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Predictors of Elevated Depressive Symptoms in Pregnancy

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### Abstract

The purpose of this study was to examine factors that may place women at risk for developing depressive symptoms during pregnancy. It was a quantitative sub-study from a larger, randomized, double-blinded, placebo-controlled trial investigating the impact of docosahexaenoic acid (DHA) in pregnancy as it relates to postpartum depression. Participants were recruited locally through newspaper advertisements and brochures in physicians' offices, and women with a confirmed pregnancy, meeting sample criteria, were included. The women ( $N=45$ ) were administered the CES-D at two different times, first at 20-22 weeks gestation and second at 30-32 weeks gestation. Factors from a self-report of personal history were included in an analysis with the CES-D scores. A significant positive correlation was found between the first CES-D scores and body mass index. The second CES-D resulted in a history of depression being significantly correlated with elevated depressive symptoms. In addition to demonstrating a need for further research, this study indicated that health care professionals need to be more aware of women with these risk factors for elevated depressive symptoms in pregnancy.

Keywords: nurs\*, prenatal, antenatal, antepartum, depress\*, predictor, risk

### Predictors of Elevated Depressive Symptoms in Pregnancy

Pregnancy is known for being a time characterized by hormonal changes resulting in emotional instability. And although there has been bountiful research done on postpartum depression, antenatal depression is relatively new in the literature, with limited studies available on the subject. Not until recently has much focus been placed on the possibility that some women may actually be experiencing depression during this antenatal period. Only some potential predictive factors have been studied, which is why this research serves to further investigate the topic. It is a substantially under-researched issue, yet affects between 7.7% (Pajulo, Savonlahti, Sourander, Helenius, & Piha, 2000) to 73% (Martin et al., 2006) of pregnant woman. The research available in the literature presented an array of predictive variables, with some remaining consistent among studies while other factors were unique to just one focused study.

### **Literature Review**

To find published research on antenatal depression, a search was conducted across disciplines. Databases searched included: CINAHL, Pubmed, PsycINFO, Medline via Ovid, Scopus, Sociological Abstracts, Women's Studies International, and Psychology and Behavioral Sciences Collection. Keywords used were: nurs\*, prenatal, antenatal, antepartum, depress\*, predictor, risk.

Eighteen quantitative studies were included in this literature review (Table 1). Seven of the studies were conducted outside of the United States: Finland (Pajulo et al., 2000), China (Lee et al., 2007), Canada (Seguin, Potvin, St. Denis, & Loiselle, 1995), Scotland (Reid, Power, & Cheshire, 2009), two in Australia (Leigh & Milgrom, 2008; Edwards, Galletly, Semmler-Booth, and Dekker, 2008), and Spain (Escriba`-Agu`ir, Gonzalez-Galarzo, Barona-Vilar, & Artazcoz,

2007). Some of the studies were longitudinal, including antenatal through the postpartum months, but in this instance, only the antenatal data were considered. There were a total of 18 risk factors derived from the available research. Some of the variables were found to be significant predictors in several of the studies, such as low social support which was identified in eight studies making it the most frequently reported predictor. Other factors, such as unemployment or spiritual perspective, were only identified in one study which further supports the need for more research to confirm these findings. The 18 studies included in this review are organized according to the predictive factor. Because the majority of the studies identified several predictors, the study is described in detail at the first reference and then only pertinent data are presented for each subsequent predictor to limit repetition.

### **History of depression**

Having a history of depression prior to pregnancy was a common identified predictor of prenatal depression in six of the studies included in this literature review. Some researchers even identified it as the strongest variable in their study. One of those that did conclude it to be the most significant predictor was a quantitative, non-experimental study by Rich-Edwards et al. (2006). The sample included 1,662 women from Project Viva, a prospective cohort study of pregnancy outcomes and maternal-child health, who were recruited from their first prenatal visit to one of eight obstetric clinics affiliated with a large group practice in Boston, Massachusetts. Data collection, which included the administration of the Edinburgh Postnatal Depression Scale (EPDS) (Cox, Holden, & Sagovsky, 1987) occurred at 10 weeks gestation, 28 weeks gestation (mid-pregnancy), and 6 months postpartum. Depressive symptomatology was defined using an EPDS score of greater than 12. Of this sample, 185 (11%) women reported a positive history of depression. Of all the predictive variables that this study examined, a history of depression was

the strongest predictor, resulting in a fourfold increased risk for antenatal depression. Having a history of depression prior to pregnancy (age adjusted  $OR= 4.51$ , 95%  $CI$  4.24, 4.80) was a strong predictor. The main limitation of this study was that it relied on a self-reported depression, rather than an actual diagnosis by a health care provider.

Lancaster et al. (2010) conducted a meta-analysis of a total of 20 risk factors for antepartum depression that were found within 57 articles. Each risk factor was evaluated in accordance with the overall trend by two blinded, independent reviewers. Six of the studies concluded a significant relationship between having a history of depression and suffering from antepartum depression. A bivariate analysis resulted in a significant association of medium size between a history of depression and prenatal depression. The strength of this review was that it examined several studies currently available in the literature to look for common factors that may be significant predictive variables. However, several limitations do exist to this meta-analysis. One such limitation was the extent of heterogeneity included in the review. There were no specific quantitative data for reporting effect sizes for the results, but rather effect sizes were measured by either small, small to medium, medium, or medium to large association. Finally, various depressive screening tools were used among the individual studies rather than one screening tool or a clinical diagnosis which would have been best.

A quantitative, cross sectional, prospective study of 3,472 pregnant women ages 18 and older were screened throughout 10 obstetric clinics in southeastern Michigan over a 3 year period (Marcus, Flynn, Blow, & Barry, 2003). The data were collected using a 10 minute questionnaire that included the Center for Epidemiological Studies Depression Scale (CES-D) such that those who scored a 16 or greater were considered depressed (Radloff, 1977). A history of depression was determined by asking participants if, “you had 2 weeks or more when nearly

every day you felt sad, blue, or depressed or in which you lost all interest in things like work?” within various time intervals (Marcus et al., 2003, p. 376). A total of 42.6% ( $N=398$ ) currently depressed women reported a history of major depression. Analysis further indicated that while holding all the other variables constant, women who reported a history of depression were 4.9 times more likely to have antepartum depression. Although this study did present a significant relationship where having a history of major depression was a predictive risk factor for having antepartum depression ( $p < .001$ ), there were some limitations. First, the study lacked generalizability because the sample was all recruited from one region of one state. Next, the information was gathered by self-report so there is no way to know if the women had been clinically diagnosed with depression in the past. Finally, this information was collected at only a single point in time and thus only captured one particular mood of each participant.

Escriba`-Agu`ir, Gonzalez-Galarzo, Barona-Vilar, and Artazcoz (2007) conducted a cross-sectional, quantitative study conducted in Spain that investigated the differences in predictive factors of depression in pregnant women and their partners attending a prenatal program. A total of 687 women in their third trimester were administered a questionnaire, which included the Spanish version of the EPDS where a score greater than or equal to 11 indicated depression (Garcia Esteve, L., Ascaso Terren, C., Oujel, J., et al., 2003). From the data collected, it was found that 21.4% (127) of women reported having a history of depression, and after analyses this factor was a significant predictor of antepartum depression ( $OR=2.18, p=.008$ ). The limitations of this study included its cross-sectional design and using a self-report to assess depression. Additionally, it consisted of only one item on the questionnaire inquiring about a “previous history of depression” to which the participants had to answer either yes or no.

The next study that identified a history of depression as a significant risk factor for antepartum depression was conducted in South Australia by Edwards, Galletly, Semmler-Booth, and Dekker (2008). The cohort included 421 women attending their first antenatal visit in a socioeconomically deprived area. At this visit, they completed an Antenatal Psychosocial Questionnaire (APQ) and the EPDS where a score of 10 or greater was used to define depression (Cox et al., 1987). Seven out of the 13 psychosocial factors researched remained significant after conducting a stepwise logistic regression. Two of these variables relevant to a history of depression were having feelings of depression/anxiety ( $OR= 3.248$ ) and requiring both past and current treatment for emotional problems ( $OR= 5.506$ ). Because of the design of this study, there were several limitations. One major drawback in reference to generalizability was that the population sampled was from the same disadvantaged region. Additional weaknesses of the study included the use of self-report to assess depressive symptoms rather than medical diagnoses and not assessing the women more than just during the single meeting at their prenatal visit.

Buesching, Glasser, and Frate (1986) was the final study in this literature review that identified a history of depression as a significant predictor of prenatal depression. The quantitative study had a prospective, longitudinal design with a sample of 57 pregnant women comprising the experimental cohort which was matched on age in a non-pregnant control cohort. The women were seeking prenatal care at a residency program in Chicago, Illinois. The women recruited were all in the first trimester and were asked to complete the Zung Self-Rating Depression Scale (Zung, 1965) at six different times during their pregnancy, with the prenatal times including the end of the first trimester, the end of the second trimester, and immediately before the end of the third trimester. The control group was established from women visiting the



resident clinic for a pelvic exam and matched by age to the number of pregnant women. The results indicated that women suffering from prenatal depression were three times more likely to have had a history of depression. Although this study was strengthened by the fact it involved data collection at several time intervals, its weakness was that a self-report questionnaire was used to assess depression rather than a more widely used and accepted clinical instrument.

### **Low Self-Esteem**

Having low self esteem was found to be a significant predictive factor of prenatal depression in three studies throughout this literature review. The first study that identified this relationship was a quantitative non-experimental, longitudinal study conducted in Australia by Leigh and Milgrom (2008). The sample was comprised of 367 multiparous and primiparous pregnant women recruited over one year from antenatal clinics in two major public hospitals in Melbourne, Australia. Two additional months of recruitment were used to gather pregnant women who were screened as depressed using an EPDS score of 12.5 or above, in an attempt to have a strong representation of depressed women to facilitate group comparison (Cox et al., 1987). The study included assessment at three points in time: antenatal screening (recruitment 26-32 wks), antenatal risk factors (28-34 wks women contacted by phone and asked to complete questionnaires at home), and postnatal screening (10-12 wks postpartum).

