



Published in final edited form as:

*Matern Child Health J.* 2014 August ; 18(6): 1532–1539. doi:10.1007/s10995-013-1394-7.

## The Relationship Between Parental Stress and Postpartum Depression Among Adolescent Mothers Enrolled in a Randomized Controlled Prevention Trial

**Kartik K. Venkatesh,**

Department of Obstetrics and Gynecology, Massachusetts General Hospital and Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Maureen G. Phipps,**

Department of Obstetrics and Gynecology, Women and Infants Hospital of Rhode Island, 101 Dudley Street, Providence, RI 02905, USA; Program in Public Health, Department of Epidemiology, Brown University, Providence, RI, USA; Alpert Medical School, Brown University, Providence, RI, USA

**Elizabeth W. Triche,** and

Program in Public Health, Department of Epidemiology, Brown University, Providence, RI, USA; Alpert Medical School, Brown University, Providence, RI, USA

**Caron Zlotnick**

Department of Obstetrics and Gynecology, Women and Infants Hospital of Rhode Island, 101 Dudley Street, Providence, RI 02905, USA; Department of Psychiatry and Human Behavior, Butler Hospital, Providence, RI, USA

Kartik K. Venkatesh: kvenkatesh@partners.org; Maureen G. Phipps: mphipps@wihri.org

### Abstract

Given the high co-occurrence of depression and parental stress among adolescent mothers, we evaluated the relationship between parental stress and postpartum depression among primiparous adolescent mothers. We conducted an observational analysis among a cohort of 106 adolescent mothers at 289 postpartum visits who were enrolled in a randomized controlled trial to prevent postpartum depression. Parental stress was measured using the Parenting Stress Index, short form. The Structured Clinical Interview for DSM-IV Childhood Diagnoses was administered to assess for postpartum depression; subthreshold depression was assessed using the Children's Depression Rating Scale, revised version. Generalized estimating equations were utilized to assess the relationship of parental stress on postpartum depression during the first 6 months postpartum. We present adjusted odds ratios (AOR) controlling for study arm, age, born in the United States, prior history of depression, and number of study visits. The median age was 16 years, 53 % were Latina, and 16 % reported a past history of depression. Nineteen adolescents (19 %) were diagnosed with postpartum depression and 25 % experienced high levels of parental stress through 6 months postpartum. Adolescent mothers who reported higher levels of parental stress were at significantly increased risk for postpartum depression [AOR 1.06 (95 % CI 1.04–1.09);  $p <$

0.0001]. High levels of parental stress predicted subsequent postpartum depression when assessing parental stress at visits prior to a depression diagnosis to determine whether we could establish a temporal association [AOR 1.06 (95 % CI 1.02– 1.09);  $p < 0.01$ ]. Parental stress was also a risk factor for subthreshold depression [AOR 1.04 (95 % CI 1.01– 1.07);  $p < 0.01$ ]. Parental stress was a significant risk factor for developing both postpartum depression as well as subthreshold depression among adolescent mothers. Interventions that target a reduction in parental stress may lead to less depression severity among primiparous adolescent mothers.

## Keywords

Teenage; Pregnancy; Depression; Social support; Parental stress

---

## Introduction

Adolescent parenting remains a challenging public health issue and despite decreases in adolescent pregnancy rates over the last decade, approximately 400,000 American women aged 15–19 give birth each year [1]. Estimates of adolescent depression during the postpartum period vary from 25 to 60 % [2, 3]. In comparison, it is estimated that between 5 and 25 % of adult women experience postpartum depression, depending on the assessment method, the timing of the assessment, and population characteristics [4]. Adolescent parenting can be challenged by family dysfunction, emotional immaturity, life stress, and a lack of social support [5]. Effective parenting is considered a key element to enhancing child health and psychosocial outcomes for adult mothers [6].

Parenting stress is defined as an imbalance between the perceived demands of parenting and the perceived available resources [7]. Parenting stressors, such as the affordability of childcare services, daily caretaking hassles including feeding and sleeping problems, excessive crying and illness, child temperamental difficulties, and balancing work-family demands, have all been associated with a greater risk of depressive symptoms [8–10]. Adolescent parents compared to their adult counterparts are more likely to experience parental stress due to developmental immaturity, inability to think abstractly, living in poverty, having experienced ineffective parenting, poor limit setting, and high family dysfunction [11–13]. Prior data have suggested that women with postpartum depression are less attached to their infants, find their infants more demanding, and experience significant parenting stress compared to those without depression, and that these interactional difficulties may persist beyond the first year postpartum [2, 14, 15].

