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Changes in Depressive Symptoms in First Time Mothers in Home Visitation

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Abstract

Objective—The expansion of home visitation programs for at-risk, first-time mothers and their young children has drawn attention to the potential impact of depression on program outcomes, yet little research has examined depression in the context of home visitation. The purpose of this study was to determine the prevalence of and changes in depressive symptoms in mothers enrolled in home visitation and identify predictors of change in symptoms over the first 9 months of service.

Methods—Subjects consisted of 806 at-risk, first-time mothers enrolled in a home visitation program. Self-reported depression was measured at enrollment and again 9 months later. Established clinical cutoffs were used to identify clinically elevated levels of depression. Additional measures were taken of interpersonal trauma history, concurrent intimate partner violence, and social support.

Results—Results indicated that (1) 45.3% of mothers had clinically elevated symptoms of depression at some point during the first 9 months of service, (2) 25.9% of mothers had elevated symptoms at both time points or at the 9 month assessment, and (3) 74.1% experienced an interpersonal trauma prior to enrollment. Lack of improvement or worsening of depressive symptoms from enrollment to 9 months was best predicted by pre-enrollment interpersonal trauma history, young maternal age, being African American, and symptoms severe enough to have led to mental health treatment.

Conclusions—Findings suggest that maternal depressive symptoms are a significant problem in home visitation. The role of interpersonal trauma in depressive symptoms, and how to best address these clinical issues in home visitation, warrants further examination.

Practice Implications—Maternal depression is prevalent in home visitation programs, and many mothers exhibit elevated symptoms at multiple time points over the first year of service. Interpersonal trauma history is also prevalent, and is predictive of increased depressive symptoms over time. Home visitation programs should note that mothers with interpersonal trauma history, young maternal age, and being African American have an increased likelihood of persistent depressive symptoms, which may in turn pose significant challenges to providing services.

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Maternal depression: Prevalence and features

Major Depressive Disorder (MDD) is characterized by dysphoric mood, anhedonia, appetite loss or gain, significant weight loss or gain, sleep disturbance (insomnia, hypersomnia, early morning awakening), fatigue, psychomotor retardation or agitation, poor concentration, and thoughts about death. (Depression has been described as both a diagnosis and a cluster of symptoms. We refer to Major Depressive Disorder when describing the diagnosis, and depressive symptoms to refer to self-reports of frequency and severity.) Prevalence of MDD in pregnant and postpartum women is high. Evans et al. (2001) found a prevalence of 13.5% in a sample of 9,028 pregnant women. In a sample of women seen in a managed health plan, Dietz et al. (2007) found that 6.9% met criteria for MDD during pregnancy, and 10.9% had MDD within 39 weeks postpartum. In a meta-analysis of prevalence studies, O'Hara and Swain (1996) reported that 13% of women experience MDD postpartum. Socially disadvantaged women may have higher prevalence rates, as demonstrated by the 27.6% prevalence during pregnancy and 23.4% postpartum in poor, inner-city mothers (Hobfoll, Ritter, Lavin, Hulsizer, & Cameron, 1995).

MDD is a disabling condition, impairing functional abilities and social roles. For example, Kessler et al. (2003) found that 69% of depressed adults reported moderate to very severe impairment in their roles at home. In particular, MDD undermines effective and nurturing parenting. In contrast to non-depressed mothers, when interacting with their children, depressed mothers have been described as disengaged, less responsive to child cues, and less warm and supportive (Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Maternal depression is associated with failure to use child safety seats (McLennan, Kotelchuck, & Cho, 2001), and inadequate seeking of preventive healthcare in young children (Minkovitz et al., 2005). Despite its negative impacts, most depressed women go untreated.

A sizable body of evidence has accrued linking maternal depression, as a diagnostic entity or characterized by severity of depressive symptoms, to negative developmental outcomes in children (Goodman & Gotlib, 2002). Maternal depression disrupts developmental processes in affective, social, and cognitive systems. Poor short and long term child outcomes include insecure attachment formation, emotional dysregulation, impaired early socialization, cognitive delays, and behavior problems (Martins & Gaffan, 2000). The deleterious effects of maternal depression on children are severe and durable if the depression occurs early in life, there are multiple episodes, and the episodes are severe (O'Hara & Swain, 1996). Early exposure to depression, particularly in the first year of life, is believed to lead to long-term developmental deficits (cognitive impairments, aggression) that have been documented as late as 11 years of age (Hay, Pawlby, Angold, Harold, & Sharp, 2003). Identification and treatment of depression in mothers is critical to altering the negative development trajectories of exposed young children.

Correlates and predictors of maternal depression during pregnancy and postpartum include both individual and ecological factors. In a meta-analysis, C. Beck (2001) identified several prominent predictors of postpartum depression, including low self-esteem, stress related to child care, low social support, and poor marital relationships. O'Hara and Gorman (2004) concluded that postpartum depression was best predicted by a history of depression, stress, poor marital relationship, and low levels of social support. Theoretical conceptualizations of depression posit the contribution of biological, psychological, and ecological factors (Goodman & Gotlib, 1999). These interact synergistically and over the course of development. Recently, childhood adversity, particularly interpersonal trauma, has been highlighted as a particularly important contributor to psychopathology in general, and depression in particular (Lara & Klein, 1999; Putnam, 2003). Intimate partner violence has also been implicated as a significant contributor to depression. Based on a meta-analysis, Golding (1999) found a strong

relationship between intimate partner violence and depression, such that 47.6% of victimized women exhibited clinically elevated levels of depressive symptoms. Physical and sexual abuse in childhood also imparts significant risk for subsequent depression (Putnam, 2003). Interpersonal trauma and intimate partner violence are believed to undermine emotional regulatory systems, contributing to negative affect and the emergence of depression (see Putnam). In contrast, several factors have been identified that decrease risk for developing depression. These include a stable and supportive social network, and other psychological resources (Goodman & Gotlib, 1999). Although there is a sizable body of research on correlates of maternal depression, relatively little research has examined predictors of change in depressive symptoms following emergence in pregnancy or postpartum.

