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Subconstructs of the Edinburgh Postpartum Depression Scale in a Postpartum Sample in Mexico City

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Abstract

Background—Postpartum depression is an important cause of morbidity in mothers and children. The Edinburgh Postpartum Depression Scale (EPDS), the most widely used self-reported measure of postpartum depression, was conceived as a one-dimensional measure. However, evidence that depressive symptoms may be experienced differentially across cultural and racial groups highlights the need to examine structural equivalence using factor analysis across populations. Variation in factor structure for the EPDS remains understudied in middle/low income countries.

Methods—We examined the factor structure of the EPDS assessed 6 months postpartum in 628 Mexican women in a longitudinal Mexico City birth cohort. We performed exploratory factor analysis (EFA) to determine the optimal fit in our sample and confirmatory factor analysis (CFA) to examine the fit of two- and three-factor models previously reported in Hispanic populations.

Results—The majority of participants had no more than high school education (77%), maternal age was 28 ± 5.4 years and the mean total EPDS score was 6.72 ± 5.8 . Using EFA, we identified that the three-factor model provided the optimal fit, with subscales for depression, anxiety, and anhedonia. CFA confirmed that the three-factor model provided the best fit.

Limitations—The study population was lower SES, potentially limiting generalizability. The single administration of the EPDS measure in the postpartum period limited our ability to assess stability over time.

Conclusions—Better delineation of the multi-factorial structure of the EPDS will allow a more comprehensive understanding of psychological functioning in postpartum women and better inform diagnosis, management and policy.

Introduction

Postpartum depression (PPD) has profound consequences for the health of the mother as well as for the child, with impacts on attachment, infant growth and neurodevelopment as well as maternal mortality and subsequent mental health (Gelaye et al., 2016; Nieto et al., 2017; Surkan et al., 2011; Wisner et al., 2006). PPD is common worldwide with prevalence of depressive symptoms in the first year postpartum ranging from 6–38% in developed countries and 20–57% in developing countries (Lara et al., 2015; Norhayati et al., 2015a). PPD is a particular concern in low and middle income countries given that its prevalence is higher and resources for diagnosis and management are more limited (Lara et al., 2015; Place et al., 2016; Shrestha et al., 2016). Understanding patterns of depressive symptoms in the postpartum period would inform clinical practice, policy, and the development of screening tools and interventions to improve health outcomes.

Variations in the epidemiology of PPD by race/ethnicity have been seen in the United States (US) (Liu and Tronick, 2013), Asia and Africa (Fisher et al., 2012). In the US and United Kingdom (UK), studies have revealed higher rates of PPD in immigrants from non-English-speaking countries (Liu and Tronick, 2014) (Onozawa et al., 2003), in particular women from Latin American countries (Liu and Tronick, 2013). In one US population, rates varied dramatically among Hispanic women by country of origin - immigrants from Mexico, Central America or South America had higher rates of PPD (32%) in comparison to immigrants from Puerto Rico or the Dominican Republic (17.24%), with much lower rates in US-born Hispanic women (7.14%) (Doe et al., 2017). There are fewer studies in Latin American countries including Mexico; however, the existing literature suggests the prevalence may be as high as 32% (de Castro et al., 2015; Lara et al., 2015).

Diagnosis of PPD involves presence of depressed mood and/or anhedonia (American Psychiatric Association, 2013) and there are several measures used in the literature that rely on clinical interview or self-report (Norhayati et al., 2015a). Depressed mood reflects high negative affect whereas anhedonia reflects low positive affect with evidence that affective states vary by culture and race/ethnicity (Kanazawa et al., 2007). One of the most widely used scales to identify depressive symptoms in the postpartum period is the Edinburgh Postpartum Depression Scale (EPDS) (Cox et al., 1987), which has been validated in several populations and languages worldwide (Alvarado-Esquivel et al., 2016; Alvarado-Esquivel et al., 2006; Gelaye et al., 2016; Howard et al., 2014; Norhayati et al., 2015b).