Current studies have generally analyzed both parental stress and depression concurrently limiting the ability to assess for a temporal association, and have not assessed parental stress and depression repeatedly over time using longitudinal analytical techniques [8]. When parental stress and postpartum depression are assessed at the same time it is not possible to elucidate whether parental stress predisposes adolescent mothers to then develop postpartum depression compared to adolescent mothers with postpartum depression having a concurrently increased perception of stress. Additionally, adolescents who have clinically relevant symptoms of major depression without meeting the full criteria for this condition

(i.e. subthreshold depression) may not only be at risk for later depression, but also for other deleterious psychosocial outcomes [16, 17]. To date studies have not assessed whether high parental stress is a risk factor for subthreshold depression, particularly among adolescent mothers.

Given the high co-occurrence of reported depression and parental stress among adolescent mothers, we hypothesized that adolescents who reported high levels of parental stress would be at risk for postpartum depression. Parental stress was defined using a standardized questionnaire and postpartum depression was defined as a major depressive disorder by psychiatric diagnostic interview within 6 months after delivery. The current analysis utilizes data from a randomized controlled trial to prevent postpartum depression among primiparous adolescent mothers; however, this trial did not target parental stress. We examine the impact of parental stress on predicting the development of postpartum depression among adolescent mothers. In sensitivity analyses, we also assessed: (1) whether the impact of parental stress on postpartum depression remained when restricting the assessment of parental stress to visits prior to a diagnosis of postpartum depression to determine temporality; and (2) whether parental stress was a risk factor for subthreshold depression after adjusting for the effects of the intervention.

## Methods

### Study Setting

The current study is a secondary observational analysis of the original randomized controlled prevention REACH (Relaxation, Encouragement, Appreciation, Communication, and Helpfulness) trial. The primary analysis found that an intervention based on interpersonal theory (IPT) reduced the risk of postpartum depression among primiparous adolescent mothers at 6 months postpartum [18]. Further details about the original trial design and development can be found elsewhere. Briefly, the attention and dose matched didactic control condition involved using the *Baby Basics: Your Month by Month Guide to a Healthy Pregnancy* book as a guide [19]. The control program provided information about maternal health throughout pregnancy and the early postpartum period, fetal development, nutrition, preparing for labor, and getting the house ready for taking home a baby. Stratified block randomization was employed to maintain balanced groups with regards to a prior history of depression. Because the intervention aimed to prevent postpartum depression, the intervention and control programs included five sessions that were delivered individually during the prenatal period.

This study was approved by the Institutional Review Board at Women and Infants Hospital of Rhode Island (Providence, RI). All participants were consented by obtaining consent from her legal guardian and assent from the minor participant.

### Participants

Participants were recruited between February 2007 and August 2008 through an urban prenatal clinic. Eligible women were 17 years of age when they conceived their pregnancy and < 25 weeks of gestational age at their first prenatal visit. Exclusion criteria included:

receiving mental health services from a healthcare provider, meeting criteria for a current affective disorder, substance use disorder, anxiety disorder (excluding simple phobia), or psychosis determined by the Structured Clinical Interview for DSM-IV Childhood Diagnoses (KID-SCID) [20]. Adolescents who met these criteria were excluded because Project REACH was designed as a prevention program and not for treatment of these disorders.

### **Study Measures**

Socio-demographic characteristics were assessed at baseline prior to randomization. Parenting stress and depression assessments were completed at three postpartum time points, namely at 6 weeks, 3 months, and 6 months. All assessments were delivered by trained research assistants who were blinded to study group assignment.

### **Baseline Assessment**

Participants completed a pre-intervention assessment, which collected data on socio-demographic characteristics, reproductive history, and substance use.

### **Parental Stress**

Parental stress was measured using the Parenting Stress Index, short form (PSI), which examined the level of stress within the parent–child system and consisted of factors reflecting parental coping and perceptions of the child. The PSI had 36 items in total with 12 items in each of three subscales, measuring parental distress, parent–child dysfunctional behavior, and difficult child interactions [21]. Participants used a 5-point scale that indicated the degree to which they agreed with each statement; all three sub-scales had score ranges of 12–60, and the composite total stress scale had a score range of 36–180. Higher scores indicated greater levels of parental stress. Briefly, the parental distress subscale analyzed feelings of parental incompetence, stress associated with restrictions on lifestyle, conflicts with the child's other parent, lack of social support, and depression. The parent–child dysfunctional interactions subscale provided an indication of parental dissatisfaction with interactions with their children and the degree to which they found their children unacceptable. The difficult child subscale measured behavioral characteristics of children that made them easy or difficult to manage. This instrument had been successfully utilized in prior studies with mothers and their infants [7]. This measure was utilized as a continuous measure in analyses because a cut-off score for high versus low parental stress using the PSI has not been uniformly defined and validated. The calculated odds ratio reflected an incremental change in the odds of developing postpartum depression resulting from a one-unit change in the parental stress score. When describing our results, a total stress score above the 85 % percentile was considered abnormally high, which was consistent with prior studies [7]. The Cronbach's  $\alpha$  value for the total stress score was 0.92 and for parental distress, parent–child dysfunctional behavior, and difficult child interactions was 0.88, 0.89, and 0.79, respectively.