Maternal depression and home visitation

Home visitation is a promising prevention strategy for young children and their families (Guterman, 2001). There are thousands of publicly and privately funded home visitation programs providing services to at least half a million children in the United States alone (Gomby, Culross, & Behrman, 1999). In home visitation, a home visitor (who, depending upon the program model, is a nurse, social worker, or paraprofessional) provides psychoeducational training and case management services to mothers and children. Initially designed to prevent child abuse and neglect, home visitation has expanded in scope to promote optimal child development and prevent negative outcomes, including academic underachievement, psychological maladjustment, and antisocial behavior. Home visits, which can begin during the prenatal period and last until the child reaches two to five years of age, target diverse areas such as parenting skills, mother-child relationships, home safety, maternal health, and infant nutrition.

Several studies have examined the scope of maternal depression in the context of home visitation and the impact of services on depressive symptoms. In the evaluation of Hawaii Healthy Start (HHS), Duggan et al. (2004) used the self-report Center for Epidemiological Studies Depression Scale (Radloff, 1977) to categorize mothers as being “probable” cases of depression based on established clinical cutoffs. Although baseline categorizations were not presented, mothers enrolled in HHS obtained the “probable” rating in 23% of the cases after one year in the program, 16% after two years, and 16% after three years. No differences were found over time between mothers in HHS and a control condition. In a subsequent clinical trial of the Healthy Families Alaska Program, Duggan et al. (2007) also found no difference between home visited and control conditions on self-reported maternal depressive symptoms when the index child had reached two years of age. Likewise, the evaluation of Early Head Start (Administration on Children Youth and Families, 2002) reported prevalence rates of elevated depressive symptoms of 38% and 32% at 14 and 36 months after the child’s birth, respectively, with no difference between intervention and control groups over this time. (A long-term follow up of this sample found a delayed positive impact on maternal depression for those receiving the intervention, albeit modest in its effect size, when the child reached age five years [Chazan-Cohen et al., 2007]. This is an intriguing finding warranting further examination, although the lack of group differences through and up to the end of services underscores the continued manifestation of maternal depression during the first years of the child’s life.) Navaie-Waliser, Martin, Tessaro, Campbell, and Cross (2000) examined the impact of a paraprofessional home visitation program on depression in prenatally enrolled, high-risk mothers. After one year, home visited mothers reported a modest decrease in depression relative to a control group of mothers sampled from similar demographic regions.

Stevens, Ammerman, Putnam, and Van Ginkel (2002) measured depressive symptoms in 123 mothers enrolled in a Healthy Families America program. Using the Beck Depression Inventory-II (BDI-II), 28.5% had elevated scores (≥ 14) at enrollment. A history of

interpersonal trauma (e.g., physical abuse), but not non-interpersonal trauma (e.g., car accident), was strongly related to depressive symptoms. Moreover, depressive symptoms were associated with increased telephone contact between home visitors and mothers outside of scheduled home visits.

Based on the extant research, it appears that for mothers in home visitation (1) the prevalence of clinically elevated levels of depression exceeds that of what is typically found in the general population of women of childbearing age (e.g., O'Hara & Swain, 1996); and (2) home visitation has little to no impact on depressive symptoms over time. Indeed, maternal depression poses considerable challenges for home visitation. In a NIH Workshop on issues in home visitation (Margie & Phillips, 1999), the panel noted that "maternal depression....can significantly impede the capacity of a home visiting program to benefit families." Depressive symptoms, such as poor concentration, memory impairment, and disengagement, make it difficult for affected mothers to fully participate in home visits. Furthermore, maternal depression challenges home visitors who have limited training with depressed women, and diverts their attention from the primary goal of delivering prevention curricula. A survey of 91 home visitors revealed that 86.7% had encountered mentally ill mothers (including depression) in the last year and that issues related to mental illness (suicidality, low motivation) were among the most difficult situations that they encountered (LeCroy & Whitaker, 2005). Home visitation was not designed to address maternal depression, and most home visitors have no formal training in mental health intervention. It is possible that the modest benefits reported by many home visitation programs are attributable, in part, to the formidable clinical challenges that accompany maternal depression.

Study overview

The purpose of this study was to document the prevalence of and changes in depressive symptoms in first-time mothers during the first 9 months of home visitation and to identify predictors of change over this time period. Depressive symptoms were measured at enrollment and again 9 months later using the BDI-II. In the first phase of the study, clinical severity was determined using established cutoff scores, and changes in clinical status over 9 months were observed. Characterizing the scope of and change in maternal depressive symptoms during the first 9 months of service provides the first elucidation of the extent of this clinical problem during the important first year of both the child's life and home visitation. In the second phase, hierarchical linear modeling was used to examine predictors of change in depression over time. Based on the etiological relevance of interpersonal trauma and intimate partner violence in depression, these variables were the focus of the phase of the study. Social support and receipt of mental health treatment were examined and hypothesized to decrease the likelihood of depression over time.

