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Explaining Disproportionately High Rates of Adverse Birth Outcomes Among African Americans: The Impact of Stress, Racism, and Related Factors in Pregnancy

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Abstract

Compared with European Americans, African American infants experience disproportionately high rates of low birth weight and preterm delivery and are more than twice as likely to die during their 1st year of life. 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. The review of literature indicates that each explanation has some merit, although none is sufficient to explain ethnic disparities in adverse birth outcomes. There is a lack of studies examining the impact of such factors jointly and interactively. Recommendations and cautions for future research are offered.

Keywords

stress; racism; pregnancy; birth outcomes; African Americans

In the United States, infants born to African American mothers are more than twice as likely to die during the 1st year of life than are infants born to mothers of European descent (Mathews, MacDorman, & Menacker, 2002). This long-standing disparity (Hogue & Hargraves, 1993; Wise, 1993) is largely attributable to disproportionately high rates of low birth weight and preterm delivery among African Americans (Hoyert, Freedman, Strobino, & Guyer, 2001), problems that have also proven to be intractable. Although socioeconomic and behavioral factors contribute to adverse birth outcomes and differences in such variables as income, education, prenatal care, marital status, and substance use have been shown to exist between African Americans and European Americans (Berg, Wilcox, & d'Almada, 2001; Gould & LeRoy, 1988; Hogan, Njoroge, Durant, & Ferre, 2001; Schoendorf, Hogue, Kleinman, & Rowley, 1992; Wise, Kotelchuch, Wilson, & Mills, 1985), these factors do not fully account for ethnic disparities in adverse birth outcomes. In this article, we review

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emerging evidence that disproportionate rates of infant mortality, low birth weight, and preterm delivery in African Americans may result from group differences in exposure or susceptibility to prenatal stress, including stress related to racism and discrimination,[1] as well as from differences in physiological responses to stress. We use European Americans as the reference group with which to compare African Americans, because the use of a single comparison standard provides greater clarity on a number of issues discussed in this article and because European Americans represent a numerically, politically, and socioeconomically dominant group in the United States.

We use the terms *African American* and *European American* to label non-Hispanic Americans of African descent and non-Hispanic Americans of European descent, respectively. Work cited may use different or less rigorous criteria in defining and labeling ethnic groups (see Kaplan & Bennett, 2003). Studies of women from the Caribbean, the African continent, or countries outside of the United States are specifically noted. We avoid the term *race* because of lack of agreement about its definition and about its biological and social underpinnings. Instead, we use the term *ethnicity* as recommended by psychologists to refer to groups whose physical characteristics affect their identity, their treatment by others, and their position in society (Betancourt & López, 1993; Phinney, 1996). Furthermore, in this article, the terms African American and European American refer to ethnicity and not nationality. For instance, White-skinned people of European descent who have emigrated from the African continent to the United States (e.g., Afrikaners) are not considered African Americans in the present article.

We reviewed only peer-reviewed publications. References were gathered by using PsycINFO, MEDLINE, and PubMed with the key words *African American, women, stress, racial discrimination, racism, pregnancy outcomes, preterm delivery, low birth weight,* and *infant mortality*. We also obtained publications through cross-referencing.

The article is organized as follows: First we describe the problem of adverse birth outcomes and the existing ethnic disparity in low birth weight, preterm delivery, and infant mortality. Next we examine causes of disproportionately high adverse birth outcomes among African Americans, including stress levels and ethnic differences in stress susceptibility. The following portion of the article examines racism as a contributor to greater stress susceptibility among African American women and as a specific form of stress with direct effects on birth outcome. We then review major physiological pathways through which stress and racism may affect birth outcomes, and we consider whether heightened physiological reactivity in African Americans may contribute to ethnic disparities in birth outcome. Finally, we offer recommendations and cautions to researchers on the basis of our findings from these topic areas.

[1]We define discrimination as “unjustifiable negative behavior toward a group or its members” (D. G. Myers, 1996, p. 391) and racism as “beliefs, attitudes, institutional arrangements, and acts that tend to denigrate individuals or groups because of phenotypic characteristics or ethnic group affiliation” (Clark, Anderson, Clark, & Williams, 1999, p. 805). We use these terms and the term *racial discrimination* interchangeably. When describing the work of others, we have retained the authors’ terminology wherever possible.

The Problem: Adverse Birth Outcomes in African Americans

Infant mortality is defined as the incidence of death in the 1st year after birth, expressed in relation to every 1,000 live births (Mathews et al., 2002). Considered a primary indicator of the general level of a nation's health, infant mortality has been recognized as a social problem in the United States for the past 130 years (Hargraves & Thomas, 1993; United States Department of Health and Human Services, 2000). In the early 20th century, expansion of public health initiatives, improvements in hygienic practices, and the later development of antibiotics and sulfa drugs resulted in a dramatic reduction in infant mortality (Miller, 1995). The infant mortality rate (IMR) has decreased over the past century from approximately 100 (per 1,000 live births) to 6.9 (Arias, MacDorman, Strobino, & Guyer, 2003; Dowling & Fisher, 1987). Despite the fact that the IMR has declined significantly among the general population in America over this period of time, infant mortality is at least two times more prevalent in African Americans than in European Americans. The IMR is currently 5.7 for European Americans and 13.3 for African Americans (Arias et al., 2003). For this reason, infant mortality is one of six focus areas in the United States' Initiative to Eliminate Racial and Ethnic Disparities in Health as part of Healthy People 2010 (United States Department of Health and Human Services, 2000).

Disorders relating to preterm delivery (<37 weeks) and low birth weight (<2,500 g) are leading causes of infant mortality, second only to congenital anomalies (Arias et al., 2003; Mathews, Menacker, & MacDorman, 2003). High rates of African American infant mortality can be attributed to the fact that African American women also experience disproportionately high rates of preterm delivery and low birth weight. In the year 2002, 6.8% of European American infants versus 13.3% of African American infants were of low birth weight (Arias et al., 2003). In addition, 11.1% of European American infants and 17.5% of African American infants were born preterm (Arias et al., 2003). Low birth weight and preterm delivery, one of the predominant reasons for low birth weight, are the leading causes of infant mortality in African Americans (Blackmore et al., 1993; MacDorman, Martin, Mathews, Hoyert, & Ventura, 2005; Mathews et al., 2003).

Although an excess of low birth weight and preterm deliveries among African Americans helps explain the disparity in infant mortality, paradoxical evidence has shown a survival advantage at younger gestational ages and low birth weights in African American neonates compared with European Americans (Alexander, Tompkins, Allen, & Hulsey, 1999; Wilcox & Russell, 1990). There is currently no consensus explaining this paradox. One suggestion has been that African American fetuses mature faster than European American fetuses, as evidenced by earlier fetal lung maturity and by greater rates of meconium-stained amniotic fluid and meconium aspiration (clinical markers for fetal maturity) among African American infants (e.g., Alexander, Hulsey, Robillard, De Caunes, & Papiernik, 1994; Robillard et al., 1994). Some have also targeted the universal standard for normal birth weight (2,500+ g), originally set in the early 20th century, as an explanation of the paradox (Rooth, 1980). According to this view, in order for low birth weight to be a better predictor of perinatal death, it should be defined by using ethnic group-specific criteria based on the birth weight distribution of that subpopulation (Hertz-Picciotto & Din-Dzietham, 1997; Rooth, 1980; Wilcox & Russell, 1990). The medical community has not adopted this method of

classifying low birth weight. Furthermore, not all ethnic groups in the United States experience higher rates of adverse birth outcomes than European Americans.

As medical advancements reduce overall rates of infant mortality, the apparent survival advantage for African American infants compared with European American infants is disappearing (Allen, Alexander, Tompkins, & Hulsey, 2000). The use of exogenous surfactant, high-frequency ventilation, and antenatal steroids have assisted in reducing overall mortality rates related to preterm delivery and have also decreased the gestational age of viability (the gestational age at which 50% of infants in the population are predicted to survive at least 28 days of life) from approximately 26 weeks in 1975 to approximately 24 weeks in the year 2000 (Allen et al., 2000). There is evidence that these medical advances are more advantageous for European American than African American women, however, which may be due to the fact that the conditions they treat are more common in the former group. For example, surfactant therapy is used to enhance fetal lung maturity and to treat respiratory distress syndrome and hyaline membrane disease in preterm infants who are deficient in production of pulmonary surfactant (Hamvas et al., 1996; Robillard et al., 1994). Respiratory distress syndrome is more prevalent in European Americans as lung maturity in this group occurs more slowly compared with African Americans (see Hamvas et al., 1996). Hamvas et al. compared neonatal mortality in St. Louis, Missouri, before (1987–1989) and after (1991–1992) the Federal Drug Administration's approval of surfactant for clinical use. Whereas there was a 41% reduction in the mortality rate among European American newborns with very low birth weight (VLBW; from 261.5 per 1,000 to 155.5 per 1,000; $p <$ 01), the mortality rate for African American infants did not change significantly (from 195.6 per 1,000 to 196.8 per 1,000). According to national data, among those at very low birth weight, African American infants had a higher mortality rate (270.0 per 1,000) than did European American infants (236.0 per 1,000) at the end of the 20th century (Mathews et al., 2002). It has been suggested that the long-standing disparity between African American and European American infants cannot be explained by different access to medical technology (Allen et al., 2000; Hamvas et al., 1996), yet further study on the effect of medical advances on viability and mortality rates between these groups is warranted.

Even when infants survive, long-term health and development problems faced by preterm and low birth weight survivors illustrate the extensive consequences of these adverse birth outcomes and their contribution to an individual's socioeconomic welfare. Children who were born preterm or at a low birth weight are more likely to display cognitive deficits; to perform at lower levels on measures of intelligence, language, and academic achievement; and to require special education; and they are less likely to graduate from high school than are those who were full term or normal birth weight (e.g., Conley & Bennett, 2000; Escobar, Littenberg, & Petitti, 1991; Hack, Klein, & Taylor, 1995; Newnham, 1998; Thompson et al., 1997). In addition, maternal birth weight predicts infant birth weight (Tavares, Rodrigues, Cardoso, Barros, & Leite, 1996). Women who were themselves low birth weight infants have a higher risk of delivering children who are low birth weight (Ruijter & Miller, 1999), who are thin (Godfrey, Barker, Robinson, & Osmond, 1997), or who die in the perinatal period (Skjaerven, Wilcox, Oyen, & Magnus, 1997).