## Postpartum Depression

The KID-SCID was used to assess for a major depressive disorder; a prior history of depression, which was utilized as one of the strata for block randomization, was assessed at baseline with the KID-SCID. The KID-SCID is a semi-structured interview that assesses DSM-IV axis I disorders [20]. Delivery was used as a clear and consistent marker for measuring the onset of postpartum depression. Given that most investigators classify a major depressive episode that occurs within the first 6 months after delivery as postpartum depression and among teens a third have scores that indicate a depressive episode within 4 months postpartum [2, 22], we utilized data up to 6 months postpartum. Hence, postpartum depression was defined as a major depressive disorder within 6 months after delivery.

Subthreshold depression was defined using the Children's Depression Rating Scale, revised version (CDRS-R), a reliable clinician-rated scale consisting of 17 symptom areas used to determine the severity of depression in children [23]. The CDRS-R, derived from the Hamilton Rating Scale for depression, has demonstrated high internal consistency and good inter-rater reliability [24, 25]. After excluding visits at which participants were diagnosed with a major depressive disorder using the KID-SCID as well as consequent follow-up visits among these participants, we utilized a CDRS-R score  $\geq 9$  to define subthreshold depression, which is concordant with earlier studies [26].

## Statistical Analyses

The primary outcome was a diagnosis of postpartum depression, and once participants met criteria for diagnosis, they were considered to have postpartum depression at all follow-up study visits. Parental stress was assessed as a time-varying covariate at each study visit. The distribution of PSI scores was assessed for normality. We employed generalized estimating equations (GEE) with an exchangeable correlation structure to assess the relative contribution of parental stress on postpartum depression due to the time varying covariation of longitudinal data [27, 28]. Consistent with clinical trials epidemiology, randomization variables were adjusted for in regression models to improve the accuracy of results [29]. The intervention program (i.e. the randomization factor) and a prior history of depression (i.e. the stratification factor for randomization) were included as covariates in all models a priori. Additional covariates were introduced to assess potential confounding based on a change of at least 10 % of the beta coefficient. We controlled for time-dependent changes in postpartum depression and parental stress by adjusting for the number of study visits. In sensitivity analyses, we assessed: (1) the temporality of parental stress preceding postpartum depression by lagging visits at which parental stress was measured, so that parental stress was taken from the visit prior to the assessment of postpartum depression [30]; and, (2) whether parental stress was also a risk factor for subthreshold depression after excluding women who were diagnosed with postpartum depression. Since parental stress was measured using a continuous scale, we present adjusted odds ratios (AOR) for each one-unit increase in parental stress scores on postpartum depression. All analyses used STATA (STACORP, version 10.0, College Station, TX) and SAS (SAS Institute, version 9.2, Cary, NC) software.

## Results

### Participant Characteristics

Overall, 106 adolescent mothers completed the behavioral intervention (54 in the REACH program and 52 in the control condition) and provided 289 postpartum study visits. Table 1 presents socio-demographic and psychological characteristics overall. The median age was 16 years; over a half of the participants were Latina (53 %), 17 % were black, and 16 % were white. Most adolescent mothers (77 %) were enrolled in school and 19 % had completed 12th grade. Almost three-fourths of the participants lived with their biological mothers, and most (59 %) reported changing housing within the past year. With regards to psychological characteristics, 16 % of participants reported a history of depression prior to the study. Almost all participants (93 %) reported their families were emotionally supportive of their pregnancy. Over three-fourths of adolescent mothers believed the father of the baby would definitely be involved in childcare. Only 9 % of participants reported their current pregnancy was intended, and 32 % believed now was a good time in life to be pregnant.