Method

Participants

Participants were 806 mothers enrolled in Every Child Succeeds (ECS) who participated between 2000–2003. ECS is a large-scale, community-based home visitation program for first time mothers and their children. ECS utilizes two models of home visitation (Nurse-Family Partnership (NFP; Olds, 2002) and Healthy Families America (HFA; Daro & Harding, 1999). Eligible mothers have at least one of four risk characteristics: unmarried; low income (<300% of poverty, or Medicaid recipient); 17 years of age or younger; and inadequate prenatal care. Mothers were enrolled prior to 28 weeks gestation in the Nurse-Family Partnership, and from 20 weeks gestation through the child reaching 3 months of age for Healthy Families America as per model parameters. Mothers were referred from prenatal clinics, hospitals, social service agencies, and community physicians.

In the NFP, home visits are provided by nurses. In HFA, home visits are provided by social workers, or related professionals and paraprofessionals (in this study, 94% were social workers or related professionals). Home visits are provided over a 2 ½–3 year period, depending on the model, starting with up to weekly visits and tapering to decreased frequency as the program progresses. Both have extensive training requirements and regular supervision of home visitors (see Daro & Harding, 1999; Olds, 2002). Although both models have a pre-determined schedule of home visits, there is variability in number and frequency of home visits due to scheduling difficulties and home visitor discretion to increase service intensity in response to acute needs. The goals of ECS are to (1) improve pregnancy outcomes through nutrition education and substance use reduction; (2) support parents in providing children with a safe, nurturing, and stimulating home environment; (3) optimize child health and development; (4) link families to health care and other needed services; and (5) promote economic self-sufficiency in families. ECS oversees 17 (14 HFA, 3 NFP) contracted healthcare and social service agencies, which provide services in 7 counties in southwestern Ohio and northern Kentucky.

Attrition is common in long-term prevention programs in general, including home visitation (e.g., Daro, McCurdy, Falconnier, & Stojanovic, 2003). Three hundred and thirty-two enrolled in the program but dropped out before the 9 month assessment. This group was compared to the retained sample ($N = 806$) on enrollment BDI-II scores, age, marital status, income, race, or home visitation model. No statistically significant ($p > .05$) differences were found with the exception of race. Specifically, African Americans were more likely to prematurely drop out (45.6%) relative to the retained sample [25.7%; $\chi^2(1) = 42.96, p < .01$]. This pattern is consistent with prior research documenting higher dropout rates in African Americans (Ammerman et al., 2006), although this finding has not been consistently identified (Daro et al., 2003). Possible implications are addressed in the Discussion.

The sample of 806 first-time mothers was young (mean = 20.36., $SD = 3.97$, range 14–41 years) and primarily Caucasian (72.7%; African American = 23.4%, Hispanic = 2.4%, Biracial = 1.2%, Asian American = 0.2%). Elevated risk status was reflected by the high proportion of unmarried (87.7%), low income (74.1%), teenage mothers (27.8% < 18 years), and mothers with inadequate prenatal care (20.1%). The majority of the sample had a high school degree (40.8%) or less (31.0%), while 17.4% had some college experience and 10.8% had a college degree. At the time of enrollment, 60.9% were prenatal and 39.1% were postnatal. In terms of home visitation model, 682 (84.6%) of mothers were in Healthy Families America and 124 (15.4%) were in the Nurse-Family Partnership (this distribution reflects the number of home visitors represented by each model in ECS).

Procedures

Referrals were processed through a centralized system at ECS and assigned to agencies based on geographic location. During the first visit, mothers signed a consent form (approved by the Institutional Review Board at Cincinnati Children's Hospital Medical Center) to participate in data collection and evaluation procedures (only 1.0% declined to participate). Data were collected as part of a community-based prevention program, and measures were administered by home visitors. Enrollment and historical measures were collected over the first three home visits as part of an extended assessment phase.

Measures

Measures were collected on depressive symptoms, historical variables (pre-enrollment interpersonal trauma history), functioning and status at enrollment, and variables measured over the 9 month interval hypothesized to influence changes in depressive symptoms (e.g., concurrent intimate partner violence, mental health treatment).

Depression—Depressive symptoms were measured using the Beck Depression Inventory-II (BDI-II) (A. Beck, Steer, & Brown, 1996). The BDI-II is one of the most widely used self-report screens of depressive symptomatology, with strong reliability and validity properties. It consists of 21 items in which mothers indicate presence and severity of depressive symptoms by endorsing one of four statements reflecting degree of severity. The BDI-II is not used to specifically diagnose MDD, however, a total score is derived, and clinical cutoffs are used to categorize depression as minimal, mild, moderate, or severe. The BDI-II was administered at enrollment and at 9 months following the first home visit.

In the first phase of the study, we described the severity of depressive symptoms at both time points using the widely applied clinical cutoff of ≥ 14 , which comprises the mild-severe ranges (A. Beck et al., 1996). However, concern has been expressed (C. Beck & Gable, 2001) that measures of depression during pregnancy and postpartum may be vulnerable to inflation secondary to the overlap of some depressive symptoms with common symptoms of this period (e.g., fatigue). In the second phase of the study, changes in depressive symptoms were examined, and it was necessary to account for this vulnerability. Accordingly, the conservative approach described by Spinelli and Endicott (2003) was adopted in which those items comprising the somatic factor of the BDI-II (Salamero, Marcos, Gutierrez, & Rebull, 1994) were dropped and analyses conducted with an adjusted score.

