

**Racial Disparities in Birth Outcomes
and Racial Discrimination as an Independent Risk Factor Affecting
Maternal, Infant, and Child Health**

An Executive Summary of Existing Research



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The International Center for Traditional Childbearing (ICTC) is a non-profit infant mortality prevention, breastfeeding support, and midwife training organization, comprised of women and men who want to improve birth outcomes and provide training opportunities in their communities. <http://ictcmidwives.org/>

The International Cesarean Awareness Network, Inc. (ICAN) is a nonprofit organization whose mission is to improve maternal-child health by preventing unnecessary cesareans through education, providing support for cesarean recovery, and promoting Vaginal Birth After Cesarean (VBAC). <http://www.ican-online.org/>

The Midwives Alliance of North America (MANA) is a professional membership organization that promotes excellence in midwifery practice, endorses diversity in educational backgrounds and practice styles, and is dedicated to unifying and strengthening the profession, thereby increasing access to quality health care and improving outcomes for women, babies, families, and communities. <http://mana.org/>

Elephant Circle is an innovative reproductive justice organization dedicated to circling around in support of strong people during vulnerable times. Elephant Circle practices circling with presently and historically marginalized groups, groups no one else is helping, and groups that share an intersectional reproductive justice analysis. <http://elephantcircle.net/>

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EXECUTIVE SUMMARY

by Shandanette Molnar, JD, MPH

“We carry our history in our bodies . . . How can we not?”
- Nancy Krieger, [Unnatural Causes](#)

Intro

Despite widespread calls to reduce the infant mortality, preterm birth, and low birthweight rates in the United States,¹ racial disparities in birth outcomes persist, with African-American infants remaining the most vulnerable. In 2013, the rate of preterm birth for African-American infants was nearly double that for white infants.² Known medical, genetic, and/or sociodemographic factors alone do not account for these disparities, leading researchers to examine race and the experience of racial discrimination as independent risk factors for affecting maternal, infant, and child health.³

This Executive Summary is organized as follows: First, we include statistical data to describe the racial disparities in birth outcomes, including preterm birth, low birthweight, and infant mortality. Next, we provide a summary of current research to examine the correlations between race, racism, and poor birth outcomes. Finally, we provide recommendations to policymakers and researchers so that meaningful strides can be made toward dismantling racism, a necessary strategy to improve birth outcomes and eliminate healthcare disparities in the United States.

Background: Statistics

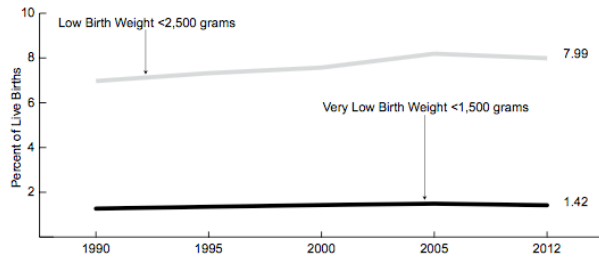
There were just under 4 million (3,932,181) births in 2013.² The rate of preterm birth, defined as birth before 37 weeks gestation, declined in 2013 to 11.39%.² According to the CDC, infants who weigh less than 2500 grams (5.5 pounds) at birth are classified as low birthweight infants.² Infants who weigh less than 1500 grams (3.25 pounds) at birth are classified as very low birthweight infants.² In 2013, the rate of low birthweight births remained unchanged at just over 8% of births.² More than one percent (1.4%) of infants were born at very low birthweights in 2013.²

African-American women, defined as non-Hispanic Black women by the CDC, gave birth to 583,834 infants in 2013.² More than 16% of African-American infants born in 2013 were born preterm, compared to only 10% of white infants born preterm.² Black women also gave birth to low birthweight (LBW) and very low birthweight (VLBW) infants at greater rates than white women (LBW = 8.5% vs. 4.6%, VLBW = 2.8% vs. 1.06%, respectively.)²

2013 was not an anomaly; African-American infants have reported higher rates of preterm birth since the CDC began comparing data in 1981.⁴ Despite efforts to improve racial disparities in birth outcomes, African-American infants are more than twice as likely as White infants to die in their first year of life.³

Low and Very Low Birth Weight, 1990–2012*

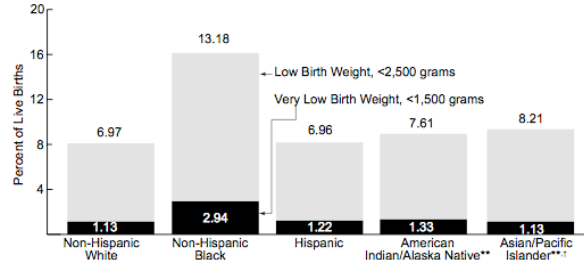
Source (I.1, I.2): Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System



*Data for 2012 are preliminary.

Low and Very Low Birth Weight, by Maternal Race/Ethnicity, 2012*

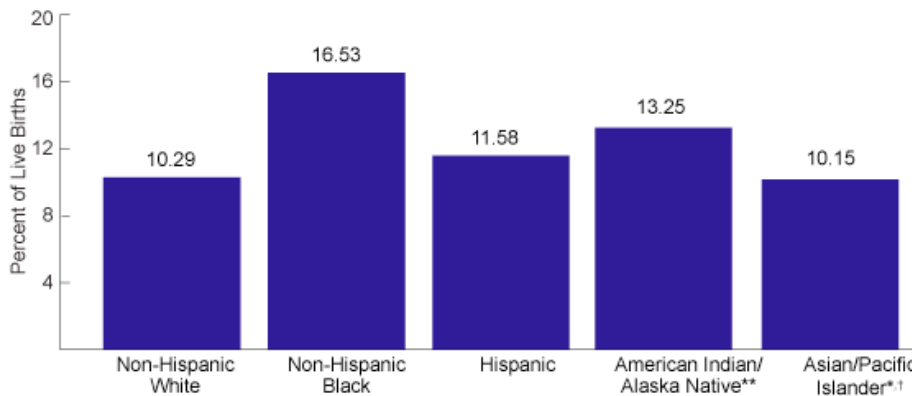
Source (I.1): Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System



*Data for 2012 are preliminary. **Includes Hispanics. †Separate data for Asians and Native Hawaiians and Other Pacific Islanders not available.

African-American pregnant women are nearly four times more likely to die from pregnancy-related complications than are white women.⁵ African-American pregnant women are also two to three times more likely to experience preterm birth,⁶ and three times more likely to give birth to a low birthweight infant.³ This disparity persists even after researchers control for confounding medical and sociodemographic risk factors, such as low income, low education, and alcohol and tobacco use.³ In fact, research shows that the gap widens as socioeconomic levels increase.^{3,7} In order to explain these persistent disparities in health outcomes, researchers now theorize that racism serves as a course of chronic stress, negatively affecting the body’s hormonal levels, which can initiate physical mechanisms that may lead to preterm birth.^{3,8} The graph below demonstrates the disparities in birth outcomes, with Non-Hispanic Black and Native American women reporting higher rates of pre-term birth than their white, Asian, and Hispanic counterparts.⁹

Preterm Birth, by Maternal Race/Ethnicity, 2012*



*Data are preliminary. **Includes Hispanics. †Separate data for Asians and Native Hawaiians and Other Pacific Islanders not available.

Source: Hamilton BE, Martin JA, Ventura SJ. Births: Preliminary data for 2012. National vital statistics reports; vol 62 no 3. Hyattsville, MD: National Center for Health Statistics. 2013.

Summary of current research to examine the correlations between race, racism, and poor birth outcomes

“[S]tress and racism are constant factors in African-American women’s lives and are inseparable from their pregnancy experiences.”

Source: Barnes GL. Perspectives of African-American women on infant mortality. *Soc Work Health Care*. 2008;47(3):293-305.

Hormones play an integral role in pregnancy and childbirth, including initiating the physiological process of labor. Researchers have identified relationships between elevated stress hormone levels and chronic exposures (i.e., throughout the life-course) to stress. Such research suggests that those who experience chronic stress, such as racism and discrimination, have measurably higher levels of stress hormones.¹⁰ Increased hormone levels cause the body to remain “chronically activated” because it is unable to return to its normal state following a stressful event.¹¹ This creates a “wear and tear” effect on the body, which researchers identify as the primary cause of malfunctions in “allostatic load” or “allostasis.”¹¹ Thus, a chronically activated maternal stress response may initiate pre-term labor.¹¹ Based on the findings in the existing scientific literature, prenatal stress, including racism, is associated with an increased risk of poor birth outcomes, including preterm birth and low birthweight.¹²

Research indicates that African-American women experience more chronic stress in their lives than white women, in part due to the effects of lifetime exposure to interpersonal racism.^{13,14} Researchers have also found that African-American women who delivered very low birthweight infants were more likely to report incidences of interpersonal racism than those who delivered higher weight infants at term.³ Another study found that African-American women who reported frequent discrimination in the form of interpersonal racism were more likely to give birth to very low birthweight infants and/or deliver preterm.¹⁵ Researchers also found that African-American participants who reported high levels of racial discrimination were at 3.1 times the risk of preterm delivery and almost five times more likely to deliver low birthweight infants.¹⁵

Increasingly, research suggests that chronic maternal stress affects fetal programming and lifelong health, highlighting the importance of implementing a life-course approach in healthcare delivery and research.¹⁶ The “fetal programming” hypothesis suggests that stimuli during critical periods of embryonic and fetal development may alter such development and influence lifelong health. In general, when humans encounter a stressor, the body responds with a quick increase then decrease of glucocorticoids, mainly the stress hormone cortisol. This physiological process is mediated by the hypothalamic-pituitary-adrenocortical axis (HPA-axis). Abnormal activity of the HPA axis, particularly quick increase or slow decrease, is associated with an increased risk of depression later in life.¹⁷ Thus, it is important to note that chronic stress, such as racial discrimination, may negatively affect maternal, infant, and child health, underscoring the importance of supporting the mother-child dyad.

