



The influence of lifestyles to cope with stress over mental health in pregnant and postpartum women during the COVID-19 pandemic

Diego Gómez-Baya¹ · Irene Gómez-Gómez²  · Sara Domínguez-Salas² · Carmen Rodríguez-Domínguez² · Emma Motrico²

Accepted: 28 May 2022 / Published online: 15 June 2022

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Abstract

The COVID-19 pandemic affected daily life routines and lifestyles of pregnant and postpartum women and increased their stress and risk of suffering from mental health problems. The aim of this study was to analyse which sociodemographic variables, COVID-19 exposure variables and lifestyles to cope with stress variables predicted anxiety, depression, and PTSD symptoms in pregnant and postpartum women during the COVID-19 pandemic. A cross-sectional design was performed with a sample of 3356 Spanish women participating in the Riseup-PPD-COVID-19 study. These participants completed an online survey composed of measures of anxiety (GAD-7), depression (EPDS), and PTSD related to COVID-19 (Checklist DSM-5), as well as demographics, exposure to COVID-19, and lifestyles to cope with stress. Regarding results, 47.2% showed depression and a third reported anxiety, whereas moderate scores were observed in PTSD symptoms. The most commonly used strategies to cope with stress in the COVID-19 pandemic were talking with friends and family and increasing time with social networks. Better results in mental health were associated with coping strategies such as talking with family and friends or participating in family activities, physical activity, sleeping well at night, eating healthier, and increasing personal care. Furthermore, poor results in mental health were observed in those participants who increased time with screens, ate fast food, reported substance use, and talked more frequently with health professionals. More symptoms were also observed in younger women, primiparous women, and those who reported more exposure to COVID-19. The results underline the need to strengthen the mental health of pregnant and postpartum women. **Trial registration:** ClinicalTrials.gov Identifier: NCT04595123.

Keywords Mental health · Covid-19 pandemic · Pregnant and postpartum women · Lifestyles · Coping strategies

Introduction

According to the World Health Organization (WHO), coronavirus disease 19 (COVID-19) is an infectious disease that mainly affects the respiratory tract and is caused by a newly discovered coronavirus (World Health Organization, 2021). Evidence suggests that pregnant women are not more likely to be infected with COVID-19 than the general population

(Prabhu et al., 2020; Smith V. et al., 2020). The most common physical clinical symptoms of pregnant and postpartum women are fever and cough (Allotey et al., 2020). However, COVID-19 and lockdowns have a great impact not only on the physical health and lifestyles of pregnant and postpartum women (Khan et al., 2020; Prabhu et al., 2020; Whitaker et al., 2021) but also on their mental health (López-Morales et al., 2021; Molgora & Accordini, 2020; Saccone et al., 2020; Yan et al., 2020).

The pre-pandemic prevalence of depression, anxiety and posttraumatic stress disorder (PTSD) during the perinatal period was 17% (Shorey et al., 2018), 10–20% (Dennis et al., 2017; Fisher et al., 2012) and 3.3%–4.0% (Yildiz et al., 2017), respectively. Combined with stress, it has been estimated that approximately 21% of women in the prenatal period and 27% of women in the postnatal period experience

✉ Irene Gómez-Gómez
igomezg@uloyola.es

✉ Emma Motrico
emotrico@uloyola.es

¹ Department of Social, Developmental and Educational Psychology, Universidad de Huelva, Huelva, Spain

² Department of Psychology, Universidad Loyola Andalucía, Dos Hermanas, Seville, Spain

psychological distress (Obrochta et al., 2020). Recent studies have highlighted an increase in the prevalence of symptoms of stress, depression and anxiety among pregnant or postpartum women during the COVID-19 pandemic (López-Morales et al., 2021; Perzow et al., 2021; Saccone et al., 2020). A systematic review and meta-analysis reported that the prevalence of depression, anxiety, psychological distress, and insomnia among pregnant women during COVID-19 was approximately 37% (Yan et al., 2020). Additionally, other studies found that 36%–37%, 23%–57% and 10.3% of women in the perinatal period reported clinically relevant symptoms of depression, anxiety and PTSD, respectively, during the COVID-19 pandemic (Liu et al., 2021; Saccone et al., 2020).

The COVID-19 pandemic has also had an important impact on daily life routines (Lambelet et al., 2021) and lifestyles in pregnant and postpartum women (Biviá-Roig et al., 2020; Zhang & Ma, 2020). Pregnant and postpartum women reported that the COVID-19 pandemic affected their personal habits in their work and relations with health care services and affected their pregnancy experience or breastfeeding experience (Lambelet et al., 2021). Regarding lifestyle, during the COVID-19 pandemic, between 17 and 28% of pregnant women reported adverse changes in physical activity, diet, and sleep duration (Whitaker et al., 2021). Conversely, other studies found an increase in time used to rest or relax during the early stages of the COVID-19 pandemic (Zhang & Ma, 2020). All these daily life changes have been able to contribute to the important impact that the COVID-19 pandemic has on stress and other mental health problems in women in the perinatal period (Liu et al., 2021; Saccone et al., 2020; Suárez-Rico et al., 2021).

Strategies to cope with stress can influence the nature and impact of psychological responses in stressful events (McPherson, 2003). Adopting healthier lifestyle behaviours, such as eating healthier, sleeping well, talking with friends or relatives and spending less time in front of screens to name few, might be a good strategy to cope with stress and to reduce the mental health impact of stressful events such as the COVID-19 pandemic. Recent studies have found that dysfunctional strategies to cope with stress during the COVID-19 pandemic were linked to elevated perinatal mental health problems (Khoury et al., 2021). Conversely, functional strategies to cope with stress, such as social support and practicing regular physical activity, appear to be protective factors to ameliorate the effects of the COVID-19 pandemic on maternal mental health (Ahmad & Vismara, 2021). However, evidence is scarce, and studies exploring the effect of coping strategies on mental health have studied it in a generic way (Khoury et al., 2021) or as a secondary outcome (Ahmad & Vismara, 2021). Therefore, the aim of the study is twofold: (1) to examine differences in clinical anxiety (referred to in the text as anxiety), clinical

depression (referred to in the text as depression) and PTSD symptoms based on the adoption of different lifestyles to cope with stress during the COVID-19 pandemic and (2) to explore which sociodemographic variables, COVID-19 exposure variables and lifestyles to cope with stress variables predicted anxiety, depression and PTSD symptoms in pregnant and postpartum women during the COVID-19 pandemic.

Methods

Study design

This was a secondary analysis of the Riseup-PPD-COVID-19 study. The Riseup-PPD-COVID-19 study consists of an international cohort study that has been developed in 11 European countries (Albania, Bulgaria, Cyprus, France, Greece, Israel, Malta, Portugal, Spain, Turkey, and the United Kingdom) and in Argentina, Brazil and Chile to explore changes in perinatal mental health outcomes during the COVID-19 pandemic (Motrico et al., 2021). This secondary data analysis study used the baseline data from the Spanish subsample. Thus, a cross-sectional design was used.

Participants

The sample consisted of 3356 Spanish women during the perinatal period (1402 pregnant women and 1954 postpartum women), with an average age of 33.67 (4.25). More than half of the participants (62.1%) were primiparous, and approximately 15.4% reported symptoms or confirmed COVID-19 diagnosis. Participants were selected based on the following inclusion criteria: (1) being pregnant or a biological mother of a child six months of age or younger; (2) aged 18 years old or older; (3) living in Spain; and (4) giving informed consent to participate in the study. The exclusion criteria were as follows: (1) not being currently pregnant or not being the biological mother of a child six months; (2) being younger than 18 years old; (3) not living in Spain; and (4) not giving informed consent to participate in the study.

Measures

Anxiety The General Anxiety Disorder-7 questionnaire (GAD-7) was used to evaluate self-reported anxiety symptoms (García-Campayo et al., 2010; Spitzer et al., 2006). The GAD-7 was created according to the diagnostic criteria for general anxiety disorder proposed by the DSM-IV. This questionnaire contains 7 items with 4 response categories ranging from “not at all” to 3 “nearly every day”, ranging the total score from 0 to 21. A cut-off point of ≥ 10 was used for the clinical significance of anxiety in each participant

(Spitzer et al., 2006). The GAD-7 has shown good psychometric properties in the Spanish population and in the perinatal period (García-Campayo et al., 2010; Simpson et al., 2014; Spitzer et al., 2006). Cronbach's α coefficient was 0.917 for the entire sample and 0.919 and 0.915 for pregnant and postpartum women, respectively.

Depression The Edinburgh Postnatal Depression Scale (EPDS) was used to evaluate self-reported depression during the perinatal period (Cox et al., 1987). The EPDS is the most widely used depression screening tool in perinatal care (Hewitt et al., 2010). The EPDS consists of a 10-item scale with 4 response categories ranging from 0 “not at all” to 3 “yes, very often”. Thus, the total score ranged from 0 to 21. A cut-off point of ≥ 10 was used for the clinical significance of depression in each participant (Garcia-Esteve et al., 2003). It has shown good psychometric properties in the Spanish population (Garcia-Esteve et al., 2003). Cronbach's α was 0.883 for our entire sample and 0.890 and 0.878 for pregnant and postpartum women, respectively.

Posttraumatic stress disorder symptoms A subset of 10 items from the post-traumatic stress disorder (PTSD) checklist for DSM-5 (PCL-5) was administered to assess symptoms of PTSD related with the COVID-19 pandemic. The items were included in the Coronavirus Perinatal Experiences—Impact Survey (COPE-IS) (Thomason et al., 2022). The COPE-IS is a global measure created to assess experiences of pregnant and postpartum women in the COVID-19 pandemic (Thomason et al., 2022). This questionnaire asks participants “in the past seven days, how often were you distressed by” feelings or experiences such as “feeling jumpy or easily startled” or “Repeated disturbing and unwanted thoughts about the COVID-19 outbreak”. The subset of items was chosen to avoid redundancy with other items in the survey and represent each DSM-5 criterion for PTSD covered in the original PCL-5, based on a Likert-like scale of 0–4 through which 0 = not at all to 4 = extremely, so that a higher score indicates higher levels of PTSD symptoms. The total PTSD score was calculated by adding the 10 items, and the internal consistency was notable (Cronbach's $\alpha = 0.88$).

COVID-19 coping strategies A total of 24 coping strategies of the modified version of Coronavirus Perinatal Experiences—Impact Survey (COPE-IS) (Thomason et al., 2022) was assessed to investigate how participants coped with the stress related to the COVID-19 pandemic. As the COPE-IS was developed in response to the recent COVID-19 outbreak, psychometric information is not yet available (Thomason et al., 2022). However, it has been used in previous studies (Kinser et al., 2021; Lega et al., 2022; Saleh et al., 2022). The main question asked to the participants

was *What are you doing to cope with your stress related to the COVID-19 outbreak?* See this list of COVID-19 coping strategies in Table 1.

Procedure

Participants were recruited through an intentional sampling method using different strategies, such as social media advertising, networks of organizations and local organizations. Participants were asked to enter the project web page and then were redirected to the Spanish online questionnaire. Before participating in the study, participants were asked to read an electronic consent form with detailed information about the study, potential risks and benefits, and ethical aspects of the study. Additionally, participants were screened to check if they fulfilled the inclusion criteria of the study. Participants fulfilling the inclusion criteria and signing the electronic informed consent form participated in a 20-min online questionnaire. More detailed information about the procedure can be found in the protocol study (reference_blind_for_review).