The EPDS is a 10-item scale which was constructed as a unidimensional tool to screen for postpartum depression (Cox et al., 1987). However, several studies have demonstrated that, rather than providing a raw score applicable solely to postpartum depression screening, the EPDS identifies multiple dimensions of postpartum psychological functioning, specifically depression, anxiety and anhedonia (Hartley et al., 2014b; Matthey et al., 2013; Phillips et al., 2009). This is supported by evidence that positive EPDS screens have been associated with

other mental health disorders including anxiety (Milgrom et al., 2005) and that specific items on the scale can discriminate between depression and anxiety (Phillips et al., 2009). There is a growing body of literature analyzing the optimal factor structure, with the best fit often seen for two- or three-factor solutions that include depressive symptoms as well as symptoms of anxiety and/or anhedonia.

A growing body of literature demonstrates variability in factor structure across race/ethnicity and culture (Chiu et al., 2017; Hartley et al., 2014b; King, 2012; Kozinszky et al., 2017; Shrestha et al., 2016). In a study of Hispanic women in the US, Hartley *et al.* reported a two-factor structure of depressive and anxiety symptoms as the best fit (Hartley et al., 2014b). Chiu *et al.* investigated the EPDS factor structure in a multi-ethnic urban Boston sample and reported a three-factor model as the best fit for all race/ethnicities but identified differences in loading of specific items for Hispanic women compared to white and African American women (Chiu et al., 2017). The observed differences across studies have been attributed to differences in cultural and linguistic translation, study population, at what point in time during the perinatal period the questionnaire was administered and statistical methodology (Shrestha et al., 2016). Additionally, there are cultural differences in depression phenotypes and recent data supports that the prevalence of depression and anhedonia varies by race/ethnicity (Liu and Tronick, 2014).

Given that maternal mental health conditions are amenable to intervention and have enormous implications for health outcomes, it is important to accurately characterize these disorders to inform decision making on a clinical and policy level (Place et al., 2016) (Lara et al., 2015; Wainberg et al., 2017). Understanding the factor structure of the EPDS in native Mexican women is critical to better understand the epidemiology of postpartum mental health conditions including depression and anxiety in this population and to develop and implement interventions on a population scale to improve outcomes through prevention, diagnosis and treatment.

The EPDS has been validated treating it as a unidimensional scale to screen for postpartum depression in native Mexican populations. To our knowledge, no study to date has evaluated the underlying factor structure in this population, specifically whether individual items associate with postpartum anxiety, anhedonia or other mental health conditions. Therefore, the main aim of the present study is to evaluate the factor structure of the EPDS in native Mexican women in a large prospective birth cohort in Mexico City, Mexico. We hypothesized that a 2- or 3-factor model, using identical EPDS items as previous studies, would demonstrate the best fit in this population. In this study, we 1) perform an exploratory factor analysis (EFA) to identify the optimal number of factors to explain variability in EPDS and 2) use confirmatory factor analysis (CFA) to determine the number of factors that best fit our data and to better understand the underlying structure of the EPDS in this cohort of native Mexican women.

Methods

Study participants

Participants in this study were from Programming Research in Obesity, Growth, Environment and Social Stressors (PROGRESS), which recruited pregnant women who were receiving health services and prenatal care through the Mexican Social Security System (Instituto Mexicano del Seguro Social –IMSS) between July 2007 and February 2011. The women had to meet the following eligibility criteria in order to participate: less than 20 weeks gestation, at least 18 years old, planned to stay in Mexico City for the next 3 years, reported no medical history of heart or kidney disease, had telephone access, did not consume alcohol daily, and reported no use of any steroid or anti-epilepsy medications.

For the PROGRESS cohort, 3898 women were approached, 3274 were eligible and 1057 (32% of those eligible) agreed to participate (Burris et al., 2013). Following birth, 815 mother-child dyads had at least one follow-up visit and 628 (77%) women completed the Spanish version of the EPDS (Cox et al., 1987) which was previously validated in Mexican populations ((Oquendo et al., 2008; Ortega et al., 2001) at 6 months postpartum. The 10-item EPDS asks about symptoms in the past 7 days including: “1: I have laughed and been able to see the funny side of things”, “2: I have looked forward with enjoyment to things”, “3: I have blamed myself unnecessarily when things went wrong”, “4: I have been anxious or worried for no good reason”, “5: I have felt scared or panicky for no very good reason”, “6: Things have been getting on top of me”, “7: I have been so unhappy that I have had difficulty sleeping”, “8: I have felt sad or miserable”, “9: I have been so unhappy that I have been crying”, and “10: The thought of harming myself has occurred to me”. Participants rate the severity or frequency of each item based on 4 levels scored from 0 indicating the most favorable condition to 3 indicating the least favorable condition for each item. Total scores can potentially range from 0 to 30.

