How does maternal childhood adversity “get under the skin” and cause adverse birth outcomes?*

Karina M. Shreffler, Ph.D.
Oklahoma State University
Karina.shreffler@okstate.edu

Kami L. Gallus, Ph.D.
Oklahoma State University
Kami.gallus@okstate.edu

*This research was supported in part by grant P20GM109097 funded by the National Institute of General Medical Sciences of the National Institutes of Health (Jennifer Hays-Grudo, PI). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. For more information, contact: Karina M. Shreffler, Department of Human Development and Family Science, Oklahoma State University, 700 N. Greenwood Ave., Tulsa, OK, 74106. Phone: 918-594-8389. Email: karina.shreffler@okstate.edu.
How does maternal childhood adversity “get under the skin” and cause adverse birth outcomes?

Abstract

Early life events, such as those captured by the ACE measures, can have substantial implications for later life health outcomes. We expand the ACEs framework to include a multigenerational focus on adverse birth outcomes. This paper applies a biobehavioral conceptualization to explain how maternal early life adversity shapes attitudes, behaviors, and physiological responses such that adverse birth outcomes are more likely. This should provide a fuller understanding of the causes of differences in pregnancy- and contraception-related attitudes and behaviors as well as highlight the negative physiological impact that early stress can have on birth outcomes.
How does maternal childhood adversity “get under the skin” and cause adverse birth outcomes?

Early adverse life events, such as those captured by the adverse childhood experiences (ACE) measures, can have important implications for birth outcomes. Although most research on the health-related outcomes of ACEs has focused on an individual’s own morbidity later in life, there are studies indicating negative birth outcomes associated with higher maternal ACEs, including miscarriage (Hillis et al., 2004; Neugebauer et al., 1996), hyperemesis, preterm contractions, premature birth (Paarlberg et al., 1995), and low birth weight (Paarlberg et al., 1999). Yet, it is unclear whether early adversity increases the risk for negative prenatal and postnatal outcomes predominately due to psychological, behavioral and/or physiological factors, or a combination of the above. A guiding framework is needed to describe how specific early adverse life events (e.g. childhood abuse, violence, sexual assault, parental addiction, mental health problems, incarceration, and divorce) experienced by mothers are associated with higher risks for their infants. This paper proposes a conceptual biobehavioral framework of the processes leading from maternal ACEs to adverse birth outcomes in an effort to inform clinical practice, programs and policies, and future research, thereby reducing negative outcomes such as preterm birth, low birthweight, and infant and maternal mortality. We seek to better define these pathways in order to identify crucial factors that medical and mental health professionals must target in order to reduce the risk of adverse birth outcomes that follow maternal early adversity.

Pathways from Maternal ACEs to Adverse Birth Outcomes

In order for maternal ACEs to affect birth outcomes, there is the necessary precursor for birth: pregnancy. The first proposed pathway linking maternal ACEs to adverse birth outcomes is behavioral. It is important to consider first the pregnancy event. The Theory of Reasoned Action...
(TRA) and the Theory of Planned Behavior (TPB) are often applied to the study of pregnancy and reproductive-related behaviors. The TRA and TPB posit that behaviors are best predicted by intentions, which are shaped by individual attitudes and normative expectations about the behaviors, and the TPB includes the requirement that there must be perceived control over the behavior in question (Ajzen, 1985; Fishbein, 1979; Montano & Kasprzyk, 2015). Identity (e.g., importance of parenthood), structural (e.g., life course), and cultural (e.g., values) factors are often included in studies of childbearing motivations and intentions (McQuillan, Greil, Shreffler, & Bedrous, 2015). These studies tend to assume that planning for a birth is within a woman’s perceived control in developed countries due to readily available contraception (Ajzen & Klobas, 2013), yet nearly half of pregnancies are unintended (Finer & Zolna, 2011)—a proportion that has not declined over the past three decades (Mosher, Jones, & Abma, 2012).

Exposure to ACEs has been linked to pregnancy-related outcomes in prior research. For example, higher ACEs are associated with an increased risk for unintended pregnancies (Dietz et al., 1999) and are among the strongest predictors of teen pregnancies (Hillis et al., 2004). Further, teen mothers who experienced interpersonal violence in childhood, one prototypical ACE, are more likely to give birth a second time and to have a short inter-pregnancy interval (Patchen et al., 2009; Raneri & Wiemann, 2007). The mechanisms underlying these associations are unclear, however. Following the TRA and TPB model, one reason for maternal ACEs to affect pregnancy has to do with childbearing motivations or attitudes. It is possible, for example, that women who experienced more adversity as children might be motivated to either not give birth because they do not desire to have children who might experience similar events, or to give birth because a child might fill a void for them. In a classroom based study of teens’ perceptions
about how their lives would change with a birth, teens in poverty held significantly more positive attitudes toward a teen birth (Herrman & Waterhouse, 2011).