Data analysis design

First, descriptive statistics were examined. Frequency and percentage distribution were described for categorical variables, while mean and standard deviation were presented for age and depression and anxious symptoms. Differences between pregnant and postpartum women were analysed by conducting t-tests and χ^2 tests. A cut-off point of ≥ 10 was used to determine the clinical significance of depression or anxiety in each participant (Garcia-Esteve et al., 2003; Spitzer et al., 2006). Second, bivariate associations were conducted between demographics (age and obstetric history), COVID-19 exposure (contact with someone diagnosed with COVID-19, symptoms and/or confirmed COVID-19, and death of a close person due to COVID-19), lifestyles to cope with the COVID-19 pandemic stress and depression and anxiety. These bivariate associations were performed using χ^2 tests separately for pregnant and postpartum women. T-tests were performed to examine the associations with PTSD symptoms in both subsamples. Cramer's V and Cohen's d were respectively reported for effect sizes.

Third, multivariate analyses were separately performed for pregnant and postpartum women based on previous results. Logistic regression analyses were conducted with depression/anxiety as dependent variables (yes/no), including as predictors the lifestyles with significant differences in the previous analyses, and controlling for the effects by demographics, obstetric history and COVID-19 exposure variables. The omnibus test and Hosmer and Lemeshow test were presented to examine the model fit. Nagelkerke R-squared was calculated to describe the percentage of

Table 1 Main characteristics of the participants

	All participants (N = 3356) N (%)	Pregnant women (N = 1402) N (%)	Postpartum women (N = 1954) N (%)	Test of differences χ^2 / t
Demographic				
Age [mean (sd)]	33.67 (4.25)	33.43 (4.18)	33.84 (4.29)	-2.67*
Primigravida/primiparous				7.59*
No	1273 (37.9)	570 (40.7)	703 (36)	
Yes	2083 (62.1)	832 (59.3)	1251 (64.0)	
COVID-19 exposures and symptoms				
Contact with someone diagnosed with COVID-19				2.03
No	2489 (74.2)	1022 (72.9)	1467 (75.1)	
Yes	867 (25.8)	380 (27.1)	487 (24.9)	
Symptoms and/or confirmed COVID-19 diagnosis				2.72
No	2839 (84.6)	1169 (83.4)	1670 (85.5)	
Yes	517 (15.4)	233 (16.6)	284 (14.5)	
Death of a close person due to COVID-19				1.32
No	2988 (89.0)	1238 (88.3)	1750 (89.6)	
Yes	368 (11.0)	164 (11.7)	204 (10.4)	
Lifestyles to cope with stress during the COVID-19 pandemic				
Nothing	314 (9.4)	112 (8)	202 (10.3)	5.31*
Sleeping well at night	606 (18.1)	381 (27.2)	225 (11.5)	135.30**
Meditation/mindfulness	397 (11.8)	245 (17.5)	152 (7.8)	73.58**
Talking with friends and family	2432 (72.5)	1025 (73.1)	1407 (72)	0.50
Participating in family activities (e.g., games, sports)	349 (10.4)	140 (10)	209 (10.7)	0.44
Talking with other pregnant women or with children	1224 (36.5)	435 (31)	789 (40.4)	30.81**
Increasing time with screens (i.e., videogames, series or films)	1021 (30.4)	490 (35)	531 (27.2)	23.31**
Increasing time in social networks (facebook, instagram or others)	1598 (47.6)	672 (47.9)	926 (47.4)	0.10
Decreasing time in social networks (facebook, instagram or others)	198 (5.9)	82 (5.8)	116 (5.9)	0.01
Increasing time watching or looking for news	514 (15.3)	213 (15.2)	301 (15.4)	0.03
Decreasing time watching or looking for news	839 (25)	333 (23.8)	506 (25.9)	2.00
Eating fast food (sweets and chips)	481 (14.3)	148 (10.6)	333 (17)	27.97**
Eating healthier	737 (22)	364 (26)	373 (19.1)	22.51**
Increasing personal care (e.g. having more bath or shower, facial treatments...)	536 (16)	277 (19.8)	259 (13.3)	25.72**
Increasing time reading books or doing activities as jigsaw or puzzles	691 (20.6)	393 (28)	298 (15.3)	81.55**
Physical exercise (intense or moderate at least three times a week)	846 (25.2)	478 (34.1)	368 (18.8)	100.84**
Drinking fermented alcoholic drinks	24 (0.7)	5 (0.4)	19 (1)	4.36*
Drinking distilled alcoholic drinks	1 (0.0)	1 (0.1)	0 (0.0)	1.39
Smoking or vaping	79 (2.4)	28 (2)	51 (2.6)	1.33
Taking sleeping pills without medical prescription	9 (0.3)	1 (0.1)	8 (0.4)	3.49
Talking with health professionals more frequently	118 (3.5)	56 (4)	62 (3.2)	1.62
Talking with mental health professional	212 (6.3)	102 (7.3)	110 (5.6)	3.74
Helping others	238 (7.1)	95 (6.8)	143 (7.3)	0.36
Other	197 (5.9)	94 (6.7)	103 (5.3)	3.04
Perinatal mental health				
GAD-7 scores [mean (sd)]	7.53 (5.36)	7.43 (5.33)	7.61 (5.39)	-0.99
GAD-7 ≥ 10	1107 (33.3)	458 (32.7)	659 (33.7)	0.41

Table 1 (continued)

	All participants (N = 3356)	Pregnant women (N = 1402)	Postpartum women (N = 1954)	Test of differences
	N (%)	N (%)	N (%)	χ^2 / t
EPDS scores [mean (sd)]	9.30 (5.76)	9.02 (6.86)	9.50 (5.69)	-2.36*
EPDS \geq 10	1585 (47.2)	628 (44.8)	957 (49.0)	5.73*
PTSD [mean (sd)]	9.98 (7.53)	9.82 (7.47)	10.09 (7.57)	-1.04

p*-value < .05; *p*-value < .001

explained variance by the predictors included in the equation, while the percentage of correctly classified cases was presented to provide information about sensitivity/specificity. To describe the effects of each variable in the model, β , standard errors, Wald test, *p*, odds ratios and 95% CI intervals for odds ratios are shown. Furthermore, hierarchical linear regression analyses were conducted to explain PTSD symptoms based on demographics, obstetric history, COVID-19 exposure and lifestyle variables. F- and R-squared were reported for each analysis for pregnant and postpartum women, and beta and t-scores were described for all the indicators introduced in the model. These analyses were conducted with the statistical package SPSS 21.0.

Results

Descriptive statistics

The sample consisted of 3356 Spanish women during the perinatal period (1402 pregnant women and 1954 postpartum women). Table 1 presents the descriptive statistics of the study variables (i.e., demographics, obstetric history, COVID-19 exposure, lifestyles to cope with stress, and depression and anxiety, as mental health results) and the test of differences between pregnant and postpartum women. The mean age was approximately 33 years old, reporting more age postpartum women. Most of the sample (62.1%) was primigravida or primiparous, with a higher percentage in postpartum women. Concerning COVID-19 exposure, 25.8% indicated contact with someone diagnosed, 15.4% reported symptoms or confirmed diagnosis, and 11% reported the death of a close person.

The most frequent lifestyles to cope with stress during the pandemic were talking with friends and family, increasing time with social networks, talking with other pregnant women or with children, and increasing time with screens. Only 25.2% reported physical exercise, intense or moderate at least three times a week, 22% indicated eating healthier, and 18.1% indicated sleeping well at night to cope with stress. A total of 11.8% of the sample practised meditation or mindfulness, 16% increased personal care and 20.6%

increased time reading books or doing activities such as jigsaw puzzles. Regarding substance abuse, 0.7% reported using fermented alcoholic drinks, and 2.4% reported using smoking or vaping. With regard to counselling, 3.5% of the sample indicated that they talked with health professionals more frequently, and 6.3% talked with mental health professionals. Some differences were observed in lifestyles to cope with stress between pregnant and postpartum women. Pregnant women showed a higher percentage of sleeping well at night, meditation/mindfulness, increasing time with screens, eating healthier, increasing personal care, increasing time reading books or doing activities as jigsaw puzzles, and practising physical exercise. Furthermore, postpartum women showed a higher percentage of doing nothing, talking with other pregnant women or with children, eating fast food and drinking fermented alcoholic drinks. Finally, a mean score of 9.30 was observed for depressive symptoms, while 7.53 and 9.98 were observed for anxiety and PTSD symptoms, respectively. Up to 47.2% of the sample showed depression, and a third reported anxiety. More depressive symptoms and more depression were detected in postpartum women. However, no significant differences were observed in PTSD symptoms.

Depression, anxiety and PTSD symptoms by lifestyles

Concerning the first aim, some analyses were performed to examine the differences in anxiety, depression and PTSD based on the adoption of different lifestyles to cope with stress, in pregnant and postpartum women during the COVID-19 pandemic. Table 2 shows the associations of demographics, COVID-19 exposure variables and lifestyles to cope with stress with anxiety and depression in the sample of pregnant women. More anxiety was observed in younger and primiparous pregnant women, those showing COVID-19 symptoms or diagnosis, and those with the following pattern of lifestyle to cope with stress: not sleeping well at night, more talking with mental health professional, eating fast food, less physical exercise, less increase in personal care, increasing time with screens and social networks, less eating healthier, increasing time watching or looking for news, less

Table 2 Association between lifestyles and perinatal mental health in pregnant women during the COVID-19 pandemic