Historical variables—Interpersonal trauma occurring during childhood and prior to enrollment was measured using the Trauma Inventory (TI). The TI is comprised of the trauma items in the Kiddie-SADS-PL (Kaufman, Birmaher, Brent, Rao, & Ryan, 1996), a semi-structured interview. Mothers indicated whether or not, prior to enrollment, they had experienced any of six traumas: witnessed intimate partner violence, witnessed violent crime, been victims of a violent crime, experienced intimate partner violence, been victims of physical abuse, or been victims of sexual abuse or sexual assault. For the sample, 74.1% of mothers experienced some type of interpersonal trauma prior to enrollment (witness intimate partner violence—43.7%; witness violent crime—32.7%; intimate partner violence—28.2%, physical abuse—26.7%, sexual abuse or assault—31.2%, victim of violent crime—13.4%). Of those reporting a trauma history, 68.9% had experienced two or more types. For purposes of analysis, a variable called interpersonal trauma history was constructed reflecting four levels of trauma experience: none (25.9%), witnessing violence only (17.7%), direct experience of violence only (15.7%), both witnessing and direct experience of violence (40.7%). Although the ranges and types of experiences were likely to be heterogeneous in this sample, the four categories represent a sequential hierarchy of directness of violence experiences (none, witness, direct experience) and multiple types of experience (none, witness or direct experience alone, both witness and direct experience), thereby allowing for examination of these trauma parameters on depressive symptoms and changes in symptoms over time. The TI was administered at enrollment.

Social Support—Social support was measured at enrollment using five items taken from the Social Provisions Scale (Russell & Cutrona, 1984) reflecting adequacy of social support (e.g., “There are people I can depend on to help me if I really need it”). Items were endorsed by mothers using a 4-point Likert scale reflecting level of agreement (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). A higher score indicates greater perceived social support. The Social Provisions Scale has acceptable test-retest reliability, demonstrates good validity, and has been used with postpartum mothers (Cutrona, 1984). Cronbach’s alpha for these items was .81.

Variables measured during home visitation—Concurrent intimate partner violence was measured through maternal reports of pushing, shoving, hitting, thrown objects, or other forms of physical aggression perpetrated by a partner or other family member. Home visitors used

standardized prompts querying mothers about the aforementioned incidents during each home visit, and they documented if intimate partner violence was reported during the interval between the prior and current home visit. Mothers were categorized as having experienced intimate partner violence if it was documented during at least one home visit over the first 9 months of service. In the sample, 14.5% of mothers experienced concurrent intimate partner violence.

Additional variables included program parameters and mental health treatment. Program parameters included number of home visits received over 9 months and home visitation model (NFP, HFA). [Although both models prescribe the frequency of scheduling of home visits, there are inevitable (and permissible within each model) deviations should mothers need additional visits, and as a result of scheduled and unscheduled missed visits.] Mothers received a mean of 22.67 visits ($SD = 7.24$) over the 9 months. Mental health treatment (psychotropic medication, psychotherapy) was measured by home visitors using standardized queries at 6 and 9 months as to whether mothers received treatment during the 9 months of service. Over the 9 months, 9.9% of mothers reported receiving mental health treatment.

Statistical analysis

In the first phase of the study, the Beck Depression Inventory-II (BDI-II) was used to describe the severity of depressive symptoms in mothers at enrollment and 9 months later. Established cutoffs were used to determine clinically significant levels of symptoms and to characterize scores as elevated (≥ 14) or non-elevated (< 14). Changes in elevated versus non-elevated status were described, and means and standard deviations (reflecting clinical severity) were calculated for each level across time points. In the second phase of the study, Hierarchical Linear Modeling (HLM) was utilized to examine predictors of change in depressive symptoms over time. A two level model, in which mothers were nested within home visitors and home visitors in turn were nested within agency, was constructed. BDI-II scores at 9 months was the dependent variable and the predictor variables (at mothers' level) included interpersonal trauma history, intimate partner violence, mental health treatment, social support, and enrollment BDI-II scores. Demographic variables including race, mothers' age, and income were included as covariates. Home visitation model, agency and home visitor were also included in the HLM model as fixed effect variables to examine their impact on outcome.

As is common in large scale, community-based research, there was missing data. Specifically, there was missing data for measures of interpersonal trauma history ($n = 92$) and social support ($n = 65$). Therefore, missing values were imputed assuming that the missing data for these two variables occurred at random. The suggestion of Schafer and Graham (2002) was followed whereby missing data points were imputed using multiple imputations through a propensity score method. The propensity score is the estimated probability that a particular element of data is missing. The missing data are filled in by sampling from the cases that have a similar propensity to be missing. The multiple imputations are independent repetitions from a posterior predictive distribution for the missing data, given the observed data. To generate the imputed values, the missing data software SOLAS 3.2 (Statistical Solutions Ltd., 2001) was used. As shown by Rubin (1987) for a rate of missing data as small as 10% with five imputations the efficiency reaches greater than 98%, therefore the optimal number of imputations is five. Five imputed datasets were generated and an HLM regression was conducted on each dataset. The resulting parameter estimates were averaged and a weighted variance was calculated. From these estimates the relevant t-statistics and corresponding p-values were calculated.

Results

Depression symptoms, severity, and changes

Mean scores on the BDI-II were 12.29 (SD=8.91) at enrollment and 10.12 (SD=8.96) at 9 months, reflecting a modest decrease for all mothers over time [$t(805)=6.52, p < .001$]. We also examined prevalence and changes in depressive symptoms using the clinical cutoff of ≥ 14 to categorize mothers as depressed (elevated) or non-depressed (non-elevated) at each time point. Figure 1 shows the depression categorizations, means and standard deviations of the BDI-II for each category, and progression of mothers over time. Results indicated that 34.3% of mothers had elevated depressive symptoms at enrollment, and 25.9% were depressed at 9 months. Overall, 45.3% were depressed during at least one of the two time points.