Furthermore, low birth weight is associated with increased risk in adulthood for cardiovascular disease (e.g., Rich-Edwards & Gillman, 1997), hypertension (e.g., Curhan et al., 1996), noninsulin dependent diabetes mellitus (NIDDM, or Type II) (Rich-Edwards et al., 1999), and gestational diabetes, which is a potent risk factor for NIDDM (Innes et al., 2002). These health conditions occur at disproportionate rates in African Americans (e.g., Macera, Armstead, & Anderson, 2001). Accumulating evidence for what has come to be known as the "fetal origins hypothesis" suggests that cardiovascular disease, hypertension, and NIDDM are programmed in utero because physiological adaptations, such as changes in blood circulation, vascular structure, insulin resistance, and liver function, all of which promote survival in an undernourished fetus, persist in adulthood (Barker, 2000). The association between birth weight and adult morbidity remains even when accounting for lifestyle factors, such as smoking, employment, alcohol consumption, and exercise (Barker, 2000).

Causes of Adverse Birth Outcomes

Efforts toward preventing adverse birth outcomes are believed capable of saving many more infant lives than additional improvements in neonatal care (Hoyert et al., 2001). Prevention efforts begin by examining the causes of adverse birth outcomes and their disparate rates among African Americans. In the following sections, we examine two of the most prominent explanations for the disparity between African Americans and European Americans in birth outcomes: (a) socioeconomic and behavioral differences that are confounded with ethnicity and (b) differences in stress between African Americans and European Americans.

Socioeconomic and Behavioral Explanations for Birth Outcome Disparities

Poverty, limited education, poor health behaviors, and poor access to health care are important factors associated with adverse birth outcomes (Mathews et al., 2002), and African American women disproportionately experience social disadvantages, such as single parenthood and poverty, compared with European American women (United States Census Bureau, 2002). However, as we discuss below, studies indicate that these unfavorable conditions do not fully explain the birth outcome disparity between African Americans and European Americans (e.g., Berg et al., 2001; Gould & LeRoy, 1988; Hogan, Njoroge, et al., 2001; Schoendorf et al., 1992; Virji & Cottington, 1991; Wise et al., 1985). This disparity continues to exist even when accounting for a series of social, economic, and behavioral factors, including income, maternal age, parity, marital status, smoking, alcohol use, and health insurance coverage (e.g., Shiono, Klebanoff, Graubard, Berendes, & Rhoads, 1986).

For instance, Berg et al. (2001) examined data from a population-based case-control study of VLBW infants conducted in Georgia. After controlling for variables including age, education, occupation, drug, alcohol, and tobacco use, financial support from the child's father, income, marital status, and grandparent's education, the odds ratio (OR) for VLBW among African American women compared with European American women was reduced from 3.7 to 3.3. In addition, although African American women were of lower socioeconomic status (SES) compared with European American women in this study, established socioeconomic and behavioral risk factors were more predictive of VLBW

delivery among European American women when compared with African American women, including maternal grandfather's education, paternal age, paternal occupation status, maternal age, maternal education, and alcohol use. Marital status and vitamin nonuse during pregnancy were associated with an increased risk of having a VLBW infant among African American mothers. Cigarette use during early pregnancy was also associated with VLBW among African American women but not among European American women, who were more likely than African American women to smoke during early pregnancy. Other studies corroborate that a greater number of risk factors predict adverse birth outcomes among European American than among African American women (Kleinman, Fingerhut, & Prager, 1991; Kleinman & Kessel, 1987).

Alexander, Kogan, Himes, Mor, and Goldenberg (1999) examined ethnic differences in birth weight and infant mortality in extremely low-risk U.S. samples, defined as married, with an age of 20–34 years, and having more than 13 years of education, at least one successful pregnancy, average number of children for maternal age, adequate prenatal care, vaginal delivery, and no reports of medical risk factors, tobacco use, or alcohol use during pregnancy. African American mothers had 2.64 times a greater risk of having an infant whose birth weight was small for gestational age compared with European American mothers and 1.61 times a greater risk of infant mortality. The results of this study suggest that low SES is not an adequate explanation for the ethnic disparity in adverse birth outcomes, because disparate rates persist among this low-risk sample.

Studies of college-educated parents have also demonstrated the existence of ethnic differences in birth outcome among those without traditional risk factors and suggest that education has paradoxical associations with adverse birth outcomes (e.g., Rowley, 1994). The disparity in perinatal (28 weeks' gestation to 28 days after birth) morbidity and mortality between African Americans and European Americans has been shown to increase with maternal education; in a large epidemiological study, education beyond high school was associated with a 20% reduction in infant mortality for European American mothers (n = 400,359) but had little impact on African Americans (n = 169,601; Din-Dzietham & Hertz-Picciotto, 1998). However, African American and European American college-educated families have similar rates of preventable mortality—such as sudden infant death syndrome—during the postneonatal period (28 days to 1 year after birth; Schoendorf et al., 1992). The higher infant mortality rate experienced by college-educated African American women is related to their higher rates of low birth weight and preterm deliveries compared with European Americans (Schoendorf et al., 1992; Scott-Wright, Wrona, & Flanagan, 1998). In a study of 655 African American and 434 European American women, McGrady, Sung, Rowley, and Hogue (1992) found that African American college graduates had 1.67 times the risk of preterm delivery and 2.48 times the risk of low birth weight infants compared with European American college graduates. Studies exploring the association of maternal education with birth outcome suggest that education may not provide the same benefit to African American and European American mothers. When compared with European American mothers with similar educational achievements, African American mothers are more likely to be single, report less annual income, and have parents who are less educated (Din-Dzietham & Hertz-Picciotto, 1998; McGrady et al., 1992; Schoendorf et al., 1992). In addition, higher education for African Americans may translate into changes in social class,

resulting in entrance into a social milieu that is more likely to be estranged from sources of self-affirmation and familiar support structures (Din-Dzietham & Hertz-Picciotto, 1998) and which may involve increased exposure to ethnically integrated occupational and residential environments where prejudice or discrimination exist (Anderson & Armstead, 1995; Buka, Brennan, Rich-Edwards, Raudenbush, & Earls, 2003; Clark et al., 1999).

In addition, when prenatal care is of high quality and when the quality and quantity of prenatal care are similar in African American and European American women, disparate rates of adverse birth outcomes persist (e.g., Alexander, Kogan, et al., 1999; Klerman et al., 2001; Lane et al., 2001; Shiono et al., 1986). For example, in a prospective study of more than 29,000 women who started prenatal care during the first trimester of pregnancy, the rate of low birth weight among African Americans ($n = 2,716$) was twice that of their European American ($n = 20,515$) counterparts (Shiono et al., 1986). This effect remained after controlling for risk factors, such as tobacco and alcohol use (however, SES and other psychosocial variables were not included in the analysis).

Studies of enlisted soldiers and their families living on military bases provide additional evidence that associations between ethnicity and birth outcome are not solely attributable to differences in SES. Although European Americans and African Americans living on military bases have virtually the same income, access to health care, and living conditions, ethnic disparities in gestational age and birth weight persist among them (Alexander, Baruffi, Mor, Kieffer, & Hulsey, 1993; Rawlings & Weir, 1992). Nonetheless, infant mortality rates of African Americans and European Americans are more similar on military bases than in the general population. These data suggest that African American infants are not disproportionately at risk of low birth weight and preterm delivery because of socioeconomic factors, such as income or living conditions. However, it is possible that preexisting ethnic differences in social status and health access influence health, including during military service.

A study of the intergenerational effects of SES on low birth weight and preterm birth among African Americans also illustrates how achieving a higher SES does not necessarily confer health parity with European Americans (Foster et al., 2000). The birth outcomes of 934 children and grandchildren of African American college graduates were compared with a cohort of 2,450 European American women. The third generation of high SES African American children had a rate of low birth weight that was 60% lower than that of the second generation of high SES African American children. However, the third generation of African American children had twice the rate of low birth weight compared with their European American cohorts. Results were similar for preterm delivery.

In summary, although ethnic group differences in SES and health behavior are a prominent explanation for the adverse birth outcome disparity between African Americans and European Americans, a variety of studies suggests that this explanation is limited. After accounting for income, maternal age, education, substance use, prenatal care, and educational status, the disparity in adverse birth outcomes continues to be approximately twofold or greater. The disparity exists after statistically controlling for socioeconomic and behavioral variables and when examining birth outcomes in higher SES samples. These

findings suggest the existence of additional explanations for the ethnic disparity in adverse birth outcomes.

Contribution of Stress to Birth Outcome Disparities

An additional factor that may help account for ethnic disparity in adverse birth outcomes is stress. As we describe below, evidence has grown over the last several decades that prenatal maternal stress is a potent contributor to adverse birth outcomes (e.g., Dunkel-Schetter, Gurung, Lobel, & Wadhwa, 2001; Hoffman & Hatch, 1996; Lederman, 1995; Lobel, 1994; Stanton, Lobel, Sears, & DeLuca, 2002). Thus, African American women may be at greater risk of these outcomes because they experience higher levels of stress during pregnancy. Or African American women may be more susceptible to the effects of prenatal stress than European Americans. After reviewing evidence that prenatal maternal stress is deleterious, we address each of these possibilities.

Pregnancy itself is stressful for some women because it affects familial, work, and other roles. The compounded demands of these roles, as well as pregnancy's physical strains, make it a stressful period for a number of women. Pregnancy also requires financial, occupational, familial, and personal adjustments that can lead to emotional distress (Lobel, 1998). Furthermore, many pregnant women worry about the health of their fetus, about the labor and delivery, and about the impending responsibilities of motherhood (Yali & Lobel, 1999, 2002). A woman's experience of pregnancy has been shown to be affected by a number of factors, including her age, health, socioeconomic resources, work or occupational status, availability of social support, obstetric history, and whether the pregnancy is planned or desired (Lobel, 1998).