### Frequency of Postpartum Depression and Parental Stress

A total of 19 adolescent mothers (19 %) met criteria for postpartum depression through 6 months postpartum. After excluding the 19 participants who were diagnosed with postpartum depression, 26 adolescent mothers (30 %) met criteria for subthreshold depression at a total of 34 follow-up visits. Twenty-eight participants (26 %) at 41 postpartum visits had high levels of parental stress (defined as >85th percentile on the PSI). Table 2 presents PSI scores overall and by subscale for participants with and without postpartum depression. The mean total score for parental stress was 64.9 (SD 15.9); those for parental distress, parent-child dysfunctional interactions, and difficult child were 25.0 (SD 8.3), 18.6 (5.6), and 21.4 (5.5), respectively. Adolescent mothers with postpartum depression had significantly higher scores for total parenting stress, parental distress, parent-child dysfunction, and a difficult child ( $p < 0.01$ ). Parental stress did not differ between having male infants relative to female infants.

### Impact of Parental Stress on a Diagnosis of Postpartum Depression

Table 3 presents the crude and multivariate analysis of the association between total parenting stress, as well as the three parental stress subscales, and postpartum depression. In the multivariate analysis, higher levels of total parenting stress were significantly associated with a diagnosis of postpartum depression [AOR 1.06 (95 % CI 1.04–1.09);  $p < 0.0001$ ]. By subscale, parental distress [AOR 1.13 (95 % CI 1.07–1.18);  $p < 0.0001$ ], parent-child dysfunctional interactions [AOR 1.06 (95 % CI 1.00–1.13);  $p = 0.03$ ], and child difficulty were significant predictors of postpartum depression [AOR 1.07 (95 % CI 1.00–1.14);  $p = 0.04$ ].

### Sensitivity Analyses

Table 4 presents the sensitivity analyses of the impact of parental stress on postpartum depression when lagging the exposure, and the impact of parental stress on subthreshold depression. When parental stress was lagged so that the exposure was taken from the study



visit prior to being diagnosed with postpartum depression, total parenting stress remained a significant predictor of postpartum depression [AOR 1.06 (95 % CI 1.02–1.09);  $p < 0.01$ ]. This association held for both the parental distress and parent–child dysfunctional interactions subscales. After excluding adolescent mothers who met criteria for postpartum depression, parental stress continued to be a significant risk factor for subthreshold depression [AOR 1.04 (95 % CI 1.01–1.07);  $p < 0.01$ ]. This association held for both the parental distress and difficult child subscales.

Though in prior analyses the REACH trial had a protective effect against developing postpartum depression, the REACH trial did not have a significant impact on parental stress [adj.  $\beta$  –1.51 (95 % CI –7.00 to 3.99);  $p = 0.59$ ].

## Discussion

In this study conducted primarily among minority primiparous adolescent mothers in an urban setting, 19 % of adolescent mothers met criteria for postpartum depression through 6 months postpartum. Participants with higher levels of parental stress were at significantly increased risk of developing postpartum depression, which held for all three parental stress subscales, namely parental distress, parental-child dysfunctional interactions, and child difficulty. Importantly, these results were robust to parental stress preceding the development of postpartum depression. Additionally, we found that after excluding adolescent mothers who developed postpartum depression, parental stress also predicted the development of sub-threshold depression. We used longitudinal analytical methods in which the association between parental stress and depression was analyzed repeatedly over time, and this association persisted at follow-up visits after a diagnosis and consequent referral and treatment for depression. These findings add further epidemiologic evidence for a possible causal association between parental stress and postpartum depression [30]. This study supports emerging data from adolescent mothers showing that postpartum depressive symptoms are associated with decreased maternal confidence in their ability to parent [5, 31], and interventions that target a reduction in parental stress may lead to less depression severity among adolescent mothers [6].

In the current study, a quarter of adolescent mothers demonstrated a high level of parental stress (i.e. >85th percentile), which is concordant with observational studies conducted among first-time adult mothers [32]. Parenting can be stressful for primiparous adolescent mothers, particularly those with postpartum depression, in the setting of limited social and financial support [8]. Adolescent mothers may be unable to adequately respond to infant cues and are less prepared for parenthood compared to adult parents [33]. In a meta-analysis of the early interactions of depressed mothers with their infants, mothers who were depressed within the first 3 months of giving birth were found to be more irritable and hostile, to be less engaged, to exhibit less emotion and warmth, and to have lower rates of play [34, 35]. Given that all adolescent mothers enrolled in the current study were primiparous, they were likely inexperienced at being parents and may have lacked the responsiveness and emotional resilience of multiparous mothers. It is possible that mothers with higher levels of parental stress experience lower self-efficacy, as well as more anxiety, predisposing them to depression. A recent study conducted among adolescent mothers found

that those experiencing high levels of parental stress were at increased risk for difficult maternal adjustment and high postpartum emotional distress [36].

