SCREENING FOR POSTPARTUM DEPRESSION IN AMERICAN INDIAN/ALASKA NATIVE WOMEN: A COMPARISON OF TWO INSTRUMENTS

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Abstract: This review examined validation studies of the Edinburgh Postnatal Depression Scale (EPDS) and the Patient Health Questionnaire-9 (PHQ-9) to identify an appropriate postpartum depression (PPD) screening tool for American Indian and Alaska Native (AI/AN) women in the U.S. Databases were searched using: EPDS paired with psychometric properties or validation and PHQ-9 paired with PPD and psychometric properties or validation, yielding a final sample of 58 articles. Both tools have good internal consistency, but discriminative validity for detecting PPD in women from non-Western cultures is low. Positive predictive values in these women are low and diverse (EPDS [n = 21] median 67%, range 21.1-90%; PHQ-9 [n = 1] median 26%). The low predictive accuracy of both tools suggests the tools may be culturally biased.

INTRODUCTION

Women often report delight after giving birth (Bina, 2008), but when they develop postpartum depression (PPD), it is far from delightful. For postpartum women with depressive symptoms and their health care providers, it is important to differentiate postpartum depressive symptoms from other symptoms that occur in the postpartum period that are normative of childbirth. Pregnancy induces changes in many body functions, so the majority of changes, or symptoms, that postpartum women experience are the body's way of reverting to a normal, non-pregnant state. These symptoms typically last for six weeks following delivery, although some can last longer. For example, alterations in sleep can occur for months after delivery (Blackburn, 2013), and poor sleep quality is a risk factor for PPD (Okun, 2015; Okun et al., 2011; Wu et al., 2014). Further, sleep deprivation is associated with higher levels of pro-inflammatory cytokines, which is important because higher plasma concentrations of pro-inflammatory cytokines are associated with PPD (Chang, Pien, Duntley, & Macones, 2010). Changes in sleeping patterns are

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a common finding for many postpartum women (Committee on Obstetric Practice, 2015), and it is difficult to discern if a woman's alteration in sleep is a symptom of her postpartum period (e.g., becoming a new mother) or if it is a symptom of postpartum depression. These issues complicate assessing postpartum depressive symptoms; therefore, it is important to have reliable and valid PPD screening instruments.

Through a pilot study (Heck, 2015) conducted in conjunction with the Department of Health and the Department of Family Services of the Chickasaw Nation, a tribal nation that operates its own tribal health system and delivers health care to its members and other AI/AN people (The Chickasaw Nation, n.d.), it was discovered that health care providers in facilities throughout the Chickasaw Nation health system use the PHQ-9 (Kroenke, Spitzer, & Williams, 2001) to screen AI/AN women for PPD. The PHQ-9 is a general screen for depressive disorders and has items that may coincide with normal symptoms of the postpartum period, such as fatigue and sleeping difficulties. Other tools, such as the EPDS (Cox, Holden, & Sagovsky, 1987), have been widely used to screen for PPD specifically, placing less emphasis on somatic symptoms of depression that are relatively common and normal findings in the postpartum period.

Despite PPD's worldwide manifestation, there is a disparity in the PPD literature. Currently in the U.S., the majority of PPD research focuses on middle class, Caucasian women, highlighting a gap in the literature investigating PPD from a culturally diverse perspective. Other minority women, particularly AI/AN women, are largely underrepresented. Few studies report on PPD in these women, demonstrating a basic lack of understanding of PPD in this population. For instance, in the U.S. five studies report PPD prevalence in American Indian women, which ranges from 18.17 to 29.3 percent (Baker et al., 2005; Ertel, Rich-Edwards, & Koenen, 2011; Oklahoma State Department of Health, 2008; Segre, Losch, & O'Hara, 2006; Wei et al., 2008). This is much higher than the 10 to 15 percent prevalence reported for the general U.S. population of women (Gaynes et al., 2005) and suggests a racial/ethnic disparity in PPD.

Evidence supports that screening for and early detection of PPD improves treatment and outcomes (Hanna, Jarman, Savage, & Layton, 2004; O'Connor, Rossom, Henninger, Groom, & Burda, 2016; Siu & U.S. Preventive Services Task Force, 2016) and contributes to its status as a national public health priority. However, the current lack of knowledge about the effectiveness of standard treatment and issues with detection in AI/AN women could be masking an even greater prevalence and incidence than what is currently reported. Therefore, the purpose of this integrative review was to examine the validation studies of the EPDS and the PHQ-9 to identify

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an appropriate PPD screening instrument for use with AI/AN women. Specific aims were to: 1) systematically examine and analyze the psychometric properties of the PHQ-9 when screening for PPD in a variety of samples of ethnic minority women and women from non-Western cultures; 2) systematically examine and analyze the psychometric properties of the EPDS in similar samples; and 3) compare and contrast the psychometric properties of the PHQ-9 to those of the EPDS when screening for PPD in culturally diverse samples of women, and specifically AI/AN women.