As in research on stress effects in other areas of health, a variety of approaches has been used to conceptually and operationally define prenatal maternal stress (see reviews by Dunkel-Schetter et al., 2001; Hoffman & Hatch, 1996; Lederman, 1995; Lobel, 1994; Stanton et al., 2002). Beginning in the 1970s and continuing through the last decade, most studies have operationally defined prenatal stress as the occurrence of major life events, subjective appraisals of their aversiveness, or as elevated maternal state anxiety (Lobel, 1994). However, operationally defining prenatal stress as life events or state anxiety has been criticized because these approaches are limited by their exclusive focus either on women's emotional responses (anxiety) or on the stimuli (life events) that may evoke stress (e.g., Dunkel-Schetter et al., 2001; Lobel, 1994; Lobel & Dunkel-Schetter, 1990; see also Lazarus & Folkman, 1984). An alternative approach to stress definition and measurement, informed by Lazarus and colleagues' extensive theoretical and empirical work on a transactional model of stress, incorporates multiple indexes of stressful stimuli, individual perception, and response (Lazarus & Folkman, 1984; Lobel & Dunkel-Schetter, 1990; similar approaches have been advocated by others: e.g., Appley & Trumbull, 1986; Hobfoll, 1989). Although each approach has particular advantages and limitations, multivariate approaches are arguably the most conceptually well fortified and offer the greatest methodological reliability (Lobel, 1994). Studies using such multivariate measurement approaches to stress (e.g., Dole et al., 2003; Hobel, Dunkel-Schetter, Roesch, Castro, & Arora, 1999; Lobel, Dunkel-Schetter, & Scrimshaw, 1992; Rini, Dunkel-Schetter, Wadhwa, & Sandman, 1999)

have provided some of the most definitive evidence that prenatal stress has a deleterious impact on birth weight and gestational age (see reviews by Dunkel-Schetter et al., 2001; Lobel, 1994; Stanton et al., 2002). In addition, studies using multivariate operational definitions of prenatal stress suggest that chronic stress is a more powerful predictor of adverse outcomes than is acute or episodic stress (Dunkel-Schetter & Lobel, 1998; Lobel, 1994; Stanton et al., 2002).

Although many studies examining obstetric effects of prenatal stress have used exclusively or predominantly European American samples, the few studies of African American pregnant women confirm that stress is a risk factor in this group for low birth weight and preterm delivery (e.g., Austin & Leader, 2000; Orr et al., 1996). For example, a study of 472 low-income African American women found that specific types of life events, such as the loss of a family member, were associated with earlier delivery, but the total number of life events was not (Barbosa, 2000). Another study found that African American women's unfavorable perceptions of their communities (e.g., safety, delivery of municipal services, cleanliness, quality of schools) were associated with higher rates of VLBW, and this association was independent of the adverse impact of stressful life events on birth weight (J. W. Collins et al., 1998). The authors speculated that such perceptions cause chronic stress, especially in those who lack the resources to move elsewhere.

Ethnic Differences in Levels or Effects of Stress

Conflicting evidence exists about whether African American women experience greater stress prenatally than do European American women (Berkowitz & Kasl, 1983; Culhane, Rauh, McCollum, Elo, & Hogan, 2002; Dole et al., 2004; Goldenberg, Cliver, et al., 1996; Mackey, Williams, & Tiller, 2000; Norbeck & Anderson, 1989). In part, these equivocal findings are explained by variability across studies in stress measurement and in other methodological parameters. However, the absence of clear and consistent evidence on ethnic differences in prenatal stress is problematic for perspectives that attribute the comparatively high rates of adverse birth outcomes in African Americans to greater prevalence of stress in this group (see H. F. Myers, Lewis, & Parker-Dominguez, 2003).

Apart from the possibility that African American women experience higher stress during pregnancy than do European American women, prenatal stress may have interactive effects with ethnicity (Lobel & Graham, 2002). That is, African American women may be particularly susceptible to prenatal stress, either for psychosocial or physiological reasons. There is some evidence to bolster this possibility. For example, in a study of women residing in urban neighborhoods in Chicago, Buka et al. (2003) found that birth weight in African Americans—but not in European Americans—was inversely associated with a neighborhood's objectively defined degree of economic disadvantage. In a separate prospective study of 480 African American and European American women of various socioeconomic levels, job strain and other sociodemographic and behavioral variables were assessed twice during early and late pregnancy (Oths, Dunn, & Palmer, 2001). The effect of job strain on low birth weight was significantly greater for African Americans than for European Americans.

Theories of Susceptibility to Stress

Why might African American women be more susceptible to prenatal maternal stress? One possibility involves allostatic load. Allostatic load is a concept of comprehensive and cumulative risk across multiple physiological regulatory systems resulting from chronic exposure to life challenges or stressors that influence health outcomes across the life span (McEwen & Stellar, 1993). Allostasis, the body's ability to maintain homeostasis and adapt to acutely stressful events, is challenged in situations of chronic or frequent stress, when there is an excessive demand on the body's regulatory systems (McEwen, 1998). Parameters used to measure allostatic load include indexes of cardiovascular activity, the sympathetic nervous system, metabolism, and neuroendocrine function (e.g., Seeman, Singer, Ryff, Love, & Levy-Storms, 2002). High allostatic load, or reduced allostasis, has been shown to predict mortality, incidence of cardiovascular disease, and decline in cognitive and physical functioning (Seeman, Rowe, McEwen, & Singer, 2001; Seeman, Singer, Rowe, Horwitz, & McEwen, 1997). Allostatic load emphasizes the importance of considering multiple factors in estimating overall risks, such as African American women's lifelong exposure to discrimination and racism as well as the stress they experience prenatally from other sources. The major difference between allostatic load and other multifactorial approaches is that allostatic load emphasizes cumulative risk across multiple physiological regulatory systems and also across time (Seeman et al., 2002).

A complementary perspective on cumulative health risk among African American women is the concept of "weathering," which also provides an explanation for potentially greater susceptibility to stress among African American women compared with European American women. The weathering framework (see Geronimus, 1992, 2001) suggests that African American women experience health decrements because of "the cumulative impact of repeated experience with social, economic, or political exclusion" (Geronimus, 2001, p. 133). Support for weathering includes evidence that disparities in the health of African American and European American women become amplified after age 25 and are most evident between the ages of 35 and 64 (Geronimus, 2001). As elaborated below, the African American experience has historically been characterized by oppression, alienation, and exclusion, involving institutional and individual discrimination (Chambers et al., 1998; Franklin & Moss, 1994). Racism has been shown to affect an individual's worldview, self-esteem, and feelings of personal value, and it assaults a major characteristic of an individual's basic identity, a characteristic that cannot be changed (Landrine & Klonoff, 1996). Thus, African Americans may experience racism throughout their lifetime. African American women's unique experiences of racism and discrimination are likely contributors to the effects of weathering and may help produce greater susceptibility to the impact of prenatal stress.

Racism as a Component of Stress

Whereas theories of allostasis and weathering suggest that racism may contribute to higher cumulative susceptibility to prenatal stress, an additional possibility is that racism is a form of stress itself and, as such, may exert direct effects on pregnant women's health. Below we show that conceptualizing racism as a component of stress is consistent with the

predominant framework for operationalizing stress in pregnancy and that effects of racism on birth outcomes are consistent with those that would be expected if it were a component or type of stress.

Fitting Racism Into Prevailing Definitions of Prenatal Stress

As noted earlier, studies using multivariate approaches to stress have provided some of the strongest evidence available that stress, particularly when chronic, is deleterious for pregnant women. Thus, there is empirical corroboration for a transactional, multi-variably determined approach to stress definition in pregnancy. According to this approach, racism can be viewed as a component of prenatal stress to the extent that it involves stressful stimuli, appraisals, or responses that occur during the prenatal period. Indeed, this framework closely matches descriptions of racism, many of which involve a multidimensional perspective (C. P. Jones, 2000; J. M. Jones, 2003; LaVeist, 1996; Utsey & Ponterotto, 1996). Utsey and Ponterotto emphasized four categories of racism: individual racism, institutional racism, cultural racism, and collective racism.

Individual racism is experienced personally and involves direct experiences with unfair or biased treatment. Broman (2000) found that a majority of African Americans experienced racial discrimination in the past 3 years. Almost two thirds of African Americans report discrimination in education, housing, work, or income (Sigelman & Welch, 1991). More recent evidence indicates that at least 96% of African Americans report having experienced some type of racially based discrimination in the past year, 98% have experienced racism during their life, and 95% report racism as stressful (Klonoff & Landrine, 1999).

Institutional racism, also labeled as *structural racism,* is embedded in the framework and policies of a formal body or organization and is typically reflected in “differential access to the goods, services, and opportunities of society by race” (C. P. Jones, 2000, p. 1212). Examples include mortgage lending practices that result in higher interest rates for African Americans and create a cascade of effects by maintaining racially segregated neighborhoods, limiting access to high-performing school systems, and contributing to poor health because of lack of mobility, lower access to health care, poorer quality food, lower earnings, and increased exposure to noise, crowding, and environmental toxins (LaVeist, 1996; Mullings et al., 2001; Suro, 1993; United States Department of Housing and Urban Development, 1999; R. A. Williams & Nesiba, 1997). Institutional racism is also manifested through differences in purchasing power and wealth. Findings of the Panel Study of Income Dynamics revealed that approximately 70% of household wealth is passed down from the previous generation; African American families have just nine cents for every dollar of wealth accumulated by European American families (University of Michigan, 2000). African Americans are also less likely to be able to translate education into improved SES when compared with European Americans, as, on average, African Americans have a lower annual income than do European Americans with the same amount of education. The net worth of African American college graduates is similar to the net worth of European American high school graduates (Herman, 1996; Scholz & Levine, 2002).

The existence of institutional racism is also evident in the criminal justice system (Haney & Zimbardo, 1998). African Americans are approximately 13% of the American population,

15% of those who use drugs, 35% of those arrested for drug crimes, and 50% of those convicted (Chideya, 2000). U.S. Department of Justice data reveal that 44.6% of the 1.8 million men incarcerated in 2001 in local, state, and federal prisons and jails are African American. Approximately 10.4% of African American men between the ages of 25 and 29 are in prison or jail, compared with 1.2% of European Americans (and 2.4% of Hispanics) in the same age group (United States Department of Justice, 2003). Finally, institutional racism also exists in the practice of health care: African American patients receive standard care less often than do European American patients, including breast cancer screening, eye examinations for patients with diabetes, emergency treatment and diagnostic evaluations for patients with signs and symptoms of heart disease, and follow-up treatment for patients suffering with mental illness (e.g., Schneider, Zaslavsky, & Epstein, 2002).

According to Utsey and Ponterotto's (1996) typology, cultural and collective racism are two additional types of racism. *Cultural racism* occurs when the cultural values, norms, and practices of one group are considered superior to those of another. *Collective racism* occurs when a fully or partially organized group seeks to restrict the rights of African Americans, such as when an African American family moves into a community and is met with open hostility by their new neighbors.

According to LaVeist (1996) and C. P. Jones (2000), an additional type of racism is *internalization*. This involves developing feelings of inferiority, loss of control, and frustration resulting from realization of a lack of resources and acceptance of negative messages received about one's own race. Negative emotions related to internalization and blaming of the self for victimization related to racism can result in adverse emotional, mental, and physical health (LaVeist, 1996).

