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MMPI-2 Predictors of Postpartum Depression Symptom-Severity

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MMPI-2 Predictors of Postpartum Depression Symptom-Severity

by

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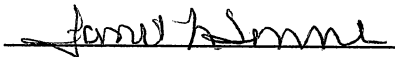
Each person whose signature appears below certifies that this doctoral project in his/her opinion is adequate, in scope and quality, as a doctoral project for the degree Doctor of Psychology.



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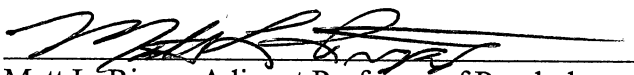

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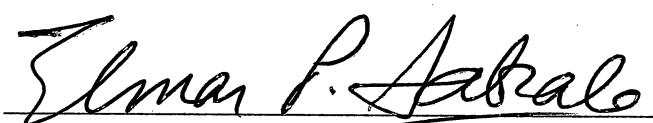

Elmar P. Sakala, Professor of Medicine

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ABSTRACT OF THE DOCTORAL PROJECT

MMPI-2 Predictors of Postpartum Depression Symptom-Severity

by

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Doctor of Psychology, Graduate Program in Psychology
Loma Linda University, June 2006
Dr. Janet Sonne, Chairperson

The following research study measured possible psychological and psychosocial predictors of postpartum depression (PPD) with specific scales from the Minnesota Multiphasic Personality Inventory, 2nd Edition (MMPI-2). This personality instrument was administered to women during their third trimester of pregnancy. In the postpartum period the same subjects were assessed by a specific measure of postpartum depression, the Edinburgh Postnatal Depression Scale (EPDS). Scores on the EPDS were subsequently correlated to specific MMPI-2 scales to determine the personality and symptom predictors of the onset of postpartum depression symptoms and to validate the MMPI-2 as a predictor of PPD symptom-severity. The following MMPI-2 scales were found to significantly positively correlate with the EPDS at both one week and three weeks following delivery: Depression (Scale 2), four of Scale 2's five Harris-Lingoes subscales, Psychasthenia (Scale 7), Social Introversion (Scale 0), and Schizophrenia's (Scale 8) subscale Social Alienation (Sc_1). One Scale 2 subscale, Psychomotor Retardation, failed to significantly correlate with the outcome measure at either follow-up administration.

Introduction

Postpartum depression (PPD) is a relatively common psychiatric disorder found in approximately 10 to 20% of women in the first two months following childbirth; however, as many as 50 to 80% report feelings of sadness and mild depression, often referred to as "baby blues" or "postpartum blues" (Affonso & Domino, 1984; Albright, 1993; Dunnewold, 1997; Hopkins, Marcus, & Campbell, 1984; Miller, 2002). O'Hara and Swain (1996) calculated a mean prevalence rate of 13% for PPD across 59 studies. Hopkins et al. (1984) noted that a more severe postpartum disorder, psychosis, was quite rare, with estimates of prevalence ranging from 0.01 to 0.02% (see also Miller, 2002).

In a study of over 1,000 women six to eight weeks after delivery, Campbell and Cohn (1991) found that nine percent of the women had depressed mood with at least three symptoms. Of these 90 depressed women, 38% endorsed depressed mood with five or more symptoms (qualifying for a diagnosis of major depression), 31% reported a sad mood with four symptoms (probable diagnosis of major depression), and 31% noted sadness with three symptoms (probable diagnosis of "minor" depression). Other research studies with large samples have found similar results for the prevalence of PPD (e.g., Gotlib, Whiffen, Wallace, & Mount, 1991; Righetti-Veltema, Conne-Perreard, Bousquet, & Manzano, 1998).

The symptoms most often associated with PPD are similar to those found with other affective disorders, particularly Major Depressive Disorder. Dunnewold (1997) summarized the symptoms most often reported in postpartum depression. Insomnia, crying, and dysphoric mood are frequent. Cognitive symptoms might also appear, such as problems with concentration and memory. A woman with PPD may present as easily

irritable and emotionally sensitive. Additionally, she may have lost interest in previously valued activities to the point of suffering from anhedonia. Affonso and Domino (1984) also listed examples of symptoms, including inability to cope, social withdrawal, weight gain or loss, and various somatic complaints. Researchers have shown that these various mood symptoms do not only impact the new mother negatively, but they can also adversely influence the infant and his or her development as well (e.g., Beck, 1998; Edhborg, Lundh, Seimyr, & Widstroem, 2001; Kurstjens & Wolke, 2001; Murray, Cooper, & Stein, 1991).

Sugawara, Sakamoto, Kitamura, Toda, and Shima (1999) assessed 1329 postpartum women and found three symptom clusters: affective symptoms and insomnia, cognitive symptoms, and attentional symptoms. Each of these symptoms clearly parallel those seen in mood disorders as defined in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (APA, 1994; DSM-IV). In fact, Eberhard-Gran, Eskild, Tambs, Samuelsen, and Opjordsmoen (2002) compared women with PPD to depressed, non-postpartum women of similar demographics, and found that risk factors were largely the same for both disorders, possibly indicating similar etiologies.

A major focus of research concerning postpartum depression has been related to what factors found in the prenatal period are predictive of the disorder. Though predictive research may, in theory, be conducted with any psychiatric condition, PPD is likely the most straight forward since there is a clear point of time for symptom onset; no other disorder's manifestation is guaranteed to occur at such a precise time frame (i.e., a few hours to a few weeks after birth).

The research into predictive factors of postpartum depression has been comprised of two main areas of inquiry. First, a limited number of studies are prospective (e.g., Appleby, Gregoire, Platz, Prince, & Kumar, 1994; Bridge, Little, Hayworth, Dewhurst, & Priest, 1985; Nhiwatiwa, Patel, & Acuda, 1998) and have employed formal assessment measures during pregnancy in an attempt to validate the specific measures as predictors of postpartum depression.

The second line of research includes general prediction studies that have investigated what constructs in the prepartum period (e.g., depression, anxiety, stress) predict PPD (e.g., Da Costa, Larouche, Dritsa, & Brender, 2000; Gotlib, Whiffen, Mount, Milne, & Cordy, 1989; Righetti-Veltema, Conne-Perreard, Bousquet, & Manzano, 1998). These studies have also utilized various measures in their research design, but have emphasized the predictive validity of certain symptoms and other constructs, and not the measures themselves. The measures only served as the means for assessing the variables of interest. These studies have also frequently used self-report interviews to collect the prepartum data.

The present study proposes to follow the lead of the first group of studies (Appleby et al., 1994; Bridge et al., 1985; Nhiwatiwa et al., 1998) and assess the validity of a prospective psychological measure in predicting postpartum depression symptoms. Instead of employing a new or lesser known predictive instrument, as have some other investigations, the present proposal intends to use the MMPI-2 (Butcher et al, 1989), the most widely used and studied measurement of psychological functioning (Greene, 2000).

In order to determine which MMPI-2 scales are most appropriate for inclusion in the hypotheses of the proposed study, the research into predictors of PPD symptoms is reviewed. The literature is grouped by the study's focus: validation of specific predictive measures and identification of predictive factors. The literature will also help guide the specific design of the proposed study, including the administration of both the MMPI-2 and the follow-up measure of PPD symptoms.

Predictive Measures of Postpartum Depression

Bridge et al. (1985) assessed 93 pregnant women to determine the validity of three measures in predicting future postpartum depression: the Zung Self-Rating Depression Scale (SRDS), a DSSI/SAD subscale to assess anxiety-based symptoms, and the Hostility and Direction of Hostility Scale (HDHQ). The study began during the first trimester and lasted through 12 months postpartum, and included multiple assessment points.

The authors found support in their study for each of the three measures. Overall, they noted that the depression scale was quite strong as a predictor: women scoring 48 or higher on the SRDS during the first trimester were at high risk for depression during the postpartum assessment periods. The DSSI/SAD and HDHQ both predicted PPD for six weeks, and six and nine months. Though all three were predictive, based on the specific results of the study, the authors recommended the SRDS as the best choice for clinical application.

The three measures in Bridge's et al. (1985) study were clearly able to predict postpartum depression. However, this fact does not delineate the potential usefulness of the MMPI-2 in the same manner. The MMPI-2, having a larger number of items and

scales, might be more sensitive in predicting PPD symptoms. In addition, the MMPI-2 covers more symptom areas than the instruments validated by Bridge et al., which collectively only measured the constructs of depression, anxiety, and hostility.

Appleby et al. (1994) attempted to screen women for subsequent postpartum depression by creating their own predictive measure. The 126 subjects who completed the study filled out a ten-item questionnaire at 36 weeks gestation which assessed concerns related to the pregnancy. They also took the Edinburgh Postnatal Depression Scale (EPDS) while attending a prenatal class. At eight weeks postpartum, each subject again took the EPDS to determine if they were suffering from PPD.

Certain questions from their study-specific measure (Appleby et al., 1994) were found to have significant predictive value. Most notably, three questions assessed whether or not the women had received treatment for depression either currently or at some point in the past. The women that responded positively were three times more likely to have postnatal depression. The rest of the results, however, were not as positive: the total score from the questionnaire accounted for very little of the variance in the EPDS scores. The authors also found that their scale resulted in an unacceptably high rate of false negatives.

Appleby et al. (1994) noted several possible reasons for the questionnaire's failure. First, based on the method used for collecting the subject pool, it is possible that women at high risk during pregnancy did not participate in the study, and/or those that became depressed dropped out before taking the EPDS. Second, the authors also questioned the symptom focus of the instrument. They believed that it might not have had

enough variety in the questions to cover all the possible symptoms. Their instrument may have been too homogenous in content.

One of the two possible errors Appleby et al. (1994) hypothesized to explain the failure of their questionnaire lend support for the use of the MMPI-2 in a predictive study. The MMPI-2 evaluates a more heterogenous mixture of symptoms, unlike Appleby's et al. (1994) ten-item measure. The test includes 567 questions that cover a wide range of symptoms; many of the scales are also comprised of multiple subscales that better define the specific factors that comprise each scale (Greene, 2000).

Appleby's et al. (1994) second concern, of possible problems with depression impacting participation, must be considered when determining how and when to administer the assessments. For example, it may be better to assess the subjects when they are meeting with their obstetricians both pre- and postnatally. It is conceivably less likely that depressed women would miss their doctor's appointments than a special postnatal assessment session. Giving the EPDS at follow-up medical appointments or by telephone could enhance the probability of the subjects completing the measure. It would also be important to compare the prenatal MMPI-2 scores of those that completed the study to those that did not to determine if self-selection occurred in the sample.

A study by Nhiwatiwa et al. (1998) sought to validate a symptom measure completed during pregnancy as a predictor of postpartum depression. The study involved 500 women residing near Harare, Zimbabwe, and utilized an indigenous psychiatric measure: the Shona Symptom Questionnaire (SSQ), which was given in the eighth month

of pregnancy. This measure is a 14-item questionnaire used to assess for non-psychotic psychological symptoms.

The subjects were later assessed during the sixth to eighth week postpartum with the Revised Clinical Interview Schedule (CISR), adapted for the population. Based on the results of the SSQ, the subjects were categorized as high or low risk. Significantly more women in the high risk group were later found to have PPD (Nhiwatiwa et al., 1998). When the results were adjusted for age, marital status, and occupation, the association was even stronger. Over 90% of the postpartum depression women reported symptoms in five of the CISR domains: anxiety, worry, depression, fatigue, and sleep problems. The SSQ was also found to have a sensitivity of 81.5%, specificity of 66%, a positive predictive value of 46%, and a negative predictive value of 91%. Therefore, the authors considered the SSQ to have adequate predictive validity for PPD.

These three studies (Appleby et al., 1994; Bridge et al., 1985; Nhiwatiwa et al., 1991) demonstrate prior attempts at validating certain measures in the prediction of postpartum depression in a similar fashion to the proposed study. The two studies (Bridge et al., 1985; Nhiwatiwa et al., 1991) that employed previously used instruments were able to validate the instrument. However, Appleby's et al. attempt to create a new measure was not as successful. Although Bridge et al. (1985) and Nhiwatiwa et al. (1991) were able to validate their measures, confirmation of MMPI-2 scales as predictors would

hopefully enhance the ability to predict postpartum depression symptoms as well as the understanding of a broader spectrum of predictive prenatal symptoms.

Predictors of Postpartum Depression

Beck (1996) noted that predictors of postpartum depression have generally been grouped into four primary categories: psychosocial, obstetrical, physiological, and history of psychiatric disorders in the mother and/or her family. According to Beck, obstetrical and physiological factors have frequently failed to predict postpartum depression; in addition, they are clearly not assessable with the MMPI-2. Therefore, both categories are excluded from this review.

The present study will utilize two categories that are similar to Beck's (1996) two remaining categories. The first, psychological and psychopathology predictors, includes the future mother's psychiatric history, as well as antenatal depression and other psychological factors. The second category, psychosocial, includes factors such as social support, social adjustment, social stress, and life events. In addition, a few studies will be reviewed in a third category, personality features, such as neuroticism.

Psychological and psychopathology predictors. The clearest predictor of postpartum depression appears by most accounts to be depression during the prenatal period (e.g., Beck, 1996 & 2001; Da Costa et al., 2000; Graff, Dyck, & Schallow, 1991). One of the strongest supports for the strength of this predictor comes from a meta-analysis conducted by Beck (1996). Her analysis examined 44 predictive studies of postpartum depression from the 1970's and 1980's. Beck's study found 26 prior research investigations of whether prenatal depression was predictive of depression following

birth; she determined 24 to be appropriate for inclusion in her analysis. She found that self-report methods of assessment, such as the Beck Depression Inventory (which was used in 11 of the 26 studies; in 6 studies it was the sole measure), were most common. Some studies included multiple self-report measures.

Beck (1996) assessed the effect size for prenatal depression in three different manners: unweighted, weighted by sample size, and weighted by quality. Prenatal depression results were .51, .49., and .51, respectively. It was the only predictor found by Beck to meet the .50 criteria (as set by Cohen) for a large effect size. Clearly, depression during pregnancy is vital in the prediction of postpartum depression.

Beck's (1996) meta-analysis also included three other psychological and psychopathology predictors. First, four studies were analyzed that examined maternity blues as a possible predictor. (In the same way postpartum blues are considered a mild depression or sadness post-delivery, maternity blues is defined by similar symptoms during pregnancy.) Again, various self-report measures, such as the Stein Maternity Blues Questionnaire and the Eighteen Blues Symptoms Questionnaire, were employed in the studies. The effect sizes were found to be .36 (unweighted), .37 (weighted by sample size), and .35 (weighted by quality). Therefore, maternity blues was judged to have a medium effect size in predicting postpartum depression.

Another predictor that Beck (1996) analyzed was the woman's history of previous depression, looking specifically at depression prior to the pregnancy. Beck found seven relevant studies. The methodologies of all seven studies were questionable; for example, each study only included one item that assessed for prior depression. The effect sizes (.29,

.27, & .29) of previous depression were found to be the smallest in Beck's study of the eight possible predictors. However, they were very close to meeting the criteria for a medium effect size.

One last relevant factor reviewed in Beck's (1996) research was anxiety. Beck found two studies that examined anxiety during the prenatal period; anxiety was measured by various scales within the two studies, such as the DDSI/SAD Anxiety Scale. A medium effect size was found with each of the three types of weighting (.36, .30, and .35).

In summary, Beck's (1996) meta-analysis found four psychological and psychopathology factors that were predictive of postpartum depression: prenatal depression, prenatal anxiety, history of previous depression, and maternity blues. While the first predictor was determined to have a large effect size, the other three met or nearly met the criteria for a medium effect size. Therefore, these four factors were established by Beck to be valuable predictors of future postpartum depression.

Beck's (1996) meta-analysis was largely based on studies conducted in the 1980's. Subsequently, Beck (2001) ran a second meta-analysis, utilizing the same methodology and study weightings (unweighted, weighted by sample size, and weighted by quality), on 84 studies published between 1990 and 2000. This updated meta-analysis found very similar results to the author's first study. Four psychological and psychopathology factors were once again found to be significant: prenatal depression (21 studies; .45, .44, & .46), prenatal anxiety (4 studies; .45, .41, & .45), history of pre-pregnancy depression (11 studies; .39, .39, & .38), and maternity blues (5 studies; .31, .25, & .31). Beck's (2001)

updated study also found a new factor, self-esteem, was predictive of postpartum depression (6 studies; .47, .45, & .46); it was negatively correlated with PPD.

