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Maternal experiences of racial discrimination and offspring sleep in the first 2 years of life: Project Viva cohort, Massachusetts, USA (1999-2002)

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Abstract

Objective—To examine the association of maternal lifetime experiences of racial discrimination with infant sleep duration over the first 2 years of life.

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Design—Pre-birth cohort study

Setting—Massachusetts, USA (baseline: 1999–2002)

Participants—552 mother-infant dyads in Project Viva, for whom the mother self-identified as being a woman of color.

Measurements—During pregnancy, mothers completed the Experiences of Discrimination survey that measured lifetime experiences of racial discrimination in eight domains. The main outcome was a weighted average of their infants' 24-hour sleep duration from 6 months to 2 years.

Results—30% reported 0 domains of racial discrimination, 35% 1–2 domains, and 34% ≥3 domains. Any racial discrimination (≥1 vs. 0 domains) was higher among black (80%) vs. Hispanic (58%) or Asian (53%) mothers and US vs. foreign-born mothers (79% vs. 58%) and was associated with higher mean pre-pregnancy BMI (26.8 vs. 24.5 kg/m^2). Children whose mothers reported ≥3 domains vs. 0 domains had shorter sleep duration from 6 months to 2 years in unadjusted analysis (β −18.6 min/d; 95% CI −37.3, 0.0), which was attenuated after adjusting for maternal race/ethnicity and nativity (−13.6 min/d; −33.7, 6.5). We found stronger associations of racial discrimination with offspring sleep at 6 months (−49.3 min/d; −85.3, −13.2) than for sleep at 1 year (−13.5 min/d; −47.2, 20.3) or 2 years (4.2 min/d; −21.5, 29.9).

Conclusions—Maternal lifetime experiences of racial discrimination was associated with shorter offspring sleep duration at 6 months, but not with infant's sleep at 1 and 2 years of age.

Keywords

sleep; infant; maternal; discrimination; racism

Introduction

Sleep is essential for the health and well-being of children and adults; nevertheless, insufficient sleep is prevalent at all ages.(1,2) In infancy, suboptimal sleep appears to be associated with poorer physical, social/emotional, and cognitive development.(3) Shorter sleep duration and poor quality of sleep are associated with excess weight gain in infancy and greater risk for childhood overweight, and difficult temperament and other behavioral problems.(4,5,6)

In the United States, sleep disparities exist by race/ethnicity. Among adults, in comparison to other racial/ethnic groups (whites, Hispanics, or Asians), blacks have shorter sleep duration. which is associated with adverse health outcomes.(7,8)In the first 2 years of life, black, Hispanic, and Asian infants sleep fewer hours than white infants.(9) Racial discrimination refers to the institutional arrangements and individual practices that adversely restrict the lives of a group of people based on phenotypic characteristics or ethnic affiliation.(10) It is one of many factors that may account for these racial/ethnic differences in sleep. In children, adolescents, and adults, discrimination is associated with shorter sleep and poorer sleep quality.(11)

To our knowledge, however, no studies have assessed the impact of maternal experiences of racial discrimination on infant sleep, yet this topic merits investigation. Not only does racism

have deleterious consequences for the individual experiencing it, but its effects can also extend to the family unit.(12) Parents who experienced racial discriminatory events tend to be less supportive and may experience depressive symptoms, which likely influences parenting behaviors.(13) Previous work has shown that parenting behaviors, including emotional availability, arousing activities and close contact at bedtime, influence child sleep.(14) Thus, mothers experiencing racism might be more likely to develop parenting practices, such as overreactivity or laxness, that adversely affect their child's sleep environment.(13)

The purpose of this study was to examine the association of maternal lifetime experiences of racial discrimination with infant sleep duration over the first 2 years of life. We hypothesized that maternal experiences of racial discrimination would be associated with shorter infant sleep duration.