Background and Significance

Postpartum depression affects about one in seven new mothers in the U.S. (O'Hara & McCabe, 2013). While there is some disagreement as to when it begins or how long it persists, PPD is clinically defined as a major depressive episode that occurs any time up to one year following childbirth (American Psychiatric Association [APA], 2013; O'Hara & McCabe, 2013). Its adverse maternal, infant/child, and family effects (Horwitz, Briggs-Gowan, Storfer-Isser, & Carter, 2007; Miklush & Connelly, 2013) increase use of health care resources, which indirectly impacts global society (Agency for Healthcare Research and Quality, 2013). This chain of influence is linked to maternal symptoms of guilt and despair, depressed mood, and fatigue (APA, 2013; O'Hara & McCabe, 2013). As one might expect, these symptoms negatively influence the mother-infant relationship, causing insecure attachment (Hennighausen & Lyons-Ruth, 2007). Attachment disorders can lead to aggression in the child during school-aged years (Hennighausen & Lyons-Ruth, 2007; Klaus & Kennell, 1976) and psychopathology in late adolescence (Hennighausen & Lyons-Ruth, 2007) that ultimately leads to more financial and social demands on the societal whole.

Screening for Postpartum Depression

The U.S. Department of Health and Human Services' (USDHHS) *Healthy People 2020* initiative for health promotion and disease prevention has recently added an objective for reducing the rate of PPD symptoms in the U.S. (USDHHS, 2016). Additionally, in January 2016 the U. S. Preventive Services Task Force released an updated recommendation for depression screening in adults to include pregnant and postpartum women (Siu & U.S. Preventive Services Task Force, 2016). This is crucial, as screening for depression in postpartum women is

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associated with improved outcomes. More specifically, depression-screening programs for pregnant and postpartum women reduce the prevalence of depression, increase remission of depression symptoms, and increase treatment response (O'Connor et al., 2016; Siu & U.S. Preventive Services Task Force, 2016). Research suggests that early identification or detection is key in the treatment of PPD (Hanna et al., 2004), so there is clear benefit to screening for depression in postpartum women.

MATERIALS AND METHODS

This integrative review serves as a comparative instrument analysis examining validation studies of the EPDS and the PHQ-9 to identify an appropriate PPD screening instrument for AI/AN women in the U.S. By extension, strengths and weaknesses of the PPD literature surrounding screening are highlighted. This is a necessary step toward improving the PPD knowledge base (Torraco, 2005).

Search Strategy

The search strategy included Medline Complete, PsychARTICLES, Embase, PubMed, and Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete databases. Initial search terms were *Edinburgh Postnatal Depression Scale* paired with *psychometric properties* or *validation* and *Patient Health Questionnaire-9* paired with *postpartum depression* and *psychometric properties* or *validation*. Studies published in English and those that sampled ethnic minority or non-Western cultured adult women were included. Research studying women still or not yet pregnant was excluded. Additionally, research studying adolescent mothers was excluded, as there is evidence that the EPDS performs differently with adolescent versus adult mothers (Logsdon & Myers, 2010). There is a growing body of literature surrounding PPD in adolescent women, and this topic is beyond the scope and purpose of this review. Reference lists from retrieved studies provided additional citations that were recovered manually, yielding a final sample of 58 articles. See Figure 1 for a visual representation of the search strategy and decision-making based on inclusion/exclusion criteria.