	Anxiety (GAD-7 ≥ 10)			Depression (EPDS ≥ 10)			χ^2/t	<i>p</i>	Effect size	
	No (N = 944)	Yes (N = 458)	Effect size	No (N = 774)	Yes (N = 628)	Effect size				
Demographic										
Age [mean (sd)]	33.69 (3.95)	32.90 (4.59)	3.09	.002	.189	33.59 (3.97)	33.24 (4.43)	1.53	.127	.084
Primiparous										
No	365 (38.7)	205 (44.8)	4.75	.029	.058	297 (38.4)	273 (43.5)	3.74	.053	.053
Yes	579 (61.3)	253 (55.2)				477 (61.6)	355 (56.5)			
COVID-19 exposures and symptoms										
Contact with someone diagnosed with COVID-19										
No	687 (67.2)	335 (32.8)	0.02	.884	.004	568 (55.6)	454 (44.4)	.21	.647	.012
Yes	257 (67.6)	123 (32.4)				206 (54.2)	174 (45.8)			
Symptoms and/or confirmed COVID-19 diagnosis										
No	804 (68.8)	365 (31.2)	6.67	.010	.069	654 (55.9)	515 (44.1)	1.55	.213	.033
Yes	140 (60.1)	93 (39.9)				120 (51.5)	113 (48.5)			
Death of a close person due to COVID-19										
No	842 (68)	396 (32)	2.23	.135	.040	693 (56)	545 (44)	2.54	.111	.043
Yes	102 (62.2)	62 (37.8)				81 (49.4)	83 (50.6)			
Lifestyles to cope with stress during the COVID-19 pandemic										
Nothing	85 (9)	27 (5.9)	4.06	.044	.054	70 (9)	42 (6.7)	2.62	.106	.043
Sleeping well at night	308 (32.6)	73 (15.9)	43.40	<.001	.176	266 (34.4)	115 (18.3)	45.16	<.001	.179
Meditation/mindfulness	153 (16.2)	92 (20.1)	3.22	.073	.048	132 (17.1)	113 (18)	0.21	.645	.012
Talking with friends and family	702 (74.4)	323 (70.5)	2.31	.128	.041	586 (75.7)	439 (69.9)	5.95	.015	.065
Participating in family activities (e.g., games, sports)	95 (10.1)	45 (9.8)	0.02	.889	.004	89 (11.5)	51 (8.1)	4.40	.036	.056
Talking with other pregnant women or with children	278 (29.4)	157 (34.3)	3.36	.067	.049	237 (30.6)	198 (31.5)	.013	.715	.010
Increasing time with screens (i.e., videogames, series or films)	301 (31.9)	189 (41.3)	11.94	.001	.092	231 (29.8)	259 (41.2)	19.81	<.001	.119
Increasing time in social networks (Facebook, Instagram or others)	423 (44.8)	249 (54.4)	11.29	.001	.090	329 (42.5)	343 (54.6)	20.38	<.001	.121
Decreasing time in social networks (Facebook, Instagram or others)	48 (5.1)	34 (7.4)	3.06	.080	.047	43 (5.6)	39 (6.2)	0.27	.603	.014
Increasing time watching or looking for news	125 (13.2)	88 (19.2)	8.54	.003	.078	94 (12.1)	119 (18.9)	12.46	<.001	.094
Decreasing time watching or looking for news	227 (24)	106 (23.1)	0.14	.710	.010	185 (23.9)	148 (23.6)	0.02	.883	.004
Eating fast food (sweets and chips)	77 (8.2)	71 (15.5)	17.62	<.001	.112	52 (6.7)	96 (15.3)	26.96	<.001	.139
Eating healthier	269 (28.5)	95 (20.7)	9.64	.002	.083	235 (30.4)	129 (20.5)	17.39	<.001	.111
Increasing personal care (e.g. having more bath or shower, facial treatments...)	214 (22.7)	63 (13.8)	15.46	<.001	.105	177 (22.9)	100 (15.9)	10.55	.001	.087
Increasing time reading books or doing activities as jigsaw or puzzles	279 (29.6)	114 (24.9)	3.33	.068	.049	221 (28.6)	172 (27.4)	0.23	.629	.013
Physical exercise (intense or moderate at least three times a week)	356 (37.7)	122 (26.6)	16.83	<.001	.110	297 (38.4)	181 (28.8)	14.07	<.001	.100
Drinking fermented alcoholic drinks	4 (0.4)	1 (0.2)	0.37	.545	.016	2 (0.3)	3 (0.5)	0.47	.493	.018
Drinking distilled alcoholic drinks	1 (0.1)	0 (0)	0.49	.486	.019	1 (0.1)	0 (0)	0.81	.368	.024

Table 2 (continued)

	Anxiety (GAD-7 ≥ 10)			Depression (EPDS ≥ 10)			Effect size
	No (N = 944)	Yes (N = 458)	χ^2/t p	No (N = 774)	Yes (N = 628)	χ^2/t p	
Smoking or vaping	14 (1.5)	14 (3.1)	3.90 .048	9 (1.2)	19 (3)	6.15 .013	.066
Taking sleeping pills without medical prescription	0 (0)	1 (0.2)	2.06 .151	0 (0)	1 (0.2)	1.23 .267	.030
Talking with health professionals more frequently	31 (3.3)	25 (5.5)	3.80 .051	26 (3.4)	30 (4.8)	1.82 .178	.036
Talking with mental health professional	47 (5)	55 (12)	22.59 <.001	36 (4.7)	66 (10.5)	17.64 <.001	.112
Helping others	63 (6.7)	32 (7)	0.048 .827	53 (6.8)	42 (6.7)	0.01 .906	.003
Other	67 (7.1)	27 (5.9)	0.713 .399	54 (7)	40 (6.4)	0.20 .651	.012

Frequencies and percentages are described in the table

doing nothing, and more smoking or vaping. Furthermore, more depression was found in pregnant women who had the following lifestyle patterns during the pandemic: not sleeping well, more talking with mental health professionals, more time in social networks, screens and watching or looking for news, eating fast food, less eating healthier, less personal care and less physical exercise, more smoking or vaping, less talking with friends and family and less participation in family activities.

Table 3 presents the results of the associations between demographics, obstetric history, COVID exposure and lifestyles, and PTSD symptoms in the sample of pregnant women. More PTSD symptoms were observed in younger pregnant women, those with COVID symptoms/diagnosis and those who suffered the death of a close person. Concerning lifestyles, fewer PTSD symptoms were detected in pregnant women who slept well at night, did nothing, participated in family activities, practised physical exercise, increased personal care and ate healthier. However, more symptoms were found in those who increased their time with screens, in social networks of watching news, ate fast food, smoked, meditated, and talked with health and mental health professionals more frequently.

Table 4 describes the interrelations of demographics, COVID-19 exposure variables and lifestyles to cope with stress with anxiety and depression in the sample of postpartum women. More anxiety in postpartum women was detected in younger participants and those who suffered the death of a close person due to COVID-19. More anxiety in postpartum women was related to eating fast food, less sleeping well at night, increasing time watching or looking for news, talking with mental health professional and health professionals more frequently, more smoking or vaping, increasing time in social networks, taking sleeping pills, less physical exercise, more drinking fermented alcoholic drinks, and less time reading books or doing activities as jigsaw puzzles. Furthermore, more depression in postpartum women was related to suffering the death of a close person and the following lifestyle to cope with stress: less sleeping well at night, more talking with mental health professional and with health professionals more frequently, increasing time watching/looking for news, with screens and in social networks, eating fast food and less eating healthier, more smoking or vaping, less physical exercise, more use of sleeping pills, and less time for reading books or doing activities as jigsaw puzzles.

Table 5 shows the associations with PTSD symptoms in the sample of postpartum women. The results indicated more PTSD symptoms in younger and not primiparous women and those who suffered the death of a close person due to COVID. With regard to lifestyles, fewer PTSD symptoms were detected in postpartum women who slept

Table 3 Associations between lifestyles and PTSD symptoms in pregnant women during the COVID-19 pandemic

	Response in demographic, COVID-19 and lifestyles variable		<i>r/t</i>	<i>p</i>	Effect size
	No	Yes			
	M(SD)*	M(SD)*			
Demographic					
Age			-0.10	<.001	.10
Primiparous	10.27(7.39)	9.51(7.52)	1.87	.062	.10
COVID-19 exposures and symptoms					
Contact with someone diagnosed with COVID-19	9.78(7.41)	9.91(7.63)	-0.28	.781	.02
Symptoms and/or confirmed COVID-19 diagnosis	9.59(7.33)	10.94(8.07)	-2.52	.012	.18
Death of a close person due to COVID-19	9.65(7.42)	11.07(7.71)	-2.30	.022	.19
Lifestyles to cope with stress during the COVID-19 pandemic					
Nothing	10.04(7.44)	7.24(7.37)	3.82	<.001	.38
Sleeping well at night	10.71(7.77)	7.42(5.99)	7.48	<.001	.47
Meditation/mindfulness	9.60(7.47)	10.82(7.41)	-2.32	.021	.16
Talking with friends and family	10.48(8.32)	9.57(7.12)	1.87	.062	.12
Participating in family activities (e.g., games, sports)	9.97(7.50)	8.47(7.04)	2.25	.023	.21
Talking with other pregnant women or with children	9.59(7.62)	10.31(7.12)	-1.66	.097	.10
Increasing time with screens (i.e., videogames, series or films)	9.12(7.19)	11.11(7.81)	-4.77	<.001	.27
Increasing time in social networks (facebook, instagram or others)	8.67(7.36)	11.04(7.40)	-5.98	<.001	.32
Decreasing time in social networks (facebook, instagram or others)	9.72(7.44)	11.38(7.78)	-1.95	.051	.22
Increasing time watching or looking for news	9.46(7.36)	11.83(7.80)	-4.30	<.001	.31
Decreasing time watching or looking for news	9.66(7.48)	10.32(7.42)	-1.42	.156	.09
Eating fast food (sweets and chips)	9.43(7.38)	13.11(7.44)	-5.73	<.001	.50
Eating healthier	10.09(7.59)	9.03(7.06)	2.43	.015	.14
Increasing personal care (e.g. having more bath or shower, facial treatments...)	10.11(7.61)	8.61(6.77)	3.24	.001	.21
Increasing time reading books or doing activities as jigsaw or puzzles	9.92(7.57)	9.55(7.20)	0.83	.408	.05
Physical exercise (intense or moderate at least three times a week)	10.40(7.79)	8.69(6.67)	4.08	<.001	.24
Drinking fermented alcoholic drinks	9.81(7.47)	12.00(7.38)	-0.66	.513	.29
Drinking distilled alcoholic drinks	9.82(7.47)	2(0)	1.05	.295	
Smoking or vaping	9.73(7.43)	14.18(8.18)	-3.13	.002	.57
Taking sleeping pills without medical prescription	9.81(7.47)	21(0)	-1.50	.134	
Talking with health professionals more frequently	9.69(7.43)	12.88(7.86)	-3.14	.002	.42
Talking with mental health professional	9.48(7.33)	14.10(7.94)	-6.10	<.001	.60
Helping others	9.80(7.49)	10(7.25)	-0.25	.804	.03
Other	9.83(7.49)	9.62(7.20)	0.27	.789	.03

*Means and standard deviations in PTSD symptoms are presented, comparing the results by the response (No/Yes) in each independent variable (i.e., demographics, COVID-19 exposure and symptoms, and lifestyles to cope with stress during the COVID-19 pandemic). PTSD symptoms (dependent variable) were analyzed as a continuous variable

well at night, participated in family activities, did nothing, ate healthier, increased time reading books or playing educational games, and practised physical exercise. Furthermore, more PTSD symptoms were detected in postpartum women who increased time with screens, social networks and watching news, ate fast food, smoked and talked more frequently with health and mental health professionals.