Sociodemographic information was collected at enrollment through a questionnaire. Thirteen variables were used to classify study families into six levels based on the socioeconomic status (SES) index created by the Asociación Mexicana de Agencias de Investigación de Mercados y Opinión Pública (AMAI) (Carrasco, 2002). These levels were then collapsed into low, medium, and high socioeconomic status. Maternal age at delivery was derived from mother’s date of birth and child’s date of birth which was extracted from the medical record. Procedures were approved by institutional review boards at the Harvard School of Public Health, Icahn School of Medicine at Mount Sinai, and the Mexican National Institute of Public Health. Women provided written informed consent.

Data analysis

We performed EFA and CFA to evaluate the underlying structure of the EPDS in our cohort. We conducted the EFA with varimax (orthogonal) rotations to extract the factor structures and standardized loadings. The number of factors to extract was determined by examining the bend in the scree plots, chi square tests (Bartlett’s chi-square) for common factors (Geweke and Singleton, 1980), as well as factor structures suggested by previous literature (Chiu et al., 2017). A value of 0.3 or above was chosen to indicate significant item factor

loading. Report of item 10, “thought of self-harming”, was rare in our cohort (0.3% for quite often, 1.8 % for sometimes and 2.1% for not very often), therefore all analyses excluded this item to avoid the calculation of potentially negative eigenvalues, (Wothke, 1993). During CFA, model fits were evaluated using maximum likelihood estimation with robust standard errors. Goodness of fit was evaluated using indices of absolute fit, relative fit, and fit with a penalty function for lack of parsimony (Bollen and Long, 1992). Specifically, we examined the traditional overall chi-square test of model fit, root mean square error of approximation (RMSEA; a good fit is root mean square error of approximation generally defined as $RMSEA < 0.08$), comparative fit index (CFI; a CFI 0.95 is generally considered an excellent fit), and the standardized root mean square residual (SMSR; which should be < 0.05 (Brown, 2015; Hartley et al., 2014a; Hu and Bentler, 1999). Analyses were performed in SAS version 9 (Cary, NC, USA).

Results

Descriptive characteristics are summarized in Table 1. The majority of the women had no more than high school education (77%) and approximately half were categorized as having low SES (52.5%). The mean age at delivery was 28 years and analysis showed reasonable variability in total EPDS scores (6.72 ± 5.8 ; range 0 to 26). We compared the included sample to those excluded from the present analysis (those with at least one follow up visit who did not have an EPDS at 6 months, $n=187$). There were no significant differences in the distribution of maternal education, SES or age.

Exploratory Factor Analysis (EFA)

Previous research has suggested either a two- or a three-factor model for EPDS scores therefore, we conducted both two- and three-factor model EFAs determine which model provided the best fit (Table 2). The two-factor model differentiated anxiety-type items (items 4–5: “scared,” “worried”) from other items. The three factors identified in our data generally referred to items related to anhedonia (items 1–2: “able to laugh,” “looking forward”), anxiety (items 4, 5 & 6: “scared,” “worried,” “overwhelmed”) and depression (items 7, 8 & 9: “difficult to sleep,” “sad,” “cry”); item 3 (“self-blame”) was on the border of depression and anxiety. For both 2- and 3-factor EFAs, the test of no common factors had a p-value < 0.0001 .

Confirmatory Factor Analysis (CFA)

CFA was conducted on the same sample using both two- and three-factor models based on the EFA to examine the fit of the structural models. Table 3 presents the results from the two and three-factor models with corresponding fit indices. Examination of the fit indices (chi-square, RMSEA, CFI, and SRMR) confirmed that the three-factor model of depression, anxiety, and anhedonia provided a better fit to our data, as compared to the two-factor model.