Yet as aforementioned, a high proportion of all pregnancies are unintended, and a high ACE score increases the risk that a pregnancy is unplanned. Thus, understanding the underlying factors associated with unintended pregnancies is critical. More than half of unintended pregnancies occur among women who were not using any method of contraception in the month they conceived, and more than four in 10 occur among women who used chosen contraception methods inconsistently or incorrectly (Kost, Singh, Vaughan, Trussell, & Bankole, 2008). Yet evidence also suggests that ambivalence about avoiding a pregnancy is a key predictor of inconsistent contraceptive use. Approximately four in 10 women who reported that avoiding pregnancy is of “little or no importance” had at least one month-long gap in contraceptive use in a year while they were at risk for pregnancy, compared with fewer than two in 10 who reported avoiding a pregnancy as “very important” (Frost & Darroch, 2008). The salience of women’s childbearing motivations and intentions, therefore, matters for pregnancy outcomes. It is possible that women with higher ACEs have greater ambivalence about getting pregnant; perhaps they have more critical or pressing concerns in daily life. It is also possible that women with higher ACEs are cognitively less able to be planful; adverse childhood experiences, especially when chronic or repeated, have pervasive impacts on brain development. In particular, ACEs are associated with deficits in emotional self-regulation, which affects impulse control, a sense of mastery, and ability to make plans and regulate behaviors (van der Kolk, 2017).

Of course, getting pregnant takes two people, and there may be factors outside of the woman’s control that lead to a pregnancy that is unintended. Women who experienced more adversity in childhood such as violence and abuse are more than three times more likely than
other women to experience intimate partner violence (IPV) in adulthood (Whitfield, Anda, & Dube, 2003). IPV, in turn, is associated with greater risk for pregnancy coercion, birth control sabotage, and unintended pregnancy (Miller et al., 2010).

Understanding the association between maternal ACES and pregnancy intentions is important because of the implications for adverse birth outcomes. In our model, pregnancy intentions serve as a mediator between maternal ACEs and adverse birth outcomes. In this pathway, unintended pregnancies can be risky because women may not be aware of a pregnancy and continue to engage in risky behaviors such as substance use (McQuillan, Greil, & Shreffler, 2011).

Indeed, ACEs have been linked to behaviors that, if occurring during pregnancy, increase the risk of adverse birth outcomes. In a sample of low-income pregnant women, Chung and colleagues (2010) reported the odds of smoking, alcohol, marijuana, and other illicit drug use during pregnancy were 2.5 times greater for women with three or more ACEs. These behaviors during pregnancy have been associated with increased risk of various adverse birth outcomes (Floyd et al., 1991; Goldenberg et al., 1997; Krulewitch, 2001). Thus, the consequences of maternal ACES for birth outcomes may be due in part to adverse health behaviors during pregnancy.

Yet it is unproductive and likely incorrect to place full blame for adverse birth outcomes on mothers for their childbearing attitudes and risky behaviors before and during pregnancy. The second primary pathway linking maternal ACEs to adverse birth outcomes is physiological. ACEs have been demonstrated to get “under the skin”. According to Anda and colleagues (2010), the role of ACEs for neurodevelopment explains much of the negative health outcomes; “…[the] cumulative exposure of the developing brain to the activated stress response…is likely
the primary pathway by which ACEs exert their broad public health impact” (p. 96). Greater exposure to ACEs has been associated with elevated C-reactive protein (CRP) and autoimmune diseases in adulthood, suggesting that adverse experiences in childhood independently increase inflammation later in life (Danese et al., 2007; Dube et al., 2009). This evidence is consistent with the “weathering” hypothesis (Geronimus, 1992), which argues that repeated exposure to acute (traumatic) and chronic stressors produces physiological “wear and tear” that undermines maternal health and the ability to carry a fetus to term. “Weathering” is conceptually consistent with the “allostatic load” hypothesis of differential aging (McEwen & Seeman, 1999). Systemic dysregulation of major bodily functions, frequently referred to as bodily “wear and tear” is typically indexed through a panel of biomarkers capturing the hormonal (e.g., cortisol), cardiovascular (e.g., blood pressure), metabolic (e.g., glycoxcylated hemoglobin) and immune (e.g., CRP) functioning (Seeman et al., 2010).

Allostatic load provides a useful physiological framework for linking maternal ACEs with adverse birth outcomes (Lu et al., 2010; Shannon, King, & Kennedy, 2007). Elevated stress hormones (e.g., CRH, cortisol) are linked with adverse birth outcomes through increased risk of spontaneous abortion and low birth weight (Nepomnaschy et al., 2006; Wadhwa et al., 2004). Deregulated immune function has been connected with pregnancy outcomes, including miscarriage, preterm labor and preeclampsia (Calleja-Aquis et al., 2012). Mothers with elevated CRH and glucocorticoid levels, both associated with chronic psychosocial stress, are more likely to experience preterm labor and birth (Erickson et al., 2001), preeclampsia (Goland et al., 1995), restricted fetal growth (Goland et al., 1993), and bacterial infections (Petralgia et al., 1995). Wallace and Harville (2012) found an association of maternal allostatic load and infant
gestational age at birth, and reported that the association is particularly adverse for younger mothers.

Current ACEs theory and research therefore emphasizes early life adversity for later life health outcomes. Yet, we argue that this is incomplete; children do not begin life on an equal playing field. Lu and Halfon (2003) proposed that disparities in birth outcomes are the consequences of differential trajectories for mothers set forth by their own early life experiences and allostatic load, as well as from risk factors during pregnancy. Following this guide, rather than focusing on an individual’s own health outcomes based on ACE score, we argue that a mother’s own ACE score has implications for her child’s health and development. With this approach, we expand the current focus on individual ACEs and outcomes to include a multigenerational lens. Our conceptual model linking maternal ACEs to adverse birth outcomes is presented in Figure 1 and emphasizes the social context of ACEs exposure and the biological and behavioral mechanisms that may be involved in unintended pregnancy and adverse birth outcomes. The model present the two distinct pathways linking maternal ACE score to adverse birth outcomes. The first pathway focuses on the motivational and behavioral sequence following the experience of adverse events in childhood. Following Miller’s (1994) model of fertility behavior wherein individual differences and experiences affect motivations and desires, which inform intentions and lead to behaviors, we posit that those individual characteristics and experiences (e.g., ACEs) influence women’s desires and attitudes about pregnancy and parenthood. In turn, those attitudes influence risky reproductive behaviors and negative health behaviors during pregnancy, and ultimately heightened risk of adverse birth outcomes. The second pathway is physiological; it is the “weathering” or “wear and tear” pathway. This pathway highlights the impact of ACEs for maternal allostatic load and suggests that adverse
Birth outcomes will be more likely for mothers and their infants when greater maternal adversity during childhood was experienced due to cumulative wear and tear to her body’s allostatic systems.

**Discussion and Conclusion**

Using theoretical contributions from social and health science fields regarding ACES and allostatic load, this study proposes a guiding framework for understanding the psychological, behavioral, and physiological consequences of maternal early adversity for adverse birth outcomes. A growing body of research indicates that adversity and stress during sensitive developmental periods can cause permanent alterations in brain, immune and endocrine systems.
functions, placing individuals at greater risk for deficits in social attachment formation, self-regulation of negative thoughts and feelings, and impulse control. The impact of these risks for later life health outcomes has been well-documented. What has been less examined, currently, is the generational link; what is the impact of a mother’s ACE score on her child’s health and development? The proposed framework addresses the need for a theoretical model and identifies two primary pathways for the relationship between maternal early adversity and adverse birth outcomes: biological and behavioral. According to Lu and Halfon (2003), this type of integrative approach that draws from social and biological perspectives is necessary to reduce health disparities. This model can be utilized in future research, resulting in findings that will have a substantive impact on the ability of health-care professionals, case workers, mental health professionals, and policy makers to develop effective methods and programs for preventing adverse outcomes such as unintended pregnancy, preterm births, and low birthweight. Practitioners will be able to utilize information based on this framework to potentially modify maternity care practice guidelines to include assessment and care for women’s adverse childhood experiences and symptoms, thus reducing the risks for adverse maternal and child outcomes.
References


neglect, and household dysfunction. *Child Abuse and Neglect*, 28, 771-784.


doi:10.1016/0022-3999(95)00018-6