Logistic and hierarchical linear regression analyses

Regarding the second aim, some analyses were carried out to explore which sociodemographic variables, COVID-19 exposure variables and lifestyles to cope with stress variables predicted anxiety, depression and PTSD symptoms in pregnant and postpartum women during the COVID-19 pandemic. Table 6 describes the

Table 4 Association between lifestyles and perinatal mental health in postpartum women during the COVID-19 pandemic

	Anxiety (GAD-7 ≥ 10)			Depression (EPDS ≥ 10)			χ^2/t	<i>p</i>	Effect size	
	No (<i>N</i> = 1295)	Yes (<i>N</i> = 659)	Effect size	No (<i>N</i> = 997)	Yes (<i>N</i> = 957)	Effect size				
Demographic										
Age [mean (sd)]	34.14 (4.12)	33.24 (4.55)	4.169	<.001	.211	33.99 (4.07)	33.68 (4.51)	1.595	.111	.072
Primiparous										
No	468 (36.1)	235 (35.7)	0.043	.835	.005	351 (35.2)	352 (36.8)	0.527	.468	.016
Yes	827 (63.9)	424 (64.3)				646 (64.8)	605 (63.2)			
COVID-19 exposures and symptoms										
Contact with someone diagnosed with COVID-19										
No	965 (65.8)	502 (34.2)	0.64	.423	-.018	747 (50.9)	720 (49.1)	0.025	.874	-.004
Yes	330 (67.8)	157 (32.2)				250 (51.3)	237 (48.7)			
Symptoms and/or confirmed COVID-19 diagnosis										
No	1112 (66.6)	558 (33.4)	0.50	.479	.016	864 (51.7)	806 (48.3)	2.34	.126	.035
Yes	183 (64.4)	101 (35.6)				133 (46.8)	151 (53.2)			
Death of a close person due to COVID-19										
No	1181 (67.5)	569 (32.5)	11.01	.001	.075	912 (52.1)	838 (47.9)	7.98	.005	.064
Yes	114 (55.9)	90 (44.1)				85 (41.7)	119 (58.3)			
Lifestyles to cope with stress during the COVID-19 pandemic										
Nothing	141 (10.9)	61 (9.3)	1.25	.263	.025	116 (11.6)	86 (9)	3.70	.055	.043
Sleeping well at night	180 (13.9)	45 (6.8)	21.43	<.001	.105	155 (15.5)	70 (7.3)	32.48	<.001	.129
Meditation/mindfulness	107 (8.3)	45 (6.8)	1.25	.263	.025	70 (7)	82 (8.6)	1.63	.202	.029
Talking with friends and family	948 (73.2)	459 (60.7)	2.74	.098	.037	732 (73.4)	675 (70.5)	2.02	.155	.032
Participating in family activities (e.g., games, sports)	138 (10.7)	71 (10.8)	0.01	.937	.002	116 (11.6)	93 (9.7)	1.88	.170	.031
Talking with other pregnant women or with children	521 (40.2)	268 (40.7)	0.03	.853	.004	406 (40.7)	383 (40)	0.10	.752	.007
Increasing time with screens (i.e., videogames, series or films)	335 (25.9)	196 (29.7)	3.31	.069	.041	243 (24.4)	288 (30.1)	8.08	.004	.064
Increasing time in social networks (facebook, instagram or others)	578 (44.6)	348 (52.8)	11.71	.001	.077	434 (43.5)	492 (51.4)	12.16	<.001	.079
Decreasing time in social networks (facebook, instagram or others)	69 (5.3)	47 (7.1)	2.55	.111	.036	59 (5.9)	57 (6)	.0001	.971	.001
Increasing time watching or looking for news	168 (13)	133 (20.2)	17.42	<.001	.094	124 (12.4)	177 (18.5)	13.75	<.001	.084
Decreasing time watching or looking for news	335 (25.9)	171 (25.9)	0.001	.970	.001	253 (25.4)	253 (26.4)	0.29	.593	.012
Eating fast food (sweets and chips)	173 (13.4)	160 (24.3)	36.84	<.001	.137	123 (12.3)	210 (21.9)	31.87	<.001	.128
Eating healthier	257 (19.8)	116 (17.6)	1.42	.233	.027	218 (21.9)	155 (16.2)	10.16	.001	.072
Increasing personal care (e.g. having more bath or shower, facial treatments...)	173 (13.4)	86 (13.1)	0.04	.849	.004	133 (13.3)	126 (13.2)	0.013	.910	.003
Increasing time reading books or doing activities as jigsaw or puzzles	217 (16.8)	81 (12.3)	6.74	.009	.059	168 (16.9)	130 (13.6)	4.03	.045	.045
Physical exercise (intense or moderate at least three times a week)	269 (20.8)	99 (15)	9.45	.002	.070	207 (20.8)	161 (16.8)	4.96	.026	.050
Drinking fermented alcoholic drinks	7 (0.5)	12 (1.8)	7.44	.006	.062	6 (0.6)	13 (1.4)	2.90	.088	.039
Drinking distilled alcoholic drinks	0 (0.0)	0 (0.0)				0	0			

Table 4 (continued)

	Anxiety (GAD-7 ≥ 10)			Depression (EPDS ≥ 10)			Effect size
	No (N = 1295)	Yes (N = 659)	χ^2/t	No (N = 997)	Yes (N = 957)	χ^2/t	
Smoking or vaping	22 (1.7)	29 (4.4)	12.54	14 (1.4)	37 (3.9)	11.64	.077
Taking sleeping pills without medical prescription	1 (0.1)	7 (1.1)	10.39	1 (0.1)	7 (0.7)	4.77	.049
Talking with health professionals more frequently	32 (2.5)	30 (4.6)	6.16	23 (2.3)	39 (4.1)	4.97	.050
Talking with mental health professional	51 (3.9)	59 (9)	20.67	33 (3.3)	77 (8)	20.62	<.001
Helping others	92 (7.1)	51 (7.7)	0.26	77 (7.7)	66 (6.9)	0.49	.483
Other	62 (4.8)	41 (6.2)	1.80	51 (5.1)	52 (5.4)	0.10	.753

Frequencies and percentages are described in the table

results of two logistic regression analyses controlling for demographics variables and exposure to COVID-19 to explain anxiety and depression in pregnant women based on lifestyles that showed significant bivariate associations. Concerning anxiety, the model pointed out that anxiety may be predicted by lower age, suffering symptoms or diagnosis of COVID-19, not doing nothing, not sleeping well at night, not increasing personal care or exercising and talking to mental health professionals. This model correctly classified 68.9% of the variance and explained 13%. In the case of depression, the model showed significant effects of not sleeping well at night, increasing time with screens, in social networks and watching/looking for news, eating fast food and talking with mental health professionals. This model correctly classified 61.9% and presented an R² of 0.12.

Table 7 shows the results of two logistic regression analyses to explain anxiety and depression in the sub-sample of postpartum women. Anxiety was related to lower age, the death of a close person due to COVID-19, not sleeping well at night, eating fast food, talking with mental health professional or with health professionals more frequently, increasing time watching or looking for news, smoking or vaping, and not increasing time for reading books or other educational activities. This model classified 69% of the variance and explained 9.7% of the variance in anxiety. Furthermore, depression may be explained by the death of a close person, not sleeping well at night, increasing time watching or looking for news, eating fast food, smoking or vaping, and talking with mental health professionals. This model classifies 60.8% and had an R² of 0.086.

Finally, Table 8 describes the results of the linear regression analyses of the predictors of PTSD symptoms in pregnant and postpartum women. Regarding pregnant women, the analysis revealed that PTSD was explained in 14% of cases by the variables introduced. Significant effects were found by age, being primiparous, COVID symptoms, death of a close person due to COVID, and some behaviours to cope, specifically, sleeping well at night, doing nothing, meditation, participating in family activities, time with screen and news, eating fast food, physical exercise and talking with health/mental health professional. Concerning postpartum women, variables reached 10% of the explained variance. Significant effects were detected on PTSD symptoms by age, being primiparous, death of a close person due to COVID, and behaviours such as sleeping well at night, talking with family/friends, doing nothing, fast food, time reading books or educational games, smoking and talking with health/mental health professionals.

Table 5 Association between lifestyles and PTSD symptoms in postpartum women during the COVID-19 pandemic

	Response in each predictor		<i>r/t</i>	<i>p</i>	Effect size
	No	Yes			
	M(SD)	M(SD)			
Demographic					
Age			-.07	.001	
Primiparous	10.59(7.65)	9.81(7.51)	2.18	.030	.10
COVID-19 exposures and symptoms					
Contact with someone diagnosed with COVID-19	10.12(7.70)	10.00(7.17)	.31	.758	.02
Symptoms and/or confirmed COVID-19 diagnosis	9.99(7.59)	10.67(7.45)	-1.40	.163	.09
Death of a close person due to COVID-19	9.91(7.44)	11.66(8.48)	-2.83	.005	.22
Lifestyles to cope with stress during the COVID-19 pandemic					
Nothing	10.25(7.40)	8.74(8.82)	2.34	.020	.19
Sleeping well at night	10.38(7.62)	7.88(6.82)	5.10	<.001	.35
Meditation/ mindfulness	10.01(7.57)	10.99(7.49)	-1.52	.128	.13
Talking with friends and family	10.74(8.53)	9.84(7.15)	2.18	.029	.11
Participating in family activities (e.g., games, sports)	10.14(7.55)	9.68(7.76)	.82	.413	.06
Talking with other pregnant women or with children	10.07(7.98)	10.11(6.92)	-.11	.914	.01
Increasing time with screens (i.e., videogames, series or films)	9.70(7.51)	11.13(7.63)	-3.74	<.001	.19
Increasing time in social networks (Facebook, Instagram or others)	9.33(7.35)	10.93(7.72)	-4.68	<.001	.21
Decreasing time in social networks (Facebook, Instagram or others)	10.04(7.58)	10.85(7.32)	-1.12	.263	.11
Increasing time watching or looking for news	9.83(7.49)	11.52(7.85)	-3.45	.001	.22
Decreasing time watching or looking for news	9.94(7.72)	10.51(7.11)	-1.50	.133	.08
Eating fast food (sweets and chips)	9.51(7.44)	12.89(7.56)	-7.51	<.001	.45
Eating healthier	10.34(7.70)	9.01(6.89)	3.28	.001	.18
Increasing personal care (e.g. having more bath or shower, facial treatments...)	10.15(7.67)	9.68(6.91)	.93	.354	.06
Increasing time reading books or doing activities as jigsaw or puzzles	10.28(7.65)	9.03(7.00)	2.80	.005	.17
Physical exercise (intense or moderate at least three times a week)	10.36(7.70)	8.94(6.89)	3.46	.001	.19
Drinking fermented alcoholic drinks	10.03(7.53)	16.37(9.52)	-2.89	.010	.74
Drinking distilled alcoholic drinks					
Smoking or vaping	9.98(7.53)	14.02(7.92)	-3.77	<.001	.52
Taking sleeping pills without medical prescription	10.04(7.54)	21(6.44)	-4.10	<.001	1.56
Talking with health professionals more frequently	10.01(7.56)	12.63(7.58)	-2.69	.007	.35
Talking with mental health professional	9.84(7.50)	14.20(7.66)	-5.91	<.001	.58
Helping others	10.07(7.62)	10.35(6.90)	-.43	.670	.04
Other	10.04(7.59)	10.98(7.16)	-1.23	.220	.13

Means and standard deviations in PTSD symptoms are presented

Discussion

To the best of our knowledge, our study was one of the first studies to assess the influence of lifestyles to cope with stress over depression, anxiety and PTSD symptoms during the COVID-19 pandemic and to explore which sociodemographic variables, COVID-19 exposure variables and lifestyle factors to cope with stress variables can predict anxiety, depression and PTSD symptoms in pregnant and postpartum women. The perinatal period is a period of vulnerability in which high levels of distress can appear (Woody et al., 2017). The COVID-19 pandemic has exacerbated this

vulnerability, and previous studies found significantly higher levels of stress symptoms during the COVID-19 pandemic in the perinatal period (Boekhorst et al., 2021; Stepowicz et al., 2020). In this study, the results showed that 47.2% reported depression and a third reported anxiety, whereas moderate scores were observed in PTSD symptoms.

