



Maternal Experiences of Racial Discrimination and Offspring Sleep in the First 2 Years of Life

Citation

Powell, Chloe A. 2018. Maternal Experiences of Racial Discrimination and Offspring Sleep in the First 2 Years of Life. Doctoral dissertation, Harvard Medical School.

Permanent link

<http://nrs.harvard.edu/urn-3:HUL.InstRepos:41973455>

Terms of Use

This article was downloaded from Harvard University's DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at <http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA>

Share Your Story

The Harvard community has made this article openly available.
Please share how this access benefits you. [Submit a story](#).

[Accessibility](#)

Date: 1 March 2018

Name: Chloé Powell, BSE

Title: Maternal Experiences of Racial Discrimination and Offspring Sleep in the First 2 Years of Life

Mentors: Elsie M. Taveras, MD, MPH,^{1,2} Matthew W. Gillman, MD, SM³

Collaborators: Sheryl L. Rifas-Shiman, MPH,⁴ Emily Oken, MD, MPH,^{2,4} Nancy Krieger, PhD,⁵ Janet W. Rich-Edwards, ScD,^{6,7} Susan Redline, MD, MPH⁸

¹ Division of General Academic Pediatrics, Department of Pediatrics, Massachusetts General Hospital for Children, Boston, MA

² Department of Nutrition, Harvard T.H. Chan School of Public Health, Boston, Massachusetts

³ Division of Chronic Disease Research Across the Lifecourse, Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, Boston, MA

⁴ Obesity Prevention Program, Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, Boston, MA

⁵ Department of Social and Behavior Sciences, Harvard T.H. Chan School of Public Health, Boston, Massachusetts

⁶ Connors Center for Women's Health and Gender Biology, Brigham and Women's Hospital and Harvard Medical School, Boston, MA

⁷ Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, MA

⁸ Department of Medicine, Harvard Medical School, Brigham and Women's Hospital, and Beth Israel Deaconess Medical School, Boston, MA

Abstract

Purpose

Insufficient sleep during infancy is associated with adverse child health outcomes including greater weight gain during infancy, childhood overweight, and developmental-behavioral conditions. Racial discrimination has been shown to be associated with shorter sleep duration in school aged children, adolescents, and adults; however, to our knowledge no studies have examined maternal experiences of lifetime racial discrimination and infant sleep duration. We hypothesize maternal lifetime experiences of racial discrimination will be associated with shorter infant sleep duration over the first 2 years of life

Methods

We analyzed data from 552 mother-infant dyads in Project Viva, a pre-birth cohort study, where the mothers self-identified as being women of color. During pregnancy, mothers completed the Experiences of Discrimination survey that measured lifetime experiences of racial discrimination in eight domains. We categorized responses as 0, 1-2, or ≥ 3 . The main outcome was infant average 24 hour sleep duration assessed at 6 months, 1 year, and 2 years, reported by mothers, from which we calculated a weighted average of daily sleep across the first 2 years of life. In multivariable analyses, we adjusted for maternal race/ethnicity (black vs other women of color), education, household income, pre-pregnancy BMI, pregnancy smoking status, urbanicity, child care outside home, and child sex.

Results

Among this cohort, 30% of the mothers reported having experienced, up to and through the time of their pregnancy, 0 domains of racial discrimination, 35% reported 1-2 domains, and 34% reported ≥ 3 domains. Women who reported at least 1 domain of racial discrimination were more likely to be black (80.4%), born in the United States (78.3%), and had higher pre-pregnancy BMI. Compared with children whose mothers reported no discrimination, those whose mothers reported ≥ 3 domains had shorter sleep duration from 6 months to 2 years in unadjusted analysis (β -0.31 h/d, 95% CI: -0.62 to 0.00), which was attenuated to -0.19 h/d, (95% CI: -0.52 to 0.14) after adjusting for maternal race/ethnicity, education, income, pre-pregnancy BMI, marital status, smoking history, childcare outside of the home, and urbanicity. We found stronger associations between maternal lifetime racial discrimination and offspring sleep at 6 months of age: β -0.79

h/d, (95% CI: -1.40 to -0.18) than for sleep at 1 year (β -0.21 h/d, 95% CI: -0.78 to 0.35) or 2 years (β 0.10 h/d, 95% CI: -0.33 to 0.52).