Currently, researchers are unclear of the exact mechanism by which maternal stress affects fetal programming and development, but there are various hypotheses posed by researchers. First, an excess of active maternal cortisol may pass the placental barrier, affecting the development and function of the fetal HPA-axis.¹⁸ Data suggests that the disruption of the hypothalamic-pituitary-adrenocortical axis (HPA-axis) may negatively affect fetal programming.¹⁹ Alternatively, the maternal HPA-axis may stimulate the production of corticotrophin releasing hormone (CRH) through the placenta, which has been found to increase the risk of preterm birth

threefold.²⁰ Finally, an increase of cortisol in the maternal bloodstream may reduce the flow of blood through the placenta and to the uterus, potentially slowing fetal growth.¹²

The association between racism, chronic stress, and preterm birth may be explained by the fact that persistent psychological stress increases levels of stress hormones. Researchers have found that women at highest risk for preterm birth had higher levels of stress hormones, including CRH, adrenocorticotropin-releasing hormone (ACTH), and cortisol.²¹ Data suggests that women who report frequent discrimination report higher levels of cortisol and are more likely to give birth to infants with higher cortisol reactivity.²² High levels of fetal cortisol can affect the fetus's ability to grow *in utero* and may predispose the fetus to diseases later in life.²³ Elevated levels of cortisol also increase the likelihood of elevated levels of CRH, which increases the risk of preterm birth.¹⁸

Current research supports the theory that chronic maternal stress affects fetal programming, with some research finding a link between racism-related maternal stress, stress hormones, and infant and child health outcomes.^{3,18} From such findings, researchers conclude that lifelong experiences of interpersonal racism serve as an independent risk factor for preterm birth.³ Thus, racism can influence maternal, infant, and child health trajectories prior to conception, as evidenced by data showing correlations between exposure to racism during childhood and increased likelihood of birthing a low birthweight infant.²⁴

Nonetheless, much remains unknown about the relationship between racism and poor birth outcomes, and more research is needed. For instance, research methodologies must account for the pervasive, chronic, and multidimensional experiences of interpersonal and structural racism throughout the life-course. Additionally, it is unclear how or why other racial minorities escape the outcome disparities that African-Americans experience. Future research must therefore implement a life course health development framework in order to examine the intergenerational affects of racism, weathering, and birth outcomes.

Recommendations

“[The] life-course framework...clearly illustrates that we will never eliminate disparities in birth outcomes if we only focus on the 9 months of pregnancy.”

Source: Rohan AM, Onheiber PM, Hale LJ, et al. Turning the ship: making the shift to a life-course framework. *Matern Child Health J.* 2013;18(2):423-30.

Racial discrimination serves as a major source of stress for African-American women, and data suggests that the physiological responses to chronic stress may explain the persistent racial disparities in birth outcomes.^{3,25} Maternal stress affects fetal development and is associated with preterm birth and low birthweight, which increases the risk of disease, disability, and early death over the life-course.²⁶ Thus, programs to reduce maternal stress during pregnancy must also

include efforts to understand and improve the lived experiences of African-American women and women of color by employing strategies to reduce stress caused by racial discrimination.

Efforts to improve birth outcomes for African-Americans must implement a life-course perspective, which strives to understand and improve population health by acknowledging that health is influenced by more than individual biology and personal choices, but also the environment, social determinants of health, and health equity. The research referenced throughout this Executive Summary demonstrates that birth outcomes are influenced by events and experiences that occur prior to pregnancy. Thus, efforts to reduce racial disparities and improve birth outcomes must shift away from a mere focus on pregnancy care and instead implement a whole-person, life-course perspective, which prioritizes primary and preventive care throughout one's life.

Perhaps most importantly, implementing a life-course perspective requires the acknowledgement and elimination of racism.²⁷ Meaningful efforts must be made to dismantle the various ways that racism pervades our society, including interpersonal and structural racism, which inhibits access to health care and utilization of social support services. Given institutional mistrust and inequities in healthcare access, policymakers and key stakeholders must increase the accessibility of healthcare to populations of color and other marginalized groups. This includes expanding access to Medicaid-approved providers, as well as addressing factors that discourage healthcare use, including inability to locate a provider, the availability of culturally competent providers in low-income communities, bolstering health care infrastructure to reduce wait times and appointment scheduling, providing additional social services for low-income or single-parent families and child care services, etc.

Additionally, "Trust . . . is the basis of quality clinical care,"²⁸ and careful attention must be paid to improve provider-patient relationships, repair institutional mistrust, and focus on patient- or client-centered care. Recent research released by Childbirth Connection names disrespectful maternity care as a source of stress during pregnancy. This factor combined with the insidious nature of internalized racism negatively affects healthcare delivery²⁹ and demonstrates the need for improving access to safe, respectful, supportive, and evidence-based maternity care.

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RESEARCH: RACIAL DISCRIMINATION, HORMONES, AND ADVERSE BIRTH OUTCOMES

Top Supporting Birth Research

Date: May 2009

Article Title: What Causes Racial Disparities in Very Preterm Birth? A Biosocial Perspective

Design: Literature Review

Summary: Premature birth is major cause of infant illness and death. African-American women are nearly three times more likely to give birth prior to 32 weeks gestation (“very preterm”) than are white pregnant women. Increasingly, research suggests that this disparity could be caused by the body’s physiological response to chronic exposure to stress and racial discrimination throughout a woman’s life.¹ This means that the experience of racism can influence maternal health trajectories prior to conception, ultimately determining birth and subsequent infant health outcomes. Therefore, we should work toward dismantling racism and addressing the social determinants of health in order to promote both maternal and child health outcomes across the life-course.

Quotes: “We found growing evidence to support the role of socially patterned maternal stress, possibly over the life course, as a cause of racial disparities in VPT birth.”^{2(p93)}

Notes: This is a fairly comprehensive literature review. This article does not present new research but provides a great overview of the relationship between racism, racial disparities, and birth outcomes.

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Kramer, M. R., and Hogue, C. R. (2009). What causes racial disparities in very preterm birth? a biosocial perspective. *Epidemiologic Reviews* 31, 84-98.

AMA Citation: Kramer MR, Hogue CR. What causes racial disparities in very preterm birth? A biosocial perspective. *Epidemiol Rev.* 2009;31:84-98.

¹ Sandman CA, Glynn L, Schetter CD, et al. Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): priming the placental clock. *Peptides*. 2006;27(6):1457-63.

² Kramer MR, Hogue CR. What causes racial disparities in very preterm birth? A biosocial perspective. *Epidemiol Rev.* 2009;31:84-98.

Date: Jan.-Feb. 2009

Article Title: The interaction between chronic stress and pregnancy: preterm birth from a biobehavioral perspective

Design: Literature review

Summary: Hormones play an integral role in pregnancy and childbirth, including initiating the physiological process of labor. Researchers have identified relationships between stress hormones and a lifetime exposure to stress. Such research suggests that those who repeatedly experience stress (also identified as chronic stress), such as racism and discrimination, report higher levels of stress hormones.³ Studies have also identified relationships between stress hormones and preterm birth. For instance, one study found that women at highest risk for preterm birth had higher levels of stress hormones, including corticotrophin-releasing hormone (CRH), adrenocorticotropin hormone (ACTH), and cortisol.⁴ A body that experiences higher levels of stress hormones remains “chronically activated” because it is unable to return to its normal state following a stressful event. This creates a “wear and tear” effect on the body, which researchers call “allostatic load” or “allostasis.”⁵ Importantly, researchers conclude that a pregnant woman whose ability to respond to stress remains “chronically activated” may give birth preterm because these stress hormones may initiate labor.^{5,6,7,8,9,10,11}

Quotes:

- “The initiation of normal term parturition is the result of an intricate interplay between the maternal, fetal, and placental endocrine, paracrine, and autocrine systems.”^{5(p4)}
- “[E]levated levels of CRH early in gestation (16–20 weeks’) is associated with a higher risk of PTB and precedes the occurrence of PTB by weeks or even months.”^{5(p4)}
- “It has been proposed that such disparities may exist as a result of a lifetime of exposure to chronic stress (allostatic load), rather than a predominant genetic predisposition.”^{5(p4)}
- “Several studies have identified relationships between ‘stress’ hormones (i.e., ACTH and cortisol) and either an increased occurrence of PTB and/or increased maternal blood levels of CRH in pregnancy.”^{5(p5)}
- “[A] chronically activated maternal stress response may prematurely provoke the physiologic mechanisms that initiate the labor and delivery process.”^{5(p6)}

Notes: This article provides a great literature review, which highlights the interaction between stress and pregnancy.

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Latendresse, G. (2009). The Interaction Between Chronic Stress and Pregnancy: Preterm Birth from A Biobehavioral Perspective. *Journal of Midwifery and Women’s Health*, 54(1), 8-17.

AMA Citation: Latendresse G. The interaction between chronic stress and pregnancy: preterm birth from a biobehavioral perspective. *J Midwifery Womens Health*. 2009;54(1):8-17.

³ Makrigiannakis A, Semmler M, Briese V, et al. Maternal serum corticotropin-releasing hormone and ACTH levels as predictive markers of premature labor. *Int J Gynaecol Obstet*. 2007;97(2):115-119.

⁴ Sandman CA, Glynn L, Schetter CD, et al. Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): priming the placental clock. *Peptides*. 2006;27(6):1457-1463.

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Date: Dec. 2004

Article Title: Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination

Design: Prospective, Case-Controlled Study

- Researchers performed a case-control study among 104 African American women who delivered very low birthweight (< 1500 g) preterm (< 37 weeks) infants and 208 African American women who delivered non-low-birthweight (> 2500g) term infants in Chicago.
- Researchers administered a study questionnaire. Using previously validated instruments, they asked about lifetime and pregnancy exposure to interpersonal racial discrimination. Experiences of racism were self reported.
 - o All participants were asked yes/no questions about their lifetime and pregnancy exposure to interpersonal racial discrimination in 5 domains: at work, at school, and getting a job, medical care, and service at a restaurant or store. Researchers determined the distribution of reported interpersonal racial discrimination in each domain, 1 or more domains, and 3 or more domains.
- Researchers accounted for Medicaid status and SES in their analyses.

Summary: Low infant birthweight is a leading cause of infant mortality, and African-American infants are more likely to be born very low birthweight (VLBW).¹² Despite efforts to improve birth outcomes and reduce health disparities in the United States, this gap persists.¹² Research indicates that African-American women experience more chronic stress in their lives than white women, in part due to the effects of lifetime exposure to interpersonal racism.¹³ In this study, African-American women who delivered very low birthweight infants were more likely to report incidences of interpersonal racism than those who delivered higher weight infants at term.¹² The association between racism, stress, and preterm birth may be explained by the fact that psychological stress increases levels of CRH, triggering the hormonal events that can lead to preterm birth. Greater exposure to racial discrimination throughout one's life also increases the risks posed by chronic stress. From such findings, researchers conclude that lifelong experiences of interpersonal racism serve as an independent risk factor for preterm birth.¹²

Quotes:

- "[P]sychophysiological stress is likely to accelerate the release of corticotropin-releasing hormone, which initiates a cascade of events leading to preterm delivery."^{12(p2132)}
- "When women aged older than 30 years or those having more than 12 years of education were compared with all others, a significantly increased association with VLBW was found ($\chi^2=4.8$, $P=.03$ for age, $\chi^2=5.4$, $P=.02$ for education)."^{12(p2133)}
- "We found that African American mothers who delivered VLBW preterm infants were more likely to report experiencing interpersonal racial discrimination during their lifetime than African American mothers who delivered NLBW infants at term."^{12(p2135)}
- "These findings provide evidence that greater lifetime exposure to racial discrimination among African American women contributes to the racial disparity in VLBW infants."^{12(p2135)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Collins, J. W., David, R. J., Handler, A., Wall, S., & Andes, S. (2004). Very low birthweight in African American infants: The role of maternal exposure to interpersonal racial discrimination. *American Journal of Public Health, 94*(12), 2132-2138.