In addition, this study has been found that the most commonly used strategies to cope with stress derived from the COVID-19 pandemic were talking with friends and family (72.5%), increasing time in social networks such as Facebook or Instagram (47.6%) and talking with other pregnant women or with children (36.5%). Few pregnant

Table 6 Logistic regression for predicting anxiety and depression in pregnant women during the COVID-19 pandemic

Predictors	Beta	S.E	Wald	df	p	OR	95% C.I. for EXP (B)		Nagelkerke R ²	Sensitivity/Specificity (Correctly classified)		
							Lower	Upper				
Anxiety (GAD-7 ≥ 10)*												
Demographics												
Age	-.05	.02	11.07	1	.001	.95	.92	.98	.130	55.8/70.6 (68.9)		
Primiparous (Ref. No)	-.22	.13	2.85	1	.091	.80	.62	1.04				
COVID-19 exposures and symptoms												
Contact with any person with confirmed infection with COVID-19 (Ref. No)	-.12	.14	.74	1	.390	.89	.67	1.17	.120	59.9/63.0 (61.9)		
Symptoms or confirmed COVID-19 diagnosis (Ref. No)	.43	.16	6.72	1	.010	1.53	1.11	2.11				
Death of a close person due to COVID-19 (Ref. No)	.28	.19	2.26	1	.133	1.33	.92	1.92				
Lifestyles to cope with stress during the COVID-19 pandemic												
Nothing	-.67	.25	7.00	1	.008	.51	.31	.84				
Sleeping well at night	-.87	.16	31.18	1	<.001	.42	.31	.57				
Increasing time with screens (i.e., videogames, series or films)	.23	.14	2.64	1	.104	1.26	.95	1.67				
Increasing time in social networks (Facebook, Instagram or others)	.05	.14	.14	1	.704	1.05	.80	1.39				
Increasing time watching or looking for news	.30	.17	3.24	1	.072	1.35	.97	1.88				
Eating fast food (sweets and chips)	.27	.20	1.79	1	.181	1.30	.88	1.93				
Eating healthier	-.04	.16	.07	1	.791	.96	.71	1.31				
Increasing personal care (e.g. having more bath or shower, facial treatments...)	-.45	.18	6.59	1	.010	.64	.45	.90				
Physical exercise (intense or moderate at least three times a week)	-.32	.14	4.88	1	.027	.73	.55	.97				
Smoking or vaping	.24	.42	.35	1	.557	1.28	.57	2.89				
Talking with mental health professional	1.00	.23	19.04	1	<.001	2.72	1.73	4.25				
Depression (EPDS ≥ 10)**												
Demographics												
Age	-.02	.01	1.35	1	.245	.98	.96	1.01	.120	59.9/63.0 (61.9)		
Primiparous (Ref. No)	-.20	.13	2.56	1	.110	.82	.64	1.05				
COVID-19 exposures and symptoms												
Contact with any person with confirmed infection with COVID-19 (Ref. No)	-.01	.13	.01	1	.990	1.00	.77	1.30	.120	59.9/63.0 (61.9)		
Symptoms or confirmed COVID-19 diagnosis (Ref. No)	.19	.16	1.45	1	.229	1.21	.89	1.65				
Death of a close person due to COVID-19 (Ref. No)	.27	.18	2.26	1	.133	1.31	.92	1.87				
Lifestyles to cope with stress during the COVID-19 pandemic												
Sleeping well at night	-.75	.14	29.29	1	<.001	.47	.36	.62	.120	59.9/63.0 (61.9)		
Talking with friends and family	-.17	.14	1.65	1	.199	.84	.65	1.10				
Participating in family activities (e.g., games, sports)	-.38	.20	3.58	1	.059	.69	.46	1.01				
Increasing time with screens (i.e., videogames, series or films)	.31	.14	5.41	1	.020	1.37	1.05	1.79				
Increasing time in social networks (Facebook, Instagram or others)	.26	.13	4.06	1	.044	1.30	1.01	1.68				

Table 6 (continued)

Predictors	Beta	S.E	Wald	df	p	OR	95% C.I. for EXP (B)		Nägelkerke R ²	Sensitivity/Specificity (Correctly classified)
							Lower	Upper		
Increasing time watching or looking for news	.34	.16	4.28	1	.039	1.40	1.02	1.93		
Eating fast food (sweets and chips)	.53	.20	7.02	1	.008	1.70	1.15	2.51		
Eating healthier	-.21	.15	2.11	1	.146	.809	.61	1.08		
Increasing personal care (e.g. having more bath or shower, facial treatments...)	-.11	.16	.47	1	.494	.897	.66	1.22		
Physical exercise (intense or moderate at least three times a week)	-.11	.13	.72	1	.397	.894	.69	1.16		
Smoking or vaping	.64	.44	2.17	1	.141	1.899	.81	4.46		
Talking with mental health professional	.82	.23	12.26	1	<.001	2.263	1.43	3.57		

* Omnibus Test ($X^2 = 133.33$; $df = 16$, $p < .001$). Hosmer and Lemeshow Test ($X^2 = 4.71$, $df = 8$, $sig = .789$)

** Omnibus Test ($X^2 = 127.90$, $df = 17$, $p < .001$). Hosmer and Lemeshow Test ($X^2 = 10.71$, $df = 8$, $p = .219$)

and postpartum women used physical activity or eating healthier to cope with stress during COVID-19. Similar results were found in previous studies that reported that more than half and approximately 40% of the women in the perinatal period used connecting with others or eating high fat or sugary foods, respectively, as a strategy to cope with stress during the COVID-19 pandemic (Barbosa-Leiker et al., 2021). Other strategies to cope with stress used by women during the COVID-19 pandemic were to obtain information from maternity staff or televised health information (Farrell et al., 2020). Few pregnant and postpartum women have reported used exercise as a strategy to cope with stress (Farrell et al., 2020). These results, can be explained due to social support derived i.e. from family and friends or health professionals could play a crucial and protective role providing emotional support (Yue et al., 2021). In addition, social support, can reduce the perceived severity of stressful events (Lakey & Orehek, 2011). Regarding mental health, this study found that more anxiety, depression and PTSD symptoms were related to an unhealthy lifestyle pattern to cope with stress in pregnant and postpartum women. Similar results were found in previous studies (Ahmad & Vismara, 2021; George et al., 2013; Gutiérrez-Zotes et al., 2015; Khoury et al., 2021; Razurel et al., 2013). Increasing time with screens, with social networks or watching news predicted poor results in mental health (e.g., depression/anxiety or higher scores in PTSD symptoms). Similar results were found in previous studies, which found that digital media use was positively correlated with negative affect and poorer quality of life during pregnancy (Smith M. et al., 2020). However, many studies point out that the use of social networks and online resources, such as blogs, is an important source of social support for women in the perinatal period (Baker & Yang, 2018; Hether et al., 2016). However, from the psychology perspective these results can be explained by information uncertainty, which has been found to be a significant correlate of psychological stress during the COVID-19 pandemic (Lin et al., 2020). According to Lin et al., (2020) timely, transparent and accurate information can reduce fear and stress. In line with previous evidence, we found poor mental health results in those participants who ate fast food, did not sleep well at night, reported substance use or did not practice exercise (Chapman & Wu, 2013; Padmapriya et al., 2016). Previous studies have highlighted that perinatal mental health has had a significant association with lifestyles (Bogaerts et al., 2013; Opie et al., 2020; Vargas-Terrones et al., 2019). Surprisingly, talking more frequently with health or mental health professionals was associated with poor mental health. These results might be explained because participants with mental health problems demand more resources and attention from health care services (Chojenta et al., 2019). On the

Table 7 Logistic regression for predicting anxiety and depression in postpartum women during the COVID-19 pandemic

Predictors	Beta	S.E	Wald	df	p	OR	95% C.I. for EXP (B)		Nagelkerke R ²	Sensitivity/Specificity (Correctly classified)
							Lower	Upper		
Anxiety (GAD-7 ≥ 10) *										
Demographics										
Age									.097	61.7/69.9 (69.0)
Primiparous (Ref. No)	-.05	.01	17.16	1	<.001	.95	.93	.97		
COVID-19 exposures and symptoms	-.10	.11	.83	1	.363	.90	.73	1.12		
Contact with any person with confirmed infection with COVID-19 (Ref. No)	-.14	.12	1.29	1	.255	.87	.69	1.10		
Symptoms or confirmed COVID-19 diagnosis (Ref. No)	.19	.14	1.74	1	.187	1.21	.91	1.61		
Death of a close person due to COVID-19 (Ref. No)	.58	.16	13.11	1	.000	1.79	1.31	2.44		
Lifestyles to cope with stress during the COVID-19 pandemic										
Sleeping well at night	-.76	.19	16.59	1	<.001	.47	.32	.67		
Increasing time in social networks (Facebook, Instagram or others)	.16	.11	2.28	1	.131	1.17	.95	1.45		
Increasing time watching or looking for news	.44	.14	9.95	1	.002	1.55	1.18	2.04		
Eating fast food (sweets and chips)	.51	.14	14.59	1	<.001	1.67	1.28	2.18		
Increasing time reading books or doing activities as jigsaw or puzzles	-.30	.15	4.08	1	.043	.74	.55	.99		
Physical exercise (intense or moderate at least three times a week)	-.19	.14	1.78	1	.182	.83	.63	1.09		
Smoking or vaping	.89	.30	8.64	1	.003	2.44	1.35	4.41		
Talking with health professionals more frequently	.61	.29	4.40	1	.036	1.83	1.04	3.23		
Talking with mental health professional	.81	.22	13.80	1	<.001	2.24	1.46	3.43	.086	61.9/60.1 (60.8)
Depression (EPDS ≥ 10) **										
Demographics										
Age										
Primiparous (Ref. No)	-.02	.01	2.32	1	.128	.98	.96	1.01		
COVID-19 exposures and symptoms	-.13	.10	1.58	1	.209	.88	.72	1.08		
Contact with any person with confirmed infection with COVID-19 (Ref. No)	-.07	.11	.40	1	.528	.93	.75	1.16		
Symptoms or confirmed COVID-19 diagnosis (Ref. No)	.23	.14	2.84	1	.092	1.26	.96	1.66		
Death of a close person due to COVID-19 (Ref. No)	.47	.16	8.65	1	.003	1.60	1.17	2.18		
Lifestyles to cope with stress during the COVID-19 pandemic										
Sleeping well at night	-.85	.16	26.98	1	<.001	.43	.31	.59		
Increasing time with screens (i.e., videogames, series or films)	.16	.12	1.72	1	.190	1.17	.93	1.48		
Increasing time in social networks (Facebook, Instagram or others)	.16	.11	2.13	1	.145	1.17	.95	1.44		
Increasing time watching or looking for news	.36	.14	6.91	1	.009	1.44	1.10	1.88		
Eating fast food (sweets and chips)	.45	.14	10.65	1	.001	1.56	1.20	2.05		
Eating healthier	-.17	.13	1.71	1	.191	.84	.66	1.09		
Increasing time reading books or doing activities as jigsaw or puzzles	-.20	.14	2.08	1	.149	.82	.62	1.074		

Table 7 (continued)

Predictors	Beta	S.E	Wald	df	p	OR	95% C.I. for EXP (B)		Nagelkerke R ²	Sensitivity/Specificity (Correctly classified)
							Lower	Upper		
Physical exercise (intense or moderate at least three times a week)	-.06	.13	.22	1	.641	.94	.73	1.211		
Smoking or vaping	1.03	.33	9.65	1	.002	2.79	1.46	5.340		
Talking with health professionals more frequently	.55	.30	3.49	1	.062	1.74	.97	3.107		
Talking with mental health professional	.77	.23	11.46	1	.001	2.16	1.38	3.378		

* Omnibus Test ($X^2 = 136.50$; $df = 14$, $p < .001$). Hosmer and Lemeshow Test ($X^2 = 8.30$, $df = 8$, $sig = .405$)

** Omnibus Test ($X^2 = 125.57$; $df = 16$, $p < .001$). Hosmer and Lemeshow Test ($X^2 = 2.68$, $df = 8$, $p = .953$)

other hand, better mental health results were associated with functional coping strategies such as talking with family and friends or participating in family activities, physical activity, sleeping well at night, reading or playing educational games, eating healthier, and increasing personal care. These results can be explained by the protective effect of social support and healthy lifestyles over the perinatal mental health (Omidvar et al., 2018). We have to note, that the perinatal period is a vulnerable and challenging period for pregnant and postpartum women, and the role of social support from family and friends is crucial to preserve mental health (Battulga et al., 2021; Bedaso et al., 2021).