Conclusion

Although we observed no association between maternal lifetime experiences of racial discrimination and the mean duration of infant's sleep in the first two years, there was a suggestion of a modest association at 6 months postpartum.

Table of Contents

Section 1: Introduction.....	5
Section 2: Student Role.....	6
Section 3: Methods.....	7
Section 4: Results.....	11
Section 5: Discussion, Limitations, Conclusions.....	13
Section 6: Acknowledgements.....	16

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.^{3,4} 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.⁵⁻⁷

In the United States, sleep disparities exist by race and 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.⁸⁻¹⁰ In the first 2 years of life, black, Hispanic, and Asian infants sleep fewer hours than white infants.¹¹ Racial discrimination, the differential treatment of people based on race, is one of many factors that may account for these racial/ethnic differences in sleep in children, adolescents, and adults, as discrimination is associated with shorter sleep and poorer sleep quality.¹²

Not only does racism have deleterious consequences for the individual experiencing it, but its effects can also extend to the family unit.¹³ Parents who experienced racial discriminatory events tend to be less supportive and exhibit depressive symptoms, which likely influences parenting behaviors.¹⁴⁻¹⁶ Previous work has shown that parenting behaviors influence child sleep.^{17,18} Thus, mothers experiencing racism might be more likely to develop parenting practices that adversely affect their child's sleep environment.¹⁶

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.

Student Role

Drs. Gillman, Taveras and I shared study conception and design responsibility. I was responsible for the initial literature search and review, refining of study variables, and analysis of the data with the assistance of Sheryl Rifas-Shiman, who performed the statistical analysis.

Methods

Subjects/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 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.¹⁹

To define the study population for this investigation, we used data on 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 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.

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 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, the 153 non-participants were less likely to be college-educated (29% vs 48%) and to have annual household incomes exceeding \$70,000 (21% vs 39%). However, the distribution of racial/ethnic minorities was similar (57% vs 57% black). Additionally, the groups did not differ on racial discrimination prevalence (69% vs. 70% with any domains) and on mean maternal age (28.7 years vs. 30.1 years).

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.

Institutional review boards of participating institutions approved the study protocols. All mothers provided written informed consent at recruitment and at the postpartum visit, and procedures were in accordance with the ethical standards for human experimentation established by the Declaration of Helsinki.²⁰

Measurements

Main exposure

Mothers self-reported experiences of racial discrimination on an adapted and expanded version of the validated ‘Experiences of Discrimination’ (EOD) measure.²¹ 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 during three time periods (before the age of 18 years, from the age of 18 years until pregnancy, and during pregnancy): 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 a personal racism exposure score (range 0-8). We categorized self-reported domains of lifetime experiences of racism as 0, 1-2, or 3 or more domains to account for potential non-linear associations, and combined 3 or more domains because of low numbers who reported more than 3 domains.²¹ We made the assumption that the total number of settings in which women reported racial discrimination was an indicator of their overall exposure to racial discrimination.

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 mothers 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.” We have used these measures in other studies demonstrating their association with childhood obesity.^{6,22} 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 of the 3 data points and divided the sum by 2. We also examined sleep duration in hours/day at each age period.

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, moved to the United States before the age of 17 years, moved to the United States after the age of 17 years). Mothers reported their pre-pregnancy weight and height from which we calculated their pre-pregnancy body mass index (BMI). At 6 months, 1 year, and 2 years postpartum, we asked mothers to report whether or not the infant attended any child care outside the home. We defined urbanicity as the proportion of urban land use within 1 km of the mother’s residential address at each of the 3 time points. 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.²³

We assessed smoking during pregnancy by asking mothers at both first and second trimester visits about their cigarette smoking habits before and during pregnancy, as well as, maternal current smoking status. After delivery, mothers reported their infants’ sex and race/ethnicity.