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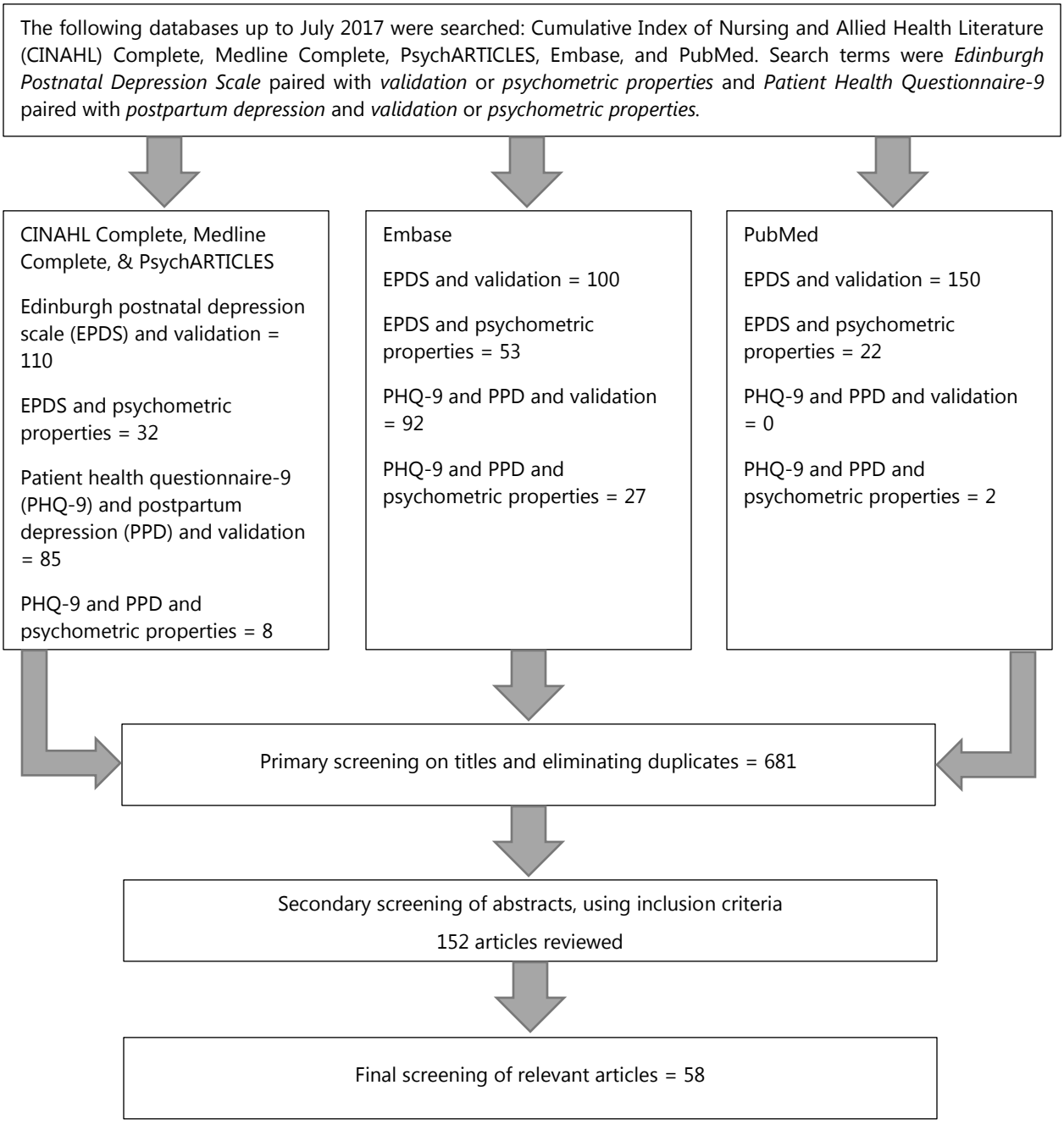
Figure 1. Search Strategy for *Screening for Postpartum Depression in American Indian/Alaska Native Women: A Comparison of Two Instruments*



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Data Evaluation and Analysis

The literature search produced 58 articles investigating PPD using either the EPDS or the PHQ-9 as the screening instrument in samples of culturally diverse women and represented several disciplines including nursing, psychology, medicine (mostly psychiatry), public health, social work, education, political science, pharmacy, and epidemiology (see Appendix Tables A1 and A2). All abstracts were read to identify relevant reports. Any studies deemed relevant (or if relevance was uncertain) were read in full, and studies were categorized according to the screening instrument used. The selected studies were evaluated in terms of level of evidence using the American Association of Critical-Care Nurses (AACN) system (see Table 1; Armola et al., 2009). Lastly, the psychometric performance of the EPDS and the PHQ-9 was critiqued for each study reviewed (see Tables 5-8).

Table 1
American Association of Critical-Care Nurse's Evidence-Leveling System (Armola et al., 2009)

Level	Evidence
A	Meta-analysis of multiple controlled studies or meta-synthesis of qualitative studies with results that consistently support a specific action, intervention or treatment
B	Well-designed controlled studies, both randomized and nonrandomized, with results that consistently support a specific action, intervention, or treatment
C	Qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled trials with inconsistent results
D	Peer-reviewed professional organizational standards, with clinical studies to support recommendations
E	Theory-based evidence from expert opinion or multiple case reports
M	Manufacturers' recommendations only

RESULTS

Findings are categorized according to format, reliability, concurrent validity, predictive validity, and predictive accuracy. Findings from studies using the PHQ-9 and the EPDS are compared and contrasted within each category.

Format

PHQ-9

The PHQ-9 was developed in 2001 and is intended to screen for a variety of depressive disorders, such as major depressive disorder, as defined by the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV; Kroenke et al., 2001). It is a nine-item, self-report scale that can be completed in less than five minutes (see Table 2; Kroenke et al., 2001). Unlike

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the EPDS, it does not exclude common somatic symptoms of the postpartum period, thereby lowering specificity when screening for PPD in women. Originally validated in a sample of 580 primary care (male and female) and OB-GYN (female) clinic patients in the U.S., the authors suggested a cut-off score of 10 (Kroenke et al., 2001). While only a few studies assess the psychometric properties of the PHQ-9 when screening specifically for PPD (n = 7), this instrument has been validated in other samples as a reliable and valid instrument for screening for other depressive disorders (Arroll et al., 2010; Martin, Rief, Klaiberg, & Braehler, 2005). It is now available in over 30 other languages, including Arabic (Sawaya, Atoui, Hamadeh, Zeinoun, & Hahas, 2016), Chinese (Yeung et al., 2008), and Korean (Shin et al., 2010).