We found that being younger was a risk factor for anxiety and PTSD symptoms but not for depression. The same results have been found in previous studies for depression and anxiety (Bener et al., 2012; Biaggi et al., 2016; Ghaedrahmati et al., 2017; Yin et al., 2020) but not for PTSD (Angelini et al., 2018). Regarding COVID-19 exposures and symptoms, our results suggest that having symptoms and/or confirmed COVID-19 diagnosis were related to anxiety and PTSD only in pregnant women. These results can be explained by concerns about foetal health (Esteban-Gonzalo et al., 2021; Meraya et al., 2021; Mortazavi et al., 2021). In addition, experiencing the death of a close person due to COVID-19 was related to anxiety and depression in postpartum women but not in pregnant women and to PTSD symptoms in both pregnant and postpartum women. Having symptoms and/or confirmed COVID-19 diagnosis was a risk factor for anxiety and PTSD symptoms in pregnant women but not in postpartum women. In addition, experiencing the death of a close person due to COVID-19 was a risk factor for anxiety, depression and PTSD symptoms in postpartum women and for PTSD symptoms in pregnant women. Although no previous studies have explored the effect of COVID-19 exposure and symptoms on perinatal mental health, many studies have concluded that the COVID-19 pandemic has considerably deteriorated pregnant and postpartum women's mental health (Demissie & Bitew, 2021; Iyengar et al., 2021; Yan et al., 2020). In addition, these results can be explained due to loss of a close person is one of the most stressful events in a person's life, and the COVID-19 pandemic due to isolation, fear and lockdown exacerbates prolonged grief disorder (Simon et al., 2020; Tang & Xiang, 2021).

The results obtained in this study contribute to a deeper understanding of strategies to cope with stress that women in the perinatal period use in stressful situations. In addition, the results found in this study highlighted the need to strengthen the mental health of pregnant and postpartum women and to create psychoeducational and psychological interventions that help pregnant and postpartum women practice functional coping strategies. These interventions

Table 8 Hierarchical linear regression for predicting PTSD symptoms in pregnant and postpartum women during the COVID-19 pandemic

Predictors	R ²	F	p	b	t	p
Pregnant women	.14	12.22	<.001			
Demographics						
Age				-.10	-3.67	<.001
Primiparous				-.06	-2.17	.030
COVID-19 exposures and symptoms						
Contact with any person with confirmed infection with COVID-19				-.02	-.80	.423
Symptoms or confirmed COVID-19 diagnosis				.06	2.17	.030
Death of a close person due to COVID-19				.06	2.24	.026
Lifestyles to cope with stress during the COVID-19 pandemic						
Nothing				-.10	-3.74	<.001
Sleeping well at night				-.19	-7.05	<.001
Meditation/mindfulness				.08	3.15	.002
Participating in family activities (e.g., games, sports)				-.07	-2.75	.006
Increasing time with screens (i.e., videogames, series or films)				.05	1.86	.063
Increasing time in social networks (Facebook, Instagram or others)				.06	2.21	.027
Increasing time watching or looking for news				.07	2.59	.010
Eating fast food (sweets and chips)				.07	2.73	.006
Eating healthier				.02	.60	.550
Increasing personal care (e.g. having more bath or shower, facial treatments...)				-.04	-1.30	.193
Physical exercise (intense or moderate at least three times a week)				-.08	-2.89	.004
Smoking or vaping				.05	1.92	.055
Talking with health professionals more frequently				.06	2.29	.022
Talking with mental health professional				.11	4.31	<.001
Postpartum women	.10	11.33	<.001			
Demographics						
Age				-.08	-3.49	.001
Primiparous				-.08	-3.50	<.001
COVID-19 exposures and symptoms						
Contact with any person with confirmed infection with COVID-19				-.01	-.58	.565
Symptoms or confirmed COVID-19 diagnosis				.03	1.46	.143
Death of a close person due to COVID-19				.07	3.34	.001
Lifestyles to cope with stress during the COVID-19 pandemic						
Nothing				-.09	-3.45	.001
Sleeping well at night				-.10	-4.23	<.001
Talking with friends and family				-.09	-3.59	<.001
Increasing time with screens (i.e., videogames, series or films)				.04	1.56	.118
Increasing time in social networks (Facebook, Instagram or others)				.05	1.95	.052
Increasing time watching or looking for news				.04	1.82	.068
Eating fast food (sweets and chips)				.11	4.62	<.001
Eating healthier				-.03	-1.34	.182
Increasing time reading books or doing activities as jigsaw or puzzles				-.06	-2.42	.016
Physical exercise (intense or moderate at least three times a week)				-.03	-1.30	.193
Smoking or vaping				.07	3.21	.001
Talking with health professionals more frequently				.05	2.04	.041
Talking with mental health professional				.10	4.51	<.001

would be especially relevant in younger and primiparous pregnant and postpartum women more exposed to COVID-19.

Our study has some limitations. First and foremost because a cross-sectional design was used; further longitudinal research is needed to achieve robust conclusions. In

addition, data were collected using an online survey with a convenience sample. Thus, inherent bias of these proceeds might exist. However, we must note that no other way to collect data was possible. Despite these limitations, this study was one of the first studies to assess the relationship between mental health and lifestyle strategies to cope with stress during the COVID-19 pandemic in pregnant and postpartum women. The study included a large and representative sample of 3356 Spanish pregnant and postpartum women recruited from all regions of Spain. In addition, the instrument used to assess mental health outcomes presented good psychometric properties (García-Campayo et al., 2010; Garcia-Esteve et al., 2003; Vázquez & Míguez, 2019) and they are widely used in both research and clinical settings. To avoid classification bias, future studies should assess mental health outcomes using structured clinical interviews.

Conclusions

The perinatal period is a period of vulnerability in which high levels of distress can appear (Woody et al., 2017). Recent studies have confirmed that the COVID-19 pandemic has an important impact on the mental health of pregnant and postpartum women (López-Morales et al., 2021; Molgora & Accordini, 2020; Saccone et al., 2020; Yan et al., 2020). This study highlights the impact of unhealthy lifestyle patterns to cope with stress on depression, anxiety and PTSD during the COVID-19 pandemic in women during the perinatal period. Interventions aiming to promote healthy lifestyles and functional and proactive coping strategies focused on pregnant and postpartum women should be a priority, especially in young and primiparous women.

Acknowledgements We thank the Management Committee of COST Action Riseup-PPD for their support. We would also like to thank the other researchers who are collaborating on the Spanish project: Patricia Moreno-Peral, Sonia Conejo-Cerón, María del Pilar Garrido-Borrego, María José Gonzalez-Vereda, Carmen Martín-Gomez and Javier Álvarez.

Author contributions E.M design the research. D.G.B performed the statistical analysis. I.G.G and D.G.B prepared the initial draft. E.M, D.G.B, I.G.G, S.D.S and C.R.D reviewed the manuscript critically and suggested revisions. Final version has been approved by all co-authors.

Funding The project is part of the COST Action Riseup-PPD CA 18138 and was financially supported by COST under COST Action Riseup-PPD CA18138; also, by the Spanish ministry of Health, the Institute of Health Carlos III, and the European Regional Development Fund «Una manera de hacer Europa» by the Prevention and Health Promotion Research Network ‘redIAPP’ (RD16/0007).

Data availability The methods of this study can be found both at ClinicalTrials.gov (Identifier: NCT04595123) and in the published protocol

study (Motrico et al., 2021). The datasets generated during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical approval The study protocol was approved by Junta of Andalucía Research Committee and the University Research Committee at the Universidad Loyola Andalucía. All participants have signed the online informed consent before participating in the study. This study was conducted according to the principles expressed in the Declaration of Helsinki.

Informed consent Informed consent was obtained from all individual participants included in the study.

Competing interests The authors declare no competing interests.

Conflict of interest The authors declare no conflict of Interest.

References

- Ahmad, M., & Vismara, L. (2021). The psychological impact of COVID-19 pandemic on women’s mental health during pregnancy: A rapid evidence review. *International Journal of Environmental Research and Public Health*, 18(13). <https://doi.org/10.3390/ijerph18137112>
- Allotey, J., Stallings, E., Bonet, M., Yap, M., Chatterjee, S., Kew, T., Debenham, L., Llavall, A. C., Dixit, A., Zhou, D., Balaji, R., Lee, S. I., Qiu, X., Yuan, M., Coomar, D., Sheikh, J., Lawson, H., Ansari, K., Wely, M. Van, ... Thangaratinam, S. (2020). *Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis*. <https://doi.org/10.1136/bmj.m3320>
- Angelini, C. R., Pacagnella, R. C., Parpinelli, M. A., Silveira, C., Andreucci, C. B., Ferreira, E. C., Santos, J. P., Zanardi, D. M., Souza, R. T., & Cecatti, J. G. (2018). Post-traumatic stress disorder and severe maternal morbidity: Is there an association? *Clinics*, 73(Criterion C), 1–7. <https://doi.org/10.6061/clinics/2018/e309>
- Baker, B., & Yang, I. (2018). Social media as social support in pregnancy and the postpartum. *Sexual and Reproductive Healthcare*, 17(September 2017), 31–34. <https://doi.org/10.1016/j.srh.2018.05.003>
- Barbosa-Leiker, C., Smith, C. L., Crespi, E. J., Brooks, O., Burduli, E., Ranjo, S., Carty, C. L., Hebert, L. E., Waters, S. F., & Gartstein, M. A. (2021). Stressors, coping, and resources needed during the COVID-19 pandemic in a sample of perinatal women. *BMC Pregnancy and Childbirth*, 21(1), 171. <https://doi.org/10.1186/s12884-021-03665-0>
- Battulga, B., Benjamin, M. R., Chen, H., & Bat-Enkh, E. (2021). The Impact of Social Support and Pregnancy on Subjective Well-Being: A Systematic Review. *Frontiers in Psychology*, 12(September). <https://doi.org/10.3389/fpsyg.2021.710858>
- Bedaso, A., Adams, J., Peng, W., & Sibbritt, D. (2021). The relationship between social support and mental health problems during pregnancy: A systematic review and meta-analysis. *Reproductive Health*, 18(1), 1–23. <https://doi.org/10.1186/s12978-021-01209-5>
- Bener, A., Sheikh, & Gerber. (2012). Prevalence of psychiatric disorders and associated risk factors in women during their postpartum period: a major public health problem and global comparison.