The exact causal mechanism by which parental stress leads to postpartum depression remains to be elucidated, and it is possible that it may be a bidirectional relationship. The current study calculates the odds of developing postpartum depression associated with an incremental one-unit change in the PSI. The effect size of a continuous measure (i.e. parental stress) can be difficult to interpret. Future studies should be conducted to define and validate PSI cut-off scores associated with high versus low parental stress, which would allow for identifying adolescents at highest risk for parental stress; this subset of adolescent mothers may be at greatest need for interventions to prevent postpartum depression.

After excluding participants who developed postpartum depression, almost a third of the adolescent mothers met criteria for subthreshold depression. The frequency of subthreshold depression was higher compared to that reported in some earlier studies conducted among adolescents [17]. These differences may reflect specific features of the study population as well as methods used to define subthreshold depression. Given that both subthreshold depression and a major depressive disorder have similar etiologic profiles, cause a substantial level of impairment, and have similar risk factors, it is plausible that parental stress serves as a risk factor for both conditions [16]. Emerging data suggest that individuals with subthreshold depression do not have similar outcomes when compared with asymptomatic individuals, and they have an increased risk for subsequent major depression and adverse health outcomes [17].

There are several study limitations. This secondary analysis utilized data from a randomized controlled trial to prevent postpartum depression. This study was limited to adolescent mothers who were enrolled in a behavioral intervention. Although the trial was not powered for the current study, the analysis was based on an a priori secondary hypothesis, and appropriate analytical techniques were employed, including adjusting for the intervention and block randomization scheme in the regression models. Despite a relatively small sample size, we utilized a robust number of postpartum study visits through longitudinal modeling. A larger sample size with follow-up beyond 6-months postpartum is warranted to determine the later impact of parental stress on maternal and infant outcomes, as well as to examine the influence of race and other sociodemographic factors on the association between parental stress and postpartum depression. Additionally, we utilized a self-reported measure of parental caregiving activities. The PSI may inadequately measure parental stress; therefore, further prospective longitudinal studies are needed to assess parental stress observationally in a naturalistic setting and to evaluate more detailed measurements of parenting style and behaviors. Unlike the current study definition for postpartum depression, we defined subthreshold depression using a validated screening tool rather than a diagnostic instrument. However, to our knowledge, this is the first study to assess whether parental stress predicted subthreshold depression among adolescent mothers.

A particular strength of this study is the longitudinal measurement of parental stress and depression at multiple postpartum time points. We utilized robust longitudinal analytical techniques to assess time varying changes in parental stress and depression severity. In



addition, we determined whether there was a temporal association between parental stress and postpartum depression by a lagging technique in which parental stress preceded a diagnosis of depression. Prior studies have generally measured parental stress concurrently with depression, limiting the ability to assess a temporal relationship between exposure and outcome. Unlike studies that have generally used self-reported measures of depression, the current study used a structured diagnostic interview to assess for postpartum depression.

The consequences of early mother-infant interaction difficulties and inadequate caregiving on postpartum depression have important clinical implications for healthcare providers. Detecting pregnant adolescent women with high levels of parental stress can be an important means of identifying women at risk for postpartum depression. Providing anticipatory guidance to adolescent mothers, including discussions of parenting practices and coping mechanisms, should be encouraged. Data suggest mothers are interested in receiving support from their pediatricians about parenting stress and depressive symptoms, but may be reluctant to discuss these topics with their pediatricians because of mistrust and fear of judgment [37]. Various techniques have been evaluated to improve interactions between mothers and their infants, including interaction coaching in which mothers with postpartum depression are provided with video feedback of their interaction behaviors [38], teaching depressed mothers to massage their infants [39], and interventions targeted at helping parents understand and respond to their infants' behaviors [6]. Additionally, interventions aimed at reducing postpartum depression may also have the potential to address the preceding development of parental stress [40].

In summary, high levels of postpartum depression and parental stress were documented among this cohort of adolescent mothers, and parental stress was a significant risk factor for subsequent postpartum depression. Further research is needed to elucidate specific mechanisms for improving parental coping mechanisms among adolescent parents, how parental stress increases the risk for postpartum depression, and why teens may be more vulnerable to parental stress. Whether the association between high parental stress and postpartum depression persists in subsequent pregnancies among adolescent mothers remains to be studied. In addition to being screened for depression, parental stress is an important parameter of maternal and child wellbeing to be assessed in the postpartum time period.