This study utilized the Beck Depression Inventory (Beck et al., 1961) to assess depression levels, with a cut-off score of 16.5. A multiple regression analyses was conducted and revealed seven significant predictors of antenatal depression which accounted for 78% of the variation in antenatal depression. Having low self-esteem was the strongest risk factor in the multiple regression ( $F(12, 361) = 101.79, p < .001$ ). The seven predictors accounted for 78% of

the variation in antenatal depression. The main limitation of this study was that the sample did not represent women without a partner or women from outside of Australia.

Lee et al. (2007) conducted a quantitative, prospective, longitudinal analysis aimed at assessing antenatal anxiety and depression throughout the stages of pregnancy and predictive factors of each at each stage. The sample included women recruited from an antenatal clinic in Hong Kong, with 335 Chinese women having completed the three assessments before giving birth. The total sample of women completing the entire four assessments ( $N= 345$ ) were administered questionnaires at each of the three trimesters and then again six months postpartum. The Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) was used antenatally to assess depression and the EPDS was used postnatally (Cox et al., 1987). After conducting a stepwise, multiple logistic regression, low self-esteem was concluded to be a predictive factor throughout all three trimesters of pregnancy: first trimester (adjusted  $OR= .89$ ,  $p= .005$ ), second trimester (adjusted  $OR= .82$ ,  $p< .001$ ), and third trimester (adjusted  $OR= .79$ ,  $p< .001$ ). The study determined rates of antenatal depression throughout the trimesters as being 22.1%, 18.9%, 21.6% respectively. The longitudinal assessments which showed that antenatal depression is consistent throughout pregnancy strengthened this study. However, weaknesses lied in the non-experimental design where there was no control group for which the women could be compared, and also in the lack of generalizability since the study was conducted in Hong Kong.

The study conducted by Jesse and Swanson (2007) aimed to investigate prenatal depression in African American, Caucasian, and Hispanic women residing in the rural, low income, southeast U.S. in addition to biopsychosocial and psychosocial risk factors. Three hundred-twenty-four women were recruited from antenatal and perinatal clinics in the rural southeast region of the U.S. The Beck Depression Inventory II (Beck, Brown, & Steer, 1996)

was used to assess depression, with a score of 16 or greater indicating depression. Each participant had a 30 minute interview with a researcher who had undergone extensive training prior to meeting with the women and administering various scales and questionnaires. Eight of the studied factors whose univariate test had a  $p$  value  $< .25$  were further analyzed through a logistic regression. Having low self-esteem was one of the predictive factors this study concluded to be significant ( $OR = 2.74, p < .01$ ). However, one weakness of the study was the convenience sample, consisting of low income women in only one region of the country. Also, the study did not differentiate between clinical depression because the symptoms analyzed in this study were not based on an actual clinical diagnosis.

### **Antenatal Anxiety**

Three articles in this literature review identified maternal anxiety as a risk factor for prenatal depression. The first is Lancaster et al.'s (2010) systematic review which was described previously in this paper. Eleven out of the 57 studies included in Lancaster et al. (2010) acknowledged maternal anxiety as a risk factor for prenatal depression. It was one of the strongest associations found in their research with maternal anxiety having a medium to large association with depressive symptoms in a bivariate analysis.

The second study by Leigh and Milgrom (2008) was also previously described under the low self-esteem predictive factor, and identified antenatal anxiety as the second most significant risk factor, with low self-esteem being first ( $F(12, 361) = 101.79, p < .001$ ) through a multiple regression. The research of Edwards et al. (2008) found feelings of anxiety/depression to be a significant risk factor. A stepwise logistic regression resulted in an odds ratio of 3.248. The weakness of this result was that anxiety was not considered as a separate entity from depression as a variable.

### **Low Social Support**

Eight studies in this literature review found low social support to be a risk factor for prenatal depression. Leigh and Milgrom (2008) concluded low social support to be the third most significant risk factor of the seven identified factors after conducting a multiple regression ( $F(12, 361) = 101.79, p < .001$ ). Lancaster et al. (2010) reviewed 26 studies total and categorized them into 17 studies that identified low social support from any source as a risk (medium correlation), and nine additional studies that addressed low social support from a partner which also showed to be one of the strongest associations in bivariate and multivariate analyses (medium to large association). The research of Jesse and Swanson (2007), as previously mentioned, also found low social support (from both partner and others) to be a significant predictive factor by performing a logistic regression ( $OR = 2.44, p < .01$ ). Lee et al. (2007) applied a multiple logistic regression to psychosocial risk factors and found low social support to be associated with prenatal depression during the first (adjusted  $OR = .59, p = .044$ ) and third (adjusted  $OR = .46, p = .002$ ) trimesters.

Reid et al. (2009) published conducted quantitative research with a cross sectional survey design. Midwives in Fife, Scotland distributed questionnaires to women at antenatal visits resulting in a sample of 302 women. The EPDS (Cox et al., 1987) was used to assess depressive symptoms in addition to other scales that addressed demographics and potential risk factors. The women were split into two groups: primiparous and multiparous and a multiple regression was conducted using the EPDS (Cox et al., 1987) scores as the dependent variable. For multiparous women the variables: age, partner discrepancy in practical support, life events, and actual emotional support from mother accounted for 42% of the variance in depression scores with significance in discrepancy in practical support from a partner and emotional support from a

mother ( $F(1, 129) = 22.971, p < .001$ ). For primiparous women the significant variables: age, partner discrepancy emotional support, discrepancy in practical support from mother, and actual emotional support from ‘other’ accounted for 38% of the variance in depression scores with significance in partner discrepancy in emotional support, discrepancy in practical support from a mother, and actual emotional support from an “other” ( $F(1, 109) = 16.806, p < .001$ ). A strength of this study was that the results highlighted the risk of depression from low maternal support and an “other” person in addition to a partner. However, the main limitation was that it used self-report rather than diagnostic interviews to report depressive symptoms.

Sequin, Potvin, St. Denis, and Loiselle (1995) conducted a quantitative study with a group comparison design where two groups of all French speaking women in their second trimester were recruited from four antenatal clinics in Montreal: a low socioeconomic group comprised of 98 women (no more than 11 years of education and living in a household with income below poverty level) and a higher socioeconomic status comprised the comparison group which included 46 women (completed at least 12 years of education and living in a household with an income one and a half times poverty level). The women were given a screening questionnaire and then an at-home interview at 30 weeks gestation. The dependent variable, depressive symptomatology, was measured using the Beck Depression Inventory (Beck et al., 1961), translated into French, with a score of 10 or above indicating depression. Social support was measured by an adapted, translated, and validated version of the Arizona Social Support Interview Schedule by Barrera (Barrera, 1981). A logistic multiple regression of all the variables studied in this research explained 47% of the score variation ( $F = 12, 459, df(11, 131), p < .0001$ ). According to the Beck Depression Inventory (Beck et al., 1961), “unavailability of help when needed,” was a significant predictor of prenatal depression and was analyzed in the multiple

regression ( $p < .001$ ). Additionally, the study found that women having a partner and not living with him reported more depression symptoms than those women who had a partner and lived with him ( $p = .024$ ). This study was limited because of its cross sectional design and all data were obtained during a single interview.

A quantitative, prospective study by Westdahl et al. (2007) aimed to demonstrate how social support and conflict affects depressive symptoms during pregnancy using a sample of low income, mostly minority women recruited from obstetric clinics in New Haven, CT and Atlanta, Georgia ( $N = 1,047$ ). Baseline interviews were given during the second trimester and then came audio computer assisted self interviewing which allowed the participants to hear recorded questions while viewing them on a computer screen. A subscale of the Social Relationship Scale (Norbeck, Lindsey, & Carrieri, 1981) was used to determine the degree of perceived social conflict and the CES-D (depression defined as a score of 16 or greater) (Radloff, 1977) was used to assess depression. After conducting a hierarchical regression ( $F(14, 1,012) = 46.60, p < .001$ ), high social conflict was found to be a stronger predictor of prenatal depression when examined independently compared to low social support ( $r = .58, p = .001$ ). Along with social conflict, social support accounted for 34% of the variance in depression symptoms. The self-report measures of depression and the specific sociodemographic sample brought limitations to this study.

Pajulo, Savonlahti, Sourander, Helenius, and Piha (2001) recruited anonymous pregnant women from 14 maternity clinics in Finland ( $N = 391$ ). It was a quantitative study where depression was measured using the EPDS (cutoff score indicating depression is 12) (Cox et al., 1987) and social support by the Social Support Questionnaire 1 (Murray, 1994) and Social Support Questionnaire 2 (Power, Champion, & Aris, 1988). The Social Support Questionnaires

involved questions regarding difficulties in relation to: partner, friends, relatives, trusted people in the first; and experienced social support from one's mother, partner, and father in the second. Of these factors, all were significant except for support from one's father which lost its significance in the multivariate analysis. In a univariate analysis, experienced difficulties in social environment ( $p < .001$ ) and experienced lack of social support ( $p = .02$ ) were significantly associated with depression. In a multivariate analysis, the significant independent factor for maternal depression was experienced difficulties in social environment ( $p < .001$ ). Although this study reinforced low social support as a predictive factor of prenatal depression, there were several limitations such as self-report interviews and low generalizability due to the narrow demographic variety from which the sample was recruited.

### **Major Life Events**

Three studies previously described in this literature review also identified major life events as a risk factor for prenatal depression. These were Leigh and Milgrom (2008), Reid et al. (2009) who found distress from life events to be significant in the total sample and then in before multiparous women after separating the women into multiparous and primiparous groups, and Seguin et al. (1995) who found that negative life events during the time of pregnancy was a significant predictor of prenatal depression.

### **Low Income/Medicaid vs. Private Insurance**

Five studies found having a low income to be a significant predictor of prenatal depression. The way some of these studies defined this demographic was by having Medicaid rather than private health insurance. Leigh and Milgrom (2008) identified low income as a significant predictor of antenatal depression after a multiple regression ( $F(12, 361) = 101.79, p = .04$ ). Lancaster et al. (2010) included six studies in their review that addressed having private

insurance rather than Medicaid, and five of these resulted in Medicaid being significant for a risk of antenatal depression of a medium association after a bivariate analysis. Seguin et al. (2005) also found having a “lack of money for basic needs” to be a significant predictor of antenatal depression after examining a multiple regression between all the predictor variables identified and depressive symptoms ( $p = .025$ ).

