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ORIGINAL RESEARCH

Evaluating the Reliability and Validity of the Korean Version of the Pandemic-Related Pregnancy Stress Scale

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Purpose: This study aimed to translate the Pandemic-Related Pregnancy Stress Scale into Korean and validate the translated instrument.

Patients and Methods: After translating the instrument, seven items of two factors (preparedness and perinatal infection stress) were selected for content validity testing. Validity and reliability were evaluated using SPSS 25.0 and AMOS 26.0. An online survey, via Google Forms, was conducted from January 20 to January 26, 2022. Participants were 283 pregnant women in Korea who consented to participate in the study.

Results: Exploratory factor analysis revealed factor loadings on two factors of 0.64–0.87 with a total variance explained of 69.77%. Confirmatory factor analysis indicated good model fit (RMR = 0.03, RMSEA = 0.06, GFI = 0.98, SRMR = 0.03), and convergent and discriminant validity were established. Concurrent validity was established based on the correlation with the Revised Prenatal Distress Questionnaire (r = 0.45), and the reliability of the final instrument was indicated by Cronbach's α = 0.87.

Conclusion: The Pandemic-Related Pregnancy Stress Scale was validated for use in the Korean population. The Korean version of the Pandemic-Related Pregnancy Stress Scale can be utilized to measure pandemic-related stress in pregnant women.

Keywords: Pandemic-Related Pregnancy Stress Scale, PREPS, Korean women, COVID-19, pregnancy stress

Introduction

Rationale for the Study

Since the index case in 2019, coronavirus disease 2019 (COVID-19) has quickly spread globally and remains active.[1] The prolonged pandemic has caused collective trauma in societies and threatened the public's mental health, as evidenced by the increased incidence of emotional stress, weakened social support systems, and escalating severity of emotional disorders.[2]

Most pregnant women face various mental health problems during their pregnancy as a result of biological and psychological changes experienced during the process and in the transition of their roles in the family and society. It is common for negative emotions, such as stress, to progress to pathological disorders. The physical distancing measures and the economic implications of the pandemic can add an extra layer of stress to pregnant women's psychological state, making them more susceptible to mental health issues.[3,4]

An international study conducted during the COVID-19 pandemic reported that 43% of pregnant and postpartum women experience high levels of stress, with the prevalence of anxiety, or depression and loneliness being 31% and 53%, respectively.[5] These statistics could be a result of the collapse of the healthcare system for pregnant women, including restricted or delayed regular prenatal checkups and perinatal mental health services owing to the transition of the healthcare system into an emergency system in response to COVID-19 and the transition of prenatal and fetal screening

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for high-risk diseases (eg gestational diabetes, intrauterine growth restriction) to a remote system.[6–8] Moreover, social distancing measures implemented to halt the spread of infection curtailed pregnant women's opportunities to utilize social resources, and thus, isolated them. Additionally, family members' job loss or reduced income posed financial difficulties in preparing for childbirth. Fear of contracting COVID-19 and transmitting it to the fetus during pregnancy and birth, as well as the uncertainty of the repercussions of the disease, elevated the psychological distress of pregnant women.[9,10]

Excessive stress experienced by women during pregnancy may increase the risk of fetal neurodevelopmental disorders and may alter their frontoparietal, striatal, temporoparietal, and neuronal networks.[11] Stress during pregnancy intensifies anxiety and depressive symptoms and has a persistent impact in the postpartum period. Depression during pregnancy has an adverse impact on children's temperament, behavioral control, and developmental outcomes by altering the maternal neuroendocrine pathways and increasing pro-inflammatory cytokines.[12] Stress and anxiety during pregnancy can also lead to poor perinatal outcomes, such as preterm birth.[13]

Children born during the COVID-19 pandemic have shown markedly slower development and poorer language, motor, and overall cognitive functions presumably because pregnancy stress due to anti-infection measures reduces interactions between parents and children and influences fetal neurological development.[14,15] Pregnant women experience intensified stress caused by a multitude of factors during the COVID-19 pandemic, which in turn leads to maternal depression and anxiety that continue to affect them during the postpartum period. Despite the adverse effects of pandemic-related stress on fetal growth among pregnant women, systematic studies measuring COVID-19 pandemic-related stress among pregnant Korean women are lacking.