AMA Citation: Collins JW, David RJ, Handler A, Wall S, Andes S. Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination. *Am J Public Health. 2004;94*(12):2132-2138.

¹² Collins JW, David RJ, Handler A, Wall S, Andes S. Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination. *Am J Public Health. 2004;94*(12):2132-2138.

¹³ Stancil T, Hertz-Picciotto I, Schramm M, Watt- Morse M. Stress and pregnancy among African-American women. *Paediatr Perinat Epidemiol. 2000;14*:127-135.

Date: Dec. 2004

Article Title: Self-reported experiences of racial discrimination and Black-White differences in preterm and low-birthweight deliveries: the CARDIA Study

Design: Prospective, Cohort-Study

- Sample size = 352 (152 African-American women, 200 white women)
 - o Racial discrimination questions were not asked until year 7. "Participants were recruited from 4 geographically diverse metropolitan areas: [Birmingham, Chicago, Oakland, and Minneapolis, Minn.] A stratified random sampling procedure was employed with the goal of achieving a sample that included equal numbers of Blacks and Whites, women and men, individuals aged 18 to 25 and 25 to 30 years, and individuals with less than a high school education and more than a high school education."^{14(p2125)}
- Birth Outcomes
 - o Self-reported: Respondents reported birth weight and gestational age at birth in weeks. PTB = before 37 weeks gestation.
 - o To minimize recall error or bias, researchers included a covariate for elapsed time between birth and year 10 interviews.
- Racial Discrimination
 - o Self-reported: Participants were asked if they "ever experienced discrimination, been prevented from doing something or been hassled or made to feel inferior . . . because of their race or color" in any of 7 situations: "at school, getting a job, at work, getting housing, getting medical care, on the street or in a public setting, and from the police or in the courts."^{14(p2125)} Respondents were then divided into three categories: 0, 1/2, or 3 (meaning that they experienced discrimination in 0/7, 1/2 of 7, or 3/7 situations).
- Poverty: Researchers accounted for income levels and educational differences.

Summary: Race-based disparities in birth outcomes are only partially explained by factors that increase the risk of preterm birth and poor birth outcomes, such as tobacco, alcohol, and drug use; the use of prenatal care; genetics; and socio-economic status. Researchers have now started to examine the effects of stress caused by racial discrimination and its impact on pregnancy and birth outcomes. For instance, one study found that African-American women who reported frequent discrimination were more likely to deliver very low birthweight infants and/or deliver preterm.¹⁴ Researchers also found that African-American participants who reported high levels of racial discrimination were at 3.1 times the risk of preterm delivery and almost five times more likely to deliver low birthweight infants.¹⁴

Quotes:

- "Extant research indicates that this Black-White gap is only partially explained by major identified determinants of these adverse birth outcomes such as tobacco, alcohol, and drug use; use of prenatal care; genetics; and socioeconomic position."^{14(p2125)}
- "The persistence of the Black-White gap, even after taking into account socioeconomic position and other known risk factors, has led to formulation of a new hypothesis: that racial discrimination, as a psychosocial stressor, may increase the risk of preterm and LBW deliveries."^{14(p2125)}
- "We found that high levels of self-reported experiences of racial discrimination were associated with both preterm and LBW deliveries and might contribute to Black-White disparities in these adverse birth outcomes."^{14(p2129)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Mustillo, S., Krieger, N., Gunderson, E. P., Sidney, S., McCreath, H., & Kiefe, C. I. (2004). Self-reported experiences of racial discrimination and black-white differences in preterm and low-birthweight deliveries: The CARDIA study. *American Journal of Public Health, 94*(12), 2125-2131.

AMA Citation: Mustillo S, Krieger N, Gunderson EP, Sidney S, McCreath H, Kiefe CI. Self-reported experiences of racial discrimination and Black-White differences in preterm and low-birthweight deliveries: the CARDIA Study. *Am J Public Health. 2004;94(12):2125-2131.*

¹⁴ Mustillo S, Krieger N, Gunderson EP, Sidney S, McCreath H, Kiefe CI. Self-reported experiences of racial discrimination and Black-White differences in preterm and low-birthweight deliveries: the CARDIA Study. *Am J Public Health. 2004;94(12):2125-2131.*

Date: Aug. 2004

Article Title: Psychosocial factors and preterm birth among African American and White women in central North Carolina

Design: Prospective, Cohort Study

- Sample size = 1898
 - o Cohort recruited at gestational weeks 24 and 29 from two clinics: one primarily serving low-income women who are eligible for publicly subsidized prenatal care and one serving both women eligible for publicly subsidized services and privately insured patients.
- Questions regarding perceived stress from racial and gender discrimination were modified slightly from the original scales developed by Krieger and Sidney.¹⁵
- Race = self-reported (94%) or abstracted from medical charts (6%).
- Researchers accounted for poverty, level of education, and various confounders.
 - o "A variety of potential confounders were assessed, including participant's age, parity, education, marital status, economic status (i.e., annual household income as a percentage of the federal poverty threshold, taking into consideration the number of adults and children in the household), pre-pregnancy body mass index, and prenatal care site; also assessed was the presence of bacterial vaginosis at 24–29 weeks of gestation."^{16(p1359)}

Summary: Race-based disparities in birth outcomes cannot be explained exclusively by differences in income, education, health behaviors, and access to prenatal care. Researchers have thus started to examine the relationship between racism, racial discrimination, and racial disparities in birth outcomes, with some concluding that the increased risk of preterm birth may be explained by psychological stress caused by high levels of interpersonal racial discrimination.¹⁷

Quotes:

- "Some researchers have postulated that increased risk for preterm birth among African American women may be attributable to psychosocial or environmental stressors that are specific to race or that differ in prevalence by race."^{16(p1358)}
- "African American women who reported high levels of perceived racial or gender discrimination were more likely than those who reported lower levels to deliver preterm."^{16(p1361)}
- "Although African American women in our sample reported more depressive symptoms, we found no association between depression and preterm birth among either African American or White women and no benefit for general social support, although White women who lacked the support presumably derived from living with a partner were at increased risk for preterm birth."^{16(p1361)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Dole, N., Savitz, D. A., Siega-Riz, A. M., Hertz-Picciotto, I., McMahon, M. J., & Buekens, P. (2004). Psychosocial factors and preterm birth among African American and white women in central North Carolina. *American Journal of Public Health, 94*(8), 1358-1365.

AMA Citation: Dole N, Savitz DA, Siega-Riz AM, Hertz-Picciotto I, McMahon MJ, Buekens P. Psychosocial factors and preterm birth among African American and White women in central North Carolina. *Am J Public Health. 2004;94*(8):1358-1365.

¹⁵ Krieger N. Racial and gender discrimination: risk factors for high blood pressure? *Soc Sci Med. 1990;30*: 1273–1281.

¹⁶ Dole N, Savitz DA, Siega-Riz AM, Hertz-Picciotto I, McMahon MJ, Buekens P. Psychosocial factors and preterm birth among African American and White women in central North Carolina. *Am J Public Health. 2004;94*(8):1358-1365.

¹⁷ Collins JW, David RJ, Handler A, Wall S, Andes S. Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination. *Am J Public Health. 2004;94*(12):2132-2138.

Top Supporting Background Research

Date: Winter 2010

Article Title: Closing the Black-White Gap in Birth Outcomes: A Life-Course Approach

Design: Applications Article

Summary: The authors provide a 12-point plan using the life-course approach to reduce Black-white disparities in birth outcomes. The first four points include increasing access to 1) interconception care, 2) preconception care, 3) quality prenatal care, and 4) healthcare throughout the life course. The next four points include strengthening 5) father involvement, 6) systems integration, 7) reproductive social capital, and 8) community building, which aims to enhance family and community systems that may influence the health of pregnant women, families, and communities. The last four points include 9) closing the education gap, 10) reducing poverty, 11) supporting working mothers, and 12) undoing racism. These last four points strive to move beyond the biomedical model to address the social and economic inequities that underlie much of health disparities.

Interestingly, Lu's findings display the interrelatedness of the weathering hypothesis and life-course perspectives. This underscores the need for a life-course health development framework that can begin to address the intergenerational effects of racism, hormones, and birth outcomes.

Quotes:

- "Closing the Black-White gap in birth outcomes requires a life course approach which addresses both early life disadvantages and cumulative allostatic load over the life course."^{18(p62)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Lu, M. C., Kotelchuck, M., Hogan, V., Jones, L., Wright, K., & Halfon, N. (2010). Closing the Black-White gap in birth outcomes: A life-course approach. *Ethnicity and Disease*.

AMA Citation: Lu MC, Kotelchuck M, Hogan V, Jones L, Wright K, Halfon N. Closing the Black-White gap in birth outcomes: a life-course approach. *Ethn Dis*. 2010;20(1 Suppl 2):S2-62-76.

¹⁸ Lu MC, Kotelchuck M, Hogan V, Jones L, Wright K, Halfon N. Closing the Black-White gap in birth outcomes: a life-course approach. *Ethn Dis*. 2010;20(1 Suppl 2):S2-62-76.

Date: May 2006

Article Title: "Weathering" and age patterns of allostatic load scores among blacks and whites in the United States

Design: Retrospective, Cohort

- Used data from the 1999-2002 NHANES study to examine gender and race differences in age-related allostatic load scores
 - o "[Ten] biomarkers were selected for inclusion in the algorithm conceptualizing allostatic load. Systolic and diastolic blood pressures and body mass index (BMI) were obtained from physical examinations. Glycated hemoglobin, albumin, creatinine clearance, triglycerides, C-reactive protein, homocysteine, and total cholesterol were collected from blood samples."^{19(p827)}
 - "The points were then summed to obtain the allostatic load score, with a maximum score of 10 possible."^{19(p827)}
 - o Researchers calculated mean scores by age category (18–24, 25–34, 35–44, 45–54, and 55–64 years), race (Black or White), and gender.

