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ORIGINAL CONTRIBUTION

Validity of the Kessler 10 (K-10) in detecting DSM-IV defined mood and anxiety disorders among pregnant women

G. Spies · D. J. Stein · A. Roos · S. C. Faure · J. Mostert · S. Seedat · B. Vythilingum

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Abstract It has been suggested that women experience depression most commonly in the childbearing years and that reproductive events such as pregnancy and child birth may coincide with the onset of mood and anxiety disorders in women. Therefore, a brief screening tool, with good sensitivity/specificity for psychiatric diagnoses that could be administered to pregnant women would be a valuable and useful proxy measure. We assessed the validity of the K-10, using the SCID as the gold standard, in a sample of 129 healthy pregnant women who presented for care at midwife obstetric units in Cape Town, South Africa. A receiver-operating characteristic curve (ROC) analysis indicated that the K-10 showed agreeable sensitivity and specificity in detecting depression (area under the receiver-operating characteristic curve, 0.66), posttraumatic stress disorder (0.69), panic disorder (0.71), and social phobia (0.76). The K-10 may be a useful screening measure for mood and anxiety disorders in pregnant women.

G. Spies · S. Seedat
Department of Psychiatry, South African Research Chairs Initiative (SARChI), PTSD program, University of Stellenbosch, Cape Town, South Africa

D. J. Stein · A. Roos · S. C. Faure · J. Mostert · S. Seedat · B. Vythilingum
MRC Unit on Anxiety and Stress Disorders, University of Stellenbosch, Cape Town, South Africa

D. J. Stein · B. Vythilingum (✉)
Department of Psychiatry, University of Cape Town, P.O. Box 19063, Tygerberg 7505 Cape Town, South Africa
e-mail: Bavanisha.Vythilingum@uct.ac.za

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Introduction

Reproductive events such as pregnancy and child birth can coincide with the onset of mood and anxiety disorders or worsen previously existing psychological distress in women (Driscoll, 2005). Women experience depression most commonly in the childbearing years (Spinelli 1998; Burke et al. 1991) and, in pregnant women, both depression and anxiety disorders are highly prevalent (e.g. Bennett et al. 2004; Guler et al. 2008; Kurki et al. 2000; Marcus et al. 2003; McKee et al. 2001; Nicholson et al. 2006; O'Hara. 1986; Zayas et al. 2002).

Mood disturbances in pregnancy have been a particular focus of attention due to potential effects on the developmental outcomes of children (Heron et al. 2004) and the health-related functioning and quality of life of mothers (McKee et al. 2001). Recent studies exploring anxiety, which is common and often co-morbid with depression (Kessler et al. 2001), have shown that maternal antenatal anxiety may also pose significant risks for a child's development. For example, antenatal anxiety has been linked to physical defects, low birth weight, fetal activity and development, and behavioral/emotional problems (DiPietro et al. 2002; Hansen et al. 2000; Hedegaard et al. 1993; Lou et al. 1992; Lou et al. 1994; O'Connor et al. 2002). Work also suggests that pregnant women with posttraumatic stress disorder are at risk for ectopic pregnancies, spontaneous abortion, hyperemesis, preterm contractions, and excessive fetal growth (Seng et al. 2001).

Many studies investigating postpartum depression have tested self-report measures (Lee et al. 2001; Eberhard-Gran

et al. 2001). However, there is a paucity of studies validating brief self-report scales in pregnant women (Su et al. 2007). Structured diagnostic instruments that assess DSM-IV and ICD-10 mental disorders are the "gold standard" for determining psychopathology in clinical and epidemiological studies. While these instruments are able to provide specific and differential psychiatric diagnoses, they are time-consuming and require skill to administer. Thus in both clinical practice and epidemiological surveys, there are advantages to using shorter scales of general mental health, especially for the purposes of screening (Kessler et al. 2002).

The most commonly used self report measure during pregnancy and the postpartum period is the Edinburgh Postnatal Depression Scale (EPDS), which is referred to as the Edinburgh Depression Scale (EDS) when used during pregnancy. The E(P) DS has been well validated for detecting depression during pregnancy and the postpartum period. It has also shown to be useful in screening for anxiety disorders. The E(P)DS, however, does not screen for other psychiatric disorders, limiting its usefulness as a general screening tool for mental illness during pregnancy and the postpartum period.