As is clear from these typologies, racism and discrimination involve stimuli—actions, events, or practices executed by individuals and organizations—that are appraised as stressful and that produce negative emotional responses. Thus, there is a strong basis for conceptualizing racism as a type of stress that can affect pregnant African American women. In addition, the effects of racism on health behaviors and disease parallel those of other types of stress, indicating that racism is at least as deleterious as them. Research on African Americans from the fields of psychology, sociology, public health, nursing, and medicine provide consistent evidence that racism has serious effects on health behaviors, such as cigarette smoking and alcohol consumption, lifetime history of physical disease, frequency of the common cold, and cardiovascular health (Guthrie, Young, Williams, Boyd, & Kintner, 2002; Kwate, Valdimarsdottir, Guevarra, & Bovbjerg, 2003; Landrine & Klonoff, 1996; Troxel, Matthews, Bromberger, & Sutton-Tyrrell, 2003). For example, in a study of 363 middle-aged African American and European American women, Guyll, Matthews, and Bromberger (2001) found that subtle mistreatment was associated with increased diastolic blood pressure reactivity for African Americans but not for European Americans. Furthermore, attributing mistreatment to racial discrimination was associated with greater average diastolic blood pressure in African American participants only. Similarly, Krieger and Sidney (1996) found that among working-class African American men, those who reported the most discrimination had greatest systolic blood pressure and diastolic blood pressure.

One important question arising from this analysis is whether stress derived from racism is distinct from other types of stress. This issue is important because if racism is a distinct contributor to stress, then the vast majority of studies of prenatal maternal stress, which do not assess racism in African American (or other ethnically diverse) women, are underestimating the degree of stress that they experience prenatally.

Work by Klonoff, Landrine, and Ullman (1999) offers compelling evidence that racism is a distinct form of stress. They found that racism predicts psychological and physical symptoms of distress over and above more general stressors, even after controlling for such variables as age, gender, income, and education (Klonoff, et al. 1999). In this study of 520 African Americans, hierarchical regression analysis showed that racial discrimination accounted for 6%–10% of unique variance in distress symptoms after SES and generic stressors were taken into account. In another study, Klonoff et al. (1999) examined a series of three nested models of distress by using structural equation modeling. The first model, which incorporated only sociodemographic variables (gender, age, income, and education) as predictors of distress symptoms, did not adequately fit the data. The second model, which allowed both sociodemographic variables and generic stressors to predict symptoms, marginally fit the data. The third model, which allowed demographic variables, generic stressors, and racial discrimination to predict symptoms of distress, was a significant improvement, resulting in adequate fit. In this model, racial discrimination was the strongest predictor of symptoms of distress, accounting for 15% of the variance.

To summarize, there is ample evidence that African Americans experience individual, institutional, and other forms of racism; that these actions, events, and institutional practices are experienced as stressful; and that they result in negative emotional responses characteristic of distress. Thus, it is reasonable to conceptualize racism as a form of stress that can contribute to the cumulative stress that African American women experience during pregnancy. Furthermore, there is some evidence that racism is distinct from other forms of stress and that it may have greater impact than them. Although this evidence is derived from merely two studies, the distinctiveness of racism from other forms of stress is a critical issue for further investigation, because it suggests that studies that have failed to assess racism in pregnant African American women may have underestimated their stress and thereby overlooked an important factor to help explain ethnic disparities in adverse birth outcomes.

Racism and Adverse Birth Outcomes: Empirical Evidence

If racism is a form of stress, then it should be expected to produce adverse outcomes in pregnancy, as do other forms of stress. Several recent studies provide evidence that perceptions of racism have an adverse impact on birth outcomes. Two investigations found that racism is associated with VLBW (<1,500 g). In the first known study to provide direct evidence of an association between racism and low birth weight, 25 African American mothers of singleton, VLBW infants were compared with 60 African American mothers of normal birth weight infants (J. W. Collins et al., 2000). Participants were low-income women (family income <$11,000) from Chicago without private medical insurance. An instrument developed by Krieger (1990) for a nonpregnant population was used, which assesses exposure to racism in five domains: school, medical care, service at a restaurant or

store, housing, and work. Mothers of VLBW infants were more likely to report exposure to racial discrimination during pregnancy than were mothers of normal birth weight infants. The unadjusted OR of VLBW for maternal exposure to racism during pregnancy was 1.9 (confidence interval [CI] = 0.5–6.6). When previous pregnancies, late or no prenatal care, social support, and tobacco, alcohol, and drug use were included in the model, the OR of VLBW for maternal exposure to racial discrimination increased to 3.3 (CI = 0.9–11.3).

Similar results from a case-control study of 312 African American mothers recruited from two Chicago hospitals also implicated racial discrimination as a risk factor for VLBW (Lespinasse, David, Collins, Handler, & Wall, 2004). Almost 50% of participants in this study were economically disadvantaged (income < $11,000). Interviews, conducted 3 days after delivery, examined potential risk factors for VLBW, such as age, timing of prenatal care, social and home environment, smoking and tobacco use, income, discrimination and racism experienced during pregnancy, and prenatal stress. Krieger's (1990) five-domain instrument was used to measure racial discrimination. Racial discrimination, older maternal age, and no companion in the delivery room were the only significant risk factors for VLBW. The OR for VLBW among women who reported exposure to racial discrimination in one or more domains was 1.9 (CI = 1.2–3.0). The OR for VLBW among women who reported exposure to racial discrimination in three or more domains was 2.7 (CI = 1.3–5.4). Similar to the work of J. W. Collins et al. (2000), interpretation of these results is limited by the retrospective design of the study, and its generalizability beyond low-income mothers is unknown.

Another retrospective yet considerably larger study examined perceptions of racism, comparing African American mothers of 422 babies born 3 or more weeks early with African American mothers of 4,544 babies of longer gestation (Rosenberg, Palmer, Wise, Horton, & Corwin, 2002). Nine questions were used to examine women's experiences with racial discrimination during their lifetime. Three questions assessed unfair treatment on the job, in housing, and by the police. Five questions were about the frequency in daily life of other people's behavior toward the participants (e.g., participant receiving poorer service than others in restaurants or stores, people acting as if they were afraid of her, and people acting as if they thought she was dishonest), and one question asked how often participants thought about their race. For the entire sample, the OR for preterm birth was 1.3 for unfair treatment on the job and 1.4 for people acting afraid. Odds for preterm birth varied with level of education. Among women with fewer than 12 years of education, the OR ranged from 2.0 to 3.5 for four of the racism variables: people acting as if the participant was not intelligent at least once a week (OR = 2.0), having been treated unfairly in housing (OR = 2.4), people acting as if they were afraid of the participant at least once a week (OR = 3.4), and receiving poorer service at least once a week (OR = 3.5). Among women with more than 16 years of education, the OR for unfair treatment on the job was 1.6, and for women with 13 to 15 years of education, the largest OR for participants who reported that people acted as if they were dishonest was 1.7. These results suggest that different experiences may be deleterious for African American women of varying SES and therefore demonstrate the value of using samples that are socioeconomically heterogeneous.

Some of the most compelling evidence about the association between racism and adverse birth outcomes derives from a large, prospectively conducted study of perceived racism and preterm birth in a socioeconomically diverse group of African American and European American women who comprised 36% and 58% of the sample, respectively (Dole et al., 2003). As in the J. W. Collins et al. (2000) and Lespinasse et al. (2004) studies, perceptions of racism were assessed in five domains (see Krieger, 1990). The 1,962 pregnant women studied were divided into groups of no racial discrimination, some racial discrimination, and higher racial discrimination. There was an increased risk of spontaneous preterm birth among women in the higher racial discrimination group (relative risk = 1.4; CI = 1.0–2.0). This effect was independent of the association of preterm birth with pregnancy-related anxiety and negatively appraised life events, suggesting that effects of racial discrimination are distinct from other forms of prenatal stress, corroborating arguments elaborated earlier in this article. Interactive effects of racial discrimination with pregnancy-related anxiety and with life events were tested, but neither interaction term resulted in an improvement over models in which the two measures were included without the interaction term. An important advantage of this study is that data collection was conducted at two time points during pregnancy, the second and third trimesters. An additional advantage is that a wide variety of sociodemographic, medical, and behavioral covariates was included. A more recent analysis from this study (Dole et al., 2004) revealed that African American women reported a greater number of negative life events and higher levels of perceived racial discrimination than did European American women, and African American women who reported perceived racial discrimination had a higher relative risk for preterm birth than did European American women. Among European American women, perceived racial discrimination did not predict preterm birth.

Finally, we located one published study that did not find an association between racism and adverse birth outcomes, nor between stress and adverse birth outcomes (Murrell, 1996). In this study, 165 African American women were interviewed in a prenatal HMO clinic in Northern California. Stress and racism were modestly but significantly correlated, independent of sociodemographic factors. Of the variables examined, only income was associated with birth weight, accounting for 12% of its variance; no variable was associated with gestational age.

Several factors may explain why the results of the Murrell (1996) study depart from others examining associations among perceived racism, stress, and adverse birth outcomes. A major difference involves measurement of the main study variables: racism and stress. In this study, racism was measured with the Perceptions of Racism Scale (Green, 1995), an instrument in which 18 of the 20 items assess attitudes and opinions regarding hypothetical situations (e.g., “There has been significant progress in ending racism in the 1980s,” “African American pregnant women have fewer options for health care,” and “African American women experience negative attitudes when they go to a white doctor’s office”). Only two items assess an individual’s direct experience with racism. In contrast, studies that find an association between racism and adverse birth outcomes have assessed personally experienced racism (J. W. Collins et al., 2000; Dole et al., 2003, 2004; Lespinasse et al., 2004; Rosenberg et al., 2002). Furthermore, stress was measured in the Murrell (1996) study as merely the total number of daily hassles.

Physiological Mediators of the Impact of Stress on Adverse Birth Outcomes

If racism is a type of stress, its influence on health should not be mechanistically different from other stressors (Stancil, Hertz-Picciotto, Schramm, & Watt-Morse, 2000). Prenatal maternal stress is thought to produce adverse birth outcomes by two sets of mechanisms: behavioral and physiological (Dunkel-Schetter et al., 2001; Lobel, 1994; Stanton et al., 2002). In a variety of studies (see Dunkel-Schetter et al., 2001), prenatal stress has been shown to be related to greater likelihood of the types of health-impairing behaviors that contribute to adverse birth outcomes, which include poor nutrition, inadequate physical activity, cigarette smoking, alcohol, and other substance use (e.g., Bresnahan, Zuckerman, & Cabral, 1992; Chomitz, Cheung, & Lieberman, 1995; Hutchins & DiPietro, 1997; McCormick et al., 1990; Rodriguez & Bohlin, 2000). However, as noted earlier, even when these behavioral risk factors are accounted for, African American women experience disproportionately higher rates of adverse birth outcomes. Thus, relative to health behaviors, physiological processes may have greater explanatory power for stress-related differences in adverse birth outcomes among African Americans.