Summary: Allostatic load measures the body's ability to respond to stress, and repeated stress can lead to higher allostatic load scores. Higher allostatic load scores are associated with older age, increased mortality, lower socioeconomic status, and poorer health. Research shows that African-Americans report higher mean level allostatic load scores than do their white counterparts, with African-American women consistently reporting the highest scores.¹⁹ This may be explained by the fact that African-American women experience both race and gender based discrimination.¹⁹ Based on this study, researchers suggest that the stress caused by racism and racial discrimination negatively affect health as high allostatic load levels lead to "weathering" of physiological systems, which contribute to an earlier deterioration of health.¹⁹

Quotes:

- "We found evidence that racial inequalities in health exist across a range of biological systems among adults and are not explained by racial differences in poverty. The weathering effects of living in a race-conscious society may be greatest among those Blacks most likely to engage in high-effort coping."^{19(p826)}
- "Blacks experience early health deterioration as a consequence of the cumulative impact of repeated experience with social or economic adversity and political marginalization."^{19(p826)}
- "[P]ersistent racial differences in health may be influenced by the stress of living in a race-conscious society."^{19(p830)}
- "In sum, racial differences in allostatic load scores are small in the late teens and early 20s, but they quickly widen beginning in young adulthood through middle age and are largest between the ages of 35 and 64 years. Black women of these ages suffer the highest probability of having a high allostatic load score whether compared with Black men or with White men or women. These findings provide evidence that the impact of chronic stress on health has important implications not only for individuals but also for the population as a whole and suggest ways that dynamic social relationships between racial and ethnic groups may shape health in a race-conscious society. The findings suggest that progress in understanding and eliminating racial health inequality may require paying attention to the ways that American public sentiment on race, including its gendered aspects, exacts a physical price across multiple biological systems from Blacks who engage in and cope with the stressful life conditions presented to them."^{19(p832)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Geronimus, A. T., Hicken, M., Keene, D., & Bound, J. (2006). "Weathering" and age patterns of allostatic load scores among blacks and whites in the United States. *American Journal of Public Health, 96*(5), 826-833.

AMA Citation: Geronimus AT, Hicken M, Keene D, Bound J. "Weathering" and age patterns of allostatic load scores among blacks and whites in the United States. *Am J Public Health. 2006;96*(5):826-833.

¹⁹ Geronimus AT, Hicken M, Keene D, Bound J. "Weathering" and age patterns of allostatic load scores among blacks and whites in the United States. *Am J Public Health. 2006;96*(5):826-833.

Other Related Birth Research

Date: Jan. 2015

Article Title: Ethnic discrimination predicts poor self-rated health and cortisol in pregnancy: Insights from New Zealand

Design: Prospective, Cohort – International

Summary: Cortisol is a stress hormone, and the overproduction of cortisol is linked to cardiovascular disease and mental illness. Postpartum women who experienced racial discrimination had higher levels of cortisol and gave birth to infants with higher cortisol reactivity.

Quotes:

“Women reporting discrimination experience had worse self-rated health, higher evening cortisol and gave birth to infants with higher cortisol reactivity, all independent of ethnicity and material deprivation. These findings suggest that discrimination experience can have biological impacts in pregnancy and across generations, potentially contributing to the ethnic gradient in health.”^{20(p36)}

Notes:

Links: [PubMed Abstract](#); [Full Article \(\\$35.95\)](#); [ScienceDaily](#)

APA Citation: Thayer, Z. M., Kuzawa, C.W. (2015). Ethnic discrimination predicts poor self-rated health and cortisol in pregnancy: Insights from New Zealand. *Social Science & Medicine*, 128, 36-42.

AMA Citation: Thayer ZM, Kuzawa CW. Ethnic discrimination predicts poor self-rated health and cortisol in pregnancy: Insights from New Zealand. *Soc Sci Med*. 2015;128:36-42.

²⁰ Thayer ZM, Kuzawa CW. Ethnic discrimination predicts poor self-rated health and cortisol in pregnancy: Insights from New Zealand. *Soc Sci Med*. 2015;128:36-42.

Date: Oct. 2013 (online); 2014 (print)

Article Title: Institutional racism, neighborhood factors, stress, and preterm birth

Design: Retrospective, Cohort

- This study focused on the association between preterm birth and institutional racism, as measured by residential racial segregation and redlining, as well as the association between preterm birth and reported stress, discrimination, and neighborhood quality.
- Relied on data from clinic-based sample of pregnant women [sample size (n)=3462] participating in stress and pregnancy study conducted from 1999-2004 in Philadelphia.
- Researchers linked data from the 2000 Census and Home Mortgage Disclosure Act (HMDA) from 1999-2004 to develop measures of redlining and segregation.
- Stress measured using the Cohen Perceived Stress Scale, which was validated among predominantly college white population

Summary: Institutional and/or structural racism can also affect birth outcomes. One such study examines the relationship between preterm birth and institutional racism, as measured by residential racial segregation and redlining.²¹ Researchers found that redlining was associated with a slightly lower risk of preterm birth in African-American women.²¹ Additionally, African-American women who owned homes were more likely to experience preterm birth than African-American women who rented homes, whether they were private or public renters.²¹

Quotes:

Notes: This is somewhat contradictory and/or surprising: researchers found that redlining associated with *lower* rates of preterm birth, to which researchers attributed to neighborhood cohesion. However, this study may pose considerable methodological questions. Researchers found NO association between stress and preterm birth. However, they used the Cohen Perceived Stress Scale, which was validated among a mostly college white population and may not have captured dimensions of stress among lower-income pregnant women of color.

Links: [PubMed Abstract](#) ; [Full Article \(\\$40 - emailed to us\)](#)

APA Citation: Mendez, D. D., Hogan, & V. K., Culhane, J. F. (2014). Institutional racism, neighborhood factors, stress, and preterm birth. *Ethnicity and Health*, 19(5), 479-499.

AMA Citation: Mendez DD, Hogan VK, Culhane JF. Institutional racism, neighborhood factors, stress, and preterm birth. *Ethn Health*. 2014;19(5):479-499.

²¹ Mendez DD, Hogan VK, Culhane JF. Institutional racism, neighborhood factors, stress, and preterm birth. *Ethn Health*. 2014;19(5):479-499.

Date: Sept. 2013

Article Title: Stress-Induced Inflammatory Responses in Women: Effects of Race and Pregnancy

Design: Prospective, Case-Control

- Sample size (n) =78; Thirty-nine women in the 2nd trimester of pregnancy (19 African American; 20 White) and 39 demographically similar nonpregnant women completed an acute stressor (Trier Social Stress Test). Psychosocial characteristics, health behaviors, and affective responses were assessed. Serum interleukin(IL)-6 was measured via high sensitivity ELISA at baseline, 45 minutes, and 120 minutes post-stressor.

Summary: Racial discrimination increases the frequency of the stress process and affects the physiological response to stress. Researchers have found that inflammation may be caused by psychological stress, and such inflammation may affect birth outcomes.²² African-American pregnant and non-pregnant women experience stress-induced inflammatory responses at higher rates than do their white counterparts.

Quotes:

- “[P]erceived racial discrimination has been repeatedly linked to increase risk of preterm delivery and low birth weight.”^{22(p1)}
- “Inflammatory processes are implicated in adverse birth outcomes including preterm birth. Therefore, more robust and extended inflammatory responses may confer increased risk of adverse birth outcomes, particularly among women who experience more frequent acute stressor exposure.”^{22(p10)}

Notes: Analyzes cortisol levels of participants (pregnant/non-pregnant; white/Black), but found no significant cortisol increases in response to the stressor.

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Christian, L. M., Glaser, R., Porter, K., & Iams, J. D. (2013). Stress-induced inflammatory responses in women: effects of race and pregnancy. *Psychosomatic medicine*, 75(7), 658-669.

AMA Citation: Christian LM, Glaser R, Porter K, Iams JD. Stress-induced inflammatory responses in women: effects of race and pregnancy. *Psychosom Med*. 2013;75(7):658-669.

²² Christian LM, Glaser R, Porter K, Iams JD. Stress-induced inflammatory responses in women: effects of race and pregnancy. *Psychosom Med*. 2013;75(7):658-669.

Date: Feb. 2013

Article Title: Turning the Ship: Making the Shift to a Life-Course Framework

Design:

- "We will highlight some of the ways in which Wisconsin has woven life-course theory, messages, and approaches into programming at the state and local levels, discuss the challenges and opportunities that have arisen during implementation, and chart our plans for continued life-course efforts."^{23(p1)}

Summary: Stress continues to serve as a major barrier to improve birth outcomes in the United States.²³

Quotes:

- "The graph of the life-course framework . . . clearly illustrates that we will never eliminate disparities in birth outcomes if we only focus on the 9 months of pregnancy."^{23(p2)}
- "The life-course framework integrates a focus on critical periods and early life events with an emphasis on the wear and tear (weathering) that a person experiences over time."^{23(p2)}
- "Stress is a major barrier to improved birth outcomes."^{23(p2)}

Notes: This article describes WI's improvements in MCH since integrating a life-course approach into its work supporting healthy birth outcomes, women's health, early childhood systems, children & youth with special needs, and chronic disease programs. It is not directly helpful to our research, although as Holly Horan notes, "It may be helpful in the sense of providing feasible applications of this work – as the approach to rectifying racism can seem daunting, disheartening, and overly complicated."

Links: [PubMed Abstract](#) ; [Full Article \(\\$39.95 - emailed to us\)](#)

APA Citation: Rohan, A. M., Onheiber, P. M., Hale, L. J., Kruse, T. L., Jones, M. J., Gillespie, K. H., Lathen, L. S., et al. (2013). Turning the ship: Making the shift to a life-course framework. *Maternal and Child Health Journal*, 18(2), 423-430.

AMA Citation: Rohan AM, Onheiber PM, Hale LJ, et al. Turning the ship: making the shift to a life-course framework. *Matern Child Health J*. 2013;18(2):423-430.

²³ Rohan AM, Onheiber PM, Hale LJ, et al. Turning the ship: making the shift to a life-course framework. *Matern Child Health J*. 2013;18(2):423-430.

Date: Dec. 2012

Article Title: **Racial discrimination, response to unfair treatment, and depressive symptoms among pregnant black and African American women in the United States**

Design: Prospective, Cohort

- Two prospective cohort studies:
 - o ACCESS = public clinics
 - Sample size (n)=525; Limited to women who self-identified as African-American and/or Latina
 - o Project Viva = private obstetrical practices
 - Sample size (n)=352; Limited to women who self-identified as African-American and/or Latina
- Racial discrimination
 - o Self-reported through a modified version of Krieger's Experiences of Discrimination (EOD) questionnaire that asked "participants to respond 'yes' or 'no' to 'I have experienced unfair or bad treatment because of my race or ethnicity' in 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 (no = 0, yes = 1)."²⁴
- Depressive symptoms were determined using the Edinburgh Postnatal Depression Scale (EPDS) during a mid-pregnancy interview for ACCESS participants and as part of a self-report questionnaire for Project Viva participants.
 - o Researchers **did not** conduct post-pregnancy testing.
- Covariates included various SES factors, included income, marital status, and level of education.

Summary: Maternal depression during pregnancy has been associated with increased risk of preterm birth and low birthweight among women of lower socioeconomic status in the United States.²⁵ African-American women who reported higher instances of racism were more likely to experience depression and/or depressive symptoms during pregnancy.²⁴

Quotes: "Our findings suggest that higher levels of perceived racial discrimination may increase depressive symptoms during pregnancy among U.S. black women."^{24(p840)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(not free, but price not listed\)](#)

APA Citation: Ertel, K. A., James-Todd, T., Kleinman, K., Krieger, N., Gillman, M., Wright, R., & Rich-Edwards, J. (2012). Racial discrimination, response to unfair treatment, and depressive symptoms among pregnant black and African American women in the United States. *Annals of Epidemiology*, 22(12), 840-846.

AMA Citation: Ertel KA, James-Todd T, Kleinman K, et al. Racial discrimination, response to unfair treatment, and depressive symptoms among pregnant black and African American women in the United States. *Ann Epidemiol*. 2012;22(12):840-846.

²⁴ Ertel KA, James-Todd T, Kleinman K, et al. Racial discrimination, response to unfair treatment, and depressive symptoms among pregnant black and African American women in the United States. *Ann Epidemiol*. 2012;22(12):840-846.

²⁵ Grote NK, Bridge JA, Gavin AR, Melville JL, Iyengar S, Katon WJ. A meta-analysis of depression during pregnancy and the risk of preterm birth, low birth weight, and intrauterine growth restriction. *Arch Gen Psychiatry*. 2010;67(10):1012-1024.

Date: Jan. 2011

Article Title: Maternal prenatal stress and cortisol reactivity to stressors in human infants

Design: Prospective, Longitudinal Cohort - International

- This is a longitudinal study, taking place in the Netherlands.
- NOTE: There is no mention of racism or discrimination.

Summary: Maternal stress has been linked with important changes in fetal programming and development.²⁶ Researchers have identified three potential pathways: 1) cortisol may cross through the placenta and through the fetal blood-brain barrier, affecting fetal brain development; 2) stress may constrict blood flow to the placenta, decreasing the availability of nutrients and oxygen to the fetus; 3) stress may cause a change in maternal behavior, including a change in eating patterns or the increase of smoking and/or alcohol use.²⁶

Quotes:

Notes: This article provides a great life-course perspective/introduction of the relationship between maternal stress and fetal development. This article also discusses the various ways that cortisol may affect fetal programming. For more information, please see page 54.

Links: [PubMed Abstract](#) ; [Full Article \(\\$52\)](#)

APA Citation: Tollenaar, M. S., Beijers, R., Jansen, J., Riksen-Walraven, J. M. A., & Weerth, C. de. (2011). Maternal prenatal stress and cortisol reactivity to stressors in human infants. *Stress (Amsterdam, Netherlands)*, 14(1), 53-65.

AMA Citation: Tollenaar MS, Beijers R, Jansen J, Riksen-Walraven JM, De Weerth C. Maternal prenatal stress and cortisol reactivity to stressors in human infants. *Stress*. 2011;14(1):53-65.

²⁶ Tollenaar MS, Beijers R, Jansen J, Riksen-Walraven JM, De Weerth C. Maternal prenatal stress and cortisol reactivity to stressors in human infants. *Stress*. 2011;14(1):53-65.

Date: May 2009

Article Title: How race becomes biology: embodiment of social inequality

Design: Critical literature review

Summary: In the United States, racial disparities exist in certain healthcare outcomes, including cardiovascular disease, diabetes, stroke, certain cancers, low birth weight, preterm delivery. Increasingly, researchers are looking to racism and social inequalities as the source of persistent racial disparities.²⁷ Gravlee argues that racial inequalities in health care provide an opportunity to refine the critique of race in three ways: “1) to reiterate why the race concept is inconsistent with patterns of global human genetic diversity; 2) to refocus attention on the complex, environmental influences on human biology at multiple levels of analysis and across the lifecourse; and 3) to revise the claim that race is a cultural construct and expand research on the sociocultural reality of race and racism.”^{28(p47)}

Quotes:

- “The specific challenge is to explain how race becomes biology. Our response to this challenge must deal with two senses in which race becomes biology: Systemic racism becomes embodied in the biology of racialized groups and individuals, and embodied inequalities reinforce a racialized understanding of human biology. To break this cycle, I propose that the conventional critique of race needs to be refined in three ways: 1) to clarify why recent genetic findings do not warrant a return to racial thinking, 2) to promote a more complex, biocultural view of human biology, and 3) to revise the conceptualization of race so that it becomes more than a mantra.”^{28(p54)}

Notes: This article provides a great background of constructs of race and how current biomedical research fails to account for the various ways that race becomes biology, a process known in the social and epidemiological sciences as “embodiment.”

Links: [PubMed Abstract](#) ; [Full Article \(\\$38\)](#)

APA Citation: Gravlee, C. C. (2009). How race becomes biology: Embodiment of social inequality. *American Journal of Physical Anthropology*, 139(1), 47-57.

AMA Citation: Gravlee CC. How race becomes biology: embodiment of social inequality. *Am J Phys Anthropol*. 2009;139(1):47-57.

²⁷ Collins JW, David RJ, Handler A, Wall S, Andes S. Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination. *Am J Public Health*. 2004;94(12):2132-2138.

²⁸ Gravlee CC. How race becomes biology: embodiment of social inequality. *Am J Phys Anthropol*. 2009;139(1):47-57.

Date: Jan. 2009

Article Title: "It's the skin you're in": African-American women talk about their experiences of racism. an exploratory study to develop measures of racism for birth outcome studies

Design: Qualitative, Ethnographic Research

- Sample size (n)=40
 - o Researchers conducted 6 focus groups of 5-10 women.
 - o To recruit a socioeconomically diverse sample, researchers utilized a snowball sampling technique and recruited women from state-funded prenatal programs and professional networks. Researchers also collected data related to income and education level.
- Data collection
 - o Researchers conducted a semi-structured interview developed by the Measures of Racism Working Group. Researchers asked open-ended questions intended to engage women in freely discussing their experiences with racism.

Summary: Racism and frequent experiences of racial discrimination affect the way bodies respond to stress. Over time, chronic exposure to discrimination, particularly when it begins during childhood, can create "wear and tear" on the body's ability to regulate its stress response and related hormones. Researchers refer to this "wear and tear" as "allostatic load."²⁹ African-American women experience racism throughout their lives, beginning in childhood, and also experience stress due to the racism their children encounter.³⁰ As a result, studies show that African-American women report higher allostatic load scores than white women, which can cause African-American to age prematurely, particularly during their reproductive years.²⁹ This may explain an additional mechanism in which racism can affect health and birth outcomes. For example, Black women who report experiencing racial discrimination may be three times more likely to have a preterm birth and/or give birth to a low birthweight or very low birthweight infant.³¹

Quotes:

- "[S]elf-reported experiences of racism have been empirically linked with up to three-fold increases in adverse birth outcomes including low birth-weight, very low birthweight, and preterm delivery."^{30(p30)}
- "African-American women's racism experiences start early in life and continue pervasively throughout the lifecourse."^{30(p39)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Nuru-Jeter, A., Dominguez, T. P., Hammond, W. P., Leu, J., Skaff, M., Egerter, S., Jones, C. P., et al. (2009). "It's the skin you're in": African-American women talk about their experiences of racism. An exploratory study to develop measures of racism for birth outcome studies. *Maternal and Child Health Journal*, 13(1), 29-39.

AMA Citation: Nuru-Jeter A, Dominguez TP, Hammond WP, et al. "It's the skin you're in": African-American women talk about their experiences of racism. an exploratory study to develop measures of racism for birth outcome studies. *Matern Child Health J*. 2009;13(1):29-39.

²⁹ Geronimus AT, Hicken M, Keene D, Bound J. "Weathering" and age patterns of allostatic load scores among blacks and whites in the United States. *Am J Public Health*. 2006;96(5):826-833.

³⁰ Nuru-Jeter A, Dominguez TP, Hammond WP, et al. "It's the skin you're in": African-American women talk about their experiences of racism. an exploratory study to develop measures of racism for birth outcome studies. *Matern Child Health J*. 2009;13(1):29-39.

³¹ Mustillo S, Krieger N, Gunderson EP, Sidney S, McCreath H, Kiefe CI. Self-reported experiences of racial discrimination and Black-White differences in preterm and low-birthweight deliveries: the CARDIA Study. *Am J Public Health*. 2004;94(12):2125-2131.

Date: Oct. 2008 (online)

Article Title: **Perspectives of African-American women on infant mortality**

Design:

Summary: African-American women report that racial discrimination serves as a constant source of stress throughout their lives, with racism and discrimination-related stress “inseparable from their pregnancy experiences.”^{32(p293)}

Quotes:

- “Participants indicated that the experiences of stress and racism are constant factors in African-American women’s lives and are inseparable from their pregnancy experiences.”^{32(p293)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(\\$40\)](#)

APA Citation: Barnes, G. L. (2008). Perspectives of African-American women on infant mortality. *Social work in health care*, 47(3), 293-305.

AMA Citation: Barnes GL. Perspectives of African-American women on infant mortality. *Soc Work Health Care*. 2008;47(3):293-305.

³² Barnes GL. Perspectives of African-American women on infant mortality. *Soc Work Health Care*. 2008;47(3):293-305.

Date: Oct. 2008 (online)

Article Title: Low Birth Weight of Contemporary African Americans: An Intergenerational Effect of Slavery?

Design: Theoretical Commentary and Literature Review

Summary: This article supports the hypothesis that the long-lasting effects of slavery play a role in persistent health disparities. Low birthweight persists even after researchers control for confounding factors such as tobacco use, socioeconomic status, level of education, etc.³³ Research suggests that low birthweight in African-Americans may be explained by slavery,³ in part due to the demanding physical labor, high rates of teen pregnancy, and poor nutrition of slaves.³⁴

Quotes:

- "The main hypothesis presented in this article states that in African Americans too few generations have elapsed with improved energetic status to counteract the tragic multigenerational effects of nutritional deprivation on birth weight of children."^{34(p23)}

Notes: The background of this article provides a great overview of research related to race and poor birth outcomes, and particularly notes those studies that account for various confounding factors.

Links: [PubMed Abstract](#) ; [Full Article \(\\$18 – emailed to us\)](#)

APA Citation: Jasienska, G. (2009). Low birth weight of contemporary African Americans: An intergenerational effect of slavery? *American Journal of Human Biology*, 21(1), 16-24.

AMA Citation: Jasienska G. Low birth weight of contemporary African Americans: an intergenerational effect of slavery?. *Am J Hum Biol.* 2009;21(1):16-24.

³³ Dominguez TP. Race, racism, and racial disparities in adverse birth outcomes. *Clin Obstet Gynecol.* 2008;51(2):360-370.

³⁴ Jasienska G. Low birth weight of contemporary African Americans: an intergenerational effect of slavery?. *Am J Hum Biol.* 2009;21(1):16-24.

Date: Oct. 2008 (online)

Article Title: Epigenetics and the Embodiment of Race: Developmental Origins of US Racial Disparities in Cardiovascular Health

Design: Literature Review

- Researchers aimed to evaluate the relationship between maternal stress during pregnancy on fetal development and the risk of cardiovascular disease in adults.