The K-10 is another shorter scale of mental health. This brief self-report instrument consists of 10 items and is designed to measure the level of distress in clinical and population surveys (Kessler et al. 2002; Furukawa et al. 2003). It has been widely implemented, including in the World Health Organization World Mental Health Survey. Prior research has shown the K-10 to be an excellent screening tool for mental health disorders (Baillie 2005; Cairney et al. 2007). However, there is a paucity of studies which have validated the K-10 in pregnant women. Given the high levels of mental health problems in these populations, and the need for less resource intensive screening measures within clinical settings, the K-10 may potentially be a useful alternative. Furthermore, the E(P)DS is not validated for a non pregnant population. In the developing world where health care workers are overburdened, having one scale that could be used to screen all patients would be more useful and more likely to be used than different scales for different populations. In the South African setting in particular, the K10 has been proposed as the standard screening tool for mental illness at primary care level. Furthermore, scoring of the K10 is simpler than the E(P)DS. The K10 requires summation of the individual item scores for a total, whereas the E(P)DS requires some items to be reverse scored. In low resource settings, simple scoring makes a scale more likely to be used, as well as more likely to be scored correctly. We therefore examined the K-10 as a brief rating scale of the most common mental disorders (depression and anxiety) among a sample of pregnant women, using the Structured Clinical Interview for the DSM (SCID) as the "gold standard" for clinical validation.

Methods

Data were drawn from an existing cohort of women taking part in a larger prospective study of maternal stress in pregnancy (n=350). These participants were healthy women over the age of 18 who presented for care at midwife obstetric units (MOUs) in the Tygerberg area of Cape Town, South Africa. All women presenting for their first antenatal visit at a gestational age of less than 20 weeks and with low risk pregnancies were invited to take part in the study. Data from all women who participated in the first phase of the study was used. The second phase of the present study is ongoing. The total sample size used for the present study was 129 pregnant women.

Ethical approval was obtained from the ethics committee of the University of Stellenbosch. All women were given a patient information leaflet detailing the purpose and procedures of the study, as well as a copy of the consent form in their home language (either English or Afrikaans). The researchers obtaining consent from participants read through and explained these documents to the subjects. All women gave informed consent for participation in the study.

The K10 was translated into Afrikaans. Accuracy of this translation was checked by two separate back translations. Participants completed the K10 in their home language. To correct for the wide variations in the reading level of our sample, the interviewer read each item of the K10 with all participants.

Participants were assessed for the presence of psychiatric disorders using the SCID. The SCID is a structured clinician diagnostic interview for DSM-IV current and lifetime psychiatric disorders (First et al. 1995). The SCID was administered in the subject's home language. All SCID assessments were conducted by the same researcher. Receiver operating characteristic curve analysis (ROC) was used to determine the level of agreement between the K-10 and the SCID mood and anxiety disorder modules.

Analysis

Data were analysed using the computer software package SPSS (version 15.0). A receiver operating characteristic curve (ROC) analysis was performed in order to determine the appropriate K-10 cut-off scores for this sample of pregnant women. The area under the ROC curve (AUC) provides an indication of a particular scale's diagnostic ability to discriminate between those with and without a particular diagnosis (Hanley and McNeil 1982). Gill et al. (2007) state that the AUC values range from 0.5 and 1.0, where a value of 0.5 indicates that the scale is performing at a chance level, and 1.0 indicates perfect discrimination.

There is no agreed standard for interpreting the significance of the AUC statistics. However, it has been suggested that values between 0.50 and 0.70 represent a scale with low accuracy, values between 0.70 and 0.90 are indicative of a useful screening scale and a value of 0.90 and above is indicative of a highly accurate screening scale with a perfect ability to identify those with the target diagnosis (Fischer et al. 2003; Swets 1988). First, using the SCID as the "gold standard" for diagnosis of depressive and anxiety disorders, the sensitivity, specificity, positive predictive values (PVP), and negative predictive values (NPV) were established. Second, AUC was calculated for each ROC curve using non-parametric methods. In addition, the utility of the measure was assessed with positive and negative likelihood ratios (LR+ and LR-), respectively. Likelihood ratios are useful to determine the likelihood that a screening test result would occur in an individual with a given psychiatric disorder compared to the likelihood that that same result would be expected in a patient without that disorder.