Research by Holzman et al. (2006) aimed to investigate the prevalence of depressive symptoms and the effect of life circumstances in a community sample of women in mid-pregnancy. This prospective study included 1,321 women at mid-gestation from clinics in Michigan. At recruitment the women were administered the CES-D (16 or greater indicating depression) (Radloff, 1977) and questions regarding life circumstances that were split into three time periods (the previous 6 months, adulthood, and childhood). The women were divided into three groups: teenagers, women >20yrs with Medicaid (labeled “disadvantaged”), and women >20yrs without Medicaid (labeled “advantaged”). The results indicated that situations of economic difficulty such as teenagers and women with Medicaid were positive for associations to prenatal depression. Economic problems was a significant predictor of elevated CES-D scores in teens with 2 or more problems ( $p < .05$ ), disadvantaged women with one ( $p < .05$ ) and two or more ( $p < .001$ ), and advantaged women with one ( $p < .001$ ) and two or more ( $p < .001$ ) economic problems. This study has several limitations including having not addressed the fact that the separate adverse life circumstances can occur simultaneously and that the women’s self report being not as reliable as other screening tools.

Pajulo et al. (2001) also identified economic difficulties as a significant factor associated with antenatal depression in a univariate analysis conducted in his research ( $p < .001$ ,  $OR = 2.7$  for



few financial difficulties,  $OR= 6.7$  for moderate financial difficulties) but not in a multivariate analysis which tested for independently significant variables ( $p= .278$ ).

### **History of Abuse and Domestic Violence**

Seven articles in this review found significant associations between a history of and/or current abuse/domestic violence and antenatal depression. Leigh and Milgrom (2008) identified history of abuse as a significant factor in antenatal depression ( $R^2= .78$ ,  $t= 2.22$ ,  $p= .03$ ). Lancaster et al. (2010) included seven studies in their review that addressed a relationship between domestic violence and antenatal depression. This review included one study which predicted a 2.5 increase in risk for depression when having experienced abuse within the past year. The bivariate analysis resulted in a small association between domestic violence and depressive symptoms, while the multivariate analysis showed a small to medium association. Jesse and Swanson (2007) also identified a significant association between prenatal depression and abuse using the Abuse Assessment Scale which had been validated for pregnant women (McFarlane, Parker, Soeken, & Bullock, 1992). However, none of the participants reported sexual abuse so that portion was left out of the assessment and only physical abuse was considered. A logistic regression yielded  $OR= 4.30$ ,  $p< .05$ . Holzman et al. (2006) additionally identified women who reported abuse as having significantly higher CES-D (Radloff, 1977) scores. Associations were found between all groups of pregnant women studied (teens: one type=  $p< .05$ , two or more types=  $p< .01$ ; disadvantaged women: one type and two or more types=  $p< .01$ ; advantaged women: one type=  $p< .05$ , two or more types=  $p< .01$ ) where having experienced physical abuse, sexual abuse, or witnessed violence within the past six months resulted in depressive symptoms.

Martin et al. (2006) conducted a between subjects group comparison study that aimed to examine the relationship between depressive symptoms in pregnant women relative to intimate partner violence. Ninety-five pregnant women were recruited from antenatal clinics in North Carolina with a non-victimized women recruited after each victimized women, in order to balance out the sample. The women were interviewed which included CES-D administration (Radloff, 1977), reported depressive symptoms, experiences of domestic violence, and sociodemographic information. Women who scored a 16 or greater on the CES-D (Radloff, 1977) comprised the “depressed” group and those who scored under 16, were the “non-depressed” group. The results showed that women who experienced psychological abuse a year before their pregnancy were not at higher risk for antenatal depression, except when it was very frequent. Psychological aggression was not significant, but significant predictors included physical assault both before ( $p < .01$ ) and during ( $p = .01$ ) pregnancy, sexual coercion before pregnancy ( $p < .01$ ), and having any violence inflicted injury before pregnancy ( $p < .01$ ). The limitations to keep in consideration with this research included self report bias and the convenience sampling resulting in limited generalizability.

Edwards et al. (2008) identified violence as a significant predictor of antenatal depression in their Australian research. Their definitions of violence included being hit by someone since becoming pregnant ( $OR = 12.353$ ) and having recently hit or hurt someone in anger ( $OR = 3.465$ ).

Chung et al. (2008) conducted a retrospective study examining the relationship between depressive symptoms in pregnant women in relation to positive or adverse childhood experiences. The method of the study included face to face interviews with 1,476 young, African American, low income women receiving prenatal care at Philadelphia community health centers. Two surveys were given, one at the first prenatal visit, and the second 11+ - 1 month

postpartum and were comprised of the CES-D (Radloff, 1977) and questions concerning childhood experiences before the age of 16 using a cutoff score of 23. Adverse childhood experiences were defined as: verbal hostility, physical and sexual abuse, domestic violence, witnessing a shooting, having a guardian in trouble with the law or in jail, and homelessness.

Overall, an increasing number of positive influences were shown to result in less depressive symptoms. These positive influences were defined as: positive maternal relationship, positive paternal relationship, given a hug often, and being told you were “great,” often. There was a dose response where the more adverse experiences, the more depressed the woman; whereas the more positive experiences, the lower the depressive rates. After conducting a multivariate logistic regression, examining how each of these variables independently relate to CES-D scores (Radloff, 1977), childhood sexual abuse was significant ( $OR= 1.69$ ) where women with this factor were 1.7 times more likely to experience prenatal depressive symptoms than women who didn’t experience childhood sexual abuse. Furthermore an interaction was found between sexual abuse and a positive maternal relationship ( $OR= .389, p= .018$ ) where women with a history of abuse and a positive maternal relationship were less likely to have prenatal depressive symptoms than those with an abusive history and no positive maternal relationship. The limitations included the retrospective design which can cause recall bias, the severity and frequency of the childhood experiences were not assessed, and the experiences were cut off at age 16.

### **Maternal Age**

Four articles included in this review identified maternal age as a significant predictor of prenatal depression. Three of the them have been previously described with the first being Rich-Edwards et al. (2005) which found women under 23 years old to be two or more times at risk

than older mothers and also found a decreasing risk of prenatal depression as age increased ( $OR=2.71$ ). Reid et al. (2009) also found younger age to be a significant risk for depressive symptoms in both of their groups, the primiparous women ( $p=.001$ ) and multiparous women ( $p=.003$ ). Lee et al. (2007) found being younger to be a significant risk factor for antenatal depression during the second ( $OR=.92$ , 95%  $CI$  0.87–0.98,  $p=.010$ ) and third trimester ( $OR=.93$ , 95%  $CI$  0.88–0.98,  $p=.007$ ).

The final study in this review to identify a significant relationship between maternal age and antenatal depression was a cross-sectional study that included 546 African American pregnant women utilizing community based risk reduction services in Florida by Luke et al. (2009). Women receiving prenatal care were administered the EPDS (Cox et al., 1987) several times throughout their pregnancy. This study found higher maternal age to be more predictive of depression rather than younger age. Women ages 25-29 had double the risk when compared to teenagers ( $OR=2.25$ , 95%  $CI$  1.19-4.27), and the risk quintupled for women 30 years or greater ( $OR=4.62$ , 95%  $CI$  2.23-9.95). Thirty years of age was found to be the critical point where beyond this the risk for antenatal depression skyrocketed. However, the limitations of this study included selection bias, and the fact that it was not an official diagnosis of depression, just results from the EPDS (Cox et al., 1987). Also because of the cross sectional design, additional information could not be obtained regarding the course of the depressive symptomatology.

### **African American**

Being an African American was a common risk factor identified in the literature as being predictive of prenatal depression. The research of Jesse and Swanson (2007) found being of this race to be a significant and independent predictor ( $OR=2.07$ ,  $p<.05$ ). Their study results indicated that pregnant women with a Beck Depression Inventory II (Beck et al., 1996) score of

16 or greater, indicating depressive symptoms, were twice as likely to be African American as Caucasian or Hispanic. Holzman et al. (2006) also had similar findings in that the mean CES-D scores (Radloff, 1977) in each of the subgroups in the study (teenagers, disadvantaged women, advantaged women) were higher than the scores of other races. Furthermore, the mean increased CES-D scores (Radloff, 1977) for those of the African American race were shown to be significant for disadvantaged ( $p < .05$ ) and advantaged women ( $p < .01$ ), but not teenagers.

### **Lack of Spouse or Partner and Marital Satisfaction**

This review includes five studies which identified not having a spouse or partner during pregnancy as being a significant predictor of prenatal depression. Rich-Edwards et al. (2006) is of these studies which found that not having either a spouse or cohabitating partner was a risk for depressive symptoms. After further calculations, this was found to double the risk for antenatal depressive symptoms in the second trimester ( $OR = 2.34$ , 95% $CI$  1.26, 4.35). The results also indicated that having a prior history of depression may adversely affect their partnership status. Therefore, a further analysis was run using the women who reported no past history of depression prior to pregnancy. The association between partnership status and antenatal depression was found to be slightly weaker than when it was examined in the full cohort ( $OR = 2.08$ , 95% $CI$  0.90, 4.84).

The research of Marcus et al. (2003), demonstrated that being unmarried is a significant risk for prenatal depression. They conducted a bivariate logistic regression using elevated CES-D scores (Radloff, 1977) (defined as a score of 16 or greater) as the outcome variable which produced an  $OR = .57$ ,  $p < .001$ . Westdahl et al. (2007) found relationship status ( $r = -.15$ ,  $p < .01$ ) as one of only two sociodemographic factors that were significant predictors of antenatal depression (the other being education).

Lee et al. (2007) found that being single or divorced was a significant predictor of having depression in the first trimester ( $OR= 3.27, p= .027$ ). After applying a multiple logistic regression to all the psychosocial factors examined in this study, low marital satisfaction was found to be an increased risk factor for depression in the second trimester (adjusted  $OR= .60, p= .017$ ).