Statistical Analysis

We used two racial/ethnic categories in our analysis: “black” and “other women of color”, which included women that identified as Hispanic, Asian, American Indian, and other. We chose the two categories because the effect size for Blacks was similar for the total population of women included in the analysis. The sample size of women that identified as

“other” was too small to have a four category racial/ethnicity covariate. We did not think it appropriate to combine those women that identified as “other” with “black”, “Hispanic”, or “Asian”; however, we still sought to include them, thus we used the two racial/ethnic categories.

Our main exposure of interest was self-reported domains of lifetime experiences of racism categorized as 0, 1-2, or 3 or more domains.²¹ 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 from 0-2 years. We then used multiple linear regression models to assess the independent associations between racism and infant sleep. In the multivariable models, we included only those covariates that were of *a priori* interest or empirically confounded associations of racism with sleep duration. We report effect estimates in hours/day of sleep with 95% confidence intervals.

We assessed for potential confounders and mediators by examining effect estimates before and after individually adding covariates to the models. We removed from the models variables that did not change the effect estimates by more than 10%, which included antenatal depression, postpartum depression at 6 months, birthweight for gestational age z-score, breastfeeding status at 6 months postpartum, timing of introduction to solids, weighted average of television or video viewing, and antenatal corticotrophin releasing hormone (CRH) levels.

Some variables in our analyses were not available for all subjects.^{24,25} We therefore used multiple imputation to generate several plausible values for each missing value. We used the chained equations approach with predictive mean matching based on linear regressions for approximating continuous variables, and logistic or generalized logistic regression for dichotomous or categorical variables. We used Imputation and Variance Estimation (IVEware) software to produce 50 complete data sets and combined multivariable modeling results (Proc MI ANALYZE) in SAS version 9.3 (SAS Institute, Cary, North Carolina, USA).

Results

We found that 168 (30%) participants 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). Black participants reported more domains of racial discrimination than participants from other racial/ethnic groups and also reported experiencing more racial discrimination for each situational domain. Compared with mothers who reported no experiences of racial discrimination, mothers who reported 1-2 or 3 or more domains showed some differences in sociodemographic and other characteristics. Women who reported more racial discrimination were more likely to be born in the United States and had higher pre-pregnancy BMI (Table 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 0 and to report greater than 3 lifetime domains of discrimination than 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 0.17 fewer hours/day (95% CI, -0.46 to 0.13), while infants slept 0.31 fewer hours/day (95% CI, -0.62 to 0.00) if their mothers reported 3 or more domains of racial discrimination.

When we adjusted for race/ethnicity only, we saw an attenuation of the effect estimates (1-2 domains: β -0.12, 95% CI: -0.43 to 0.18; ≥ 3 domains: β -0.24, 95% CI: -0.57 to 0.09). This association was unchanged in models that added, individually, each of the following covariates: infant sex, maternal education, household income, pre-pregnancy BMI, prenatal smoking history, urbanicity, and childcare outside of the home. In multivariable analyses, after we adjusted for all of the listed covariates, the association of maternal experiences of racial discrimination with infant sleep duration was attenuated (1-2 domains: β -0.08, 95% CI: -0.38 to 0.23; ≥ 3 domains: β -0.19, 95% CI: -0.52 to 0.14) (Table 3). Analysis of infant sleep at 6 months, 1 year, and 2 years postpartum separately revealed a stronger association between racial discrimination and sleep

duration at 6 months (β -0.79, 95% CI: -1.40 to -0.18 for ≥ 3 vs. 0) compared with 1 year (β -0.21, 95% CI: -0.78 to 0.35), and 2 years (β 0.10, 95% CI: -0.33 to 0.52). (Table 3).

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 0.8 hours, or approximately 45 minutes of sleep per day. By 2 years the association had disappeared. 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, even small reductions in sleep durations are associated with behavioral problems, cognitive delays, and weight gain in childhood.