Results

A total of 129 female participants with data for the K-10 screening test and SCID-defined mental illnesses were included. Three participants (2%) were Black and 74 (54%) were of mixed race (Coloured). The age of participants ranged from 15.5 to 43.0 years (mean age of 25.0 years) and the highest level of education was grade 12, of which 28% had obtained. All but one participant had completed Grade 7 or higher.

Analysis of the ROC curve revealed that the performance of the K-10 as a predictor of major depression was acceptable. The AUC for current major depression is 66% (LR+ = 1.6; LR− = 0.5) respectively. Moreover, the results showed that the K-10 performed agreeably as a predictor of anxiety disorders. The magnitude of the AUC for current anxiety disorders is as follows: current panic disorder = 71% (LR+ = 21.2; LR− = 0.5), current social phobia = 76% (LR+ = 4; LR− = 0), and current PTSD = 69% (LR+ = 2.5; LR − = 0.6) respectively.

In examining the sensitivity and specificity values for each possible cut-off of SCID-defined depressive and anxiety disorders, a score of ≤21.5 was chosen as the best screening cut-off for current major depression respectively (sensitivity, 0.73; specificity, 0.54). The cut-off score for current PTSD was ≤28.5 (sensitivity, 0.5; specificity, 0.8). A score of ≤38.5 was selected for current panic disorder respectively (sensitivity, 0.5; specificity, 0.98). Finally, the cut-off score for current social phobia (social anxiety disorder) was ≤26.5 (sensitivity, 1; specificity, 0.75). The test characteristics are summarized in Table 1 and the percentage of SCID-defined psychopathology are summarized in Table 2.

Discussion

We found the K-10 to be a useful screening measure for major depression in pregnant women. The measure was able to identify cases of current major depression (66%), and identify true non-cases 73% of the time. Further, identification of SCID-defined anxiety disorders ranged from acceptable to good (0.69 to 0.76) for PTSD, panic disorder, and social phobia. The sensitivity for PTSD, panic disorder, and social anxiety disorder ranged from 0.50 to 1, respectively. The specificity for PTSD, panic disorder, and social anxiety disorder ranged from 0.75–0.98, respectively. In summary, we found that the K-10 is a useful measure of both depression and some anxiety disorders. These findings were in keeping with prior international validation studies of the K-10 (e.g. Baillie 2005; Cairney et al. 2007; Furukawa et al. 2003; Kessler et al. 2002) and similar self-report measures in pregnant women (e.g. Su et al. 2007). Given our findings, it may be useful to consider a short and reliable screening tool, such as the K-10 to screen for depression in pregnant women.

A possible limitation of this study is the small sample size. This may have limited the power to show sensitivity

Table 1 Results of Receiver-Operating-Characteristic (ROC) Curve analysis within one hundred twenty nine healthy pregnant women

	Sensitivity	Specificity	AUC	PVP	NPV	LR+	LR-	K10 cut-off total
Current MDE	0.73	0.54	0.66	0.18	0.94	1.6	0.5	21.5
Past MDE	0.53	0.63	0.58	0.19	0.90	1.4	0.8	23.5
Past bipolar disorder	1	0.52	0.55	0.016	1	2.1	0	21.5
Past dysthymic disorder	1	0.93	0.93	0.103	1	14.2	0	33.5
Current panic disorder	0.5	0.98	0.71	0.28	0.99	21.2	0.5	38.5
Past panic disorder	0.83	0.53	0.68	0.08	0.98	1.77	0.32	21.5
Social anxiety disorder	1	0.75	0.76	0.26	1	4	0	26.5
Current PTSD	0.5	0.8	0.69	0.07	0.98	2.5	0.6	28.5
Past PTSD	0.67	0.52	0.57	0.06	0.97	1.4	0.6	21.5

Table 2 Percentage (%) of SCID-defined psychopathology within one hundred twenty nine pregnant women

