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Instrument Development for Measuring Stress during Pregnancy among Women in Beijing, China

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Abstract

The purpose of study was to investigate the psychometric properties of the *Wang-34 Scale (*the *Scale)* for measuring pregnancy stress among pregnant women in Beijing, China. A cross-sectional, descriptive, and correlation design was

used. Exploratory factor analysis (EFA) was conducted to assess the factor structure of the *Scale.* Data were collected in three obstetric and gynecological clinics in Beijing in 2002. A total of 685 pregnant women voluntarily participated. Translation and back translation of the *Scale* were reviewed by three bilingual researchers to determine the conceptual and language equivalence for study of the *Scale* for pregnant women in China. EFA and internal consistency reliability were used to examine the psychometrics. Three-factor and four-factor structures emerged for the *Wang-34 Scale;* the internal reliability of the *Scale* as measured by Cronbach's alpha, was 0.86 for the total scale, with alphas ranging from 0.74 to 0.84 for subscales. These findings support the validity of the translated *Scale* and scoring of the items. Both Cronbach's alphas (0.86) and standardized alpha (0.88) values indicated a high degree of internal consistency. Thus, the *Wang-34 Scale* is a valid and reliable measure of pregnancy stress and can be used to prioritize interventions to prevent or reduce stress during pregnancy.

Keywords: Stress during pregnancy, instrument development, psychometric testing and pregnant women in China.

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Introduction and Background

Researchers have reported that as many as 18% of pregnant women suffer depression during pregnancy; 13% experience major depression, and 14% have a new episode of depression during pregnancy.[1,2] Some researchers[3] found that the prevalence of depression was 7% in the first trimester, 13% in the second trimester, and 12% in the third trimester. Studies have also indicated that high stress and mood disturbances during pregnancy are related to a variety of negative maternal and birth outcomes.[4,5] High stress during pregnancy has been associated with low birth weight and may increase pregnant women's smoking and alcohol consumption during pregnancy; these behaviors in turn have adverse effects on birth outcomes.[6]

Physical distress during pregnancy is often reported as the most frequent stressor women experience during pregnancy.[7,8] Fatigue, physical limitations, and weight gain are main stressors pregnant women experience during pregnancy,[9] and women also have body image concerns and physical discomforts during pregnancy,[10] Understanding stress during pregnancy and specific stressors that are perceived by women during pregnancy will enable professionals to develop strategies to reduce stress and help pregnant women cope with stressors during pregnancy.

No specific stress scale, however, is currently available for measuring stress in pregnant women among different cultural groups. Furthermore, pregnant women frequently do not receive screening, prevention or treatment for mood and stress concerns.[4,5] Accurate measurement of pregnancy stress is important to help women prioritize and prevent stress during pregnancy. With a sound, reliable, and valid assessment tool, nursing care for this population can be based on objective and culturally relevant constructs.

Problem Statement

This study investigated the psychometric properties of *the Wang-34 Scale* with respect to a sample of pregnant women in Beijing, China. There is currently no instrument to measure stress during pregnancy among women in China.

The *Pregnancy Stress Rating Scale (PSRS)* was developed by Chen[11] and tested among pregnant women in Taiwan. Using principal axis factor analysis, she found a three-factor structure and factor loadings ranging from 0.33 to 0.87 for *Chen's*[11] *S*cale*.* Chen's[11] 28 stress items were distributed into three factors with factor 1, "stress from seeking safe passage for herself and her child through pregnancy, labor and delivery," containing 11 items; factor 2, "stress from Identifying maternal role," containing 12 items; and factor 3, "Stress from altering body structure and body function," containing 5 items**.** Affonso's[8] pregnancy stress variables observed among women in the US include physical distress, weight gain and body change, emotional instability, job and career, money, and changes in living pattern.