## References

1. Martin, J.; Hamilton, BE.; Sutton, PD.; Ventura, SJ.; Menacker, F.; Kirmeyer, S.; Matthews, TJ. Births: Final data for 2011. National vital statistics reports. 2013. [cited 62 1]; Available from [http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62\\_01.pdf](http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62_01.pdf)
2. Barnett B, Joffe A, Duggan AK, Wilson MD, Repke JT. Depressive symptoms, stress, and social support in pregnant and postpartum adolescents. *Archives of Pediatrics and Adolescent Medicine*. 1996; 150(1):64–69. [PubMed: 8542009]
3. Deal LW, Holt VL. Young maternal age and depressive symptoms: Results from the 1988 National Maternal and Infant Health Survey. *American Journal of Public Health*. 1998; 88(2):266–270. [PubMed: 9491019]
4. Gaynes B, Meltzer-Brody S, Lohr KN, Swinson T, Gartlehner G, Brody S, Willer WC. Perinatal depression: Prevalence, screening accuracy, and screening outcomes. Agency for healthcare

research and quality: Evidence report/technology assessment. 2005; 19 Available from <http://archive.ahrq.gov/clinic/epcsums/peridepsum.pdf>.

5. Cox JE, Buman M, Valenzuela J, Joseph NP, Mitchell A, Woods ER. Depression, parenting attributes, and social support among adolescent mothers attending a teen tot program. *Journal of Pediatric and Adolescent Gynecology*. 2008; 21(5):275–281. [PubMed: 18794023]
6. Field T. Postpartum depression effects on early interactions, parenting, and safety practices: A review. *Infant Behavior and Development*. 2010; 33:1–6. [PubMed: 19962196]
7. Abidin, R. Parenting Stress Index: A measure of the parent–child system. In: Woods, RJ.; Zalaquett, CP., editors. *Evaluating stress: A book of resources*. Lanham, MD: Scarecrow Press; 1997. p. 277-291.
8. Manuel JI, Martinson ML, Bledsoe-Mansori SE, Bellamy JL. The influence of stress and social support on depressive symptoms in mothers with young children. *Social Science and Medicine*. 2012; 75(11):2013–2020. [PubMed: 22910191]
9. Horwitz SM, Briggs-Gowan MJ, Storfer-Isser A, Carter AS. Prevalence, correlates, and persistence of maternal depression. *Journal of Womens Health (Larchmt)*. 2007; 16(5):678–691.
10. Naerde A, Tambs K, Mathiesen KS, Dalgard OS, Samuelsen SO. Symptoms of anxiety and depression among mothers of pre-school children: Effect of chronic strain related to children and child care-taking. *Journal of Affective Disorders*. 2000; 58(3):181–199. [PubMed: 10802127]
11. Sadler LS, Catrone C. The adolescent parent: A dual developmental crisis. *Journal of Adolescent Health Care : Official Publication of the Society for Adolescent Medicine*. 1983; 4(2):100–105. [PubMed: 6863104]
12. Hillis SD, Anda RF, Dube SR, Felitti VJ, Marchbanks PA, Marks JS. The association between adverse childhood experiences and adolescent pregnancy, long-term psychosocial consequences, and fetal death. *Pediatrics*. 2004; 113(2):320–327. [PubMed: 14754944]
13. Miller, B. *Families matter: A research synthesis of family influences on adolescent pregnancy*. Washington, DC: National Campaign to Prevent Teen Pregnancy; 1998.
14. Milgrom J, Westley D, Gemmill AW. The mediating role of maternal responsiveness in some longer-term effects of postnatal depression on infant development. *Infant Behavior and Development*. 2004; 27:443–454.
15. Milgrom J, et al. Stressful impact of depression on early mother–infant relations. *Stress and Health*. 2006; 22:229–238.
16. Chen LS, Eaton WW, Gallo JJ, Nestadt G, Crum RM. Empirical examination of current depression categories in a population-based study: Symptoms, course, and risk factors. *The American Journal of Psychiatry*. 2000; 157(4):573–580. [PubMed: 10739416]
17. Fergusson DM, Horwood LJ, Ridder EM, Beautrais AL. Subthreshold depression in adolescence and mental health outcomes in adulthood. *Archives of General Psychiatry*. 2005; 62(1):66–72. [PubMed: 15630074]
18. Phipps M, Raker CA, Jocelyn CF, Zlotnick C. Randomized controlled trial to prevent postpartum depression in adolescent mothers. *American Journal of Obstetrics and Gynecology*. 2013; 208(3): 192.e1–192.e6. [PubMed: 23313720]
19. Rand, N.; Greenwood, A. *Baby basics: Your month by month guide to a healthy pregnancy*. New York: What to Expect Foundation; 2007.
20. Hein, D.; Matzner, F.; First, M.; Spitzer, R.; Williams, J.; Gibbons, M. *Structured clinical interview for DSM-IV childhood disorders, KID-SCID*. New York: Department of Psychiatry, Columbia University Medical School; 1998.
21. Abidin, R. *Parenting Stress Index: Short form*. Lutz, FL: Psychological Assessment Resources, Inc; 1995.
22. Miller LJ. Postpartum depression. *The Journal of the American Medical Association*. 2002; 287(6): 762–765. [PubMed: 11851544]
23. Poznanski, E.; Mokros, HB. *Children's Depression Rating Scale, revised (CDRS-R)*. Torrance, CA: Western Psychological Services; 2012.
24. Poznanski EO, Grossman JA, Buchsbaum Y, Banegas M, Freeman L, Gibbons R. Preliminary studies of the reliability and validity of the children's depression rating scale. *Journal of the American Academy of Child Psychiatry*. 1984; 23(2):191–197. [PubMed: 6715741]