To describe changes in symptoms, the sample was divided into four groupings based on transitions within and between depressed and non-depressed categories over the two time points: Never Depressed (54.7%; non-depressed at both enrollment and 9 months), Recovered (19.4%, depressed at enrollment but non-depressed at 9 months), Emerged (11.0%, non-depressed at enrollment but depressed at 9 months), and Persistent (14.9%, depressed at both enrollment and 9 months). Over half (56.5%) of depressed mothers at enrollment moved into the non-depressed category at 9 months. A substantial proportion (25.9%), however, became depressed or remained depressed over the 9 month interval.

Mean BDI-II scores in each elevated group at both time points exceed cutoffs typically used in clinical trials for depression treatments (Hollon et al., 2005) indicating a high level of clinical severity. Clinical significance is further demonstrated by reference to Steer, Brown, Beck, and Sanderson (2001) who provide guidance on the relationship between BDI-II scores and clinical diagnoses of major depression. These authors administered the BDI-II to adult patients independently diagnosed with mild, moderate, and severe depressive episodes, and documented mean scores for each of these severity groups. Using the mean scores for each of these severity groups (18, 27, and 34, for mild, moderate, and severe, respectively) and applying these to scores of home visited mothers, 20.0% of mothers obtained scores consistent with mild (12.1%), moderate (4.3%), and severe (3.6%) depressive episodes at enrollment. At 9 months, 16.4% had scores in these ranges (mild—9.6%, moderate—3.9%, severe—2.9%). Finally, 7.1% of mothers had such scores at both time points. Although self-reported symptoms and clinical diagnosis of major depression are separate (albeit overlapping) constructs, these comparisons provide a useful reference point from which to describe the severity of clinical presentations in the sample.

In terms of mental health treatment, mothers who were in one of the three depression groups were more likely to receive treatment over the 9 months than non-depressed mothers [14.4% vs. 5.0%; $\chi^2(3) = 29.95, p < .01$]. Specifically, mental health treatment was received by 20.0% of the Persistent, 14.1% of the Recovered, and 13.5% of the Emerged groups. There were no differences between prenatal and postnatal enrollees in their representation in the four groups [$\chi^2(3) = 2.16, p > .05$]. There were no differences between prenatal and postnatal enrollees in their representation in the four groups [$\chi^2(3) = 2.16, p > .05$].

Relationships between demographic and predictor variables

Table 1 presents Pearson bivariate correlations (for continuous variables), point-biserial correlations (for continuous and ordinal variables), and Cramer's V coefficients (for ordinal variables) between demographic and predictor variables. Interpersonal trauma history was divided into two variables, one reflecting those who have or have not witnessed violence, and the other with those with or without direct experience of violence. With the exception of BDI-II scores at enrollment and 9 months, correlation coefficients are small in size. Depressive

symptoms at both time points were consistently associated with young maternal age, lower levels of social support, witnessing and directly experiencing violence, and receiving mental health treatment. A small correlation ($r = .11, p < .01$) was found between concurrent intimate partner violence and depressive symptoms at 9 months. Number of home visits received was unrelated to depressive symptoms, demographics, or predictor variables. Additional analyses found no differences in BDI-II scores at enrollment and 9 months based on model (HFA and NFP) or race ($p > .05$).

Predictors of Change in Depression

In order to determine predictors of change in depressive symptoms from enrollment to 9 months, we conducted a HLM via SAS proc mixed procedure using those variables hypothesized to be related to depressive symptoms in this population at the mothers' level. As noted, because of the potential vulnerability of the BDI-II to inflation at enrollment due to endorsement of symptoms that overlap with common complaints of pregnancy and postpartum, an adjusted score was calculated in which eight items loading on the somatic factor of the measure were dropped (Salamero et al., 1994). Correlations between full and adapted scores were $r = .95$ ($p < .001$) for both time points.

In the first step, a random coefficient model was fitted to estimate the amount of variance in 9 month BDI-II scores that can be explained at the individual ($n = 806$), home visitor ($n = 141$), and agency level ($n = 17$). This was accomplished by allowing the intercept at each cluster level to vary randomly in the HLM model setting. Results from this analysis indicated that almost none of the variability was explained by agency (0.0%) or home visitor (1.5%) levels. Plotting the within and between (agency and home visitor) variability further revealed very little between agency and home visitor variability, but large within home visitor and agency variability (reflecting variability in mother 9 month BDI-II scores). Although the amount of variability explained at the cluster levels was small, home visitor was kept in the model for subsequent analysis because of its impact on the available degrees of freedom. Table 2 presents the regression coefficients for the predictor variables on the BDI-II at 9 months. All hypothesized predictor variables (concurrent intimate partner violence, mental health treatment, interpersonal trauma history, social support) and covariates (enrollment BDI-II score, race, mother's age, income) were kept in the model. Results indicated that interpersonal trauma history, receiving mental health treatment, young maternal age, elevated enrollment BDI-II score and being African-American (compared to Caucasian) were associated with elevated depressive symptoms at 9 months. Concurrent intimate partner violence approached, but did not reach, statistical significance ($p = .064$). Examination of interpersonal trauma history shows that all three levels of experiences predicted depressive symptoms at 9 months. However, the pattern of coefficients indicates that there were more robust relationships as the experience of violence became more direct (witness only = 1.063 vs. violence only = 1.261) and both types of trauma were combined (witness and violence = 1.703). Removing the non-significant variables such as income, social support and concurrent intimate partner violence resulted in very little change in the estimated coefficients.

Discussion

Findings from this study document the prevalence and clinical severity of depressive symptoms in mothers participating in home visitation. One-third (34.3%) of mothers presented with clinically elevated scores on a widely used depression screen at enrollment, and almost half (45.3%) exhibited elevated scores at either enrollment or 9 months later. These rates are consistent with those found in low income women (Hobfoll et al., 1995), and with other home visitation programs serving similar populations (e.g., Administration on Children Youth and Families, 2002). Measuring depressive symptoms at two time points in the first year of service

provided a more comprehensive picture of the extent of elevated symptoms experienced by mothers in contrast to single point in time administrations separated by longer intervals, and allowed for documenting patterns and change over this time period. A portion (14.9%) of mothers had elevated levels (using clinical cutoffs) at both time points, indicating a persistence of depressive symptoms. Yet, 56.5% of mothers who had elevated symptoms at enrollment were no longer depressed after 9 months. Finally, 25.9% of mothers either remained in the depressed category or became depressed by 9 months. In terms of clinical severity, it is noteworthy that, for mothers obtaining scores indicative of clinically significant depressive symptoms, mean BDI-II scores were in the moderate range and consistent with a major depressive episode (Steer et al., 2001).

For those experiencing reductions in symptoms, improvement may have occurred secondary to the natural course of depression, which is typified by periods of remission. The typical length of a depressive episode in postpartum women is about 1–6 months, and the 9 month interval between administrations of the BDI-II is sufficiently long for some mothers to have improved regardless of intervention (Eaton et al., 2008). Changing circumstances (e.g., decreased stress) may have contributed to lowered scores over time. Our data do not directly address the role of home visiting in changes in depressive symptoms. Research has indicated that home visitation has little effect on depressive symptoms (e.g., Duggan et al., 2007; Mitchell-Herzfeld, Izzo, Greene, Lee, & Lowenfels, 2005) and the finding that home visitor and agency features did not meaningfully contribute to variability in change over time is consistent with these results.

It is possible that BDI-II scores were inflated at enrollment (which included the late pregnancy and early postpartum periods) because of the overlap of somatic symptoms of depression and the typical physical discomforts of pregnancy and the postpartum period (i.e., sleep disturbance, fatigue). This concern has been extensively discussed in the literature (C. Beck & Gable, 2001). Yet, although the prevalence of depression was higher at enrollment (34.3%) in contrast to 9 months later (25.9%), the overall rates at both time points were quite high. Also, mean BDI-II scores of mothers classified as depressed at either time point are very similar and reflect clinically significant elevations. Finally, there were no differences between mothers enrolled prenatally or postnatally on representation in the four groups reflecting changes in depressive symptoms over time. Nonetheless, in examining predictors of change in depressive symptoms over time, a conservative approach was utilized in that the BDI-II was recalculated omitting the somatic items. This analysis identified several theoretically meaningful and hypothesized predictors which, in turn, were also related to elevated depressive symptoms at each time point.

Several variables were associated with depressive symptoms and predicted change in scores over time. Interpersonal trauma history was associated with higher depression scores and a stable or worsening manifestation of symptoms over time. This is consistent with a growing body of literature linking trauma and violence to psychiatric distress in general, and depression in particular (Golding, 1999). A large proportion (74.1%) of mothers had a history of violence and trauma prior to enrollment, underscoring the significant clinical presentations of these participants in a prevention program. Both witnessing violence and experiencing violence directly were predictive of depressive symptoms, and the combination of the two was most strongly related to BDI-II scores at 9 months. These findings underscore that experiencing violence in either indirect or direct forms early in life can have profound negative impacts on psychological adjustment at later time points, and these in turn are manifested in the context of participating in a prevention program.

A smaller proportion (14.5%) of mothers reported having been the victims of intimate partner violence during home visitation. This rate is lower than has been found in other home visitation programs, which range from 19% to 29% (Duggan et al., 2007; Mitchell-Herzfeld, Izzo,

Greene, Lee, & Lowenfels, 2005). Discrepancies in rates are in part attributable to use of differences in definitions of intimate partner violence, measures used, and time intervals covered. Concurrent intimate partner violence did not reach statistical significance in the hierarchical linear model, but trended towards contributing to increased depressive symptoms. Maternal age was also related to depressive symptoms, in that younger mothers had higher BDI-II scores at both time points and were less likely to improve over time than their older counterparts. Although social support was associated with depressive symptoms at both time points, this variable was not a significant predictor of change when considered in conjunction with other variables. Neither type of home visitation model nor number of home visits was associated with the presentation or change in symptoms of depression over time, suggesting that depression is a likely problem for all prevention programs of this type.

The finding that mental health treatment was associated with an increase in symptom severity instead of improvement over time is, at first glance, paradoxical. However, mental health treatment was a proxy for severity of depressive symptoms. Possibly they were more effective in helping these mothers obtain treatment in contrast to those with mild or moderate symptom levels, or that severely affected mothers may have been willing or motivated to seek treatment. Still, only 14.4% of women with elevated depressive symptoms received treatment, and a sizable proportion of untreated mothers likely warranted evaluation and treatment. As part of their efforts to link mothers to other needed services in the community, home visitors were trained to refer mothers with elevated scores to primary care physicians or community mental health centers. There are numerous barriers to obtaining mental health treatment in low income women, no doubt contributing to the small percentage receiving treatment. Other home visitation programs have examined receipt of mental health treatment, reporting rates of receiving treatment between 8%–32% (Administration of Children, Youth, and Families, 2002; Jacobs & Easterbrooks, 2005; Klagholz, 2005; LeCroy & Milligan Associates, Inc., 2006). Differences between programs in reported rates are at least partly attributable to measurement (different definitions, sources of information, time intervals) and contextual (availability of mental health services, barriers to obtaining services) factors. Our measure of mental health treatment is inadequate to answer more complicated questions about the relationship between depressive symptoms and treatment, such as adherence or type of treatment received. However, several studies have documented the relatively modest effectiveness of mental health treatment delivered in community settings (Weersing & Weisz, 2002), suggesting that increasing referrals to such services may only have a modest impact on mental health outcomes, and underscoring the need to develop better ways to provide effective treatment to new, low income mothers.

The relatively small percentage of depressed mothers who receive mental health treatment (Lennon, Blome, & English, 2001) further suggests that home visitors may be the primary providers of services in general for this population. It is essential that prevention programs address maternal depression proactively, as sufficient help is unlikely to come from mental health care systems that are already overburdened. At a minimum, home visitors should be trained in the identification of depression in order to facilitate recognition and referral to mental health treatment providers. Indeed, failure to identify and effectively treat depression early may impart risk for severe and recalcitrant depression later in life (Judd et al., 2000). Research on training nurse home visitors to screen for depression postpartum has demonstrated the utility of this strategy (Holden, 1996) and deserves widespread dissemination. Intensive interventions may also be needed. Recently, Ammerman et al. (2007, 2005) described In-Home Cognitive Behavior Therapy, an intensive treatment for depressed mothers in home visitation that is delivered in the home by a trained therapist and is tightly integrated with ongoing home visitation in order to facilitate recovery.

African American mothers were more likely to have higher depressive symptoms at 9 months than their Caucasian and other race counterparts. Although African Americans have been found to have lower rates of depression compared with other races and ethnic groups, recent research suggests that they are more likely to have chronic depression. Williams et al. (2007) reported that, among adults with Major Depressive Disorder, 56.5% of African Americans had a chronic course, in contrast to 38.6% of Caucasians. Although we measured depressive symptoms over a 9 month interval rather than the psychiatric diagnosis of MDD, the finding that African American mothers were likely to have elevated symptoms at 9 months is consistent with the patterns reported by Williams et al. It is also widely acknowledged that depression is under-recognized in African American women, and that they face considerable barriers in obtaining treatment relative to males and other races (Das, Olfson, McCurtis, & Weissman, 2006). In our study, there were no racial differences in receiving mental health treatment, although the overall rate the overall sample was low. African American women face numerous ecological challenges that increase vulnerability to depression, and the chronic nature of many of these factors may promote persistence of symptoms over time. This underscores the importance of addressing the unique social and emotional needs of African American women in home visitation.

There are several strengths to this study that advance the literature. First, we obtained a sample from a community-based, scaled up home visitation program, which enhances the relevance and external validity of the findings. Second, this is the first study of maternal depression in home visitation to consider two national models of service (HFA, NFP). Much of the research on home visitation examines only one model, thereby precluding identification of common elements and distinctive features of different models. In the current study, we found that the prevalence and severity of maternal depressive symptoms was similar in both models, underscoring the universal challenges of depression in these prevention programs. Third, this is one of the few studies that examines changes in depressive symptoms in the context of ongoing home visitation. Studying depression at multiple time points allows examination of both the manifestation of depressive symptoms in general as well as changes over time, which may have differential implications for future intervention. In the current study, although there was overlap in the variables that significantly predicted depressive symptoms at either time point and changes in scores over time, there were also differences in the types of variables and strengths of association. Fourth, the sample size ($N = 806$) was larger than that typically found in home visitation research. Fifth, we examined maternal depression across a wide age range, covering adolescence through adulthood. Many home visitation programs target circumscribed age ranges, yet an expanded age range allows for consideration of the relationship between maternal age and depression. Sixth, this is the first study of which we are aware that examines both historical interpersonal trauma and concurrent intimate partner violence in the manifestation of and changes in depressive symptoms in home visitation.

There were also limitations to this study that must be considered. First, the lack of a control group that did not receive home visitation prevents contrasting the manifestation of and changes in depressive symptoms in mothers receiving home visitation with mothers who did not receive home visitation. The study design allowed us to describe prevalence and change of depressive symptoms in home visited mothers, and to contrast differences between those who did and did not exhibit significant depressive symptoms, or differences in symptoms over time within and between these mothers. Such analyses are useful to the prevention field, although inclusion of a non-visited control group would have permitted description of differential manifestations and changes in depressive symptoms in a similar population not receiving home visitation. Second, our sample consisted of mothers who were self-selected in that they volunteered to participate in a prevention program designed to optimize their children's developmental outcomes and improve their lives. This limitation is true of all studies of prevention programs in which participants voluntarily join interventions. Yet, as a result, applying findings from

this study to demographically similar mothers who have not joined prevention programs (perhaps because they are disinterested or less motivated) must be made cautiously. A third limitation is that we used a screening tool and did not diagnose depression using a standardized clinical interview. Although the BDI-II is a widely used and well-validated measure, it is not a proxy for a comprehensive diagnostic interview. A fourth limitation is subject attrition. Although common in home visitation programs, full sample retention would have been desirable. The lack of differences between retained and dropped out subjects on demographics and BDI-II scores at enrollment suggest no systematic bias on these variables. However, African Americans were more prevalent in the dropped out group than other racial groups, and this is a potential confound that warrants caution in interpreting results. It is possible that African American women with improved symptoms in depression over time were more likely to drop out. The fact that enrollment BDI-II scores had the strongest predictive relationship with 9 month scores, and there was no difference between retained and dropped out subjects on depression at enrollment, argues against (but does not eliminate concerns about) such a confound. A fifth limitation is the reliance on maternal self-report for much of the data. Possibly mothers with high levels of depressive symptoms are more willing to report intimate partner violence and trauma history than those with low symptom levels, thereby potentially inflating the associations among these variables. In addition, the use of face to face interviews to obtain information about intimate partner violence and trauma history may have increased the likelihood of socially desirable reporting, which would potentially lead to under reporting. For interpersonal trauma history, this concern is offset by the high rate of reported maltreatment which is inconsistent with a systematic reluctance to reveal such information. Finally, a sixth limitation is the documentation of the occurrence only of intimate partner violence and mental health treatment, precluding identification of missed prompts and potentially leading to under reporting of these variables.

Future research should also build upon and expand areas of inquiry based on our findings. Extending the time period to monitor longer term changes in depressive symptoms is needed. Home visitation programs typically cover the first 2 to 3 years of the child's life, and the current study's focus on the first 9 months of service does not allow for examination of maternal depression in the second and third years of service. Research has demonstrated that exposure to even one episode of maternal depression in early childhood can have deleterious consequences for subsequent social and emotional development (Hay et al., 2003), underscoring the need to examine prevalence throughout home visitation. Depression is multidetermined, and numerous variables have been identified that contribute to or covary with elevated symptoms (Goodman & Gotlib, 1999). The current study focused on interpersonal trauma history and concurrent intimate partner violence, in conjunction with social support and demographics. Examination of the relative contributions of these factors, when examined along with other potentially important variables, is warranted. To this end, a more fine grained measurement of interpersonal trauma and concurrent intimate partner violence, including detailed explication of trauma parameters and the dynamic interplay of intimate partner violence and depressive symptoms, may provide additional elucidation. Regarding receipt of mental health treatment, closer tracking of the processes by which mothers with elevated depressive symptoms are identified, referred for treatment, and subsequently receive treatment is needed. Such an approach would help determine where in the sequence opportunities exist to enhance the linkage of mothers to mental health services in the community.

An important but understudied issue is psychiatric comorbidity in mothers with depressive symptoms. Comorbidity is high in depression, with about 72.1% of depressed adults presenting with at least one additional concurrent psychiatric disorder (Kessler et al., 2003). In a study of 26 mothers in home visitation who were psychiatrically evaluated prior to treatment for depression, 54.5% had a second psychiatric condition (Ammerman et al., 2005). Comorbidity can complicate identification of depression, undermine effectiveness of treatment, and may

further negatively impact child development. Expanding measurement of mental health to other types of psychiatric symptoms in addition to depression is needed to comprehensively characterize the emotional and behavioral adjustment of mothers in home visitation. A second area in need of additional research is the impact of maternal depression and its interrelationship with concurrent intimate partner violence on home visitation outcomes. It is unclear if maternal depression mitigates the benefits of home visitation, or if mothers and children receiving such services show gains in spite of clinically elevated symptoms.

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Figure 1.

Percentages, means and standard deviations, and progression of BDI-II scores at enrollment to nine months. Elevation of symptoms are categorized as depressed (≥ 14) or non-depressed (< 14).

Table 1

Relationships between BDI-II scores and selected variables, and means and standard deviations for continuous variables. Associations between continuous or ordinal and continuous variables are Pearson coefficients, and between ordinal variables are Cramer's V coefficients.

	2	3	4	5	6	7	8	9	10	11	Mean (SD)
1. BDI-II en	.44**	-.08*	.03	-.18**	-.01	-.01	.09*	.17**	.05	.23**	12.29 (8.91)
2. BDI-II 9mo		-.11**	.03	-.10**	-.05	-.04	.14**	.18**	.11**	.20**	10.12 (8.96)
3. Age			.05	.09*	.02	.23**	-.05	.04	-.01	.05	20.40 (3.96)
4. Visits				-.04	.03	.03	.05	.03	.00	.01	22.67 (7.24)
5. SPS					.06	.03	-.06	-.06	-.03	-.12	16.79 (2.65)
6. Income [†]						.05	.02	.02	.03	.02	
7. Educ [†]							.11*	.05	.06	.03	
8. ITH—Wit [†]								.32**	.02	.01	
9. ITH—Vio [†]									.10**	.15**	
10. IPV [†]										.11**	
11. MHTxt [†]											

BDI-II en = BDI-II enrollment, BDI-II 9mo = BDI-II nine month, Age = mother's age, Income = income level—low vs. average/high, Educ = education level—<12 years, high school degree, some college, college degree, Visits = number of home visits over 9 months, SPS = Social Provisions Scale, ITH—Wit = witnessing violence vs. no witnessing violence, ITH—Vio = direct experience of violence vs. no direct experience of violence, IPV = intimate partner violence during home visitation—yes vs. no, MHTxt = mental health treatment over 9 months—yes vs. no

[†] Indicates ordinal variable.

* $p < .05$,

** $p < .01$

Table 2
Results from the HLM model with mother (n = 806), home visitor (n = 141), and agency (n = 17) levels.

<u>Fixed Effects</u>				
Variable	Coefficient	SE	T-value	P-value
Intercept	3.131	1.5540	2.015	0.044
BDI-II at Enrollment	0.358	0.031	11.383	0.000
Mental Health Treatment (yes)	1.970	0.583	3.381	0.001
Interpersonal Trauma History				
Witness only vs. none	1.063	0.531	2.001	0.046
Violence only vs. none	1.261	0.558	2.260	0.024
Witness and Violence vs. none	1.703	0.438	3.885	0.000
Concurrent Intimate Partner Violence (yes)	0.879	0.475	1.852	0.064
Social Provisions Scale	-0.002	0.064	-0.033	0.973
Mother Age	-0.094	0.042	-2.209	0.027
Race: AA vs. Caucasian	0.957	0.405	2.361	0.018
Race: Other vs. Caucasian	1.098	0.869	1.263	0.206
Income (low)	-0.208	0.611	-0.340	0.734
<u>Random Effects</u>				
	Estimate			
Mother level	21.459			
Home visitor level	0.329			
Agency level	0.000			