Thus far, the Pregnancy Instrument developed by Ahn,[16] which assesses anxiety or worries of the mother about the fetus, themselves, and their spouse,[16] has been the most widely used pregnancy-related scale in Korea. In recent years, Kim and Chung have translated the Korean version of the Pregnancy Stress Scale[17] and it has been used to assess physical and psychological changes, coping with daily living, maternal and fetal health, maternal roles, family support, healthcare services, social climate, and harmony with work life. However, the COVID-19 pandemic is a novel phenomenon that cannot be equated to any situation in the past; therefore, there are limitations to using existing instruments to assess pregnancy stress during the pandemic.

Thus, Preis et al[18] developed the Pandemic-Related Pregnancy Stress Scale (PREPS) to examine stress-related psychological characteristics among pregnant women in the United States;[18] this instrument has been validated for pregnant women in European countries, including Poland and Germany. However, the instrument is yet to be validated in Asian countries and thus cannot be used to analyze pandemic-related stress among pregnant women in Asia, particularly Korea, highlighting the need to validate the instrument for the Korean population. Therefore, this study validated the PREPS for pregnant Korean women so that the instrument can be utilized in subsequent studies to predict pandemic-related pregnancy stress and develop early interventions.

Aim

The study aimed to translate the PREPS into Korean and validate the translated instrument.

Materials and Methods

Participants and Data Collection

Pregnant women aged ≥ 19 years who provided informed consent were enrolled in the study. To validate an instrument, 5–10 participants are required for each item (75–150 participants overall for 15 items) for exploratory factor analysis (EFA). The recommended sample size for confirmatory factor analysis (CFA) using AMOS software is 200–400.[19] In the present study we enrolled 330 participants, factoring in possible withdrawals.

We posted an explanation of the study and linked it to a questionnaire on "Momsholic", the largest online community for pregnant women in Korea. A total of 330 women who voluntarily registered through the link and consented to participate were enrolled, and an online questionnaire was administered from January 20 to January 26, 2022. After excluding 47 questionnaires with missing responses, 283 were included in the final analysis.

Instruments

General and Obstetric Characteristics

Data on participants' general characteristics including age, religion, marital status, highest education level, occupation, economic status, and job loss and changes in income because of COVID-19 were collected.

The obstetric characteristics of the participants included gestational age, parity, planned pregnancy, type of pregnancy, method of pregnancy, high-risk pregnancy, cancellation of prenatal checkups because of COVID-19, diagnosis of COVID-19 during pregnancy, and self-quarantine for COVID-19 during pregnancy.

PREPS

The PREPS, developed by Preis et al,[18] was used to assess pandemic-related pregnancy stress. This 15-item tool assesses the following factors: perinatal infection stress (five items), preparedness stress (seven items), and positive appraisal (three items). Each item is rated on a five-point scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree), with a higher score indicating greater pandemic-related pregnancy stress. The reliability (Cronbach's α) of the instrument at the time of development was 0.86, 0.81, and 0.68 for perinatal infection stress, preparedness stress, and positive appraisal, respectively. In the present study, Cronbach's α was 0.87 for the overall instrument, 0.81 for preparedness stress, and 0.85 for perinatal infection stress.

Revised Prenatal Distress Questionnaire (Nu PDQ)

The Prenatal Distress Questionnaire (PDQ) was developed by Lobel et al[20] for pregnant women in the United States, and it has been validated and widely used in several countries, including Germany, Spain, China, and Korea. Kim and Chung[17] translated this instrument into Korean and validated it for use in Korea. The Korean version of the Nu PDQ comprises 17 items that are each rated on a three-point scale (0 = not at all, 1 = slightly, and 2 = very). Cronbach's α was 0.79 in Lobel et al[20] at the time of development and 0.87 in this study.