Participants and Methods

Participants/study design

Mothers and children were participants in Project Viva, a pre-birth cohort study of gestational factors, pregnancy outcomes, and offspring health. We recruited women who were attending their initial prenatal visit from 1999 to 2002 at 8 urban and suburban obstetrical offices of Atrius Harvard Vanguard Medical Associates, a large, multi-specialty group practice in eastern Massachusetts. Eligibility criteria included fluency in English, gestational age less than 22 weeks at the initial prenatal clinical appointment, and singleton pregnancy. Recruitment and retention procedures have been reported in detail.(15)

To define the study population for this investigation, we used data on self-reported race/ethnicity. At study enrollment, research assistants asked mothers the question, "Which of the following best describes your race or ethnicity?" Mothers had a choice of one or more of the following mutually exclusive racial/ethnic groups: Hispanic or Latina, white or Caucasian, black or African American, Asian or Pacific Islander, American Indian or Alaskan Native, and other (please specify). For the participants who chose 'other' race/ethnicity, we compared the specified responses to the US census definition for the other five race and ethnicities and reclassified them where appropriate. If a participant chose more than one racial/ethnic group, we used a hierarchy to assign to one category: black, Hispanic, Asian, American Indian, other, white. In the present analysis, we excluded white mothers. We used three racial/ethnic categories in our analysis: "black", "Hispanic" and "Asian". We included eight women that identified as "other" race/ethnicity in "Asian" because the sample size was too small to use a separate category for "other".

Among the 2128 women who delivered a live singleton infant, 2104 identified their race/ethnicity, which we categorized as white (67%), black (17%), Hispanic (7%), Asian (6%), and other (4%). Among the 705 women of color, 552 of their children had non-missing data for at least 1 of the 3 time points at which we determined sleep duration: ages 6 months, 1 year, and 2 years. These 552 women and their infants constituted the analytic dataset. Compared with the 552 participants, non-participants who were women of color (22%) were less likely to be college-educated (29% vs. 48%) and less likely to have annual household incomes exceeding $70,000 (21% vs. 39%). However, the distribution of racial/ethnic

groups was similar (both were 57% black and 43% other women of color). Additionally, the groups did not differ on racial discrimination prevalence (69% vs. 70% with any domains).

We performed in-person study visits with the mother at the end of the first and second trimesters of pregnancy, and with the mother and infant in the first few days after delivery and at 6 months postpartum. Mothers completed mailed questionnaires at 1 and 2 years postpartum. The Institutional Review Board of Harvard Pilgrim Health Care approved the experimental protocol and all mothers provided written informed consent at recruitment and at the postpartum visit. All procedures were in accordance with the ethical standards for human experimentation established by the Declaration of Helsinki.(16)

Measurements

Main exposure—On the early pregnancy questionnaire (median 9.9 weeks of gestation), mothers self-reported experiences of racial discrimination on an adapted and expanded version of the validated 'Experiences of Discrimination' (EOD) measure.(17) Participants responded 'yes' or 'no' to the prompt "I have experienced unfair or bad treatment because of my race or ethnicity" for each of eight different situational domains: at school, getting hired or getting a job, at work, getting housing, getting medical care, getting service in a store or restaurant, on the street or in a public setting, and from the police or in the courts. We summed 'yes' responses to produce an EOD score for self-reported experiences of racial discrimination (range 0–8), with the total number of domains conceptualized as an indicator of overall exposure.(17,18) Exposure categories corresponding to no, moderate, and high exposure were 0, 1–2, and 3+ domains.(17,18) For each of eight domains, if the participant responded 'yes', we further assessed whether it happened during three time periods (before 18 years, from 18 years until pregnancy, and during this pregnancy). In this manuscript, we were interested in maternal lifetime experience of racial discrimination, given our *a priori* hypothesis that an important likely causal pathway linking exposure to racial discrimination and infant sleep is via the impact on parenting behavior, which would more plausibly be shaped by lifetime experiences of racial discrimination, not solely discrimination experienced during early pregnancy.

Outcome measures—The main outcome was a weighted average of mothers' report of their infants' average 24-hour sleep duration from 6 months to 2 years. At 6 months, we asked mothers during an interview 3 questions about their child's sleep: 1) "In the past month, on average, for how long does your baby nap during the morning?" 2) "In the past month, on average, for how long does your baby nap during the afternoon?", and 3) "In the past month, on average, how many hours does your baby sleep during the night?" Response options were in hours and minutes. At 1 year we asked, "In the past month, on average, for how long does your child sleep in a usual 24-hour period? Please include morning naps, afternoon naps, and nighttime sleep." Response options were in hours and minutes. At 2 years, we asked parents to report the number of hours their child slept in a usual 24-hour period on an average weekday and weekend day in the past month. Response categories included, "<9 hours, 9 hours a day, 10 hours a day, 11 hours a day, 12 hours a day, 13 hours a day, and 14 or more hours a day." To calculate a weighted average of sleep duration from ages 6 months to 2 years, we created a sum that was weighted by the interval of time

between the data collection of all 3 data points and divided the sum by 2. We also examined sleep duration in hours/day at each timepoint. We have previously found that these measures predict higher childhood obesity and poorer cognition.(3,19)

Other Measures—Using a combination of self-administered questionnaires and interviews, we collected information about other maternal characteristics including age, education, parity, household income, and nativity (US born versus foreign born). Mothers reported their pre-pregnancy weight and height from which we calculated their pre-pregnancy body mass index (BMI). We defined urbanicity as the proportion of urban land use within 1 km of the mother's residential address at each of the 3 timepoints. This categorization makes use of nationwide land use data derived from satellite images with approximately 30 m resolution (the Multi-Resolution Land Characteristics Consortium (www.mrlc.gov) 2001 National Land Cover Data Set). We have previously found an association between residential urbanicity and infant sleep duration in this cohort.(20)

We assessed smoking during pregnancy, by asking mothers at both first and second trimester visits about their cigarette smoking habits before and during pregnancy. At 6 months and 1 year postpartum, mothers reported the average number of hours of sleep they obtained during a 24-hour period in the last month.

Statistical Analysis

Our main exposure of interest was self-reported domains of lifetime experiences of racial discrimination categorized as 0, 1–2, or ≥3 domains. We used 0 domains as the reference category. We first examined the bivariate associations of racism domain categories and of other covariates with our main outcome, weighted average of sleep during 0–2 years. We then used multiple linear regression models to assess the independent associations of racism with infant sleep. We adjusted Model 2 for baseline characteristics (maternal race/ethnicity and nativity). We additionally adjusted Model 3 for potential mediators (maternal education, household income, pre-pregnancy BMI, pregnancy smoking status, and urbanicity). As our main exposure was lifetime experiences of racial discrimination, some of the variables in Model 3 could also be considered potential confounders. We performed Model 3 to examine the residual effect of racial discrimination after adjusting out the effects of these potential mediators. Other mediators we considered but did not include in our models as they did not change our effect estimate were antenatal depression, postpartum depression, breastfeeding status, infant television or video viewing, and mother's postpartum sleep duration. We also examined associations of racism with infant sleep among black women only. In the multivariable models, we included only those covariates that were of *a priori* interest. We report effect estimates in minutes/day of sleep with 95% confidence intervals. We checked the distribution of the residuals from the regression models and found them to be normally distributed.

To account for missing data, we performed multiple imputation for all 705 women of color in Project Viva. We then limited the analysis to the 552 included participants (non-missing data at 6 months, 1 year, or 2 years). We used SAS (PROC MI) to impute 50 values for each missing observation and combined multivariable modeling estimates using PROC MI

ANALYZE in SAS version 9.4 (SAS Institute, Cary NC). We included all exposures, outcomes, covariates in the PROC MI model. We also included additional variables to help predict missing values. We used imputed values for missing exposures, covariates, and outcomes. In Supplemental Table 1 we show distributions and sample sizes of imputed vs. non-imputed variables; distributions are very similar. An alternative approach, including only participants with all non-missing data (complete cases), yielded similar results (data not shown).

Results

Among the Project Viva women of color, 168 (30%) reported 0 domains of lifetime experiences of racial discrimination, 194 (35%) reported 1–2 domains of experiences, and 190 (34%) reported 3 or more domains of experiences (Table 1). Self-report of any racial discrimination (≥1 vs. 0 domains) was higher among the black mothers vs. Hispanic and Asian mothers (80% vs. 58% and 53%, respectively) and US- vs. foreign-born mothers (79% vs. 58%) and also associated with higher mean pre-pregnancy BMI (26.8 vs. 24.5 kg/m^2). Maternal education and household income had U-shaped associations with reported experiences of racism; mothers with higher educational attainment or income were more likely to report both no (0 domains) and high (≥3 domains) compared to women with lower education or income (Table 2). Mothers reporting ≥3 domains of discrimination had infants that slept a weighted mean (SD) duration of 11.5 (1.3) h/d from ages 6 months to 2 years, while mothers reporting 0 domains had infants that slept a weighted mean (SD) of 11.8 (1.3) h/d (Table 2).

In bivariate analyses, we observed lower infant sleep duration with more experiences of racial discrimination (Table 3). Compared to infants whose mothers reported 0 domains of racial discrimination, across the 6-month to 2-year period, infants of mothers who reported 1–2 domains of racial discrimination slept 9.9 fewer minutes/day (95% CI −27.8 to 7.9), while infants slept 18.6 fewer minutes/day (95% CI −37.3 to 0.00) if their mothers reported ≥3 domains of racial discrimination.

When we adjusted for race/ethnicity and nativity, we saw an attenuation of the effect estimates (1–2 domains: β −7.0 minutes/day, 95% CI −25.4 to 11.4 and ≥3 domains: β −13.6, 95% CI −33.7 to 6.5). The results were similar when we additionally adjusted for potential mediators (maternal education, household income, pre-pregnancy BMI, pregnancy smoking status, and urbanicity). In Model 3, after we adjusted for potential mediators, the association of maternal experiences of racial discrimination with infant sleep duration was (1–2 domains: β −5.6 minutes/day, 95% CI −24.0 to 12.8 and ≥3 domains: β −13.9, 95% CI −34.1 to 6.3) (Table 3). Analysis of infant sleep at 6 months, 1 year, and 2 years postpartum separately revealed a stronger association was at 6 months (β −49.3 minutes/day, 95% CI −85.3 to −13.2 for ≥3 vs. 0 domains) compared with 1 year (β −13.5, 95% CI −47.2 to 20.3), and 2 years (β 4.2, 95% CI −21.5 to 29.9) (Table 3, Model 2). Results limited to black participants were similar to the overall results. For example, in Model 2 (adjusted for nativity), compared to infants whose mothers reported 0 domains of racial discrimination, across the 6-month to 2-year period, infants of mothers who reported 1–2 domains of racial discrimination slept 9.0 fewer minutes/day (95% CI −27.1 to 9.2), while infants slept 17.5

fewer minutes/day (95% CI −36.7 to 1.7) if their mothers reported 3 or more domains of racial discrimination.

Discussion

Our study suggests that mothers who experienced more racial discrimination over their lifetimes had children with lower sleep duration during the first 6 months of life – a reduction of approximately 50 minutes of sleep per day. By 1 year the association had attenuated. The overall estimate from 6 months to 2 years did not reveal an association. Although there is uncertainty on how to define clinically significant decreases in sleep duration, especially in infancy, even small reductions in sleep durations may be associated with behavioral problems, cognitive delays, and weight gain in childhood.(4,5,6)

Central to racism is an ideology that some human groups, races, are inferior to others. Racism can affect health status by influencing socioeconomic status, determining exposures to risk factors and resources, and affecting psychological and physiological functioning.(10) Racism has been linked to numerous adverse physical and mental health outcomes among individuals of all ages including cardiovascular disease, metabolic disorder, substance use, and depression.(18,21) Maternal experiences of racial discrimination are associated with preterm birth and with low birth weight independent of preterm birth status.(22,23)

To our knowledge, this is the first study to examine the association of maternal experiences of racial discrimination with infant sleep duration. Despite substantial evidence that racial discrimination is a psychosocial stressor (18,21), previous studies examining maternal experiences of psychological stress and infant sleep disturbance have focused only on depression and anxiety as potential factors (24,25), without investigating the social causes of these psychological outcomes. Our findings that racial discrimination may adversely affect infant sleep duration are consistent with studies conducted with children, adolescents, and adults that documented associations between poor sleep quality and quantity with the self-reported exposure to racial discrimination.(11)

Given the paucity of studies examining racism and infant sleep duration, we can only speculate on potential pathways by which maternal experiences of racial discrimination could influence infant sleep, drawing from other literature on predictors of infant sleep. Infant sleep is influenced by underlying biological factors, as well as by environmental and social cues. As Sadeh and Ander's transactional model suggest, the link between parental behaviors, especially at night, and infant sleep is the most direct and is a significant predictor of infant sleep problems.(26) Parenting practices such as high levels of parental involvement, short response latency to infant awakenings, and active soothing at bedtime have been associated with poor infant sleep quality.(27) However, a growing body of research suggests parenting quality (e.g. sensitivity, intrusiveness, hostility, structuring, infant responsiveness and involvement), as measured by emotional availability, might be a better predictor of bedtime infant sleep quality.(28) Positive emotional availability has been related to longer and better infant sleep at night.(29)

Postpartum depression is one factor that influences maternal emotional availability, whereby it hinders maternal sensitivity and structuring.(30) The effects of maternal experiences of racial discrimination on infant sleep could involve its influence on postpartum depression. Postpartum depression is associated with maternal negative nighttime behaviors that lead to more nighttime waking.(25) Though adjustment for postpartum depressive symptoms did not attenuate our observed relationship, it is possible that mothers who have experienced more racial discrimination experience higher psychological stress or postpartum anxiety, which have also been shown to hinder maternal emotional availability.(30)

Another potential mechanism involves the effects of racial discrimination on the family unit. Racial discrimination can negatively impact co-parenting and result in marital conflict.(31) In school aged children, marital conflict has been associated with increased sleep problems. (32) Additionally, as our study did not investigate the role of fathers in infant sleep, it is possible that maternal experiences of racial discrimination and its association with child sleep could be moderated by paternal involvement at bedtime. A growing body of evidence has shown that paternal involvement in child care positively influences child development. Not only may paternal involvement act to buffer maternal stress, but also lead to more consolidated sleep for infants.(33)

We observed reported maternal experiences of racial discrimination to have a greater association with infant sleep duration at 6 months than at 1 year and 2 years. This relationship could be the result of the complex interplay between physiological and psychosocial factors. The first year of life is marked by many changes in sleep structure, where infant sleep is typically inconsistent in the first half of the year and stabilizes by the second half, which might be susceptible to environmental cues.(24) Though mother-infant interactions are crucial to development throughout infancy, the mother is likely to play more of a role in the regulatory processes of the infant in the first months of life than later in infancy when infants are more independent in their state of regulation.(34) Infants' reliance upon maternal interactions for the co-regulation of sleep suggests that negative interactions could adversely affect infant sleep duration.

Our study had several strengths, including adjustment for potential demographic and socio-economic confounders and mediators, use of multiple imputation, which limits bias due to missing data, and use of a validated racial discrimination survey instrument. Our study also had several limitations. First, a limitation of any observational study is confounding by factors poorly measured or not available. Second, we measured sleep duration by parents' report on questionnaires as opposed to objective estimates of sleep such as from actigraphy. Also, although we asked separate questions about morning and afternoon naps at 6 months, it is possible that parents may have underestimated sleep time during naps (if the infant took >1 morning nap and the parent counted only 1 morning nap session; or if the infant took >1 afternoon nap and the parent counted only 1 afternoon nap session). Although parental report has limitations, a previous validation study among infants found that parental report of total sleep duration was associated with severe sleep problems that necessitated referral for sleep evaluation.(35) Additionally, we did not have information on maternal parenting behavior, especially, as it related to infant sleep. An additional limitation is that we lacked the power to test the hypothesis that the impact on infant sleep of mothers who experienced

racial discrimination differs comparing those who experienced this discrimination: (a) solely during early pregnancy; (b) solely before early pregnancy; (c) both before and during early pregnancy; as compared to (d) neither before or during early pregnancy, given the small number of women in category (a). However, if the impact of exposure to racial discrimination on infant sleep is primarily via its influence on parenting practices, lifetime exposure would be more relevant than solely exposure during early pregnancy. Finally, levels of maternal education and household income were relatively high in this cohort of women drawn from a multispecialty group practice setting in Massachusetts. Our results may not be generalizable to women of color with fewer socioeconomic resources or living elsewhere.

Conclusions

Our findings suggest that maternal lifetime experience of racial discrimination is associated with shortened sleep duration in their offspring in the first 6 months of life. Although further studies are needed to examine the mechanisms for such an association, our study suggests that racial discrimination might contribute to the racial/ethnic differences in sleep duration in infancy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Distribution of self-reported domains of lifetime experiences of racism, overall and by race/ethnicity, among 552 women of color from Project Viva, a pre-birth cohort study in Massachusetts, enrolled 1999–2002

Characteristic	Overall	Black	Hispanic	Asian*
	n=552	n=312	n=123	n=117
	N (%)			
Situational domains in which participants reported ever experiencing racial discrimination				
At school				
No	355 (64)	187 (60)	90 (73)	78 (67)
Yes	197 (36)	125 (40)	33 (27)	39 (33)
Getting hired or getting a job				
No	461 (84)	241 (77)	111 (90)	109 (93)
Yes	91 (16)	71 (23)	12 (10)	8 (7)
At work				
No	393 (71)	199 (64)	99 (80)	95 (82)
Yes	159 (29)	113 (36)	24 (20)	22 (18)
Getting housing				
No	488 (88)	263 (84)	111 (91)	114 (97)
Yes	64 (12)	49 (16)	12 (9)	3 (3)
Getting medical care				
No	524 (95)	293 (94)	118 (96)	113 (97)
Yes	28 (5)	19 (6)	5 (4)	4 (3)
Getting service in a store or restaurant				
No	302 (55)	130 (42)	83 (67)	89 (76)
Yes	250 (45)	182 (58)	40 (33)	28 (24)
On the street or in a public setting				
No	350 (63)	174 (56)	91 (74)	85 (72)
Yes	202 (37)	138 (44)	32 (26)	32 (28)
From the police or in the courts				
No	452 (82)	237 (76)	106 (86)	109 (93)
Yes	100 (18)	75 (24)	17 (14)	8 (7)
Number of domains, 3-level category				
0	168 (30)	61 (20)	51 (42)	56 (47)
1–2	194 (35)	111 (36)	43 (35)	40 (35)
3+	190 (34)	140 (45)	29 (24)	21 (18)