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.^{22,23} 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.²⁴ 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.^{26,27} Maternal experiences of racial discrimination are associated with preterm birth and with low birth weight independent of preterm birth status.^{28–30}

To our knowledge, this is the first study to examine the association of maternal experiences of racial discrimination with infant sleep duration. Though racial discrimination is gaining recognition as an important type of psychosocial stressor,^{31,32} previous studies examining maternal experiences of psychological stress and infant sleep disturbance have focused only on depression and anxiety as potential factors.^{33,34} However, these studies did not examine the cause of these psychological stresses. Our findings that racial discrimination may adversely affect infant sleep duration are consistent with studies conducted in the adult population that documented poor sleep quality and quantity with the reporting of racial discrimination.^{35,36}

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, 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.³⁷

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.³⁸ 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.³⁹ Positive emotional availability has been related to longer and better infant sleep at night.^{39,40}

Postpartum depression is one factor that influences maternal emotional availability, whereby it hinders maternal sensitivity and structuring.^{41,42} The effects of maternal experiences of racial discrimination on infant sleep could involve its influence on postpartum depression.^{15,16} Postpartum depression is associated with maternal negative nighttime behaviors that lead to more nighttime waking.³³ Though adjustment for postpartum depressive symptoms did not attenuate our observed relationship, it is possible that mothers who have encountered more racial discrimination experience higher psychological stress or postpartum anxiety, which have also been shown to hinder maternal emotional availability.⁴¹

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.⁴³ In school aged children, marital conflict has been associated with increased sleep problems.⁴⁴ 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.^{45,46}

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.³⁴ 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 the infant is more

independent in his/her state of regulation.⁴⁷ 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 adjusting for potential demographic and socioeconomic confounders, 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 mothers' report on questionnaires as opposed to objective measures of sleep such as actigraphs. Although parental report has limitations, a previous validation study among infants found that parental report of sleep duration correlated significantly with sleep measures derived from actigraphy.⁴⁸ Finally, levels of maternal education and household income were relatively high in this cohort of women drawn from a multi-specialty group practice setting in Massachusetts. Our results may not be generalizable to racial/ethnic minority women 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.

Acknowledgements

Project Viva is supported by R01 HD034568. Dr. Taveras was also supported by a K24 grant (DK10589) from the National Institutes of Health and Dr. Oken was supported by K24 HD069408 and P30 DK092924 . The authors would like to thank the participants and staff of Project Viva.

References

1. Matricciani L, Olds T, Petkov J. In search of lost sleep: Secular trends in the sleep time of school-aged children and adolescents. *Sleep Med Rev.* 2012;16(3):203-211.
2. Centers for Disease Control and Prevention (CDC). Unhealthy sleep-related behaviors--12 States, 2009. *MMWR Morb Mortal Wkly Rep.* 2011;60(8):233-238.
3. Ednick M, Cohen AP, McPhail GL, Beebe D, Simakajornboon N, Amin RS. A review of the effects of sleep during the first year of life on cognitive, psychomotor, and temperament development. *Sleep.* 2009;32(11):1449-1458.
4. Taveras EM, Rifas-Shiman SL, Bub KL, Gillman MW, Oken E. Prospective Study of Insufficient Sleep and Neurobehavioral Functioning Among School-Age Children. *Acad Pediatr.* 2017;17(6):625-632.
5. Zuckerman B, Stevenson J, Bailey V. Sleep problems in early childhood: continuities, predictive factors, and behavioral correlates. *Pediatrics.* 1987;80(5):664-671.
6. Taveras EM, Rifas-Shiman SL, Oken E, Gunderson EP, Gillman MW. Short sleep duration in infancy and risk of childhood overweight. *Arch Pediatr Adolesc Med.* 2008;162(4):305-311.
7. Zhou Y, Aris IM, Tan SS, et al. Sleep duration and growth outcomes across the first two years of life in the GUSTO study. *Sleep Med.* 2015;16(10):1281-1286.
8. Carnethon MR, De Chavez PJ, Zee PC, et al. Disparities in sleep characteristics by race/ethnicity in a population-based sample: Chicago Area Sleep Study. *Sleep Med.* 2016;18:50-55.
9. Cappuccio FP, D'Elia L, Strazzullo P, Miller MA. Sleep Duration and All-Cause Mortality: A Systematic Review and Meta-Analysis of Prospective Studies. *Sleep.* 2010;33(5):585-592.
10. Cappuccio FP, Cooper D, D'Elia L, Strazzullo P, Miller MA. Sleep duration predicts cardiovascular outcomes: a systematic review and meta-analysis of prospective studies. *Eur Heart J.* 2011;32(12):1484-1492.
11. Nevarez MD, Rifas-Shiman SL, Kleinman KP, Gillman MW, Taveras EM. Associations of Early Life Risk Factors With Infant Sleep Duration. *Acad Pediatr.* 2010;10(3):187-193.
12. Slopen N, Lewis TT, Williams DR. Discrimination and sleep: a systematic review. *Sleep Med.* 2016;18:88-95.
13. Coll CG, Crnic K, Lamberty G, et al. An Integrative Model for the Study of Developmental

