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The psychological impact of the COVID-19 pandemic on pregnant women

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ABSTRACT

The aim was to examine the psychological effects caused by the COVID-19 pandemic on pregnant women, as well as the factors influencing these effects. The study design was cross-sectional and the participants were 200 pregnant women. The first group called the Pandemic Group (PG) included 100 women who were evaluated with psychological assessment instruments during the COVID-19 pandemic. The second group titled Pre-Pandemic Group (PPG) consisted of 100 women who were evaluated prior to the pandemic. Perceived stress, prenatal concerns and psychopathological symptoms were evaluated and compared. Pandemic Group scored significantly higher than Pre-Pandemic Group in the depression dimension of the SCL-90, in the phobic anxiety dimension, and in the Perceived Stress Scale. In addition, insomnia, along with having recently suffered the loss of a loved one explained 25% of the score variance in the depression dimension of the SCL-90. Insomnia also explained 13% of the variance of the results found in the Perceived Stress Scale. The fear of contagion by COVID-19 increased the scores obtained in the phobic anxiety dimension, explaining 11% of the variance. Thus, the COVID-19 pandemic could produce an increase in psychopathological symptomatology and stress, which can lead to negatively affecting pregnant women's mental health.

1. Introduction

In December 2019 an outbreak of the new coronavirus pneumonia disease (COVID-19), of unknown etiology, appeared in Wuhan, the capital of Hubei Province in China (Chen et al., 2020). Thus, in March 2020, a few months after the onset of COVID-19, the World Health Organization (WHO) declared a pandemic caused by the new disease (WHO (World Health Organization) 2020). Due to the impact of the outbreak in Spain, the Spanish Government declared a national state of alarm and health alert on 14 March 2020. In addition to numerous deaths, the pandemic caused by COVID-19 has generated stress, agitation and anxiety among the population, for fear of contagion and its adverse consequences (Yenan Wang et al., 2020). Previous studies developed in China describe among other consequences of living in lockdown, increases in levels of stress, anxiety, depression and general emotional dysphoria in persons highly predisposed to these conditions (Cuiyan Wang et al., 2020). In this line, different studies conducted during the initial phases of expansion of the previous 2003 pandemic caused by Severe Acute Respiratory Syndrome (SARS) showed an

increase in psychiatric disorders. These disorders included: anxiety, depression, panic attacks, psychotic symptoms and even cases of suicide (Liu et al., 2003; Maunder et al., 2003).

One particularly vulnerable group could be pregnant women due to their condition. In fact, it is well known that during pregnancy the likelihood of experiencing mental disorders increases. For example, 22% of pregnant women have anxiety, and 12% experience depression (Palladino et al., 2012; Woody et al., 2017). Moreover, several studies conducted in different countries (United States, China, Canada, Italy, Turkey and Greece) suggest that the prevalence of anxiety and depression symptoms may have increased in pregnant women during the pandemic (Hessami et al., 2020; Liu et al., 2020; Wu et al., 2020).

A study carried out in Spain by Romero-Gonzalez et al. (2020), has shown that perceived stress, specific pregnancy stress, as well as insomnia are predictive variables in most anxiety and depressive symptoms related to COVID-19 in pregnant women. However, this study did not have a control group to compare the psychopathology of pregnant women prior to the pandemic and after the pandemic. We hypothesize an increase in the rate of mental health symptoms from before

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to during the pandemic, among women in Spain. Thus, the objective of this study was to analyze this psychological impact on pregnant women and the factors that may influence these effects. Specifically, the objective was to study the psychological health of pregnant women during the pandemic by evaluating psychopathological symptomatology and stress. In addition, we sought to understand how the different variables relating to the COVID-19 pandemic and the lockdown could affect the psychological state of pregnant women.

2. Methods

2.1. Participants

The sample was made up of a total of 200 pregnant women, aged on average 33.1 years ($SD = 4.6$), in their second or third trimesters of pregnancy ($X = 26.9$ weeks of pregnancy; $SD = 8.9$).

All study participants were informed about the procedure and objectives of the study and participated voluntarily. The inclusion criteria were as follow: being aged over 18 years; being pregnant; and knowing how to read and write in Spanish. The exclusion criteria consisted of being actively treated with psychopharmaceuticals.

Thus, the sample was made up of a total of 200 pregnant women divided into two groups: Pandemic Group (PG), consisting of 100 (50%) pregnant women evaluated with psychological assessment instruments during the COVID-19 pandemic; and Pre-Pandemic Group (PPG), consisting of 100 (50%) pregnant women who were evaluated prior to the pandemic.

Ethical approval for the study was granted by the Human Ethics Research Committee of the University of Granada, Spain (reference 1518/CEIH/2020).