O'Hara and Swain (1996) also conducted a meta-analysis of the research and found similar results to Beck (1996 & 2001). Thirteen studies were analyzed and demonstrated a strong effect size between prepartum and postpartum depression. The authors also found that studies using self-reporting demonstrated stronger results than those employing interview assessments.

O'Hara and Swain (1996) also found two other significant psychological and psychopathology predictors similar to Beck (1996/2001). They identified 12 studies that reported an association between the mother's pre-pregnancy psychiatric history and PPD. Further, five studies demonstrated a significant relationship between prenatal anxiety and postpartum depression. The authors were unable to find an association between PPD and history of depression in the mother's family, a variable not explored by Beck.

Several large studies published after Beck (1996) and O'Hara and Swain (1996) also point to the predictive value of prior depression and other psychological and psychopathology factors. Bernazzani, Saucier, David, and Borgeat (1997) studied 213 pregnant women during their second trimester and again at 6 months after delivery. They found that both prenatal depression (the largest effect in the study) and self-reported personal psychiatric history had a significant direct effect on postpartum depression. Eberhard-Gran et al. (2002) determined that history of depression in pre-pregnancy was associated with postpartum depression in their study of 485 postpartum women.

Righetti-Veltema et al. (1998) assessed 570 pregnant European women both prior to and three months after delivery. Ten percent of the subjects met the chosen criterion for postpartum depression and were compared to the women without postpartum depression. Four psychiatric factors in the prenatal period were found to be significantly higher in the PPD women: anxiety, depression, obsessive-compulsiveness, and somatization. One personality factor, interpersonal sensitivity, was also found to be significant. The study utilized a study-specific questionnaire and Derogatis' Hopkins Symptom Checklist to measure the prenatal variables.

Other researchers have established similar results. Da Costa et al. (2000) employed multiple assessment instruments during pregnancy, as early as the third month, in order to determine predictors of postpartum depression. The outcome measures were given 4 to 5 weeks postpartum. The study was able to account for 11% of the outcome variance with prepartum depression levels. A study of 42 primiparous mothers by Graff et al. (1991) determined that depression during the pregnancy was the strongest predictor in their study of postpartum depression. This study included the Center for Epidemiological Studies - Depression scale given at about eight weeks before the due date and again two months after birth.

Kennerley and Gath (1989) were able to confirm a relationship between anxiety and depression during the prenatal period and postpartum blues. The results of the investigation were similar to other reported studies: both depression and anxiety during the prenatal period predicted "blues" in the postpartum period. However, one result is contradictory to the findings of Beck (1996), O'Hara and Swain (1996), and Bernazzani

et al. (1997): Kennerley and Gath were unable to find a relationship between prior (pre-pregnancy) psychiatric history and the postpartum mood. This discrepancy may be the result of the different scopes of the postpartum inquiry. Beck (1996), O'Hara and Swain (1996), and Bernazzani et al. (1997) assessed for postpartum depression, while Kennerley and Gath (1989) were investigating the less severe condition of postpartum blues. Therefore, it is possible that the presence of a history of pathology may be a factor in determining the severity of a postpartum mood disorder: women without a psychiatric history might be more likely to suffer from the blues, while women with such a history may be more likely to have a diagnosable case of postpartum depression.

In their literature review, Hopkins, Marcus, and Campbell (1984) noted that the majority of studies investigating the relationship between previous pre-pregnancy psychiatric history and postpartum depression have found a significant relationship. They listed eight studies from 1959 to 1980 that found a relationship. Only two studies, occurring in 1968 and 1971, were unable to support the role of prior psychiatric history.

Although the results of Saks et al. (1985) were included in the meta-analysis of Beck (1996), the study has several specific results beyond what was reviewed by Beck. The authors employed the Adjective Checklist and found that depressed women rated higher prenatally on seven of the adjective subscales than their non-depressed counterparts. These seven were loneliness, distress, inward-directed anger, outward-directed anger, lacking a feeling of well-being, shyness, and defeat.

In summary of the psychological and psychopathology factors, research clearly has shown that depression during the prepartum period is one of the strongest and most

consistent predictors of postpartum depression. However, with the possible exception of Saks et al. (1985) and their Adjective Checklist, research has not attempted to examine the specific facets of depression that most contribute to PPD. Hopefully, the present study will expand the literature in this area.

General support was also found for pre-pregnancy anxiety and the presence of a psychiatric history of mental illness as predictors by most of the research. The other possible psychological predictors of postpartum depression reviewed did not find as much empirical support, largely because of the limited number of studies.

Personality predictors. Psychiatric disorders and psychological factors, though clearly significant, are not the only possible predictors of postpartum depression. Some limited research has also explored personality factors, including neuroticism and psychoticism.

Research results have been inconsistent regarding the validity of neuroticism as a personality style in predicting PPD. Kennerley and Gath (1989) and Kendell, Mackenzie, West, McGuire, and Cox (1984) found a positive relationship. In their meta-analysis, O'Hara and Swain (1996) found a weak to moderate positive relationship between neuroticism and PPD in five studies. However, the original manual of the Eysenck Personality Inventory (EPI) by Eysenck and Eysenck (as cited in Kennerley & Gath, 1989) report no such relationship between the measure, which assesses for neuroticism, and maternity blues, a finding that was also supported by Pitt (1973) and Nott et al. (1976).

Kumar and Robson (1984) were unable to establish a relationship between either neuroticism or psychoticism and postpartum depression. However, a relationship was found between both personality dimensions and prenatal depression, which has been shown to be predictive of later PPD.

Psychosocial predictors. Of the psychosocial predictors of PPD examined to date, life stress appears to have the most empirical support (e.g., Beck, 1996). Life stress also could be considered an umbrella category under which the other potential psychosocial predictors would fall. For example, marital discord, relationship problems in general, and financial difficulties would most likely all increase "life stress." Similarly, higher levels of social support could buffer against the perceived amount of stress (Swendsen & Mazure, 2000). However, most researchers have examined these variables individually and the present literature review will follow the same format.

Beck (1996) found seven studies applicable to her meta-analysis that examined the role of life stress as a predictor of postpartum depression. The results found effect sizes in the moderate range: .40, .36, and .40 (unweighted, weighted by sample size, and weighted by quality). In her follow-up analysis, Beck (2001) found 16 new studies with life stress as a variable, and calculated almost identical effect sizes (.40, .38, & .40).

O'Hara and Swain (1996) concluded in their meta-analysis that life events were strongly related to postpartum depression. The analysis involved 15 studies. It is interesting to note, however, that while the strong association was found in the studies conducted in the United States or Britain, the two studies from Japan showed no

significance. Also, self-report methods demonstrated a stronger association than did interviews.

In their review of the literature concerning life stress as a risk factor for postpartum depression or depressive symptomatology, Swendsen and Mazure (2000) found significant support for its role. The authors reviewed 12 relevant studies, of which only three were unable to find an association. However, they raised some questions as to the methodology employed in these three studies. First, the assessment of stress has often been done with checklists, which limit the participants to a specific number of possible responses and do not take contextual factors into consideration. Second, Swendsen and Mazure noted that many studies only utilized subjective reports by mothers and not by independent raters. However, this factor would only seem important if the *actual* stress level was being measured; instead, most consideration is given to the woman's *perceived* amount of stress. Third, the time when assessment of stress was conducted varied across the studies. Only one of the twelve studies involved concurrent measurement, the rest were limited to retrospective recall by the subjects. The time of measurement ranged from during pregnancy to as much as one year following delivery. Lastly, Swendsen and Mazure noted that there was also some variability in the specific characteristics of stress measured. For example, some examined acute stress factors while others looked at more chronic issues.

Other authors have also investigated life events. Righetti-Veltema et al. (1998) examined both the actual stressful life-event and the emotional consequences of these events during pregnancy. Four events were found to be higher in depressed women than

in non-depressed participants: cultural change, loss of a job, financial troubles, and professional difficulties. Bernazzani et al. (1997) assessed for life events during the second trimester. The authors concluded that stressful life events within the past 12 months during the prepartum were related to the presence of PPD. Eberhard-Gran et al. (2002) found a significant relationship between their life event scale and postpartum depression. The scale included items regarding major life events such as divorce, familiar conflicts, occupational troubles, serious illness ro injury, accidents, or loss of a close relative to death.

Beck (1996) examined two other psychosocial variables in her meta-analysis. First, seven studies including measures of marital satisfaction were analyzed. A moderate effect size was found between low marital satisfaction and postpartum depression with the unweighted (.37) and weighted by quality (.35) methods; weighting by sample size was borderline moderate (.29). Low marital satisfaction was the seventh highest of Beck's eight predictors of PPD. Beck (2001) confirmed the results with 14 new studies and moderate effect sizes (.39 for all three weightings). Therefore, there is clearly a relationship between low marital satisfaction and PPD.

Second, Beck (1996) found 15 studies that addressed the influence of social support upon postpartum depression. The results found moderate effect sizes, ranging from .37 to .39 across the three different weighting methods. With 27 studies, Beck (2001) again supported the role of social support (.41, .36., & .40). The role of social support during pregnancy has also been investigated by Bernazzani et al. (1997). They found that social support satisfaction and interpersonal conflict did not directly influence

postpartum depression. Cutrona (1984) agreed that social support did not predict depression two weeks after delivery, but did have an inverse effect at eight weeks. Specifically, factors that influence depression at eight weeks included assistance, reliable alliance and guidance, social integration, and reassurance of worth.

O'Hara and Swain (1996) also found support in their meta-analysis for the predictive value of the marital relationship and social support. The former demonstrated a small, but significant negative relationship, while the latter was shown to have a strong negative association. The authors also examined the role of support from the baby's father. The overall effect size was moderate. Specifically, the father's level of support was not associated with an actual diagnosis of PPD but was strongly negatively associated with the severity of any depression.

Marital relationship issues, as a predictor of PPD, have been supported by other studies. Kumar and Robson (1984) established that marital conflict and infrequent sexual intercourse both were positively associated with depression in the postpartum. Marital conflict was also strongly positively associated with depression during pregnancy. More specifically, Graff et al. (1991) reported that less cohesion and affection between partners predicted higher rates of PPD; Kennerley and Gath's (1989) results were consistent. Further, poor relationships in the family unit and within the extended family were also significantly positive. Eberhard-Gran et al. (2002) found that a woman's self-report of her poor attachment to her partner, as assessed in the prenatal period, was positively related to postpartum depression.

Social adjustment, measured by the Modified Social Adjustment Scale, was another of the multiple factors investigated by Kennerley and Gath (1989). A significant positive link was found between poor overall social adjustment and postnatal blues. The pregnant woman's social adjustment (measured by the Social Adjustment Scale) was assessed by O'Hara, et al. (1982) in their study of possible cognitive-behavioral models of postpartum depression. The results of the study found that it was negatively correlated with the outcome depression scores.

Hall et al. (1996) ran a study to determine the potential mediator role of self-esteem in relation to the effects of stress and social support on postpartum depression. The authors examined the relationship of self-esteem as four factors: everyday stressors, life events, quality of relationship, and quantity of ties. First, both everyday stressors and life events had a direct effect upon depression symptoms. Second, everyday stressors were mediated by self-esteem, whereas life events were not. Third, quality of relationships, including marital, was mediated by self-esteem, and did not have a direct relationship to depressive symptoms. Fourth, quantity of ties had no significant relationship to either self-esteem or depression. Lastly, self-esteem had a strong inverse relationship to depression, a finding supported by Beck's (2001) updated meta-analysis. Hall et al. specifically noted that mothers with low self-esteem were 39 times more likely to have more depressive symptoms as compared to their higher self-esteem counterparts.

Though the results of Hall's et al. (1996) research are important, one issue must be noted: all measurements occurred after delivery. Therefore, the levels of stress and support being investigated refer to these factors in the postpartum. The authors were not

studying the effects of stress and social support prior to birth. Though it is likely stress increases after delivery, it is quite probable that support levels remain consistent from the prenatal to the postpartum period. The results of this study are therefore limited in their relationship to the present research study.

In summary, examination of the predictive value of the psychosocial factors demonstrate that it is clear that stressful life events play a strong role in postpartum depression, although the possible mediating role of self-esteem (Hall et al., 1996), must be considered. Also, research supports the possibility that a strong social support system might buffer against depression, though at least one study (Cutrona, 1984) only found this effect at a later point in postpartum (eight weeks) and another (Bernazzani et al., 1997) found no relationship. A strong marriage, which would offer more social support, also appears to have a positive impact, minimizing the risk for postpartum depression. In contrast, poor social adjustment was related to increased rates of PPD.

Summary of predictors. It is clear that several psychological and psychosocial factors may be predictive of PPD, and likely many of these factors occur and are measurable prior to delivery. The reviewed research has shown that certain factors assessed during the prenatal time can predict the later onset of postpartum depression. Seven of these factors are measurable with the MMPI-2 and were therefore included in the present study. These include prenatal depression, prenatal anxiety, poor social adjustment, life stress, loneliness, marital dissatisfaction, low self-esteem, and relationship problems/poor social support.

The present study assessed participants with the Minnesota Multiphasic Personality Inventory, 2nd Edition (MMPI-2; Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989), the most popular and extensive measure of psychological functioning (Greene, 2000). By utilizing the MMPI-2, the study sought to validate the instrument as a predictor of PPD, to better clarify the specific predictive factors of PPD, to better specify one known predictor (depression), and to increase the sensitivity of prediction.

Minnesota Multiphasic Personality Inventory, 2nd Edition

History and development of the MMPI-2. The origin of the MMPI and MMPI-2 can be attributed to Starke Hathaway and J. C. McKinley (Greene, 2000). Their goal was to create a large set of items that various scales would be constructed on to design a larger variety of personality constructs. They accumulated in excess of 1,000 items from various textbooks and other tests and eventually narrowed down the items to 504 comprising 25 categories; 55 items were later added with nine deleted. The first version was published in 1942. There were several revisions, leading to the final version of the original MMPI in 1951 (Nichols, 2001).

The original MMPI included three Validity Scales, Lie (L), Infrequency (F), and Correction (K). The Clinical Scales were Hypochondriasis (Scale 1; Hs), Depression (Scale 2; D), Hysteria (Scale 3; Hy), Psychopathic-Deviate (Scale 4; Pd), Masculinity-Femininity (Scale 5; Mf), Paranoia (Scale 6; Pa), Psychasthenia (Scale 7; Pt), Schizophrenia (Scale 8; Sc), Hypomania (Scale 9; Ma), and Social Introversion (Scale 0; Si). The determination of the appropriateness of the items for the MMPI was accomplished through criterion referencing (Greene, 2000). The items were compared

between norm and clinical groups to find which items best differentiated the two groups. This process was undertaken with each of the selected scales that the authors chose to include in the original version of the MMPI.

Six of the Clinical Scales (D, Hy, Pd, Pa, Sc, and Ma) contain within them subsections, known as Harris-Lingoes subscales (Nichols, 2001). The number of subscales within each Clinical Scale range from three to six. The Harris-Lingoes subscales were rationally derived by grouping similar items and can be used to better isolate sub-factors of clinically elevated scales. For the present study, subscales of two Clinical Scales were utilized. Scale 2 (Depression) is comprised of five subscales: Subjective Depression (D_1), Psychomotor Retardation (D_2), Physical Malfunctioning (D_3), Mental Dullness (D_4), and Brooding (D_5); each of these were included in the final analysis. The study also used one of the subscales for Scale 8: Social Alienation (Sc_1). In fact, the study only utilized the one subscale for Scale 8 and not the full Clinical Scale.

The MMPI's original norm sample comprised 724 individuals who were friends or family members of patients in the University Hospitals in Minneapolis (Greene, 2000; Nichols, 2001). This group reflected the cross section for gender and marital status of Minnesota; however, it has been noted that the sample included no ethnic minorities. Other samples were later established to assess the validity of the use of the MMPI with various ethnic groups.