Although Chen's[11] instrument measured stress experienced by pregnant women in Taiwan, the instrument was in the traditional Chinese used in Taiwan, not in China. Chen's[11] instrument tested only with pregnant women in Taiwan, and the instrument does not incorporate socio-economic variables that may affect the stress experienced by pregnant women.[8] We combined Chen's[11] 28-items instrument and Affonso's[8] 6 variables related to pregnancy stress to form the *Wang-34 Scale.* We translated and edited the entire 34 items from Chinese to English and back translated from English to Chinese for data collection in China in a simplified Chinese language. A panel of three Chinese-English bilingual researchers evaluated several versions of the *Scale*. Agreement of 95% was reached among the three bi-lingual researchers regarding the cross-cultural equivalence of Chinese and English wording in the two different versions of the *Scale.*

Because the *Scale* combined two instruments, we treated the *Scale* as a new instrument. Research questions were: (1) is there evidence of cross-cultural equivalence of the concepts and language in the English and Chinese versions of *the Scale*? (2) Is *the Scale* a reliable and valid tool to measure pregnancy stress?

Theoretical Framework

The vulnerability-stress model was used as our conceptual framework for this study. The etiology of emotional disorders in women, especially depression, has clearly demonstrated that there is a vulnerability-stress conceptualization on risk factors during pregnancy.[12,13] Studies indicated that stress may trigger the onset of major depression in vulnerable pregnant women.[14] Two areas of vulnerability have been identified: (a) the risk associated with environmental factors such as lack of support and disadvantaged socio-economic conditions[15,16] and (b) psychosocial vulnerability such as low self-esteem and helplessness,[17] as variables related to pregnancy stress. We used this vulnerability-stress model to examine the stress of Chinese women during pregnancy.

Methods

This cross-sectional, descriptive, and correlational study was approved by the West Virginia University Institutional Review Board (WVUIRB). Data were collected in three obstetric and gynecological clinics in three hospitals in Beijing, China. A total of 685 pregnant women voluntarily participated in the study.

Study Subjects

Chinese pregnant women attending OBGYN clinics for various purposes were recruited to participate in a study of the *Scale* psychometrics. The *Scale* was administered to 685 pregnant women in Beijing, China. Criteria for participation in the study were that the women were pregnant, had no medical problems, and were able to speak and read Simplified Chinese. When the women visited one of the three OBGYN clinics, a staff member approached potential subjects to explain the study and offer study material to review in Simplified Chinese. If a patient agreed to participate in the study, a consent form was signed, and the questionnaire was administered and completed.

Study Questionnaire

The *Wang-34 Scale* included 49 questions,15 on demographic and background information, and 34 pregnancy stress items. The 15 demographic variables were age, number of pregnancies, number of living children, marital status, education, religion, occupation, income, pounds gained during pregnancy, gender-preference of the child, feeding modes, sleeping arrangements, months that will be slept with the baby, eating special foods during pregnancy, and satisfaction with pregnancy. Demographic data were collected in order to describe the sample and compare this sample of Chinese women to women from other cultural groups. The demographic variables were not used in the factor analyses.

The 34 stress items on the *Scale* were Likert-type questions in four categories: (a) concerns about the baby: 9 items, (b) concerns about pregnancy: 14 items, (c) concerns about body image: 5 items, and (d) concerns about career and lifestyle: 4 items. The score for each item ranged from 1 (very worried) to 4 (not worried at all). The total score was computed and transformed to a 1-to-100 point scale. A higher score corresponded to lower stress during pregnancy.

Analysis

We used the *Statistical Program for Social Sciences (SPSS*) version 18 for analysis of the data. Exploratory factor analyses (EFA) were conducted to test the validity of the hypothesized three-factor and four-factor construct of the *Scale* in Beijing, China. Principal components analysis with varimax rotation was performed in order to assess the construct of the *Scale*, using the eigenvalue criterion (eigenvalue > 1) to determine the number of factors. Cronbach's alpha was used to examine the internal consistency of the *Scale,* and item correlations with total scale and subscales were also computed.