2.2. Procedure

All questionnaires were created using Google Forms. Both groups of participants were recruited at San Cecilio University Hospital, Góngora and Mirasierra health centers in Granada. When the potential participants attended their pregnancy follow-up appointment with their midwife, they were given information about the study and were offered the possibility of participating. Later, the contact details of the women who consented to take part in the study were noted and the online questionnaires were subsequently sent to them. At this moment, they were also asked to put us in contact with potential participants to include them in the study.

Pre-Pandemic Group (PPG) participants were recruited and evaluated between March and June 2019. The PPG participants were part of a previous study called Gestastress. In addition to recruitment through their medical professionals, the participants in Pandemic Group (PG) were also recruited through various social network groups of pregnant women (through WhatsApp, Facebook and internet forums) and evaluated between March and June 2020, during the COVID-19 state of health emergency in Spain. The use of two groups in different years has already been used to study the effects of the pandemic on psychological health in the perinatal period (Zanardo et al., 2020).

2.3. Instruments

Sociodemographic, obstetric, and confinement related variables were collected using a questionnaire designed with the previously mentioned target for the present investigation. This questionnaire evaluated different dimensions related to the COVID-19 pandemic and the confinement, through dichotomous and Likert-type responses. The dimensions covered were: losses, leisure, fear of contagion and social support ("Have you recently suffered the loss of a loved one?"; "Have you taken advantage of the lockdown to spend time on hobbies, pending tasks, tidying, etc.?"; "From 0 to 10, how afraid are you of going out for fear of contagion?"; "Have you spoken to family or friends by phone or

audio-visual media during the lockdown?"). In addition, the following psychological assessment tools were used:

- The Symptom Checklist-90-Revised (SCL-90-R) (Derogatis, 1994; Caparros-Caparros et al., 2007): this is a 90-item scale scored using a 5-point Likert scale from 0 (never) to 4 (extremely). This instrument is used to assess 9 dimensions: Somatization, Obsession-compulsion, Interpersonal sensitivity, Depression, Anxiety, Hostility, Phobic anxiety, Paranoid ideation, and Psychoticism. The scale also has 7 extra items distributed among 3 global indexes of distress: the GSI, which measures overall psychological distress; the PSDI, which is used to measure the intensity of symptoms; and Positive Symptom Total, used to measure the number of self-reported symptoms. Using the author's instructions, the scores are transformed to percentiles (0-100). Percentiles ≥ 75 represent clinical symptoms in any of the subscale of this instrument. The nine dimensions show an acceptable reliability, with a Cronbach's alpha for internal consistency between 0.69 and 0.97 in its Spanish version (Caparros-Caparros et al., 2007).

- Perceived Stress Scale (PSS) (Cohen et al., 1983; Remor, 2006): the PSS provides information on the perception of general stress during the preceding month. It consists of 14 items scores on a 5-point Likert scale (0 = never, 1 = almost never, 2 = once in a while, 3 = often, 4 = very often). Scores range from 0 to 56 (higher scores represent higher levels of stress). Spanish reliability alpha's Cronbach coefficient is 0.81 (Remor, 2006).

- Prenatal Distress Questionnaire (PDQ) (Yali and Lobel, 1999; Caparros-Gonzalez et al., 2019): this is a 12-item scale that measures pregnancy-specific stress related to maternal concerns about pregnancy, such as medical problems, labor and delivery, physical symptoms, bodily changes and the baby's health. Responses are given using a 5-point Likert-type scale where 0 = not at all and 4 = very much. The Cronbach's alpha reliability coefficient is 0.71 in its Spanish version (Caparros-Gonzalez et al., 2019).

- Athens Insomnia Scale (AIS) (Soldatos et al., 2000; Portocarrero and Jiménez-Genchi, 2005): this scale has a self-administrated format and allows to evaluate the subjective presence of insomnia, based on the diagnostic criteria of the Classification of Mental Disorders and of Behavior (ICD-10) (World Health Organization, 1992). It is composed of a total of 8 items, the first 5 measure the difficulty of sleep induction, early awakening, nocturnal awakenings, total duration of sleep and overall sleep quality. The other three assess the daytime consequences of insomnia: daytime drowsiness, functioning and problems concerning the feeling of wellbeing. Cronbach's alpha reliability coefficient is 0.90 in its Spanish version (Portocarrero and Jiménez-Genchi, 2005).

2.4. Data analysis

The analyses were performed using the *Statistical Program for Social Sciences* (SPSS) version 25.0 package for Windows (SPSS, Armonk, New York). First, a series of comparisons were conducted between the groups to check whether the two groups were evenly homogenous regarding the main sociodemographic and obstetric variables. To do this, we used Student's *t*-test for continuous variables and the Chi-square test (χ^2) for the categorical variables.

Secondly, in order to verify whether there were differences between pregnant women during the COVID-19 pandemic versus pregnant women who had not experienced the pandemic, various Student's *t*-tests were performed on the major psychological variables. Prior to that, the normality of psychological variables was verified using the Kolmogorov-Smirnov test and homoscedasticity, using Levene's test. The assumptions of normality were met. In variables where significant differences were found, the size of the effect was subsequently calculated using Cohen's *d*, and interpreted based on the following values: small effect size > 0.20 , median effect size > 0.50 and large effect size > 0.80 (Cohen, 1988).

Finally, in order to verify which pandemic variables were related to the psychopathological symptoms presented, linear regressions were

performed. The dependent variables were the psychological variables for which significant differences were found between the groups; and the predictor variables were the variables related to the participants' lockdown.

3. Results

3.1. Sample description

A total of 200 pregnant women participated in the study. Pandemic Group (PG) ($n = 100$) formed by women who were pregnant during the COVID-19 pandemic and Pre-Pandemic Group (PPG) ($n = 100$), formed by women who were pregnant prior to the COVID-19 pandemic. The main sociodemographic and obstetric variables of the two groups were compared. No significant differences between them were found so they were homogenous. These results are shown in Table 1.

3.2. Differences in psychological symptomatology and stress between groups

Regarding differences in psychological symptoms between women who were pregnant during the COVID-19 pandemic (PG) versus women who were pregnant prior to the COVID-19 pandemic (PPG), the difference of Student's t -test means showed that significant differences existed in the depression dimensions of the SCL-90 [t x 3.493; p 0.001; (d) 0.50]; SCL-90 phobic [t x 2.185; p 0.030; (d) 0.31]; and in the PSS [t x 2.260; p 0.025; (d) 0.33]. PG obtained higher scores than PPG with an average effect size in the depression dimension of the SCL-90, and with a small effect size in the phobic anxiety dimension of the SCL-90 and in the PSS. No statistically significant differences were found between the groups in the other 7 dimensions of the SCL-90 or in the PDQ. The results are broken down in Table 2.

3.3. Lockdown variables as predictors of the psychological state

Finally, to verify that pandemic variables were predictors of psychological states in pregnant women, simple linear regressions were performed using the enter method including only PG. To do this, the

scores of the three variables that presented differences between groups were used as result variables: the two dimensions of SCL-90 (depression and phobic anxiety) and PSS scores. The objective was to know which pandemic variables and lockdown-related variables could be influencing the results obtained. The predictor variables in the three models were: insomnia scores obtained on the AIS; the answers to the question "Have you recently suffered the loss of a loved one? "; the answers to the question "Have you taken advantage of the lockdown to spend time on hobbies, pending tasks, tidying, etc.?" ; the answers to the question "From 0 to 10, how afraid are you of going out for fear of contagion?"; answers to the question "Have you spoken to family or friends by phone or audiovisual media during the lockdown?".

Thus, based on the first analysis, it was found that insomnia, together with having recently lost a loved one, increased the scores obtained in the depression dimension of the SCL-90, explaining 25% of the variance [$R^2 = 0.254$ ($F = 6.335$; $p = 0.001$)]. Regarding phobic anxiety of the SCL-90, it was found that the fear of contagion increased the scores obtained in this dimension, explaining 11% of the variance [$R^2 = 0.111$ ($F = 2.331$; $p = 0.048$)]. Finally, regarding the predictive variables of the PSS scores, it was found that insomnia increased perceived stress, this variable explaining 13% of the variance [$R^2 = 0.131$ ($F = 2.568$; $p = 0.033$)]. The results are shown in Table 3.

4. Discussion

The present study focused on the psychological health of pregnant women during the COVID-19 pandemic in Spain. The psychopathological symptoms and stress of a group of women who were pregnant prior to the COVID-19 pandemic were compared with that of a group of women who were pregnant during the COVID-19 pandemic. Finally, the factors that could potentially influence the differences found between both groups were studied.

First, the group of women who were pregnant during the COVID-19 pandemic (PG) were found to present more psychopathological symptoms than the group of women who did not experience the COVID-19 pandemic during their pregnancy (PPG). Specifically, PG showed higher levels of depression and phobic anxiety. These results support the data obtained in another similar situation: that of the previous 2003

Table 1
Sociodemographic and obstetric variables compared to Student and Chi-square t-tests.

	Pregnant women during the pandemic ($n = 100$) M (SD)	Pregnant women prior to the pandemic ($n = 100$) M(SD)	t	p
Age	33.20(4.71)	33.04(4.45)	.247	.805
Weeks of pregnancy	26.47(9.12)	27.26(8.70)	-0.628	.531
	Pregnant women during the pandemic ($n = 100$) n (%)	Pregnant women prior to the pandemic ($n = 100$) n (%)	χ^2	p
Sociodemographic variables				
Current couple	Yes 97(97%) No 3(3%)	95(95%) 5(5%)	.521	.470
Nationality	Spanish 93(93%) Immigrant 7(7%)	88(88%) 12(12%)	1.454	.228
Education level	Primary school 2(2%) Secondary school 26(26%) University 72(72%)	1(1%) 27(27%) 72(72%)	.352	.839
Obstetric information				
Primiparous	No 38(38%) Yes 62(62%)	46(46%) 54(54%)	1.314	.252
Pregnancy method	Spontaneous 89(89%) Fertility treatment 11(11%)	88(88%) 12(12%)	.049	.825
Previous miscarriages	0 71(71%) 1 21(21%) ≥ 2 8(8%)	68(68%) 23(23%) 9(9%)	.214	.898
Previous children	0 67(67%) 1 29(29%) ≥ 2 4(4%)	61(61%) 32(32%) 7(7%)	1.247	.536
Risk pregnancy	No 84(84%) Yes 16(16%)	78(78%) 22(22%)	1.170	.279

Table 2
Comparison of means through student *t*-test of psychological variables.

	Pregnant women during the pandemic (n = 100) M (SD)	Pregnant women prior to the pandemic (n = 100) M (SD)	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
SCL-90 Somatization	66.34 (22.97)	61.22 (24.08)	1.538	.126	0.22
SCL-90 Obsession-compulsion	71.65 (23.36)	69.14 (25.47)	.726	.469	0.10
SCL-90 Interpersonal sensitivity	54.66 (31.40)	54.91 (29.58)	-0.058	.954	0.01
SCL-90 Depression	65.17 (28.45)	51.56 (26.61)	3.493	.001**	0.50
SCL-90 Anxiety	64.56 (25.02)	63.26 (26.60)	.356	.722	0.05
SCL-90 Hostility	50.65 (32.07)	50.66 (29.66)	-0.002	.998	0.01
SCL-90 Phobic anxiety	66.59 (30.55)	56.45 (34.93)	2.185	.030*	0.31
SCL-90 Paranoid ideation	38.28 (33.60)	46.15 (35.19)	-1.617	.107	0.23
SCL-90 Psychoticism	54.28 (35.50)	60.80 (33.87)	-1.349	.179	0.19
SSP	25.76 (4.56)	24.14 (5.18)	2.260	.025*	0.33
PDQ	16.34 (6.68)	15.33 (5.72)	1.150	.252	0.16

Note: ** = *p* < 0.02; * = *p* < 0.05; SCL-90 = The Symptom Checklist-90- Revised; PSS = Perceived Stress Scale; PDQ = Prenatal Distress Questionnaire.

Table 3
Linear regressions with the variables of the pandemic and lockdown from the pregnant women of Pandemic Group as predictors.

	β	R-squared	<i>F</i>	<i>t</i>	<i>p</i>
IV: SCL-90 Depression		.254	6.335		.001**
Insomnia	2.745			4.889	.001**
Have you recently suffered the loss of a loved one?	21.237			2.596	.011**
Have you taken advantage of the lockdown to spend time on hobbies, pending tasks, tidying, etc.?	-0.416			-0.147	.883
From 0 to 10, how afraid are you of going out for fear of contagion?	1.422			1.310	.193
Have you spoken to family or friends by phone or audiovisual media during the lockdown?	-3.831			-1.381	.171
IV: SCL-90 Phobic anxiety		.111	2.331		.048*
Insomnia	.875			1.299	.197
Have you recently suffered the loss of a loved one?	5.956			.607	.545
Have you taken advantage of the lockdown to spend time on hobbies, pending tasks, tidying, etc.?	-2.947			-0.869	.387
From 0 to 10, how afraid are you of going out for fear of contagion?	3.618			2.780	.007**
Have you spoken to family or friends by phone or audiovisual media during the lockdown?	-3.554			-1.068	.288
IV: PSS		.131	2.568		.033*
Insomnia	.325			3.124	.002**
Have you recently suffered the loss of a loved one?	-0.308			-0.195	.846
Have you taken advantage of the lockdown to spend time on hobbies, pending tasks, tidying, etc.?	-0.038			-0.073	.942
From 0 to 10, how afraid are you of going out for fear of contagion?	-0.185			-0.932	.354
Have you spoken to family or friends by phone or audiovisual media during the lockdown?	-0.320			-0.620	.537

Note: ** = *p* < 0.02; * = *p* < 0.05; IV = independent variable; SCL-90- Revised = The Symptom Checklist-90; PSS = Perceived Stress Scale.

pandemic caused by SARS, during which an increase in anxiety and depression morbidity was found (Liu et al., 2003; Maunder et al., 2003). Furthermore, the results obtained are compatible with studies carried

out in other countries, in which an increase in anxiety and depression levels was found, as well as an increase in the severity of symptoms in this population. (Hessami et al., 2020; Liu et al., 2020; Wu et al., 2020).

Moreover, the group of women who were pregnant during the pandemic also showed higher levels of perceived stress than the group of women who were pregnant before the pandemic. Uncertainty, high contagion rate, high mortality rate and, consequently, fear of contracting the disease, jointly affecting the mother and foetus, may be stressors underlying these increases in levels in pregnant women during the pandemic, compared to those who were not pregnant in the pandemic (Craske and Stein, 2016). Thus, the radical change of life caused by lockdown could increase these stress levels in especially vulnerable populations such as that of pregnant women (Smith et al., 2020; Cuiyan Wang et al., 2020). Furthermore, it is worth noting that increases in these types of symptoms during pregnancy could lead to: an increased risk of postpartum depression, preeclampsia and hypertension, low foetal weight, premature delivery, and a greater risk of spontaneous abortion (Woods et al., 2010; Christian, 2012; Caparros-Gonzalez et al., 2017; Kaboli et al., 2017).

Regarding the variables related to this increase in psychopathology and stress, insomnia was found to increase depressive symptoms and stress. This relationship is well established scientifically, since insomnia is considered a precedent for depression (Fang et al., 2019). Reduced physical activity and decreased exposure to sunlight, as well as increased use of electronic devices (mobile phones, television, computers, etc.) could affect circadian rhythms (Voitsidis et al., 2020). Thus, several studies have found that levels of insomnia rose in the general population during the COVID-19 pandemic (Huang and Zhao, 2020; Kokou-Kpolou et al., 2020; Rossi et al., 2020; Voitsidis et al., 2020). However, it is important to mention that the relationship between insomnia and stress can be bidirectional, so insomnia could increase stress levels, and stress could increase insomnia levels (Garefelt et al., 2020). On the other hand, having recently lost a loved one was also found to influence depressive symptom increases. This latter fact is highly coherent, as the emotions of sadness and depression are understood to be strongly associated with grief. Lastly, the fear of contagion by COVID-19 was found to increase phobic anxiety levels in this population. These results reflect that the steady increase in the number of deaths and infections caused by COVID-19, its serious threat to life and the uncertainty of the future due to lack of knowledge of the new disease and its evolution may have provoked fear among this population, thus increasing levels of specific phobia in response. Possibly as a method of self-protection (Cuiyan Wang et al., 2020).

Finally, the results of the study may have various explanatory factors. A number of previous studies have in fact demonstrated increases in psychological dysphoria, anxiety and depression during pandemics (Taha et al., 2014; Wheaton et al., 2012). A possible explanation may be the population having to personally confront the situation in order to adapt to an unconventional context and its uncertain evolution. Thus,

this sudden and abrupt change may have had direct consequences on the lifestyle of the Spanish and international population, radically restricting people's liberty to leave their homes and move freely (Cornwell and Laumann, 2015; Santini et al., 2020). For pregnant women, this may be an even greater source of anxiety and stress, since awareness of a direct biological connection to the foetus could lead to a higher state of alertness and self-protection (Wu et al., 2020). Moreover, concerns linked to the economic crisis deriving from the COVID-19 health crisis may affect pregnant women's future prospects of quality of life and the upbringing of their children, an uncertainty that could increase these depressive symptoms. In addition, the media's constant streaming (press, radio, television, etc.) of the severity and lethality of the virus may also play a key role in increasing symptoms of anxiety, depression and psychological dysphoria (Smith et al., 2020).

Regarding the study's limitations, it is worth mentioning that the psychological evaluation instruments used were limited to the psychological state experienced in the last month. It was not possible to follow-up on the participants' psychological health throughout the COVID-19 pandemic. This would have been of interest, as it would have allowed examining the psychological variances according to the different weeks of the pandemic. Beside, it would be interesting to study in which trimesters of pregnancy women are more vulnerable to stress and psychopathology for future interventions. In addition, in the future, it would be important to also evaluate the fathers' psychological states, to understand how the pandemic and lockdown may affect their psychological health. On the other hand, the fact that the two group of women were recruited through different means (the first through a provider, and the other through a provider and social networks), and the use of some single-item variables used in the regression models are methodological limitation of this research. Therefore, the results should be interpreted with caution. Finally, it is important to note that the evaluation of Pandemic Group was carried out during the lockdown due to the COVID-19 pandemic in Spain. Therefore, it is possible that apart from the COVID-19 pandemic, the lockdown may have influenced the increase in the psychopathological symptoms and stress in the participants.

4.1. Conclusions

Pregnant women are particularly vulnerable to anxious and depressive symptomatology (Palladino et al., 2012; Woody et al., 2017) which, based on the results of this study, could increase in situations of pandemic and lockdown.

These results are compatible with studies that showed that pandemics were a precursor of an increase in psychopathological symptomatology and could affect pregnant women's mental health. In addition, the factors of insomnia, the recent loss of a loved one, and the fear of contagion by COVID-19 medium were found to predict an increase or decrease in this symptomatology. However, this is the only study in Spain that shows that pregnant women during the pandemic suffer more stress and psychopathology than pregnant women in the previous year, prior to the pandemic, highlighting which psychopathological symptoms are most affected, which gives us key information for the intervention.

To finish, the finding, in this study, that pregnant women's psychological health worsened during the COVID-19 pandemic reveals the need to encourage the use of psychological tools that have proven to be effective in reducing both stress and psychological discomfort in this population (Romero-Gonzalez et al., 2020b). One such tool would be cognitive behavioral therapy.

Ethical approval

Ethical approval for the study was granted by the Human Ethics Research Committee of the University of Granada (reference 1518/CEIH/2020).

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CRediT authorship contribution statement

Jose A. Puertas-Gonzalez: Conceptualization, Methodology, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Carolina Mariño-Narvaez:** Conceptualization, Methodology, Data curation. **Maria Isabel Peralta-Ramirez:** Funding acquisition, Conceptualization, Methodology. **Borja Romero-Gonzalez:** Formal analysis, Writing - review & editing, Supervision.

Declaration of Competing Interest

All the authors have declared no conflicts of interest and have approved of the submission of the manuscript entitled "The psychological impact of the COVID-19 pandemic on pregnant women".

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References

- Caparros-Caparros, B., Villar-Hoz, E., Juan-Ferrer, J., Viñas-Poch, F., 2007. Symptom Check-List-90-R: reliability, normative data, and factor structure in university students | Symptom Check-List-90-R: fiabilidad, datos normativos y estructura factorial en estudiantes universitarios. *Int. J. Clin. Health Psychol.*
- Caparros-Gonzalez, R.A., Perra, O., Alderdice, F., Lynn, F., Lobel, M., García-García, I., Peralta-Ramírez, M.I., 2019. Psychometric validation of the prenatal distress questionnaire (PDQ) in pregnant women in Spain. *Women Health*. <https://doi.org/10.1080/03630242.2019.1584143>.
- Caparros-Gonzalez, R.A., Romero-Gonzalez, B., Strivens-Vilchez, H., Gonzalez-Perez, R., Martínez-Augustin, O., Peralta-Ramírez, M.I., 2017. Hair cortisol levels, psychological stress and psychopathological symptoms as predictors of postpartum depression. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0182817>.
- Chen, Q., Liang, M., Li, Y., Guo, J., Fei, D., Wang, L., He, L., Sheng, C., Cai, Y., Li, X., Wang, J., Zhang, Z., 2020. Mental health care for medical staff in China during the COVID-19 outbreak. *Lancet Psychiatry*. [https://doi.org/10.1016/S2215-0366\(20\)30078-X](https://doi.org/10.1016/S2215-0366(20)30078-X).
- Christian, L.M., 2012. Physiological reactivity to psychological stress in human pregnancy: current knowledge and future directions. *Prog. Neurobiol.* <https://doi.org/10.1016/j.pneurobio.2012.07.003>.
- Cohen, J., 1988. *Statistical Power Analysis For the Behavioral Sciences (revised ed.)*. Academic Press, New York.
- Cohen, S., Kamarck, T., Mermelstein, R., 1983. A global measure of perceived stress. *J. Health Soc. Behav.* <https://doi.org/10.2307/2136404>.
- Cornwell, B., Laumann, E.O., 2015. The health benefits of network growth: new evidence from a national survey of older adults. *Soc. Sci. Med.* <https://doi.org/10.1016/j.socscimed.2013.09.011>.
- Craske, M.G., Stein, M.B., 2016. Anxiety. *Lancet*. [https://doi.org/10.1016/S0140-6736\(16\)30381-6](https://doi.org/10.1016/S0140-6736(16)30381-6).
- Derogatis, L., 1994. *The SCL-90-R symptom checklist 90-R administration, scoring, and procedures manual*. *Int. J. Clin. Health Psychol.*
- Fang, H., Tu, S., Sheng, J., Shao, A., 2019. Depression in sleep disturbance: a review on a bidirectional relationship, mechanisms and treatment. *J. Cell Mol. Med.* <https://doi.org/10.1111/jcmm.14170>.
- Garefelt, J., Platts, L.G., Hyde, M., Magnusson Hanson, L.L., Westerlund, H., Åkerstedt, T., 2020. Reciprocal relations between work stress and insomnia symptoms: a prospective study. *J. Sleep Res.* <https://doi.org/10.1111/jsr.12949>.
- Hessami, K., Romanelli, C., Chiurazzi, M., Cozzolino, M., 2020. COVID-19 pandemic and maternal mental health: a systematic review and meta-analysis. *J. Matern. Fetal Neonatal Med.* <https://doi.org/10.1080/14767058.2020.1843155>.
- Huang, Y., Zhao, N., 2020. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Res.* <https://doi.org/10.1016/j.psychres.2020.112954>.

- Kaboli, K.S., Mahmoodi, Z., Tourzani, Z., Tehranizadeh, M., Kabir, K., Dolatian, M., 2017. The effect of group counseling based on cognitive-behavioral approach on pregnancy-specific stress and anxiety. *Shiraz E Med. J.* <https://doi.org/10.5812/semj.45231>.
- Kokou-Kpolou, C.K., Megalaki, O., Laimou, D., Kousouri, M., 2020. Insomnia during COVID-19 pandemic and lockdown: prevalence, severity, and associated risk factors in France population. *Psychiatry Res.* <https://doi.org/10.1016/j.psychres.2020.113128>.
- Liu, C.H., Erdei, C., Mittal, L., 2020. Risk factors for depression, anxiety, and PTSD symptoms in perinatal women during the COVID-19 Pandemic. *Psychiatry Res.* <https://doi.org/10.1016/j.psychres.2020.113552>.
- Liu, T.B., Chen, X.Y., Miao, G.D., Zhang, L., Zhang, Q., Cheung, T., 2003. Recommendations on diagnostic criteria and prevention of SARS-related mental disorders. *J. Clin. Psychol. Med.*
- Maunder, R., Hunter, J., Vincent, L., Bennett, J., Peladeau, N., Leszcz, M., Sadavoy, J., Verhaeghe, L.M., Steinberg, R., Mazzulli, T., 2003. The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. *CMAJ.*
- World Health Organization, 1992. *The ICD-10 Classification of Mental and Behavioural Disorders: Diagnostic Criteria for Research.* World Health Organization.
- Palladino, C.L., Singh, V., Campbell, J., Flynn, H., Gold, K.J., 2012. Homicide and suicide during the perinatal period. *Obstet. Gynecol.* <https://doi.org/10.1097/aog.0b013e31825888c7>.
- Portocarrero, A.N., Jiménez-Genchi, A., 2005. Estudio de validación de la traducción al Español de la Escala Atenas de Insomnio. *Salud Ment.*
- Remor, E., 2006. Psychometric properties of a European Spanish version of the perceived stress scale (PSS). *Span. J. Psychol.* <https://doi.org/10.1017/S1138741600006004>.
- Romero-Gonzalez, B., Puertas-Gonzalez, J.A., Mariño-Narvaez, C., Peralta-Ramirez, M.I., 2020a. Variables del confinamiento por COVID-19 predictoras de sintomatología ansiosa y depresiva en mujeres embarazadas. *Med. Clín.* <https://doi.org/10.1016/j.medcli.2020.10.002>.
- Romero-Gonzalez, B., Puertas-Gonzalez, J.A., Strivens-Vilchez, H., Gonzalez-Perez, R., Peralta-Ramirez, M.I., 2020b. Effects of cognitive-behavioural therapy for stress management on stress and hair cortisol levels in pregnant women: a randomised controlled trial. *J. Psychosom. Res.* <https://doi.org/10.1016/j.jpsychores.2020.110162>.
- Rossi, R., Succi, V., Talevi, D., Mensi, S., Niolu, C., Pacitti, F., Marco, A.Di, Rossi, A., Siracusano, A., Lorenzo, G.Di, 2020. COVID-19 pandemic and lockdown measures impact on mental health among the general population in Italy. An $N=18147$ web-based survey. *medRxiv.* <https://doi.org/10.1101/2020.04.09.20057802>.
- Santini, Z.I., Jose, P.E., York Cornwell, E., Koyanagi, A., Nielsen, L., Hinrichsen, C., Meilstrup, C., Madsen, K.R., Koushede, V., 2020. Social disconnectedness, perceived isolation, and symptoms of depression and anxiety among older Americans (NSHAP): a longitudinal mediation analysis. *Lancet Public Health.* [https://doi.org/10.1016/S2468-2667\(19\)30230-0](https://doi.org/10.1016/S2468-2667(19)30230-0).
- Smith, L., Jacob, L., Yakkundi, A., McDermott, D., Armstrong, N.C., Barnett, Y., López-Sánchez, G.F., Martin, S., Butler, L., Tully, M.A., 2020. Correlates of symptoms of anxiety and depression and mental wellbeing associated with COVID-19: a cross-sectional study of UK-based respondents. *Psychiatry Res.* <https://doi.org/10.1016/j.psychres.2020.113138>.
- Soldatos, C.R., Dikeos, D.G., Paparrigopoulos, T.J., 2000. Athens Insomnia Scale: validation of an instrument based on ICD-10 criteria. *J. Psychosom. Res.* [https://doi.org/10.1016/S0022-3999\(00\)00095-7](https://doi.org/10.1016/S0022-3999(00)00095-7).
- Taha, S., Matheson, K., Cronin, T., Anisman, H., 2014. Intolerance of uncertainty, appraisals, coping, and anxiety: the case of the 2009 H1N1 pandemic. *Br. J. Health Psychol.* <https://doi.org/10.1111/bjhp.12058>.
- Voitsidis, P., Gliatas, I., Bairachtari, V., Papadopoulou, K., Papageorgiou, G., Parlapani, E., Syngelakis, M., Holeva, V., Diakogiannis, I., 2020. Insomnia during the COVID-19 pandemic in a Greek population. *Psychiatry Res.* <https://doi.org/10.1016/j.psychres.2020.113076>.
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R.S., Choo, F.N., Tran, B., Ho, R., Sharma, V.K., Ho, C., 2020. A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav. Immun.* <https://doi.org/10.1016/j.bbi.2020.04.028>.
- Wang, Y., Di, Y., Ye, J., Wei, W., 2020. Study on the public psychological states and its related factors during the outbreak of coronavirus disease 2019 (COVID-19) in some regions of China. *Psychol. Health Med.* <https://doi.org/10.1080/13548506.2020.1746817>.
- Wheaton, M.G., Abramowitz, J.S., Berman, N.C., Fabricant, L.E., Olatunji, B.O., 2012. Psychological predictors of anxiety in response to the H1N1 (swine flu) pandemic. *Cognit. Ther. Res.* <https://doi.org/10.1007/s10608-011-9353-3>.
- WHO (World Health Organization), 2020. *Statement on the Meeting of the International Health Regulations (2005) Emergency Committee Regarding the Outbreak of Novel Coronavirus (2019-nCoV).* WHO. News.
- Woods, S.M., Melville, J.L., Guo, Y., Fan, M.Y., Gavin, A., 2010. Psychosocial stress during pregnancy. *Am. J. Obstet. Gynecol.* <https://doi.org/10.1016/j.ajog.2009.07.041>.
- 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. *J. Affect. Disord.* <https://doi.org/10.1016/j.jad.2017.05.003>.
- Wu, Y., Zhang, C., Liu, H., Duan, C., Li, C., Fan, J., Li, Hong, Chen, L., Xu, H., Li, Xiangjuan, Guo, Y., Wang, Y., Li, Xiufeng, Li, J., Zhang, T., You, Y., Li, Hongmei, Yang, S., Tao, X., Xu, Y., Lao, H., Wen, M., Zhou, Y., Wang, J., Chen, Y., Meng, D., Zhai, J., Ye, Y., Zhong, Q., Yang, X., Zhang, D., Zhang, J., Wu, X., Chen, W., Dennis, C.-L., Huang, H., 2020. Perinatal depressive and anxiety symptoms of pregnant women along with COVID-19 outbreak in China. *Am. J. Obstet. Gynecol.* <https://doi.org/10.1016/j.ajog.2020.05.009>.
- Yali, A.M., Lobel, M., 1999. Coping and distress in pregnancy: an investigation of medically high risk women. *J. Psychosom. Obstet. Gynaecol.* <https://doi.org/10.3109/01674829909075575>.
- Zanardo, V., Manghina, V., Giliberti, L., Vettore, M., Severino, L., Straface, G., 2020. Psychological impact of COVID-19 quarantine measures in northeastern Italy on mothers in the immediate postpartum period. *Int. J. Gynecol.* <https://doi.org/10.1002/ijgo.13249>.