Restandardization of the MMPI was undertaken in order to generate current norms, create a larger and more representative sample (especially regionally and with ethnic minorities), and update item content as needed (Greene, 2000; Nichols, 2001). The

original MMPI had 566 items; the process of restandardization led to dropping 16 repeated items, 13 items from the standard validity and clinical scales, and 77 items from the last 167 items. However, 86 items were added for new scales and 21 unscored items were also included. The final MMPI-2 consisted of 567 items.

The MMPI-2 kept the original Validity and Clinical Scales of the MMPI, but also added 15 Content Scales and various Supplementary Scales (Greene, 2000). Examples of the Content scales include Anxiety, Fears, Obsessions, Health Concerns, Anger, Antisocial Practices, and nine other similar scales. For the present study, three Content Scales will be utilized: Depression (DEPI), Low Self-Esteem (LSE) and Family Problems (FAM). Greene (2000) lists 17 Supplementary Scales; the present study will use one scale: Marital Distress Scale (MDS).

The new sample included 2,600 individuals living in seven different states (Greene, 2000; Nichols, 2001). They were selected to reflect the national census parameters on age, marital status, ethnicity, education, and occupational status. The last three areas demonstrated significant differences from the original MMPI sample. However, the last two categories, education and occupational status, still varied from the United States census.

Postpartum research with the MMPI-2. Only one study has employed either edition of the MMPI in predicting any components of postpartum depression. Sendbuehler, Bernstein, Nemeth, and Sarwer-Foner (1976) conducted an analysis of retrospective case histories and MMPI (first edition) profiles of women who attempted suicide during pregnancy (28 subjects) or during the postpartum (16 subjects). (Five of

the women who attempted suicide in the postpartum period had previously also made suicide attempts during their pregnancy.)

The study results were quite general. First, the suicide attempts were found to be related to the pregnancies. Second, the pregnancy was not determined to be the cause of the depression. Instead, it served as a stressor which contributed to other psychological factors. Based on these two findings, the authors noted that pregnancy can be interpreted by the patient in many different ways. Therefore, the treating physician must be aware of each patient's views of her pregnancy.

Selected MMPI-2 scales. The MMPI-2 is comprised of many scales that assess for a large variety of psychological and psychopathology factors. Clearly, all of the scales will not equally predict PPD. Therefore, in order to assess for the various predictors of postpartum depression with the MMPI-2, the known predictors were as closely matched as possible to the scales on the MMPI-2. The selected factors from the literature included prenatal depression, prenatal anxiety, poor social adjustment, life stress, loneliness, marital dissatisfaction, low self-esteem, relationship problems and poor social support.

To measure depression during the pregnancy, Scale 2 (Depression) was included in the study. Scale 2 is comprised of 57 items that assess a variety of symptoms in areas such as apathy, somatic complaints, sensitivity, and lack of sociability (Greene, 2000).

Scale 2 is thought to best measure depression arising from situational factors as compared to endogenous ones (Greene, 2000). It has also been determined to cover five different factors, known as Harris-Lingoes Subscales: Subjective Depression (D_1),

Psychomotor Retardation (D_2), Physical Malfunctioning (D_3), Mental Dullness (D_4), and Brooding (D_5) (Greene, 2000).

Although they both measure depression, there is limited overlap between Scale 2 and the Depression (DEP) content scale (Greene, 2000). The latter scale has a negative view of oneself as primary, while Scale 2 has it as secondary. Also, somatic symptoms tend to fall more on Scale 2 than DEP. The correlation between DEP and Scale 2 is .796 (Greene, 2000). According to Greene, when Scale 2 is 10 T points or higher than DEP, the symptoms are more vegetative and acute. In contrast, if DEP is 10 T points or higher, the presentation is more chronic with predominately characterological symptoms. Therefore, inclusion of both scales was deemd appropriate to best cover all depressive symptoms, both acute and chronic, and to better differentiate the type(s) of prenatal depression most predictive of PPD.

Anxiety, and more specifically trait anxiety, has been found to predict postpartum depression (e.g., Knight & Thirkettle, 1987). Therefore, Scale 7, Psychasthenia, was included. This scale attempts to measure long-term trait anxiety, although it is also partially influenced by situational factors (Greene, 2000). It also taps symptoms of chronic depression. Greene described seven factors comprising this scale: neuroticism, anxiety, withdrawal, poor concentration, agitation, psychotic tendencies, and poor physical health. The findings of the predictive value of depression, neuroticism, distress, loneliness, stressful life events, specific stress caused by the pregnancy, and low social support all help to justify the inclusion of this scale. The Welsh Anxiety Scale of the MMPI-2 was another possible measure of anxious symptoms; however, it correlates very

highly with Scale 7 (.951; Greene, 2000), making its use largely redundant. Therefore, it was not included.

Stressful life events can be assessed in several ways. First, more chronic stressors were likely to be measured by Scale 7 and DEP. In contrast, more acute stressors were evaluated by Scale 2.

The research findings regarding poor social adjustment and poor social support justified the use of Scale 8, Schizophrenia's subscale, Social Alienation (Sc_1). A high score on this 21-item subscale indicates a lack of rapport with people and the withdrawal from meaningful relationships (Greene, 2000; Nichols, 2001).

Since social support often comes from one's spouse or family, and since marital dissatisfaction is also a predictor of postpartum depression, two other content scales were appropriate for inclusion in the proposed study: Family Problems (FAM) and Marital Distress Scale (MDS) (Greene, 2000). High scores on MDS are found in people distressed in their marriages and alienated from others. The FAM scale has two parts. First it measures whether a person feels mistreated by his or her family. Second, it measures the extent to which a person is emotionally detached or alienated from his or her family. It is the second feature which appears to be most relevant.

The research indicating a inverse relationship between self-esteem and symptoms of postpartum depression (e.g., Beck, 2001; Hall et al., 1996) justified the inclusion of a Content Scale, Low Self-Esteem (LSE). This scale assesses self-confidence, self-criticism and blame. It is comprised of two primary components, self-doubt and submissiveness.

In summary, based on the results of the empirical research into the predictors of postpartum depression, six scales of the MMPI-2 were chosen for inclusion in the analysis of the proposed study as predictors of postpartum depression symptoms: Depression (Scale 2), Psychasthenia (Scale 7), Depression (DEP), Low-Self Esteem (LSE), Family Problems (FAM), and the Marital Distress Scale (MDS). In addition, Scale 2's five Harris-Lingoes subscales and Schizophrenia (Scale 8) subscale, Social Alienation (Sc_1), were also included in the analysis, for a total of twelve predictor scales.

Methods

Participants

The participants for the study were 64 pregnant women obtained through the Department of Obstetrics and Gynecology of a major university medical center. Patients were recruited from both the private physicians and the residency clinic. Patients being served in the latter clinic are generally on Medical and/or Medicare and represent a lower socioeconomic group. Those patients treated by private physicians have private insurance and generally are of a higher socioeconomic status.

Inclusion criteria for the study was pregnant women, 18 years of age or older, of any ethnic background, and in the third trimester of pregnancy. Exclusion criteria included any woman who was unable to complete the MMPI-2 (e.g, low reading level, unable to read English, or delivered prior to completion of at least the first 370 items), had an invalid MMPI-2 protocol, or failed to take both administrations of the follow-up measure (EPDS). Lastly, if a baby was still-born or perished before the EPDS measures were administered, the participant was excluded; such a situation is more likely to lead to symptoms of Post-Traumatic Stress Disorder than PPD (Miller, 2002).

Materials

The research study included two measures: the Minnesota Multiphasic Personality Inventory, 2nd Edition (MMPI-2; Butcher et al., 1989) was given during pregnancy, while the Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) served as the assessment instrument for postpartum depression and was administered twice following delivery.

Minnesota Multiphasic Personality Inventory, 2nd Edition. The MMPI-2 is a 567-item instrument (Greene, 2000). The participants responded with true or false, indicating whether or not the statement was indicative of them. The MMPI-2 is currently the most widely used and studied measure of personality. The test assesses a wide variety of personality features and symptoms through a number of Validity, Clinical, Content and Supplementary scales. Raw scores are converted to T scores for final analysis.

Edinburgh Postnatal Depression Scale. The Edinburgh Postnatal Depression Scale (EPDS) is a 10 item scale designed by Cox et al. (1987). (See Appendix A.) It is one of the most common measures of postpartum depression currently in use. Beck (2001) found that the EPDS was the most popular measure of PPD used in the 84 studies reviewed in her meta-analysis; 36% of the studies utilized the scale. In addition, it was recommended by Miller (2002) as an appropriate screener for PPD. A listing of research studies that employed the EPDS, as well as a review of ten validation studies, is presented in a thorough review by Guedeney, Fermanian, Guelfi, and Kumar (2000).

The original model for the EPDS was based on several previous measures, including the Irritability, Depression and Anxiety Scale (IDA), the Hospital Anxiety and Depression Scale (HAD), and Bedford and Foulds' (as cited in Cox et al., 1987) Anxiety and Depression Scale. Cox et al. conducted a detailed analysis of the usability of various questions and arrived at 21 items. The researchers then ran several studies with the 21-item measure and eventually eliminated eleven items.

The final scale was validated by Cox et al. (1987). For reliability, split-half analyses revealed a correlation of 0.88, and a standardized α-coefficient of 0.87. The

original validation study also found that the EPDS was sensitive to symptom change: when subjects were assessed at two different points, the EPDS scores remained stable for those women that continued to meet diagnostic criteria. However, if the criteria was no longer met, the EPDS score also dropped with all but one subject. Three other studies also validated the Edinburgh: Holden (1991), Harris, Huckle, Thomas, Johns, and Fung (1989), and Murray and Carothers (1990). Guedeney et al. (2000) presented data concerning ten different validation studies of the EPDS.

Attempts have been undertaken to validate the EPDS in other languages and cultures. Examples include Arabic (Ghubash, Abou, & Daradkeh, 1997), Australian (Boyce, Stubbs, & Todd, 1993), Chilean (Jadresic, Araya, & Jara, 1995), Chinese (Lee et al., 1998), French (Guedeney & Fermanian, 1998), Italian (Benvenuti, Ferrara, Niccolai, Valoriani, & Cox, 1999), Norwegian (Eberhard-Gran, Eskild, Tambs, Schei, & Opjordsmoen, 2001), Portuguese (Areias, Kumar, Barros, & Figueiredo, 1996), and Swedish (Wickberg & Hwang, 1996). According to each of the authors, validation was achieved in their studies. A computerized version of the EPDS has also been found to be valid (Glaze & Cox, 1991).

Research Procedures

At the outset of data collection, third trimester patients attending an appointment at the medical center's outpatient obstetrics clinic were approached by their nurses and were given a short description of the study. (See Appendix B.) If they agreed, the participants were then introduced to the graduate student investigator (GSI) who talked with them about the study. All patients of the obstetrics department are informed through

the *Notice of Privacy Practices* (HIPAA compliance form) that their private health information may be used for research purposes, thereby permitting the graduate student investigator to speak with them without further written consent.

However, after a few months of utilizing the above participation recruitment procedures, it was determined that not enough participants were being successfully identified. The reasons for the failure in recruitments were not clear, though it seemed as if the nursing staff was uncomfortable asking the patients about the study.

Therefore, a new recruitment procedure was implemented. The reception staff were given a form to hand out to clinic patients. [See Appendixes C1 and C2. (The second version was utilized towards the end of the study in order to select participants closer to their delivery dates.)] The form asked for permission to contact the patient regarding a research study on postpartum depression and had the patient write down basic information, including her name and phone numbers. The graduate research investigator then contacted those patients who returned the completed forms by phone and discussed the study in more detail, including the specific procedures, such as the need for two follow-up phone calls. If the patient agreed to participate, the GSI met the participant at her next appointment at the obstetrics clinic.

Upon meeting with the patient in person for the first time, the graduate student investigator quickly reviewed the process and asked the patient if she was still willing to participate. The GSI then gave the patient the consent form (see Appendixes D1 and D2), and responded to any further questions. (The consent form was updated midway through

the study to make adjustments for researcher contact phone numbers and more accurate estimates of the time requirement for the EPDS phone call administrations.)

Once all questions were answered and the consent form was signed, the patient was given the MMPI-2 to complete. Each participant was asked to put her first name, expected date of delivery, whether she was in a significant relationship or not, whether or not the patient saw the same doctor at each appointment (to establish if she was a clinic or private patient), and phone numbers on a cover sheet attached to the test protocol. (See Appendix E.) This information allowed the graduate student investigator to contact the participants for the follow-up questions and also to match the MMPI-2 protocol to the EPDS scores once both were done.

As for the MMPI-2, the GSI instructed the participants to: (1) answer each question, but not to take too long on any one question; and (2) to fill in the circles completely without any stray marks, as the forms were computer-scored. In addition, the GSI showed each participant the MMPI-2 and how to complete it. The participants were then given the MMPI-2 to work on while waiting for the doctor. Most participants were unable to complete the entire MMPI-2 during one visit to the clinic. Therefore, most participants completed the measure across several appointments, typically at one-week intervals. The majority of participants needed only two sessions to complete the MMPI-2, while a few required three or more.

Later on in the study, it came to the attention of the GSI by a member of the clinic's nursing staff that some participants may have had family members complete some of the MMPI-2 items. Therefore, the GSI began to include in the instructions given that

the MMPI-2 should only be completed by the identified participant and not accompanying family members or friends.

Once finished with the MMPI-2, the participants were again informed that they would be receiving a follow-up phone call at about one week after their delivery date for verbal administration of the second measure. MMPI-2 protocols were then locked in a file cabinet of the principle investigator's lab to ensure the participant's privacy.

The graduate student investigator called each participant in the study approximately one week following her delivery date. Due to the difficulty in reaching various participants, some were not contacted until at most 12 days following delivery. The investigator asked for the participant by her first name, then identified himself and reminded her of the study. The investigator then asked for her verbal consent to administer the EPDS questions. After she consented, the investigator explained the scoring of the EPDS and administered the items. Approximately two weeks following the first administration of the EPDS, the investigator again contacted the participant by phone to administer the scale for the second time utilizing the same procedure.

Participants' identities were kept completely confidential until both follow-up phone calls were completed. The following steps were taken to ensure the confidentiality of the protocols. First, all protocols were kept in a locked location within the psychology department only available to the graduate student investigator and the principle investigator. Second, the cover sheet with the identifying information was separated from the MMPI-2 protocol and was replaced by a participant number. Third, the MMPI-2 protocols were not scored until all identifying information was separated from the test.

Due to simplistic scoring nature and administration procedures of the EPDS, it was not possible for the scores to be kept anonymous from the GSI. However, the EPDS forms were also kept in a locked location to ensure confidentiality.

Hypotheses

The first hypothesis for the study was that a significant positive correlation would be found between the total score on the Edinburgh Postnatal Depression Scale and the T score of 12 MMPI-2 scales at each administration: Depression (Scale 2) and its five Harris-Lingoes subscales, Psychasthenia (Scale 7), Schizophrenia's (Scale 8) Harris-Lingoes subscale Social Alienation (Sc_1), Depression (DEP), Low-Self Esteem (LSE), Family Problems (FAM), and the Marital Distress Scale (MDS) administered prenatally. Each of the MMPI-2 scales are justified through their relationship to the predictive factors established in the review of the literature.

A second hypothesis for the proposed study was that a combination of the study's seven primary MMPI-2 scales (2, 7, DEP, LSE, FAM, and MDS) would account for a significant portion of the total variance of the EPDS scores.

Results

Data Screening

Of the 64 total participants completing the MMPI-2, 36 finished the entire measure. The remaining 28 participants only completed the first 370 items, thereby limiting the useable scales to the Validity and Clinical Scales, and Harris-Lingoes subscales. Since such a high percentage of the participants only completed the first part of the test, it was decided that the study's analysis would be limited to those scales found within the first 370 items.

Therefore, the study explored the predictive value of Depression (Scale 2) and its five Harris-Lingoes subscales, Psychasthenia (Scale 7), and Schizophrenia's (Scale 8) Harris-Lingoes subscale Social Alienation (Sc_1). The four other scales, Depression (DEP), Low-Self Esteem (LSE), Family Problems (FAM), and the Marital Distress Scale (MDS), were eliminated from the analysis. Social Introversion (Scale 0), a Clinical Scale, was added to the included scales in order to further assess for issues of social support and adjustment.