EPDS

The EPDS was created in 1987 and has been used globally to screen for PPD (Cox et al., 1987). It is a ten-item, self-report scale that can be completed in less than five minutes (see Table 2; Cox et al., 1987). The EPDS was born from the need for a depression screening scale with fewer limitations when used with childbearing women. In particular, authors were interested in placing less emphasis on somatic symptoms of depression, such as sleep disturbances and fatigue, because they are relatively common and can be normal findings in the postpartum period. In reducing the emphasis on these somatic symptoms, the EPDS was the first instrument to screen specifically for PPD, thereby increasing specificity. It was originally validated in a sample of 84 postpartum women in an out-of-hospital setting in England; the authors suggested a cut-off score of 9/10 (Cox et al., 1987). It is now available in 23 other languages, including Greek (Leonardou et al., 2009), Hungarian (Töreki et al., 2014), and Sudanese (Khalifa, Glavin, Bjertness, & Lien, 2015) and has also been validated in samples of fathers (Loscalzo, Giannini, Contena, Gori, & Benvenuti, 2015) and adolescent mothers (Logsdon & Myers, 2010).

Table 2
Format Findings

	PHQ-9	EPDS
# Items	9	10
Range of Scores	0 – 27	0 – 30
Diagnostic Cut Point	10	9/10
Minutes to Complete	5	5
Reading Level	3rd grade	4th – 5th grade
Item Characteristics	DSM-IV criteria, no anxiety items for major depressive disorder	Differentiate symptoms from pregnancy/ postpartum; includes anxiety item for PPD

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Reliability

Table 3 shows a summary of the reliability of the PHQ-9 and EPDS when screening for PPD from the studies reviewed (n = 58). While the reviewed studies included seven using the PHQ-9 and 54 using the EPDS, not all studies reported reliability values or statistics. For example, some reported internal consistency and no sensitivity, specificity, positive predictive value, or negative predictive value, while others reported all five values. Of the 58 studies reviewed, 37 reported some or all reliability information, with three using the PHQ-9 and 36 using the EPDS.

Internal consistency is one component of reliability and speaks to the extent to which the items on a scale are 1) interrelated and 2) all measuring the same attribute (Polit & Yang, 2016). Internal consistency is measured by computing Cronbach's alpha (α), and values of .70 and higher are desirable (Adams & Lawrence, 2015; DeVellis, 2017). In terms of screening for PPD, internal consistency values were above .70 for both tools and were, therefore, acceptable (see Table 3).

Another approach to establishing internal consistency is split-half reliability (Adams & Lawrence, 2015), which offers a method of determining test-retest reliability without administering the test twice (Grove, Burns, & Gray, 2013). Test-retest reliability speaks to the degree to which scores can be replicated with repeated administrations of the tool (Polit & Yang, 2016). There are no reports of split-half or test-retest reliability for the PHQ-9 when used to screen for PPD; however, in its original validation study, test-retest reliability was reported as "excellent," yet no value was given. For the EPDS, split-half reliability (Pearson's r) and test-retest reliability were acceptable (see Table 3). Based on biostatistician guidelines, Pearson's r values above .70 are generally acceptable (Adams & Lawrence, 2015), and ICC values above .60 are generally acceptable (Cicchetti, 1994).

Table 3
Reliability Findings

	Cronbach's alpha	Split-Half (Pearson's *r*)	Split-Half (Guttman's coefficient)	Test-Retest	ICC
PHQ-9 Median (Range)	.85 (.79 - .88) *n* = 3	Not Reported (NR)	NR	NR	.75 *n* = 1
EPDS Median (Range)	.83 (.47 - .90) *n* = 36	.855 (.83 - .88) *n* = 2	.74 *n* = 1	.82 (.74 - .9) *n* = 2	.714 (.51 - .918) *n* = 2

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Concurrent Validity of the PHQ-9 to the EPDS

Concurrent validity is demonstrated when a test correlates well with an instrument that has previously been validated (Polit & Yang, 2016), and two studies report on this validity for the PHQ-9 and the EPDS in women (see Table 4). Both report acceptable correlations, but it is noteworthy that in the Hanusa, Scholle, Hakett, Spadaro, and Wisner (2008) study 72 percent of the sample was Caucasian. In addition, Flynn, Sexto, Ratliff, Porter, and Zivin (2011) used summary scoring for the acceptable Pearson's *r*. When PHQ-9 diagnostic scoring was used, the degree of agreement between the EPDS and the PHQ-9 ($k > .7$) was only 0.5 for postpartum women (Flynn et al., 2011). It appears that correct identification of the diagnostic group was reduced due to decreased sensitivity in using this method (diagnostic versus summary scoring). Yawn et al. (2009) reported 17 percent discordance between the EPDS and the PHQ-9. It seems as though the two screening tools, when screening for PPD, are categorizing differently.

Table 4
Concurrent Validity of the PHQ-9 to the EPDS

First Author (Year)	Sample	Correlation
Hanusa (2008)	123 women in the first six months postpartum	Pearson's *r* = .75
Flynn (2010)	104 postpartum women	Pearson's *r* = .769 Kappa = .54

Predictive Validity

Table 5 displays a summary of the predictive validity of the PHQ-9 and the EPDS when screening for PPD from the studies reviewed ($n = 58$). Again, not all studies reported validity values or statistics. Of the 58 studies reviewed, 49 reported some or all predictive validity values or statistics, with five using the PHQ-9 and 47 using the EPDS. Both instruments had comparable sensitivity in screening for PPD in the studies reviewed. As might be expected due to the inclusion of items related to somatic symptoms of depression, the PHQ-9 had reduced specificity when screening for PPD as compared to the EPDS.