*We included N=8 participants with “other” race/ethnicity in the Asian category.

Table 2.

Participant characteristics by reported number of domains of racial discrimination. Data from 552 mother-infant pairs of color in Project Viva, a pre-birth cohort study in Massachusetts, enrolled 1999–2002

	Number of domains		
	0	1 to 2	≥3
	n=168	n=194	n=190
	N (%) or mean (SD)		
Mother			
Race/ethnicity, %			
Black	61 (37)	111 (57)	140 (73)
Hispanic	51 (31)	43 (22)	29 (15)
Asian *	56 (32)	40 (21)	21 (11)
Born in the US, %	67 (40)	120 (62)	126 (67)
Age at enrollment, years	30.4 (5.8)	29.2 (5.9)	30.6 (6.1)
Pre-pregnancy BMI, kg/m^2	24.5 (5.7)	26.4 (5.9)	27.2 (6.5)
College graduate, %	86 (51)	83 (43)	98 (52)
Smoking status, %			
Never	130 (78)	154 (80)	138 (73)
Former	14 (8)	20 (10)	21 (11)
During pregnancy	24 (14)	20 (10)	31 (16)
Household income >$70,000/year	72 (43)	66 (34)	77 (41)
Mother's sleep 6 m-1 y, h/d	7.1 (1.3)	7.0 (1.6)	6.9 (1.4)
Child			
Female, %	80 (48)	87 (45)	97 (51)
Infant sleep 6 m-2 y, h/d	11.8 (1.3)	11.6 (1.3)	11.5 (1.3)

* We included N=8 participants with "other" race/ethnicity in the Asian category.

Table 3.

Associations of racial discrimination score with infant sleep duration (weighted average 6 months to 2 years, minutes/day and separately at each timepoint)

Model	Racial Discrimination Score		
	0	1 to 2	≥3
		Minutes/day (95% CI)	
Weighted avg. 6 months - 2 years			
Model 1. Unadjusted	0.0 (ref)	−9.9 (−27.8, 7.9)	−18.6 (−37.3, 0.0)
Model 2. Adjusted for race/ethnicity and nativity	0.0 (ref)	−7.0 (−25.4, 11.4)	−13.6 (−33.7, 6.5)
Model 3. Model 2 + potential mediators	0.0 (ref)	−5.6 (−24.0, 12.8)	−13.9 (−34.1, 6.3)
6 months			
Model 1. Unadjusted	0.0 (ref)	−38.8 (−71.3, −6.3)	−51.0 (−84.0,−18.0)
Model 2. Adjusted for race/ethnicity and nativity	0.0 (ref)	−38.4 (−72.3, −4.6)	−49.3 (−85.3,−13.2)
Model 3. Model 2 + potential mediators	0.0 (ref)	−37.5 (−71.9, −3.2)	−51.0 (−87.9,−14.1)
1 year			
Model 1. Unadjusted	0.0 (ref)	4.9 (−25.8, 35.5)	−18.2 (−50.4, 14.1)
Model 2. Adjusted for race/ethnicity and nativity	0.0 (ref)	7.9 (−23.3, 39.1)	−13.5 (−47.2, 20.3)
Model 3. Model 2 + potential mediators	0.0 (ref)	9.3 (−21.9, 40.6)	−13.9 (−48.4, 20.6)
2 years			
Model 1. Unadjusted	0.0 (ref)	−2.9 (−25.3, 19.4)	−2.7 (−26.8, 21.3)
Model 2. Adjusted for race/ethnicity and nativity	0.0 (ref)	1.2 (−21.7, 24.2)	4.2 (−21.5, 29.9)
Model 3. Model 2 + potential mediators	0.0 (ref)	2.0 (−21.1, 25.1)	3.6 (−22.2, 29.4)

Potential mediators in Model 3: maternal education, household income, pre-pregnancy BMI, pregnancy smoking status, and urbanicity.