Results

Demographic and Background Information

A total of 685 pregnant subjects were recruited to answer a 2-page questionnaire. Of these subjects, 24 (3.5%) did not complete the questionnaire, resulting in 661 participants. About 98.7% of the respondents were married, and the rest were not married, remarried or divorced. About 5.3% (n = 35) were between 26 and 30 years of age, and about 86.6% (n = 572) were 25 or below. About 16.3% (n = 108) had a middle school education, 27.2% (n = 180) had a high school education, and 47.5% (n = 314) had a 4-year college education. A total of 85.8% (n = 567) said they were currently employed, and 2.9% (n = 19) were unemployed.

Factor Analysis and Results

Because the *Scale* combined the structure of *Chen's*[11] *and Affonso's*[8] stress items related to pregnancy, we treated the *Scale* as a new instrument, and used EFA to analyze the factor structure of the instrument. Principal components analysis with varimax rotation was then performed in order to assess the construct of the *Scale*. Using the eigenvalue criterion (eigenvalue > 1) to determine the number of factors led to a 10 factors construct. After examining a scree plot of the eigenvalues, we decided to investigate three-factor and four-factor structures. Cronbach's alpha for the *Scale* was 0.86, with a standardized alpha of 0.88. These values indicate a high degree of internal consistency for the *Scale*. The three-factor construct explained approximately 41% of the total variance in the data.

Three-factor construct. Chen's[11] *Scale* partitioned into three factors: concerns about the baby, concerns about the pregnancy, and concerns about body image. Affonso's[8] items, however, also addressed socioeconomic and career concerns. Our three-factor EFA generated factors that seemed to address "concerns about post-delivery and body image", "concerns about the baby and delivery", and "concerns about the career and lifestyle."

The primary factor was related to "concerns about post-delivery and body image". This factor contained 15 items and accounted for 17.6 % of the total variance in the data. Factor loadings for the items primarily associated with this factor ranged from 0.35 to 0.74. The items, in order of importance, were concerns about "figure changes", "worry about weight gain and body change ", "getting too fat", "darkened spotting on face", "control enlarged body", "decreased social contacts/activities", "tied down by baby", "name of baby", "baby's sex", "family not like baby", "where recuperate after baby born", "finding good babysitter", "physical distress", "no one take care of your family during your labor", and "breast/bottle feed".

The second factor related to "concerns about the baby and delivery". This factor contained 10 items and accounted for 13.5 % of the total variance in the data. Factor loadings for the 10 items ranged from 0.35 to 0.73. The items, in order of importance, were "safe delivery for your baby", "safe delivery for yourself", "contractions during pregnancy", "your behaviors affect fetus", "premature labor", "baby may not be normal", "abnormal labor or cesarean section", "the doctor may not arrive on time", "baby's future ", and "baby's birth weight". The third factor related to "concerns about career and lifestyle". This factor contained three items and accounted for 9.8 % of the total variance. Factor loadings for these items ranged from 0.88 to 0.89. The items, in order of importance, were concerns about "emotional instability", "mobility and career", and "money".

Some items loaded approximately equally on more than one factor. These included concerns that “sexual activity hurt baby”, which had a loading of 0.32 on the first factor and a loading of 0.31 on the second factor. The item “labor pain may be severe” also loaded on the first factor (0.34) and the second factor (0.55). The item “baby may not be attractive” loaded on the first factor (0.50) and the second factor (0.32). While the item “changes in living pattern” loaded onto the third factor (0.78) and the first factor (0.32). The item “giving up work with baby” did not load heavily on any of the three factors, though this item should probably have loaded onto the third factor, “concerns about the career and lifestyle”.

Another item, “physical space for the baby” also did not load onto any of the three factors. Some of the items did not load as expected. For example, the item “physical distress” loaded most heavily on factor 1 (post-delivery and body image), though we had expected that this item would load most heavily on the second factor (baby and delivery). Similarly, the item “no one take care of your family during your labor” loaded most heavily on factor 1 (post-delivery and body image), rather than on factor 2 (baby and delivery). These results suggested a possible need for a factor construct using more than three factors. Therefore, we ran a four-factor EFA. The results are displayed in Table 1.