Convergent evidence identifies three physiological pathways through which prenatal maternal stress may affect birth outcomes. These include a neuroendocrine pathway, a maternal vascular disease pathway, and an immune–inflammatory pathway. As extensive explanations of these pathways have been published elsewhere (e.g., Hobel et al., 1999; Holzman, Bullen, et al., 2001; Lockwood, 1999; Wadhwa, Culhane, Rauh, & Barve, 2001; Wadhwa, Culhane, Rauh, Barve, et al., 2001), only major findings regarding the association between physiological responses to stress and adverse birth outcomes are discussed.

Neuroendocrine Pathway

A major physiological marker to explain prenatal maternal stress effects on birth outcomes is corticotropin-releasing hormone (CRH) (Lockwood, 1999). CRH plays a pivotal role in the activity of the hypothalamic–pituitary–adrenal axis and in physiological responses to stress. Corticotropin stimulates secretion of cortisol by the adrenal cortex. Elevated cortisol inhibits release of corticotropin by the anterior pituitary gland and inhibits release of CRH by the hypothalamus. Chronic emotional or physical stress can interrupt this negative feedback loop, resulting in an overproduction of cortisol. Excessive and unlimited cortisol secretion is associated with depression, hypertension, immunosuppression, insulin resistance, and cerebrovascular disease (Chrousos & Gold, 1998).

During pregnancy, a favorable environment for cellular growth and maturation is established and maintained as CRH is expressed in the placenta and gestational membranes, and CRH is released in increasing amounts as pregnancy progresses. Placental CRH also coordinates fetal and maternal endocrine events involved in parturition (the act of giving birth). CRH stimulates the release of prostaglandins from the placenta and fetal membranes and facilitates the actions of oxytocin, both of which are necessary to stimulate contractions of the myometrium (smooth muscle layer of the uterine wall) at term and during labor.

Both maternal stress and preterm delivery are associated with increases in placental, decidual, and amniochorionic expression of CRH (Wadhwa, Culhane, Rauh, & Barve,

2001). Women in preterm labor have significantly elevated levels of CRH across the entire period of gestation compared with women without preterm labor (Hobel et al., 1999). Significant associations between maternal pituitary–adrenal stress hormones and placental CRH levels have also been found. Maternal stress hormone levels are associated with placental CRH levels, and through this mechanism maternal stress may contribute to early spontaneous labor (e.g., Austin & Leader, 2000; Wadhwa, Dunkel-Schetter, Chicz-DeMet, Porto, & Sandman, 1996). For example, in a study of 524 ethnically and socioeconomically diverse women, Hobel et al. (1999) found that maternal psychosocial stress levels at 18–20 weeks' gestation were associated with changes in maternal CRH levels between 18–20 and 28–30 weeks' gestation.

To date, only one published study has examined how the neuroendocrine stress response may explain the disparity in birth outcome between African Americans and European Americans. Holzman, Jetton, Siler-Khodr, Fisher, and Rip (2001) studied 181 African American and 304 European American women in a case-control study to assess the associations among second trimester CRH levels, preterm delivery, and ethnicity. This study unexpectedly found African American women to have lower CRH levels compared with European American women. However, CRH levels were significantly higher among African American women who delivered preterm compared with African American women who delivered after 37 weeks. The pattern for European American women was similar, with higher CRH levels for women who delivered preterm. Holzman, Jetton, et al. (2001) noted that these findings may signify ethnic differences in CRH levels: "If ethnic differences in maternal CRH prevail, analyses that disregard this difference might result in reverse confounding, attenuating the true relationship between CRH levels and risk of preterm delivery" (p. 662). In addition, the authors noted that although ethnic differences in birth outcome have been hypothesized to result from differences in stress-induced CRH levels, this theory may not be correct in cases of chronic stress. Chronic stress could, instead, result in lower CRH levels, perhaps through processes of adaptation. Stress was not assessed in this study. As this is the only study known to compare CRH in African American and European American women, firm conclusions are not possible.

Vascular Pathway

A second physiological pathway that mediates prenatal maternal stress effects on birth outcome involves vascular reactivity. The association between stress and increased risk for cardiovascular disorders, such as hypertension, has been well documented in nonpregnant populations (e.g., Krantz & McCeney, 2002; Light, 2001; Light et al., 1999). Cardiovascular reactivity to stress may result from functional changes in neuroendocrine and autonomic nervous system mechanisms. These changes may be an acute, direct response to stress or an indication of an underlying pathologic process (McCubbin, 1991).

Although there is limited research examining cardiovascular reactivity to stress in pregnancy, existing evidence suggests that cardiovascular disorders put women at risk for adverse birth outcomes. Vascular pathology during pregnancy, such as chronic hypertension, is a major risk factor for preterm delivery, both as a result of medical intervention and as spontaneous preterm delivery (Ananth, Peedicayil, & Savitz, 1995). Increased blood

pressure reactivity to stress in pregnancy may result in vasoconstriction, causing a decrease in uterine blood flow and fetal hypoxia, leading to elevations in CRH and increased risk for preterm delivery (Holzman, Bullen, et al., 2001; Wadhwa, Culhane, Rauh, & Barve, 2001; Warren, Gurewitsch, & Goland, 1995). Uteroplacental vascular insufficiency related to hypertension during pregnancy may also result in intrauterine growth retardation and subsequent low birth weight (Fang, Madhavan, & Alderman, 1999). In a study of 40 healthy pregnant women, those with larger diastolic blood pressure responses to stress had infants with significantly lower birth weight and significantly younger gestational age (McCubbin et al., 1996). Diastolic blood pressure responses to psychological stress were more than twice as large in women who delivered preterm infants. These results remained significant after adjusting for maternal age, maternal race, baseline blood pressure, and time of stress testing. Similarly, in a study of 70 healthy pregnant women, Gomez Ponce de Leon, Gomez Ponce de Leon, Coviello, and DeVito (2001) found that vascular reactivity in response to physiological stress resulted in greater risk for adverse birth outcomes. Every unit increase in diastolic blood pressure in response to the cold pressor stress test was associated with a 47-g decrease in birth weight and a 0.07-week decrease in gestational age. In a similar study, Sjostrom, Valentin, Thelin, and Marsal (1997) found that there were no differences in birth weight, fetal length, and head circumference based on maternal trait anxiety, but that women who were more trait anxious exhibited alterations in fetal–maternal circulation patterns. Finally, using Doppler ultrasound assessment of uterine blood flow, Teixeira, Fisk, and Glover (1999) found higher state and trait anxiety scores to be associated with compromised uterine arterial resistance, which is thought to affect fetal development and birth weight. Trait and state anxiety were likely indicators of maternal stress in these studies.

The impact of stress on vascular functioning is a scientifically plausible explanation for disparities in birth outcomes between African Americans and European Americans. African Americans are more likely to have exaggerated cardiovascular reactivity to stress compared with European Americans (Anderson, McNeilly, & Myers, 1991). In the United States, both nonpregnant and pregnant African American women have higher rates of hypertension than do European American women at all adult ages (American Heart Association, 2001). In one study, African American women were found to be twice as likely as European American women to enter their pregnancies with preexisting hypertension (Geronimus, Andersen, & Bound, 1991).

A growing body of work provides evidence that perceived racism might account for some of the ethnic differences in cardiovascular reactivity and hypertension prevalence (see review by Brondolo, Rieppi, Kelly, & Gerrin, 2003). Although this does not undermine the possibility that other variables, including diet and obesity prevalence, also explain blood pressure differences (American Heart Association, 2001), evidence of the unfavorable contribution of stress and racism to cardiovascular health is quite provocative. Both field and laboratory studies indicate that current and past exposure to racism can influence cardiovascular reactivity and hypertension. Furthermore, most of the laboratory studies have shown that exposure to racist provocation is associated with greater increases in physiological reactivity than nonracist provocation (see Brondolo et al., 2003).

There appear to be no published studies on ethnic differences in cardiovascular response to stress and racism in pregnant women. Yet two important issues could clarify the relationships among stress, racism, cardiovascular health, and differences in birth outcomes between African Americans and European Americans. One is whether racism contributes to blood pressure reactivity or hypertension in pregnant women. Stancil et al. (2000) investigated social factors, including experiences of discrimination and neighborhood crime, and the influence of stress and cortisol on blood pressure in a sample of 94 African American pregnant women. Racial discrimination, sexual discrimination, higher income, and lower education were related to greater perceived stress. Higher income, higher body mass index (an indicator of obesity), greater perceived stress, and urinary cortisol predicted higher systolic blood pressure measured in Weeks 32 through 36 of pregnancy. However, at Week 36, only body mass index and urinary cortisol (but not perceived stress) predicted higher systolic blood pressure. According to Stancil et al. (2000), it is possible that "pregnancies most susceptible to the effects of stress tend to deliver early, reducing any effect among the surviving pregnancies" (p. 133). This study did not examine the effects of any of these variables on birth outcomes.

If racism does contribute to greater prevalence of high blood pressure in pregnant women, a second important issue is whether African American women are more physically susceptible to the effects of high blood pressure than are European American women. Fang et al.'s (1999) results suggest that this is not the case. They found that the impact of hypertension on birth weight is greater for European American women than for African American women. The relative risk ratio of low birth weight for European American mothers with hypertension compared with nonhypertensive European American mothers was 3.58 (CI = 3.38–3.79). The relative risk ratio of low birth weight for African American mothers with hypertension compared with nonhypertensive African American mothers was 1.99 (CI = 1.93–2.06). However, because of the greater prevalence of hypertension among African American mothers compared with European American mothers, there was actually a higher incidence of low birth weight related to hypertension among African American infants compared with European American infants (Fang et al., 1999).