25. Poznanski E, Mokros HB, Grossman J, Freeman LN. Diagnostic criteria in childhood depression. *The American journal of psychiatry*. 1985; 142(10):1168–1173. [PubMed: 4037128]
26. Mayes TL, Bernstein IH, Haley CL, Kennard BD, Emslie GJ. Psychometric properties of the Children's Depression Rating Scale—revised in adolescents. *Journal of child and adolescent psychopharmacology*. 2010; 20(6):513–516. [PubMed: 21186970]
27. Allison, P. *Logistic regression using the SAS system: Theory and application*. Cary, NC: SAS Institute; 1999.
28. Allison, P. *Fixed effects regression methods for longitudinal data using SAS*. Cary, NC: SAS Institute Inc; 2005.
29. Peduzzi P, Henderson W, Hartigan P, Lavori P. Analysis of randomized controlled trials. *Epidemiologic Reviews*. 2002; 24(1):26–38.
30. Rothman, K.; Greenland, S.; Lash, TL. *Modern epidemiology*. 3rd. Philadelphia: Walters Kluwer; 2008.
31. Brown JD, Harris SK, Woods ER, Buman MP, Cox JE. Longitudinal study of depressive symptoms and social support in adolescent mothers. *Maternal and Child Health Journal*. 2012; 16(4):894–901. [PubMed: 21556696]
32. Glazebrook C, Sheard C, Cox S, Oates M, Ndukwe G. Parenting stress in first-time mothers of twins and triplets conceived after in vitro fertilization. *Fertility and Sterility*. 2004; 81(3):505–511. [PubMed: 15037391]
33. Clemmons D. Adolescent mothers' depression after the birth of their babies: Weathering the storm. *Adolescence*. 2002; 37:551. [PubMed: 12458692]
34. Lovejoy MC, Graczyk PA, O'Hare E, Neuman G. Maternal depression and parenting behavior: A meta-analytic review. *Clinical Psychology Review*. 2000; 20(5):561–592. [PubMed: 10860167]
35. Weinberg MK, Olson KL, Beeghly M, Tronick EZ. Making up is hard to do, especially for mothers with high levels of depressive symptoms and their infant sons. *Journal of Child Psychology and Psychiatry and Allied Disciplines*. 2006; 47(7):670–683.
36. Holub C, Kershaw TS, Ethier KA, Lewis JB, Milan S, Ickovics JR. Prenatal and parenting stress on adolescent maternal adjustment: Identifying a high-risk subgroup. *Matern and Child Health Journal*. 2007; 11(2):153–159.
37. Heneghan A, Mercer M, DeLeone NL. Will mothers discuss parenting stress and depressive symptoms with their child's pediatrician? *Pediatrics*. 2004; 113:460–467. [PubMed: 14993535]
38. Field T, Diego M, Hernandez-Reif M. Prenatal depression effects on the fetus and newborn: A review. *Infant Behavior and Development*. 2006; 29(3):445–455. [PubMed: 17138297]
39. Field T, Grizzle N, Scafidi F, Schanberg S. Massage and relaxation therapies' effects on depressed adolescent mothers. *Adolescence*. 1996; 31(124):903–911. [PubMed: 8970662]
40. Forman D, O'Hara MW, Stuart S, Gorman LL, Larsen KE, Coy KC. Effective treatment for postpartum depression is not sufficient to improve the developing mother-child relationship. *Development and Psychopathology*. 2007; 19(2):585–602. [PubMed: 17459185]