Discussion

This is the first study to investigate the factor structure of the EPDS in a population of native Mexican women. Our results support a multi-dimensional nature of the EPDS in this population, with a 3-factor model characterizing depressive, anxiety and anhedonia symptoms providing the most optimal fit. This is consistent with the factor structure identified in other multi-ethnic US populations including within a subgroup of Hispanic women (Chiu et al., 2017; King, 2012). The results of this study further support the call for broadening the definition of postpartum distress to include other subconstructs in addition to depressive disorders (Goodman et al., 2016).

There is a small body of literature exploring the factor structure in subgroups of race/ethnicity in the US and worldwide (reviewed in (Coates et al., 2017)) which overall supports a 2–3 factor structure. In an African American population, King et al. identified that a 3-factor model provided the optimal fit, with subconstructs including anhedonia, depression and anxiety (King, 2012). Similarly, a 3-factor structure was the most optimal fit in a sample of Hispanic women in the Northeastern US (Chiu et al., 2017).

In the literature to date, there is variability in loading of specific items by study population. We observed clustering of factors related to anhedonia (items 1 and 2), depression (items 7, 8 and 9) and anxiety (items 4, 5 and 6), with item 3 (“self-blame”) aligning with depressive symptoms in our sample. However, in a study investigating the factor structure in an African American population in the US, King et al. observed that item 3 (“self-blame”) was more strongly aligned with anxiety (King, 2012). In a study investigating the factor structure in subgroups of race/ethnicity in the US, item 6 (“overwhelmed”) clustered with depression in the non-Hispanic white and African American subgroups and clustered with anxiety in the Hispanic subgroup (Chiu et al., 2017). In the present study in native Mexican women, item 6 also clustered with anxiety. Our study population is similar to that of Chiu et al. in terms of timing of EPDS (6 months postpartum), maternal age (mean maternal age in present study is 28 ± 5.4 versus 27 ± 5.8 years) and maternal educational attainment as a marker of SES (23% of participants in the present study versus 22% in US population had >12 years of education). However, the mean EPDS score was higher in the native Mexican population compared with the US population (6.7 in Mexican women versus 4.6 in the US Hispanic subgroup).

In contrast, in a population of Hispanic women in the Southeastern US, the optimal fit was a 2-factor model of depression and anxiety (Hartley et al., 2014a). However, the study population included a smaller sample size of 220 mothers, 98 of whom were Spanish-speaking and completed the Spanish version of the EPDS. This subgroup was analyzed separately, and the small sample size may have impaired the ability to detect stable correlation patterns and thus isolate more than 2 factors. They also include a wider range of time periods after delivery (mean 4 months, range 0–10 months) which may have introduced variability. In addition, the population is higher SES with the majority of participants (>60%) reporting more than 12 years of education.

While there is increasing evidence for differences in EPDS factor structure in multi-ethnic populations in the US, there are a limited number of such investigations in Latin American countries. A study of 811 mothers attending clinics postpartum in Rio de Janeiro, Brazil identified a 3-factor structure. However, the authors concluded that the use of a single factor structure was still the best clinical practice because the factors they identified did not qualify as independent dimensions when used individually and therefore lacked factor-based discriminant validity (Reichenheim et al., 2011).

This study suggests that a three-dimensional structure best characterizes the EPDS in a population of native Mexican women. This is important given the phenotypic heterogeneity of postpartum mood disorders regarding risk factors, management and prevention. For example, Petrozzi and Gagliardi reported that women whose EPDS responses clustered with depression after birth were more likely to have an elevated EPDS score 3 months after delivery than those whose symptoms clustered with anxiety (Petrozzi and Gagliardi, 2013). Understanding these sub-constructs could thus help in determining the optimal management and follow-up of patients. Different dimensions (e.g., depressive symptoms, anhedonia, anxiety) may have variable antecedents or risk factors. Each domain itself may be related to different behavioral or functional outcomes in both mothers and their children followed longitudinally. Furthermore, anhedonia is not always clinically identified (Sibitz et al., 2010) which suggests that psychological dysfunction may be overlooked if women are not more comprehensively characterized.

Our study has several strengths. This is the first study to evaluate the factor structure of the EPDS in a cohort of lower income native Mexican women, an understudied population in this regard with a large burden of disease that has the potential to impact outcomes for mother and infant. Our larger sample size likely enhances our ability to identify a three-factor solution for the EPDS secondary to the ability to determine more stable correlation patterns as pointed out previously (Chiu et al., 2017; Coates et al., 2017). We also acknowledge some limitations. The majority of women in our study had less than a high school education, potentially limiting the generalizability of our findings to other populations with higher SES. We did not split the sample for the EFA and CFA due to the samples sizes required to effectively implement these approaches. A relatively large sample is required to adequately model underlying factor structures, and our concern in splitting for training/validation is that these models, each on a smaller sub-sample, would not adequately capture variation across the population as a whole. However, this approach is comparable to others in the literature (e.g. (Chiu et al., 2017), (Reichenheim et al., 2011), (Phillips et al., 2009)). Furthermore, future research is needed to determine if the factor structure is stable over time in the postpartum period. Notably, stability has been observed in other populations, for example Coates et al. demonstrated stability of the 3 subscales in pregnancy and the postpartum period through 8 months in a UK sample (Coates et al., 2017). It is also important to extend these results by exploring differences in risk factors and outcomes for manifestations of anxiety, depression and anhedonia.

In conclusion, this is the first study to examine the factor structure of the EPDS, a widely used instrument to screen for maternal distress in the postpartum period among native Mexican women. Understanding subtleties in diagnosis has the potential to better guide

management to mitigate the impact of postpartum depression and mood disorders. Given our findings, future epidemiological studies designed to identify risk factors or adverse maternal-child consequences of impaired postpartum psychological functioning in this population should consider EPDS subconstructs in addition to the conventionally used total score. Furthermore, optimal cut-offs for each of these subconstructs should be identified in Mexican populations in order to ensure better screening. These subconstructs may have different risk factors and may be related to different behavioral or functional outcomes in both mothers and their children (Liu and Tronick, 2014) with important implications for both diagnosis and management.

Abbreviations

AMAI	Asociación Mexicana de Agencias de Investigación de Mercados y Opinión Pública
CFA	Confirmatory factor analysis
CFI	Comparative fit index
EPDS	Edinburgh Postpartum Depression Scale
EFA	Exploratory factor analysis
IMSS	Instituto Mexicano del Seguro Social
PPD	Postpartum depression
PROGRESS	Programming Research in Obesity, Growth, Environment and Social Stressors
RMSEA	Root mean square error of approximation
SES	Socioeconomic status
SMSR	Standardized root mean square residual
UK	United Kingdom
US	United States

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Table 1

Participant characteristics

	N	%
Education grade level		
12	483	77
>12	145	23
Socioeconomic status (n, %)		
Low	330	52.5
Medium	230	36.6
High	68	10.9
Maternal age at delivery, years	Mean 28.00	SD 5.42
Total EPDS score	6.72	5.80

Table 2

Factor loadings of Exploratory Factor Analysis (EFA) of EPDS for two- and three-factor models

EPDS Items	Three-factor Model			Two-factor Model	
	F1	F2	F3	F1	F2
1 Able to laugh	0.22	0.19	0.74	0.44	0.35
2 Look forward	0.23	0.20	0.58	0.41	0.32
3 Self-blame	0.41	0.38	0.35	0.49	0.44
4 Worry	0.27	0.72	0.24	0.30	0.75
5 Scared	0.29	0.68	0.18	0.31	0.68
6 Overwhelmed	0.41	0.42	0.32	0.48	0.46
7 Difficult to sleep	0.63	0.29	0.24	0.66	0.31
8 Sad	0.74	0.23	0.28	0.78	0.26
9 Cry	0.68	0.35	0.22	0.69	0.36

*
Item 10 excluded from analysis

Table 3

Confirmatory factor analysis (CFA) of EPDS

Factor structure	χ^2	df	p	CFI	RMSEA	SRMR
F1=1, 2, 3, 6, 7, 8, 9 F2=4, 5	147.3	26	<0.0001	0.948	0.086	0.045
F1 = 3, 7, 8, 9 F2 = 4, 5, 6 F3 = 1, 2	90.3	24	<0.0001	0.971	0.066	0.037

df=degree of freedom; CFI=comparative fit index; RMSEA=root mean square error of approximation; SRMR=standardized root mean square residual