Another study that addressed marital satisfaction was the research of Escribà-Agüir et al. (2007). The multivariate results showed women who had low marital satisfaction during pregnancy to be more likely to experience symptoms of depression ( $OR= 3.05, 95\% CI 1.59$  to  $5.82, p= .001$ ).

### **Unintended/Unwanted Pregnancy**

As would be expected, an unwanted pregnancy was found to be related to increased depressive symptomatology in some pregnant women. Four studies in this literature review found a significant association between antenatal depression and unwanted or unintended pregnancy. Rich-Edwards et al. (2006) found that an unwanted pregnancy doubled the risk that a woman would experience depression symptoms in the second trimester ( $OR= 2.31, 95\% CI 1.29, 4.16$ ). After these results were adjusted accounting for social support, the relationship was weakened somewhat but still remained significant. Additionally, because having a history of depression may have an impact on current feelings of depression during pregnancy if the pregnancy was unintended, further analysis was done using the sample of women with no prior depressive history. The result as compared to that of the full cohort was a slightly weaker relationship between antenatal depressive symptoms and having the pregnancy be unintended, but was still significant ( $OR= 1.89, 95\% CI .88, 4.09$ ).

In conducting their systematic review, Lancaster et al. (2010) identified six studies that showed a relationship between antenatal depressive symptoms and an unwanted pregnancy. In a bivariate analysis, having an unwanted pregnancy resulted in a medium correlation with antenatal depressive symptoms. Lee et al. (2007) explored the relationship by controlling the demographic risk factors and focused on the psychosocial risk factors with a forward stepwise multiple logistic regression. Having the pregnancy be unwanted showed an increased risk greater than six fold of experiencing depression during the first trimester (adjusted *OR* 6.51,  $p = .011$ ).

Field et al. (2007) found that feelings women experienced when finding out they were pregnant were associated with prenatal depression. The sample consisted of 110 depressed (determined by scoring above 16 on CES-D (Radloff, 1977) and 104 non-depressed women who were recruited from a nursery on their newborn's first day of life. The women were issued the Feelings About Pregnancy and Delivery Scale (Field, Yando, & Bendell, 2002) and several questionnaires and self tests including three additional questions the researchers found to be associated with prenatal depression in their review of the literature. Two of which were: "Did you feel happy when you found out you were pregnant?" and "Was your significant other happy when you announced your pregnancy?" After a multiple regression, it was determined that 27% of the variance was explained by the factors analyzed. Field et al. (2007) found that 30% of the depressed cohort was unhappy and only 15% of the non-depressed group was unhappy when learning of their pregnancy ( $p = .009$ ). Additionally, 20% of women in the depressed group said their spouses were not happy when learning of their pregnancy, whereas 8% in the non-depressed group ( $p = .009$ ).

**Lower levels of Educational Attainment**

Two of the studies in this literature review examined the relationship between having less education and prenatal depression. The first was the systematic review by Lancaster et al. (2010) which consisted of five studies that addressed socioeconomic status, of which was broken down into income, education, and employment. The results were not significant, but in bivariate studies, there was a small association between lower educational levels and depressive symptoms in pregnancy.

Through screening women in an obstetric setting, Marcus et al. (2003) found lower educational attainment to be significantly associated with depression during pregnancy ( $OR = .90$ ,  $p = .04$ ). There were various classifications of educational level ranging from less than 8<sup>th</sup> grade to beyond college. Lower educational level for this study was not clearly defined but it was mentioned that most participants reported education beyond high school.

**Housing Density**

Two studies specifically addressed non-cohabitation with a partner, in addition to one also researching housing density, as predictors of prenatal depression. In the systemic review of Lancaster et al. (2010), 19 studies found non-cohabitation to be a small to medium significant risk for prenatal depression in a bivariate analysis, yet non-significant in multivariate analysis.

Sequin et al. (1995) found a small negative association related to mental health between not living with a partner compared to women who lived with one ( $p = .024$ ). However, when examining the comparison between women not having a partner with women who lived with one, there was no statistical significance regarding elevated depressive symptomatology. In regards to housing density, the researchers found a very significant inverse relationship between the number of rooms per person and depressive symptoms ( $p = .002$ ).



**History of Drinking/Substance Abuse**

Four studies in the review of the literature identified a relationship between prenatal depression and a history of drug and alcohol abuse. Lee et al. (2007) found that women with a history of drinking were more likely to have depressive symptoms in the first ( $OR= 2.00$ ,  $p=.021$ ) and third trimesters ( $OR= 2.15$ ,  $p=.001$ ).

Marcus et al. (2003) found consequences from greater alcohol use was related with depressive symptoms during pregnancy. The study used a TWEAK (Russell, 1994) a five item measure, which is a screening tool to identify risk drinking in women including during pregnancy. Women who had elevated TWEAK scores were more likely to have elevated CES-D scores (16 or greater indicating depression) ( $OR= 1.2$ ,  $p< .001$ ). Holzman et al. (2006) identified substance use in someone close to the woman as a significant risk factor in teens, disadvantaged, and advantaged women ( $p< .01$ ). Pajulo et al. (2000) also found substance dependency to be a significant predictor in a univariate ( $OR= 9.4$ ,  $p< .001$ ) and multivariate analysis ( $OR= 3.4$ ,  $p< .001$ ) while using the EPDS (Cox et al., 1987) with a score greater than 12 to signify depression.

**Poorer Overall Health**

Five studies addressed poor health as being a predictive factor of prenatal depression, one of which addressed smoking, and another three which referred to high stress levels. Marcus et al. (2003) included self-ratings of the overall health of the women, which demonstrated that lower ratings were significantly associated with elevated CES-D scores (Radloff, 1977) where depression was defined as greater than or equal to 16. The self-rating used was a five point scale of physical health ranging from poor to excellent ( $OR= 1.5$ ,  $p< .001$ ). They also investigated the relationship between smoking and prenatal depression as a separate factor in this study.

Smoking while pregnant was found to be a significant risk factor for antenatal depression because it was associated with elevated CES-D scores (Radloff, 1977) ( $OR= 1.1, p< .001$ ).

In their systemic review, Lancaster et al. (2010) found 18 of the total 57 studies to identify major life stress as a predictor of antepartum depression. Increased stress levels resulted in a medium association with depressive symptoms in pregnancy in a bivariate and multivariate analysis.

Field et al. (2007) included stress as a variable in their research and assessed it by asking the women to answer yes or no regarding having experienced a stressful situation during pregnancy. Fifty percent of the depressed group answered yes, whereas did only 29% of the non-depressed group ( $p= .002$ ).

Jesse and Swanson (2007) measured stress using the Prenatal Psychosocial Profile which is an instrument comprised of 44 items assessed using a likert scale (Curry, M., Burton, D., & Fields, J., 1998). They found stress to be a very significant risk factor of prenatal depression in the entire sample ( $OR= 3.97, p< .001$ ). When they completed a multiple logistic regression looking at the three separate races, only African Americans ( $OR= 3.26, p< .01$ ) and Hispanic women ( $OR= 14.75, p< .001$ ), not Caucasian, remained significant for stress causing elevated depressive symptoms.

### **Unemployment**

Only one study found a significant relationship between unemployment and prenatal depressive symptoms. Through a bivariate logistic regression, with a CES-D score of 16 or greater as the outcome variable (Radloff, 1977), Marcus, Flynn, Blow, and Barry (2003) found that women who were not working were significantly more likely to experience depressive

symptoms ( $OR = .74, p = .01$ ). However, there was no significant association with depressive symptoms and whether or not they were actively seeking work.

### **Higher Parity**

Two studies investigated the relationship between parity and prenatal depression. Jesse and Swanson's (2007) research resulted in high parity being one of the eight variables whose univariate test had a  $p$  value  $< .25$ . Therefore, it was further analyzed in a logistic regression with these eight other variables. It was found to be significant in African American women ( $OR = 3.36, p < .01$ ) but not Hispanic or Caucasian women.

Pajulo et al. (2001) found parity to be non-significant as a risk factor, but did find significance in the number of children under school age in a univariate analysis. Having two to three children under school age resulted in more prenatal depression as defined by EPDS  $> 12$  (Cox et al., 1987) than those with either one or no young children ( $p = .041$ ).

### **Spiritual Perspective**

Jesse and Swanson (2007) was the only study that found spirituality as having a significant relationship with prenatal depression ( $OR = 2.09, p < .05$ ). They concluded that women with lower spirituality are one and a half times more likely to have a BDI-II (Beck et al., 1996) score of 16 or higher indicating depression.

### **Conclusion**

Overall, these 18 predictive factors were found to be significant within the 18 different quantitative studies included in this literature review. Although the studies included a variety of methods, most used either the CES-D (Radloff, 1977) or EPDS (Cox, 1987) to measure depressive symptom levels, which are reliable screening tools as they have been tested through past research. There were six other screening tools utilized which were described in the

literature review and these studies can be further validated by repeating the research using the CES-D (Radloff, 1977). One suggestion that most of the studies mentioned in their discussion was that further research should be undertaken on studying this mood disorder. The range of different studies included in this review support this need so that the predictors identified can be confirmed.

### **Research Question**

What factors are predictors of women experiencing elevated depressive symptoms during pregnancy?

### **Purpose of Study**

The aim of this study was to identify factors that may predispose women to experiencing elevated depressive symptoms in the prenatal period so that these women can be closely monitored for any signs and symptoms indicative of the development of this mood disorder.

### **Methods**

#### **Research Design**

This study is part of a larger, IRB approved, randomized, double-blinded, placebo-controlled trial designed to determine if docosahexaenoic acid (DHA) intervention during pregnancy can decrease depressive symptoms associated with childbirth. It was a three year long project that assessed the effect of a DHA enriched diet in pregnancy with the severity of depressive symptoms during the first 6 months postpartum. The sample was one of convenience with a plan to recruit 73 women for each of two cohorts. Assignment to a cohort was random with one group consuming 300mg of DHA-functional food/fish oil capsules and the other a placebo of corn oil capsules once a day for five days a week, from 24 weeks of pregnancy to delivery.