Immune–Inflammatory Pathway

A third physiological pathway to explain prenatal maternal stress effects on birth outcome involves immunosuppression and infection. The impact of stress on human immune functioning has been extensively documented. There is evidence that stress impairs cellular immunity, decreasing white blood cell counts, and natural killer cells specifically (e.g., Benschop et al., 1998; Glaser & Kiecolt-Glaser, 1994). In normal human response to acute stress, glucocorticoid secretion as a result of hypothalamic–pituitary–adrenal axis system activation provides energy to overcome environmental demands and prevents immune system overreaction. Excessive immunosuppression can result if the physiological stress response does not cease or if stress is chronic (Shanks & Lightman, 2001). Alterations in immune functioning resulting from stress adversely affect health (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002). Rates of respiratory infection have been shown to be significantly higher in people experiencing psychological distress (e.g., Cohen, Tyrrell, & Smith, 1991). Caregivers who report higher levels of perceived stress than controls experience altered

immune response and slower wound healing than them (Kiecolt-Glaser, Marucha, Malarkey, Mercado, & Glaser, 1995). In an extensive study of 82 HIV-infected gay men, more rapid progression to AIDS was associated with more cumulative life events and less cumulative social support (Leserman et al., 1999).

Urogenital Infections

A few studies have examined the role of chronic stress-influenced immune processes and infection in pregnancy. Normal pregnancy is accompanied by decreased immunity (see Hogan, Richardson, Ferre, Durant, & Boisseau, 2001); further reductions in immune response as a result of stress may increase a woman's susceptibility to infection and may adversely affect pregnancy outcomes. High levels of distress and low levels of social support are associated with depressed lymphocyte activity in pregnant women (Herrara, Alvarado, & Martinez, 1998). High levels of chronic stress during pregnancy have also been shown to be associated with urogenital infection, increasing women's risk for adverse birth outcomes, even after adjusting for sociodemographic and behavioral risk factors (Culhane et al., 2001). Urogenital microbial colonization is associated with amniotic infections, premature rupture of membranes, and subsequent preterm delivery (Goldenberg & Andrews, 1996; Lu & Goldenberg, 2000; Newton, Piper, Shain, Perdue, & Peairs, 2001).

Adverse birth outcomes related to urogenital infections occur as a result of the ascension into the uterus of potentially pathologic, exogenous microorganisms present in the vaginal environment prior to or at the beginning of pregnancy. Preterm delivery associated with urogenital infections most commonly occurs after the 20th week of gestation, the period of decidual implantation of membranes. By this time, the uterine opening is sealed, creating a closed environment for the bacterial infection, initially asymptomatic, to create noticeable physiologic changes. After 4 to 8 weeks of implantation, labor-initiating inflammatory cytokines are released from the decidual lining as a protective host response to the bacterial infection. This explains why most spontaneous preterm births associated with infection occur at less than 30 weeks' gestation (Goldenberg & Andrews, 1996). Inflammation and bacterial colonization are more common in the amniotic membranes of women who deliver spontaneously before 30 weeks gestation. The disparity in adverse birth outcomes between African American and European American women increases at gestations of less than 30 weeks (see Goldenberg & Andrews, 1996).

As early as 1979, urogenital infections were suspected as a leading cause of the disparity in perinatal mortality between African Americans and European Americans (Naeye, 1979). Although this work received relatively little attention in the 1970s, some argue today that urogenital infections are the most important contributor to ethnic disparities in preterm birth (see Fiscella, 2004). African American women have a disproportionately higher prevalence of urogenital tract infections even after statistically controlling for possible confounders, such as sexual behavior, number of partners, and hormonal status (e.g., Goldenberg, Andrews, Yuan, MacKay, & St. Louis, 1997; Newton et al., 2001). In a study of 13,747 ethnically diverse women at 23 to 26 weeks' gestation, Goldenberg, Klebanoff, et al. (1996) found that compared with European American, Hispanic, and Asian women, African American women had significantly higher rates of vaginal colonization with potentially

pathogenic organisms, including Chlamydia trachomatis, Neisseria gonorrhoeae, Bacteroides, and bacterial vaginosis. Although African American women experience disproportionate rates of such infections as N. gonorrhea and syphilis, these infections are treated in 99% of cases and therefore do not significantly affect rates of adverse birth outcomes. However, bacterial vaginosis, an often asymptomatic urogenital infection that is independently associated with adverse birth outcomes (Hillier et al., 1995), may account for 30% or more of the ethnic disparity in preterm birth (see review by Fiscella, 1996). Bacterial vaginosis has a prevalence rate of 23% among African American women, 15% among Hispanic women, 9% among European American women, and 6% among Asian women (Goldenberg, Klebanoff, et al., 1996). In pregnant women, too, prevalence is higher among African Americans: African American women have at least a twofold greater prevalence of bacterial vaginosis than do European American women early in their third trimester of pregnancy (Royce et al., 1999). Moreover, African American women have a significantly higher risk of preterm delivery associated with bacterial vaginosis than do European American women, with a relative risk of 3.3 versus 1.8 (McGregor et al., 1995).

Hygienic Practices and Behavior

Why do African American women experience disproportionate rates of urogenital infections, placing them at greater risk for preterm birth and infant mortality? Compromised vaginal flora can be a result of numerous factors, including sexual behavior; hygienic practices; hormonal fluctuations and vaginal bleeding normally observed as part of a healthy menstrual cycle; insertion of foreign bodies; contraceptive devices, including oral contraceptives; or use of medications, such as antibiotics and antifungals (Newton et al., 2001). A study of 377 African American women and 387 European American women showed that even in the absence of a bacterial vaginosis diagnosis, compared with European American women, African American women are more likely to exhibit alkaline vaginal pH (pH > 4.5), which is more amenable to infection than acidic pH (pH < 4.5), and they are more likely to have other contributing features of bacterial vaginosis, including low concentrations of lactobacilli, which are independently associated with preterm delivery (see Royce et al., 1999).

Sexual and other behavioral differences, such as greater substance abuse, are sometimes assumed to explain the higher prevalence of compromised vaginal ecology experienced by African American women compared with European American women (Newton et al., 2001). However, African American women are less likely than European American women to use tobacco, alcohol, or illicit drugs during pregnancy (e.g., Goldenberg, Klebanoff, et al., 1996; Meis et al., 2000). In addition, although African American women report first coitus at an earlier age, European American women report an equal or higher number of lifetime sexual partners when compared with African American women. African American women report less sexual activity, including coitus, during pregnancy, and European American women are more likely to report having more than one sexual partner in the last year (Fiscella, 1996).

Hygienic practices, specifically vaginal douching, have also been explored as an explanation for the higher prevalence of urogenital infections in African American women. Although douching is likely to only temporarily affect the vaginal ecology, these transient changes

may exist long enough to increase the risk of infection if exposed to sexually transmitted diseases (Newton et al., 2001). The direction of association between douching and urogenital infections is unknown (Fiscella, Franks, Kendrick, & Bruce, 1998). Douching may cause infection by chemically altering the healthy vaginal pH or by acting as a vehicle of transit, promoting the ascension of existing microorganisms into the uterus (Zhang, Thomas, & Leybovich, 1997). Instead of acting as a direct cause, vaginal douching could be a behavior initiated as a response to signs and symptoms of an existing infection, such as abnormal or malodorous vaginal discharge (Fiscella et al., 1998).

Both African American and European American women who douche monthly are at slightly higher risk of having low birth weight infants; daily douching exposes women to substantially greater risk (Fiscella et al., 1998). In a national cross-sectional study of 4,665 women conducted as part of the National Survey of Family Growth, vaginal douching was associated with a 30% higher risk of having a low birth weight infant. Approximately two thirds of African American women and one third of European American women douche regularly (Fiscella et al., 1998). When African Caribbean and European women were compared in a British study, ethnic differences in vaginal hygienic practices explained a twofold increase in the risk of bacterial vaginosis (Rajamanoharan, Low, Jones, & Pozniak, 1999).

It is believed that the more frequent practice of vaginal douching among African American women may explain as much as 12.5% of the disparity in low birth weight between African Americans and European Americans (Fiscella et al., 1998). This explanation is promising as widespread health education can play a significant role in preventing urogenital infections and adverse birth outcomes by decreasing vaginal douching. Nevertheless, even if the impact of douching is as large as estimated, a substantial portion of the difference in rates of adverse birth outcomes for African American and European American women remains unexplained by this factor.

A major question about studies of ethnicity, behavioral practices, and urogenital infections is whether these associations could be an effect of SES instead of ethnicity. However, when SES is controlled, ethnic group differences remain (e.g., Royce et al., 1999). Meis et al. (2000) found that although African American women were more likely to be poor than their European American counterparts, measures of SES, including income, medical insurance, education, marital status, and living conditions, were not associated with differences in rates of bacterial vaginosis, with the exception of one variable: absence of a home telephone. Although this study concluded that SES does not explain ethnic differences in bacterial vaginosis, it is possible that absence of a telephone indicates very poor status and may suggest an association between extreme poverty and bacterial vaginosis.

Many studies of ethnicity and urogenital infections have recruited study participants from public prenatal care clinics, often yielding samples of lower SES (e.g., Goldenberg, Klebanoff, et al., 1996; Newton et al., 2001; Royce et al., 1999). Nevertheless, adverse vaginal microecology may also be a factor in the disproportionate prevalence of preterm delivery and infant mortality in African American women of higher social and economic

status. To understand whether SES contributes to observed differences in urogenital infections and their association with adverse birth outcomes, further research is imperative.

It has also been proposed that genetic differences explain ethnic differences in vaginal microecology, vaginal infection, and subsequent disparate adverse birth outcomes in African American women (see Newton et al., 2001). Caution should be used in labeling African American ethnicity as a risk factor for adverse vaginal flora, even though ethnicity has been shown to be independently and more consistently associated with adverse vaginal flora than sexual behavior, hygienic practices, or hormonal physiologic features (Fiscella, 1996; Goldenberg, Klebanoff, et al., 1996; Newton et al., 2001). As discussed earlier, race or ethnicity may be a marker for unmeasured variables, such as stress and racism, which have been found to affect immunity and promote infection (Fiscella, 1996; Newton et al., 2001).