Competencies in Minority Children. *Child Dev.* 1996;67(5):1891-1914.

14. Sanders-Phillips K, Settles-Reaves B, Walker D, Brownlow J. Social Inequality and Racial Discrimination: Risk Factors for Health Disparities in Children of Color. *Pediatrics.* 2009;124(Supplement 3):S176-S186.
15. Brody GH, Chen Y-F, Kogan SM, Murry VM, Logan P, Luo Z. Linking Perceived Discrimination to Longitudinal Changes in African American Mothers' Parenting Practices. *J Marriage Fam.* 2008;70(2):319-331.
16. Anderson RE, Hussain SB, Wilson MN, Shaw DS, Dishion TJ, Williams JL. Pathways to Pain: Racial Discrimination and Relations Between Parental Functioning and Child Psychosocial Well-Being. *J Black Psychol.* 2015;41(6):491-512.
17. Mindell JA, Li AM, Sadeh A, Kwon R, Goh DYT. Bedtime Routines for Young Children: A Dose-Dependent Association with Sleep Outcomes. *Sleep.* 2015;38(5):717-722.
18. Philbrook LE, Teti DM. Bidirectional associations between bedtime parenting and infant sleep: Parenting quality, parenting practices, and their interaction. *J Fam Psychol.* 2016;30(4):431-441.
19. Oken E, Baccarelli AA, Gold DR, et al. Cohort profile: project viva. *Int J Epidemiol.* 2015;44(1):37-48.
20. World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *JAMA.* 2013;310(20):2191.
21. Krieger N, Smith K, Naishadham D, Hartman C, Barbeau EM. Experiences of discrimination: Validity and reliability of a self-report measure for population health research on racism and health. *Soc Sci Med.* 2005;61(7):1576-1596.
22. Taveras EM, Gillman MW, Peña M-M, Redline S, Rifas-Shiman SL. Chronic sleep curtailment and adiposity. *Pediatrics.* 2014;133(6):1013-1022.
23. Bottino CJ, Rifas-Shiman SL, Kleinman KP, et al. The association of urbanicity with infant sleep duration. *Health Place.* 2012;18(5):1000-1005.
24. Horton NJ, Kleinman KP. Much Ado About Nothing: A Comparison of Missing Data Methods and Software to Fit Incomplete Data Regression Models. *Am Stat.* 2007;61(1):79-90.
25. Rubin DB. *Multiple Imputation for Nonresponse in Surveys.* New York: Wiley; 1987.
26. Paradies Y, Ben J, Denson N, et al. Racism as a Determinant of Health: A Systematic Review and

Meta-Analysis. Hills RK, ed. *PLOS ONE*. 2015;10(9):e0138511.

