0.001$). For the pregnancy complications, the percentage of "possible depression" was higher for its presence (31.7%) and lower for its absence (23.5%), and the differences were significant ($\chi^2_1 = 12.022$, $p < 0.001$). For the support, the percentage of "possible depression" was higher for its absence (43.3%) and lower for its presence (13.4%), and the differences were significant ($\chi^2_1 = 191.565$, $p < 0.001$). Regarding the trimester of pregnancy, the percentage of "possible depression" was higher for 3rd trimester (29.9%), intermediate for 2nd trimester (21.5%) and lower for 1st trimester (20.4%), so it increased with increasing pregnancy time, especially for the 3rd trimester, and the differences were significant ($\chi^2_2 = 16.074$, $p < 0.001$). For the psychiatric medical history, the percentage of "possible depression" was higher for women who felt in need of support at the moment and with no previous psychiatric history (55.5%), followed by women who were having mental health support at the moment (36.6%) and women with mental health support in the past (30.6%) and lower for women who reported no psychiatric support or feeling the need of psychiatric support (13.7%), and the differences were significant ($\chi^2_3 = 185.053$, $p < 0.001$).

The subjective level of concern/anxiety related to COVID pandemic had a higher mean value of 4.74 ± 0.52 for women with "possible depression" and lower mean value of 4.19 ± 0.86 for women with "no depression", and the differences were statistically significant ($t_{1696} = -12.923$, $p < 0.001$); the concerns about COVID Scale had a higher mean value of 23.89 ± 1.98 for women with "possible depression" and lower mean value of 22.10 ± 3.34 for women with "no depression", and the differences were

Table 1 Sociodemographic characterization and pregnancy data

	Categories	% (n)	Mean ± SD (Min–Max)
Final sample		100 (1698)	
Age (years)			31.9 ± 4.33 (19–49)
	< 20	0,12 (2)	
	20–30	36.98 (628)	
	≥ 31	62.9 (1068)	
Area of residence	Lisbon and Tagus Valley	48.7 (827)	
(Portugal)	North	27.1 (460)	
	Center	16.1 (274)	
	Alentejo	2.7 (45)	
	Algarve	3.4 (58)	
	Azores Islands	1.0 (17)	
	Madeira Islands	1.0 (17)	
Marital status	Married/cohabitation	85.4 (1450)	
	Single	13.7 (233)	
	Divorced/separated	0.9 (15)	
Education level	College or higher	76.0 (1291)	
	High school	20.7 (351)	
	Elementary school or less	3.3 (56)	
Occupation	Working	90.5 (1536)	
	Student	0.8 (13)	
	Domestic	1.8 (30)	
	Unemployed	7.0 (119)	
Place of professional activity of those women working	Suspended professional activity	46.4 (788)	
	Teleworking	23.6 (401)	
	Remained at usual place of work	5.2 (89)	
	Other situations	24.7 (420)	
Household	Husband/partner	53.9 (916)	
	Husband/Partner and children	33.7 (573)	
	Children	0.8 (14)	
	Living alone	0.9 (16)	
	Other family compositions	10.5 (179)	
Trimester of pregnancy	3rd	57.7 (979)	
	2nd	34.3 (582)	
	1st	8.1 (137)	
Current pregnancy	1st	58.4 (992)	
	2nd	30.2 (512)	
	3rd or more	11.4 (194)	
Surveillance of pregnancy	OB-GYN	81.2 (1379)	
	GP	18.2 (309)	
	None	0.6 (10)	
Negative impact of pandemic in the surveillance	No	17.6 (299)	
	Yes	82.4 (1399)	
Impact on the surveillance	Postponement of scheduled appointments	41.0 (697)	
	Cancellation/postponement of ultrasounds	15.8(269)	
	Impossibility/difficulty in scheduling new appointments	26.5 (450)	
	Impossibility of going accompanied by any family member	74.1(1258)	
	Other	10.8 (183)	
Pregnancy complications	No	66.1 (1123)	
	Yes	33.9 (575)	

Table 1 (continued)

	Categories	% (n)	Mean ± SD (Min–Max)
Support	No	43.0 (730)	
	Yes	57.0 (968)	