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Table 5
Predictive Validity

	PHQ-9 Median (Range) *n*=5	EPDS Median (Range) *n*=47
Sensitivity (%)	85.5 (80 – 94)	88.5 (62 – 100)
Specificity (%)	70 (31 – 84)	84 .5 (25.5 – 98.18)
Positive Predictive Value (%)	26 (N/A)	67.45 (21.1 – 90)
Negative Predictive Value (%)	98 (63 – 99)	97 (64 – 100)

Predictive Accuracy

The EPDS excludes common symptoms of the postpartum period such as fatigue, but discriminative validity for detecting PPD in samples of women drawn from non-Western cultures is low (see Table 6). Reported positive predictive values in non-Western samples range from 21.1 to 90 percent and negative predictive values range from 70 to 100 percent. However, 46.6 percent (*n* = 27) of the studies reviewed did not report a negative predictive value (eight from non-Western countries), and 29.3 percent (*n* = 17) did not report a positive predictive value (seven from non-Western countries). Also important to note is that 36.2 percent (*n* = 21) of these studies report a prevalence at or below reported U.S. prevalence estimates (10%-15%). Moving from the Felice, Saliba, Grech, and Cox (2006) study to the Teng et al. (2005) study, there appears to be a natural drop in positive predictive values (see Table 6). Finally, for the PHQ-9, discriminative validity for detecting PPD in culturally diverse samples of women is extremely limited, as only one study was found that reported psychometric properties of the EPDS in screening for PPD, and it was conducted outside the U.S. (see Table 6; Weobong et al., 2009).

Table 6
Predictive Accuracy

First Author (Year)	Country (*n*)	PPV (%)	NPV (%)	Prevalence (%) T1, T2, etc.
Mahmud (2003)	Malaysia (64)	90	100	14.1
Agoub (2005)	Morocco (144)	86	NR	18.7, 6.9, 11.8, 5.6
Husain (2014)	Pakistan (601)	82	70	NR
Pollock (2006)	Mongolia (94)	81.4	77.1	NR
Rowel (2008)	Sri Lanka (204)	80.6	91.8	NR
Bhusal (2016)	Nepal (346)	77	99.3	17.1
Uwakwe (2003)	Nigeria (225)	75	97	10.7
Chibanda (2009)	Zimbabwe (220)	74	94	33.0
Felice (2006)	Malta (239)	68.2	98.5	8
Teng (2005)	Taiwan (203)	46	99	10.3

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Table 6
Predictive Accuracy

First Author (Year)	Country (*n*)	PPV (%)	NPV (%)	Prevalence (%) T1, T2, etc.
Lee (1998)	China (145)	44	97	12.0
Ghubash (1997)	UAE (95)	44	99	26.0
Tesfaye (2010)	Ethiopia (105)	42.9	93.8	NR
Regmi (2002)	Nepal (100)	42	100	5.0
Gausia (2007)	Bangladesh (100)	40	99	9.0
Bunevičius (2009)	Lithuania (94)	35	98	14
Khalifa (2015)	Sudan (238)	33	98	9.2
Aydin (2004)	Turkey (341)	30	95	35.8
Pitanupong (2007)	Thailand (351)	26	96	8.4
Weobong (2009) using PHQ-9	Ghana (160)	26	99	NR
Weobong (2009) using EPDS	Ghana (160)	22	97	Not Reported (NR)
Lawrie (1998)	South Africa (103)	21.1	100	24.5

DISCUSSION

Both the PHQ-9 and the EPDS are intended to screen for depression and are quick and easy to complete. Neither scale has been normed, but there have been recommended cut-off scores established for both (Cox et al., 1987; Kroenke et al., 2001). With the EPDS, more false positives are possible, with a greater likelihood to diagnosis women without PPD as having PPD. Clinically, this is good for screening, assuming the cost of workup and treatment outweighs the cost of starting women on the treatment regimen and labeling them with a disorder they do not have. In terms of research, this can be problematic for finding women that meet inclusion criteria.

While possessing excellent concurrent validity, the low predictive accuracy of both instruments in samples of culturally diverse women suggests a cultural bias, where perhaps the terms used in the scales are not meaningful and/or PPD is viewed, characterized, or manifested differently in these cultures of women. The low predictive accuracy could also be attributed to underreporting. The EPDS is far more validated for PPD screening than the PHQ-9, yet neither instrument has been cross-culturally adapted or validated for PPD screening with AI/AN women. Neither instrument may be appropriate for use in this population, so investigators should examine psychometric properties of both instruments before using them with AI/AN and other underrepresented ethnic minority populations in the U.S.

Issues with PPD screening in AI/AN women may contribute to inaccurate and unreliable

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prevalence reporting. There are no studies that report on PPD screening in AI/AN women, and no PPD or general depression screening instruments have been validated or otherwise psychometrically evaluated to screen for PPD in AI/AN women. PPD in underrepresented ethnic minorities is a public health priority in the U.S., complicated by what appears to be a stark racial/ethnic disparity. The absence of a culturally and/or linguistically appropriate screening tool raises concern for the accuracy of PPD prevalence reports for AI/AN women. The PHQ-9 needs more validation in screening for PPD in diverse samples of women. Validation of the EPDS and/or the PHQ-9 in underrepresented ethnic minority women in the U.S., particularly AI/AN women, will assist in accurately assessing PPD prevalence in these populations. Finally, despite the issues with PPD screening for AI/AN women (including the need for further research), it is still clinically important that AI/AN women are screened for PPD, that appropriate referrals to care are made when indicated, and that follow-up is accomplished in a timely and unwavering fashion. These steps are vital to improve PPD care for AI/AN women.

Cross-cultural research has been conducted for hundreds of years, resulting in a massive and varied body of literature. More specifically, cross-cultural research has focused on measurement and scale development issues for decades. For example, Flaherty et al. (1988) proposed five steps for accomplishing cross-cultural equivalence in the context of instrument adaptation. More recently, Sidani, Guruge, Miranda, Ford-Gilboe, and Varcoe (2010) developed a five-phase, integrative method for exploring conceptual equivalence (as part of the process of cross-culturally adapting and translating instruments) during their work concerning the health effects of intimate partner violence in Sri Lankan Tamil women.

Given the issues surrounding PPD prevalence in AI/AN women, a logical next step is determining the cross-cultural validity of a widely used, globally validated PPD screening instrument such as the EPDS in a sample of AI/AN women. Cross-cultural adaptation advances the science of comparative effectiveness research in the area of PPD in AI/AN women, and therefore a logical next step is conceptual equivalence of PPD for these women. Equivalence concerns the degree to which an adapted and/or translated measure is comparable to the original measure (Polit & Yang, 2016). Conceptual equivalence is a more specific type of equivalence that is concerned with whether the concept being measured even exists in the target culture, and if so, its relevance and the extent to which it has similar meaning in that culture (Polit & Yang, 2016; Sidani et al., 2010). Conceptual equivalence can been visualized as being on a continuum, where one end represents 100 percent agreement of the existence and meaning of a concept

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between the source (the culture in which the concept and measure were originally developed) and target cultures, and the other end represents zero percent agreement – where the concept does not exist in the target culture (Polit & Yang, 2016; Sidani et al., 2010). While there are other types of equivalence to consider in adapting an instrument, conceptual equivalence is the most important, and often the first step in the cross-cultural adaptation process (Gjersing, Caplehorn, & Clausen, 2010; Polit & Yang, 2016; Sidani et al., 2010; Waltz, Strickland, & Lenz, 2010).

Limitations for this review are few. The major limitation was prohibiting prenatal/antenatal depression research from inclusion, because many investigations combine prenatal and postpartum depression as various measures or variables. However, research surrounding PPD in AI/AN women is severely limited, and research regarding prenatal depression in AI/AN women is nonexistent. Therefore, PPD was chosen as the primary focus for this review.

Future Directions

The literature reveals a variety of interventions for PPD treatment; currently, standard PPD treatment involves antidepressant medication, psychotherapy, or both (Dennis & Dowswell, 2013). However, no studies report on the effectiveness of standard PPD treatment in AI/AN women. This lack of evidence substantiates the need for further research surrounding not only the effectiveness of standard PPD treatment for these women, but also desired and/or preferred treatments based on cultural preference. Exploring the acceptability, compatibility, and feasibility of integrating traditional native healing into current interventions and treatment for PPD with AI/AN women is another area for future investigation.

Lastly, future studies should explore the role of acculturation in AI/AN women's experiences of PPD, as level of acculturation may impact their PPD risk and therefore prevalence. Acculturation has been studied rarely in the context of PPD and not at all for AI/AN women in that same context. Results in studies examining the relationship between PPD and acculturation are contradictory. For example, Beck, Froman, and Bernal (2005) found no statistically significant relationship between acculturation and PPD or the presence of PPD symptoms. Yet other studies report with more acculturation, a woman's risk of PPD increases (Heilemann, Frutos, Lee, & Kury, 2004; Martinez-Schallmoser, Telleen, & MacMullen, 2003). These studies were conducted with Latina women, and no studies have been conducted that

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examine the relationship between acculturation and PPD in samples of AI/AN women. This begs the question: Does a relationship exist between acculturation and PPD for AI/AN women? Further, the type of relationship may depend upon the cultural traditions and beliefs to which AI/AN women more strongly ascribe. Furthermore, acculturation scales have not been validated in samples of AI/AN women. Given that acculturation has been associated with an increased risk of PPD in other minority women, it is possible that the same will be true for AI/AN women. Perhaps a woman's level of acculturation could be a partial explanation for the disparity seen in PPD prevalence, where AI/AN women have higher rates than the general U.S. population of women. There is a compelling need for further PPD research with AI/AN women.

CONCLUSION

The low predictive accuracy of the EPDS and the PHQ-9 in samples of culturally diverse women suggests these tools may be culturally biased. Neither instrument may be appropriate for use with AI/AN samples of women. As a consequence, the absence of culturally and/or linguistically appropriate PPD screening tool raises concern about the assessment of PPD among AI/AN women and about the reported prevalence of PPD in AI/AN women. Future research should examine the validity of these screening tools with AI/AN postpartum women and guide the development of more culturally appropriate tools, if needed.

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ACKNOWLEDGEMENTS

Jennifer L. Heck is a 2014-2016 Women Child Health Initiative Predoctoral Scholar and a Jonas Scholar Nurse Leader, 2016-2018 cohort. The financial support received through these awards funded this work. Additionally, the mentoring and editorial and other support provided by Barbara Carlson, PhD, RN, The Bob and Doris Klabzuba Professor of Nursing, and Barbara Holtzclaw, PhD, RN, FAAN, Associate Dean of Research, was invaluable and forever appreciated.

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Appendix A. Summary Tables of PHQ-9 and EPDS Studies

Table A1
Summary of PHQ-9 Studies (*n* = 7)

First Author (year)	Level of Evidence	Location	Discipline(s)	Sample	Diagnostic Criteria/ Instrument	Cronbach's alpha	Cut-off Score(s)
Beck (2012)	C	U.S.	Nursing, Social Work, Education	80 low-income, ethnically diverse mothers	N/A	0.88	Not reported (NR)
Davis (2013)	B	U.S.	Medicine	1011 postpartum (PP) women	Structured Clinical Interview for the DSM-IV (SCID-IV)	NR	12
Flynn (2011)	C	U.S.	Psychiatry	104 PP women	N/A	0.85	10 or higher
Gjerdingen (2009)	C	U.S.	Psychiatry, Public Health	506 PP women	SCID-IV	NR	10 or higher
Hanusa (2008)	C	U.S.	Psychiatry, Nursing, OB-GYN	123 PP women	Diagnostic Interview Schedule	NR	10
Kroenke (2001)*	C	U.S.	Medicine	580 men & women in primary & OB-GYN settings	Mental health professional structured psychiatric interview	0.89, 0.86	10
Weobong (2009)	B	Ghana	Psychiatry, Medicine	160 PP women	Comprehensive Psychopatho-logical Rating Scale	0.79	4/5
Yawn (2009)	C	U.S.	Medicine, Nursing, Public Health	481 PP women	N/A	NR	NR

*Original validation study with major depressive disorder, not postpartum depression.

Table A2
Summary of EPDS Studies (*n* = 54)

First Author (year)	Level of Evidence	Location	Discipline(s)	Sample	Diagnostic Criteria/ Instrument	Cronbach's alpha	Cut-off Score(s)
Agoub (2005)	C	Morocco	Psychiatry	144 mothers	Mini International Neuropsychiatric Interview (MINI)	Not reported (NR)	12
Areias (1996)	C	Portugal	Psychiatry	54 women & men at 12 months PP	Research Diagnostic Criteria (RDC); Schedule for Affective Disorders and Schizophrenia	NR	10

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Table A2
Summary of EPDS Studies (*n* = 54)

First Author (year)	Level of Evidence	Location	Discipline(s)	Sample	Diagnostic Criteria/ Instrument	Cronbach's alpha	Cut-off Score(s)
Aydin (2004)	C	Turkey	Psychiatry, Public Health	341 PP women	Diagnostic & Statistical Manual of Mental Disorders, fourth edition (DSM-IV); Structured Clinical Interview for the DSM-IV (SCID)	0.72	12.5
Benvenuti (1999)	C	Italy	Psychiatry	113 PP women	Diagnostic & Statistical Manual of Mental Disorders, third edition (DSM-III); MINI	0.7894	8/9
Berle (2003)	C	Norway	Psychology, Psychiatry	100 PP women	DSM-IV; MINI	0.87	11
Bhusal (2016)	C	Nepal		346 PP mothers	The International Classification of Diseases, 10th revision (ICD-10)	0.74	12/13
Boyce (1993)	C	Australia	Psychiatry	103 PP women	Diagnostic Interview Schedule (DIS)	NR	12.5
Bunevičius (2009)	C	Lithuania	Medicine	94 women	Composite International Diagnostics Interview (CIDI) Short-Form	0.83	7
Carpiniello (1997)	C	Italy	Psychiatry	61 PP women	Clinical Interview Present State Examination	NR	9/10
Chibanda (2010)	C	Zimbabwe	Medicine	210 PP women with and without HIV infection	DSM-IV	NR	11
Cox (1987)	C	UK	Psychiatry, Psychology	84 mothers	RDC	0.87	9/10
Eberhard-Gran (2001)	C	Norway	Public Health	56 PP women	DSM-IV; Primary Care Evaluation of Mental Disorders	0.81	10
Ekeroma (2012)	C	New Zealand	Psychiatry	85 Samoan women & 85 Tongan women	World Health Organization Composite International Diagnostic Interview version 3	0.86	10
Felice (2006)	C	Malta	Psychiatry, Pediatrics	239 PP women	Diagnostic Criteria for Research -10	NR	11/12

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Table A2
Summary of EPDS Studies (*n* = 54)