**Table 1**  
**Baseline characteristics of study participants (N = 106)**

<b>Socio-demographic characteristics</b>	<b>%<sup>a</sup></b>
Age in years, median (IQR)	16 (15–17)
Race/ethnicity	
Latina	52.8
Black	16.9
White	16.0
Other	14.2
Currently in school	
Yes	77.4
No, completed 12th grade	18.9
No	3.8
Age of father of the baby in years, median (IQR)	18 (17–20)
Number of siblings, median (IQR)	3 (2–5)
Number of individuals living in home, median (IQR)	5 (3–5)
Number of times changed housing in the past year	
0	40.6
1	26.4
2 or more	33.0
Lives with biological mother	71.7
Lives with biological father	16.0
Lives with husband/boyfriend	16.0
Perceptions of current pregnancy	
Current pregnancy was intended	9.4
I am very/somewhat glad to be having a baby	94.3
Father of the baby will definitely be involved in childcare	81.1
Family is emotionally supportive of pregnancy	93.4
Psychological characteristics	
Past history of depression	16.0
I feel I am currently depressed	4.7
Previous diagnosis of depression	10.4

<sup>a</sup> All values are % unless otherwise noted

**Table 2**  
**Mean parental stress overall and by postpartum depression status (N = 289 visits)**

Parental stress, overall and by subscale	Overall Mean (SD)	Postpartum depression Mean (SD)	No postpartum depression Mean (SD)	<i>p</i> value
Total stress (range, 36–180)	64.9 (15.9)	80.7 (13.1)	62.4 (14.8)	<0.0001
Parental distress subscale (range, 12–60)	25.0 (8.3)	35.6 (7.9)	23.4 (7.0)	<0.0001
Parent–child dysfunction subscale (range, 12–60)	18.6 (5.6)	21.0 (5.0)	18.2 (5.6)	<0.01
Difficult child subscale (range, 12–60)	21.4 (5.5)	24.1 (6.2)	21.0 (5.3)	<0.01

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

**Table 3**  
**Bivariate and multivariate analysis of the impact of parental stress on postpartum depression (N = 289 visits)**

Variable	Bivariate analysis OR (95 % CI); <i>p</i> value	Multivariate analysis <sup>a</sup> AOR (95 % CI); <i>p</i> value
Total stress	1.05 (1.03–1.08); <0.0001	1.06 (1.04–1.09); <0.0001
Parental distress subscale	1.10 (1.05–1.16); <0.0001	1.13 (1.07–1.18); <0.0001
Parent–child dysfunction subscale	1.03 (0.98–1.08); 0.25	1.06 (1.00–1.13); 0.03
Difficult child subscale	1.05 (1.01–1.09); 0.02	1.07 (1.00–1.14); 0.04

OR odds ratio, AOR adjusted odds ratio

<sup>a</sup> All multivariate models were adjusted for study arm, age, born in the United States, prior history of depression, and number of study visits

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript



**Table 4**  
**Sensitivity analyses of the (a) impact of parental stress on postpartum depression when lagging the exposure of parental stress and (b) impact of parental stress on subthreshold depression**

Variable	Bivariate analysis OR (95 % CI); <i>p</i> value	Multivariate analysis <sup>a</sup> AOR (95 % CI); <i>p</i> value
(a)		
Total stress	1.05 (1.02–1.09); <0.001	1.06 (1.02–1.09); <0.01
Parental distress subscale	1.16 (1.07–1.26); 0.0001	1.20 (1.08–1.32); <0.001
Parent–child dysfunction subscale	1.06 (1.01–1.12); 0.01	1.08 (1.02–1.15); <0.01
Difficult child subscale	1.06 (1.00–1.13); 0.05	1.05 (0.99–1.11); 0.07
(b)		
Total stress	1.04 (1.01–1.07); <0.01	1.04 (1.01–1.07); <0.01
Parental distress subscale	1.12 (1.04–1.19); <0.001	1.12 (1.04–1.19); <0.001
Parent–child dysfunction subscale	1.05 (0.97–1.14); 0.25	1.04 (0.96–1.13); 0.37
Difficult child subscale	1.06 (1.00–1.14); 0.05	1.08 (1.01–1.16); 0.01

OR odds ratio, AOR adjusted odds ratio

<sup>a</sup> All multivariate models were adjusted for study arm, age, born in the United States, prior history of depression, and number of study visits

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript