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# The Association Between Exposure to Maternal Depression During Year 2 of a Child's Life and Future Child Problem Behavior

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## Abstract

**Introduction** We examined the association of exposure to maternal depression during year 2 of a child's life with future child problem behavior. We conducted a secondary analysis to investigate whether race/ethnicity is a moderator of this relationship.

**Methods** We used Fragile Families and Child Well-Being Study data (age 3 N = 3288 and 49% Black, 26% Hispanic, 22% non-Hispanic White; age 5 N = 3001 and 51% Black, 25% Hispanic, 21% non-Hispanic White; age 9 N = 3630 and 50% Black, 25% Hispanic, 21% non-Hispanic White) and ordinal logistic regression to model problem behavior at ages 3, 5, and 9 on maternal depression status during year 2.

**Results** At age 9, children whose mother was depressed during year 2 were significantly more likely to have higher internalizing (AOR = 1.92, 95% CI: 1.42,2.61) and externalizing (AOR = 1.65, 95% CI: 1.10,2.48) problem behavior scores. In our secondary analysis, race/ethnicity did not have moderating effects, potentially due to a limitation of the data that required use of maternal self-reported race/ethnicity as a proxy for child race/ethnicity.

**Discussion** Exposure to maternal depression after the prenatal and perinatal periods may have a negative association with children's behavioral development through age 9. Interventions that directly target maternal depression during this time should be developed. Additional research is needed to further elucidate the role of race/ethnicity in the relationship between maternal depression and child problem behavior.

**Keywords** Child problem behavior · Maternal depression · Race/ethnicity

## Significance Statement

Maternal depression during prenatal/perinatal periods impacts child mental health and behavior, and the relationship may vary by race/ethnicity. We found that depression mothers have in their child's preschool years is associated with child problem behaviors up to 6 years later; race/ethnicity did not moderate this relationship in our study. Our findings emphasize the importance of evaluating children's exposure to maternal depression beyond the prenatal/perinatal time and highlight the need for research on the impact of exposure to maternal depression during this period. Interventions and policies that target maternal depression may be effective in reducing risks that lead to problem behavior.

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## Introduction

Child problem behavior negatively impacts educational and economic outcomes in adolescence and adulthood (Knapp, King, Healey, and Thomass 2011). Risk factors for children's poor behavioral development include low birth weight, low socioeconomic status (SES), and maternal mental health issues (Turney 2012).

About 1 in 10 children has a depressed mother in any given year (Ertel, Rich-Edwards, and Koenen 2011). Extensive research has been done showing that maternal depression during prenatal and perinatal periods impacts child mental health and behavior (Goodman et al. 2011), and the U.S. Preventative Services Task Force recommends screening mothers for depression during the perinatal period. Possible mechanisms of the impact of prenatal and perinatal maternal depression include exposure to maternal negative affect and maladaptive behaviors (Goodman and Gotlib 1999). The one meta-analysis we identified included few longitudinal studies; the authors suggest that the younger children are first exposed to maternal depression, the greater the risk for problem behavior compared to older children (Goodman et al. 2011).

Although children are highly responsive to changes in their environment between infancy and entrance into school (Duncan et al. 1994), less is known about the relationships between maternal depression during this time period and child behavior. We identified two studies that examine maternal depression in the preschool years, both of which are cross sectional. A study of preschoolers (14% White, 75% Black, measured by maternal race) found that those with mothers with depressive symptoms had greater externalizing problem behaviors (Conners-Burrow, Swindle, McKelvey, and Bokony 2015); another study found that preschoolers (race/ethnicity not reported) whose mothers had high levels of depressive symptoms in the preschool period had increased levels of conduct problems compared to children whose mothers were never depressed (van der Waerden et al. 2015). These studies did not utilize longitudinal data of child behavior.

The relationship between maternal depression and child problem behavior has been examined across child and family characteristics (Turney 2011a, b). Although race/ethnicity has confounded the relationship between maternal depression and child behavior in previous studies, it may be a modifier of the relationship, potentially due to differences in representation among lower socioeconomic groups, in access to and use of mental healthcare and family support services, in adverse life events associated with biases on the basis of race/ethnicity (Johnson et al. 2017; Ligthart Buitendijk, Koes, and van Middelkoop 2017; McCauley 2017), or in family culture or dynamics (Brown and Tylka 2011). However, little is known about the moderating effects of race/ethnicity on this relationship. The majority of studies on the relationship between maternal depression and problem behavior have focused mostly or entirely on White mothers; few studies have examined the relationship between maternal depression and child problem behavior across racial/ethnic groups (Goodman et al. 2011). Of those included in a meta-analysis, studies with samples including more ethnic minorities yielded higher effect sizes of the association between maternal depression and problem behavior (Goodman et al. 2011). Other research suggests that risks associated with maternal depression may have less of an effect on Black and Hispanic children's behavior compared to White children (Goodman et al. 2011; Meadows, McLanahan, and Brooks-Gunn 2007).

We extend this prior work by examining the association between exposure to maternal depression during year 2 of a child's life on child problem behaviors at ages 3, 5, and 9 using longitudinal data. Later in development, children (1) are less dependent on their mothers as fathers, teachers, and peers have more influence, potentially attenuating the effects of maternal depression and (2) have increasing cognitive maturity, which may enable them to better understand their mothers' depressive symptoms and develop better emotion regulation (Crick and Dodge 1996). Therefore, we hypothesized that the association would be attenuated over time. In a secondary analysis, we explore if race/ethnicity is a moderator of this relationship. Given differences across race/ethnicity in access to and use of healthcare and support services and in adverse life events associated with biases on the basis of race/ethnicity, which may impact the effects of maternal depression on problem behavior, we hypothesized that the relationship varies by race/ethnicity. This work may further develop our understanding of lasting implications of maternal depression beyond the prenatal and perinatal periods.

## Methods

### Data Source

The Fragile Families and Child Wellbeing Study (FFCWS) is a cohort study of 4,898 infants born in 20 U.S. cities in 1998–2000; its complex sampling strategy is described elsewhere and its data are available through the Princeton University Office of Population Research (Reichman, Teitler, Garfinkel, and McLanahan 2001). Interviews were conducted at birth and ages 1, 3, 5, and 9; we conducted analyses on data from participants of behavior assessments at ages 3 (N = 3288), 5 (N = 3001), and 9 (N = 3630). The University of Wisconsin-Madison Health Sciences Institutional Review

Board determined the study exempt in accordance with federal regulations.

## Measures

### Child Behavior

Child problem behavior was the outcome of interest and was assessed by primary caregivers at ages 3, 5, and 9 (95%, 96%, and 92% were biological mothers, respectively) using Child Behavior Checklists (CBCL) (T. M. Achenbach 1991; T.M. Achenbach 1992). The CBCLs are age-specific established measures of children's internalizing and externalizing behaviors with extensive normative data. For each CBCL item, the primary caregiver indicated whether the statement was not true (0), somewhat/sometimes true (1), or very/often true (2). We used a continuous measure of internalizing, externalizing, and overall problem behaviors (sum of internalizing and externalizing scores). In the surveys that took place at ages 3 and 5, the internalizing behavior scale (year 3 range: 0–32, year 5 range: 0–32) included most items from the anxious/depressed and withdrawn/depressed subscales. In the age 9 survey, all items from the somatic complaints subscale were also included in the internalizing behavior scale (range: 0–62). The externalizing behavior scale (year 3 range: 0–48, year 5 range: 0–50, year 9 range: 0–68) included all items from the aggressive behavior subscale and all items from the destructive (age 3), delinquent (age 5), or rule-breaking behavior (age 9) subscale.

Based on the age 3 survey, the α for internalizing, externalizing, and overall scales was 0.81, 0.88, and 0.90 respectively. Based on the age 5 survey, the α for internalizing, externalizing, and overall scales was 0.75, 0.86, and 0.90 respectively. Based on the age 9 survey, the α for internalizing, externalizing, and overall scales was 0.88, 0.91, and 0.95 respectively. Although behavior assessments were made by center-based caregivers, family/friend caregivers, teachers, and children themselves, these additional measures of behavior were very limited in terms of the scope of behaviors assessed. We relied only upon primary caregiver assessments.

### Maternal Depression

The primary exposure of interest was maternal depression status during year 2 of a child's life, assessed by the Composite International Diagnostic Interview Short Form (CIDI-SF), Version 1.0 (Kessler et al. 1998), which is a validated measure that identifies individuals who likely had a major depressive episode (MDE) in the previous year. Mothers were asked two stem questions: if they had feelings of depression or if they were unable to enjoy normally pleasurable things at some time during the previous year. Mothers who experienced one or both conditions for at least half of the day, every day, over a 2-week period were asked seven additional questions regarding symptoms (losing interest in things, feeling tired, experiencing a change in weight of at least 10 lb, having trouble sleeping, having trouble concentrating, feeling worthless, thinking about death). We used a dichotomous variable (depression status) to compare those mothers who likely experienced a MDE, who reported at least 3 of these symptoms, to those with no or few depressive symptoms, as has been done in previous studies using FFCWS data (Reid and Taylor 2015).

Maternal depression at years 1, 5, and 9 was also ascertained using the CIDI-SF. To determine whether to include depression status at year 1 in adjusted analyses, we added two terms to adjusted models of behavior at years 3, 5, and 9 on depression at year 3: (1) maternal depression at year 1 and (2) an interaction term of maternal depression at year 1 and year 3. Maternal depression at years 1 and 3 was significantly associated with problem behavior at years 3, 5, and 9, with very similar magnitudes of association; the interaction term between year 1 and year 3 depression status was not statistically significant. Therefore, we decided not to include maternal depression status at year 1 and to only include depression status at year 3 in our analyses. To isolate the role of maternal depression at year 3, in our fully adjusted models for behavior outcomes at ages 5 and 9, we included depression status at years 5 and 9, respectively.

### Additional Variables

Based on previous research, variables that may be associated with both maternal depression at year 3 and child problem behavior were included in adjusted analyses. Mothers' self-reported health at year 3 was included (Schnittker 2005); because a relatively small number of mothers reported poor health, we combined the fair and poor categories and compared them to a combined category of excellent, very good, and good (dichotomous). We included the mother's age at childbirth (continuous measure in years), her relationship with the child's biological father at the year 3 survey (dichotomous: married or cohabiting versus non-residential romantic relationship, separated, divorced, just friends, or no relationship) (Meadows et al. 2007). Using maternal self-report, we included whether at least one of her biological parents experienced a 2-week period of feeling depressed, down in the dumps, or blue (Turney 2011a, b).

Although data on child race/ethnicity was not available, a dummy variable was created for maternal race/ethnicity (non-Hispanic Black, Hispanic, non-Hispanic White, other), which serves as a measure for child race/ethnicity, as has been done in other studies (Campbell et al. 2009; Conners-Burrow et al. 2015). We include race/ethnicity as a confounder in our primary analysis, and we evaluate it as a

modifier in our secondary analysis. A dummy variable indicated whether the child is female, whether the birth was paid for by Medicaid, and whether the child was born with low birth weight (< 2500 g). We included maternal education (less than high school diploma, high school diploma or GED, postsecondary education) and maternal household poverty category at the year 3 survey, measured as a percent of the federal poverty line (FPL) of the year prior as established by the U.S. Census Bureau (0–49%, 50–99%, 100–199%, 200–299%, and 300% + of the FPL). We included a continuous variable for the number of children in the household at year 3.

## Analysis

SAS version 9.4 was used to perform statistical analyses. Statistical significance was set at the $\alpha = 0.05$ level. At the year 3 wave, 3288 families participated compared to 1610 who did not. At year 5, 3001 families participated, and 1897 did not. At year 9, 3630 families participated, and 1268 did not. To examine baseline characteristics of those who did and did not participate in the year 3, 5, and 9 waves, we calculated frequency distributions, means, and standard deviations and used chi-squared tests and t-tests to test whether differences between those who did and did not participate were statistically significant. We examined characteristics of the participants stratified by maternal depression status at the year 3 wave again using chi-squared tests and t-tests to test differences (Table 1). We used analysis of variance (ANOVA) methods to compare problem behaviors at years 3, 5, and 9 by maternal depression status at year 3 (Table 2).

Each age-appropriate CBCL is different in content and range of possible scores. Therefore, we chose to use ordinal logistic regression to facilitate interpretation of results and practical implications. We used ordinal logistic regression to model problem behavior assessed by primary caregivers at years 3, 5, and 9. First we examined the unadjusted association between maternal depression status at year 3 and

**Table 1** Demographics of those who participated in year 3 survey wave of the Fragile Families and Child Wellbeing Study, stratified by maternal depression status (N = 3288)

| | Year 3 survey wave—maternal depression | Year 3 survey wave—no maternal depression | Year 3 survey wave—all participants |
|---|---|---|---|
| Child gender: Female, n (%) | 335 (22) | 1231 (78) | 1566 (48) |
| Race/ethnicity, n (%)* | | | |
| Black, non-Hispanic | 387 (24) | 1216 (76) | 1604 (49) |
| Hispanic | 148 (18) | 697 (82) | 845(26) |
| White, non-Hispanic | 150 (21) | 563 (79) | 714 (22) |
| Other | 25 (22) | 91 (78) | 116 (4) |
| Fair or poor maternal health, n (%)** | 90 (35) | 166 (65) | 256 (8) |
| Maternal education, n (%) | | | |
| Post-secondary Education | 232 (20) | 937 (80) | 1169 (36) |
| High school diploma or GED | 171 (21) | 660 (79) | 832 (25) |
| Less than high school | 307 (24) | 975 (76) | 1283 (39) |
| Maternal age at birth, mean (SD)[a]* | 24.63 (5.76) | 25.27 (6.11) | 25.13 (6.04) |
| Medicaid birth, n (%)* | 461 (37) | 1580 (63) | 2041 (62) |
| Foreign-born mother, n (%)** | 76 (16) | 396 (84) | 472(14) |
| Household income, n (%)** | | | |
| 0–49% FPL[b] | 144 (24) | 454 (76) | 599 (18) |
| 50–99% FPL | 145 (25) | 425 (75) | 571 (17) |
| 100–199% FPL | 203 (23) | 687 (77) | 890 (27) |
| 200–299% FPL | 105 (21) | 391 (79) | 496 (15) |
| 300% + FPL | 115 (16) | 617 (84) | 732 (22) |
| Low birth weight, n (%) | 72 (23) | 239 (77) | 311 (10) |
| Maternal relationship with father: Married or cohabiting, n (%) | 414 (21) | 1587 (79) | 2002 (61) |
| Children living in household, mean (SD) | 1 (1) | 1 (1) | 1 (1) |

[a]*SD* standard deviation, [b]*FPL* federal poverty line, *p-value < 0.05, **p-value < 0.01

**Table 2** ANOVA results of child problem behavior scores assessed by primary caregivers at years 3, 5, and 9 of the Fragile Families and Child Wellbeing Study by year 3 (y.3) maternal depression status[a]

| Survey year | Internalizing Behavior, mean (SD)[b] | Externalizing Behavior, mean (SD) | Overall Behavior, mean (SD) |
|---|---|---|---|
| Year 3 | | | |
| Maternal depression (y.3) | 6.5 (4.4)* | 13.7 (7.0)* | 20.1 (10.0)* |
| No maternal depression (y.3) | 5.2 (3.8)* | 10.8 (6.4)* | 16.0 (9.1)* |
| Year 5 | | | |
| Maternal depression (y.3) | 4.0 (3.9)* | 8.8 (7.3)* | 12.7 (10.2)* |
| No maternal depression (y.3) | 3.2 (3.4)* | 7.2 (6.3)* | 10.5 (8.8)* |
| Year 9 | | | |
| Maternal depression (y.3) | 6.1 (5.8)* | 7.9 (7.3)* | 14.0 (11.7)* |
| No maternal depression (y.3) | 4.6 (5.2)* | 5.8 (6.5)* | 10.3 (10.7)* |

[a]Asterisk indicates $p < 0.001$

[b]*SD* standard deviation

children's problem behaviors at years 3, 5, and 9, then added the covariates mentioned previously to examine adjusted estimates. Then, we conducted the same analyses using data weighted at the city level (Table 3).

City level weights, which adjust for the sample design, non-response at baseline, and attrition, were used in our study and make the data representative of all births that took place in 1998–2000 in each of the sampled cities (Garfinkel and Zilanawala 2015). The use of a basic weight and a set of replicate weights in place of strata and primary sampling unit variables has the added benefit of masking locations of respondents while allowing for estimation of variance.

In our secondary analysis, to test race/ethnicity as a potential moderator of the relationship between maternal depression status at year 3 and problem behavior at years 3, 5, and 9, interaction terms for each race/ethnicity with depression status were added to the unadjusted and adjusted weighted models (Tables 4–6) (Baron and Kenny 1986).

## Results

In the surveys that took place at ages 3, 5, and 9, approximately 21%, 20%, and 21% of mothers respectively met CIDI-SF criteria for depression in the year prior (i.e. during year 2, 4, and 8 of a child's life). Across these three times points, approximately 64% of mothers never reported depression, 30% experienced depression at one time point, and 6% experienced depression at every time point. At year 3, of those who did not participate, 45% were Black non-Hispanic, 31% were Hispanic, 20% were White non-Hispanic; of those who did participate, 49% were Black non-Hispanic, 26% were Hispanic, and 22% were White non-Hispanic. These differences were statistically significant and persisted at years 5 and 9. In addition, a considerably greater percentage of non-participants tended to be families with foreign-born mothers (year 3:

**Table 3** Odds ratios (OR) and associated 95% confidence intervals (CI) in stepwise ordinal logistic regressions (Models 1–3) of the impact of exposure to maternal depression at year 3 on internalizing, externalizing, and overall behavior scores of Fragile Families and Child Wellbeing Study children at years 3, 5, and 9 as assessed by primary caregivers using weighted data[a]

| | Model 1 | | | Model 2[b] | | | Model 3[c] | | |
|---|---|---|---|---|---|---|---|---|---|
| | Internalizing | Externalizing | Overall | Internalizing | Externalizing | Overall | Internalizing | Externalizing | Overall |
| Year 3 | 1.39 (0.83,2.32) | 2.72 (1.83,4.05)* | 2.30 (1.94,2.73)* | 1.25 (0.73,2.15) | 2.45 (1.40,4.28)* | 2.09 (1.71,2.56)* | 1.33 (0.56,3.17) | 2.31 (1.13,4.72)* | 2.01 (0.89,4.52) |
| Year 5 | 1.75 (1.03,2.97)* | 1.89 (1.22,2.90)* | 1.99 (1.26,3.16)* | 1.74 (1.1,2.63)* | 1.70 (1.5,2.77)* | 1.89 (1.14,3.11)* | 1.47 (0.77,2.80) | 1.35 (0.42,4.35) | 1.49 (0.58,3.85) |
| Year 9 | 1.84 (1.52,2.22)* | 1.99 (1.72,2.30)* | 2.22 (2.04,2.40)* | 1.83 (1.49,2.26)* | 1.98 (1.71,2.28)* | 2.19 (1.99,2.41)* | 1.92 (1.42,2.61)* | 1.65 (1.10,2.48)* | 2.14 (1.62,2.84)* |

[a]Asterisks indicate the 95% CI does not include 1.00, indicating statistical significance

[b]Model 2 controls for child race/ethnicity

[c]Model 3 controls for child (gender, race/ethnicity, low birth weight status, Medicaid birth status), maternal (self-reported health at year 3, educational attainment, age at childbirth, foreign-born status, relationship with child's biological father at year 3, current depression status at years 5 and 9 in those respective models, parental history of depression), and household (income at year 3, number of children at year 3) factors

**Table 4** Point estimates and associated standard errors (SE) in ordinal logistic regressions of the impact of exposure to maternal depression at year 3 on overall behavior scores of Fragile Families and Child Wellbeing Study children at years 3, 5, and 9 as assessed by primary caregivers using weighted data with examination of interactions

| | | Year 3 | | Year 5 | | Year 9 | |
|---|---|---|---|---|---|---|---|
| | | Model 1 | Model 2[a] | Model 1 | Model 2[a] | Model 1 | Model 2[a] |
| Overall Behavior | Maternal depression | 0.83 (0.11)*** | 0.34 (0.27) | 0.42 (0.11)*** | 0.19 (0.26) | 0.72 (0.06)*** | 0.34 (0.09)** |
| | *Race/ethnicity* | | | | | | |
| | Black, non-Hispanic | Reference | Reference | Reference | Reference | Reference | Reference |
| | Hispanic | 0.00020 (0.091) | − 0.05 (0.33) | − 0.053 (0.087) | − 0.33 (0.22) | 0.0039 (0.09) | − 0.05 (0.19) |
| | White, non-Hispanic | − 0.37 (0.095)*** | 0.04 (0.34) | − 0.23 (0.091)* | − 0.10 (0.33) | − 0.27 (0.14) | 0.27 (0.18) |
| | Other | 0.48 (0.20) | 0.51 (1.19) | − 0.31 (0.20) | 0.26 (0.36) | 0.42 (0.10)** | 0.89 (0.25)** |
| | Maternal depression x Hispanic | − 0.095 (0.20) | − 0.30 (0.25) | 0.018 (0.20) | − 0.39 (0.28) | 0.011 (0.29) | − 0.04 (0.24) |
| | Maternal depression x White | 0.10 (0.20) | 0.20 (0.28) | − 0.0029 (0.19) | 0.21 (0.24) | 0.36 (0.19) | 0.20 (0.12) |
| | Maternal depression x Other | 0.10 (0.46) | − 0.47 (1.04) | 0.23 (0.46) | 1.10 (0.35)* | − 0.38 (0.14)* | − 0.07 (0.29) |

[a]Model 2 controls for child (gender, race/ethnicity, low birth weight status, Medicaid birth status), maternal (self-reported health at year 3, educational attainment, age at childbirth, foreign-born status, relationship with child's biological father at year 3, current depression status at years 5 and 9 in those respective models, parental history of depression), and household (income at year 3, number of children at year 3) factors

*p < 0.05 **p < 0.01 ***p < 0.001

22%, year 5: 23%, year 9: 25%) compared to survey participants (year 3: 14%, year 5: 13%, year 9:14%).

Multiple characteristics were significantly different among those exposed to maternal depression and those who were not, including race/ethnicity, maternal health, maternal age at birth, Medicaid birth status, maternal foreign born status, and household income level (Table 1). Although several factors were not significantly associated with maternal depression (child gender, maternal education level, low birth weight status, maternal relationship with the child's father, and the number of children living in the home), these factors have previously been demonstrated or theorized to be associated with maternal depression, and we proceeded to include these variables in our controlled models.

Those with mothers depressed during year 2 of a child's life had significantly higher problem behavior scores at years 3; overall behavior scores among those exposed to maternal depression was 20.1 compared to 16.0 among those who were not exposed. These differences persisted in the year 5 and 9 waves; those with mothers who were depressed during year 2 of a child's life had significantly higher problem behavior scores at years 5 and 9 (Table 2).

In our primary analysis, specifically in unadjusted analyses (Table 3, Model 1), children whose mothers were depressed during year 2 of a child's life were significantly more likely to demonstrate higher externalizing and overall problem behavior scores at age 3 (externalizing: OR = 2.72, overall: OR = 2.30), age 5 (externalizing: OR = 1.89, overall: OR = 1.99), and age 9 (externalizing: OR = 1.99, overall: OR = 2.22). They were more likely to demonstrate higher internalizing problem behavior scores at ages 5 (OR = 1.75) and 9 (OR = 1.84). When race/ethnicity was included in the model, results were similar in magnitude and significance (Table 3, Model 2). In the fully adjusted model, some estimates were slightly smaller in magnitude and no longer significant (Table 3, Model 3). Children whose mothers were depressed at age 3 were significantly more likely to demonstrate higher externalizing problem behavior scores at age 3 (AOR = 2.31), and were significantly more likely to demonstrate higher internalizing (AOR = 1.92), externalizing (AOR = 1.65), and overall problem behavior scores (AOR = 2.14) at age 9.

In our secondary analysis, Tables 4–6 include unadjusted (Model 1) and adjusted (Model 2) weighted models that examine race/ethnicity as a potential moderator of the relationship between maternal depression at year 3 and overall (Table 4), internalizing (Table 5), and externalizing (Table 6) child problem behavior. We identified two significant interactions (*maternal depression x other race/ethnicity* at year 5 and *maternal depression x White race/ethnicity* at year 9) and evaluated the relationship between maternal depression status during year 2 of a child's life and problem behavior at ages 5 and 9 for each race/ethnicity. Given the wide and overlapping 95% confidence intervals (CI), particularly the extremely wide 95% CI for the other race/ethnicity category, the point estimates identified do not indicate a clear moderating effect of race/ethnicity.

Because maternal race/ethnicity was used as a surrogate for child race/ethnicity, we conducted sensitivity analyses on children whose biological mother was of the same

**Table 5** Point estimates and associated standard errors (SE) in ordinal logistic regressions of the impact of exposure to maternal depression at year 3 on internalizing behavior scores of Fragile Families and Child Wellbeing Study children at years 3, 5, and 9 as assessed by primary caregivers using weighted data with examination of interactions

| | | Year 3 | | Year 5 | | Year 9 | |
|---|---|---|---|---|---|---|---|
| | | Model 1 | Model 2[a] | Model 1 | Model 2[a] | Model 1 | Model 2[a] |
| Internalizing Behavior | Maternal depression | 0.59 (0.11)*** | 0.19 (0.29) | 0.31 (0.11)** | 0.07 (0.10) | 0.21 (0.18) | 0.19 (0.18) |
| | *Race/ethnicity* | | | | | | |
| | Black, non-Hispanic | Reference | Reference | Reference | Reference | Reference | Reference |
| | Hispanic | 0.21 (0.092)* | − 0.20 (0.39) | 0.16 (0.088) | − 0.04 (0.87) | 0.32 (0.11)* | 0.06 (0.39) |
| | White, non-Hispanic | − 0.73 (0.096)*** | − 0.02 (0.35) | − 0.16 (0.092) | 0.12 (0.37) | − 0.17 (0.15) | 0.61 (0.32) |
| | Other | − 0.074 (0.20) | 1.00 (0.67) | − 0.17 (0.20) | 0.40 (0.37) | 0.30 (0.16) | 0.33 (0.46) |
| | Maternal depression x Hispanic | − 0.10 (0.20) | − 0.41 (0.39) | 0.13 (0.20) | − 0.15 (0.21) | 0.50 (0.29) | 0.07 (0.42) |
| | Maternal depression x White | 0.17 (0.20) | 0.27 (0.32) | 0.11 (0.19) | 0.24 (0.26) | 0.93 (0.26)*** | 0.46 (0.14)** |
| | Maternal depression x Other | − 0.16 (0.46) | 0.04 (0.49) | 0.45 (0.47) | 1.36 (0.39)** | 0.60 (1.16) | − 0.13 (0.54) |

[a]Model 2 controls for child (gender, race/ethnicity, low birth weight status, Medicaid birth status), maternal (self-reported health at year 3, educational attainment, age at childbirth, foreign-born status, relationship with child's biological father at year 3, current depression status at years 5 and 9 in those respective models, parental history of depression), and household (income at year 3, number of children at year 3) factors

*p < 0.05 **p < 0.01 ***p < 0.001

**Table 6** Point estimates and associated standard errors (SE) in ordinal logistic regressions of the impact of exposure to maternal depression at year 3 on externalizing behavior scores of Fragile Families and Child Wellbeing Study children at years 3, 5, and 9 as assessed by primary caregivers using weighted data with examination of interactions

| | | Year 3 | | Year 5 | | Year 9 | |
|---|---|---|---|---|---|---|---|
| | | Model 1 | Model 2[a] | Model 1 | Model 2[a] | Model 1 | Model 2[a] |
| Externalizing Behavior | Maternal depression | 0.78 (0.11)*** | 0.45 (0.18)* | 0.37 (0.11)*** | 0.22 (0.41) | 0.87 (0.15)** | 0.37 (0.16)* |
| | *Race/ethnicity* | | | | | | |
| | Black, non-Hispanic | Reference | Reference | Reference | Reference | Reference | Reference |
| | Hispanic | − 0.14 (0.091) | − 0.14 (0.32) | − 0.20 (0.087)* | 0.43 (0.52) | − 0.20 (0.08)* | − 0.19 (0.28) |
| | White, non-Hispanic | − 0.12 (0.095) | − 0.04 (0.53) | − 0.23 (0.091)* | − 0.32 (0.47) | − 0.25 (0.19) | − 0.19 (0.23) |
| | Other | 0.074 (0.20) | 1.44 (0.84) | − 0.40 (0.20)* | − 0.02 (0.60) | 0.42 (0.53) | 1.03 (0.34)* |
| | Maternal depression x Hispanic | − 0.0063 (0.20) | − 0.28 (0.30) | − 0.0067 (0.20) | − 0.41 (0.47) | − 0.39 (0.36) | − 0.32 (0.36) |
| | Maternal depression x White | 0.085 (0.20) | − 0.13 (0.16) | − 0.038 (0.19) | 0.16 (0.53) | − 0.12 (0.37) | − 0.10 (0.19) |
| | Maternal depression x Other | 0.36 (0.46) | 0.41 (1.06) | 0.16 (0.46) | 0.77 (0.80) | − 0.85 (0.64) | − 0.01 (0.39) |

[a]Model 2 controls for child (gender, race/ethnicity, low birth weight status, Medicaid birth status), maternal (self-reported health at year 3, educational attainment, age at childbirth, foreign-born status, relationship with child's biological father at year 3, current depression status at years 5 and 9 in those respective models, parental history of depression), and household (income at year 3, number of children at year 3) factors

*p < 0.05 **p < 0.01 ***p < 0.001

race/ethnicity as the biological father, as reported by the mother. Approximately 15% of children at baseline were of mixed race/ethnicity. After excluding this subset of children, weighted ordinal logistic analyses of maternal depression during year 2 of a child's life on problem behaviors at years 3, 5, and 9 resulted in similar trends to those of the entire sample.

## Discussion

We found a statistically significant relationship between maternal depression during year 2 of a child's life and behavioral outcomes measured at ages 3 (externalizing) and 9 (internalizing, externalizing, and overall behavior

problems). This suggests that maternal depression during year 2 of a child's life has a negative association with their behavioral development at age 9, and, importantly, this association was demonstrated even after controlling for concurrent depression at age 9. However, no significant relationship between maternal depression during year 2 of a child's life and problem behavior at age 5 was identified in adjusted analyses. In our secondary analysis, we did not find moderating effects of race/ethnicity on the relationship between maternal depression and child behavior.

Research on the impact of exposure to maternal depression at various childhood ages has mostly focused on the role of prenatal and perinatal maternal depression. Although it is possible that women in our study experienced prenatal or perinatal depression, our study shows that depression mothers have in their child's preschool years is associated with child problem behaviors up to six years later. Our findings suggest that the association with maternal depression may persist over years, rather than decrease in magnitude. This may be related to (1) continued dependency of children on their mothers throughout their development and (2) a lack of emotion regulation and cognitive ability to understand their mothers' depressive symptoms until early adolescence (Crick and Dodge 1996). Healthcare professionals and social workers should evaluate the extent to which particular children, namely those whose mother was depressed during the period after infancy and before transitioning into school, may be at risk for developing problem behaviors.

Providing appropriate resources for these children is critical; interventions that focus on maternal mental health should extend their attention into early childhood years. One mechanism by which depression may impact child behavior is through its effects on maternal parenting behaviors (Turney 2011b), and interventions focused on the postpartum period have resulted in increased maternal sensitivity to infants' behaviors, more positive mother-infant interactions, and improved infant behavioral ratings (Brahm et al. 2016). Some interventions have included mothers with children beyond infancy with a positive impact on the child. For example, an attachment-based parenting intervention for high-risk mothers and their children (age < 6 years) resulted in decreased symptoms of maternal depression and caregiving helplessness (Muzik et al. 2015).