The final sample comprised 61 of the 64 participants who completed at least the first 370 items of the MMPI-2. One participant was excluded due to a still-born death, while two participants were excluded based on invalid MMPI-2 profiles. Determination of inclusion or exclusion of specific MMPI-2 protocols based on validity scales was made in consultation with the appropriate literature (e.g., Butcher, Graham, & Ben-Porath, 1995 & Nichols, 2001) and expert consultation (J. N. Butcher, personal communication, April 20, 2004). One participant was excluded based on an L-Scale score of T = 90, demonstrating an excessive attempt to present herself in a more favorable light than is

actual, while the second excluded participant's VRIN score of T = 86 indicated an inconsistent response style.

Sixteen additional participants consented to participate in the study but did not complete at least the first 370 items of the MMPI-2 prior to delivery or were discontinued for other reasons. Most notably, one participant was excluded after it was observed that her husband was completing some of the items. In addition, it was not possible to contact all of the participants for each follow-up EPDS administration; three participants were only reached for the first administration, while one was only available for the second.

The data was screened for outliers, linearity, homoscedasticity, and normality. As for outliers, all MMPI-2 predictor scales and EPDS outcome scores fell within three and one-half standard deviations from the mean; therefore no outliers were identified in the data. The data was visually screened for linearity. While all of the data fit linear models, seven of the regression lines actually improved slightly with a quadratic fit. Specifically, all but one of the second EPDS outcome scores showed modest improvements with a quadratic model. This issue will be addressed later under *Supplemental Analyses*. Homoscedasticity was inspected visually with scatterplots. Each of the scatterplots demonstrated no significant deviation from homoscedasticity.

Each predictor and outcome score was also evaluated for normality. The MMPI-2 predictors all showed a generally normal bell curve. The two EPDS outcome measures did not show a normal curve, however. Instead, each was positively skewed; skewness was found to be 1.353 for Time 1 and 1.036 for Time 2. (See Figures 1 and 2 for the EPDS histograms.) These findings are expected and not due to errors in data collection;

postpartum depression is not normally distributed in the population. It should be noted however that the skewed nature of the outcome measures may decrease the resulting correlations.

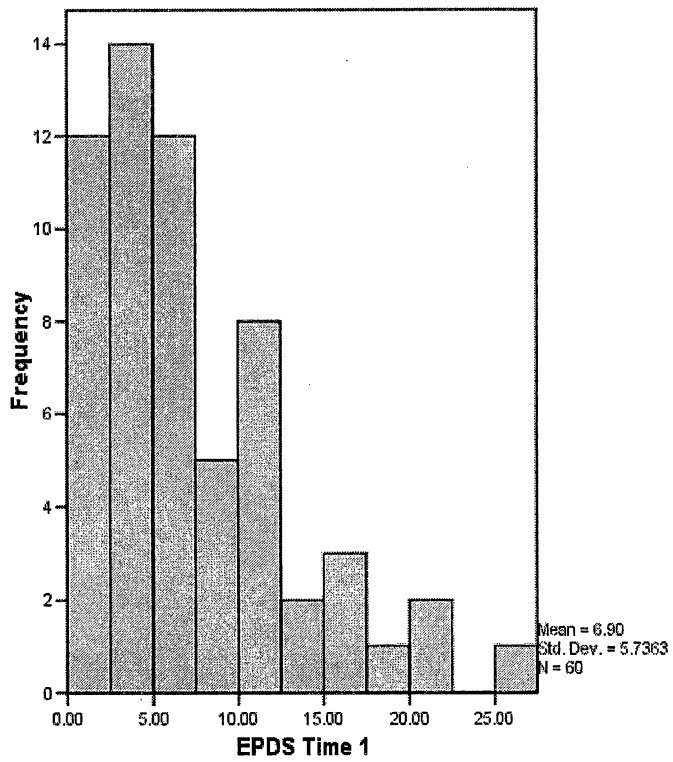

Figure 1. EPDS Time 1 Histogram

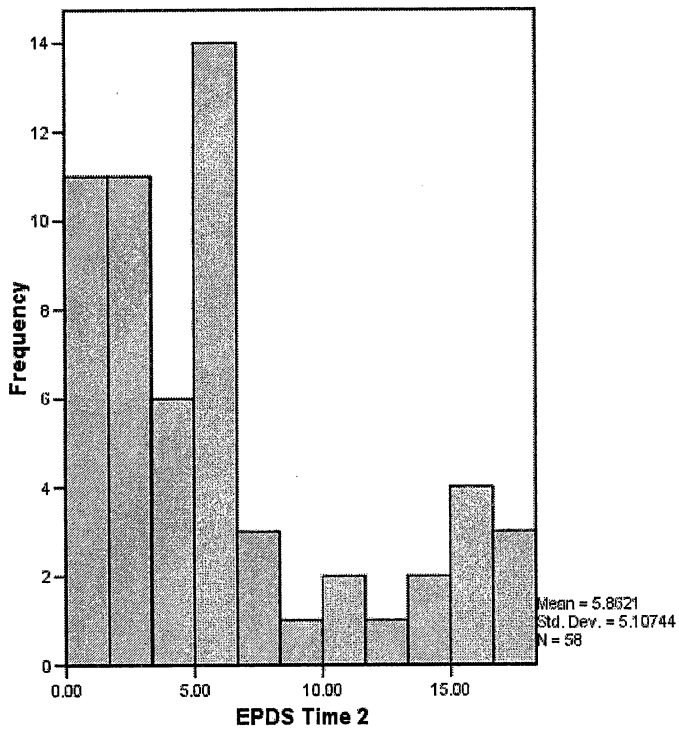

Figure 2. EPDS Time 2 Histogram

Descriptive Statistics

The mean age of the 61 participants completing the study was 26.4 years old, with a standard deviation of 5.9 years. The ages of the participants ranged from 18 to 40 years old at the time of the MMPI-2 administration, with a mode of 24 and median of 25.5. Of the total sample, 14 (23%) were private patients of the attending physicians, while the remaining 47 (77%) were treated in the residents' clinic. Fifty-two (85%) reported being married or in a significant relationship.

EPDS scores for the first administration (approximately one week following delivery) ranged from 0 to 26 out of a possible 30 points, with 60 completed measures. The mean was 6.90 with a standard deviation of 5.74. As for the second administration (approximately three weeks post-delivery), the scores ranged from 0 to 18 with a mean of 5.86 and standard deviation of 5.11, with 58 completed measures. The correlation

between the two EPDS administrations was r = .667 ($p < .000$). Table 1 lists the descriptive statistics for the two EPDS outcome measures, including median and mode.

Table 1

EPDS Descriptive Statistics

Descriptive Statistics	Number	Mean	St. Dev.	Median	Mode	Range
EPDS Time 1 (1 week postpartum)	60	6.90	5.74	5	3	0-26
EPDS Time 2 (3 weeks postpartum)	58	5.86	5.11	5	5	0-18

In comparing the two EPDS outcome scores for the 57 participants completing both measures, 28 individuals improved between the administrations; nine of those decreased in score by roughly one standard deviation or more. Sixteen participants worsened, with four of them increasing their EPDS score by at least one standard deviation.

Table 2 lists the mean, standard deviation, median, mode, and range for each T score of the nine MMPI-2 scales and subscales utilized in the study: Scales 2, 7, and 0, and Subscales D_1, D_2, D_3, D_4, D_5, and Sc_1.

Table 2

MMPI-2 Scale Predictors Descriptive Statistics

Scale	2	7	0	D_1	D_2	D_3	D_4	D_5	Sc_1
Mean	59.44	55.59	53.25	57.21	55.21	61.11	55.77	53.67	55.41
St. Dev.	12.61	13.20	9.84	14.02	9.10	11.55	15.21	12.02	12.56
Median	57	53	52	56	57	63	52	53	53
Mode	53	53	50	65	57	56	43	42	42
Range	36-96	33-86	34-80	39-96	41-79	41-93	38-102	37-83	38-92

Table 3 lists the mean, standard deviation, median, mode, and range for each T score of the primary MMPI-2 validity scales: VRIN, TRIN, F, Fp, L, and K. (F-back was excluded since only the first 370 items were used in the study.)

Table 3

MMPI-2 Validity Scales Descriptive Statistics

Scale	VRIN	TRIN	F	Fp	L	K
Mean	49.28	58.13	59.26	54.64	60.00	48.75
St. Dev.	11.49	7.61	16.28	11.35	12.56	9.73
Median	46	58	55	57	57	48
Mode	42	58	55	57	57	48
Range	30-78	50-80	37-120	41-81	33-86	30-67

Hypothesis 1: Bivariate Correlations

For the first EPDS administration (n = 60), of the nine MMPI-2 scale predictors, eight significantly positively correlated with the outcome measure, each one meeting the $p.< 0.01$ level of significance. The statistically significant predictor correlations ranged from r = .335 to .556 with five predictors exceeding r = .500 and hence meeting Cohen's criteria for a large effect. These included Scales 2 (.534) and 7 (.502), and Subscales D_1 (.556), D_4 (.537), and D_5 (.547). Subscale Sc_1 positively correlated with the first administration at r = .462, followed by Scale 0 and Subscale D_3 at r = .377 and r = .335, respectively. According to Cohen, these three latter correlations are considered medium in strength. Subscale D_2 correlated to Time 1 at r =.059, which was far from significant.

For the second administration of the EPDS (n = 58), of the nine predictors, eight significantly positively correlated with the EPDS, with seven of the eight significant scales meeting the $p.< 0.01$ level significance. For the second outcome score, four

predictors were above r = .500 and hence large effect sizes: Subscales D_1 (.565), D_4 (.553), D_5 (.552), and Sc_1 (.546). Scales 2 (.455) and 0 (.442) were well within Cohen's medium strength correlations. The remaining two significant predictors, Scale 7 (.389) and Subscale D_3 (.331), were still greater than r = .300, also meeting Cohen's criteria for a medium size effect. As with the first EPDS outcome score, Subscale D_2 was not significantly correlated to the second EPDS administration; it correlated at r = -.001. Table 4 lists the bivariate correlations for each of the predictors for both follow-up measures, with corresponding significance levels.

Table 4

Bivariate Correlations for MMPI-2 Scale Predictors

Scale	**2**	**7**	**0**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Sc_1**
EPDS 1 (n = 60)	.534	.502	.377	.556	.059	.335	.537	.547	.462
Significance (*p*-value)	.000	.000	.003	.000	.657	.009	.000	.000	.000
EPDS 2 (n = 58)	.455	.389	.442	.565	-.001	.331	.553	.552	.546
Significance (*p*-value)	.000	.003	.001	.000	.993	.011	.000	.000	.000

In comparing the second EPDS administration to the first, of the eight significant positive correlations, two predictor scales decreased in correlation (Scales 2 and 7), while two increased (Scale 0 and Subscale Sc_1). The remaining four (Subscales D_1, D_3, D_4, and D_5) were very similar in each administration, barely increasing or decreasing at all. However, using Fisher's r-to-Z transformation, none of the correlation differences were

found to be even close to significant at the $p. < .05$ level. See Table 5 for comparisons between the significant correlations of the two outcome administrations.

Table 5

Differences Between the Two EPDS Correlations with the Predictor Scales

Scale	2	7	0	D_1	D_3	D_4	D_5	Sc_1
EPDS 1	.534	.502	.377	.556	.335	.537	.547	.462
EPDS 2	.455	.389	.442	.565	.331	.553	.552	.546
Difference	.079	.113	-.065	-.009	.004	-.016	-.005	-.084

Hypothesis 2: Linear Regression

Linear regression was run using simultaneous entry of the three Clinical Scales (Scales 2, 7, and 0) utilized in the study for each of the EPDS outcome administrations, in order to determine if the combination of the multiple predictors accounted for a larger portion of the variance. The linear regression found that the addition of the two extra predictors did not account for much variance beyond each individual predictor. The second and third predictors were found to be largely redundant to the first. Table 6 lists the results of the linear regression as well as the variance accounted for by each of the included predictors individually.

Table 6

R^2 for Linear Regression and Three Separate Predictors

R^2	Linear Regression	Scale 2	Scale 7	Scale 0
EPDS Time 1	.309	.285	.252	.142
EPDS Time 2	.251	.207	.151	.195

Most likely the redundancy in the linear regression is due to high correlations between the three predictors included in the analysis. Such high correlations demonstrate

shared-variance between the predictors. Table 7 lists the bivariate correlations for the three predictors used in the linear regression, which were all significant at the $p. < .001$ level.

Table 7

Bivariate Correlations for Linear Regression Predictor Scales

Scale	2	7	0
2	--	.734	.626
7		--	.541
0			--

Supplemental Analyses

With seven of the scatterplots, it was determined that the variance accounted for of the outcome measure was increased by using a quadratic model as opposed to a linear one. The seven improved predictors were Scales 2, 0, and 7, and Subscales D_1, D_4, D_5, and Sc_1 for the second EPDS score. Subscale D_3 for the second administration, as well as all the predictors for the first EPDS administration, showed little to no improvement with a quadratic model. Table 8 lists the accounted for variance (R^2) for each of the significant predictors and outcome scores. Appendix F includes the scatterplots of the scale predictors for which the quadratic model increased the accounted for variance over the linear model.

Table 8

R^2 for MMPI-2 Predictors with Linear and Quadratic Models

Scale	2	7	0	D_1	D_3	D_4	D_5	Sc_1
EPDS 1 Linear	.285	.252	.142	.320	.112	.289	.300	.213
EPDS 1 Quadratic	.292	.252	.149	.320	.113	.289	.302	.215
EPDS 2 Linear	.207	.151	.195	.319	.110	.306	.305	.298
EPDS 2 Quadratic	.300	.200	.227	.385	.112	.415	.348	.343

A second supplemental analysis was undertaken to compare the predictor scores between women with and without postpartum depression. Instead of analyzing the outcome measure as a continuous variable, this investigation utilized dichotomous groupings based on an EPDS cut-off score and sought to compare the predictors between those above and those below the chosen cut-off.

Cox et al. (1987) recommended a cut-off of 12 to 13 to determine a significant likelihood of postpartum major depression with the EPDS. However, many follow-up studies and reviews (e.g., Appleby et al., 1994; Cox et al., 1993; Eberhard-Gram et al., 2002, Guedeney et al, 2000; Holden, 1991; Lane, 1997; Warner et al., 1996) offered other suggestions of possible cut-off scores, ranging from 9 to 13. It was decided to set the minimum cut-off for probable PPD at 10; this level was recommended in a more recent study by Eberhard-Gram et al. (2002). This cut-off score also permitted the inclusion of those with minor depression, in addition to a more major condition, as recommended by Cox et al. (1993).

The MMPI-2 predictor scales are considered clinically relevant when the T score is greater than or equal to 65 (Butcher et al., 2001; Greene, 2000). Hence, this supplemental analysis sought to determine if those individuals scoring at or above T = 65 on each MMPI-2 predictor scale were more likely to score at 10 or above on the EPDS following delivery, and therefore have severe enough depressive symptoms to be classified as suffering from postpartum depression. Scatterplots were visually assessed to determine differences between the two groups. Appendix G includes the dichotomous scatterplots for each follow-up EPDS assessment for Scales 2, 7, and 0, as well as Subscales D_1, D_3, D_4, D_5, and Sc_1.

Based on visual examination, Scale 2 proved to be the best predictor of the presence of the disorder at both follow-up EPDS administrations, showing both low false-negatives and low false-positives for each one. In other words, the vast majority of cases were accurately predicted to be categorized as depressed or non-depressed by Scale 2. Scale 7 was similar to Scale 2 in that it also minimized false-positives, but Scale 7 also created a higher number of false-negatives. Scale 0 had very few false positives, as was with Scale 2, but had a higher amount of false-negatives than either Scale 2 or Scale 7.

As for the four significant Scale 2 subscales, overall, each one tended to be moderate in predictive capacity as compared to Scales 2, 7, and 0. Each subscale showed both moderate false-positives and false-negatives, except for Subscale D_4 which had fewer false-negatives, especially with the second EPDS administration. Subscale Sc_1 was quite varied, showing moderate false-positives and high false-negatives at one week, and low false-positives and moderately-low false-negatives at three weeks.