SCID-defined mental disorder	Percentage (n=129)
Current MDE	n=16 (12.2%)
Past MDE	n=18 (13.7%)
Past bipolar disorder	n=1 (0.8%)
Past dysthymic disorder	n=1 (0.8%)
Current panic disorder	n=2 (1.5%)
Past panic disorder	n=6 (4.6%)
Current social phobia	n=1 (0.8%)
Current PTSD	n=4 (3.1%)
Past PTSD	n=6 (4.6%)
Current specific phobia	n=3 (2.3%)
Past specific phobia	n=1 (0.8%)
Current substance dependence	n=1 (0.8%)
Past substance dependence	n=5 (3.8%)
Current substance abuse	n=2 (1.5%)
Past substance abuse	n=6 (4.6%)
Past alcohol dependence	n=3 (2.3%)
Current alcohol abuse	n=1 (0.8%)
Past alcohol abuse	n=1 (0.8%)
Past substance induced mood disorder	n=1 (0.8%)
Past substance induced psychosis	n=1 (0.8%)
Past panic disorder with agoraphobia	n=2 (1.5%)
Current bulimia	n=1 (0.8%)

and specificty of the K-10 in this sample of pregnant women. It is not known whether the findings of this study may be generalisable to all pregnant women. In addition, whether these findings are generalisable to other groups of South African women is not known. However, despite this limitation, our study showed the K-10 to be an agreeable screening measure that can be used for the detection of mood and some anxiety disorders in pregnant women.

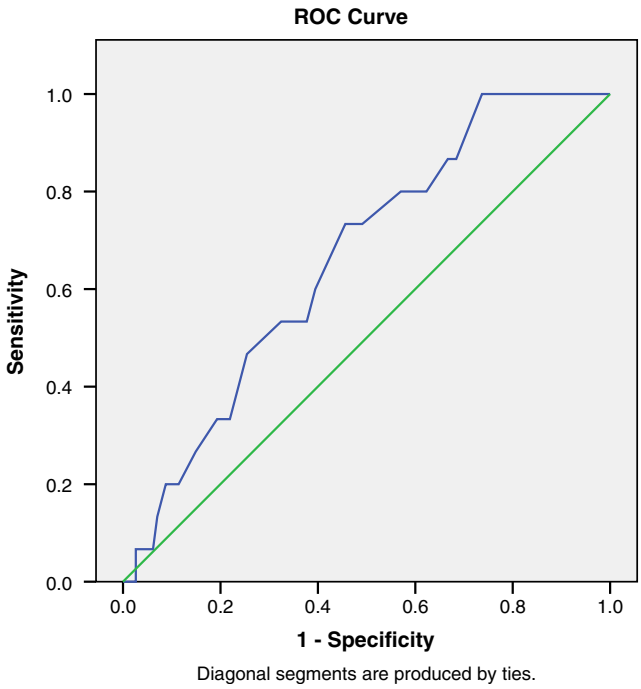

Fig. 1 Receiver-Operating-Characteristic (ROC) Curve for the diagnosis of Major depression within one hundred twenty nine healthy pregnant women

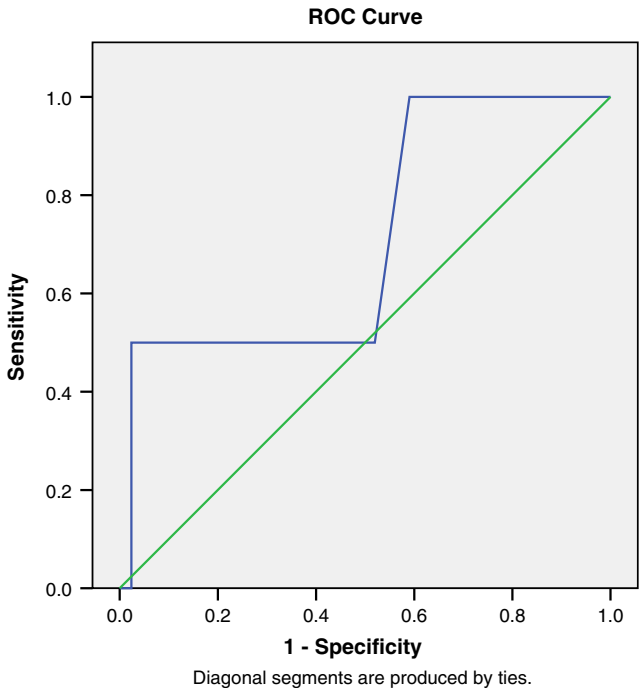

Fig. 2 Receiver-Operating-Characteristic (ROC) Curve for the diagnosis of current social phobia within one hundred twenty nine healthy pregnant women