- International Journal of Women's Health*, 191. <https://doi.org/10.2147/IJWH.S29380>
- Biaggi, A., Conroy, S., Pawlby, S., & Pariante, C. M. (2016). Identifying the women at risk of antenatal anxiety and depression: A systematic review. *Journal of Affective Disorders*, 191, 62–77. <https://doi.org/10.1016/j.jad.2015.11.014>
- Biviá-Roig, G., La Rosa, V. L., Gómez-Tébar, M., Serrano-Raya, L., Amer-Cuenca, J. J., Caruso, S., Commodari, E., Barrasa-Shaw, A., & Lisón, J. F. (2020). Analysis of the impact of the confinement resulting from covid-19 on the lifestyle and psychological wellbeing of spanish pregnant women: An internet-based cross-sectional survey. *International Journal of Environmental Research and Public Health*, 17(16), 1–14. <https://doi.org/10.3390/ijerph17165933>
- Boekhorst, M. G. B. M., Muskens, L., Hulsbosch, L. P., Van Deun, K., Bergink, V., Pop, V. J. M., & van den Heuvel, M. I. (2021). The COVID-19 outbreak increases maternal stress during pregnancy, but not the risk for postpartum depression. *Archives of Women's Mental Health*, 0123456789. <https://doi.org/10.1007/s00737-021-01104-9>
- Bogaerts, A. F. L., Devlieger, R., Nuyts, E., Witters, I., Gyselaers, W., & Van Den Bergh, B. R. H. (2013). Effects of lifestyle intervention in obese pregnant women on gestational weight gain and mental health: A randomized controlled trial. *International Journal of Obesity*, 37(6), 814–821. <https://doi.org/10.1038/ijo.2012.162>
- Chapman, S. L. C., & Wu, L.-T. (2013). Postpartum Substance Use and Depressive Symptoms: A Review. *Women & Health*, 53(5), 479–503. <https://doi.org/10.1080/03630242.2013.804025>
- Chojenta, C., William, J., Martin, M. A., Byles, J., & Loxton, D. (2019). The impact of a history of poor mental health on health care costs in the perinatal period. *Archives of Women's Mental Health*, 22(4), 467–473. <https://doi.org/10.1007/s00737-018-0912-4>
- Cox, J. L., Holden, J. M., & Sagovsky, R. (1987). Detection of Postnatal Depression. *British Journal of Psychiatry*, 150(6), 782–786. <https://doi.org/10.1192/bjpp.150.6.782>
- Demissie, D. B., & Bitew, Z. W. (2021). Mental health effect of COVID-19 pandemic among women who are pregnant and/or lactating: A systematic review and meta-analysis. *SAGE Open Medicine*, 9, 205031212110261. <https://doi.org/10.1177/20503121211026195>
- Dennis, C. L., Falah-Hassani, K., & Shiri, R. (2017). Prevalence of antenatal and postnatal anxiety: Systematic review and meta-analysis. *British Journal of Psychiatry*, 210(5), 315–323. <https://doi.org/10.1192/bjpp.bp.116.187179>
- Esteban-Gonzalo, S., Caballero-Galilea, M., González-Pascual, J. L., Álvaro-Navidad, M., & Esteban-Gonzalo, L. (2021). Anxiety and Worries among Pregnant Women during the COVID-19 Pandemic: A Multilevel Analysis. *International Journal of Environmental Research and Public Health*, 18(13), 6875. <https://doi.org/10.3390/ijerph18136875>
- Farrell, T., Reagu, S., Mohan, S., Elmidany, R., Qaddoura, F., Ahmed, E. E., Corbett, G., Lindow, S., Abuyaqoub, S. M., & Alabdulla, M. A. (2020). The impact of the COVID-19 pandemic on the perinatal mental health of women. *Journal of Perinatal Medicine*, 48(9), 971–976. <https://doi.org/10.1515/jpm-2020-0415>
- Fisher, J., de Mello, M. C., Patel, V., Rahman, A., Tran, T., Holton, S., & Holmesf, W. (2012). Prevalence and determinants of common perinatal mental disorders in women in low-and lower-middle-income countries: A systematic review. *Bulletin of the World Health Organization*, 90(2), 139–149. <https://doi.org/10.2471/BLT.11.091850>
- García-Campayo, J., Zamorano, E., Ruiz, M. A., Pardo, A., Pérez-Páramo, M., López-Gómez, V., et al. (2010). Cultural adaptation into Spanish of the generalized anxiety disorder-7 (GAD-7) scale as a screening tool. *Health and Quality of Life Outcomes*, 8(11), 8. <https://doi.org/10.1186/1477-7525-8-8>
- García-Esteve, L., Ascaso, C., Ojuel, J., & Navarro, P. (2003). Validation of the Edinburgh Postnatal Depression Scale (EPDS) in Spanish mothers. *Journal of Affective Disorders*, 75(1), 71–76. [https://doi.org/10.1016/S0165-0327\(02\)00020-4](https://doi.org/10.1016/S0165-0327(02)00020-4)
- George, A., Luz, R. F., De Tyche, C., Thilly, N., & Spitz, E. (2013). Anxiety symptoms and coping strategies in the perinatal period. *BMC Pregnancy and Childbirth*, 13. <https://doi.org/10.1186/1471-2393-13-233>
- Ghaedrahmati, M., Kazemi, A., Kheirabadi, G., Ebrahimi, A., & Bahrami, M. (2017). Postpartum depression risk factors: A narrative review. *Journal of Education and Health Promotion*, 6(January), 60. https://doi.org/10.4103/jehp.jehp_9_16
- Gutiérrez-Zotes, A., Labad, J., Martín-Santos, R., García-Esteve, L., Gelabert, E., Jover, M., Guillamat, R., Mayorca, F., Gornemann, I., Canellas, F., Gratacós, M., Guitart, M., Roca, M., Costas, J., Luis Ivorra, J., Navinés, R., de Diego-Otero, Y., Vilella, E., & Sanjuan, J. (2015). Coping strategies and postpartum depressive symptoms: A structural equation modelling approach. *European Psychiatry*, 30(6), 701–708. <https://doi.org/10.1016/j.eurpsy.2015.06.001>
- Hether, H. J., Murphy, S. T., & Valente, T. W. (2016). A social network analysis of supportive interactions on prenatal sites. *Digital Health*, 2, 205520761662870. <https://doi.org/10.1177/2055207616628700>
- Hewitt, C. E., Gilbody, S. M., Mann, R., & Brealey, S. (2010). Instruments to identify post-natal depression: Which methods have been the most extensively validated, in what setting and in which language? *International Journal of Psychiatry in Clinical Practice*, 14(1), 72–76. <https://doi.org/10.3109/13651500903198020>
- Iyengar, U., Jaiprakash, B., Haitsuka, H., & Kim, S. (2021). One Year Into the Pandemic: A Systematic Review of Perinatal Mental Health Outcomes During COVID-19. *Frontiers in Psychiatry*, 12(June). <https://doi.org/10.3389/fpsy.2021.674194>
- Khan, S., Peng, L., Siddique, R., Nabi, G., Nawsherwan, Xue, M., Liu, J., & Han, G. (2020). Impact of COVID-19 infection on pregnancy outcomes and the risk of maternal-to-neonatal intrapartum transmission of COVID-19 during natural birth. *Infection Control and Hospital Epidemiology*, 41(6), 748–750. <https://doi.org/10.1017/ice.2020.84>
- Khoury, J. E., Atkinson, L., Bennett, T., Jack, S. M., & Gonzalez, A. (2021). Coping strategies mediate the associations between COVID-19 experiences and mental health outcomes in pregnancy. *Archives of Women's Mental Health*, 0123456789. <https://doi.org/10.1007/s00737-021-01135-2>
- Kinser, P. A., Jallo, N., Amstatter, A. B., Thacker, L. R., Jones, E., Moyer, S., Rider, A., Karjane, N., & Salisbury, A. L. (2021). Depression, Anxiety, Resilience, and Coping: The Experience of Pregnant and New Mothers During the First Few Months of the COVID-19 Pandemic. *Journal of Women's Health*, 30(5), 654–664. <https://doi.org/10.1089/jwh.2020.8866>
- Lakey, B., & Orehek, E. (2011). Relational regulation theory: A new approach to explain the link between perceived social support and mental health. *Psychological Review*, 118(3), 482–495. <https://doi.org/10.1037/a0023477>
- Lambelet, V., Ceulemans, M., Nordeng, H., Favre, G., Horsch, A., & Stojanov, M. (2021). Impact of the COVID-19 pandemic on Swiss pregnant and breastfeeding women – a cross-sectional study covering the first pandemic wave. *Swiss Medical Weekly*, 151(37–38), 1–10. <https://doi.org/10.4414/smww.2021.w30009>
- Lega, I., Bramante, A., Lauria, L., Grussu, P., Dubini, V., Falcieri, M., Ghiani, M. C., Giordano, A., Guidomei, S., Mignuoli, A. D., Paris, S., Bettinelli, M. E., Proietti, P., Andreozzi, S., Brenna, V., Bucciarelli, M., Martelli, G., Ferraro, C., Torrisi, M., ... Donati, S. (2022). The Psychological Impact of COVID-19 among Women Accessing Family Care Centers during Pregnancy and the Postnatal Period in Italy. *International Journal of Environmental*