Summary: Maternal stress during pregnancy may alter fetal development and correlates with preterm birth and low-birth weight in African-American infants.³⁵ Low birthweight also increases the risk of adult cardiovascular disease, diabetes, and hypertension.³⁵

Quotes:

- "There is extensive evidence for a social origin to prematurity and low birth weight in African Americans, reflecting pathways such as the effects of discrimination on maternal stress physiology. In light of the inverse relationship between birth weight and adult CVD, there is now a strong rationale to consider developmental and epigenetic mechanisms as links between early life environmental factors like maternal stress during pregnancy and adult race-based health disparities in diseases like hypertension, diabetes, stroke, and coronary heart disease."^{36(p2)}

Notes: This article has a good discussion of biology of stress, hormones, crossing the placenta, and fetal development.

Links: [PubMed Abstract](#) ; [Full Article \(\\$28 - emailed to us\)](#)

APA Citation: Kuzawa, C. W., & Sweet, E. (2009). Epigenetics and the embodiment of race: Developmental origins of US racial disparities in cardiovascular health. *American Journal of Human Biology*, 21(1), 2-15.

AMA Citation: Kuzawa CW, Sweet E. Epigenetics and the embodiment of race: developmental origins of US racial disparities in cardiovascular health. *Am J Hum Biol*. 2009;21(1):2-15.

³⁵ Gluckman PD, Hanson MA, Cooper C, Thornburg KL. Effect of in utero and early-life conditions on adult health and disease. *N Engl J Med*. 2008;359(1):61-73.

³⁶ Kuzawa CW, Sweet E. Epigenetics and the embodiment of race: developmental origins of US racial disparities in cardiovascular health. *Am J Hum Biol*. 2009;21(1):2-15.

Date: Jun. 2008

Design: Literature Review

Article Title: Race, racism, and racial disparities in adverse birth outcomes

Summary: While race is largely a social construct, racial stratification and the stress caused by racism negatively affect health and may explain persistent racial disparities in birth outcomes, including preterm birth, low birthweight, and infant mortality.³⁷ Racism remains pervasive and multidimensional, affecting clinical practice and access to health care.³⁷

Quotes:

- "Given the legacy and continuing presence of racism in the United States, race operates as a social stratifier, resulting in racial group hierarchies and marked inequalities in resources, power, opportunity, and social status."^{37(p360)}
- "[R]esearchers often focus on the interpersonal manifestations of racism, typically operationalized as race-based experiences with unfair treatment, prejudiced attitudes, personal attacks or harassment, social exclusion, and daily hassles."^{37(p363)}
- "Although results are somewhat mixed, perceived or self-reported racism has been related in the expected direction to a number of health behaviors (e.g., smoking, alcohol/substance use), mental (eg, depression, anxiety, self-esteem, life satisfaction), and physical health outcomes (e.g., hypertension, heart disease, diabetes)."^{37(p363)}
- "The chronic stress of racism and the social inequality it engenders may be underlying social determinants of persistent racial disparities in health, including infant mortality, preterm delivery, and low birth weight."^{37(p360)}
- "Trust, therefore, is the basis of quality clinical care."^{37(p366)}

Notes: This article notes the "healthy immigrant effect", which might be helpful to illustrate the point that Collins & David³⁸ highlight: first generation African immigrants have birth outcomes comparable to white women. Once African women relocate to the U.S., birth outcomes decline after just one generation, which suggests that the lived experiences of racial discrimination in the U.S. may explain poor birth outcomes.

This article also notes the fact that poor birth outcomes remain higher for African-Americans, even after controlling for known risk factors, and that this gap widens at higher socioeconomic levels.³⁷

Links: [PubMed Abstract](#) ; [Full Article \(not free, but price not listed\)](#)

APA Citation: Dominguez, T. P. (2008). Race, racism, and racial disparities in adverse birth outcomes. *Clinical obstetrics and gynecology*, 51(2), 360-370.

AMA Citation: Dominguez TP. Race, racism, and racial disparities in adverse birth outcomes. *Clin Obstet Gynecol*. 2008;51(2):360-370.

³⁷ Dominguez TP. Race, racism, and racial disparities in adverse birth outcomes. *Clin Obstet Gynecol*. 2008;51(2):360-370.

³⁸ Collins JW, David RJ, Handler A, Wall S, Andes S. Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination. *Am J Public Health*. 2004;94(12):2132-2138.

Date: Mar. 2008

Article Title: Racial differences in birth outcomes: the role of general, pregnancy, and racism stress

Design: Prospective, Cohort

- Sample size (n)=124
 - o 51 African-American and 73 non-Hispanic White pregnant women
 - o Smokers and those who used drugs were excluded.
 - o Race was self-reported.
- Researchers controlled for confounding factors, including childhood and adulthood SES; level of education; level of income.
- "A prospective, repeated-measures observational study design was used to collect psychosocial and medical data at 18–20 weeks (Time 1), 24–26 weeks (Time 2), and 30–32 weeks (Time 3) gestation via structured interview and chart review."^{39(p3)}
 - o "A 24-item stressful life events inventory was completed at Time 1 and Time 3 to assess the number of stressful life events participants, and/or someone close to them, had been exposed to in the previous year and during the course of the pregnancy."^{39(p5)}
 - o "A 12-item brief version of the Perceived Stress Scale (PSS) was developed for this study to assess subjective feelings of chronic stress at Time 1 and Time 3."^{39(p5)}
 - o Researchers measured anxiety at Times 1, 2, and 3 using the Spielberger State-Trait Anxiety Inventory.
 - o Experiences of racism were self-reported.

Summary: African-American infants are twice as likely to die before their first birthday than are white infants.⁴⁰ African-American infants have twice the rate of preterm birth and low birthweight, and three times the rate of very low birthweight, than white infants.⁴⁰ Perceived racism correlated with low birthweight, even after researchers controlled for medical and sociodemographic risk factors.³⁹

Quotes:

- "[P]erceived racism across the lifetime and perceived racism vicariously experienced as a child predict birth weight in African Americans and help to account for racial differences in birth weight, controlling for medical and sociodemographic risk factors."^{39(p9)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Dominguez, T. P., Dunkel-Schetter, C., Glynn, L. M., Hobel, C., & Sandman, C. A. (2008). Racial differences in birth outcomes: the role of general, pregnancy, and racism stress. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association*, 27(2), 194-203.

AMA Citation: Dominguez TP, Dunkel-Schetter C, Glynn LM, Hobel C, Sandman CA. Racial differences in birth outcomes: the role of general, pregnancy, and racism stress. *Health Psychol.* 2008;27(2):194-203.

³⁹ Dominguez TP, Dunkel-Schetter C, Glynn LM, Hobel C, Sandman CA. Racial differences in birth outcomes: the role of general, pregnancy, and racism stress. *Health Psychol.* 2008;27(2):194-203.

⁴⁰ Collins JW, David RJ, Handler A, Wall S, Andes S. Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination. *Am J Public Health.* 2004;94(12):2132-2138.

Date: May 2007

Article Title: Maternal serum corticotropin-releasing hormone and ACTH levels as predictive markers of premature labor

Design: Prospective, Case Studies

- Sample size (n)=79
 - o Single serum samples of 79 women with the diagnosis of preterm labor were admitted. Researchers divided patients into 3 gestational age groups based on their week of gestation (24th–28th, 29th–32nd, 33rd–37th).
 - NOTE: This study does not provide demographic information about the sample.

Summary: Women who gave birth to preterm infants reported significantly higher levels of CRH than women who give birth at term, with CRH levels averaging 14 pg/ml versus 10.2 pg/ml respectively.⁴¹ Women who gave birth preterm also reported significantly higher levels of ACTH than women who gave birth at term, with ACTH levels averaging 18.9 pg/ml in preterm birth and 12.8 pg/ml in term birth.⁴¹

Quotes: “Mean maternal peripheral plasma values of CRH and ACTH were significantly higher ($p < 0.001$) in women who were initially diagnosed with preterm labor and finally delivered a preterm birth, compared to women with the same diagnosis but with term birth.”^{41(p115)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(\\$31.50\)](#)

APA Citation: Makrigiannakis, A., Semmler, M., Briese, V., Eckerle, H., Minas, V., Mylonas, I., Friese, K., et al. (2007). Maternal serum corticotropin-releasing hormone and ACTH levels as predictive markers of premature labor. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*, 97(2), 115-119.

AMA Citation: Makrigiannakis A, Semmler M, Briese V, et al. Maternal serum corticotropin-releasing hormone and ACTH levels as predictive markers of premature labor. *Int J Gynaecol Obstet*. 2007;97(2):115-119.

⁴¹ Makrigiannakis A, Semmler M, Briese V, et al. Maternal serum corticotropin-releasing hormone and ACTH levels as predictive markers of premature labor. *Int J Gynaecol Obstet*. 2007;97(2):115-119.

Date: June 2006

Article Title: Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): priming the placental clock

Design: Prospective, Cohort

Summary: Elevated levels of cortisol increases the likelihood of elevated levels of CRH, which increases the risk of preterm birth.⁴²

Quotes:

- "CRH levels increased faster and were higher in women who delivered preterm compared with women who delivered at term ($F_{3,603} = 5.73$, $p < .001$)."^{42(p1457)}
- "Elevated cortisol at 15 weeks predicted the surge in placental CRH at 31 weeks ($R = .49$, $d.f. = 1,199$, $F_{change} = 61.78$, $p < .0001$)."^{42(p1457)}
- "These findings suggested that early detection of stress signals by the placenta stimulated the subsequent release of CRH and resulted in increased risk for preterm delivery."^{42(p1457)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(\\$39.95\)](#)

APA Citation: Sandman, C. A., Glynn, L., Schetter, C. D., Wadhwa, P., Garite, T., Chicz-DeMet, A., & Hobel, C. (2006). Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): Priming the placental clock. *Peptides*, 27(6), 1457-1463.

AMA Citation: Sandman CA, Glynn L, Schetter CD, et al. Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): priming the placental clock. *Peptides*. 2006;27(6):1457-1463.

⁴² Sandman CA, Glynn L, Schetter CD, et al. Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): priming the placental clock. *Peptides*. 2006;27(6):1457-1463.