Four-factor construct. Our four-factor EFA generated factors that seemed to address “concerns about the baby and delivery”, “concerns about baby and post-delivery”, “concerns about body image”, and “concerns about the career and lifestyle”. The four-factor construct explained approximately 47% of the total variance in the data.

The primary factor was related to “concerns about baby and delivery”. This factor contained nine items, and accounted for 13.5 % of the total variance. Factor loadings for the items ranged from 0.38 to 0.73. The items, in order of importance, were concerns about “safe delivery for your baby”, “premature labor”, “safe delivery for yourself”, “contractions during pregnancy”, “your behaviors affect fetus”, “baby may not be normal”, “abnormal labor or cesarean section”, “the doctor may not arrive on time”, “labor pain may be severe”, and “baby's birth weight”.

The second factor was related to “concerns about the baby and post-delivery”. This factor contained ten items and accounted for 12.3% of the total variance in the data. Factor loadings for the ten items primarily associated with the second factor ranged from 0.30 to 0.71. The items, in order of importance, were concerns about “where recuperate after baby born”, “name of baby”, “family not like baby”, “baby’s sex”, “decreased social contacts/activities”, “finding a good babysitter”, “breast/bottle feed”, “no one take care of your family during your labor”, “physical space for baby”, and “giving up work with baby”.

The third factor “concerns about body image,” accounted for about
11.7% of the variance in the data, and contained five items. These items, in order of importance, were concerns about “getting too fat”, “mother’s figure changes”, “darkened spotting on face”, “weight gain and body change”, and “physical distress”. Factor loadings for the five items ranged from 0.33 to 0.87.

The fourth factor was related to “concerns about the career and lifestyle”. This factor contained four items and accounted for 9.5 % of the total variance. Factor loadings ranged from 0.77 to 0.91. The items, in order of importance, were concerns about “emotional instability”, “mobility and career”, “money”, and “changes in living pattern”.

Some items loaded approximately equally onto more than one factor. They included concerns that “labor pain may be severe,” which loaded onto the first factor (0.52) and the third factor (0.34). The item “baby may not be attractive” loaded onto the first factor (0.31) and the second factor (0.38). Concerns about “the baby’s future” also loaded onto the first factor (0.41) and the second factor (0.36). It was not surprising that concerns about “being tied down by baby,” loaded on the second factor (0.51); but it was surprising to find that this item also loaded onto the third factor “body image” (0.33). Another item, concerns about “control enlarged body”, loaded onto the second factor (0.32) and the third factor (0.59). One item, concerns that “sexual activity may hurt baby,” did not load onto any of the four factors.

Assessment of validity. To test the *Scale’s* content validity, a panel of three bilingual nurse researchers who had experience in maternal and child nursing reviewed the Chen’s[11] 28 items for the *Scale,* and discrepancies in the translation were discussed. Re-edits and modification of wordings were done to ensure accuracy and conceptual equivalence to the original constructs. The final version of the *Scale* was judged by the three content experts to be acceptable, with 95% agreement.

Using EFA, three-factor and four-factor structures emerged and were perceived as evidence that the *Scale* is a valid and internally consistent measure of the factors of the instrument. Factor loadings of the *Scale* ranged from 0.30 to 0.91 and were distributed fairly evenly among Wang’s factors. The factors that resulted from the EFA strongly support the construct validity of the total scale and its subscales.

Item statistics and correlation. Table 2 reports the mean and standard deviation for each scales item and shows item-to-subscale correlations and item-to-total-scale correlations. Item-to-total-scale correlations varied between 0.27 (item 16) to 0.58 (item 27). Item 16, “giving up work with baby,” had the lowest item-to-total-scale correlation. Item 27, “control

enlarged body," had the highest item-to-total-scale correlation. Item 1, "safe delivery for the baby," correlated 0.70 with subscale A, "concerns about baby"; and item 3, "premature labor", was correlated 0.67 with subscale A, indicating that these two items were highly correlated to the sum of the scale scores. The 9 items in subscale A was all correlated to the total score.