- Research and Public Health*, 19(4), 1983. <https://doi.org/10.3390/ijerph19041983>
- Lin, D., Friedman, D. B., Qiao, S., Tam, C. C., Li, X., & Li, X. (2020). Information uncertainty: A correlate for acute stress disorder during the COVID-19 outbreak in China. *BMC Public Health*, 20(1), 1–9. <https://doi.org/10.1186/s12889-020-09952-3>
- Liu, C. H., Erdei, C., & Mittal, L. (2021). Risk factors for depression, anxiety, and PTSD symptoms in perinatal women during the COVID-19 Pandemic. *Psychiatry Research*, 295(October 2020), 113552. <https://doi.org/10.1016/j.psychres.2020.113552>
- López-Morales, H., del Valle, M. V., Canet-Juric, L., Andrés, M. L., Galli, J. I., Poó, F., & Urquijo, S. (2021). Mental health of pregnant women during the COVID-19 pandemic: A longitudinal study. *Psychiatry Research*, 295(January), 113567. <https://doi.org/10.1016/j.psychres.2020.113567>
- McPherson, S. (2003). Stress and coping in accident and emergency senior house officers. *Emergency Medicine Journal*, 20(3), 230–231. <https://doi.org/10.1136/emj.20.3.230>
- Meraya, A. M., Syed, M. H., Yasmeen, A., Mubarak, A. A., Kariry, H. D., Maabouj, W., Moraya, D., & Makeen, H. A. (2021). COVID-19 related psychological distress and fears among mothers and pregnant women in Saudi Arabia. *PLoS ONE*, 16(8), e0256597. <https://doi.org/10.1371/journal.pone.0256597>
- Molgora, S., & Accordini, M. (2020). Motherhood in the Time of Coronavirus: The Impact of the Pandemic Emergency on Expectant and Postpartum Women's Psychological Well-Being. *Frontiers in Psychology*, 11(October), 1–16. <https://doi.org/10.3389/fpsyg.2020.567155>
- Mortazavi, F., Mehrabad, M., & KiaeTabar, R. (2021). Pregnant Women's Well-being and Worry During the COVID-19 Pandemic: A Comparative Study. *BMC Pregnancy and Childbirth*, 4(21), 1–22.
- Motrico, E., Bina, R., Domínguez-Salas, S., Mateus, V., Contreras-García, Y., Carrasco-Portiño, M., Ajaz, E., Apter, G., Christoforou, A., Dikmen-Yildiz, P., Felice, E., Hancheva, C., Voursour, E., Wilson, C. A., Buhagiar, R., Cadarso-Suárez, C., Costa, R., Devouche, E., Ganho-Ávila, A., ... Mesquita, A. (2021). Impact of the Covid-19 pandemic on perinatal mental health (Riseup-PPD-COVID-19): protocol for an international prospective cohort study. *BMC Public Health*, 21(1), 368. <https://doi.org/10.1186/s12889-021-10330-w>
- Obrochta, C. A., Chambers, C., & Bandoli, G. (2020). Psychological distress in pregnancy and postpartum. *Women and Birth*, 33(6), 583–591. <https://doi.org/10.1016/j.wombi.2020.01.009>
- Omidvar, S., Faramarzi, M., Hajian-Tilak, K., & Amiri, F. N. (2018). Associations of psychosocial factors with pregnancy healthy life styles. *PLoS ONE*, 13(1), 1–13. <https://doi.org/10.1371/journal.pone.0191723>
- Opie, R. S., Uldrich, A. C., & Ball, K. (2020). Maternal Postpartum Diet and Postpartum Depression: A Systematic Review. *Maternal and Child Health Journal*, 24(8), 966–978. <https://doi.org/10.1007/s10995-020-02949-9>
- Padmapriya, N., Bernard, J. Y., Liang, S., Loy, S. L., Shen, Z., Kwek, K., Godfrey, K. M., Gluckman, P. D., Chong, Y. S., Saw, S. M., Meaney, M. J., Chen, H., Müller-Riemenschneider, F., Agarwal, P., Biswas, A., Bong, C. L., Broekman, B. F. P., Cai, S., Chan, J. K. Y., ... Yeo, G. S. H. (2016). Association of physical activity and sedentary behavior with depression and anxiety symptoms during pregnancy in a multiethnic cohort of Asian women. *Archives of Women's Mental Health*, 19(6), 1119–1128. <https://doi.org/10.1007/s00737-016-0664-y>
- Perzow, S. E. D., Hennessey, E. P., Hoffman, M. C., Grote, N. K., Poggi, E., & Hankin, B. L. (2021). Mental health of pregnant and postpartum women in response to the COVID-19 pandemic. *Journal of Affective Disorders Reports*, 4(February), 100123. <https://doi.org/10.1016/j.jadr.2021.100123>
- Prabhu, M., Cagino, K., Matthews, K. C., Friedlander, R. L., Glynn, S. M., Kubiak, J. M., Yang, Y. J., Zhao, Z., Baergen, R. N., DiPace, J. I., Razavi, A. S., Skupski, D. W., Snyder, J. R., Singh, H. K., Kalish, R. B., Oxford, C. M., & Riley, L. E. (2020). Pregnancy and postpartum outcomes in a universally tested population for SARS-CoV-2 in New York City: a prospective cohort study. *BJOG: An International Journal of Obstetrics and Gynaecology*, 127(12), 1548–1556. <https://doi.org/10.1111/1471-0528.16403>
- Razurel, C., Kaiser, B., Sellenet, C., & Epiney, M. (2013). Relation Between Perceived Stress, Social Support, and Coping Strategies and Maternal Well-Being: A Review of the Literature. *Women and Health*, 53(1), 74–99. <https://doi.org/10.1080/03630242.2012.732681>
- Saccone, G., Florio, A., Aiello, F., Venturella, R., De Angelis, M. C., Locci, M., Bifulco, G., Zullo, F., & Di SpiezioSardo, A. (2020). Psychological impact of coronavirus disease 2019 in pregnant women. *American Journal of Obstetrics and Gynecology*, 223(2), 293–295. <https://doi.org/10.1016/j.ajog.2020.05.003>
- Saleh, L., Canclini, S., Greer, K., Mathison, C., Combs, S. M., Dickerson, B., & Collins, K. (2022). Mothers' Experiences of Pregnancy, Labor and Birth, and Postpartum During COVID-19 in the United States. *Journal of Perinatal & Neonatal Nursing*, 36(1), 55–67. <https://doi.org/10.1097/JPN.0000000000000624>
- Shorey, S., Chee, C. Y. I., Ng, E. D., Chan, Y. H., Tam, W. W. S., & Chong, Y. S. (2018). Prevalence and incidence of postpartum depression among healthy mothers: A systematic review and meta-analysis. *Journal of Psychiatric Research*, 104(August), 235–248. <https://doi.org/10.1016/j.jpsychires.2018.08.001>
- Simon, N. M., Saxe, G. N., & Marmar, C. R. (2020). Mental Health Disorders Related to COVID-19–Related Deaths. *JAMA*, 324(15), 1493. <https://doi.org/10.1001/jama.2020.19632>
- Simpson, W., Glazer, M., Michalski, N., Steiner, M., & Frey, B. N. (2014). Comparative Efficacy of the Generalized Anxiety Disorder 7-Item Scale and the Edinburgh Postnatal Depression Scale as Screening Tools for Generalized Anxiety Disorder in Pregnancy and the Postpartum Period. *The Canadian Journal of Psychiatry*, 59(8), 434–440. <https://doi.org/10.1177/070674371405900806>
- Smith, M., Mitchell, A. S., Townsend, M. L., & Herbert, J. S. (2020). The relationship between digital media use during pregnancy, maternal psychological wellbeing, and maternal-fetal attachment. *PLoS ONE*, 15(12 December), 1–15. <https://doi.org/10.1371/journal.pone.0243898>
- Smith, V., Seo, D., Warty, R., Payne, O., Salih, M., Chin, K. L., et al. (2020). Maternal and neonatal outcomes associated with COVID-19 infection: A systematic review. *PLoS ONE*, 15(6), 1–13. <https://doi.org/10.1371/journal.pone.0234187>
- Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine*, 166(10), 1092–1097. <https://doi.org/10.1001/archinte.166.10.1092>
- Stepowicz, A., Wencka, B., Bienkiewicz, J., Horzelski, W., & Grzesiak, M. (2020). Stress and anxiety levels in pregnant and post-partum women during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, 17(24), 1–9. <https://doi.org/10.3390/ijerph17249450>
- Suárez-Rico, B. V., Estrada-Gutierrez, G., Sánchez-Martínez, M., Perichart-Perera, O., Rodríguez-Hernández, C., González-Leyva, C., Osorio-Valencia, E., Cardona-Pérez, A., Helguera-Repetto, A. C., Sosa, S. E. Y., Solis-Paredes, M., & Reyes-Muñoz, E. (2021). Prevalence of depression, anxiety, and perceived stress in postpartum Mexican women during the covid-19 lockdown. *International Journal of Environmental Research and Public Health*, 18(9), 1–9. <https://doi.org/10.3390/ijerph18094627>
- Tang, S., & Xiang, Z. (2021). Who suffered most after deaths due to COVID-19? Prevalence and correlates of prolonged grief disorder

- in COVID-19 related bereaved adults. *Globalization and Health*, 17(1), 1–9. <https://doi.org/10.1186/s12992-021-00669-5>
- Thomason, M. E., Graham, A., & VanTieghem, M. R. (2022). *The COPE-IS: Coronavirus Perinatal Experiences – Impact Survey*. Available at: www.nlm.nih.gov/dr2/COPE-Impact_Survey_Perinatal_Pandemic_Survey.pdf. Accessed March 2021.
- Vargas-Terrones, M., Barakat, R., Santacruz, B., Fernandez-Buhigas, I., & Mottola, M. F. (2019). Physical exercise programme during pregnancy decreases perinatal depression risk: A randomised controlled trial. *British Journal of Sports Medicine*, 53(6), 348–353. <https://doi.org/10.1136/bjsports-2017-098926>
- Vázquez, M. B., & Míguez, M. C. (2019). Validation of the Edinburgh postnatal depression scale as a screening tool for depression in Spanish pregnant women. *Journal of Affective Disorders*, 246, 515–521. <https://doi.org/10.1016/j.jad.2018.12.075>
- Whitaker, K. M., Hung, P., Alberg, A. J., Hair, N. L., & Liu, J. (2021). Variations in health behaviors among pregnant women during the COVID-19 pandemic. *Midwifery*, 95(January). <https://doi.org/10.1016/j.midw.2021.102929>
- Woody, C. A., Ferrari, A. J., Siskind, D. J., Whiteford, H. A., & Harris, M. G. (2017). A systematic review and meta-regression of the prevalence and incidence of perinatal depression. *Journal of Affective Disorders*, 219, 86–92. <https://doi.org/10.1016/j.jad.2017.05.003>
- World Health Organization. (2021). *Health topics: Coronavirus*. Available at: https://www.who.int/health-topics/coronavirus#tab=tab_1. Accessed March 2021.
- Yan, H., Ding, Y., & Guo, W. (2020). Mental Health of Pregnant and Postpartum Women During the Coronavirus Disease 2019 Pandemic: A Systematic Review and Meta-Analysis. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.617001>
- Yildiz, P. D., Ayers, S., & Phillips, L. (2017). The prevalence of post-traumatic stress disorder in pregnancy and after birth: A systematic review and meta-analysis. *Journal of Affective Disorders*, 208(October 2016), 634–645. <https://doi.org/10.1016/j.jad.2016.10.009>
- Yin, X., Sun, N., Jiang, N., Xu, X., Gan, Y., Zhang, J., Qiu, L., Yang, C., Shi, X., Chang, J., & Gong, Y. (2020). Prevalence and associated factors of antenatal depression: Systematic reviews and meta-analyses. *Clinical Psychology Review*, 83, 101932. <https://doi.org/10.1016/j.cpr.2020.101932>
- Yue, C., Liu, C., Wang, J., Zhang, M., Wu, H., Li, C., & Yang, X. (2021). Association between social support and anxiety among pregnant women in the third trimester during the coronavirus disease 2019 (COVID-19) epidemic in Qingdao, China: The mediating effect of risk perception. *International Journal of Social Psychiatry*, 67(2), 120–127. <https://doi.org/10.1177/0020764020941567>
- Zhang, Y., & Ma, Z. F. (2020). Psychological responses and lifestyle changes among pregnant women with respect to the early stages of COVID-19 pandemic. *International Journal of Social Psychiatry*. <https://doi.org/10.1177/0020764020952116>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.