Date: Oct. 2005

Article Title: Cortisol awakening response in pregnant women

Design: Literature Review

Summary: Increasingly, research suggests that maternal stress affects fetal programming and lifelong health, which highlights the importance of implementing a life-course approach in healthcare delivery and research.⁴³ Researchers have identified the disruption of the hypothalamic-pituitary-adrenocortical axis (HPA-axis) as one such passageway of negatively affecting fetal programming.⁴⁴ Prenatal stress is associated with an increased risk of poor birth outcomes, including preterm birth and low birthweight.⁴⁵ When humans encounter a stressor, the body responds with a quick increase then decrease of glucocorticoids, mainly cortisol. This physiological process is mediated by the hypothalamic-pituitary-adrenocortical axis (HPA-axis). Abnormal activity of the HPA axis, particularly quick increase or slow decrease, is associated with an increased risk of depression later in life.⁴⁶ Currently, researchers are unclear of the exact mechanism by which maternal stress affects fetal development, but there are various hypotheses posed by researchers. First, cortisol may exceed the enzymatic-converting capacities of the placenta, affecting the fetal HPA-axis.⁴⁷ Alternatively, the maternal HPA-axis may stimulate the production of CRH through the placenta, which has been found to increase the risk of preterm birth threefold.⁴⁸ Finally, an increase of cortisol in the maternal bloodstream may reduce the flow of blood through the placenta and to the uterus, resulting in slowed or restricted intrauterine growth. Data supports the theory that maternal stress affects fetal programming, with some research finding a link between maternal stress, HPA disruption, and fetal behavior.⁴⁹

Quotes:

Notes: This article provides a great background on the limitation of current research.

Links: [PubMed Abstract](#) ; [Full Text \(\\$31.50\)](#)

APA Citation: De Weerth, C., & Buitelaar, J. K. (2005). Cortisol awakening response in pregnant women. *Psychoneuroendocrinology*, 30(9), 902-907.

AMA Citation: De Weerth C, Buitelaar JK. Cortisol awakening response in pregnant women. *Psychoneuroendocrinology*. 2005;30(9):902-907.

⁴³ De Weerth C, Buitelaar JK. Cortisol awakening response in pregnant women. *Psychoneuroendocrinology*. 2005;30(9):902-907.

⁴⁴ Mulder EJH, Robles de Medina PG, Huizink AC, Van den Bergh BR, Buitelaar JK, Visser GH. Prenatal maternal stress: effects on pregnancy and the (unborn) child. *Early Hum Dev* 2002;70:3–14.

⁴⁵ Tollenaar MS, Beijers R, Jansen J, Riksen-Walraven JM, De Weerth C. Maternal prenatal stress and cortisol reactivity to stressors in human infants. *Stress*. 2011;14(1):53-65.

⁴⁶ Checkley S. The neuroendocrinology of depression and chronic stress. *Br Med Bull* 1996;52:597–617.

⁴⁷ Van den Bergh BR, Mulder EJ, Mennes M, Glover V. Antenatal maternal anxiety and stress and the neurobehavioural development of the fetus and child: links and possible mechanisms. A review. *Neurosci Biobehav Rev*. 2005;29(2):237-258.

⁴⁸ Wadhwa PD, Garite TJ, Porto M, et al. Placental corticotropin-releasing hormone (CRH), spontaneous preterm birth, and fetal growth restriction: a prospective investigation. *Am J Obstet Gynecol*. 2004;191(4):1063-1069.

⁴⁹ Sandman CA, Glynn L, Wadhwa PD, Chicz-DeMet A, Porto M, Garite T. Maternal hypothalamic-pituitary-adrenal dysregulation during the third trimester influences human fetal responses. *Dev Neurosci* 2003;25:41–49.

Date: Sep. 2005

Article Title: Explaining disproportionately high rates of adverse birth outcomes among African Americans: the impact of stress, racism, and related factors in pregnancy

Design: Literature review

Summary: The authors examine 5 explanations for these differences in rates of adverse birth outcomes: (a) ethnic differences in health behaviors and socioeconomic status; (b) higher levels of stress in African American women; (c) greater susceptibility to stress in African-Americans; (d) the impact of racism acting either as a contributor to stress or as a factor that exacerbates stress effects; and (e) ethnic differences in stress-related neuroendocrine, vascular, and immunological processes.⁵⁰

Quotes: The review of literature indicates that each explanation has some merit, although none is sufficient to explain ethnic disparities in adverse birth outcomes, which begs for qualitative data collection of perceived stress.

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(\\$11.95\)](#)

APA Citation: Giscombé, C. L., & Lobel, M. (2005). Explaining disproportionately high rates of adverse birth outcomes among African Americans: the impact of stress, racism, and related factors in pregnancy. *Psychological bulletin*, 131(5), 662-683.

AMA Citation: Giscombé CL, Lobel M. Explaining disproportionately high rates of adverse birth outcomes among African Americans: the impact of stress, racism, and related factors in pregnancy. *Psychol Bull.* 2005;131(5):662-683.

⁵⁰ Giscombé CL, Lobel M. Explaining disproportionately high rates of adverse birth outcomes among African Americans: the impact of stress, racism, and related factors in pregnancy. *Psychol Bull.* 2005;131(5):662-683.

Date: July 2005

Article Title: Transgenerational effects of posttraumatic stress disorder in babies of mothers exposed to the World Trade Center attacks during pregnancy.

Design: Mothers (n = 38) collected salivary cortisol samples from themselves and their 1-yr-old babies at awakening and at bedtime.

- "In the current study, we report on the relationship between maternal PTSD symptoms and salivary cortisol levels obtained at awakening and at bedtime, in mothers and infants of mothers directly exposed to the World Trade Center (WTC) collapse on September 11 during pregnancy who agreed to participate in a prospective, longitudinal epidemiologic study examining the effects of September 11 exposures on fetal growth and other pregnancy outcomes."⁵¹

Summary: Researchers found that the effects of maternal PTSD and cortisol are observable in infants.⁵¹ Data suggests that lower levels of cortisol were noted in infants born to mothers who developed PTSD during their third trimesters.⁵¹ Infants born to mothers with PTSD reported significantly lower salivary cortisol levels during the first year of life than those infants born to mothers without PTSD.⁵¹ Previous research links reduced cortisol levels with vulnerability to posttraumatic stress disorder, suggesting that the infants may be more likely to develop PTSD later in life.⁵²

Quotes:

- "Lower cortisol levels were observed in both mothers ($F = 5.15$, $df = 1, 34$; $P = 0.030$) and babies of mothers ($F = 8.0$, $df = 1, 29$; $P = 0.008$) who developed PTSD in response to September 11 compared with mothers who did not develop PTSD and their babies. Lower cortisol levels were most apparent in babies born to mothers with PTSD exposed in their third trimesters."^{51(p4115)}
- "The data suggest that effects of maternal PTSD related to cortisol can be observed very early in the life of the offspring and underscore the relevance of *in utero* contributors to putative biological risk for PTSD."^{51(p4117)}
- "Strikingly, babies of mothers who developed PTSD also showed lower salivary cortisol levels in the first year of life. Lower cortisol levels were most apparent in babies born to mothers with PTSD in their third trimesters on September 11, yet PTSD symptom severity in the entire sample was correlated with infant cortisol levels regardless of trimester."^{51(p4117)}
- "Stress-induced increases in glucocorticoids during pregnancy influences fetal brain development, producing permanent changes in glucocorticoid programming in offspring in both human and animals, that are, in part, dependent on the gestational age of the fetus."^{51(p4115),53}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Yehuda, R., Engel, S. M., Brand, S. R., Seckl, J., Marcus, S. M., & Berkowitz, G. S. (2005). Transgenerational effects of posttraumatic stress disorder in babies of mothers exposed to the World Trade Center attacks during pregnancy. *Journal of Clinical Endocrinology and Metabolism*, 90(7), 4115-4118.

AMA Citation: Yehuda R, Engel SM, Brand SR, Seckl J, Marcus SM, Berkowitz GS. Transgenerational effects of posttraumatic stress disorder in babies of mothers exposed to the World Trade Center attacks during pregnancy. *J Clin Endocrinol Metab*. 2005;90(7):4115-4118.

⁵¹ Yehuda R, Engel SM, Brand SR, Seckl J, Marcus SM, Berkowitz GS. Transgenerational effects of posttraumatic stress disorder in babies of mothers exposed to the World Trade Center attacks during pregnancy. *J Clin Endocrinol Metab*. 2005;90(7):4115-4118.

⁵² Yehuda R. Current status of cortisol findings in post-traumatic stress disorder. *Psychiatr Clin North Am*. 2002;25(2):341-68, vii.

⁵³ Seckl JR. Prenatal glucocorticoids and long-term programming. *Eur J Endocrinol*. 2004;151 Suppl 3:U49-62.

Date: May 2005

Article Title: Psychosocial stress and neuroendocrine mechanisms in preterm delivery

Design: Literature Review

Summary: Studies show that women who report repeated exposure to racial discrimination affects hormones and stress responses, thereby increasing the risk of preterm birth.⁵⁴

Quotes:

- "We argue that chronic exposure to poverty, racism, and insecure neighborhoods may condition stress responses and physiologic changes in ways that increase the risk of preterm delivery."^{55(pS30)}
- "Cumulative stressors may impact pregnancy outcomes through several intersecting pathways, which include neuroendocrine, behavioral, immune, and vascular mechanisms."^{55(pS30)}

Notes: This study provides a great background of the various research on stress and preterm birth.

Links: [PubMed Abstract](#) ; [Full Article \(not free, but price not listed\)](#)

APA Citation: Rich-Edwards, J. W., & Grizzard, T. A. (2005). Psychosocial stress and neuroendocrine mechanisms in preterm delivery. *American Journal of Obstetrics and Gynecology*, 192(5 Suppl), S30-35.

AMA Citation: Rich-Edwards JW, Grizzard TA. Psychosocial stress and neuroendocrine mechanisms in preterm delivery. *Am J Obstet Gynecol*. 2005;192(5 Suppl):S30-35.

⁵⁴ Collins JW, David RJ, Handler A, Wall S, Andes S. Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination. *Am J Public Health*. 2004;94(12):2132-2138.

⁵⁵ Rich-Edwards JW, Grizzard TA. Psychosocial stress and neuroendocrine mechanisms in preterm delivery. *Am J Obstet Gynecol*. 2005;192(5 Suppl):S30-35.

Date: Apr. 2005

Article Title: Antenatal maternal anxiety and stress and the neurobehavioural development of the fetus and child: links and possible mechanisms. A review.

Design: Literature review

Summary: Numerous studies have found a link between antenatal maternal anxiety and/or stress and cognitive, behavioral, and/or emotional issues in the child. Researchers have found that cortisol appears to cross the placenta and disrupts fetal development.⁵⁶

Quotes:

- "Possible underlying mechanisms are just starting to be explored. Cortisol appears to cross the placenta and thus may affect the fetus and disturb ongoing developmental processes. The development of the HPA-axis, limbic system, and the prefrontal cortex are likely to be affected by antenatal maternal stress and anxiety."^{56(p237)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(\\$35.95\)](#)

APA Citation: Van den Bergh, B. R. H., Mulder, E. J. H., Mennes, M., & Glover, V. (2005). Antenatal maternal anxiety and stress and the neurobehavioural development of the fetus and child: Links and possible mechanisms. A review. *Neuroscience and Biobehavioral Reviews*, 29(2), 237-258.