As evidence, a recent study of 454 pregnant women showed that chronic maternal stress is significantly and independently associated with urogenital infection, specifically bacterial vaginosis, even after controlling for maternal age, marital status, SES, ethnicity, and behavioral practices, such as douching, drug use, and sexual activity (Culhane et al., 2001). The sample was 62% African American. In this cross-sectional clinical study, chronic maternal stress was assessed with the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983), a widely used self-report scale that measures the degree to which respondents appraise their life as being stressful. Women who were positive for bacterial vaginosis had a significantly higher mean perceived stress score (24.6) than did women who were negative for bacterial vaginosis (22.2). The relationship between increasing perceived stress scores and the increasing probability of having bacterial vaginosis was approximately linear (Culhane et al., 2001). Compared with women in the low perceived stress group, the risk of having bacterial vaginosis was 2.4-fold in the high stress group, 2.5-fold in the moderate-to-high stress group, and 1.4-fold in the low-to-moderate stress group. After controlling for maternal sociodemographic variables, there were only small decreases in the unadjusted ORs (from 2.4 to 2.2 in the high stress group and 2.5 to 2.3 in the moderate-to-high stress group). Furthermore, the perceived stress effect was larger than the magnitude of all other assessed risk factors for bacterial vaginosis. African American women were more than twice as likely to have bacterial vaginosis compared with non-African American women; however, ethnic group differences in chronic stress were not reported. This appears to be the first published study to examine associations between maternal stress and urogenital infections. So far, research on bacterial vaginosis among African American women has not examined the contribution of stress and its physiological sequelae. The work of Culhane et al. (2001), which demonstrated that stress predicts bacterial vaginosis, provides an important foundation for further study of this issue.

Discussion

Summary of Findings

We have reviewed research from a variety of domains to identify contributors to the disproportionately high rates of adverse birth outcomes among African Americans. Although behavioral and sociodemographic factors increase risks for adverse birth outcomes, our review of the pertinent evidence indicates that these variables do not fully

account for the disproportionately high rates of adverse birth outcomes in African Americans. Disparities in birth outcomes between European Americans and African Americans exist at all levels of SES, even after controlling for health behaviors, and have been shown to increase with higher levels of education. Furthermore, a growing body of work provides evidence for the deleterious effects of maternal stress on birth outcome. Although some have suggested that higher levels of stress in African Americans account for ethnic disparities in birth outcome, the little evidence that bears on this issue is inconsistent. However, as perspectives on allostatic load and weathering as well as some supportive empirical evidence suggest, African American women may be more susceptible to the adverse impact of prenatal stress on birth outcomes. This is particularly plausible because the vast majority of African American women experience racism, which heightens their allostatic load, or cumulative burden. Whether racism is conceptualized as a form of stress, as we have argued it can be, or whether it is a different construct that exacerbates the impact of stress, there is increasing evidence from recent studies that racism is associated with adverse birth outcomes in African American women. Preliminary evidence suggests that racism is distinct from other types of stress and that it may have greater unfavorable effects on health. These findings suggest that the failure to examine racism in studies of pregnant African American women is a serious oversight that can result in underestimation of stress levels or in the inability to observe interactive effects of stress and racism, which may predict adverse birth outcomes.

In addition, we described three physiological mechanisms that mediate the impact of prenatal stress on birth outcomes. There is equivocal evidence about whether these mechanisms can explain why African Americans experience higher rates of adverse birth outcomes. For example, although CRH elevations appear to mediate the impact of stress on birth outcomes, the limited evidence available suggests that CRH levels may be lower, not higher, in African Americans than in European Americans. More compelling evidence exists that implicates increased cardiovascular reactivity in African Americans as a contributor to adverse birth outcomes; there is some indication that cardiovascular differences by ethnicity are attributable to stress or racism. Finally, there is strong evidence that immunological susceptibility may play a role in ethnic disparities in birth outcome. Greater rates of urogenital infection, especially bacterial vaginosis, exist in African American women than in European American women, and these appear to be attributable in part to stress and to hygienic practices, such as douching, that are more common in African American women.

Where Do We Go From Here? Recommendations and Cautions for Researchers

The research reviewed in this article raises a number of critical issues relevant to further exploration of stress, racism, and related factors as contributors to adverse birth outcomes among African Americans. The first issue concerns the heterogeneity of African Americans and the influence of African American culture on adverse birth outcomes. A second issue involves methodological challenges, including individual differences in perceptions of racism, the role of study participants and researchers, and the importance of methodologically and theoretically sophisticated approaches to conceptualize and operationally define stress, racism, and socioeconomic status. An additional issue that we discuss below is the importance of multivariate approaches that enable researchers to

examine mediators of effects and interactions among variables and that offer robust tests of the impact of SES, stress, racism, and physiology on birth outcomes. We also offer some cautions to researchers about treating ethnicity as a risk factor and identify questions that remain unresolved in this area of study.

Influence of Ethnic Group Heterogeneity on Birth Outcomes

It is critical that research on ethnically disparate rates of adverse birth outcomes recognize the heterogeneity of people of African descent (Reid, 2004). American-born women of African descent, for example, have less favorable birth outcomes, including low birth weight and infant mortality, than do foreign-born African American women (Cabral, Fried, Levenson, Amaro, & Zuckerman, 1990; J. W. Collins, Wu, & David, 2002; Fuentes-Afflick & Hessol, 1996; Kleinman et al., 1991; Mathews et al., 2002; Wasse, Holt, & Daling, 1994). Other health differences between these groups also exist: First-generation African immigrants have lower prevalence of hypertension compared with U.S.-born African Americans (Hyman, Ogbonnaya, Pavlik, Poston, & Ho, 2000), and data from the National Health Interview Survey and the National Death Index indicate that native-born African Americans have the highest odds of death, with foreign-born African Americans displaying especially low odds of death (Hummer, Rogers, Nam, & LeClere, 1999). In general, foreign-born immigrants have better health than those born in the United States, and recent immigrants are healthier than foreign-born persons living in the United States for 10 years or more (Stephen, Foote, Hendershot, & Schoenborn, 1994).

It is possible that a “healthy immigrant effect” explains the less favorable health of American-born individuals, because immigrants to America may not be representative of their native population, in health status or resources. However, intergenerational data comparing birth outcomes in descendants of native- and foreign-born women suggest that if true, the healthy immigrant effect does not apply equally well to European Americans and African Americans (J. W. Collins et al., 2002). That is, the descendants of African-born women experience poorer birth outcomes after immigrating to the United States relative to descendants of foreign-born European American women. J. W. Collins et al. speculated that different intergenerational patterns of birth weight experienced by African Americans and European Americans result from the way these groups are treated in American society, both before and during pregnancy. Furthermore, in studies examining the effect of nativity on birth outcomes, there is a lack of consistency across different ethnic groups in the favorable effect associated with being foreign born (Fuentes-Afflick & Hessol, 1996; Hummer et al., 1999; Kleinman et al., 1991). The reduced risk of adverse pregnancy outcome associated with being foreign born tends to be substantially larger for African Americans than for some other ethnic groups (Singh & Yu, 1996). These findings suggest that place of birth may mitigate or exacerbate effects of stress and racism on adverse health outcomes within African Americans. The specific reasons for this are unknown. However, it is likely that African- and Caribbean-born women of African descent living in the United States do not share the same social, political, economic, and historical experiences of African American women born in this country.

It is also likely that strong family ties, levels of acculturation, and cultural identity contribute to within-group differences in birth outcome among African Americans. Such factors may buffer the impact of stress and racism on health and well-being. Attributing unfair treatment to racial prejudice is negatively associated with well-being, but ethnic group identification protects against this effect (Branscombe, Schmitt, & Harvey, 1999). As explained by social identity theory, activating in-group identification preserves self-esteem and confidence (Hogg & Abrams, 1988). It has been hypothesized that African American women who are surrounded by an affirmative, supportive environment that enhances cultural identity and protection against potentially pathogenic effects of stress and racism have better birth outcomes than do women who lack such affirmation and protection (James, 1993). This protection comes in part from culturally indigenous close-knit families and communities. There is considerable evidence that social support improves birth outcomes in women across ethnic groups (N. L. Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993; Dunkel-Schetter, Sagrestano, Feldman, & Killingsworth, 1996; Sagrestano, Feldman, Killingsworth-Rini, Woo, & Dunkel-Schetter, 1999). Familial support has been shown to be especially important for African Americans. Among African American women, particularly, lack of support from family, especially from a pregnant woman's mother or partner, is a significant predictor of gestational complications, prolonged labor, and cesarean section complications (Norbeck & Anderson, 1989).

Visible markers of ethnicity, such as skin color, are also potential contributors to the variability in adverse birth outcomes among African American women. African Americans with darker skin complexion have been shown to exhibit higher rates of hypertension than African Americans with lighter skin; recent evidence indicates that the association between skin complexion and hypertension in African Americans is mediated by higher exposure to racial discrimination in darker complexioned African Americans (Klonoff & Landrine, 2000). Similar effects may exist for birth outcomes.

As this discussion illustrates, within-group research may be a helpful approach to better understand why disproportionately high rates of adverse birth outcomes exist among African Americans. Between groups, comparative studies provide a limited understanding of the influence of stress and racism on adverse birth outcomes among African American women, because the stress and coping experiences among and between African Americans and European Americans vary in content in addition to magnitude. Within-group analyses may be more conducive to highlighting the particular characteristics that place African American women at risk for low birth weight, preterm delivery, and infant mortality.

Other Methodological Challenges

Influences on perceiving racism—Several important challenges confront researchers examining the impact of racism on birth outcomes. One is that African Americans are more likely to attribute negative events to racism or discrimination when they are in the presence of members of a stigmatized group than when in the presence of European Americans (Stangor, Swim, Van Allen, & Sechrist, 2002). This is thought to occur in part because African Americans experience both benefits and repercussions from such attributions. Maintenance of self-esteem and avoidance of depressed affect are benefits (Crocker &

Quinn, 1998; Crocker, Voelkl, Testa, & Major, 1991), but there are also social ramifications, such as being labeled as hypersensitive, whining, or a troublemaker (Kaiser & Miller, 2001), and concerns about possible confrontation with or retaliation from perpetrators of discrimination (Swim & Hyers, 1999). These findings underscore the value of enhancing the participation and visibility of African American researchers in this area of study.

In addition, it has been suggested that because African Americans have historically been exposed to both institutional and individual racism, they may be more accustomed to adversity and less likely to identify racism as a stressor (Parker-Dominguez, Dunkel-Schetter, Hobel, Glynn, & Sandman, 2004). According to prevailing theories of stress (e.g., Lazarus & Folkman, 1984), for a stimulus to contribute to stress, it must be subjectively appraised as stressful. However, if a person negates or minimizes the stressfulness of a stimulus to avoid aversive responses or because he or she is accustomed to dealing with the stimulus, does the stimulus no longer have deleterious impact? Research on denial, distancing, and nondisclosure provides reason to suspect that stressors that elicit these responses may have pernicious effects on psychological and physical health (e.g., Aldwin & Revenson, 1987; Carver, Scheier, & Weintraub, 1989; Leserman et al., 2000; McKenna, Zevon, Corn, & Rounds, 1999; Schwartz, 1990; Smyth & Pennebaker, 2001). Instruments used to assess stress and coping related to racism must take these issues into account.