Table 2 Issues related to the COVID-19 pandemic

	Categories	% (n)	Mean ± SD
Women that were tested to COVID 19 infection during pregnancy	No	92.6 (1572)	
	Yes	7.4 (126)	
Diagnosis of COVID 19 infection	No one is or has been infected	95.6 (1623)	
	Myself (the patient herself)	0.3 (5)	
	Other family member	4.1 (70)	
Concerns about COVID			
Fearing absence of a partner at delivery	None	1.9 (32)	3.63 ± 0.67
	Little	5.3 (90)	
	Moderate	20.8 (353)	
	Much	72.0 (1223)	
Fearing contact with the child's skin	None	1.1 (19)	3.71 ± 0.61
	Little	5.1 (86)	
	Moderate	15.1 (257)	
	Much	78.7 (1336)	
Fear of withdrawal newborn	None	1.4 (23)	3.73 ± 0.62
	Little	5.2 (88)	
	Moderate	12.5 (213)	
	Much	80.9 (1374)	
Fearing breastfeeding	None	3.6 (61)	3.55 ± 0.79
	Little	7.7 (130)	
	Moderate	19.1 (324)	
	Much	69.7 (1183)	
Fearing newborn infection	None	0.6 (11)	3.61 ± 0.66
	Little	8.0 (136)	
	Moderate	20.8 (354)	
	Much	70.5 (1197)	
Subjective general level of concern/anxiety related to COVID pandemic	Very little	1.0 (17)	4.33 ± 0.82
	2	2.1 (35)	
	3	10.5 (178)	
	4	35.6 (605)	
	Very much	50.8 (863)	

statistically significant ($t_{1696} = -10.664$, p < 0.001). So, the preoccupations about COVID were always significantly higher for women with "possible depression".

Aspects Associated with the Presence of Depressive Symptoms

In binary logistic regression, the higher category of the dependent variable EPDS Categories (Possible depression = 1) was predicted and the lower category (No depression = 0) was the comparison reference by default.

Observing Table 4, the odds of having "possible depression" were decreased by a factor of 0.298 (95% CI 0.230–0.385) for women with support compared to women without support and the relation of EPDS with support is significant (p < 0.001); and were decreased by a factor of 0.753 (95% CI 0.572–0.991) for women in 2nd trimester of pregnancy compared to women in 3rd trimester of pregnancy and the relation of EPDS with the 2nd trimester of pregnancy was significant (p = 0.043); and were increased by a factor of 2.633 (95% CI 1.964–3.531) for women with psychiatric medical history in the past compared to women

Table 3 Relation between EPDS Scale and education level, pregnancy complications, support, subjective level of concern/anxiety related to COVID pandemic, concerns about COVID Scale, trimester of pregnancy and psychiatric medical history

	All (n = 1698)	EPDS Scale		p
		No depression (n = 1252)	Possible depression (n = 446)	
Education level: % (n)				< 0.001
College or higher	76.0 (1291)	76.6 (989)	23.4 (302)	
High school	20.7 (351)	66.1 (232)	33.9 (119)	
Elementary school or less	3.3 (56)	55.4 (31)	44.6 (25)	
Pregnancy complications: % (n)				< 0.001
No	66.1 (1123)	76.5 (859)	23.5 (264)	
Yes	33.9 (575)	68.3 (393)	31.7 (182)	
Support: % (n)				< 0.001
No	43.0 (730)	56.7 (414)	43.3 (316)	
Yes	57.0 (968)	86.6 (838)	13.4 (130)	
Trimester of pregnancy: % (n)				< 0.001
3rd	57.7 (979)	70.1 (686)	29.9 (293)	
2nd	34.3 (582)	78.5 (457)	21.5 (125)	
1st	8.1 (137)	79.6 (109)	20.4 (28)	
Psychiatric medical history: % (n)				< 0.001
No	49.1 (834)	86.3 (720)	13.7 (114)	
Yes, in the past	30.3 (514)	69.1 (355)	30.9 (159)	
Yes, at the moment	6.6 (112)	63.4 (71)	36.6 (41)	
No, but feel needed at moment	14.0 (238)	44.5 (106)	55.5 (132)	
Subjective level of concern/anxiety related to COVID pandemic: M ± SD	4.33 ± 0.82	4.19 ± 0.86	4.74 ± 0.52	< 0.001
Concerns about COVID Scale: M ± SD	22.57 ± 3.14	22.10 ± 3.34	23.89 ± 1.98	< 0.001

Tests used to compare variables between EPDS Scale groups: Chi-square test (Education level, Pregnancy complications, Support, Trimester of pregnancy and Psychiatric medical history); t test (Subjective level of concern/anxiety related to COVID pandemic, Concerns about COVID Scale)

