

## Stress and Reproduction: Introduction to the Special Section

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This special section on stress and reproduction is devoted to an emerging frontier in interdisciplinary research that merits the attention of health psychologists. The majority of the studies concern the role of stress and emotion on birth outcomes such as low birth weight, fetal growth and preterm delivery, or mechanisms underlying these findings. The implications of this research extend from maternal and infant health to life-span development and adult health and mortality.

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Health psychology is familiar with the role of stress in the etiology of adult-onset diseases such as cardiovascular disease, Type II diabetes, and other chronic degenerative diseases. In contrast, the role of stress and related psychosocial factors in reproduction has not been much subjected to rigorous research. Instead, myths and misconceptions are common. For example, it is often believed that stress in women can cause miscarriage despite only a weak scientific basis for this belief in past decades (cf. Stanton & Dunkel-Schetter, 1991). Moreover, nearly all research on stress and reproduction has been with women, with relatively little attention to men's reproductive issues.

The focus of past research on women has included these topics: psychosocial stress and specific reproductive outcomes such as the ability to conceive and carry a pregnancy, abortion, labor and delivery outcomes, pregnancy complications, birth weight and preterm delivery, and pediatric outcomes such as infant health and development. In this special issue, for example, Boyles et al. (2000) study spontaneous abortion and find that those occurring at 11 weeks or later are associated with increased amounts of life event stress, whereas those occurring earlier are not. Because 11 weeks is used as a prudent cutoff for miscarriage resulting from chromosomal abnormality, this study suggests that stress may play a role only in late miscarriages that are not due to chromosomal

problems. This is an important contribution, because it may help to clarify confusing earlier results on this topic and points the way to more sophisticated models of miscarriage etiology.

The majority of studies in this special section concern the role of stress or related variables in birth outcomes such as birth weight, length of gestation, and fetal growth (birth weight adjusted for length of gestation). Gestational length of fewer than 37 weeks at birth is categorized as preterm delivery and poses risks for the infant, especially of low birth weight. Fetal growth and infant birth weight are very important indices of infant health. Furthermore, a growing body of evidence now suggests that infant birth weight is a powerful and independent predictor or risk for several chronic degenerative diseases in adult life, including hypertension and coronary heart disease, Type II diabetes mellitus, and some forms of cancer (Barker, 1998; Nathanielsz, 1999).

Ickovics et al. (2000) report that women who were HIV positive in pregnancy were 2.6 times more likely to have an infant with reduced fetal growth compared with pregnant women who were HIV negative. In another article in this section, Stein, Lu, and Gelberg (2000) demonstrate that severity of homelessness (an indicator of intense chronic stress) was associated with both low birth weight and preterm birth after controlling for prenatal care and other risk factors. Hoffman and Hatch (2000) report that maternal depression at 28 weeks in lower occupational status women is associated with a 9.1-reduction in birth weight adjusted for length of gestation. This finding did not hold for high occupational status women, suggesting that depression in the context of socioeconomic stress may be a risk factor for adverse outcome. Altogether, these three studies support the growing evidence for the role of stress, especially chronic stress and its emotional effects, on important outcomes such fetal growth and preterm delivery (Dunkel-Schetter, Gurung, Lobel, & Wadhwa, 2000). They also begin to pinpoint some of the moderators of such associations.

Finally, Lobel, DeVincent, Kaminer, and Meyer (2000) find that stress does not predict birth outcomes when a personality factor,

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optimism, is simultaneously examined. Optimism was significantly associated with birth weight adjusted for length of gestation. The possibility that personality factors indirectly influence birth outcomes by stress reduction or minimization is an intriguing implication of this study. This study challenges stress researchers to untangle effects of distinct aspects of stress, related causal agents such as individual differences, and confounding variables in modeling the mechanisms producing adverse outcomes.

Two more of the articles in this section represent new directions in research on stress and reproduction. Evidence suggests that the maternal environment has implications not only for birth outcomes but also for fetal development in utero and development over the life course. Prenatal experience plays a critical role in development with longer lasting and more permanent consequences than experience later in life. Many animal and human studies suggest that a stressful prenatal environment may contribute to abnormalities in brain morphology and function (cognition, emotionality, and behavior), sexual differentiation, integrity of the endocrine and immune systems, time course of normal aging, and longevity (Wadhwa, 1998). Coe and Crispen (2000) as well as Light et al. (2000) examine specific aspects of psychobiological mechanisms that may underlie the relations between stress and developmental outcomes at birth or in infancy. In the first case, neonatal monkeys were gestated under different conditions, one of which was repeated disturbance (i.e., chronic stress). This condition led to disrupted placental transfer of maternal antibody or lower immunoglobulin G (IgG) in female neonates. The IgG receptor may be unregulated selectively in female fetuses, compensating for reduced antibodies in disturbed mothers. This elegant work begins to elucidate some of the maternal-fetal processes that respond immediately to stressful environmental conditions and has implications for the physiological functioning of the offspring.