The means of the depressed and non-depressed groups, as determined by the EPDS cut-off score, were also compared on each significant MMPI-2 scale predictor using t-tests. Each predictor scale was found to be significantly different between the two groups at the $p.< .05$ level, expect for D_3 with the second EPDS administration, which was found to not be significant. Table 9 lists the t-test results and corresponding significance levels for each comparison.

One unexpected finding in regards to the bivariate correlations should be noted. When the non-K-corrected Scale 7 was used, the correlations were larger for both EPDS administrations as compared to Scale 7 with K-correction. The uncorrected Scale 7 correlated with the first EPDS at r = .597 ($p.<.000$) and the second at r = .590 ($p.<.000$), as compared to r =.502 and r =.389, respectively, for the K-corrected Scale 7.

Table 9

T-tests for Differences Between EPDS Depressed vs. EPDS Non-Depressed Participants

EPDS Time	Scale/ Subscale	t	df	Significance	Mean Difference
EPDS 1	2	-3.630	22.553	.001	-13.387
	7	-2.865	25.140	.008	-11.063
	0	-3.550	29.553	.001	-9.150
	D_1	-3.620	24.210	.001	-14.416
	D_3	-2.274	29.423	.030	-7.250
	D_4	-2.798	22.495	.010	-13.122
	D_5	-3.322	25.850	.003	-11.185
	Sc_1	-2.193	24.996	.038	-8.331
EPDS 2	2	-2.539	13.296	.024	-12.348
	7	-2.180	13.552	.047	-11.326
	0	-2.656	14.655	.018	-9.290
	D_1	-2.977	13.088	.011	-15.891
	D_3	-1.913	13.890	.077	-8.583
	D_4	-3.016	12.575	.010	-18.435
	D_5	-3.174	13.900	.007	-13.431
	Sc_1	-2.605	12.730	.022	-13.264

Discussion

Hypothesis 1

The bivariate correlations between the MMPI-2 predictor scales and the two EPDS outcome scores, with the exception of Subscale D_2, Psychomotor Retardation, supported the hypothesis that a significant positive correlation would be found with each predictor. Scales 2, 7, 0, and Subscales D_1, D_3, D_4, D_5 and Sc_1 all predicted each EPDS administration, with the majority showing a large effect size.

The significant capability of Scale 2, Depression, to predict postpartum depression symptomology supports previous research (e.g., Beck, 1996 & 2001; Da Costa et al., 2000; Graff, Dyck, & Schallow, 1991) showing that the best predictor of postpartum depression is depression during pregnancy. However, the present study's use of the Harris-Lingoes subscales for Scale 2 attempted to explore possible variance in the predictive ability of different aspects or symptoms of prepartum depression. Subjective Depression, Mental Dullness, and Brooding each individually were the strongest predictors in the current study. In fact, each one of these three subscales individually showed a slightly higher predictive ability than the parent scale, though none of the differences were statistically significant.

Greene (2000) described high scorers on each of the subscales for Scale 2. Those individuals high on Subjective Depression are "depressed, pessimistic, and have poor morale and low self-esteem. They lack energy for coping with problems. They have problems with attention and concentration. They have difficulties sleeping" (p.139). Individuals scoring high on Mental Dullness are described by Greene (2000, p.139) as having "problems with attention, concentration, and their memory. They are apathetic and

have difficulty in starting to do things." Lastly, high scores on Brooding are associated with clients that are "depressed, feel useless, and are easily upset by others" (p.139).

Not surprisingly, these three subscales of Scale 2 (D_1, D_4 and D_5) collectively describe individuals who are experiencing symptoms that parallel the clusters Sugawara et al. (1999) found in their factor analysis of PPD symptoms: affective/insomnia, cognitive, and attentional. The results suggest that at least some of the predictors and symptoms of postpartum depression are very similar, if not identical.

It is important to note that Greene (2000) reported that the three subscales have many items in common. Ten of the Brooding items are also found on Subjective Depression, while 12 of the 15 items on Mental Dullness also show up on Subjective Depression. Thus it is not surprising that these three subscales were similar in predictive capability.

Physical Malfunctioning (Subscale D_3) also significantly predicted the presence of depressive symptoms in the postpartum. However, it explained for less of the variance in outcome scores than the other significant predictors. Greene (2000, p. 139) described clients scoring high on this subscale as "generally concerned about their poor health." It is likely that many, if not most, pregnant women experience concerns about the physical health. In fact, of the predictor scales and subscales utilized in this study, Physical Malfunctioning had the highest mean, less than four T points from clinical significance of T = 65, supporting the idea that such concern is not unusual or unexpected during pregnancy. According to Greene, this subscale shares few to no items with the other Scale 2 subscales.

Of the nine predictors included in this study, only Psychomotor Retardation was found to not significantly correlate with the EPDS outcome scores. According to Greene (2000, p. 139), high scores on this subscale are related to the avoidance of social relations and difficulty in initiating activity. Though it is possible that a decrease in motor activity is common in pregnancy and therefore unrelated to predicting depression, the mean for this subscale was actually less than both Subscales D_1 and D_4. Hence, it is unlikely that any normality in psychomotor retardation adequately explains this subscale's failure to predict the outcome measure.

Instead, the failure of Subscale D_2 to predict the EPDS outcome scores may lie more in the limitations of the EPDS itself. Guedeney et al. (2000) found that EPDS, while good at measuring symptoms of anhedonia and anxiousness, was unable to assess for symptoms of psychomotor retardation. Their study examined three case studies of false-negatives with the EPDS and found that each of the three patients experienced symptoms of psychomotor retardation but did not experience sadness or anxiety. Each of them subsequently fell below the cut-off score for the EPDS. It is understandable, then, that Psychomotor Retardation was unable to correlate with the EPDS since the latter does not assess for those specific symptoms of postpartum depression.

Psychasthenia's significant positive correlation with each of the follow-up EPDS scores supports the research (e.g., Beck, 1996/2000; Kennerley & Gath, 1989; O'Hara & Swain, 1996; Righetti-Veltema et al., 1998) indicating that anxiety during pregnancy is a strong predictor of postpartum depression. Scale 7's correlation did drop slightly with the second EPDS administration, but not to a significant degree.

As discussed previously, Psychasthenia not only assesses for anxiety-based symptoms, such as long-term trait anxiety, but also evaluates for chronic mood symptoms, as compared to more acute mood symptoms, which are better measured by Depression (Greene, 2000). As cited previously, Greene noted seven factors measured by Psychasthenia: neuroticism, anxiety, withdrawal, poor concentration, agitation, psychotic tendencies, and poor physical health. It taps symptoms of abnormal fears, self-criticism, difficulties in concentration, and feelings of guilt. The scale was included in the present study based on previous findings of the predictive value of depression, neuroticism, distress, loneliness, stressful life events, specific stress caused by the pregnancy, and low social support. Therefore this study helps to confirm these factors as predictors of PPD.

Beck (1996/2000) established through her meta-analyses that prepartum depression has a large effect size (around .50) in predicting PPD. Prenatal anxiety was found by Beck to have a smaller effect size, usually falling in the moderate range (between .35 and .45). In the present study, both Depression and Psychasthenia demonstrated large effect sizes. This difference with the prior research is most likely accounted for by the heterogeneity of Psychasthenia, in that it includes not only symptoms of anxiety but those of chronic depression and general upset as well.

The present study included Scale 0, Social Introversion, and Subscale Sc1, Social Alienation, to assess for the lack of social support and poor social adjustment. Simply, those highly introverted and/or socially alienated are unlikely to have a strong support system, which may be related to poor social adjustment. According to Greene (2000), Social Introversion measures discomfort in social situations, feelings of isolation, general

maladjustment, and self-deprecation. As for Social Alienation, Greene described high scorers as those who "feel a lack of rapport with other people; they withdraw from meaningful relationships with others" (p. 168).

Previously cited research has examined the role of social support as a buffer against postpartum depression, as well as poor social adjustment as a predictor of PPD. Beck's (1996/2001) meta-analyses established a moderate effect size (ranging between .36 and .41) for the ability of a social support system to protect against postpartum depression, findings corroborated by others (e.g., O'Hara & Swain, 1996). In addition, poor social adjustment has been shown to predict future PPD (Kennerley & Gath, 1989 & O'Hara et al., 1982). It is interesting to note that social support as a buffer against PPD is one of the few positive variables examined in the literature. The vast majority of research has been focused on risk factors and not protective ones.

The current study found both of these MMPI-2 psychosocial scales to be significant predictors of PPD. Social Introversion demonstrated moderate effect sizes for both follow-up assessments, while Social Alienation was moderate for the first EPDS, but rose to a large effect size for the second. In fact, both of these scales showed somewhat higher, though not significantly different, correlations in predictive ability for the second outcome score.

These results could be tentatively interpreted to mean that the role of social support may have a greater impact upon functioning farther along in the postpartum period. Initially, a woman may be too involved in caring for her newborn child to utilize any support system; the lack of such a system may be noticeable and relevant only later

on, once the novelty of the new child has dissipated. The new mother may only then find herself wanting and needing social support. This hypothesis is reinforced by Cutrona (1984) who found that social support at two weeks was not correlated with PPD, but a significant negative association was found at eight weeks.

One additional observation about Scale 0 is warranted. Scale 0, unlike the other predictors utilized in the study, is not a measure of psychopathology. Greene (2000) noted that it was created from a psychological test of introversion-extroversion and not psychiatric symptoms. In fact, Greene stated that "Scale 0 scores tend to be unrelated to psychopathology since elevations may reflect a schizoid withdrawal from interpersonal relationships, neurotic withdrawal, and self-deprecation as a function of personal distress, or merely an introverted orientation" (p. 173).

Scale 0 is primarily a measure of a characterological trait, much like the few personality variables discussed previously in the literature review, such as neuroticism (see Kendell et al., 1984; Kennerley & Gath, 1989; O'Hara & Swain, 1996). Most research to date has focused on psychiatric disorders and symptoms as predictors of PPD. The current study's use of Scale 0 helps to support the limited research indicating that personality and characterological factors can also predict postpartum depression. Scale 0 demonstrated significant predictive capacity, especially at the second EPDS administration. It is clear that personality traits also play a role in understanding who is and who is not at risk for PPD.

Hypothesis 2

The results of the present study failed to support the second hypothesis regarding multiple predictors accounting for a significant portion of the variance. Very little additional variance was accounted for by the inclusion of two or more Clinical Scale predictors into the linear regression beyond the influence of each one individually. The inter-correlations between the three Clinical Scale predictors likely accounted for too much shared variance to increase the predictive value.

As was explained previously in regards to Scales 2 and 7, there is conceptual overlap between the three predictor scales that were utilized in the linear regression. For example, Psychasthenia not only measures anxiety, about also chronic depression. In addition, there is some item-overlap between the scales. According to Greene (2000), Scales 2 and 7 share 13 items, 2 and 0 share seven, and 7 and 0 have eight items in common. It is likely that more variance would have been accounted for if the scales had been based on more discrete theoretical constructs.

Supplemental Findings

The current study explored two areas beyond the original hypotheses. First, it was found that seven of the predictors for the second EPDS administration were better accounted for by a quadratic model, instead of a linear one, while none of predictors for the first administration were found to be improved by a quadratic model. Second, visual examination of scatterplots and t-tests demonstrated that the MMPI-2 predictor scales were significantly able to predict the future grouping of the participants as depressed or not depressed, as measured by the EPDS, using a cut-off score of ten.

As for the first supplementary finding, there is no clear explanation for why the relationships between all but one the predictors and the second EPDS score were better explained by a quadratic model. One possibility may involve defensiveness at Time 2. Using Scale 2 as an example, examination of the curve (see Appendix F) shows that prior to an EPDS score of about five, the line has a negative slope. After five or six, the slope begins to turn upward and become positive.

The problem seems to be with those scores falling below an EPDS score of around five, and hence in the negative-slope range, but still high ($T > 65$) on Scale 2. Simply, they are scoring lower on the second EPDS than would be expected given their Scale 2 scores. Either they are overreporting on the MMPI-2 or underreporting on the EPDS. Since the MMPI-2 has built in measures to detect such overreporting, it is reasonable to assume that problem most likely lies in defensive responding to the EPDS.

One question remains, however. Why was this defensiveness only seen for the second EPDS? Since a quadratic model did not improve the first EPDS score, no defensiveness was identified. Hence, why were some women defensive at three weeks and not one week? One explanation is that as more time goes on, the women began to feel more odd or wrong for feeling depressed. Some sadness was acceptable one week after deliver but by three weeks, the women became too embarrassed to respond accurately to the EPDS questions. Instead, they responded defensively and underreported symptoms.

The second exploratory finding demonstrated that those scoring in the clinically-significant range on the selected MMPI-2 scales were more likely to score above the cut-off score of ten on the EPDS, and be classified as depressed in the postpartum period. The

scatterplots showed that the scales somewhat differed in their ability to minimize false negatives and false positives. Overall, Depression (Scale 2) seemed to best predict those that would later be depressed without an excessive amount of false cases. This finding confirms the literature (e.g., Beck, 1996/2000) that has found that prepartum depression is the best predictor of postpartum depression. The analysis also helped to confirm Eberhard-Gram et al. (2002) who recommended ten as a cut-off score for the EPDS.

The t-tests expounded the same point by showing that there are significant differences on the predictor scales between those later found to be depressed and those scoring below the depression cut-off score. Again, these findings help to confirm that clinically significant scores on the EPDS following delivery are predicted by high scores on the included MMPI-2 scales.

Limitations

A major limitation of the present study was its inability to utilize the four other proposed MMPI-2 scales: Depression, Marital Distress, Family Problems, and Low Self-Esteem. This failure was due entirely to the difficulty of the participants in being able to complete the full MMPI-2. A large number of the participants delivered prior to finishing the entire measure and only completed enough items to utilize the Clinical and Validity Scales. Though the sample size was strong enough to measure the nine included scales, a larger sample size would be necessary if more predictor scales were included.

Another possible limitation of the study was in obtaining a clinically heterogeneous sample. Specifically, patients suffering from depression or other psychiatric conditions may have been less willing to participate in the study and hence

engaged in self-selection. Obtaining a broader spectrum of participants may have enhanced the results. However, descriptive statistics from the MMPI-2 showed a large range of scores, including many participants that had clinically significant scores.

Though a broad range of scores was found with the EPDS in the study, there is a possibility that some participants did not respond in an entirely open manner since the outcome measure was administered verbally over the phone. Participants may have not answered accurately due to attempts at impression management. This possibility is supported by the tentative explanation for the quadratic modeling found with the predictors at the second outcome administration. Participants might have been more willing to be more honest if they had completed the measure by hand and not over the phone.

Additionally, outcome scores may have been limited by the times chosen to assess for PPD. Some women may not yet have had symptom-onset at three weeks after delivery. Dunnewold (1997) cited multiple research studies indicating that rates of depression tend to increase later on in the postpartum, especially after three weeks. Follow-up EPDS administrations farther out from delivery may have resulted in more identification of PPD and better understanding of the condition's course.

Conclusions and Future Directions

The results of this study help to bolster the literature demonstrating that certain variables assessed during pregnancy are predictive of postpartum depression. In addition it gave evidence that certain MMPI-2 scales serve as valid predictors of PPD. The present investigation sought to confirm some of the most frequently identified psychological and

psychosocial predictors of PPD with an instrument that goes beyond basic interview and/or self-report, a measure with high validity, reliability, and clinical respect. In this way, the study was successful: the results confirmed all but one of the tested variables.

In addition, the study took the literature one step further by more closely examining sub-facets of depression. Though depression is commonly accepted as a singular primary construct, symptoms of depression are actually quite heterogeneous (Buchwald & Rudick-Davis, 1993). Two individuals could both be diagnosed with depression and have few, if any, overlapping symptoms. In fact, Buchwald and Rudick-Davis reported that the criteria for depression can be met by 163 different subsets of symptoms. The present study helped to focus attention on possible inequalities in components of prepartum depression in their predictive value.

This study can also serve as a bridge to new research endeavors in the prediction of postpartum depression. First, future research should examine the four potential predictor scales eliminated from this study: Depression, Marital Distress, Family Problems, and Low Self-Esteem. Each scale was well supported by the previous literature and should be investigated as possible predictors of PPD. Similarly, future investigations could utilize other MMPI-2 scales that may be also potentially supported by the literature, including other Clinical, Content, or Supplementary Scales.