M mean, *SD* standard deviation

without psychiatric medical history and the relation of EPDS with psychiatric medical history in the past is significant ($p < 0.001$); and were increased by a factor of 3.904 (95% CI 2.408–6.330) for women with psychiatric medical history at the moment compared to women without psychiatric medical history and the relation of EPDS with psychiatric medical history at the moment was significant ($p < 0.001$); and were increased by a factor of 6.240 (95% CI 4.396–8.859) for women with need of psychiatric medical support compared to women without psychiatric medical history and the relation of EPDS with need of psychiatric medical support was significant ($p < 0.001$); and were increased by a factor of 1.255 (95% CI 1.175–1.342) for women with an unitary increase in the Concerns about COVID Scale and the relation of EPDS with Concerns about COVID Scale was significant ($p < 0.001$).

All other variables, such as age ($p = 0.476$), education level ($p = 0.350$), household ($p = 0.631$), occupation ($p = 0.681$), pregnancy complications ($p = 0.293$), 1st trimester of pregnancy ($p = 0.875$) and current pregnancy ($p = 0.789$) were not significant predictors of the dependent variable EPDS categories.

Discussion

This cross-sectional study examined the relationship between COVID 19 pandemic and maternal mental health status in terms of symptoms of depression. This study revealed a significant increase in clinically significant depressive symptoms in Portuguese pregnant women during the national state of emergency lockdown.

A large group of 1698 pregnant women from the general population in Portugal was assessed using the EPDS and 26.3% (n = 446) had a global score of 13 or higher. Few studies have been performed in Portugal assessing perinatal depression prevalence and/or incidence before the COVID pandemic. Furthermore, some of them have considerable methodological limitations and/or small samples (Areias et al., 1996; Gorman et al., 2004; Maia et al., 2011). Results of these previous studies reported a pregnancy period prevalence of 1.3% (using DSM-IV criteria) and of 2.3% (using ICD-10 criteria) (Maia et al., 2011). Another study performed in several countries (among which was Portugal), reported a point prevalence rate of antenatal depression of 9.4% in Portuguese pregnant women living in
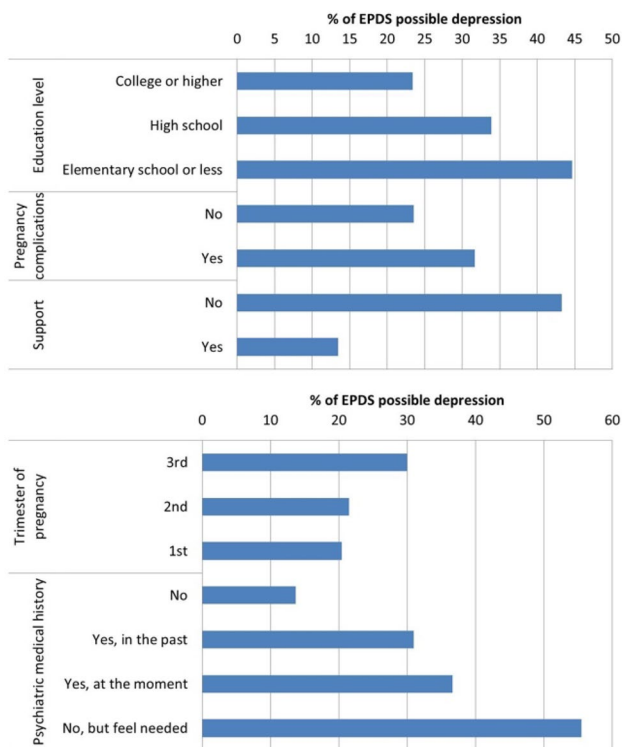
Fig. 1 Top: EPDS prevalence comparison between education level, pregnancy complications, support, trimester of pregnancy and psychiatric medical history
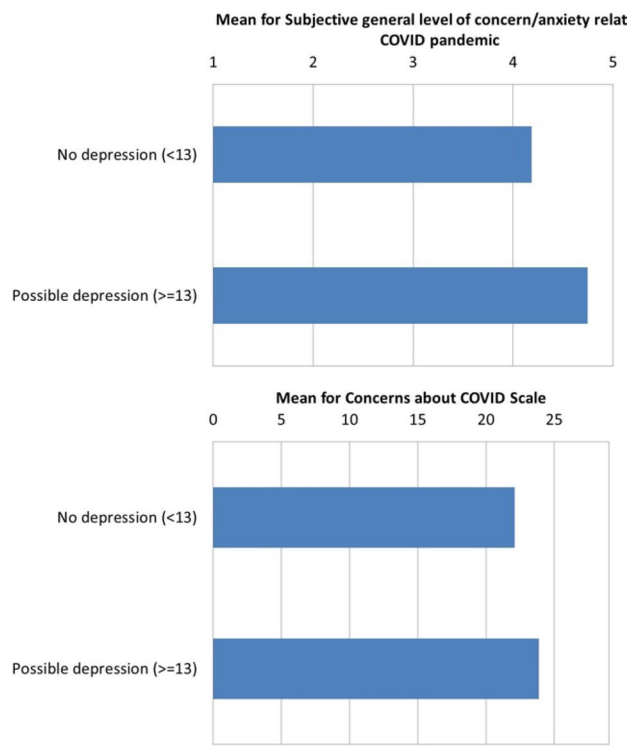

Fig. 2 Top: subjective level of concern/anxiety related to COVID pandemic and Concerns about COVID Scale comparison between EPDS Scale Groups

Porto (indicated by a score of 13 + on the EPDS) (Gorman et al., 2004). Despite the differences of the methodological approach to access clinical significant depressive symptoms, our results seem to contrast with previous national studies performed in normal circumstances in Portugal (before the pandemic).

Our results also contrast with previous international studies performed in normal circumstances, that reported lower prevalence rates of depression during pregnancy (Howard et al., 2014). In fact, studies performed predominantly in high-income countries estimated a point prevalence of major depressive disorders between 3.1 and 4.9% during pregnancy (Howard et al., 2014).

Some studies investigating maternal mental health during COVID-19 pandemic have recently been published. Although research is still limited, so far the findings appear to consistently report a negative impact of COVID-19 on perinatal mental health.

A study carried out in China found a significant increase in the prevalence of depressive symptoms among pregnant women after the official announcement of the COVID-19 outbreak by the Chinese government (Wu et al., 2020). In Canada, 37% of the pregnant women participating in an online survey reported clinically relevant symptoms of depression (using the EPDS scale and the same cut-off

value) (Lebel et al., 2020). A Turkish study on pregnant women during COVID-19 pandemic refers to 35% of participants presenting symptoms of depression at a clinical level (Durankuş & Aksu, 2020).

In our study, the regression analysis revealed that the possibility of depression in pregnant women increased as the concerns about COVID also increased. It also revealed that the possibility of depression was lower for women with support compared to women without support, and for women in 2nd trimester of pregnancy compared to women in 3rd trimester of pregnancy. It revealed that clinically significant depressive symptoms were higher for women with psychiatric medical history in the past or at the moment, compared to women without psychiatric medical history.

The association of possible depression with the advancement of pregnancy is in line with previous literature reports (Biaggi et al., 2016). During the final stage of pregnancy, women usually experience concerns regarding child birth and tend to feel much more secure and calm when it is possible to have a supportive companion present during labour (Ip, 2000). Since this was initially not allowed by the health authorities, the circumstances might have contributed to our findings.

The sudden appearance of a pandemic, without clear information about the virus and it's possible consequences to

Table 4 Parameter estimates to predict EPDS categories from baseline and treatment characteristics

	OR	(95% CI)	p
Age	0.988	(0.955, 1.022)	0.476
Education level			0.350
High school	0.954	(0.692, 1.316)	0.776
Elementary school or less	1.553	(0.812, 2.967)	0.183
Household			0.631
Husband/partner and children	1.191	(0.707, 2.006)	0.512
Children	1.690	(0.448, 6.371)	0.438
Living alone	0.904	(0.257, 3.179)	0.875
Other family compositions	1.395	(0.900, 2.163)	0.136
Occupation			0.681
Student	0.548	(0.137, 2.191)	0.395
Domestic	0.832	(0.342, 2.022)	0.685
Unemployed	1.185	(0.748, 1.879)	0.470
Support (yes)	0.298	(0.230, 0.385)	*** 0.000
Pregnancy complications (yes)	1.151	(0.886, 1.494)	0.293
Trimester of pregnancy			0.126
2nd	0.753	(0.572, 0.991)	* 0.043
1st	0.961	(0.582, 1.585)	0.875
Current pregnancy			0.789
2nd	0.986	(0.607, 1.600)	0.954
3rd or more	1.149	(0.622, 2.123)	0.657
Psychiatric medical history			0.000
Yes, in the past	2.633	(1.964, 3.531)	*** 0.000
Yes, at the moment	3.904	(2.408, 6.330)	*** 0.000
No, but feel needed	6.240	(4.396, 8.859)	*** 0.000
Concerns about COVID Scale	1.255	(1.175, 1.342)	*** 0.000
Constant	.002		0.000

OR odds, *CI* confidence interval, *LB* lower bound, *UB* upper bound

*p < 0.05, *** p < 0.001

the mother and fetus, can have contributed to unprecedented stress in mothers. Moreover, the absence of targeted therapies, as well as the disclosure of a lot of misinformation, can have increased concerns that negatively affected pregnant women mental health.

Although the protective measures defined by national health authorities were designed to safeguard mothers and babies from the COVID-19 disease, they may have led to a negative impact on the mental health of this population. In fact, previous studies established associations between worry, trauma and mental health issues during pregnancy (Charlson et al., 2019).

These findings suggest it is essential to regularly screen for depressive symptoms at appointments during pregnancy surveillance, particularly at this current moment we are living. It is importantly to remember that the scale is not a diagnostic instrument and that clinical judgement should always take precedence over any score obtained. However, women

with global scores over 13 are considered at risk for depression and should be referred to psychiatric services in order to be assessed. It is also fundamental to have a fast response from mental health services to begin the assessment and follow up this population.

Other aspects related to the pandemic lockdown such as social distancing and lack of family support, may also have contributed to the escalation of psychiatric symptoms. In fact, the lack of support was one of the variables associated with increased clinically relevant depressive symptoms.

During the pandemic, this vulnerable population might have had even less access to mental health services, limiting early detection and intervention of depressive disorders.

If left untreated, depression during pregnancy tends to persist during post partum (Cêpeda et al., 2005), affecting not only the woman, but also her child. Antenatal depression is associated with multiple complications, such as premature birth (Alder et al., 2007), low birth weight, foetal growth restriction (Ciesielski et al., 2015), and postnatal complications (Becker et al., 2016). Post-partum depression is associated with reduced attachment, reduced parent–child bonding, and delays in offsprings' cognitive and emotional development of the child (Bonari et al., 2004; Bosquet & Egeland, 2001; Weinberg & Tronick, 1998).

Strengths of this study are the large sample size, the use of a validated and widely well-known scale to access symptoms of depression and the gathering of multiple information on maternal and pregnancy surveillance characteristics. Another strength is the recognition of some of the characteristics of the population probably "at risk", allowing us to define a more targeted approach to early detection and intervention.

A limitation of this study is that it was delivered online and only available to those who had access to internet and were on social media or other platform associated to healthcare centers. The authors do not know the response rate of those who had access to the questionnaire or the profile of those who did not complete the questionnaire. Information about the pregnant women experience in terms of deaths in the family or deaths of friends with Covid was not collected, being this another limitation of the study. Another limitation may be the fact that it was limited in time and the majority of the participants were from Lisbon and Tagus Valley area, limiting the generalization of our findings. Finally, response bias may exist if the nonrespondents were either too depressed or anxious to respond or not at all interested in this survey due to the lack of symptomatology. These factors should be taken in consideration by future studies.

Our findings suggest that COVID-19 represents a serious challenge for pregnant women, particularly in terms of impact in mental health. Despite few studies having been performed, we can say that all of them are consistent in the findings: rates of depression were substantially higher than

the findings from previous community pregnancy cohorts presenting similar demographic characteristics (Bina et al., 2020).

These findings reinforce the urgent need for early detection and intervention, in order to reduce psychological distress during pregnancy during these times of uncertainty. They also emphasise the need of more extensive antenatal screening in this population, and the importance of implementing additional mental health resources in the community and of rapid referral to specialized units (when indicated).

Data Availability All data are transparent and available for consultation.

Code Availability Not applicable.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Consent to Participate All participants agreed to take part on the study, completing an informed consent.

Consent for Publication Not applicable.

Ethical Approval This study followed the ethical principles for medical research involving human subjects and was aligned by recommendations of the Declaration of Helsinki. It was submitted and approved by the IRB of the Hospital Dona Estefânia, CHULC, were the investigators work.

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