Item 24, "figure changes", were highly correlated (0.86) with subscale C, "concerns about body image;" but "figure changes" was not as highly correlated (0.52) with the total scale score. That means that figure changes and body image were closely related, and figure changes seemed to be a major stressor in pregnancy. Each of Affonso's[8] stressors showed a high correlation with subscale D and total pregnancy stress scores. The analysis indicated that most items in *the Wang-34 Scale* were highly correlated with their subscale scores and also with the total score. We concluded that the *Scale* is reliable, exhibits a higher Cronbach's alpha than *Chen's*[11] *Scale* and explains more variance in the data. This gives evidence that the *Scale* is useful in identifying pregnancy stress in Chinese women.

Internal consistency and reliability. Cronbach's alpha for the *Scale* was 0.86, with a standardized alpha of 0.88. Both Cronbach's alpha and the standardized alpha values indicated a high degree of consistency for the *Scale.* While the *Scale* had a reliability value of 0.88, the Affonso[8] subscale had a reliability of 0.82 and Chen's[11] 28 items had a reliability of 0.87.

Discussion

Response rates were high, exceeding 98%. The high response rate could be due to the fact that the questionnaire was short (two pages) which were more acceptable to the Chinese pregnant women. The instrument was valid and reliable, as indicated in the results of the EFA and appears to be an improved Scale to measure pregnancy stress among women in China. De Von[18] recommends that when creating and administering a new instrument, one must make the instrument as concise as possible without sacrificing necessary content, so that alpha coefficients can be increased.

In general, the results from Beijing, China, are consistent with the study by Chen[11] in Taiwan two decades ago. The translation process was successful in achieving conceptual equivalence in Chinese and English. The results support the construct validity of the *Scale* and the scoring of pregnancy stress in Beijing, China. The *Scale* exhibited a high validity and reliability for measuring pregnancy stress among women in Beijing, China. Nunnally[19] suggests that an alpha coefficient of .70 or higher is acceptable for a newly developed instrument. We consider the *Scale* to be a new scale, because it combines Chen's[11] and Affonso and Mayberry's[8] variables. In this study, Cronbach's alpha for the *Scale* was

0.86, with a standardized alpha of 0.88. Both Cronbach's alpha and the standardized alpha values indicate a high degree of reliability for the *Scale.*

Nunnally[19] suggested having 10 times as many participants as variables in conducting factor analysis in order to make sampling error a trivial concern. In this study the numbers of subjects was more than 10 times the number of variables (34 x 10 = 340 subjects). The results showed that the *Scale* is better than *Chen's Scale,*[11] and has high validity and reliability for measuring stress among pregnant women in Beijing, China.

Limitations

There are some limitations to this study: the sample was overwhelmingly urban women in Beijing, and the sample was one of convenience. In addition, the reliability and validity assessments were limited to homogeneous samples of Chinese women in Beijing, who were educated, earned considerable money and were living in a city. Although the *Scale* exhibited high reliability and validity when tested in Beijing, China, further studies are warranted and should include women from diverse ethnic groups and health backgrounds to detect variations in stress during pregnancy.

Conclusion

The *Wang-34 Scale* can be useful for measuring stress during pregnancy among Chinese women. Studies are needed, however, to examine the usability of the instrument for assessing the pregnancy stress in different cultural groups.