Second, future research should utilize the same predictive measure, but assess the participants earlier in their pregnancies. For example, are symptoms in second-trimester able to predict PPD as strongly as third-trimester? In addition, a more longitudinal study could also assess for depression farther out into the postpartum period. In support of the

literature cited by Dunnewold (1997), future research could follow the participants longer into the postpartum period, when additional women may tend to exhibit PPD symptoms.

Third, research should continue to examine the symptom-clusters of the known predictors of PPD. Research should attempt to predict PPD with other measures that breakdown depression, and other known predictors, into more specific symptom factors. Simply stated, future studies should move from more general to more specific predictive constructs.

Fourth, future research should attempt to first replicate and then explain the role of the quadratic model in explaining the results of the present study. For example, investigators could address the issue of defensiveness by comparing attempts at underreporting at different time periods in the postpartum. Studies could also focus on explaining the quadratic models with hypotheses other than defensiveness.

Finally, results of the present study should assist future research in creating a complex model to explain the predictors of postpartum depression. Such a model could be based on a biopsychosocial-spiritual framework. It would include not only psychological and psychosocial factors, such as those examined in the current study, but also biological and medical ones as well. Possible predictors to be examined for inclusion in the model are social factors such as culture and ethnicity, spiritual issues like religious-coping, psychological ones such as adaption, and medical factors, including chronic physical illness.

The present study addressed several areas that should also be considered when creating such a model. First, the current study examined one characterological predictor,

social introversion. Any complete model would need to include other personality factors that play a role in PPD. Most of the literature has been narrowly focused on behavioral symptoms, such as those found in the DSM-IV. Future research should seek to identify and better clarify characterological predictors as well.

Second, with the exception of social support, the current research into the predictors of postpartum depression has not examined numerous possible factors that may buffer against the disorder. Future research needs to investigate potential moderators and mediators that could make a woman resilient to PPD. Emotional insight and a spiritual belief system are two possible variables that may provide protection and need to be studied.

Once a more complete model of the predictors of postpartum depression has been supported through research, a screener for PPD should be created based on the model. While the MMPI-2 served as a more valid and reliable research tool than those measures utilized by previous investigations, this study's intent is not to endorse the MMPI-2 as a screener to predict postpartum depression. It is too long for a screener and additionally only assesses psychological and psychosocial predictors. Such a purpose would be better served by a much less time-consuming instrument that would measure a broader scope of factors within a biopsychosocial-spiritual model. If used correctly, such a measure could lead to early preventative interventions (see Ogrodniczuk & Piper, 2003) that would decrease the impact and severity of depression following delivery.

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Appendix A

Edinburgh Postnatal Depression Scale (EPDS)

J. L. Cox, J. M. Holden, R. Sagovsky
Department of Psychiatry, University of Edinburgh

First name:
Phone number:
Baby's date of birth:

As you have recently had a baby, we would like to know how you are feeling. Please UNDERLINE the anser which comes closest to how you have felt IN THE PAST 7 DAYS, not just how you feel today.

Here is an example, already completed
I have felt happy:

Yes, all the time.
Yes, most of the time.
No, not very often.
No, not at all.

This would mean: "I have felt happy most of the time" during the past week. Please complete the other questions in the same way.

In the past 7 days:

1. I have been able to laugh and see the funny side of things

As much as I always could	0
Not quite so much now	1
Definitely not so much now	2
Not at all	3

2. I have looked forward with enjoyment to things

As much as I ever did	0
Rather less than I used to	1
Definitely less than I used to	2
Hardly at all	3

*3. I have blamed myself unnecessarily when things were wrong

Yes, most of the time	3
Yes, some of the times	2
Not very often	1
No, never	0

4. I have been anxious or worried for no good reason
   - No, not at all 0
   - Hardly every 1
   - Yes, sometimes 2
   - Yes, very often 3

*5. I have felt scared or panicky for no very good reason
   - Yes, quite a lot 3
   - Yes, sometimes 2
   - No, not much 1
   - No, not at all 0

*6. Things have been getting on top of me
   - Yes, most of the time I haven't been able to cope at all 3
   - Yes, sometimes I haven't been coping as well as usual 2
   - No, most of the time I have coped quite well 1
   - No, I have been coping as well as ever 0

*7. I have been so unhappy that I have had difficulty sleeping
   - Yes, most of the time 3
   - Yes, sometimes 2
   - Not very often 1
   - No, not at all 0

*8. I have felt sad or miserable
   - Yes, most of the time 3
   - Yes, quite often 2
   - Not very often 1
   - No, not at all 0

*9. I have been so unhappy that I have been crying
   - Yes, most of the time 3
   - Yes, quite often 2
   - Only occasionally 1
   - No, never 0

*10. The thought of harming myself has occurred to me
   - Yes, quite often 3
   - Sometimes 2
   - Hardly every 1
   - Never 0

TOTAL SCORE:_____

Appendix B
Participant Recruitment Script

"We have a doctoral student here from Loma Linda University's Graduate School who is doing a study on postpartum depression. He is looking for participants to take a psychological measure in the near future and then to answer some follow-up questions from another measure after they have given birth. In no way will your decision to or to not participate affect your treatment by me or this department. Would you be willing to talk with him about the study? You can then decide if you wish to participate."

Appendix C1
Original Patient Contact Form

Dear obstetrics patient:

As you may know, part of Loma Linda University's mission is to educate future healthcare professionals and to conduct medical research. Currently, our Obstetrics department is participating in a research study of postpartum depression being conducted by a graduate student from the Department of Psychology. We are looking for any patients willing to participate in the study. If you are at least 22 weeks along in your pregnancy, and would be willing to receive a phone call from the researcher about the study, please fill in the information below and return this form to the front desk or your nurse. By completing this form, you are only agreeing to be contacted by the researcher; if you later agree to participate in the study, you will then be asked to sign a formal consent.

Name:_____

Home phone number:_____

Other phone number:_____

Weeks pregnant:_____

Today's date:_____

Appendix C2
Revised Patient Contact Form

Dear obstetrics patient:

As you may know, part of Loma Linda University's mission is to educate future healthcare professionals and to conduct medical research. Currently, our Obstetrics department is participating in a research study of postpartum depression being conducted by a graduate student from the Department of Psychology. We are looking for any patients willing to participate in the study. If you are at least 30 weeks along in your pregnancy, and would be willing to receive a phone call from the researcher about the study, please fill in the information below and return this form to the front desk or your nurse. By completing this form, you are only agreeing to be contacted by the researcher; if you later agree to participate in the study, you will then be asked to sign a formal consent.

Name:_____

Home phone number:_____

Other phone number:_____

Weeks pregnant:_____ Due date:_____

Today's date:_____Please circle the day(s) and time you usually have appointments: M T W Th F / AM or PM

Appendix D1
Informational Letter
Potential Factors Related to Postpartum Depression

Purpose

You are invited to participate in this study. The goal of the study is to gather information that will help health care providers to better understand, predict, and treat postpartum depression. The study is being conducted as part of the graduate student investigator's degree requirements.

Requirements for Participation

You must be pregnant, 18 years of age or older, and in your third trimester.

Procedure

If you are willing to participate, you will be asked first to complete a psychological measurement that takes approximately 60 minutes. You may take this measure at your doctor's office before or after your appointment, or during a separately scheduled appointment with the graduate student research investigator. At eight days following delivery, and again two weeks later, you will be contacted by the investigator by phone. He will remind you of the study and ask you to answer 10 questions. Each phone call should take 10 to 15 minutes.

Risks

Participating in this study exposes you to some risk of experiencing anxiety based on the self-reflection you will do when completing the measures. There is no more than minimal risk involved in participating in the study. If anxiety or other problems should occur, you will be provided with the opportunity to speak with the graduate student investigator. In case problems persist, please contact either Loma Linda University Psychological Services Clinic at (909) 558-8576 or Dr. Jan Sonne at (909) 558-8710.

Benefits

You will probably not receive any benefits from participating in this study. However, your participation will help health care professionals to understand more about postpartum depression. It will help health care professionals to anticipate and better provide for the needs of women with postpartum depression.

Participants' Rights

Your participation in this study is completely voluntary. You have the right to stop responding to the questions on the first measure at any time. If you decide to stop, you may give your measure to the graduate student investigator. You also have the right to refuse to answer the questions when the investigator calls you following your delivery.

Confidentiality

All the information that is collected in this study will be kept strictly confidential. You will be asked to write down your first name, marital or relationship status, expected date of delivery, and phone number on a cover sheet. This information will be kept in a locked file cabinet in the lab office of the Primary Investigator until you have completed, or decide not to complete, the questions posed to you over the phone once you have delivered your baby. At that point, all information that could identify you will be destroyed and the measures you completed will be anonymous. No measures will be scored until your identifying information is separated from the measures and destroyed. Any publication of presentation resulting from this study will refer only to the entire group of people who completed the measures.

Additional Costs/Reimbursement

There is no cost to you for participating in this study, nor any reimbursement for your effort.

Impartial Third Party Contact

If you wish to contact an impartial third party not associated with this study regarding nay concerns or complaints that you may have, please feel free to contact the Office of Patient Relations at Loma Linda University Medical Center, Loma Linda, CA, 92354, phone (909) 558-4647 for information or assistance.

Informed Consent Statement

Once you have read the contents of this informational letter, please sign, pint, and date your name below to indicate your consent to participate in the study. This consent does not waive your rights, nor does it release the investigators, institution, or sponsors from their responsibilities. You may call the graduate student investigator, Brandon Yakush, M.A., or the faculty advisor, Janet Sonne, Ph.D., at Loma Linda University, Department of Psychology during normal office hours at (909) 558-8710 if you have additional questions or concerns. Please keep a copy of this letter for your future reference.

_____
Participant's name

_____
Participant's signature

_____
Date

Appendix D2
Informational Letter (Revised)
Potential Factors Related to Postpartum Depression

Purpose

You are invited to participate in this study. The goal of the study is to gather information that will help health care providers to better understand, predict, and treat postpartum depression. The study is being conducted as part of the graduate student investigator's degree requirements.

Requirements for Participation

You must be pregnant, 18 years of age or older, and in your third trimester.

Procedure

If you are willing to participate, you will be asked first to complete a psychological measurement that takes approximately 60 minutes. You may take this measure at your doctor's office before or after your appointment, or during a separately scheduled appointment with the graduate student research investigator. At eight days following delivery, and again two weeks later, you will be contacted by the investigator by phone. He will remind you of the study and ask you to answer 10 questions. Each phone call should take less then 5 minutes.

Risks

Participating in this study exposes you to some risk of experiencing anxiety based on the self-reflection you will do when completing the measures. There is no more than minimal risk involved in participating in the study. If anxiety or other problems should occur, you will be provided with the opportunity to speak with the graduate student investigator. In case problems persist, please contact either Loma Linda University Psychological Services Clinic at 909 558-8576 or Dr. Jan Sonne at 909-798-0324.

Benefits

You will probably not receive any benefits from participating in this study. However, your participation will help health care professionals to understand more about postpartum depression. It will help health care professionals to anticipate and better provide for the needs of women with postpartum depression.

Participants' Rights

Your participation in this study is completely voluntary. You have the right to stop responding to the questions on the first measure at any time. If you decide to stop, you may give your measure to the graduate student investigator. You also have the right to refuse to answer the questions when the investigator calls you following your delivery.

Confidentiality

All the information that is collected in this study will be kept strictly confidential. You will be asked to write down your first name, marital or relationship status, expected date of delivery, and phone numbers on a cover sheet. This information will be kept in a locked file cabinet in the lab office of the Primary Investigator until you have completed, or decide not to complete, the questions posed to you over the phone once you have delivered your baby. At that point, all information that could identify you will be destroyed and the measures you completed will be anonymous. No measures will be scored until your identifying information is separated from the measures and destroyed. Any publication of presentation resulting from this study will refer only to the entire group of people who completed the measures.

Additional Costs/Reimbursement

There is no cost to you for participating in this study, nor any reimbursement for your effort.

Impartial Third Party Contact

If you wish to contact an impartial third party not associated with this study regarding nay concerns or complaints that you may have, please feel free to contact the Office of Patient Relations at Loma Linda University Medical Center, Loma Linda, CA, 92354, phone (909) 558-4647 for information or assistance.

Informed Consent Statement

Once you have read the contents of this informational letter, please sign, print, and date your name below to indicate your consent to participate in the study. This consent does not waive your rights, nor does it release the investigators, institution, or sponsors from their responsibilities. You may call the graduate student investigator, Brandon Yakush, M.A., or his faculty advisor, Janet Sonne, Ph.D., at Loma Linda University, Department of Psychology during normal office hours at 909-798-0324 if you have additional questions or concerns. Please keep a copy of this letter for your future reference.

_____ _____

Participant's name Date

_____ _____

Participant's signature GSI's signature

Appendix E
MMPI-2 Cover Sheet

Dear OB/Gyn Patient:

Thank you for your willingness to participate in this study. Please complete the following questions in order to help us track you in the study:

FIRST NAME:_____

PRIMARY PHONE NUMBER:_____

SECONDARY PHONE NUMBER:_____

EXPECTED DUE DATE:_____

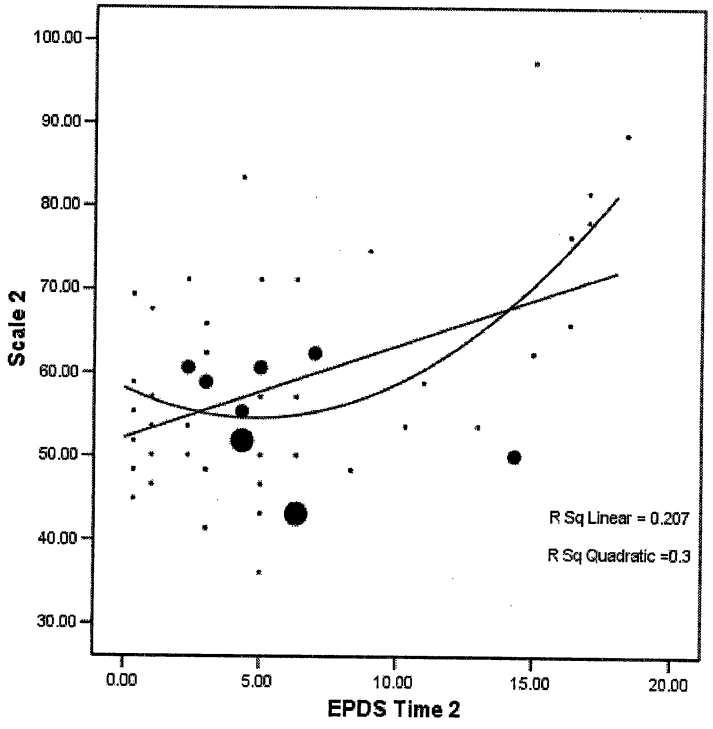
DO YOU SEE THE SAME DOCTOR EACH TIME YOU HAVE A CHECK-UP? Y N

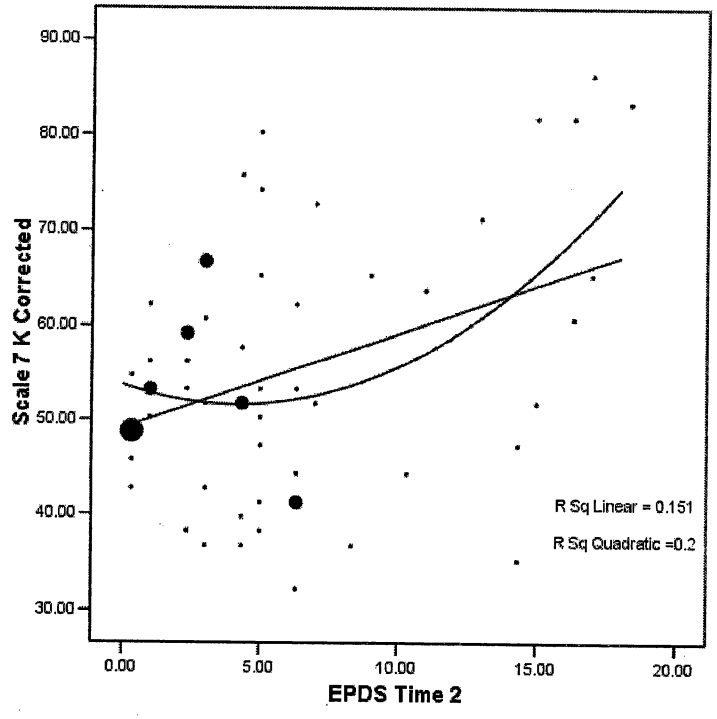
CURRENT TRIMESTER:_____

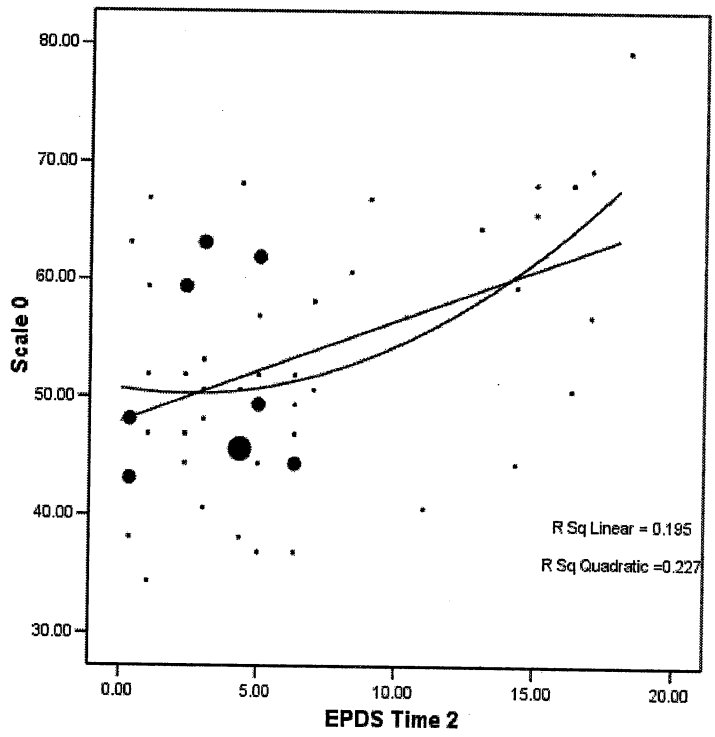
ARE YOU CURRENTLY MARRIED OR IN A SIGNIFICANT RELATIONSHIP? Y N

Appendix F

Scatterplots for Scales with Increased Explained Variance for Quadratic Model



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60.00
50.00
40.00
30.00
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5.00
10.00
15.00
20.00
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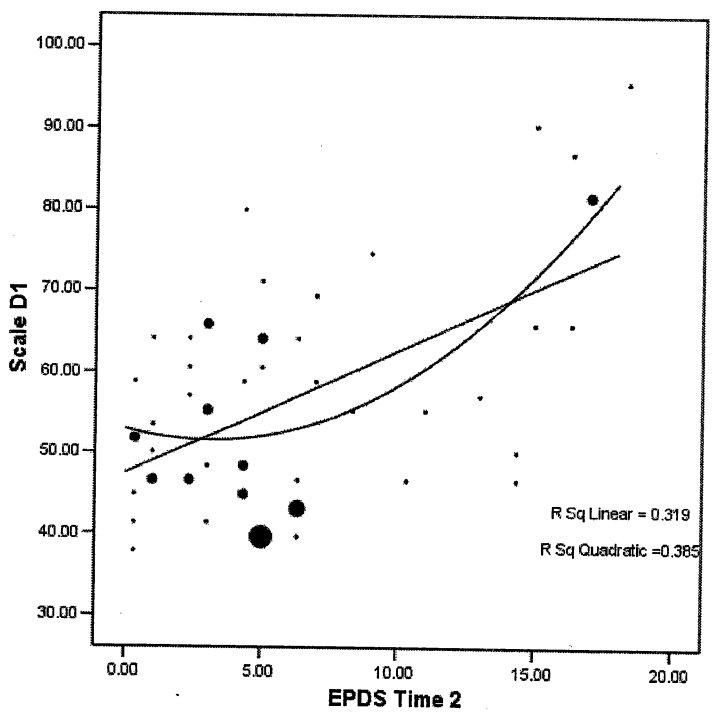
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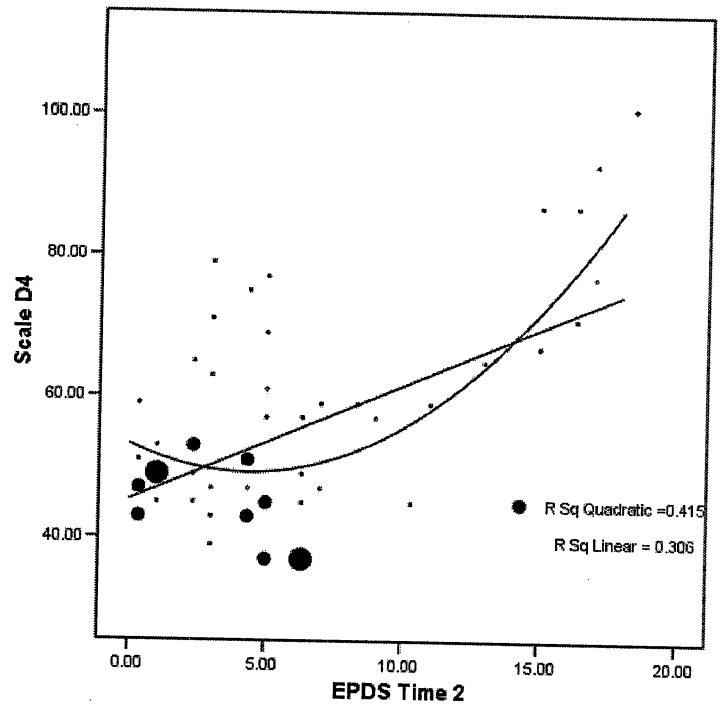
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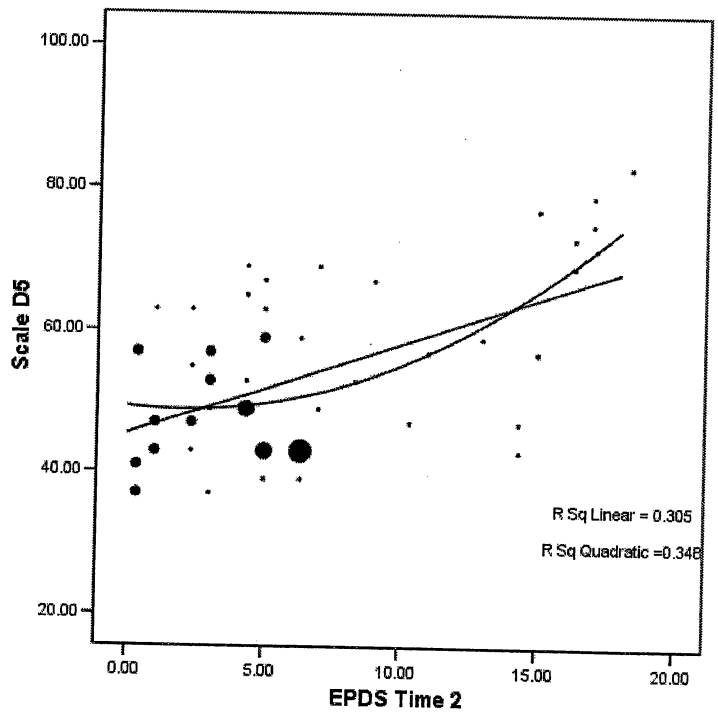
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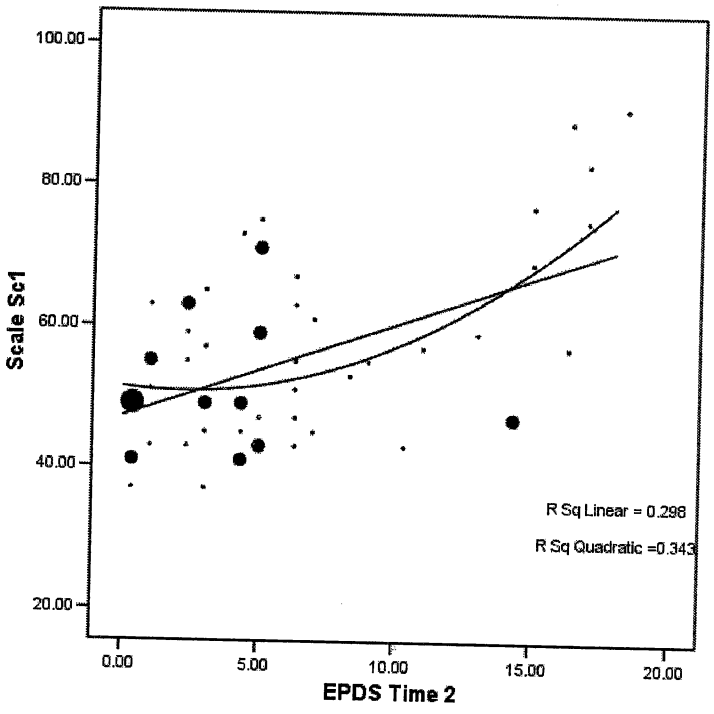
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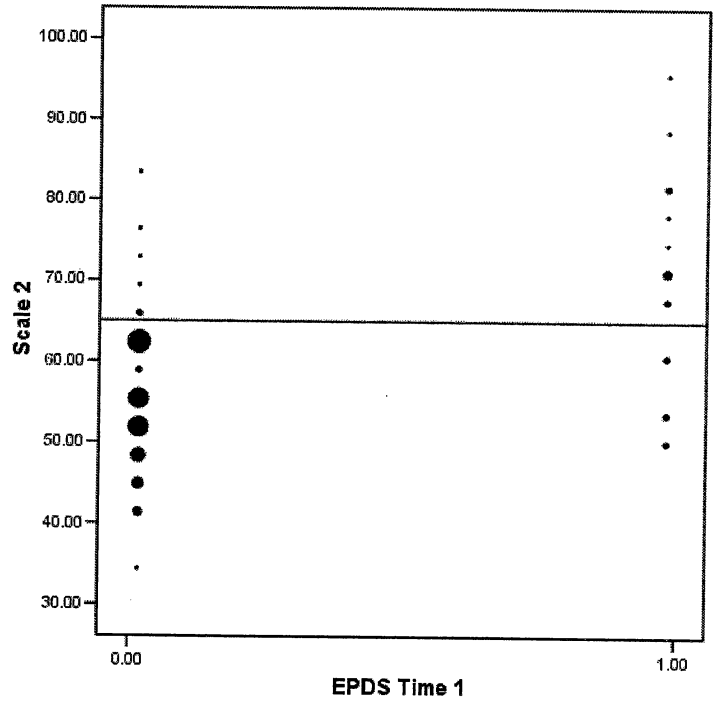
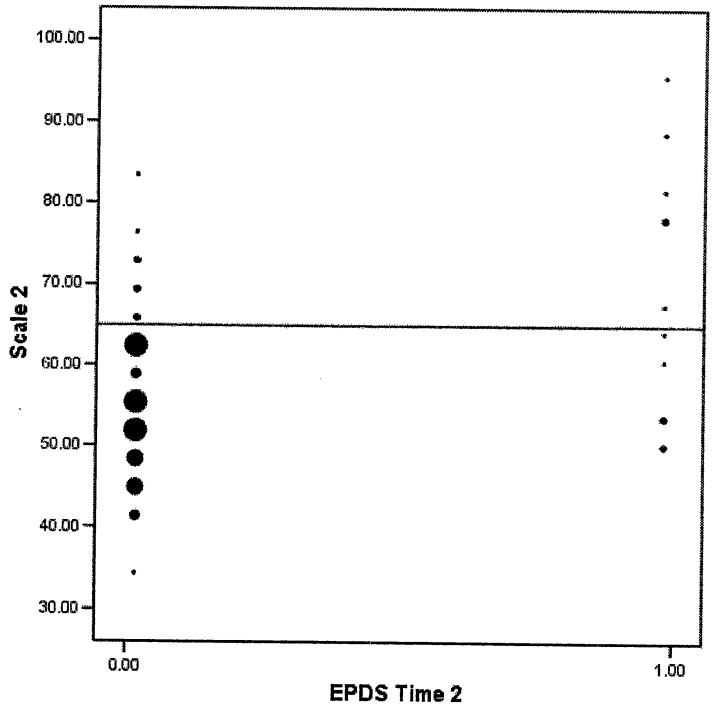
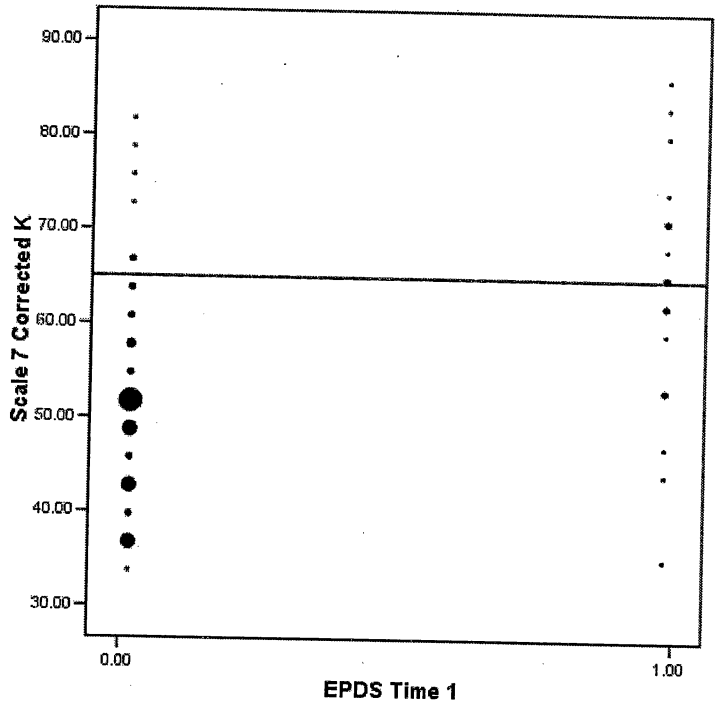
Appendix G
EPDS Dichotomous Scatterplots