**Sample**

Women ages 18-40 years were recruited over a period of 2 years through advertisements in several offices affiliated with Women Infants and Children (WIC) across Connecticut, including Hartford Hospital and Windham Hospital. The women were less than 20 weeks pregnant and either primiparous, or multiparous; however, if multiparous, had not been pregnant or lactating for the past 2 years. Excluded were any women with parity greater than five, history of chronic hypertension, hyperlipidemia, renal or liver disease, heart disease, thyroid disorder, multiple gestations, pregnancy induced complications, or current diagnosis of depression or other psychiatric illness. The various ethnicities of the sample were self-reported as: Caucasian, Native American, African American, Northern European, Asian Indian, Hispanic, Puerto Rican and French Canadian, Spanish, Dominican, Mexican, Middle Eastern, Guatemalan, Indian, Colombian, and Latino. These were then coded into six different groups for running analysis on the sample which were: Caucasian, African American, Hispanic, Middle Eastern, Asian Indian, and Native American. The final sample of women included in this study was  $N=45$ . Each of these participants had completed a baseline CES-D at 20-22wks and a second CES-D at 30-32wks (Radloff, 1977). The complete characteristics and demographics can be found in Table 2.

**Procedure**

After the proposal was approved by the Office of Research Compliance at the University of Connecticut, informed consent was obtained from each interested participant. The women began the study by initially filling out a self-report of personal history at approximately 20-26 weeks of pregnancy. The participants had blood drawn at three times (20-22 weeks pregnant, 36-38 weeks pregnant, and 6 weeks postpartum) and had to complete 24 hour diet recalls at five different times (20-22, 24-26, 30-32, 38 weeks pregnant, 2 weeks postpartum). Postpartum depressive

symptom level was measured with the Postpartum Depression Screening Scale (PDSS) (Beck & Gable, 2002) at 2wks, 6wks, 12wks, and 6months after delivery. This screening tool was selected because it has been shown to have higher sensitivity and specificity when screening for depression than the BDI-II or EPDS (Beck & Gable, 2001). The CES-D (Radloff, 1977) was used as a screening tool to measure prenatal depressive symptoms. It was completed by the participants twice, initially at 20-22 weeks and again at 30-32 weeks of pregnancy. The information obtained from the self-report of personal history and whether the woman was in the intervention or control group of the larger study yielded a total of 26 variables that were analyzed to investigate for any relationship with elevated CES-D (Radloff, 1977) scores.

### **Instrument Used**

The CES-D was devised in 1977 by Lenore Radloff as a self-report survey to measure depression symptomatology in the general population. Unlike other psychological screening tools that diagnose or assess depression symptoms' response to treatment, the purpose of the CES-D is to measure current levels of depression with emphasis on a depressed mood. It has been shown to have very high internal consistency (Cronbach's Alpha= 0.84) in the general population (Corcoran and Fisher, 1987), but also specifically in pregnant women (Cronbach's Alpha= 0.88-0.91) (NCHD Early Child Care Research Network, 1999). Adequate test-retest reliability with moderate correlations was demonstrated by Radloff (1977) and this along with the high internal consistency indicated good reliability of the CES-D. Validity was confirmed because of the scale's sensitivity to levels of depressive symptoms, good correlations with other scales that measure depression, and sensitivity to reactive depression during certain life events (Radloff, 1977).

The survey is a 20 item screening with a four point rating scale referring to the past seven days. Possible scores range from 0-60 with higher scores indicating presence of more depressive symptoms. Many researchers use a score of 16 or greater as the cutoff for where depression is indicated which has been demonstrated by clinically significant elevated depressive symptoms in pregnant women beyond this point (NCHD Early Child Care Research Network, 1999).

### **Data Analysis**

The data for this study were analyzed using the Statistical Package for the Social Sciences (SPSS) version 18. It is an IBM computer program that allows for advanced statistical analysis. The data were entered into the system and first the descriptive statistics were produced. The number of people who answered the specific question, the mean, the minimum, the maximum, and the standard deviation were interpreted for each factor. Next, a frequency distribution was created for each variable in order to systematically arrange the data so that visualizing how many participants answered in a particular way was more discernable.

Subsequently, Pearson Correlations were established for each of the demographic factors and the CES-D (Radloff, 1977). A *t* test was conducted for two of the categorical variables that were shown to be significant in the initial correlation: DHA supplementation in addition to the intervention or placebo and a History of Depression, in an attempt to further interpret their relationship with the CES-D scores. In order to further analyze the significance found between CES-D 1 and CES-D 2, a repeated measures ANOVA was computed. This was necessary because in order to draw conclusions, this correlation needed to be interpreted according to group, intervention or control, and time.

## **Results**

### **Sample**

With 73 women having been initially recruited, the final total number of participating maternal infant dyads that completed the entire larger study was 53. Of these 53 women, 24 were randomly assigned to the DHA intervention group and 29 to the control group. However, for this study's purpose of researching predictors of elevated depressive symptoms during pregnancy, only the data on those women who completed both the CES-D tests were required. This comprised a total sample of 45 women for which we had complete CES-D data sets.

The outline of the demographic characteristics of the women who completed this study can be found in Table 2. The majority of the women were between the ages of 26-30 and Caucasian. According to citizenship, 36 participants were U.S. citizens and 13 were non-U.S. citizens. The most common pre-pregnant weight was reported as between 100-150lbs, with the most prevalent body mass index falling in the normal range of 18.5-24.9. Most women reported moderate work activity and regular exercise as leisure activity. In relation to family history of depression, having a mother with suspected depression was the most frequent report among the participants, with the second most common being having a mother diagnosed with depression. The most common household consisted of the participant having some college education, living with either two or three people, and a total income of between \$15,000-\$30,000. Four women reported smoking, two reported consuming alcohol, and none reported using drugs. The majority of women took prenatal vitamins and a few supplemented with iron and/or DHA in addition to that of the intervention or control.



### **Predictors of Elevated Prenatal Depressive Symptomatology**

After using SPSS to synthesize the data into an organized set of descriptive statistics, a frequency distribution was computed for each variable. This organized the data so that the range of answers and CES-D scores could be visualized along with percentages for each variable.

On the first CES-D, the range of scores was from 0 to 43, with a mean of 13.38 ( $SD=9.42$ ). The most frequently occurring score was a tie between 8, 9, and 11, with four women answering each of these three scores and all yielding a valid percent of 8.9%. The range of scores on the second CES-D was from 0 to 35, with a mean of 10.87 ( $SD=8.79$ ). The most frequently occurring score in this second CES-D distribution was a 5, which was reported by five people and yielded a valid percent of 11.1%.

Correlations were examined between each variable included in the study. The focus was on how each particular variable correlated with either of the CES-D tests. The relationship was identified by Pearson's Correlation Coefficient ( $r$ ) which summarized the intensity and the direction of the relationship. From these correlation coefficients produced by SPSS, significance ( $p$ ) was given to those that had a level of  $p < .05$  with a stronger relationship indicated by those with a  $p < .01$ . In relation to the first CES-D, body mass index (BMI) was significant ( $N=37$ ,  $r=.407$ ,  $p=.012$ ). This positive correlation concluded that there is significant relationship between elevated CES-D scores and elevated BMI values.

Analyses conducted for the second CES-D resulted in a significant positive correlation between scores and women who supplemented with DHA in addition to the intervention or placebo ( $N=45$ ,  $r=.307$ ,  $p=.04$ ). Because this variable was categorical, where the participants answered either yes or no, it required further analysis using a  $t$  test in order for an interpretation to be made. After conducting a  $t$  test, significance remained between the difference in scores of

women who supplemented with additional DHA and those who did not supplement. Women who supplemented had higher scores at both CES-D administration times in comparison to women who did not supplement. However, the mean score for these women who did supplement remained the same from the first through the second CES-D administration. The significance is in the second CES-D because women who did not take DHA in addition to the intervention or placebo had a decrease in their mean CES-D score at 30-32 weeks (Table 3).

This decrease in the mean CES-D 2 score was expected because it is at the point when the intervention has been in effect for several weeks as opposed to CES-D 1, which is the baseline assessment administered at admission to the study. Importantly, the women who supplemented with additional DHA had a higher mean CES-D score at baseline than did the women who did not supplement. This suggests that there may have been some underlying clinical symptomatology in the women who took additional DHA because of these higher baseline scores. One possibility is that the women were already taking DHA in an attempt to combat current depressive symptoms holding the belief that it helps treat depression. Furthermore, only six women took additional DHA so it was hard to draw definite conclusions without more investigation.

Additionally, the second CES-D was found to have a significant positive correlation with having a history of depression ( $N= 44$ ,  $r= .391$ ,  $p= .009$ ). Having a history of depression was another categorical variable where participants reported either yes or no and therefore also required further analysis using a  $t$  test. This original relationship remained significant ( $t(42)= -2.752$ ,  $p= .009$ ) and the result was that women with a history of depression had higher CES-D scores at the 30-32 weeks (Table 4).

Finally, both CES-D tests had a correlation with each other of ( $N=45$ ,  $r=.585$ ,  $p<.001$ ) in a two tailed correlation. The correlation, group statistics, and  $t$  test can be seen in Table 5. To further test this finding, a repeated-measures ANOVA was completed. This looked at the CES-D scores over time in relation to whether the women were in the intervention or control group (Table 5). These data include a plot depicting the relationship between the mean CES-D scores for the intervention and control groups over time (Figure 1). This analysis allowed all the 45 participants to be examined in regards to whether they were in the intervention or control group and how that impacted their CES-D scores at both administration times. Unfortunately, the expected outcomes were not able to be produced; however, the CES-D a trend for time ( $F=3.676$ ,  $p=.062$ ), but not a significant effect for group ( $F=.326$ ,  $p=.571$ ) or for the interaction of group and time ( $F=.638$ ,  $p=.429$ ).

## **Discussion**

### **Clinical Implications**

Most of the articles included in the literature review agreed with Leigh and Milgrom (2008) in concluding that further research is needed on prenatal depression and its potential risk factors. Marcus et al. (2003) also attested that more research is needed; but in the meantime, suggested that women and their families be educated on psychotherapeutic interventions and pharmacological treatments. Additionally, this research is clinically important because prenatal depression was found to be the strongest predictor of postpartum depression, (Leigh & Milgrom, 2008) which is a more acknowledged and researched mood disorder.

Articles that found certain populations to be more at risk suggested that healthcare providers need to be more aware of prenatal depression in these women and provide optimal screenings and management. Luke et al. (2009) proposed that African American women ages 25

and older be followed more closely for prenatal depression. Jesse and Swanson (2007) suggested possibly tailoring care based on the woman's ethnicity to allow for better intervention and assessment of different risk factors affecting various racial groups. Pajulo et al. (2001) stressed the need for women who abuse drugs and alcohol to be closely followed. They recommended this topic be discussed early on in the pregnancy to prevent it from being withheld and difficult to admit as the pregnancy progresses.

Some researchers suggested that timing is important when intervening or assessing for prenatal depression. Beginning at a young age, Chung et al. (2008) recommended that pediatricians be more alert to potential signs of child abuse since they found that adverse childhood experiences contribute to prenatal depression. Holzman et al. (2006) also identified the need for healthcare workers to demonstrate increased awareness for violence or adverse life experiences beginning in childhood and lasting at least up until the time women plan to conceive. Lee et al. (2007) reported different trimesters to contain different pathogenesis and symptom presentation which leads to monitoring the woman throughout the entire pregnancy for various symptoms that may arise.

Reid et al. (2009) discussed the need for both practical and emotional support possibly through interpersonal interventions to prevent prenatal depression. This may even include a supportive midwife, in which case the researchers are suggesting that midwives be adequately and appropriately trained. Westdahl et al. (2007) additionally concluded that healthcare providers to assess interpersonal social conflict in addition to interpersonal support which is all most providers address. Because their research showed low social support and high interpersonal social conflict to be predictive of prenatal depression, they suggested that assessment focus be shifted to include both variables rather than traditionally focusing on only

social support. Once these women are identified, they can be assisted with developing strategies to manage the conflict and build supportive relationships.

### **Research Implications**

Lancaster et al. (2010) identified the need for research that uses consistent screening tools, diagnostic assessments for depression, and longitudinal designs. This would allow for cross-study comparisons and causality to be better analyzed. Jesse and Swanson (2007) also addressed the need for a clinical diagnosis of depression because depressive symptoms are not equivalent to an actual diagnosis. Buesching et al. (1986) suggested that tools stronger than self-report be used to analyze factors such as a previous history of depression, since this was found to be a very significant predictor and should be further investigated for validation. Edwards et al. (2008) reported that randomized controlled studies such as those included in this literature review, which utilized brief, well-validated screening tools to analyze risk factors, will be of help in the future when studies assessing effectiveness of interventions begin to appear. Rich-Edwards et al. (2006) questioned whether prenatal depression is what creates some of the “risk factors” discussed in this review. For instance, maybe it is the depressive symptoms that cause economic hardship and social conflict. This indicates a need for further investigation of the topic and to analyze correlations.

Throughout the entire literature review, a total of six tools were used to measure elevated depressive symptoms: CES-D (Radloff, 1977), EPDS (Cox et al., 1987), Zung Self Rating Depression Scale (Zung, 1965), Beck Depression Inventory (Beck, et al., 1961), Beck Depression Inventory II (Beck, Brown, & Steer, 1996), and The Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). This present study utilized the CES-D to measure depressive symptoms because it measures current level of depression with an emphasis on mood

and has been used before in pregnant populations. The EPDS is designed to be administered in the postpartum and does not assess depression as it relates to the women's current experience of being a new mother. The Zung Self Rating Depression Scale (Zung, 1965) has even less validity in this study than the EPDS (Cox et al., 1987) because it has not been validated in a population of pregnant women which was evident when Buesching et al. (1986) described having to alter the questions so they were appropriate to the population. Therefore, a screening tool should be standardized for use in the pregnant population so that all results are considered comparable.

## **Conclusion**

An increased awareness of certain demographics and predictive risk factors is needed to identify those women at risk of prenatal depression. This study indicated a significant relationship such that having an elevated body mass index is associated with having elevated depressive symptoms at the 20-22 week period. None of the studies in the review of the literature found this to be a significant risk factor. Therefore, it is a new predictor of which healthcare providers should be aware and that should be studied in future research.

This study also found that having a history of depression is predictive of increased depressive symptoms at the 30-32 week period. Several studies in the literature review identified this risk factor; and additionally, most of them acknowledged it as being the strongest predictor. For instance, Rich-Edwards et al (2006) stated this to be the most powerful risk factor in which women who had a prior history of depression experienced a fourfold increased risk of antenatal depressive symptoms. A history of depression as a risk factor therefore gained validity since it was again demonstrated to be significant in this study.

Attention needs to be given to monitoring these variables at the start of and throughout a woman's pregnancy. Women presenting to antenatal clinics fitting any of the risk factors

presented in this study need to be screened and closely followed. This will allow for early identification of depressive symptoms and the prevention from their increase in severity.

The various findings in the studies included in the literature review indicate a need for further research to confirm these results. Until then, healthcare providers should be screening and paying close attention to pregnant women possessing any of these traits presented in this study and the literature review.

Limitations of this study include that it was a sub-study from a larger one focusing on DHA intervention during pregnancy and depression so not as much emphasis was placed on collecting data on all possible risk factors that may contribute to prenatal depression. Related to this is the fact that the instrument administered in this study, the CES-D, is a screening tool and not an actual diagnostic tool. Further evaluation of the women with elevated CES-D scores is needed to determine a clinical diagnosis of depression. Therefore, the study was only able to examine predictors of elevated depressive symptoms and not actual prenatal depression.

Another weakness was the small sample size. Also the sample was one of convenience with recruitment being locally through advertisements in the newspaper and at physician's offices in the state of Connecticut. Also, women with any health problems were excluded from the sample, along with women with multiple gestations and those who had been pregnant or lactating in the previous 2 years due to the depletion of DHA stores in these women. Therefore, the results of this study have limited generalizability. To increase the generalizability, repeated studies on this topic need to be conducted and then demonstrate reliability and validity.

This study helped to increase awareness on the subject of prenatal depression and elevated depressive symptoms in pregnancy in hope that healthcare providers can be more conscious of this issue while more research is carried out in the future. In the meantime, the first

step is being alert to possible risk factors requiring close monitoring and preparing for appropriate intervention to best protect the mental-health of the pregnant woman.



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**Table 1** Studies Included in the Literature Review of Predictors of Prenatal Depression

<b>Risk Factor</b>	<b>HISTORY OF DEPRESSION</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Rich-Edwards et al., 2006	United States	1,662 women	EPDS	9%	OR= 4.51, 95% CI 4.24, 4.80
Lancaster et al., 2010	United States	6 of the 57 studies	Various	12.7%	Medium association (bivariate analysis)
Marcus, Flynn, Blow, and Barry, 2003	United States	3,472 women	CES-D	20%	OR= 4.9, p= 0.00
Escribà-Aguir, Gonzalez-Galarzo, Barona-Vilar, and Artazcoz, 2007	Spain	687 women in	EPDS	10.3%	OR= 2.18, p= .008
Edwards, Galletly, Semmler-Booth, and Dekker, 2008	South Australia	421 women	EPDS, APQ	29.7%	having feelings of depression/anxiety (OR= 3.248) and requiring both past and current treatment for emotional problems (OR= 5.506)
Buesching, Glasser, and Frate, 1986	United States	57 pregnant women	Zung Self Rating Depression Scale	17.5%	Women with high levels of prenatal depression were three times more likely to have a history of depression
<b>Risk Factor</b>	<b>LOW SELF-ESTEEM</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>

Leigh and Milgrom, 2008	Australia	367 women	EPDS, Beck Depression Inventory	16.9%	$F(12, 361) = 101.79, p < .001$
Lee et al., 2007	China	335 women	EPDS, Hospital Anxiety and Depression Scale	22.1%	First trimester (adjusted OR= 6.51, $p = .011$ ) Second trimester (adjusted OR= 0.82, $p = .001$ ) Third trimester (adjusted OR= 0.79, $p = .001$ )
Jesse and Swanson, 2007	United States	324 women	Beck Depression Inventory II	33%	OR= 2.74, $p < .01$
<b>Risk Factor</b>	<b>ANTENATAL ANXIETY</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Lancaster et al., 2010	United States	11 out of the 57 studies	Various	12.7%	Medium to large association (bivariate analysis)
Leigh and Milgrom, 2008	Australia	367 women	EPDS, Beck Depression Inventory	16.9%	$F(12, 361) = 101.79, p < .001$
Edwards, Gallety, Semmler-Booth, and Dekker, 2008	South Australia	421 women	EPD-S, APQ	29.7%	OR= 3.248
<b>Risk Factor</b>	<b>LOW SOCIAL SUPPORT</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Leigh and Milgrom, 2008	Australia	367 women	EPDS, Beck Depression Inventory	16.9%	$F(12, 361) = 101.79, p < .001$
Lancaster et al., 2010	United States	26 out of 57 studies	Various	12.7%	Total social support from any source had a medium association and partner status had medium to large association (bivariate

					and multivariate)
Jesse and Swanson, 2007	United States	324 women	Beck Depression Inventory II	33%	OR=2.44, $p<.01$
Lee et al., 2007	China	335 women	EPDS, Hospital Anxiety and Depression Scale	22.1%	First trimester (adjusted OR= 0.59, $p=.044$ ) Third trimester (adjusted OR= 0.46, $p=.002$ )
Reid, Power, and Cheshire, 2009	Scotland	302 women	EPDS, Depression, Anxiety, and Stress Scale	17.2%	Multiparous: $F(1, 129)= 22.971$ , $p<.001$ Primiparous: $F(1, 109)= 16.806$ , $p<.001$
Sequin, Potvin, St. Denis, and Loiselle, 2005	Canada	144 women	Beck Depression Inventory, Arizona Social Support Interview Schedule	46.9%	$p<.001$ , $R^2=.51$ $F= 12, 459$ , $df(11, 131)$ , $p<.0001$
Westdahl et al., 2007	United States	1,047 women	subscale of the Social Relationship Scale, CES-D	33%	$R^2=.38$ , $F(14, 1,012)= 46.60$ , $p<.001$
Pajulo, Savonlahti, Sourander, Helenius, and Piha, 2001	Finland	391 women	EPDS, Social Support Questionnaires 1 and 2	7.7%	Difficulties in social environment ( $p<.001$ ) and experienced social support ( $p=.02$ )
<b>Risk Factor</b>	<b>MAJOR LIFE EVENTS</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Leigh and Milgrom, 2008	Australia	367 women	EPDS, Beck Depression Inventory	16.9%	$F(12, 361)= 101.79$ , $p<.001$
Reid, Power, and Cheshire, 2009	Scotland	302 women	EPDS, Depression, Anxiety, and Stress Scale	17.2%	Total sample of women: $r=.580$ , $p<.001$ Multiparous women: $r=.607$ , $p<.001$