Light et al. (2000) examine the effects of the neuropeptide oxytocin on blood pressure in human mothers; oxytocin is a hormone associated with reproductive processes and social bonding. Their preliminary report suggests that the magnitude of oxytocin response to mothers holding their infant is inversely associated with maternal blood pressure during laboratory stress and normal ambulatory activity. This study thus supports the notion that oxytocin may have stress-reducing effects.

Research on stress as an independent variable or causal agent in reproductive events such as birth is heavily represented in this issue; in contrast, investigations on psychological adjustment to reproductive experiences is underrepresented. For example, research on psychological adjustment to infertility has been the subject of increasing inquiry in recent years (Stanton & Dunkel-Schetter, 1991). Confronting barriers to conceive or carry a pregnancy to term represents a significant stressor in the lives of many individuals. In this section, Domar et al. (2000) address the role of stress ensuing from infertility. In a randomized, controlled trial, these authors build on predictive studies to develop and test a treatment for the distress experienced by infertile women. The Domar et al. study is the sole clinical intervention trial in this selection of articles. Its inclusion highlights the fact that clinical implications of findings regarding stress and reproduction merit attention. This article illustrates both the problems of translating empirical findings into psychosocial intervention trials (e.g., participant accrual and retention in a randomized, controlled trial) and

the promise of such interventions for improving quality of life and health for those experiencing reproductive challenges.

Ritter, Hobfoll, Lavin, Cameron, and Hulsizer (2000) also focus on issues of psychological adjustment rather than medical outcomes. They examine depression in both the prenatal and postpartum periods among 191 inner-city pregnant women. Stress was associated with increases in depression over the course of pregnancy and postpartum, whereas income and social support were related to decreases in depression. The ability of the research design to address changes in depressed mood over the course of pregnancy and after birth is a definite strength of this study.

It is particularly exciting to see relatively large sample sizes in several of these studies (Hoffman & Hatch, 2000; Ickovics et al., 2000; Stein et al., 2000) and to see understudied populations investigated, such as the homeless and women of lower socioeconomic status (Hoffman & Hatch, 2000; Ritter et al., 2000). In addition, the selection of women at high risk because of medical conditions in one study is worth noting (Lobel et al., 2000). Researchers have tended to group low-risk and high-risk women together in considering the effects of stress on birth outcomes. Heterogeneity of risk conditions can complicate designs and obscure significant effects of other factors, or lead to equivocal results across studies.

The operationalizations of stress in the studies in this section are illustrative of the many approaches one may take as a researcher. Traditional standardized measures of life event stress and anxiety are used in some of the studies (Boyles et al., 2000; Domar et al., 2000). In one case, several self-report instruments were administered and combined by statistical means (Lobel et al., 2000). Two studies focus on depression (Hoffman & Hatch, 2000; Ritter et al., 2000), with careful attention to specifying the validity of depression assessment methods and the cutoffs for levels of clinically significant depression. Severity of homelessness and a positive HIV status can be viewed as proxies for stress; the chronic stress experienced by these populations makes these studies highly relevant to a broad understanding of the effects of stress in pregnancy. Homeless pregnant women and pregnant women with HIV are at very high risk in pregnancy, and they deserve special attention in future research and public health efforts. Of course, manipulating stress in experimental designs, as was done in the study of monkeys in gestation by repeated environmental disturbance (Coe & Crispen, 2000), has advantage compared with merely assessing naturally occurring stress. Practically speaking, few studies of pregnancy, or any reproductive outcomes for that matter, have manipulated stress in humans. Use of mental arithmetic and similar laboratory paradigms for studying human stress offer some possibilities in this respect although ethical issues must be considered carefully. Overall, the range of options for studying stress in reproduction is large and can draw from strong health psychology research in other domains.

We noted in the beginning of this introduction that most existing research has examined female reproductive outcomes, whereas relatively little research has addressed issues of stress and male reproduction. The underrepresentation of men in reproductive research means we are missing opportunities to understand and treat important issues such as male infertility, the effects of abortion and pregnancy on men, the role of men in female reproductive outcomes, and male reproductive changes in midlife, to name just a few topics.

This special section addresses a developing, exciting, and relatively new research topic. A large number of interesting papers were submitted, from which we selected this set of especially significant and informative articles. Together they provide a flavor for this developing area of research. We hope that this special section will draw attention to this important and burgeoning area of research.

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