27. Black LL, Johnson R, VanHoose L. The Relationship Between Perceived Racism/Discrimination and Health Among Black American Women: a Review of the Literature from 2003 to 2013. *J Racial Ethn Health Disparities*. 2015;2(1):11-20.
28. Rankin KM, David RJ, Collins JW. African American women's exposure to interpersonal racial discrimination in public settings and preterm birth: the effect of coping behaviors. *Ethn Dis*. 2011;21(3):370-376.
29. Earnshaw VA, Rosenthal L, Lewis JB, et al. Maternal experiences with everyday discrimination and infant birth weight: a test of mediators and moderators among young, urban women of color. *Ann Behav Med Publ Soc Behav Med*. 2013;45(1):13-23.
30. Wallace ME, Mendola P, Liu D, Grantz KL. Joint Effects of Structural Racism and Income Inequality on Small-for-Gestational-Age Birth. *Am J Public Health*. 2015;105(8):1681-1688.
31. Williams DR, Mohammed SA. Discrimination and racial disparities in health: evidence and needed research. *J Behav Med*. 2009;32(1):20-47.
32. Williams DR, Mohammed SA. Racism and Health I: Pathways and Scientific Evidence. *Am Behav Sci*. 2013;57(8).
33. Teti DM, Crosby B. Maternal depressive symptoms, dysfunctional cognitions, and infant night waking: the role of maternal nighttime behavior. *Child Dev*. 2012;83(3):939-953.
34. Sorondo BM, Reeb-Sutherland BC. Associations between infant temperament, maternal stress, and infants' sleep across the first year of life. *Infant Behav Dev*. 2015;39:131-135.
35. Grandner MA, Hale L, Jackson N, Patel NP, Gooneratne NS, Troxel WM. Perceived racial discrimination as an independent predictor of sleep disturbance and daytime fatigue. *Behav Sleep Med*. 2012;10(4):235-249.
36. Slopen N, Williams DR. Discrimination, other psychosocial stressors, and self-reported sleep duration and difficulties. *Sleep*. 2014;37(1):147-156.
37. Sadeh A, Anders TF. Infant sleep problems: Origins, assessment, interventions. *Infant Ment Health J*. 1993;14(1):17-34.
38. Sadeh A, Tikotzky L, Scher A. Parenting and infant sleep. *Sleep Med Rev*. 2010;14(2):89-96.
39. Teti DM, Kim B-R, Mayer G, Countermine M. Maternal emotional availability at bedtime

predicts infant sleep quality. *J Fam Psychol*. 2010;24(3):307-315.

40. Jian N, Teti DM. Emotional availability at bedtime, infant temperament, and infant sleep development from one to six months. *Sleep Med*. 2016;23:49-58.
41. Licata M, Zietlow A-L, Träuble B, Sodian B, Reck C. Maternal Emotional Availability and Its Association with Maternal Psychopathology, Attachment Style Insecurity and Theory of Mind. *Psychopathology*. 2016;49(5):334-340.
42. Trapolini T, Ungerer JA, McMahon CA. Maternal depression: relations with maternal caregiving representations and emotional availability during the preschool years. *Attach Hum Dev*. 2008;10(1):73-90.
43. Riina EM, McHale SM. Parents' Experiences of Discrimination and Family Relationship Qualities: The Role of Gender. *Fam Relat*. 2010;59(3):283-296.
44. El-Sheikh M, Hinnant JB, Erath SA. Vi. Marital conflict, vagal regulation, and children's sleep: a longitudinal investigation. *Monogr Soc Res Child Dev*. 2015;80(1):89-106.
45. Tikotzky L, Sadeh A, Glickman-Gavrieli T. Infant sleep and paternal involvement in infant caregiving during the first 6 months of life. *J Pediatr Psychol*. 2011;36(1):36-46.
46. Millikovsky-Ayalon M, Atzaba-Poria N, Meiri G. The role of the father in child sleep disturbance: child, parent, and parent-child relationship. *Infant Ment Health J*. 2015;36(1):114-127.
47. de Weerth C, van Geert P. Changing patterns of infant behavior and mother-infant interaction: Intra- and interindividual variability. *Infant Behav Dev*. 2001;24(4):347-371.
48. Sadeh A. A brief screening questionnaire for infant sleep problems: validation and findings for an Internet sample. *Pediatrics*. 2004;113(6):e570-577.