					Multiparous: $F(1, 129) = 22.971, p < .001$ Primiparous: $F(1, 109) = 16.806, p < .001$
Sequin, Potvin, St. Denis, and Loiselle, 2005	Canada	144 women	Beck Depression Inventory, Arizona Social Support Interview Schedule	46.9%	$F = 12, 459, df(11, 131), p < .0001$
<b>Risk Factor</b>	<b>LOW INCOME/MEDICAID VS. PRIVATE INSURANCE</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Leigh and Milgrom, 2008	Australia	367 women	EPDS, Beck Depression Inventory	16.9%	$F(12, 361) = 101.79, p < .001$
Lancaster et al., 2010	United States	6 of the 57 studies	Various	12.7%	Having Medicaid showed significance of a medium association for depressive symptoms (bivariate analysis)
Sequin, Potvin, St. Denis, and Loiselle, 2005	Canada	144 women	Beck Depression Inventory, Arizona Social Support Interview Schedule	46.9%	$F = 12, 459, df(11, 131), p < .0001$
Holzman et al., 2006	United States	1,321 women	CES-D	35%	Teens with 2 or more problems ( $p < .05$ ), Disadvantaged Women with one ( $p < .05$ ) and two or more problems ( $p < .001$ ), and Advantaged Women with one ( $p < .001$ ) and two or more economic problems ( $p < .001$ )

Pajulo, Savonlahti, Sourander, Helenius, and Piha, 2001	Finland	391 women	EPDS, Substance Abuse Subtle Screening Inventory, 2 Social Support Questionnaires	7.7%	OR= 2.7 (few difficulties), OR= 6.7 (moderate difficulties), $p < .001$
<b>Risk Factor</b>	<b>HISTORY OF ABUSE AND DOMESTIC VIOLENCE</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Leigh and Milgrom, 2008	Australia	367 women	EPDS, Beck Depression Inventory	16.9%	$F(12, 361) = 101.79, p < .001$
Chung et al., 2008	United States	1,476 women	CES-D	35%	OR= 1.69 (childhood sexual abuse) OR= .389, $p = .018$ (sexual abuse and positive maternal relationship)
Lancaster et al., 2010	United States	7 of the 57 studies	Various	12.7%	Small association (bivariate) Small to medium association (multivariate)
Jesse and Swanson, 2007	United States	324 women	Beck Depression Inventory II, Abuse Assessment Scale	33%	OR= 4.30, $p < .05$
Holzman et al., 2006	United States	1,321 women	CES-D	35%	Teens who experienced one type of abuse ( $p < .05$ ), two or more types ( $p < .01$ ), Disadvantaged Women for any number of types of abuse ( $p, .01$ ), and Advantaged Women for one type ( $p < .05$ ) and for two or more types ( $p < .01$ )

Martin et al., 2006	United States	95 women	CES-D	73%	Physical assault both before ( $p < .01$ ) and during ( $p = .01$ ) pregnancy, sexual coercion before pregnancy ( $p < .01$ ), and having any violence inflicted injury before pregnancy ( $p < .01$ )
Edwards, Gallety, Semmler-Booth, and Dekker, 2008	South Australia	421 women	EPD-S, APQ	29.7%	Being hit by someone since becoming pregnant ( $OR = 12.353$ ) and having recently hit or hurt someone in anger ( $OR = 3.465$ )
<b>Risk Factor</b>	<b>MATERNAL AGE</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Luke et al., 2009	United States	546 women	EPDS	25%	Women ages 25-29 had double the risk compared to teenagers ( $OR = 2.25$ , 95% CI 1.19-4.27), and the risk quintupled for women 30yrs or greater ( $OR = 4.62$ , 95% CI 2.23-9.95)
Rich-Edwards et al., 2006	United States	1,662 women	EPDS	9%	Women under 23 yrs are two or more times at risk than older mothers and risk of prenatal depression decreases as age increases ( $OR = 2.71$ , 95% CI(1.40,5.24))
Reid, Power, and Cheshire, 2009	Scotland	302 women	EPDS, Depression, Anxiety, and Stress Scale	17.2%	Younger age was a significant risk for depressive symptoms in primiparous women and multiparous women

					Multiparous: $F(1, 129) = 22.971, p < .001$ Primiparous: $F(1, 109) = 16.806, p < .001$
Lee et al., 2007	China	335 women	EPDS, Hospital Anxiety and Depression Scale	22.1%	Younger age was a significant risk factor during the second trimester ( $OR = .92, 95\% CI 0.87-0.98, p = .010$ ) and third trimester ( $OR = .93, 95\% CI 0.88-0.98, p = .007$ )
<b>Risk Factor</b>	<b>AFRICAN AMERICAN</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Jesse and Swanson, 2007	United States	324 women	Beck Depression Inventory II, Abuse Assessment Scale	33%	$OR = 2.07, p < .05$
Holzman et al., 2006	United States	1,321 women	CES-D	35%	Significant for Disadvantaged Women ( $p < .05$ ) and Advantaged Women ( $p < .01$ ), but not Teenagers
<b>Risk Factor</b>	<b>LACK OF SPOUSE OR PARTNER</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Rich-Edwards et al., 2006	United States	1,662 women	EPDS	9%	Double the risk for antenatal depressive symptoms in the second trimester ( $OR = 2.34, 95\% CI 1.26, 4.35$ )
Lee et al., 2007	China	335 women	EPDS, Hospital	22.1%	Low marital satisfaction in the

			Anxiety and Depression Scale		second trimester (adjusted OR= .60, p= .017)
Marcus, Flynn, Blow, and Barry, 2003	United States	3,472 women	CES-D	20%	OR= .57, p= .00
Westdahl et al., 2007	United States	1,047 women	subscale of the Social Relationship Scale, CES-D	33%	Relationship Status: r= -.15, p<.01  F(14, 1,012)= 46.60, p< .001
Escibar`- Agu`ir, Gonzalez-Galarzo, Barona-Vilar, and Artazcoz, 2007	Spain	687 women	EPD-S	10.3%	Low marital satisfaction during pregnancy to be more likely to experience symptoms of depression (OR= 3.05, 95% CI 1.59 to 5.82)
<b>Risk Factor</b>	<b>UNINTENDED/UNWANTED PREGNANCY</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Rich-Edwards et al., 2006	United States	1,662 women	EPDS	9%	Second trimester (OR= 2.31, 95% CI 1.29, 4.16)
Lancaster et al., 2010	United States	6 of the 57 studies	Various	12.7%	Unwanted pregnancy resulted in a medium association with antenatal depressive symptoms (bivariate analysis)
Lee et al., 2007	China	335 women	EPDS, Hospital Anxiety and Depression Scale	22.1%	First trimester (adjusted OR= 6.51, p= .011)
Field et al., 2007	United States	214 women	CES-D, Feelings About Pregnancy and	27% of the variance was explained	30% of the depressed cohort was not happy and only 15% of the non-depressed group

			Delivery Scale	by the factors	was unhappy when learning of their pregnancy (p= .009)
<b>Risk Factor</b>	<b>LOWER LEVELS OF EDUCATIONAL ATTAINMENT</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Lancaster et al., 2010	United States	5 of the 57 studies	Various	12.7%	Small association (bivariate analysis)
Marcus, Flynn, Blow, and Barry, 2003	United States	3,472 women	CES-D	20%	OR= .90, p= .04
<b>Risk Factor</b>	<b>HOUSING DENSITY</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Lancaster et al., 2010	United States	19 of the 57 studies	Various	12.7%	Small to medium association (bivariate)
Sequin, Potvin, St. Denis, and Loisele, 2005	Canada	144 women	Beck Depression Inventory, Arizona Social Support Interview Schedule	46.9%	F= 12, 459, df(11, 131), p< .0001
<b>Risk Factor</b>	<b>HISTORY OF DRINKING/SUBSTANCE USE</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Lee et al., 2007	China	335 women	EPDS, Hospital Anxiety and Depression Scale	22.1%	First trimester (OR= 2.00, p= .021) and third trimester (OR= 2.15, p= .001)
Marcus, Flynn, Blow, and Barry,	United States	3,472 women	CES-D, TWEAK	20%	OR= 1.2, p= .00

2003					
Holzman et al., 2006	United States	1,321 women	CES-D	35%	Significant risk factor in Teens, Disadvantaged Women, and Advantaged Women who reported having “one or more” substance use problems ( $p < .01$ )
Pajulo, Savonlahti, Sourander, Helenius, and Piha, 2001	Finland	391 women	EPDS, Substance Abuse Subtle Screening Inventory, 2 Social Support Questionnaires	7.7%	OR= 9.4 (univariate) and OR= 3.4 (multivariate), $p < .001$
<b>Risk Factor</b>	<b>POORER OVERALL HEALTH</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Marcus, Flynn, Blow, and Barry, 2003	United States	3,472 women	CES-D, TWEAK	20%	Self-rated health OR= 1.5, smoking while pregnant OR= 1.1, $p = .00$
Lancaster et al., 2010	United States	18 of the 57 studies	Various	12.7%	Increased stress levels resulted in a medium association with depressive symptoms (bivariate and multivariate analyses)
Field et al., 2007	United States	214 women	CES-D, Feelings About Pregnancy and Delivery Scale	27% of the variance was explained by the factors	50% of depressed group and 29% non-depressed group answered yes to stress during pregnancy ( $p = .02$ )
Jesse and Swanson, 2007	United States	324 women	Beck Depression Inventory II, Abuse Assessment	33%	Stress is a very significant risk factor of prenatal depression (OR= 3.97, $p < .001$ )