However, interventions that aim to improve child problem behaviors may not be as successful if maternal depression itself is not addressed (Dempsey, McQuillin, Butler, and Axelrad 2016). Remission of mothers' depression is associated with decreases in child problem behaviors the year after remission (Wickramaratne et al. 2011). In a longitudinal study, findings indicated that as maternal depressive symptoms become more or less severe, children's problem behavior increased or decreased in a reciprocal manner, and changes in severity of depressive symptoms had a greater impact on children's behavior than changes in children's behavior had on severity of mothers' depressive symptoms (Nicholson, Deboeck, Farris, Boker, and Borkowski 2011). There may be a mutual deterioration in functioning if depressive symptoms increase and a mutual improvement if symptoms decrease. It may be important for efforts aimed at addressing child behaviors to directly identify maternal depression after the prenatal and perinatal time period and target it through intervention. Additional factors may be linked to increased problem behavior (negative parenting practices, marital conflict, adverse life events); these might remain risk factors even in the absence of maternal depression and also serve as potential targets of intervention.

Structural factors resulting in differences across race/ethnicity in representation among lower socioeconomic groups, in access to and use of healthcare and support services, and in adverse life events associated with biases on the basis of race/ethnicity (Johnson et al. 2017; Ligthart et al. 2017; McCauley 2017) may impact the effect of maternal depression on problem behavior. However, in our secondary analysis, we did not find that race/ethnicity itself moderated this relationship. The few studies that have evaluated this relationship for different racial/ethnic groups suggest that maternal depression may have more or less of an effect on racial/ethnic minority children's behavior compared to White children depending on the study (Goodman et al. 2011; Meadows et al. 2007). Although our findings may be due to a limitation of the data that required use of maternal self-reported race/ethnicity as a proxy for child race/ethnicity, our findings suggest a possible universality to the negative child outcomes associated with maternal depression across race/ethnicity. Broad-based interventions may be applicable to all families, and interventions at the level of policy may be effective in addressing maternal depression as a risk factor for child problem behavior. The U.S. Preventative Services Task Force, American Association of Family Physicians, American College of Obstetricians and Gynecologists (ACOG), and American Academy of Pediatrics recommend screening mothers for depression during the perinatal period. The ACOG's recommendations calls for screening for all women; other clinical organizations could formally recommend this as well. Over 10 states have adopted legislation, awareness campaigns, or task forces to address screening of new mothers for postpartum depression (Rhodes and Segre 2013); similar efforts could be made to promote screening for maternal depression beyond the postpartum period.

## Limitations

Approximately a third of FFCWS families did not participate in each of the survey waves. This attrition makes it difficult to conclude that our findings using city level weights are

representative of all births that took place in 1998–2000 in each of the sampled cities. This may also be the reason for the wide, and potentially unreliable, CI estimates in our analyses of the potential moderating effects of race/ethnicity. Although sensitivity analyses indicated that using maternal race/ethnicity as a surrogate for child race/ethnicity was appropriate, mothers could have misreported their own race/ethnicity or that of the child's father. Although the CIDI-SF does not provide a formal diagnosis of depression, it is a validated tool to examine in a dichotomous manner whether a mother likely experienced a MDE in the year prior. This study was limited to primary caregiver assessments of behavior and maternal depressive symptomatology may have influenced perceptions of behavior and contributed to shared method variance (Geiser, Eid, Nussbeck, Courvoisier, and Cole 2010). However, primary caregiver reports are a useful measure, because many children display problem behaviors at home that may not be viewed by others (Briggs-Gowan, Carter, and SchwabStone 1996). Furthermore, we did not use a clinically depressed sample, and the likelihood of mothers' symptoms impacting their perceptions of behavior is less likely (Ashman, Dawson, and Panagiotides 2008). Because of time constraints during in-home interviews, the entire CBCL could not be administered, and the psychometric property of the scales may differ from the original scales. However, the items included provide subscales for subtypes of problem behavior, and other prominent studies, including the Project on Human Development in Chicago Neighborhoods, have used reduced CBCLs as well.

## Conclusions

Because children's problem behavior has negative long-term educational and economic consequences (Claussens, Duncan, and Engel 2009; Knapp et al. 2011), it is important to examine the risks of developing problem behavior and identify factors that can be targeted for intervention. The exposure to maternal depression after infancy and prior to transitioning into school may increase the risk of problem behavior several years after entrance into school. Our findings emphasize the importance of evaluating children's exposure to maternal depression beyond the prenatal and perinatal time and highlight the need for research on the impact of exposure to maternal depression during this period on various aspects of child development. Interventions and state policies that directly target maternal depression may be effective in reducing risks that lead to problem behavior, and these should be the focus of future research.

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## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

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