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## Pandemic-related pregnancy stress among pregnant women during the COVID-19 pandemic in Spain

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### ABSTRACT

**Objective:** The aim was to develop and establish the psychometric properties of the Pandemic-Related Pregnancy Stress Scale (PREPS) in European Spanish speaking pregnant women in Spain.

**Design:** A cross section design using a non-random sample of 206 women completed the questionnaire during the first COVID-19 pandemic lockdown from April to June 2020 in Spain. Psychological, sociodemographic and obstetric factors and the new PREPS were collected.

**Results:** Bartlett's test of sphericity ( $\chi^2(105) = 580.36, p < .001$ ), and KMO = .79 confirmed appropriateness for factor analysis of the PREPS. Confirmatory factor analyses based on the factor structure of the original USA English version of this instrument confirmed three factors - Preparedness Stress (7 items), Perinatal Infection Stress (5 items), and Positive Appraisal (3 items). The 15-item version of the PREPS demonstrates internal consistency and reliability are adequate ( $\alpha > .77$ ), and for F1 - Preparedness ( $\alpha > .65$ ), for F2 - Infection ( $\alpha > 0.60$ ) and for F3 - Positive appraisal ( $\alpha > .55$ ). The three factors exhibited good inter-item correlations, (F1 – Preparedness: .21; F2 – Infection: .23, and F3 – Positive Appraisal: .29). Convergent validity was examined through the Pearson's correlation coefficients of the PREPS with the Perceived Stress Scale (PSS) and the Prenatal Distress Questionnaire (PDQ). Correlation between PREPS total and PSS was high, and moderate with PDQ ( $p < .05$ ).

**Conclusion:** The psychometric properties of the Spanish version of the PREPS make it a valuable psychological measure to assess pandemic-related stress among pregnant women.

### Introduction

The COVID-19 pandemic is having a tremendous impact on pregnant women. Since the World Health Organization declared that COVID-19 was a worldwide pandemic (WHO, 2020), restrictions related to maternal care emerged. In many countries, including Spain, prenatal and postnatal appointments were cancelled or delivered by video-conference or telephone, accompaniment during delivery was restricted, wearing a mask was compulsory, and breastfeeding was in some places discouraged (de Freytas-Tamura 2020; Gupta, 2020). In addition, evidence on the potential impact of COVID-19 on maternal and neonatal health was not clear (Caparros-Gonzalez, 2020, b; Knight et al., 2020). Furthermore, pregnant women have been facing a wide range of pandemic-

related stressors such as restriction of movement, social isolation, financial difficulties, homeschooling, remote work and an increase in intimate partner violence (RCOG, 2020).

Previous studies have reported that high levels of maternal stress during pregnancy, including maternal exposure to natural disasters, such as the Spanish flu pandemic in 1918, can have detrimental effects on both the mother and the fetus (Helgertz et al., 2019). Some preliminary studies suggest that the COVID-19 pandemic is associated with high levels of stress and mental health problems (Holmes et al., 2020).

In the context of the present pandemic, there is an urgent need to investigate the potential negative effects of psychological stress during pregnancy (Abdoli et al., 2020). In this respect, it is crucial to develop

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psychometrically validated instruments to assess the potential impact of the pandemic on pregnant women. The Pandemic-Related Pregnancy Stress Scale (PREPS) has been developed to specifically assess stress-related consequences of the pandemic on pregnant women and their neonates (Preis et al., 2020a; Preis et al., 2020b). The PREPS is a novel measure originally developed to assess pandemic-related stress among English speaking pregnant women in the USA (Preis et al., 2020a). In addition, a Polish, Italian and German version have been adapted and validated, in which the 3 factors identified in the American version were confirmed (Ilska et al., 2021; Penengo et al., 2021; Schaal et al., 2021). Validation studies demonstrate the importance of culturally adapted instruments to measure both content and construct, demonstrating sensitivity and reliability in the evaluated sample. In Spain, there is no instrument to help assess stress levels related to COVID-19 in pregnant women. Considering the lack of instruments to assess pandemic-related stress, the aim of this study was to develop and establish the psychometric properties of the Pandemic-Related Pregnancy Stress Scale (PREPS-S) in European Spanish speaking pregnant women in Spain.

## Methods

### Sample

Eligible participants were selected according to the definition established on the Pregnancy Health Document for a low-risk pregnancy (Andalusian Ministry of Health 2014a): spontaneous pregnancy, absence of medical diseases, and a singleton pregnancy. Inclusion criteria also included proficiency in the Spanish language and  $\geq 18$  years old. A total of 262 participants were invited to participate while attending an antenatal appointment with a midwife in the South of Spain during the COVID-19 pandemic from April to June 2020. Forty-one women declined to participate due to lack of time and 15 women were excluded from analyses due to the information provided was sociodemographic data. The final sample consisted on 206 pregnant women. Participants were recruited from the Department of Obstetrics and Gynecology of the Hospital de Antequera through consecutive admissions. The sample size of  $N = 206$  was above the minimum requirement of  $N = 150$  to conduct a confirmatory factor analysis (CFA) of the 15-item PREPS (Schreiber et al., 2006).

### Study measures

The PREPS is a novel instrument consisting of 15 items to specifically assess COVID-19 related stress; the original version of this measure was developed in the USA during the COVID-19 pandemic (Preis et al., 2020a). The original 15-item version (Preis et al., 2020a) comprises three factors related to 1) stress about lack of preparation for birth, delivery and the postpartum (7 items; e.g., "I am concerned that the pandemic may ruin my birth plans"); 2) stress associated with worries and concerns about the infection (5 items; e.g., "I am concerned that my baby may contract COVID-19 in the hospital after birth"); and 3) perceiving benefits of being pregnant during the pandemic (3 items; e.g., "I feel that being pregnant is giving me strength during the pandemic"), with responses on a 5-point Likert scale ranging from 1 (Very little) to 5 (Very much). The three factors were respectively labeled as: PREPS-Preparedness, PREPS-Infection, and PREPS-Positive Appraisal (Preis et al., 2020a). The Polish version corroborates the 3-factor solution (Ilska et al., 2021).

### PREPS translation procedure

The translation from English into Spanish and the back translation were carried out to certify understanding of the items. Thus, two independent researchers (both of whom are Spanish and fluent in both languages) adapted the PREPS to Spanish and back translated it to English. Then, a committee of three experts, both in the PREPS-S construct

and in cross-cultural validations, reviewed the items for the preliminary version of the scale. They were researchers on maternal stress, familiar with the construct and experts in cross-cultural validation studies. Finally, a pilot study was conducted with a sample of 5 pregnant women, which demonstrated that the PREPS was clearly understood. Then, the final version of the PREPS-S was consolidated and data collection began. The instrument was applied in order to verify the comprehension of the items, important for the content validity. The majority of the selected participants were pregnant women from Spain, with a low-risk pregnancy, age ranging from 25-30 years old, and attending a public hospital. This process was carried out in accordance with the international guidelines for cross-cultural adaptations of questionnaires (Epstein et al., 2015; Martin and Savage-McGlynn, 2013).

The convergent validity of the PREPS-S was evaluated through associations with two psychological stress measures:

The Spanish version of the 12-item Prenatal Distress Questionnaire (PDQ) was used to assess pregnancy-specific stress, including worries and concerns pregnant women have about medical problems, labor and delivery, relationships, parenting and the health of the baby (Caparros-Gonzalez et al., 2019a, Yali and Lobel, 1999; Ibrahim and Lobel, 2020). Responses are on a 5-point Likert scale ranging from 0 (Not at all) to 4 (Extremely). Responses are summed and provide a prenatal stress score ranging from 0 to 48. A cut-off point has to be developed for this instrument. A higher score is indicative of a higher level of pregnancy-specific stress. The mean score obtained in Spain in a previous study conducted before the COVID-19 pandemic was 15 (Caparros-Gonzalez, 2020). The Cronbach's alpha reliability coefficient of the Spanish version is  $\alpha = .74$  (Caparros-Gonzalez et al., 2019a), and  $\alpha = .72$  in this study. The PDQ was used on the psychometric validation of the PREPS-S due to its capacity to measure a similar construct (pregnancy-specific stress) associated with maternal stress during pregnancy. In this respect, items of the PDQ associated with the PREPS-S are as follows: "I am anxious about labor and delivery"; "The possibility of a premature delivery frightens me"; "I worry about having an unhealthy baby".

The Perceived Stress Scale (PSS) assesses perceptions of general stress during the last month. The Spanish version of the 14-item PSS was used (Cohen et al., 1983, Remor 2006). Responses are on a 5-point Likert scale from 0 (never) to 4 (very often). The score ranges from 0 to 56. The Spanish mean in the validation study was 25 (Remor, 2006), and the cut-off point is 23.49 (Cohen & Janicki-Deverts, 2012). The Cronbach's alpha reliability coefficient of the Spanish version is  $\alpha = .81$ ,  $\alpha = .79$  in this study. Some of the items that are included in the PSS are: "Have you been affected by something unexpected"; "Are you feeling that you have effectively coped with the major changes in your life"; "I felt that I had everything under control".

Socio-demographic and obstetric data were collected through the Pregnancy Health Document (AMH, 2014b). Obstetric variables included gravidity (primigravid vs. multigravid), weeks of gestation and previous miscarriages.

### Statistical Analysis

A Confirmatory Factor Analysis (CFA) using the Maximum Likelihood estimator was conducted on the 15 PREPS items which were identified as indicators of three underlying dimensions (Preis et al., 2020a). Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) were conducted to ensure the PREPS-S items were suitable for factor analyses. Adequate model fit was indicated by a Comparative Fit Index (CFI) over .90, Root Mean Squared Error of Approximation (RMSEA) less than .08 with a non-significant p-value, and Standardized Root Mean Square Residual (SRMR) less than .08 (Hu & Bentler, 1999). Modification Indices (MI) with high values and Standardized Expected Parameter Change (SEPC) equal to or greater than a positive value of .20 (Whittaker, 2012) were considered to improve the model (e.g., by including correlations between residual item variances supported by theory, see Results). The initial and the modified model were compared

using the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) indices (a smaller value indicates a better fit), as well as using the method by Satorra and Bentler (2010) to confirm significant differences in favor of the new model.

Internal consistency analyses of the PREPS-S were conducted using Cronbach’s alpha coefficients. Values > .70 were considered satisfactory (Kline, 2000).

Pearson’s correlation coefficients were evaluated to examine convergent validity between the three PREPS-S factors and other concurrent measures of stress during pregnancy (Carlson and Herdman, 2012).

The psych package (Revelle, 2011) for R (R Core Team, 2020) was used for Bartlett’s test of sphericity, KMO, internal consistency, and convergent validity analyses. The CFA was run using the lavaan package (Rosseel, 2012) for R (R Core Team, 2020).

**Ethics**

This study was approved by the Biomedical Ethics Research Committee of Andalusia (Spain) named PEIBA, Number 0904-N-20. The study also conformed with guidelines of the Helsinki Declaration (AMM) and the Good Clinical Practice Directive (Directive 2005/28/EC) of the European Union for human research. Participation was voluntary. An informed written consent document was signed by every participant.

**Results**

*Sociodemographic characteristics and obstetric history*

The participants’ mean age was 32.23 years (SD = 5.48) and the mean length of pregnancy at the time of assessment was 25.77 weeks (SD = 10.45). A total of 97.1% (n = 200) of participants had a singleton pregnancy, and type of pregnancy was spontaneous (natural) for 91.7% (n = 189), while 8.3% (n = 17) used assisted reproductive technology. All pregnant women in this study attended the free public health system. Complete information regarding sociodemographic variables, obstetric history, and stress levels is displayed in Table 1.

The mean score for each of the PREP-S factors was: Preparation = 3.51, Infection = 3.10, Positive Evaluation = 3.10. The mean score regarding the PSS = 25.60, and PDQ = 23.45.

*Confirmatory Factor Analysis*

Correlations among the 15 items of the PREPS-S are shown in Fig. 1. Bartlett’s test of sphericity ( $\chi^2(105) = 580.36, p < .001$ ), and KMO = .79 confirmed appropriateness for factor analysis. The initial run of the CFA did not indicate adequate model fit (i.e. Model 1), see Table 2. The modified model including associations between residual covariances of some items (Model 2) performed significantly better than the initial model ( $\Delta\chi^2(5) = 45.83, p < .001$ ), showing acceptable fit (see Table 2). Associations between residual item variances are displayed in Fig. 2. Model 2 indicates that all of the items were significantly related to the underlying dimension at  $p < .05$  (see Fig. 2). The findings also indicate significant associations between the underlying dimensions, particularly between PREPS-S - Preparedness and PREPS - Infection (standardized coefficient = .945,  $p < .001$ ). Finally, associations between residual variances of items modeled in Fig. 2 were statistically significant ( $p < .05$ ).

*Internal consistency*

The internal consistency of the 15-item version of the PREPS-S is adequate for the total score ( $\alpha = .77$ ). As to the factors, Cronbach’s alpha was .65 for F1 – Preparedness (7 items), .60 for F2 – Infection (5 items), and .55 for F3 – Positive Appraisal (3 items). The three factors exhibited good inter-item correlations, .21 for F1 – Preparedness, .23 for F2 – Infection, and .29 for F3 – Positive Appraisal.

**Table 1**  
Sociodemographics, obstetric history, and stress levels of participants (N = 206).

Variables	Frequency (%)
<i>Sociodemographics</i>	
Country of origin	
Spain	80.1 (165)
South America	13.1 (27)
Europe (not Spain)	5.8 (12)
Russia	1 (.5)
Morocco	1 (.5)
Marital status	
Married/Cohabiting	92.7 (191)
Single/Divorced	7.2 (15)
Level of education completed	
Primary School	3.9 (8)
Secondary School	51 (105)
University	45.1 (93)
Employment situation	
Full-time	56.8 (117)
Part-time	16 (33)
Unemployed	27.2 (56)
Health insurance	
Public	58.3 (120)
Private	4.4 (9)
Both	37.4 (77)
<i>Obstetric history</i>	
Primigravid	
Yes	50 (103)
No	50 (103)
Weeks of gestation	
7–15	22.3 (46)
16–30	34 (70)
31–37	43.7 (90)
Previous miscarriages	
None	84 (173)
1 miscarriage	10.2 (21)
2 miscarriages	3.9 (8)
3 or more miscarriages	2 (4)
Intended pregnancy	
Yes	84.5 (174)
No	15.5 (32)
Stress evaluation	
PREPS - Preparedness	3.51 (0.73)
PREPS - Infection	3.58 (0.73)
PREPS - Positive Appraisal	3.10 (0.93)
PDQ	23.45 (3.79)
PSS	25.60 (3.51)

*Convergent validity*

Convergent validity was examined through the Pearson’s correlation coefficients of the PREPS-S with the PSS and the PDQ (Fig. 3). Pearson’s correlation between PSS and PDQ was .598,  $p = .000$ . Correlations between the PREPS-S factors and the PSS were high (F1 - Preparedness), moderate (F2 - Infection) and low (F3 - Positive appraisal), indicating that the PREPS-S and the PSS measure related aspects of stress. Factor 3 reflects the positive aspects of a stressful situation.

**Discussion**

The objective of this study was to establish the validity and reliability of the Spanish version of the Pandemic-Related Pregnancy Stress Scale

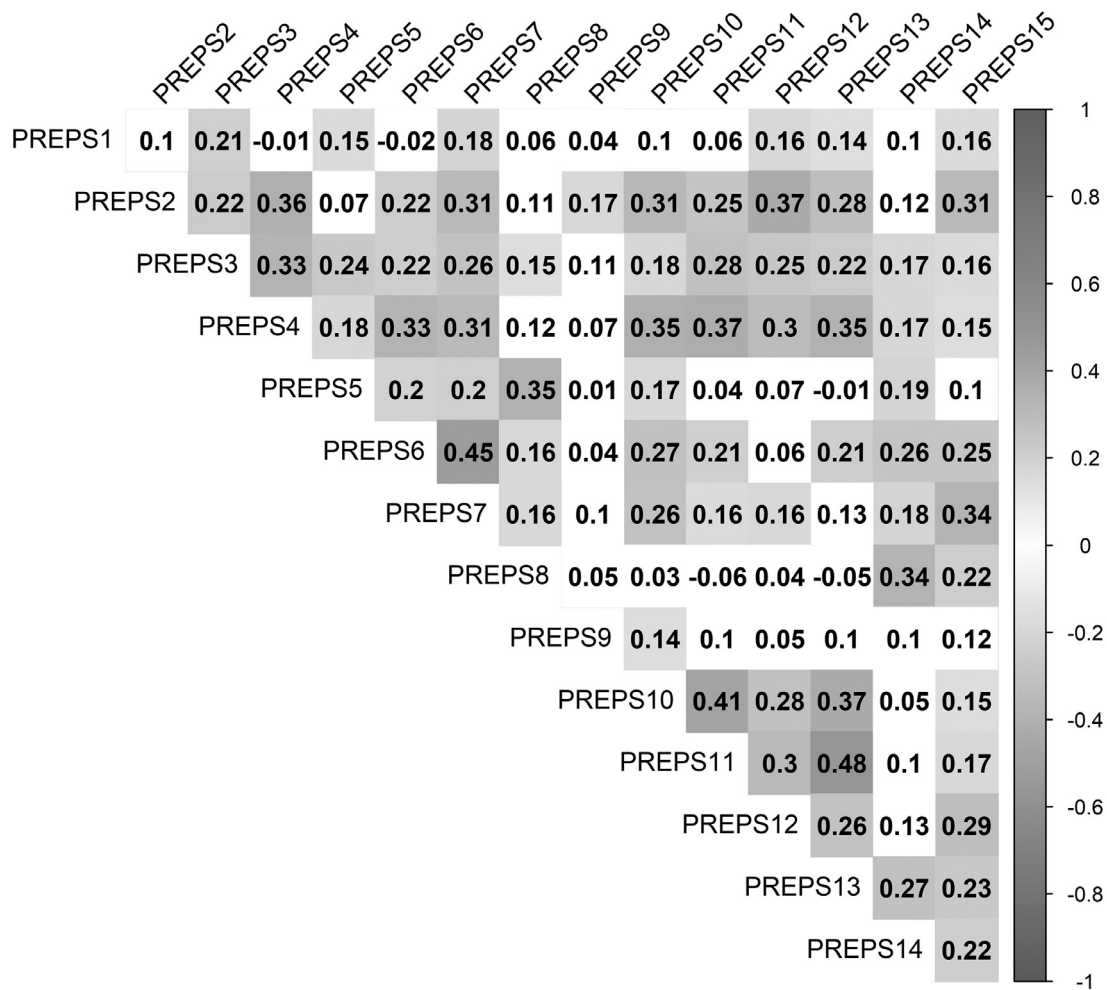


Fig. 1. No matter.

**Table 2**  
Fit of PREPS models.

	$\chi^2$ (df)	CFI	RMSEA [90% CI], p-value	SRMR	AIC	BIC	$\Delta\chi^2$ ( $\Delta$ df), p-value
Model 1	179.85(87)	.81	.07 [.06, .09], p = .009	.07	9758.52	9868.34	45.83(5), p < .001
Model 2	134.03(82)	.90	.05 [.04, .07], p = .31	.06	9720.70	9843.83	

Note. Model 1: Initial model; Model 2: Final model after including residual covariances;  $\chi^2$ (df): Chi-Square (degrees of freedom); CFI: Comparative Fit Index; RMSEA: Root Mean Squared Error of Approximation; SRMR: Standardized Root Mean Square Residual; AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion;  $\Delta\chi^2$  ( $\Delta$ df): Delta Chi-Square and degrees of freedom of the difference between model (Satorra and Bentler, 2010 method for models' comparison)

(PREPS-S) and to assess maternal stress levels associated to the COVID-19 pandemic. Findings in this study highlight the stressful impact the COVID-19 pandemic can have on pregnant women. The present study suggests that pandemic-related stress during pregnancy is a multidimensional construct. The PREPS-S is a psychometrically robust instrument to assess pandemic-related stress on pregnant women in Spain. The PREPS-S score in the Spanish sample was higher than in the American sample. We hypothesized that this finding is associated to a higher prevalence of infected individuals in Spain at the time of assessment. In addition, to the most severe lockdown measures were applied in Spain (Preis et al., 2020b).

In order to evaluate the psychometric properties of the PREPS-S, a confirmatory factor analysis was performed and based on the factorial solution, three factors were extracted: factor 1 refers to prepared-

ness: concerns regarding pregnancy and childbirth; factor 2 to infection: concerns regarding infection by COVID-19; and factor 3 to positive appraisal: perceiving benefits of being pregnant during the pandemic. These findings agree with the three-factor solution reported in the original version of the PREPS (Preis et al., 2020a).

Findings in the present study indicate that the PREPS-S is a reliable instrument to measure pandemic-related stress during pregnancy. Correlations of the PREPS-S factors with the PDQ were moderate (F1) and low (F2 and F3), which is also expected since factor 1 refers to concerns related to birth preparedness and factors 2 and 3 to infection and positive appraisal, respectively. Correlations of the PREPS-S total score with the PSS were high, and moderate with the PDQ. The rationale for using these measures (PSS, PDQ) lies on their appropriate psychometric prop-

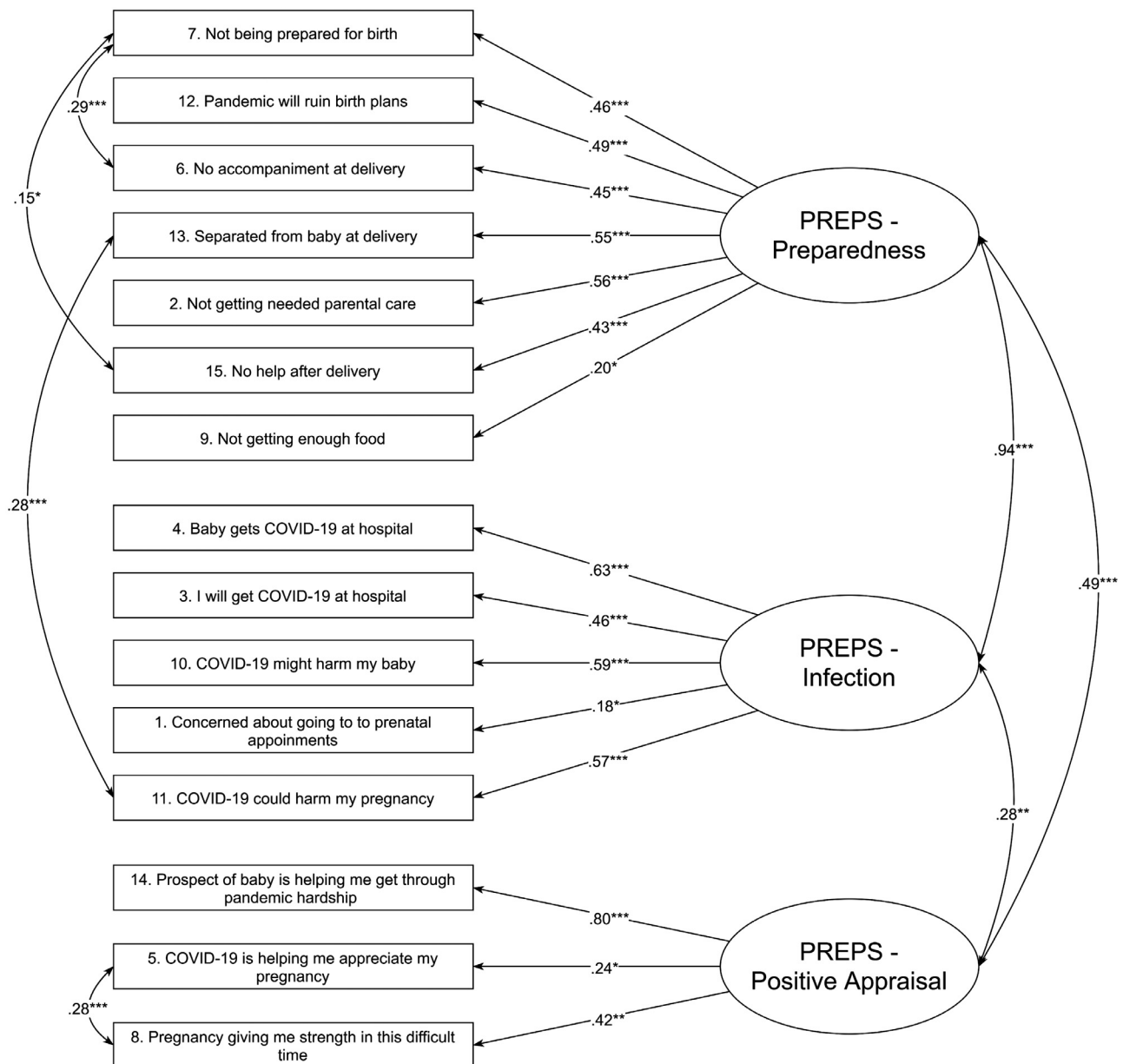


Fig. 2. No matter.

erties and a balance between perceived stress and pregnancy-specific stress (Caparros-Gonzalez, 2020; Remor, 2006).

In respect to the mean score reported in a previous study in the USA, the mean score for each factor was Preparation = 3.50, Infection = 3.40, and Healthy Prenatal Behaviors = 3.55 (Preis et al., 2020). These scores significantly correlated with anxiety symptoms in the aforementioned study. The concern of pregnant women about the possibility of infection has been demonstrated by the score on factor 2: infection.

To sum up, study findings offer healthcare providers and researchers a psychometrically robust tool to assess pandemic-related stress during pregnancy in Spain. Findings indicate that the PREPS-S is a valid and reliable instrument that can be used to design, deliver, and evaluate the effectiveness of a psychological intervention to reduce stress levels among Spanish pregnant women during the COVID-19 pandemic. Concerns associated to the medical condition of the fetus, the negative consequences of lockdown, remote pre and postnatal appointments and restrictions to access prenatal support during the perinatal period have been reported as potential sources that can improve maternal stress (Thapa et al., 2020;

Rashidi and Simbar, 2020). The use of the PREPS-S can help identifying pregnant women exposed to high levels of maternal stress (Thapa et al., 2020; Rashidi and Simbar, 2020). During the lockdown of the COVID-19 pandemic, online therapeutic interventions may have a key role (Rashidi and Simbar, 2020; Thapa et al., 2020; Grussu et al., 2020).

The COVID-19 pandemic has been reported to increase maternal stress and have a negative effect on the infant's health (Abdoli et al., 2020; Preis et al., 2020a). Pregnant women exposed to high levels of stress have been reported to develop postpartum depression (Caparros-Gonzalez et al., 2017) and have an adverse impact on their infant's length (Caparros-Gonzalez et al., 2019b). These events support the need to develop and adapt adequate measures to assess levels of stress among pregnant women during sensitive periods.

#### Limitations

Future studies using the PREPS-S should apply this measure to a wider sample from different cultural backgrounds. Prospective studies

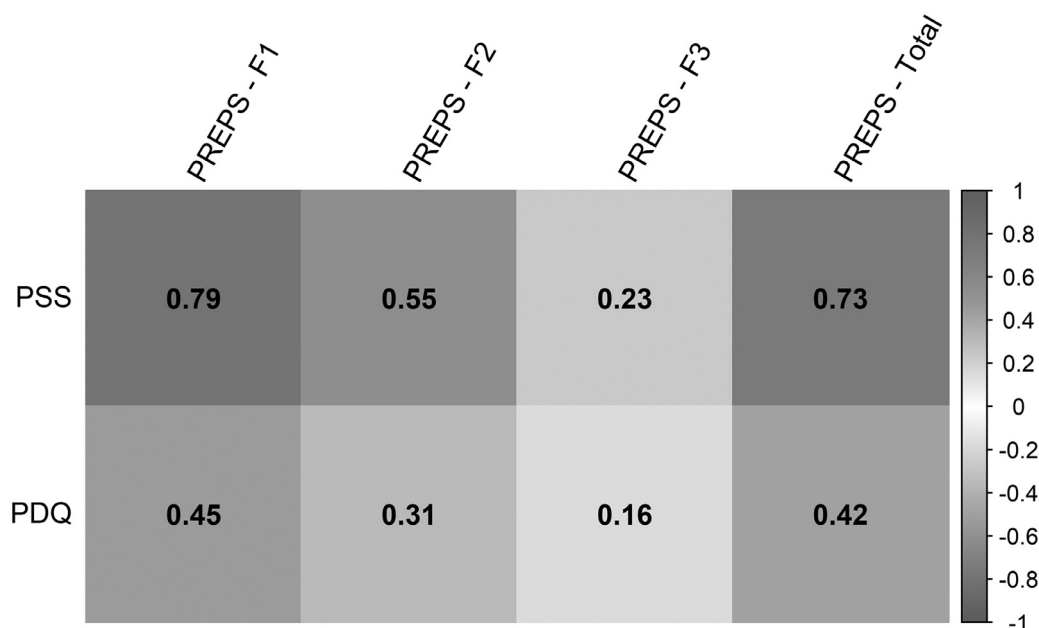


Fig. 3. No matter.

would be valuable to assess variability in responses and stability of the structure of the PREPS-S throughout pregnancy. Furthermore, this study was based on a relatively small sample, although it exceeds the minimum number of subjects to carry out psychometric analysis.

**Conclusions**

Findings confirm the presence and magnitude of pandemic-related stress in pregnant women during the COVID-19 pandemic. It is essential to have a valid and specific instrument to assess this specific type of stress during pregnancy. The PREPS-S provides information about stress levels during pregnancy associated to the COVID-19 pandemic. Pandemic-related stress appears as an independent construct. The PREPS-S is a valid and reliable instrument for pregnant Spanish women to assess COVID-19 related concerns about preparedness for birth and postpartum, infection, and positive appraisal, demonstrating its value for assessing stress and positive aspects that may reflect pregnant women’s resilience and successful coping.

**Declaration of Competing Interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**CRedit authorship contribution statement**

**Jaqueline Garcia-Silva:** Data curation, Writing – original draft, Writing – review & editing. **Alfonso Caracuel:** Writing – review & editing. **Alvaro Lozano-Ruiz:** Visualization, Investigation, Software, Validation, Writing – review & editing. **Fiona Alderdice:** Writing – review & editing. **Marci Lobel:** Writing – review & editing. **Oliver Perra:** Software, Validation, Writing – review & editing. **Rafael A. Caparros-Gonzalez:** Conceptualization, Methodology, Visualization, Investigation, Supervision, Writing – review & editing.

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