First Author (year)	Level of Evidence	Location	Discipline(s)	Sample	Diagnostic Criteria/ Instrument	Cronbach's alpha	Cut-off Score(s)
Figueira (2009)	C	Brazil	NR	245 mothers	Mini-Plus 5.0	0.87	10
Flynn (2011)	C	USA	NR	104 PP women	NR	0.84	13
Fuggle (2006)	C	UK & Bengal	NR	48 PP women	NR	0.73	NR
Garcia-Esteve (2003)	C	Spain	Psychiatry, Psychology, Public Health	261 PP women	DSM-IV; SCID	NR	10/11
Gausia (2007)	C	Bangladesh	Public Health	100 PP women	DSM-IV;SCID	0.84	10
Ghubash (1997)	C	United Arab Emirates	Psychiatry	95 PP women	Catego definition of depression	0.84	10
Guedeney (1998)	C	France	Psychiatry	87 PP women	RDC	0.76	10.5
Hanlon (2008)	C	Ethiopia	Psychiatry; Medicine	101 PP women	Comprehensive Psychopathological Rating Scale (CPRS)	0.47	5/6
Hanusa (2008)	C	USA	Psychiatry; Nursing; OB/GYN	123 PP women	DIS	NR	10
Hartley	C	USA	Psychology	220 Hispanic women with infant aged 0-10 months	NR	0.84	NR
Husain (2014)	C	Pakistan	NR	601 mothers	ICD-10; Clinical Interview Schedule-Revised (CIS-R)	NR	14
Jadresic (1995)	C	Chile	Psychiatry	108 middle-class mothers	RDC	0.77	9/10
Kernot (2015)	C	Australia	NR	118 PP women	NR	NR	NR
Khalifa (2015)	C	Sudan	Community Medicine; Public Health	238 PP women	DSM-IV; MINI	NR	12
Kheirabadi (2012)	C	Iran	Psychiatry; Psychology; Epidemiology	262 PP women	Hamilton Depression Rating Scale (HDRS)	0.79	12
Lau (2010)	C	China	Nursing	300 PP women	DSM-IV-TR; SCID	0.78	10.5
Lawrie (1998)	C	South Africa	OB-GYN; Psychiatry	103 PP women	DSM-IV; SCID & Montgomery-Asberg Depression Rating Scale (MADRS)	NR	11/12
Lee (1998)	C	China	OB-GYN; Psychiatry	145 PP women	DSM-III-R; SCID	NR	9/10
Leonardou (2009)	C	Greece	Psychiatry	81 PP women	DSM-III-R; SCID	0.9	11/12

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Table A2
Summary of EPDS Studies (*n* = 54)

First Author (year)	Level of Evidence	Location	Discipline(s)	Sample	Diagnostic Criteria/ Instrument	Cronbach's alpha	Cut-off Score(s)
Lundh (1993)	C	Sweden	Psychology	53 mothers	CPRS-Depression	NR	9/10
Mahmud (2003)	C	Malaysia	Psychiatry; Social Development	64 PP women	ICD-10; HDRS	0.86	11/12
Mazhari (2007)	C	Iran	Neuroscience	200 PP women	DSM-IV; Clinical Interviews	0.83	12/13
Montazeri (2007)	C	Iran	Nursing	100 PP women	NR	0.77, 0.86	NR
Odalovic (2015)	C	Serbia	Pharmacy; Public Health	125 PP women	NR	0.83	NR
Pitanupong (2007)	C	Thailand	Psychiatry; OB-GYN	351 PP mothers	DSM-IV; SCID	NR	6/7
Pollock (2006)	C	Mongolia	Health & Social Care; Medicine	94 women	CIS-R	0.84	11/12
Pop (1992)	C	The Netherlands	Medicine; Psychology	293 Caucasian PP women	NR	0.80	NR
Regmi (2002)	C	Nepal	Psychiatry	100 PP women	DSM-IV	NR	13
Rowel (2008)	C	Sri Lanka	Medicine	204 PP women	ICD-10	NR	9
Santos (2007)	C	Brazil	Medicine	378 PP women	ICD-10	NR	10
Small (2007)	C	Australia	NR	1621 PP women	NR	0.8 to 0.87	NR
Teng (2005)	C	Taiwan	Psychiatry; Gynecology	203 PP women	DSM-IV; MINI	0.87	12/13
Tesfaye (2010)	C	Ethiopia	Psychiatry	105 PP women	CPRS	0.71	6/7
Töreki (2014)	C	Hungary	OB-GYN; Psychiatry	266 PP women	DSM-IV; SCID	0.75	12/13
Uwakwe (2003)	C	Nigeria	OB-GYN	225 PP women	ICD-10; CIDI	0.83	9
Vivilaki (2009)	C	Greece	Social Medicine; Nursing; Political Science; Epidemiology	120 mothers	NR	0.804	8
Weobong (2009)	B	Ghana	Psychiatry; Medicine	160 PP women	CPRS	0.79	10/11
Werrett (2006)	C	UK	NR	23 new mothers	ICD-10	0.87	11.5
White (2008)	C	New Zealand	Nursing	60 PP women	DSM-IV; SCID	0.87	9
Wickberg (1996)	C	Sweden	Psychology	128 PP women	MADRS	NR	11.5

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