			Scale		
<b>Risk Factor</b>	<b>UNEMPLOYMENT</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Marcus, Flynn, Blow, and Barry, 2003	United States	3,472 women	CES-D, TWEAK	20%	OR= .74, p= .01
<b>Risk Factor</b>	<b>HIGHER PARITY</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Jesse and Swanson, 2007	United States	324 women	Beck Depression Inventory II, Abuse Assessment Scale	33%	Significant in African American women (OR= 3.36, p< .01) but not Hispanic or Caucasian women
Pajulo, Savonlahti, Sourander, Helenius, and Piha, 2001	Finland	391 women	EPDS, Substance Abuse Subtle Screening Inventory, 2 Social Support Questionnaires	7.7%	Having 2-3 children under school age resulted in more prenatal depression than those with one or no young children (p= .041)
<b>Risk Factor</b>	<b>SPIRITUALITY</b>				
<b>Author and Year</b>	<b>Country</b>	<b>Sample Size</b>	<b>Instruments</b>	<b>Prevalence of Antenatal Depression</b>	<b>Results</b>
Jesse and Swanson, 2007	United States	324 women	Beck Depression Inventory II, Abuse Assessment Scale	33%	OR= 2.09, p< .05



**Table 2** Demographics and Characteristics of the Sample (N= 45)

<b>RESEARCH STUDY INFORMATION</b>		<b>N</b>	<b>Percent</b>
<b>Total Number of Participants</b>		45	
<b>DHA Intervention</b>		25	44.4%
<b>Control Group (No DHA)</b>		29	55.6%
<b>Age</b>			
Missing		1	2.2%
18-21		11	24.4%
22-25		6	13.3%
26-30		15	28.8%
31-35		14	22.1%
36-40		4	8.8%
<b>Ethnicity</b>			
Missing		5	11.1%
Caucasian		18	40%
African American		1	2.2%
Hispanic		17	37.8%
Native American		1	2.2%
Asian Indian		3	6.7%
<b>Citizenship</b>			
Missing		4	8.9%
U.S. Citizen		28	62.2%
Non U.S. Citizen		13	28.9%
<b>Pre-pregnant Weight</b>			
Missing		2	4.44%
<100lbs		3	6.67%
100-150lbs		24	53.33%
151-200lbs		9	20%
>200lbs		7	15.56%
<b>Body Mass Index</b>			
Missing		8	17.78%
<19		2	4.44%
19-25		22	48.89%
26-30		5	11.11%
31 or greater		8	17.78%
<b>Work Activity</b>			
Missing		7	15.6%
Sedentary		8	17.8%
Mild		10	22.2%
Moderate		19	42.2%
Strenuous		1	2.2%
<b>Leisure Activity</b>			
Missing		2	4.4%
No Regular Exercise		19	42.4%

Regular Exercise	24	53.3%
<b>Mother Suspected of Having Depression</b>		
Missing	4	8.9%
Yes	7	15.6%
No	34	75.6%
<b>Father Suspected of Having Depression</b>		
Missing	3	6.7%
Yes	2	4.4%
No	40	88.9%
<b>Siblings Suspected of Having Depression</b>		
Missing	3	6.7%
Yes	4	8.8%
No	38	84.4%
<b>Mother Diagnosed with Depression</b>		
Missing	5	11.1%
Yes	5	11.1%
No	35	77.8%
<b>Father Diagnosed with Depression</b>		
Missing	5	11.1%
Yes	2	4.4%
No	38	84.4%
<b>Siblings Diagnosed with Depression</b>		
Missing	5	11.1%
Yes	2	4.4%
No	38	84.4%
<b>History of Depression</b>		
Missing	1	2.2%
Yes	8	17.8%
No	36	80%
<b>Past Diagnosis of Depression</b>		
Missing	1	2.2%
Yes	8	17.8%
No	36	80%
<b>Household Income</b>		
Missing	6	13.3%
<\$15,000	12	26.7%
\$15-30,000	15	33.3%
\$31-45,000	2	4.4%
\$46-60,000	6	13.2%
\$61-75,000	1	2.2%
\$76-90,000	0	0%
\$91-100,000	0	0%
\$101-150,000	2	4.4%
\$151-200,000	1	2.2%
<b>Number of People Living in Participant's Household</b>		

Missing	3	6.7%
One	1	2.2%
Two	12	26.7%
Three	12	26.7%
Four	8	17.8%
Five	7	15.6%
Six	1	2.2%
Seven	1	2.2%
<b>Education Level</b>		
Missing	2	4.4%
Some High School	10	22.2%
High School Diploma	6	13.3%
Some College	14	31.1%
College Degree	7	15.6%
Some graduate school	1	2.2%
Masters Degree	4	8.9%
Doctoral Degree	1	2.2%
<b>Smoke</b>		
Missing	3	6.7%
yes	3	6.7%
no	39	86.7%
<b>Drink Alcohol</b>		
Missing	3	6.7%
yes	2	4.4%
no	40	88.9%
<b>DHA Supplementation in addition to intervention or placebo</b>		
Missing	0	0%
Yes	6	13.3%
No	39	86.7%
<b>Prenatal Vitamins</b>		
Missing	0	0%
Yes	38	84.4%
No	7	15.6%
<b>Iron Supplementation</b>		
Missing	0	0%
Yes	4	8.9%
No	41	91.1%
<b>Parity</b>		
Missing	17	37.8%
0	11	24.4%
1	10	22.2%
2	4	8.9%
4	2	4.4%
7	1	2.2%
<b>Gravidity</b>		

Missing	17	37.8%
0	1	2.2%
1	10	22.2%
2	9	20%
3	4	8.9%
4	1	2.2%
5	2	4.4%
7	1	2.2%

**Table 3** CES-D 2 Scores and DHA Supplementation

DHA Supplements		N	Mean	Std. Deviation	Std. Error Mean	<i>t</i> test
<b>CES-D 1</b>	No	39	12.72	9.271	1.484	t(43)= -1.204, p= .235
	Yes	6	17.67	10.113	4.128	
<b>CES-D 2</b>	No	39	9.82	8.078	1.294	t(43)= -2.115, p= .04
	Yes	6	17.67	10.930	4.462	

**Table 4** CES-D 2 Scores and History of Depression

History of Depression		N	Mean	Std. Deviation	Std. Error Mean	t test
<b>CES-D 1</b>	No	36	12.39	8.069	1.345	t(8.018)= -.878, p= .405
	Yes	8	17.00	14.353	5.074	
<b>CES-D 2</b>	No	36	9.22	7.449	1.242	t(42)= -2.752, p= .009
	Yes	8	18.13	11.557	4.086	

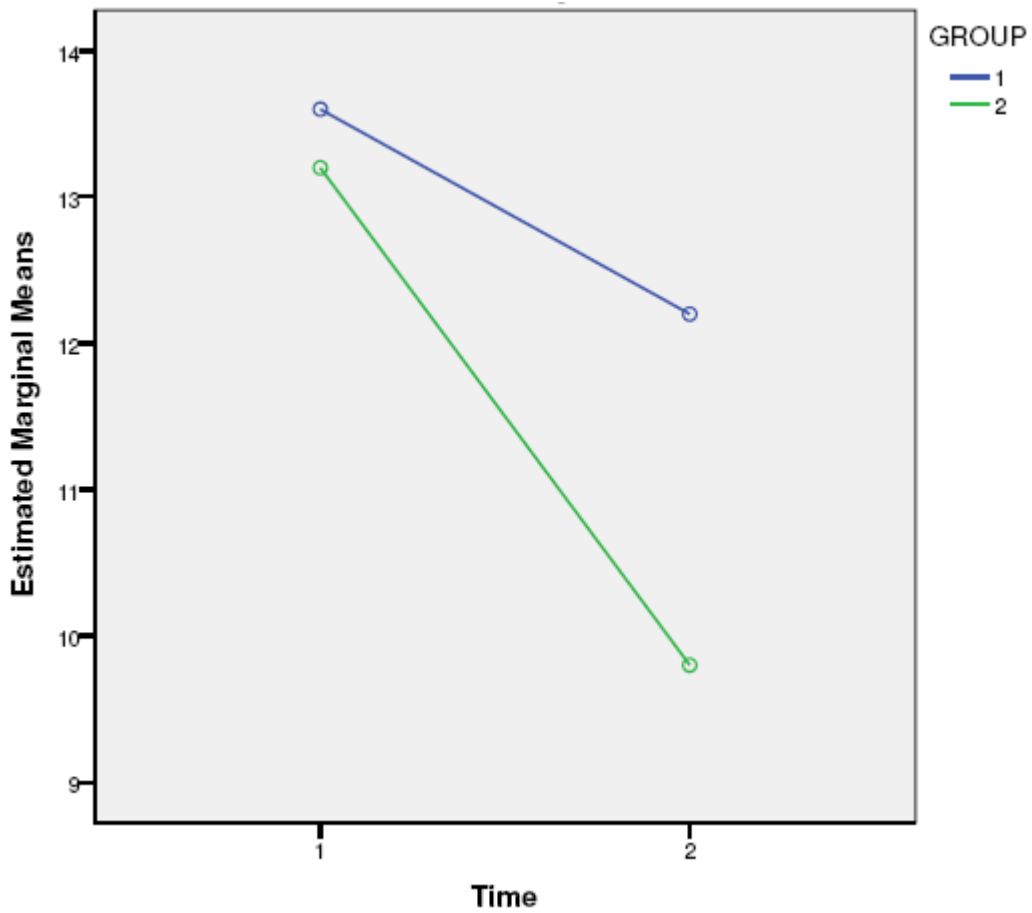
**Table 5** CES-D 1 and CES-D 2 Scores

Group*	N	Mean	Std. Deviation	Std. Error Mean	t test	
CES-D 1	1	20	13.60	8.804	1.969	t(43)= .140, p= .889
	2	25	13.20	10.062	2.012	
CES-D 2	1	20	12.20	9.446	2.112	t(43)= .909, p= .369
	2	25	9.80	8.261	1.652	

\*Group 1= DHA Intervention

\*Group 2= Control

**Figure 1.** Estimated Marginal Means of CES-D



\*Group 1= DHA Intervention

\*Group 2= Control