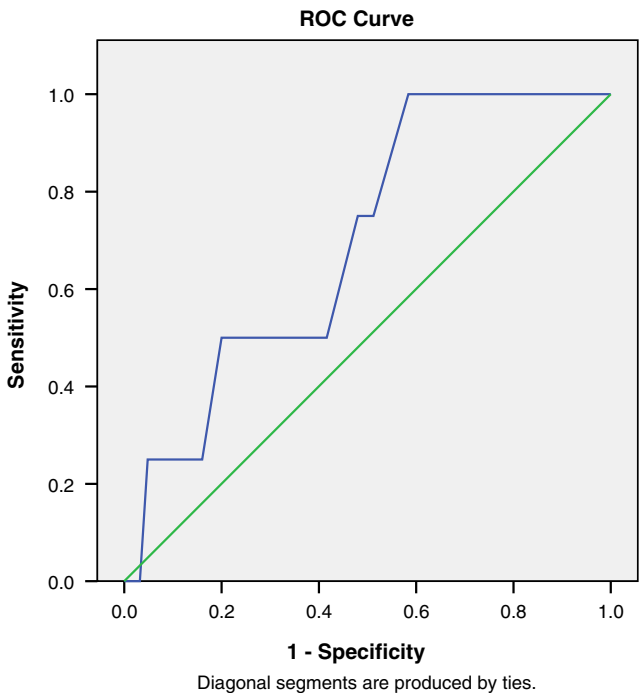

Fig. 3 Receiver-Operating-Characteristic (ROC) Curve for the diagnosis of current PTSD within one hundred twenty nine healthy pregnant women

Based on our findings, further research is needed to assess the extent to which the K-10 remains a useful screening measure of psychological distress in larger samples and other populations of pregnant women.

In conclusion, the K-10, a screening instrument with strong psychometric properties, may be useful in pregnant women. To date, there have been few published studies attempting to validate the use of brief screening tools to explore mental illness in pregnant women. Within our sample, the K-10 has proven to be fairly agreeable in screening for some anxiety and mood disorders, both of which are common co-morbidities with pregnancy. The K-10's conciseness and ability to discriminate cases from non-cases makes this measure an attractive option for use in general health surveys (Brooks et al. 2006). The fact that the K-10 is less resource intensive and can be self-administered or interviewer-administered in only 2–3 min increases its favourability over clinician-administered diagnostic interviews. The K-10 is also able to assess the severity of non-specific distress and might therefore be a useful proxy screening measure in clinical studies (Kessler et al. 2002) Figs. 1, 2, 3.

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References

Baillie AJ (2005) Predictive gender and education bias in Kessler's psychological distress Scale (K10). Soc Psychiatry Psychiatr Epidemiol 40:743–748

Bennett HA, Einarson A, Taddio A, Koren G, Einarson TR (2004) Prevalence of depression during pregnancy: a systematic review. Obstet Gynecol 103:698–709

Brooks RT, Beard J, Steel Z (2006) Factor structure and interpretation of the K10. Psychol Assess 18:62–70

Burke KC, Burke JD, Rae DS, Regier DA (1991) Comparing age at onset of major depression and other psychiatric disorders by birth cohorts in five U.S. community populations. Arch Gen Psychiatry 48:789–795

Cairney J, Veldhuizen S, Wade TJ, Kurdyak P, Streiner DL (2007) Evaluation of 2 measures of psychological distress as screeners for depression in the general population. Can J Psychiatry 52:111–120

DiPietro JA, Hilton SC, Hawkins M, Costigan KA, Pressman EK (2002) Maternal stress and affect influence fetal neurobehavioral development. Dev Psychol 38:659–668

Driscoll J (2005) Recognizing women's common mental health problems: the earthquake assessment model. JOGNN 34:246–254

Eberhard-Gran M, Eskild A, Tambs K, Opjordsmoen S, Samuelsen SO (2001) Review of validation studies of the Edinburgh postnatal depression scale. Acta Psychiatr Scand 104:243–249

First MB, Spitzer MB, Gibbon RL, Williams JB (1995) Structured Clinical Interview for DSM-IV Axis I disorders-Clinician Version. Biometrics Research Department, New York State Psychiatric Institute, 722 West 168th Street, New York, New York 10032

Fischer JE, Bachmann LM, Jaeschke R (2003) A readers' guide to the interpretation of diagnostic test properties: clinical example of sepsis. Intensive Care Med 29:1043–1051