Procedure

Translation of the PREPS

After obtaining permission from the original author to translate the PREPS into Korean and use it, we translated the instrument in accordance with the World Health Organization guidelines through forward translation, expert panel review, and back translation.[21]

The forward translation of the PREPS was performed by a bilingual English education professor with expert knowledge of American culture. The translated tool was reviewed by a nursing professor for accuracy and language and was modified accordingly to finalize the preliminary translation. The preliminary Korean translation of the PREPS was back-translated without viewing the original scale by a bilingual nursing professor who majored in nursing and psychology in the United States. The translator and back-translator remained independent of each other. We emailed the back-translated PREPS to the original developer to confirm that the back translation did not markedly deviate from the original tool. We then reviewed and modified the tool upon discussion about expressions and terminology and finalized the translation.

Content Validity

The content validity of the Korean-translated PREPS [K-PREPS] was evaluated by an expert panel consisting of a women's health nursing professor, an obstetrics and gynecology specialist, and a nursing unit manager at an obstetrics and gynecology hospital. The fit of each item was assessed via the item content validity index (I-CVI) using a four-point scale (1 = not relevant at all, 2 = not relevant and requires revision, 3 = relevant but requires revision, 4 = very relevant and concise). The I-CVI was calculated as the ratio of total experts to the number of experts who obtained scores of 3 and 4 points. The experts were asked to present their opinions regarding any requirements for revision or deletion of items. A CVI of 0.80 or higher was deemed to indicate good content validity.

Three items for positive appraisal (items 5, 8, and 14 of the original tool) had a CVI below 0.50. Additionally, items that overlapped with other items (items 2, 7, and 10 of the original tool), items regarding the postpartum situation (item 15 of the original tool), and an item that does not reflect the Korean culture (item 9 of the original tool) had a CVI below

0.8. Thus, items of the original scale that did not meet the criteria were reviewed and either revised or deleted to finalize the items. The average scale-level CVI (S-CVI) was 1.00.

To examine the clarity and comprehensibility of the final items among the targeted population, face validity was assessed using the same method as expert validity testing, in this case by three pregnant women at ≥ 14 weeks' gestation who were naïve to this instrument. Items with a CVI of 0.80 or higher were deemed appropriate and the average scale-level CVI (S-CVI) was 1.00.

Main Survey and Data Analysis

Prior to the main survey, we conducted a pilot survey with 20 participants from the target population. There were no problems during the survey process; therefore, we proceeded with the main survey. The survey was conducted between January 20 and January 26, 2022, and 283 participants were included in the final analysis. Data were analyzed using SPSS 25.0 and AMOS 26.0 to evaluate construct validity, concurrent validity, and reliability.

Construct validity was evaluated using EFA and CFA. Skewness (< 2.0), kurtosis (< 7.0), Kaiser-Meyer-Olkin (KMO), and Bartlett's sphericity tests were performed for item analysis and normality testing. After confirming the good fit of the EFA, principal components analysis was performed using varimax rotation. Two factors were extracted and assessed based on the following criteria: factor loading ≥ 0.30 and cumulative variance explained ≥ 60%. The fit of the two-factor model was tested using CFA. Convergent validity was examined using criteria of $\beta > 0.50$, average variance extracted (AVE) > 0.50, and construct reliability (CR) > 0.70; discriminant validity was examined using the criteria of AVE > r^2 and ($r \pm 2 \times SE$) ≠ 1.[22]

The relationship between the K-PREPS and Nu PDQ was analyzed using Pearson's correlation coefficient. Cronbach's α was calculated for each factor, and the total score and internal consistency reliability were evaluated with a criterion of Cronbach's $\alpha > 0.70$.

Ethical Considerations

This study was conducted between January 20 and January 26, 2022, after obtaining approval from the Institutional Review Board of Jeonju University to protect the participants' rights and ensure the ethical stringency of the study, and complied with the declaration of Helsinki. To recruit participants, we posted an advertisement for the study on "Momsholic", an online community, after obtaining permission from the community admin. Participants were provided with an explanation of the study purpose, data collection procedure, anonymity, autonomy regarding participation and withdrawal from the study, confidentiality, and data storage and disposal through the postings. Those who voluntarily made an informed decision to participate in the study accessed the survey via the link provided. The participants were informed that all personal and study-related data would only be used for research purposes and that they had the freedom to withdraw from the study at any time.

Each participant was allowed to complete the survey only once, and data were only available for review to the authors and research assistants. All participants were given a small gift (coffee voucher) of appreciation within one week after study completion.

Results

Participants' Characteristics and Pandemic-Related Pregnancy Stress

The study sample comprised women aged 20–29 years (15.19%), 30–34 years (55.48%), 35–39 years (25.80%), and ≥ 40 years (3.53%). A total of 39.22% followed a religion, and 60.78% did not. Most participants (99.29%) were married. Their educational levels were high school or lower (6.71%), college (84.45%), or graduate school or higher (8.83%). Occupations included office workers (36.75%), professionals and technicians (16.96%), self-employed (8.48%), and housewives (36.04%). The self-perceived financial statuses were below average (10.25%), average (77.39%), and above average (12.37%).

In terms of pregnancy, the current trimesters of the participants were first (19.08%), second (55.83%), and third (25.09%); 81.27% and 18.73% were primigravida and multigravida, respectively. Most participants (70.67%) reported

having planned their pregnancy, and 96.47% and 3.53% had a single fetal pregnancy and multi-fetal pregnancy, respectively. Further, 9.54% of participants had high-risk pregnancies, and 90.46% did not.

In terms of COVID-19-related characteristics, 25.80% had regular checkups cancelled because of COVID-19, and 2.12% had been diagnosed with COVID-19 during pregnancy. A total of 14.84% had been in self-quarantine for COVID-19 during pregnancy, and 14.13% had lost their jobs because of COVID-19. A total of 33.22% had their income reduced because of COVID-19, whereas 3.53% and 63.25% had their income increase and remain unchanged, respectively.

The K-PREPS score significantly differed according to the cancellation of prenatal checkups due to COVID-19 ($t = 6.54$, $p < 0.001$) and self-quarantine for COVID-19 during pregnancy ($t = 2.52$, $p = 0.01$; Table 1). Table 1 presents the descriptive statistics of K-PREPS based on participant characteristics.

Construct Validity

Exploratory Factor Analysis

The normality of the seven items selected for content validity testing was evaluated (Figure 1). The data had skewness of −0.95– −0.52 (<2.0) and kurtosis of −0.06–0.61 (< 7.0) and thus met the criteria for normality. All items had an item–total correlation of 0.30 or higher, confirming the scale's internal consistency. The appropriateness of the sample for factor analysis was examined. We confirmed that the correlation coefficient matrix was not diagonal based on a KMO value of 0.86 and Bartlett's sphericity test ($p < 0.001$). Thus, we performed principal components analysis using varimax rotation. Based on the original instrument and the results of content validity testing, we extracted two factors. Factor loadings ranged from 0.64 to 0.83 and from 0.77 to 0.87 for preparedness and infection stress, respectively. Communality ranged from 0.55 to 0.74, and the total variance explained was 69.7% (Table 2).

Confirmatory Factor Analysis

Model fit was tested using CFA; the results indicated good fit ($\chi 2 = 24.67$, $p < 0.001$; $\chi 2/df = 1.90$; root mean square residual (RMR) = 0.03; root mean square error of approximation (RMSEA) = 0.06; goodness of fit index (GFI) = 0.98; standardized RMR (SRMR) = 0.03; Table 3).

Convergent Validity

Convergent validity is to check whether the items constituting the tool are highly correlated with each other, convergent validity was evaluated based on the following criteria: $\beta > 0.05$, AVE > 0.05, and CR > 0.70. All items had a $\beta > 0.05$, and AVE was 0.56 and 0.67 for preparedness and infection stress, respectively. CR was 0.83 for preparedness and 0.86 for infection stress. All criteria were, therefore, met (Table 3).

Discriminant Validity

Factors that measure different constructs must have low inter-factor correlations; therefore, discriminant validity was tested. In the first discriminant validity test, the correlation coefficient (r) between preparedness and infection stress was 0.73, namely r2 = 0.53, which was smaller than the AVE values of 0.56 and 0.67, thus meeting the criterion. In the second discriminant validity test, $r \pm 2 \times SE$ was in the range of 0.63–0.83; as this did not include 1, the criterion was met (Table 4).

Concurrent Validity

The concurrent validity of the K-PREPS was evaluated by testing its correlation with the Nu PDQ scores. There was a positive correlation between K-PREPS scores and character scores of the Nu PDQ ($r = 0.52$, $p < 0.001$). The Nu PDQ and in terms of each factor of the K-PREPS, there was a positive correlation between preparedness ($r = 0.50$, $p < 0.001$) and perinatal infection stress ($r = 0.45$, $p < 0.001$) scores. In Table 5, the mean, median, and mode of K-PREPS and Nu PDQ are presented.

Reliability

The Cronbach's α value for the K-PREPS was 0.87, and those for preparedness and infection stress were 0.81 and 0.85, respectively, based on which internal consistency reliability was established (Table 5).

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Table 1 Korean Version of the Pandemic-Related Pregnancy Stress Scale (K-PREPS) According to Participants' Characteristics (N = 283)

Characteristics		n	%	K-PREPS								
				Total			Preparedness Stress			Perinatal Infection Stress		
				M	SD	t/F (p)	M	SD	t/F (p)	M	SD	t/F (p)
Age	20~29	43	15.19	3.96	0.75	0.31 (0.82)	4.06	0.73	0.46 (0.71)	3.84	0.94	0.24 (0.87)
	30~34	157	55.48	3.85	0.71		3.91	0.75		3.78	0.84	
	35~39	73	25.80	3.91	0.76		3.97	0.83		3.84	0.83	
	>40	10	3.53	3.84	0.54		4.00	0.61		3.63	0.85	
Religion	Yes	111	39.22	3.84	0.83	−0.78 (0.43)	3.91	0.88	−0.68 (0.50)	3.75	0.92	−0.78 (0.44)
	No	172	60.78	3.91	0.64		3.98	0.68		3.83	0.80	
Marital status	Married	281	99.29	3.89	0.72	0.62 (0.54)	3.95	0.76	0.14 (0.89)	3.80	0.85	1.06 (0.29)
	Single	2	0.71	3.57	0.81		3.88	1.24		3.17	0.24	
Highest education	High school or lower	19	6.71	3.97	1.14	0.21 (0.81)	4.17	1.18	1.75 (0.17)	3.70	1.22	0.51 (0.60)
	College	239	84.45	3.87	0.69		3.91	0.74		3.82	0.80	
	Graduate school or higher	25	8.83	3.93	0.68		4.13	0.62		3.67	0.94	
Occupation	Office worker	104	36.75	3.95	0.76	1.07 (0.37)	4.01	0.77	0.47 (0.17)	3.87	0.92	1.74 (0.14)
	Professional/technician	48	16.96	3.81	0.71		3.92	0.75		3.65	0.86	
	Self-employed	24	8.48	3.92	0.61		3.95	0.72		3.88	0.69	
	Housewife	102	36.04	3.88	0.71		3.92	0.79		3.82	0.79	
	Other	5	1.77	3.34	0.64		3.60	0.72		3.00	0.62	
Financial status	Below average	29	10.25	4.03	0.86	0.83 (0.44)	4.09	0.93	0.51 (0.60)	3.97	0.93	1.05 (0.35)
	Average	219	77.39	3.88	0.70		3.94	0.75		3.80	0.81	
	Above average	35	12.37	3.81	0.72		3.92	0.69		3.66	0.98	
Trimester	1st	54	19.08	3.87	0.80	0.08 (0.93)	3.99	0.81	0.10 (0.91)	3.72	0.97	0.71 (0.49)
	2nd	158	55.83	3.90	0.61		3.94	0.67		3.85	0.73	
	3rd	71	25.09	3.86	0.89		3.95	0.92		3.75	0.99	

Parity	**Primigravida**	230	81.27	3.87	0.72	−0.97 (0.33)	3.93	0.77	−0.77 (0.44)	3.78	0.85	−1.01 (0.31)
	Multigravida	53	18.73	3.97	0.72		4.02	0.73		3.91	0.84	
Planned pregnancy	**Yes**	200	70.67	3.93	0.70	1.41 (0.16)	3.98	0.76	1.01 (0.32)	3.85	0.83	1.61 (0.11)
	No	83	29.33	3.79	0.76		3.88	0.78		3.67	0.88	
Type of pregnancy	**Single fetus**	273	96.47	3.89	0.70	0.47 (0.65)	3.95	0.74	0.07 (0.95)	3.81	0.83	1.4 (0.16)
	Twin	10	3.53	3.71	1.19		3.93	1.26		3.43	1.22	
Method of pregnancy	**Natural**	259	91.52	3.89	0.70	0.12 (0.91)	3.94	0.74	−0.82 (0.41)	3.82	0.83	1.23 (0.22)
	Infertility procedure	24	8.48	3.87	0.92		4.07	1.04		3.60	1.00	
High-risk pregnancy	**Yes**	27	9.54	3.97	0.82	0.62 (0.53)	4.19	0.88	1.68 (0.09)	3.68	0.95	−0.78 (0.44)
	No	256	90.46	3.88	0.71		3.93	0.75		3.81	0.84	
Cancelation of prenatal checkup because of COVID-19	**Yes**	73	25.80	4.28	0.53	6.54 (<.001)	4.29	0.57	5.34 (<.001)	4.26	0.63	6.49 (<.001)
	No	210	74.20	3.75	0.73		3.83	0.79		3.64	0.86	
Diagnosis of COVID-19 during pregnancy	**Yes**	6	2.12	3.50	1.36	−0.71 (0.51)	3.54	1.40	−0.73 (0.50)	3.44	1.34	−1.04 (0.30)
	No	277	97.88	3.89	0.70		3.96	0.75		3.81	0.83	
Self-quarantine for COVID-19 during pregnancy	**Yes**	42	14.84	4.14	0.73	2.52 (0.01)	4.22	0.70	2.66 (0.01)	4.04	0.92	2.00 (0.05)
	No	241	85.16	3.84	0.71		3.90	0.77		3.76	0.83	
Loss of job because of COVID-19	**Yes**	40	14.13	3.99	0.72	1.01 (0.31)	4.11	0.70	1.39 (0.17)	3.84	0.89	0.34 (0.74)
	No	243	85.87	3.87	0.72		3.92	0.77		3.79	0.84	
Change of income during COVID-19	**No change**	179	63.25	3.84	0.72	1.29 (0.28)	3.92	0.74	0.48 (0.62)	3.74	0.86	2.16 (0.12)
	Decreased	94	33.22	3.98	0.70		4.01	0.77		3.94	0.81	
	Increased	10	3.53	3.80	1.01		3.95	1.11		3.60	0.90	

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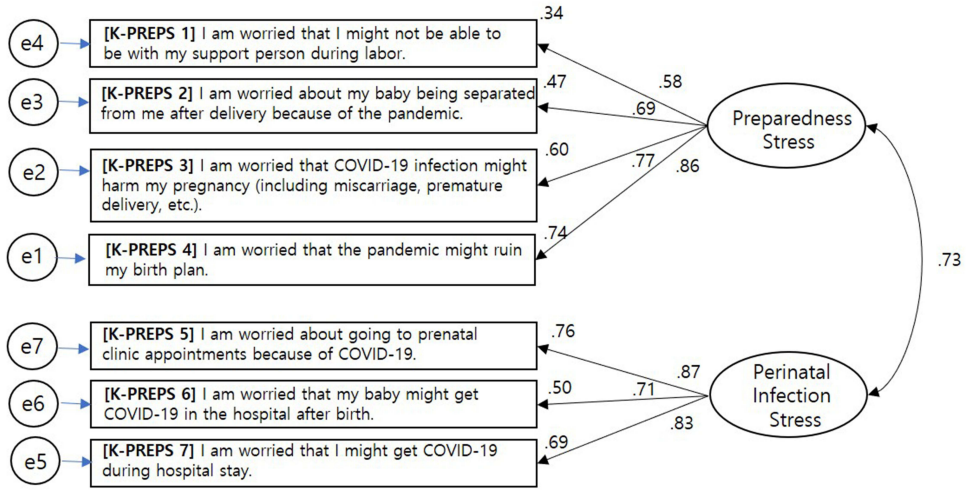

Figure 1 Confirmatory factor analysis and item content of Korean version of the Pandemic-Related Pregnancy Stress Scale (K-PREPS).

Discussion

This study translated the PREPS into Korean and validated the translated instrument. The K-PREPS was validated for the Korean population as a two-factor (preparedness and infection stress), seven-item instrument. The "positive appraisal" factor in the original PREPS developed by Preis et al[18] was removed after content validity testing. The expert panel in this study stated that the items under "positive appraisal" (eg "I feel that COVID-19 helped me be more grateful for my pregnancy") are unnecessary because they are not relevant to stress. Preis et al[18] developed this item to reflect women's stress coping in relation to personal growth. In a validation study in the Polish population, Ilska et al[23] mentioned that "positive appraisal" can be excluded if the focus is on stress, and we determined that the factor is unnecessary in the Korean version.

In addition, some of the items (items 2, 7, 9, 10, and 15) were removed during the content validity testing process for overlapping with other items or being culturally inappropriate. Despite the scale-down from the original instrument, the Korean version had good model fit according to CFA, and convergent and discriminant validity were established for the

Table 2 Normality and Exploratory Factor Analysis of Korean Version of the Pandemic-Related Pregnancy Stress Scale (K-PREPS) (N = 283)

Item No.	M	SD	Skewness	Kurtosis	Factor Loading		Communality	Item–Total Correlation
					Preparedness	Infection		
K-PREPS 4	3.98	0.97	−0.74	0.00	0.83	0.28	0.77	0.71
K-PREPS 2	3.96	0.96	−0.89	0.39	0.77	0.21	0.64	0.60
K-PREPS 3	4.07	0.92	−0.95	0.61	0.77	0.29	0.68	0.66
K-PREPS 1	3.79	0.98	−0.81	0.32	0.64	0.27	0.49	0.55
K-PREPS 7	3.81	0.99	−0.78	0.26	0.26	0.87	0.82	0.67
K-PREPS 6	3.97	0.97	−0.84	0.34	0.23	0.82	0.73	0.61
K-PREPS 5	3.62	0.95	−0.52	−0.06	0.42	0.77	0.77	0.74

Notes: Kaiser-Meyer-Olkin value = 0.86; Bartlett's sphericity test: χ^2 = 919.47, p < 0.001; total variance explained = 69.77%.
Abbreviations: M, mean; SD, standard deviation.

Table 3 Confirmatory Factor Analysis, Model Fit, and Convergent Validity of Korean Version of the Pandemic-Related Pregnancy Stress Scale (K-PREPS) (N = 283)

Factor	Item	Estimate (β)	Error Variances	AVE (≥ 0.5)	CR (≥ 0.7)
Preparedness Stress	K-PREPS 1	0.584	0.631	0.56	0.83
	K-PREPS 2	0.689	0.479		
	K-PREPS 3	0.775	0.334		
	K-PREPS 4	0.86	0.246		
Perinatal Infection Stress	K-PREPS 5	0.869	0.22	0.67	0.86
	K-PREPS 6	0.709	0.464		
	K-PREPS 7	0.833	0.298		

Notes: Model fit: χ^2 = 24.67 (p < 0.001); χ^2/df = 1.90; RMR = 0.03; RMSEA = 0.06; GFI = 0.98; SRMR = 0.03.
Abbreviations: AVE, average variance extracted; CR, construct reliability; RMR, root mean square residual; RMSEA, root mean square error of approximation; GFI, goodness of fit index; SRMR, standardized root mean square residual.

Table 4 Discriminant Validity of Korean Version of the Pandemic-Related Pregnancy Stress Scale (K-PREPS) in Confirmatory Factor Analysis (N = 283)

Factor	r	SE	r^2	AVE	r ± 2 × SE	
					(-)	(+)
Preparedness Stress <-> Perinatal Infection Stress	0.73	0.05	0.54	0.56	0.63	0.83
				0.67		

Abbreviations: AVE, average variance extracted; SE, standard error.

Table 5 Concurrent Validity of Korean Version of the Pandemic-Related Pregnancy Stress Scale (K-PREPS) Against Prenatal Distress Questionnaire (PDQ) and Reliability (N = 283)

		K_PREPS r(p)			M ± SD	Median	Mode	Cronbach's α
		Total	Preparedness Stress	Perinatal Infection Stress				
K-PREPS	Total	1	0.920 (<0.001)	0.882 (<0.001)	3.89 ± 0.72	4.00	4.14	0.87
	Preparedness Stress	0.920 (<0.001)	1	0.628 (<0.001)	3.95 ± 0.77	4.00	4.00	0.81
	Perinatal Infection Stress	0.882 (<0.001)	0.628 (<0.001)	1	3.80 ± 0.58	4.00	4.00	0.85
Nu PDQ		0.525 (<0.001)	0.499 (<0.001)	0.445 (<0.001)	1.04 ± 0.41	1.12	1.18	0.87

Abbreviations: M, mean; SD, standard deviation.

factors, along with high reliability. Thus, the K-PREPS is a useful psychological instrument for measuring stress in pregnant women.

Furthermore, we examined the concurrent validity of the instrument against the widely used Nu PDQ, and a significant positive correlation was found (0.53); however, the strength of the correlation was relatively weak, indicating that the two instruments do not measure the same construct.[24] Therefore, the K-PREPS is an appropriate instrument for measuring pregnancy stress in special circumstances caused by an infectious disease pandemic.

The mean K-PREPS score in our study sample was 3.89. This is higher than the score (3.16) reported by Ilska et al[23] in a Polish validation study. However, as the Korean version excluded one factor and some items, a direct comparison was difficult. Nevertheless, the score was higher than that reported for preparedness and infection stress factors by Preis et al,[18] suggesting that pregnant women in Korea displayed a relatively high level of pandemic-related stress.

Our results indicate that pregnant women who had their prenatal checkup cancelled because of COVID-19 or had been in self-quarantine for COVID-19 obtained significantly higher K-PREPS scores. The high perceived stress among these women might be due to their experiencing inconveniences as a direct result of the pandemic. Similar results were observed in previous studies that used the PREPS.[18,23,25] Hence, to reduce pregnancy stress amid another potential pandemic in the future, sound systems need to be established, and the healthcare system should be designed such that prenatal checkups are not cancelled even during a pandemic.

The PREPS has been validated in several countries, including the United States and countries in Europe. Preis et al,[18] who developed the original instrument, mentioned that data should be collected and integrated from myriad races and cultural contexts. This study is significant in that it evaluated the feasibility of the instrument in an Asian country. In particular, Korea features a unique prenatal and postpartum culture that emphasizes the importance of prenatal education or care and protection of the mother and fetus as they near full term.[26] Therefore, we proposed that a modified version of the PREPS, as opposed to the version validated in Western countries, needs to be used for this population. Furthermore, its shortened form will make it easier for those taking the survey to complete and understand, leading to greater adoption of the PREPS in the future.

One important implication of validating an instrument for measuring stress among pregnant women during an actual pandemic is that it provides baseline data to prepare for future pandemics. However, the findings were obtained from a subset of pregnant women in Korea recruited through an online source. Thus, its generalizability cannot be extended to all pregnant women in Korea. We recommend replication studies with larger samples in the future.

Conclusions

The K-PREPS validated in this study is a two-factor (preparedness and infection stress), seven-item instrument that was validated for measuring pandemic-related stress in pregnant women in Korea. This instrument comprises concise items, which could increase its utility in subsequent research to prevent pandemic-related stress in pregnant women. However, the findings have limited generalizability because of the limited study population, and some items from the original instrument were excluded, calling for further research to examine gaps across races or countries.

Abbreviations

COVID-19, coronavirus disease 2019; PREPS, Pandemic-Related Pregnancy Stress Scale; EFA, exploratory factor analysis; CFA, confirmatory factor analysis; Nu PDQ, Revised Prenatal Distress Questionnaire; PDQ, Prenatal Distress Questionnaire; K-PREPS, Korean-translated PREPS; I-CVI, item content validity index; CVI, content validity index; S-CVI, average scale-level; KMO, Kaiser-Meyer-Olkin; CR, construct reliability; RMR, root mean square residual; RMSEA, root mean square error of approximation; GFI, goodness of fit index; SRMR, standardized RMR.

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

Institutional Review Board approval was obtained from the Jeonju University (IRB No. jjIRB-211215-HR-2021-1215).

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Disclosure

The authors have no conflicts of interest to declare in this work.

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