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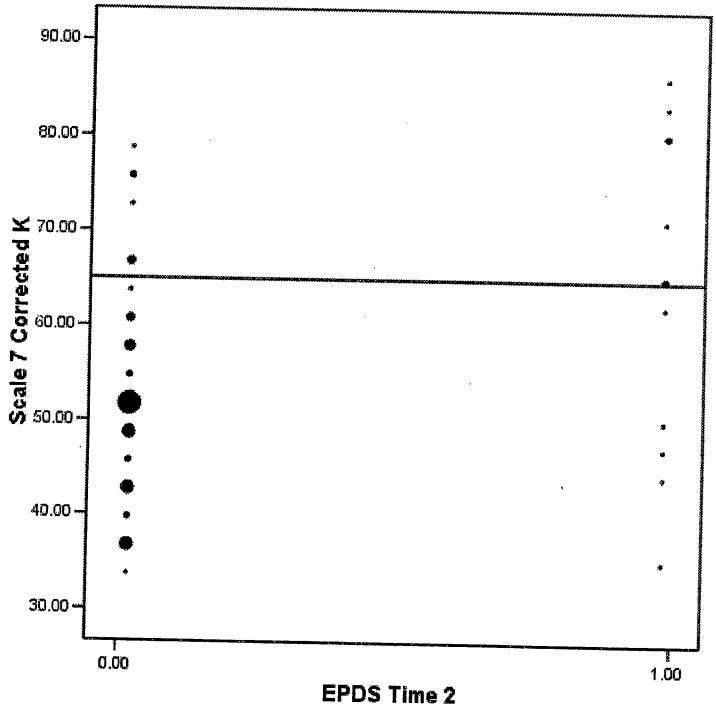
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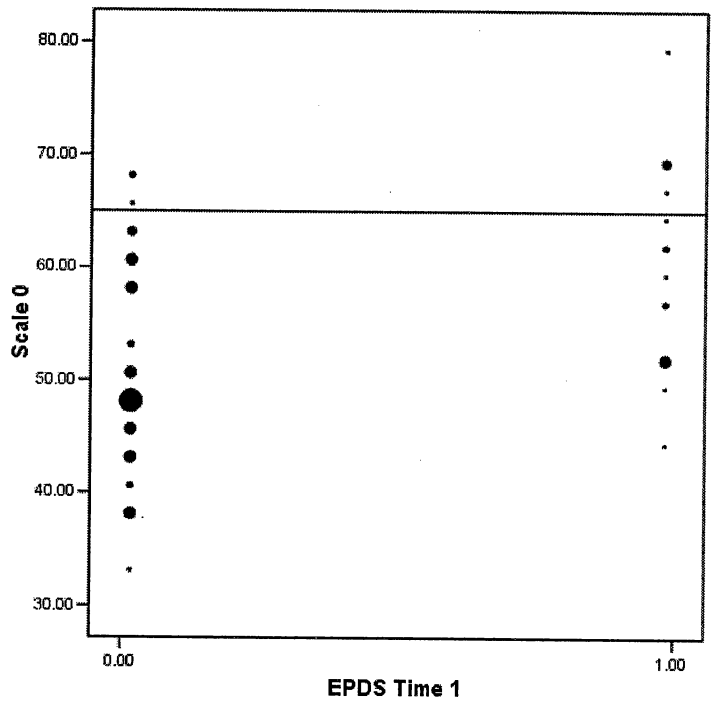
EPDS Time 2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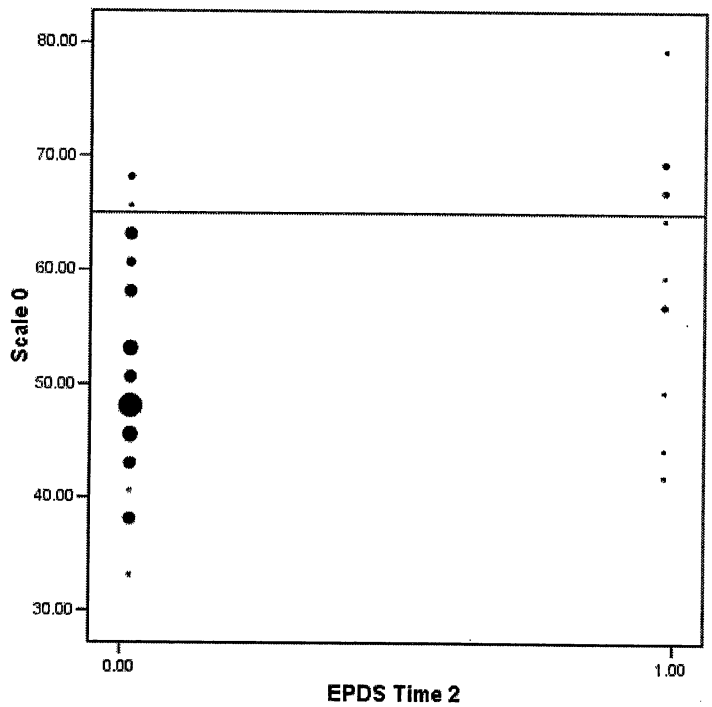
EPDS Time 1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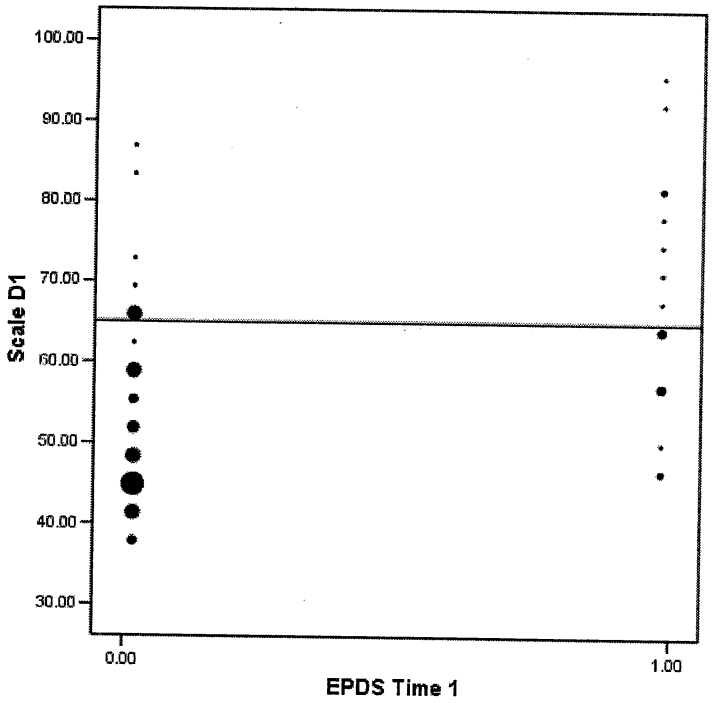
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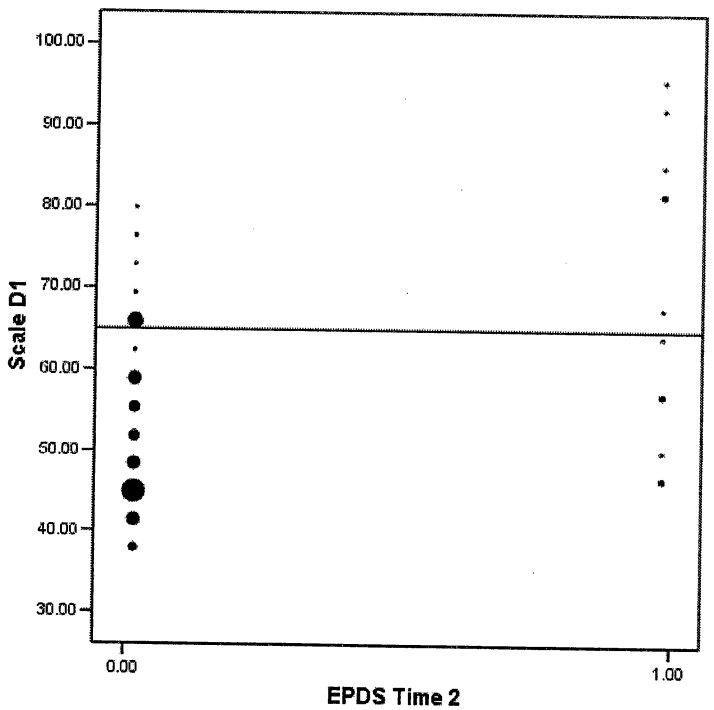
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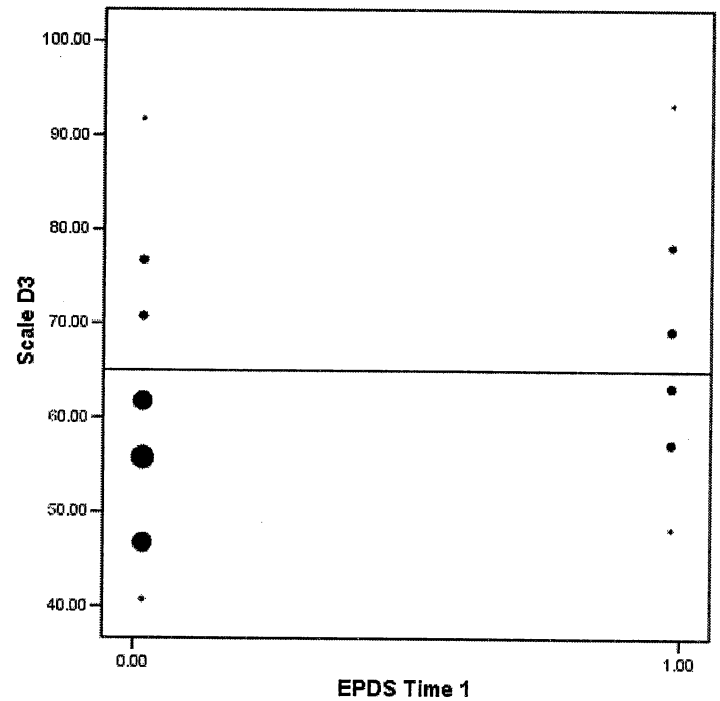
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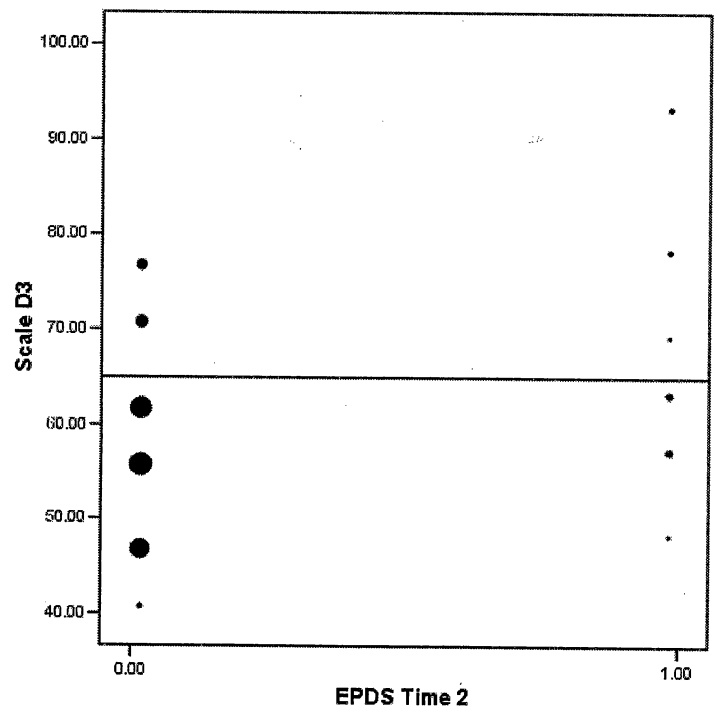
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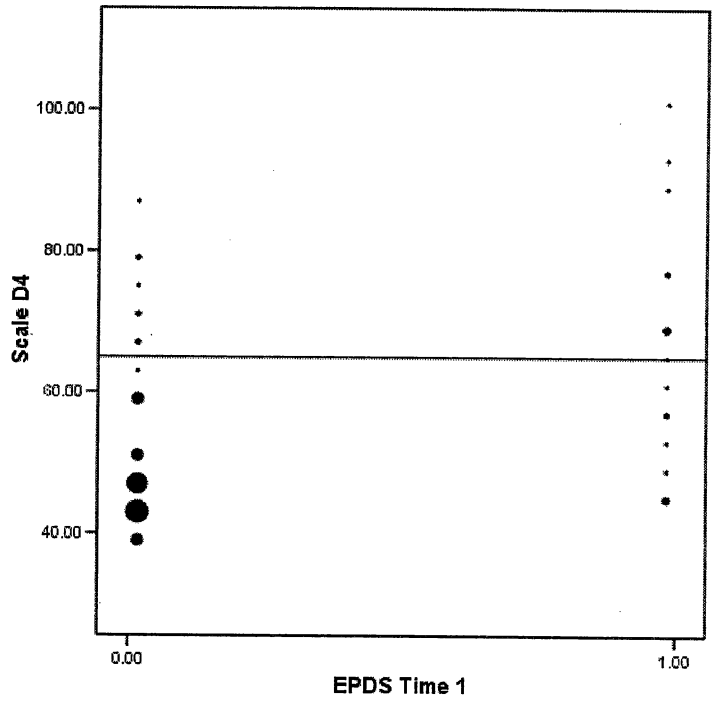
EPDS Time 2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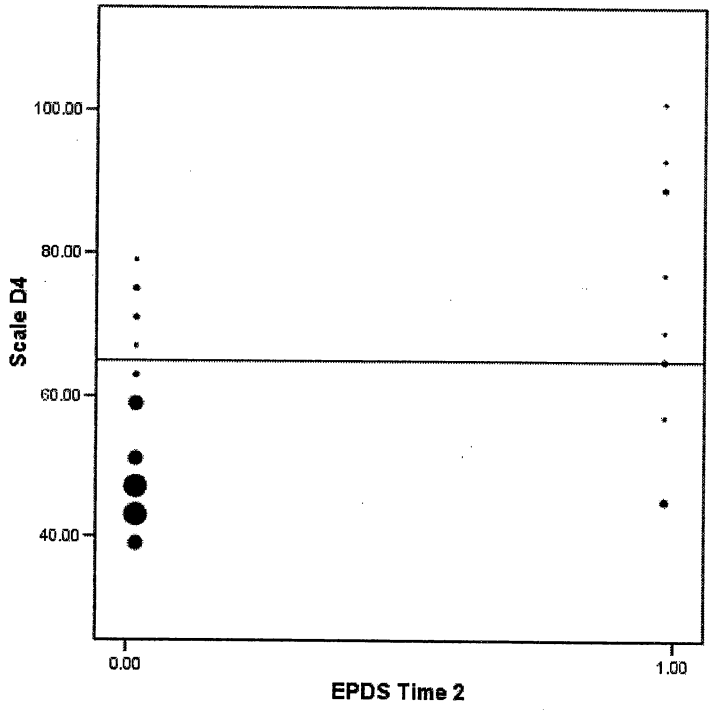
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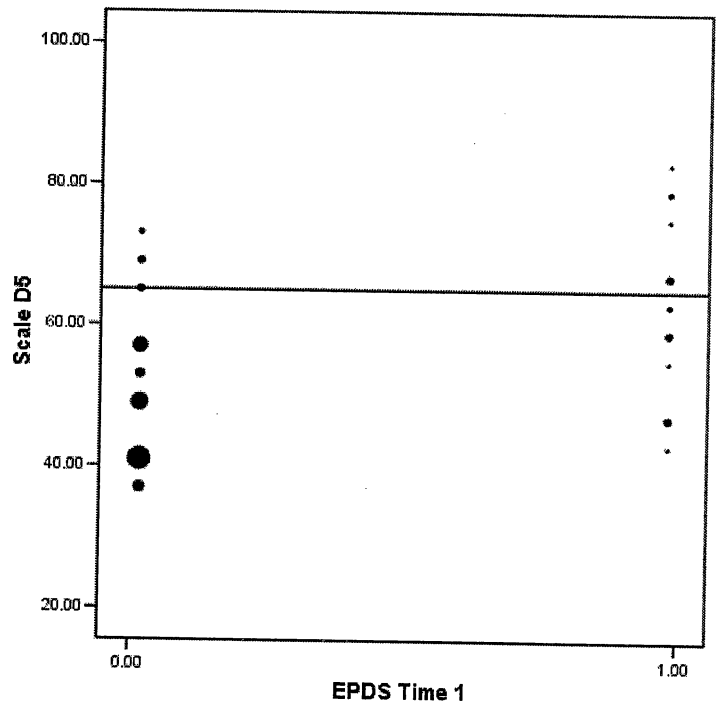
EPDS Time 2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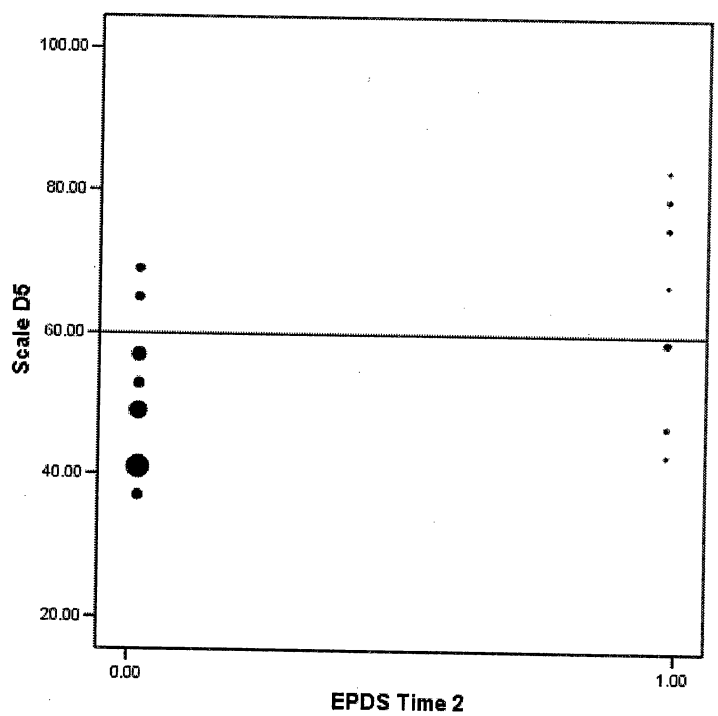
EPDS Time 1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1.00
EPDS Time 2