Partnerships with study participants—Study designs that allow participants to be involved in research as collaborators or coinvestigators may lead to the identification of overlooked contextual elements of life experiences that affect the association between stress or racism and birth outcomes. The importance of this approach in conducting research in understudied populations has been well articulated (see Jackson, Phillips, Rowland Hogue, & Curry-Owens, 2001; Leonard, Keys, Suarez-Balcazar, Taylor, & Davis, 2004; Mullings et al., 2001; Schensul & Stull, 1987) and should be considered when designing studies to determine causes of ethnic disparities in birth outcomes. Benefits to researchers include fostering a sense of respect for the perspectives, needs, and unique experiences of study participants. This may, in turn, lead to the identification of previously unrecognized factors as well as an enhanced ability to design realistic, applicable, and culturally appropriate interventions (Jackson et al., 2001). In addition, retention and full participation, historically thwarted as a result of medical mistrust among understudied populations (Gamble, 1993), may be enhanced.

Enhanced approaches to stress and racism—Measures of stress, racism, and other relevant psychosocial factors will also have to be sensitive, reliable, and valid in African Americans. Longitudinal assessments of psychosocial and physiological variables prior to and across pregnancy are needed to identify how timing, patterns, and chronicity of these factors influence birth outcomes. Existing psychometric tools inadequately assess the range of stressors encountered by African American women, including stressors associated with ethnicity, class, oppression, and gender (Jackson et al., 2001). The majority of studies that have examined the association of racism with African American birth outcomes did not measure subjective appraisals of stress related to racist experiences. Accurate assessment of racism also requires greater attention to its multidimensionality (e.g., structural or

institutional, individual, internalized, and cultural) in order to more reliably evaluate its impact (Utsey, 1998). Furthermore, existing studies vary in whether they examine racism during the prenatal period only or whether they examine lifetime experiences of racism. Allostatic load and weathering perspectives suggest that the latter approach may be necessary to capture the full extent of health effects, but focused discussion and investigation of this measurement issue is needed. Parallel measurement approaches may be indicated for stress, which is typically assessed for the prenatal period only. There is evidence that a history of stress has deleterious effects on some aspects of women's health (e.g., sexual assault history and physical health; see Golding, 1994, 1996, 1999). A similar impact may exist for lifetime stress and birth outcomes.

In addition, in studies of African American women, comprehensive measurement of discrimination includes gender discrimination and gendered racism, because experiences of racism and sexism may overlap (Moradi & Subich, 2003). Some investigators are currently conducting research using interactive focus groups, interviews, and pilot tests to determine how African American women's experiences with stress are linked to their identities and dual roles of being both African American and female (see Jackson et al., 2001). Jackson et al. hypothesized that stress experiences related to gendered racism are risk factors for adverse birth outcomes. Preliminary analysis reveals that workplace racism and a sense of obligation for protecting children from racism are potent stressors for African American women, corroborating other findings (Brett, Strogatz, & Savitz, 1997).

Conceptualization and measurement of SES—Although existing evidence indicates that socioeconomic factors alone are not sufficient to explain ethnic disparities in birth outcome, the importance of socioeconomic factors should not be diminished. Some researchers have argued that stress mediates the relationship between economic factors and the well-being of African Americans (see Conger et al., 2002; McLoyd, 1998). SES is often assessed with simple measures, such as highest educational attainment or family income, although as we elaborated earlier in this article, education and income have different benefits for African Americans and European Americans. More sophisticated measurement of SES, and particularly measures that have been shown to offer validity across ethnic groups (e.g., Ostrove, Adler, Kuppermann, & Washington, 2000), will provide a stronger test of whether and how SES is associated with stress, racism, and adverse birth outcomes. For example, intergenerational SES has received little attention, but some of the evidence that we reviewed indicates that it is an important factor affecting birth outcomes in African Americans (e.g., Foster et al., 2000). Is the finding of increased ethnic disparity in adverse birth outcomes with increasing SES confounded by intergenerational SES? Might birth outcome differences emerge from comparisons between college-educated African American women whose parents and grandparents were college-educated and college-educated African American women whose immediate forebears were not? In which generation might benefits of intergenerational improvements in SES appear?

Conceptualization of ethnicity—Future research must also critically examine the assumption that African American ethnicity is a risk factor for adverse birth outcomes. Race and ethnicity have minimal basis in genetic differences between people and are constructs

with more sociological than biological meaning (Landrine & Klonoff, 1996). The use of race or ethnicity as a risk factor for adverse health is offensive to some (Chambers et al., 1998; Lane et al., 2001) because of its hegemonic implications and its inherent suggestion that there is something stable about an individual that causes problems with health. Instead, a risk factor should be amenable to intervention. When genetic differences are used to explain health disparities, it is often assumed erroneously that race is a valid biological category, that the genes that determine race are linked to those that determine health, and that the health of a population is determined by its biological makeup (D. R. Williams, Lavizzo-Mourey, & Warren, 1994). Yet because race is not a biological construct, genetic explanations for the disparity in adverse birth outcomes between African Americans and European Americans are insufficient; explanations need focus on the characteristics, culture, and experiences of ethnic groups that contribute to differences in birth outcomes (Kaplan & Bennett, 2003). The genetic perspective also removes responsibility from social structures and policies that influence disease patterns in subpopulations. This perspective can be used to maintain social stereotypes reinforcing the idea that African Americans are biologically inferior, providing the basis for exploitation and mistreatment (D. R. Williams et al., 1994).

The Importance of Multivariate Perspectives

Understanding the cause of ethnic disparity in adverse birth outcomes is a complex task that will require interdisciplinary teamwork (Rowley, 2001) and a biopsychosocial perspective that is applicable to the experiences of African Americans (see Clark et al., 1999). To understand how numerous risk factors act jointly and interactively to explain ethnic disparities in birth outcome, stateof-the-art data analytic approaches, such as multilevel modeling or structural equation modeling, which allow for multifactorial analysis and the examination of multiple mediators, must be used (Vasconcelos, Almeida, & Nobre, 1998). Such approaches will permit researchers to examine the relative impact of different factors, which is an important step in determining where intervention efforts should be targeted. It is critical that researchers explore interactions among predictor variables (e.g., between stress and ethnicity) and between predictor variables and theorized mediators (e.g., ethnicity and bacterial vaginosis). These types of interactive effects have been overlooked in many prior studies that have tended to adopt simple approaches that examine main effects only. In this article, we have proposed several alternative conceptual associations among stress and racism that can be examined only with sophisticated analytic approaches: that stress and racism are differentiable constructs, that they affect birth outcomes independently or interactively, that racism is a form of stress but its effects are confounded with those of other stress variables, or that racism is a distinct form of stress with unique and potentially more powerful effects on birth outcome. The use of latent variables to represent such complex constructs as stress and racism is particularly valuable to test such propositions (see Lobel, 1994; Lobel & Dunkel-Schetter, 1990).

Kramer et al. (2001) are presently using a multivariate approach in one of the most thorough studies to date examining disparities in preterm birth. This study is examining a host of possible mediators to explain the association of SES with preterm birth, including chronic and acute stressors, folate intake, social support, bacterial vaginosis, impaired genital tract immunity, health behaviors, and CRH. Although this study does not include variables related

to perceptions of racism, discrimination, or other unique stressors experienced by African Americans that may influence the ethnic disparity in birth outcomes, it represents a critical advance toward understanding biopsychosocial causes of adverse birth outcomes.

Similarly, in an ongoing study, Holzman, Bullen, et al. (2001) are assessing the underlying biological and psychosocial determinants of preterm birth among an ethnically diverse cohort of pregnant women in Michigan. These researchers are examining how social and personal antecedents, including poverty, discrimination, education, violence, stress, anxiety, coping skills, health behaviors (e.g., tobacco and drug use, sexual activity), and hygienic practices (e.g., douching) affect the biological pathways to adverse birth outcomes (Holzman, Bullen, et al., 2001). Another ongoing study is examining how experiences of racism and violence are associated with CRH levels and preterm birth (Rich-Edwards et al., 2001). These two studies are among the first to integrate the examination of racism with established physiological mediators of adverse birth outcomes. As we have argued in this article, African American ethnicity may be a marker or proxy for measurable lifestyle experiences that are associated with greater stress. The simultaneous investigation of ethnicity, sociodemographic variables, stress, racism, coping, health behaviors, and biological pathways to adverse birth outcomes will enable researchers to understand how and why ethnicity may affect birth outcomes and to estimate the relative impact of various explanatory factors.

Additional Unresolved Questions

The present review has focused on disparate rates of infant mortality resulting from preterm birth and low birth weight delivery. Nonetheless, the disparity in infant mortality between African Americans and European Americans also exists among normal birth weight (2,500–4,459 g) infants and infants that are large for gestational age (>4,500 g) (Mathews et al., 2002). Although explanations for these disparities are beyond the scope of the current review, this topic also merits careful attention.

Further study is also needed to consider how coping among African Americans contributes to differences in birth outcome. Differences in exposure to discrimination may influence how individuals cope with the stress of racism (Branscombe & Ellemers, 1998; Utsey, Ponterotto, & Reynolds, 2000) and with stressors unrelated to racism. In addition, some coping strategies, such as passive coping or suppression of negative affect, have been associated with higher blood pressure and diminution of immune functioning (Harburg, Blakelock, & Roeper, 1979; Krieger, 1990; Petrie, Booth, & Pennebaker, 1998). Krieger (1990) found that middle-aged African American women who responded to racism and gender discrimination with quiet acceptance were more likely to have hypertension than African American women who expressed their feelings of mistreatment. We have not addressed the role of coping in our discussion of factors that contribute to ethnic disparities in birth outcome, but we call attention to recent research on related issues that should be helpful in guiding future research (see Bennett et al., 2004; H. F. Myers et al., 2003; Yali & Lobel, 1999, 2002).

Conclusion

It is imperative that we continue to rigorously explore the reasons why African American infants are born earlier, with lower birth weight and with higher rates of mortality than European American infants to enable the development of interventions that effectively prevent these outcomes. Adverse birth outcomes can result in a lifetime of physical, financial, interpersonal, and other challenges that continue the self-perpetuating cycle of unfavorable conditions and poor health in African Americans. The field of psychology has a legacy of contributing to social change (Anderson, 2004). This legacy provides inspiration and hope that solutions to complex problems are within our reach. Examining the impact of such critical psychosocial variables as stress and racism and their complex interactive effects with behavior and physiology may not only illuminate how the life experiences of African American women influence birth outcomes, but also give us insight into explanations for other long-standing ethnic disparities in health in the United States.

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