Furukawa TA, Kessler RC, Slade T, Andrews G (2003) The performance of the K6 and K10 screening scales for psychological distress in the Australian National Survey of Mental Health and Well-Being. Psychol Med 33:357–362

Gill SC, Butterworth P, Rodgers B, Mackinnon A (2007) Validity of the mental health component scales of the 12-item short-form health survey (MCS-12) as a measure of common mental disorders in the general population. Psychiatry Res 152:63–71

Guler O, Sahin FK, Emul HM, Ozbulut O, Gecici O, Uguz F, Gezginc K, Zeytinci I, Karatayli S, Askin R (2008) The prevalence of panic disorder in pregnant women during the third trimester of pregnancy. Compr psychiatry 49:154–158

Hanley JA, McNeil BJ (1982) The meaning of the use of the area under a receiver operating characteristic (ROC) Curve. Radiology 143:29–36

Hansen D, Lou HC, Olsen J (2000) Serious life events and congenital malformations: a national study with complete follow-up. Lancet 356:875–880

Hedegaard M, Henriksen TB, Sabroe S, Secher NJ (1993) Psychological distress in pregnancy and preterm delivery. Br Med J 307:234–239

Heron J, O'Connor TG, Evans J, Golding J, Glover V (2004) The course of anxiety and depression through pregnancy and the postpartum in a community sample. J Affect disord 80:65–73

Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand S-L, Walters EE, Zaslavsky AM (2002) Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med 32:959–976

Kessler RC, Keller MB, Wittchen HU (2001) The epidemiology of generalized anxiety disorder. Psychiatr Clin North Am 24:19–39

Kurki T, Hiilesmaa V, Raitasalo R, Mattila H, Ylikorkala O (2000) Depression and Anxiety in early pregnancy and risk for preeclampsia. Obstet Gynecol 95:487–490

Lee DT, Yip AS, Chiu HF, Leung TY, Chung TK (2001) Screening for postnatal depression: are specific instruments mandatory? J Affect disord 63:233–238

Lou HC, Hansen D, Nordentoft M, Pryds O, Jensen F, Nim J, Hemmingsen R (1994) Prenatal stressors of human life affect fetal brain development. Dev Med Child Neurol 36:826–832

Lou HC, Nordentoft M, Jensen F, Pryds O, Nim J, Hemmingsen R (1992) Psychosocial stress and severe prematurity. Lancet 340:54

Marcus SM, Flynn HA, Blow FC, Barry KL (2003) Depressive symptoms among women screened in obstetric settings. J Women's Health 12:373–380

McKee MD, Cunningham M, Jankowski KR, Zayas L (2001) Health-related functional status in pregnancy: relationship to depression and social support in a multiethnic population. Obstet Gynecol 97:988–993

Nicholson WK, Setse R, Hill-Briggs F, Cooper LA, Strobino D, Powe NR (2006) Depressive symptoms and health-related quality of life in early pregnancy. Obstet Gynecol 107:798–806

O'Connor TG, Heron J, Glover V, The Alspac Study Team (2002) Antenatal anxiety predicts child behavioral/emotional problems independently of postnatal depression. J Am Acad Child Adolesc Psych 41:1470–1477

O'Hara MW (1986) Social support, life events, and depression during pregnancy and the puerperium. Arch Gen Psychiatry 43:569–573

Seng JS, Oakley DJ, Sampselle CM, Killion C, Graham-Bermann S, Liberzon I (2001) Posttraumatic stress disorder and pregnancy complications. Obstet Gynecol 97:17–22

Spinelli MG (1998) Antepartum and postpartum depression. J Gender Spec Med 1:33–36

Su K-P, Chiu T-H, Huang C-L, Ho M, Lee C-C, Wu P-L, Lin C, Liau C, Liao C, Chiu W (2007) Different cut-off points for different trimesters? The use of Edinburgh postnatal depression scale and Beck depression inventory to screen for depression in pregnant Taiwanese women. Gen Hosp Psych 29:436–441

Swets JA (1988) Measuring the accuracy of diagnostic systems. Science 240:1285–1293

Zayas LH, Cunningham M, McKee MD, Janowski KR (2002) Depression and negative life events among pregnant African-American and Hispanic women. Women's Health Issues 12:16–22