AMA Citation: Van den Bergh BR, Mulder EJ, Mennes M, Glover V. Antenatal maternal anxiety and stress and the neurobehavioural development of the fetus and child: links and possible mechanisms. A review. *Neurosci Biobehav Rev*. 2005;29(2):237-258.

⁵⁶ Van den Bergh BR, Mulder EJ, Mennes M, Glover V. Antenatal maternal anxiety and stress and the neurobehavioural development of the fetus and child: links and possible mechanisms. A review. *Neurosci Biobehav Rev*. 2005;29(2):237-258.

Date: Oct. 2004

Article Title: Placental corticotropin-releasing hormone (CRH), spontaneous preterm birth, and fetal growth restriction: a prospective investigation.

Design: Prospective, Cohort

- Sample size (n)=232
 - o "In a sample of 232 women with a singleton, intrauterine pregnancy, maternal plasma was collected at 33 weeks' gestation and CRH concentrations were determined by radioimmunoassay."^{57(p1063)}
- Researchers adjusted for the effects of established obstetric risk factors.

Summary: Research suggests that elevated levels of CRH at 33 weeks gestation is associated with a three-fold increase in the risk for preterm birth.⁵⁷ Likewise, low levels of CRH at 33 weeks associated with a later onset of labor.⁵⁷ Based on their findings, researchers conclude that CRH levels play an important role in the timing of birth.⁵⁷ Additionally, researchers concluded that the timing of childbirth may be influenced by events that happen earlier in pregnancy, which may cause an increase in CRH levels.⁵⁷

Quotes:

- "[E]levated CRH levels at 33 weeks' gestation were significantly associated with a 3.3-fold increase in the adjusted relative risk (RR) for spontaneous preterm birth and with a 3.6-fold increase in the adjusted relative risk for fetal growth restriction."^{57(p1063)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(\\$30.00\)](#)

APA Citation: Wadhwa, P. D., Garite, T. J., Porto, M., Glynn, L., Chicz-Demet, A., Dunkel-Schetter, C., & Sandman, C. A. (2004). Placental corticotropin-releasing hormone (CRH), spontaneous preterm birth, and fetal growth restriction: A prospective investigation. *American Journal of Obstetrics and Gynecology*, 191(4), 1063-1069.

AMA Citation: Wadhwa PD, Garite TJ, Porto M, et al. Placental corticotropin-releasing hormone (CRH), spontaneous preterm birth, and fetal growth restriction: a prospective investigation. *Am J Obstet Gynecol*. 2004;191(4):1063-1069.

⁵⁷ Wadhwa PD, Garite TJ, Porto M, et al. Placental corticotropin-releasing hormone (CRH), spontaneous preterm birth, and fetal growth restriction: a prospective investigation. *Am J Obstet Gynecol*. 2004;191(4):1063-1069.

Date: Oct. 2004

Article Title: Editorial: Maternal corticotropin-releasing hormone, fetal growth, and preterm birth

Design: Editorial Review, Wadhwa 2004

Summary: As CRH increases, the risk of preterm labor increases as well.⁵⁸ Additionally, as stress increases, a pregnant woman's cortisol levels increase, which then pass to the fetus via the placental membrane.⁵⁹ This could potential exacerbate the natural rise in cortisol during the third trimester, exceeding the capacity of the placenta to convert active material cortisol in to inactive fetal cortisone. High levels of fetal cortisol affect the fetus's ability to grow *in utero* and may predispose the fetus to diseases later in life.⁵⁹

Quotes:

- "[T]he progressive rise in CRH through normal gestation is accelerated with risk of PTL."^{59(p1059)}
- "Inappropriate elevations in fetal cortisol impair normal fetal growth, and even lead to predisposition to later life disease. This relationship is exacerbated in circumstances of placental or uteroplacental compromise. One can imagine that stress-induced increases in maternal cortisol could affect this axis similarly, particularly in circumstances in which the 11b hydroxysteroid dehydrogenase activity of the placenta is impaired, and more maternal cortisol crosses to the fetus."^{59(p1059)}
- "Inappropriate levels of fetal cortisol generate a common pathway to growth restriction and to elevations in placental CRH output."^{59(p1059)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Challis, J. R. (2004). Maternal corticotropin-releasing hormone, fetal growth, and preterm birth. *American Journal of Obstetrics and Gynecology*, 191(4), 1059-1060.

AMA Citation: Challis JR. Maternal corticotropin-releasing hormone, fetal growth, and preterm birth. *Am J Obstet Gynecol*. 2004;191(4):1059-1060.

⁵⁸ Wadhwa PD, Garite TJ, Porto M, et al. Placental corticotropin-releasing hormone (CRH), spontaneous preterm birth, and fetal growth restriction: a prospective investigation. *Am J Obstet Gynecol*. 2004;191(4):1063-1069.

⁵⁹ Challis JR. Maternal corticotropin-releasing hormone, fetal growth, and preterm birth. *Am J Obstet Gynecol*. 2004;191(4):1059-1060.

Date: Jan. 2003

Article Title: Maternal stress and preterm birth.

Design: Prospective, Longitudinal Cohort

- Sample Size (n)=1962. Participants were recruited from Pregnancy, Infection, and Nutrition Study with pregnancies beginning April 1996–August 2000.
 - o African-American: 707; White: 1,134; Other: 121
- Stress was self-reported using a psychosocial questionnaire (Life Experiences Survey) administered during gestational weeks 24-30. A phone interview was administered around 29 weeks gestation.
 - o “Women were asked if they had experienced 39 life events since the start of pregnancy, and they could report two more events of their choice. If the event occurred, they were asked to weight their perception of its impact on their lives, from extremely negative (–3) to extremely positive (+3). The count of events was used to assess external stressors, while impact ratings were used to assess perception of stress.”^{60(p16)}
 - o “A social support scale assessed support as a buffer of stress. Measures of enhancers of stress included depression and six questions about pregnancy-related anxiety taken from a prenatal inventory. The weighted impact of pregnancy-related anxiety items was assessed using the same approach as described for life events.”^{60(p16)}
- Researchers controlled for various medical and sociodemographic risks for preterm birth, including income level, bacterial vaginosis, alcohol use, and smoking.

Summary: Researchers found that high score on the racial discrimination scale was associated with an increased risk of preterm birth.⁶⁰

Quotes:

- “A high score on the racial discrimination scale was associated with an increased risk of preterm birth (RR = 1.4, 95 percent CI: 1.0, 2.0).”^{60(p19)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Dole, N., Savitz, D. A., Hertz-picciotto, I., Siega-riz, A. M., McMahon, M. J., & Buekens, P. (2003). Maternal Stress and Preterm Birth. *American Journal of Epidemiology*, 157(1), 14-24.

AMA Citation: Dole N, Savitz DA, Hertz-Picciotto I, Siega-Riz AM, McMahon MJ, Buekens P. Maternal stress and preterm birth. *Am J Epidemiol*. 2003;157(1):14-24.

⁶⁰ Dole N, Savitz DA, Hertz-Picciotto I, Siega-Riz AM, McMahon MJ, Buekens P. Maternal stress and preterm birth. *Am J Epidemiol*. 2003;157(1):14-24.

Date: Nov. 2002

Article Title: Perceptions of racial discrimination and the risk of preterm birth

Design: Prospective, Cohort

- "The BWHS, a follow-up study of U.S. black women, began in 1995 when 64,500 women age 21–69 years enrolled through postal health questionnaires."^{61(p646)}
- Experiences of racism were self-reported, using a questionnaire, which contained nine questions regarding experiences of racial discrimination
- Researchers controlled for level of education and income

Summary: Research suggests there is an increase in preterm birth among women who report frequent experiences of racism.⁶¹ In particular, marginalized women, such as those with less than 12 years of education, may be more at risk than their well-educated counterparts.⁶¹

Quotes:

- "In the United States, preterm birth is the most important cause of perinatal mortality. Black babies are more likely to be born preterm than white babies, and known risk factors do not fully explain the difference."^{61(p646)}
- "[W]e found stronger associations of some of the racism variables with preterm birth among women with no more than 12 years of education (most of whom had completed 12 years)."^{61(p651)}
- "The excess of preterm births among black women compared with white women persists at the highest educational levels."^{61(p651)}
- "In conclusion, the BWHS adds mixed results to the sparse body of data bearing on whether African-Americans' experiences of racism affect preterm birth. Some perceived experiences of racism among BWHS participants were associated with an increased rate overall, and based on small numbers it appeared that an effect might be stronger among women with lower levels of education. However, other results suggested no association. In view of the high rates of preterm birth among African-American women and the possibility that racism may be a contributor, further assessment of this issue is of great importance."^{61(p652)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(Free\)](#)

APA Citation: Rosenberg, L., Palmer, J. R., Wise, L. A., Horton, N. J., & Corwin, M. J. (2002). Perceptions of racial discrimination and the risk of preterm birth. *Epidemiology (Cambridge, Mass.)*, 13(6), 646-652.

AMA Citation: Rosenberg L, Palmer JR, Wise LA, Horton NJ, Corwin MJ. Perceptions of racial discrimination and the risk of preterm birth. *Epidemiology*. 2002;13(6):646-652.

⁶¹ Rosenberg L, Palmer JR, Wise LA, Horton NJ, Corwin MJ. Perceptions of racial discrimination and the risk of preterm birth. *Epidemiology*. 2002;13(6):646-652.

Date: June 2001

Article Title: Examining the Burdens of Gendered Racism: Implications for Pregnancy Outcomes Among College-Educated African American Women

Design: Prospective, Cohort

- Sample Size (n)=474 African-American women
- Data Collection:
 - o Focus groups, interviews, and the administration of a pilot stress instrument developed from the qualitative data.
 - o Analysis of the qualitative and quantitative data from the responses of a subsample of 167 college-educated women was conducted to determine how the women experienced racism as a stressor.

Summary: African-American experience the chronic stress of racism in two notable ways. First, they feel obligated to protect their children from racism, and second, they experience discrimination in the workplace.⁶²

Quotes:

- "We hypothesize that the stressors of gendered racism that precede and accompany pregnancy may be risk factors for adverse birth outcomes."^{62(p95)}

Notes:

Links: [PubMed Abstract](#) ; [Full Article \(\\$39.95\)](#)

APA Citation: Jackson, F. M., Phillips, M. T., Hogue, C. J., & Curry-Owens, T. Y. (2001). Examining the burdens of gendered racism: implications for pregnancy outcomes among college-educated African American women. *Maternal and child health journal*, 5(2), 95-107.

AMA Citation: Jackson FM, Phillips MT, Hogue CJ, Curry-Owens TY. Examining the burdens of gendered racism: implications for pregnancy outcomes among college-educated African American women. *Matern Child Health J*. 2001;5(2):95-107.

⁶² Jackson FM, Phillips MT, Hogue CJ, Curry-Owens TY. Examining the burdens of gendered racism: implications for pregnancy outcomes among college-educated African American women. *Matern Child Health J*. 2001;5(2):95-107.