Table 1. Distribution of self-reported domains of lifetime experiences of racism, overall and by race/ethnicity, among 552 racial/ethnic minority women from Project Viva, a pre-birth cohort study in Massachusetts

Characteristic	Total n=552	Black n=312	Hispanic n=123 (%)	Asian n=109	Other n=8
Situational domains in which participants reported ever experiencing racial discrimination					
At school					
No	64.3	59.8	72.8	69.7	35.8
Yes	35.7	40.2	27.2	30.3	64.3
Getting hired or getting a job					
No	83.6	77.2	90.5	94.3	80.8
Yes	16.4	22.8	9.5	5.7	19.3
At work					
No	71.2	63.9	80.1	83.6	53.8
Yes	28.8	36.1	19.9	16.4	46.3
Getting housing					
No	88.4	84.3	90.6	97.4	93.5
Yes	11.6	15.7	9.4	2.6	6.5
Getting medical care					
No	95.0	94.0	95.5	97.0	96.8
Yes	5.0	6.0	4.5	3.0	3.3
Getting service in a store or restaurant					
No	54.7	41.8	67.4	77.2	60.0
Yes	45.3	58.2	32.6	22.8	40.0
On the street or in a public setting					
No	63.4	55.7	74.4	73.3	61.0
Yes	36.6	44.3	25.6	26.7	39.0
From the police or in the courts					
No	81.8	75.9	86.3	95.2	58.3
Yes	18.2	24.1	13.7	4.8	41.8
Number of domains, 3-level category					
0	30.4	19.6	41.8	48.8	21.8
1-2	35.2	35.6	34.7	34.9	33.0
3+	34.4	44.8	23.6	16.3	45.3

Table 2. Participant characteristics by reported number of domains of racial discrimination. Data from 552 mother-infant pairs of color in Project Viva

	Number of domains		
	0 n=168	1 to 2 n=194	≥3 n=190
	% or mean (SD)		
Mother			
Race/ethnicity			
Black	37%	57%	73%
Hispanic	31%	22%	15%
Asian	32%	20%	9%
Other populations of color	1%	1%	2%
Age at enrollment, y	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	51%	43%	52%
Smoking status			
Never	78%	80%	73%
Former	8%	10%	11%
During pregnancy	14%	10%	16%
Household income >\$70,000/year	43%	34%	41%
Child			
Female	48%	45%	51%
Infant sleep 6 m-2 y, h/d	11.8 (1.3)	11.6 (1.3)	11.5 (1.3)

Table 3. Associations of racial discrimination score with infant sleep duration (weighted average 6 months to 2 years, h/d)

Model	Racial Discrimination Score		
	0	1 to 2	≥3
	Hours/day (95% CI)		
Weighted avg. 6 months to 2 years			
Unadjusted	0.0 (ref)	-0.17 (-0.46, 0.13)	-0.31 (-0.62, 0.00)
Adjusted*	0.0 (ref)	-0.08 (-0.38, 0.23)	-0.19 (-0.52, 0.14)
6 months			
Unadjusted	0.0 (ref)	-0.65 (-1.19,-0.11)	-0.85 (-1.40,-0.30)
Adjusted*	0.0 (ref)	-0.58 (-1.15,-0.02)	-0.79 (-1.40,-0.18)
1 year			
Unadjusted	0.0 (ref)	0.08 (-0.43, 0.59)	-0.30 (-0.84, 0.24)
Adjusted*	0.0 (ref)	0.14 (-0.37, 0.65)	-0.21 (-0.78, 0.35)
2 years			
Unadjusted	0.0 (ref)	-0.05 (-0.42, 0.32)	-0.05 (-0.45, 0.36)
Adjusted*	0.0 (ref)	0.05 (-0.33, 0.43)	0.10 (-0.33, 0.52)

*Adjusted for maternal race/ethnicity (black vs. other women of color), education, household income, pre-pregnancy BMI, pregnancy smoking status, urbanicity, child care outside home, and child sex