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Table 1. Factor Analysis of the *Wang-34 Scale* Tested on Pregnant Women in Beijing, China (N = 608) Factor Loadings (4 Factors)

Worry or Concern About:	Baby and Delivery	Baby and Post Delivery	Body Image	Career and Lifestyle
Subscale A: Concerns about Baby				
1. safe delivery for your baby	.726			
2. safe delivery for yourself	.691			
3. premature labor	.693			
4. abnormal labor or cesarean section	.645			
5. the doctor may not arrive on time	.588			
6. baby may not be normal	.660			
7. labor pain be severe	.521		.344	
8. contractions during pregnancy	.686			
9. your behaviors affect fetus	.675			
10. baby's birth weight	.382			
Subscale B: Concerns about Pregnancy				
11. baby may not be attractive	.351	.382		
12. no one take care of your family during your labor		.512		
13. the baby's future	.408	.364		

14. where recuperate after baby born	.710		
15. finding good babysitter	.554		
16. giving up work with baby	.301		
17. family not like baby	.674		
18. tied down by baby	.514	.331	
19. name baby	.695		
20. decreased social contacts/activities	.570		
21. physical space for baby	.306		
22. baby's sex	.591		
23. breast/bottle feed	.538		
Subscale C: Concerns about Body Image			
24. mother's figure changes		.872	
25. darkened spotting on face		.814	
26. getting too fat		.874	
27. control enlarged body	.315	.588	
28. sexual activity hurt baby			
Subscale D: Affonso's Items			
29. physical distress		.333	
30. weight gain and body change		.807	
31. emotional instability			.907

32. mobility and career				.906
33. money				.874
34. changes in living pattern				.774
Eigenvalues	4.57	4.18	3.99	3.24
Variation Explained (%)	13.5	12.3	11.7	9.5

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Factor loadings below 0.3 are omitted from Table 1.

Table 2. Items and Item Statistics for the *Wang-34 Scale* Tested on Pregnant Women in Beijing, China (N=638)

Item/ Worry about	Mean	Standard Deviation	Subscale Score	Total Scale Score
Subscale A: Concerns about Baby				
1 safe delivery for your baby	3.28	.75	.70	.41
2 safe delivery for yourself	2.90	.84	.72	.45
3 premature labor	2.67	.90	.67	.35
4 abnormal labor or cesarean section	2.86	.92	.66	.36
5 the doctor may not arrive on time	2.78	1.20	.64	.40
6 baby may not be normal	3.30	.80	.66	.40

7 labor pain may be severe	2.87	.91	.62	.51
8 the contractions during pregnancy	2.62	.90	.73	.51
9 your behaviors affect fetus	2.95	.84	.66	.45
Subscale B: Concerns about Pregnancy				
10 baby's birth weight	2.33	1.49	.40	.33
11 baby may not be attractive	2.09	.85	.52	.55
12 no one take care of family during labor	1.88	.75	.51	.46
13 the baby's future	2.39	.90	.47	.47
14 where recuperate after baby born	1.74	.65	.63	.49
15 finding good babysitter	1.85	.82	.54	.38
16 giving up work with baby	1.90	1.46	.45	.27
17 family not like baby	1.71	.68	.61	.49
18 tied down by baby	2.01	.77	.55	.51
19 name baby	1.67	.61	.61	.44
20 decreased social contacts/activities	1.84	.73	.60	.45
21 physical space for baby	1.96	1.52	.46	.28
22 baby's sex	1.64	.73	.56	.45
23 breast/bottle feed	1.85	.72	.51	.40
Subscale C: Concerns about Body				

Image					
24	figure changes	2.26	.92	.86	.52
25	darkened spotting on face	2.24	.93	.85	.56
26	getting too fat	2.32	.93	.85	.52
27	control enlarged body	2.02	.78	.69	.58
28	sexual activity hurt baby	2.28	.92	.52	.43
Subscale D: Affonso's Items					
29	physical distress	2.07	.78	.33	.40
30	weight gain and body change	2.12	.87	.38	.51
31	emotional instability	2.34	1.54	.90	.52
32	job and career	2.04	1.50	.90	.51
33	money	1.98	1.18	.88	.50
34	changes in living pattern	1.90	.82	.80	.55