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# Evolution, Stress, and Sensitive Periods: The Influence of Unpredictability in Early Versus Late Childhood on Sex and Risky Behavior

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According to a recent evolutionary life history model of development proposed by Ellis, Figueredo, Brumbach, and Schlomer (2009), growing up in harsh versus unpredictable environments should have unique effects on life history strategies in adulthood. Using data from the Minnesota Longitudinal Study of Risk and Adaptation, we tested how harshness and unpredictability experienced in early childhood (age 0–5) versus in later childhood (age 6–16) uniquely predicted sexual and risky behavior at age 23. Findings showed that the strongest predictor of both sexual and risky behavior was an unpredictable environment between ages 0 and 5. Individuals exposed to more unpredictable, rapidly changing environments during the first 5 years of life displayed a faster life history strategy at age 23 by having more sexual partners, engaging in more aggressive and delinquent behaviors, and being more likely to be associated with criminal activities. In contrast, exposure to either harsh environments or experiencing unpredictability in later childhood (age 6–16) was, for the most part, not significantly related to these outcomes at age 23. Viewed together, these findings show that unpredictable rather than merely harsh childhood environments exert unique effects on risky behavior later in life consistent with a faster life history strategy. The findings also suggest that there is a developmentally sensitive period for assessing environmental unpredictability during the first 5 years of life.

*Keywords:* life stress, social development, sexual behavior, evolution, life history theory

Imagine that Heather and Uma both grew up in stressful and negative environments. Although they had enough to eat, their childhoods were filled with many challenges and social turmoil. Heather and Uma, for example, both lived in impoverished neighborhoods, and their families often felt pressure to make ends meet.

Despite the similarities of their high-stress environments, Heather and Uma's lives differed in one critical way. Heather's environment was consistently harsh. Although her family was poor, she knew that yesterday, today, and tomorrow would be consistently difficult, and she expected and experienced hardships on a regular basis. Uma's environment, in contrast, was unpredictable. Although she was also poor, she experienced a consistently changing environment, moving from place to place and witnessing different people moving in and out of her house.

Given their childhood environments, what will Heather and Uma be like as they grow older? According to the standard developmental psychopathology model (see Ellis et al., 2012), high levels of stress tend to undermine healthy development, resulting in emotionally and behaviorally dysregulated psychological functioning. This perspective suggests that Heather and Uma should both start having sex at a young age, have many sexual partners by the time they are young adults, and engage in risky and socially deviant behaviors. Although these outcomes are viewed negatively from a developmental psychopathology perspective, an evolutionary perspective views these outcomes as neither bad nor good. Instead, risky behaviors often make adaptive sense based on what a given person has experienced earlier in life and what he or she is likely to encounter in future environments (Belsky, Steinberg, & Draper, 1991; Belsky, Steinberg, Houts, Halpern-Felsherd, & the NICHD Early Child Care Research Network, 2010; Del Giudice, 2009; Ellis, Figueredo, Brumbach, & Schlomer, 2009; Simpson & Belsky, 2008). Precocious sexual behavior and an opportunistic "get what you can while you can" attitude are likely to reflect the enactment of an adaptive life history strategy in response to difficult or unpredictable early social environments. In these environments, risky strategies would have increased the probability of getting one's genes into the next generation in evolutionary history (Chisholm, 1993).

Recent evolutionary life history models posit that stress differs on two basic dimensions (Belsky, Schlomer, & Ellis, 2012; Ellis et al., 2009). Stressful childhood environments can be harsh and/or unpredictable, and each dimension may have unique effects in predicting future behavior. Ellis et al. (2009), for example, proposed that stress associated with unpredictable environments early in life (e.g., changes in parents' employment status, residence, or cohabitation patterns) may be particularly consequential in shaping

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sexual and perhaps risk-taking behavior in early adulthood (see also Belsky et al., 2012). To return to Heather and Uma, both girls grew up in stressful and difficult environments, but Heather was exposed to a consistently harsh early environment, whereas Uma was exposed to an unpredictable, rapidly changing early environment. As we shall see, the subtle differences between Heather's harsh and Uma's unpredictable environments may have unique implications for both their sexual and risky behavior in early adulthood.

In the current research, we examined how exposure to harsh versus unpredictable environments during early childhood (ages 0–5) and during later childhood (ages 6–16) predicts the age of first sexual intercourse (sexual debut), the number of sexual partners, aggression, delinquency, and ties to criminal activities in early adulthood. We tested these predictions using data from the Minnesota Longitudinal Study of Risk and Adaptation (MLSRA; Sroufe, Egeland, Carlson, & Collins, 2005), a project that has followed approximately 165 longitudinal participants who were born into poverty from before birth (prenatally) into adulthood. Compared to most longitudinal studies, the MLSRA is unique because of its frequent measurement of assorted life history variables, many of which have been repeatedly assessed across the life of each participant. This allowed us to investigate and test how the two major dimensions of stress (harshness and unpredictability) assessed both earlier (ages 0–5) and later (ages 6–16) during social development prospectively predict sexual and risky behavior when participants enter young adulthood (at age 23). We begin by reviewing the evolutionary framework of life history theory.

## Life History Theory

Life history theory was developed in evolutionary biology to explain how and why organisms in most species allocate resources among competing life tasks. All organisms, including humans, must allocate effort to potentially conflicting life tasks, including bodily maintenance (e.g., immune functioning, predation defenses), growth (e.g., acquisition of physical, social, and cognitive competencies), and reproduction (e.g., mating and parenting; Kaplan & Gangestad, 2005; Roff, 2002; Stearns, 1992). Because energy and resources are limited, all organisms must make important tradeoffs in how they divide their resources among different competing tasks at any given point in their development. Energy allocated to one task cannot simultaneously be allocated to another task. For example, energy used to maintain the body's immune system cannot concurrently be spent on somatic growth (Kaplan & Gangestad, 2005; Roff, 2002). These tradeoffs are usually made nonconsciously and are reflected in an individual's preferences, desires, and behaviors (Kenrick, Griskevicius, Neuberg, & Schaller, 2010; Simpson, Griskevicius, & Kim, 2011).

A person's life history–relevant preferences, desires, and behaviors constitute his or her *life history strategy*. Life history strategies are believed to exist along a slow-to-fast continuum (Griskevicius, Ackerman, et al., 2011; Promislow & Harvey, 1990). Slower strategies are associated with reproducing at a relatively later age, having fewer but more committed and stable sexual relationships, having fewer children, and investing more time, effort, and resources in each child. Faster strategies, which have the opposite characteristics, are associated with reproducing at an earlier age, having more uncommitted and less stable sexual relationships, having more children, and investing less time, effort, and resources into each child. Life history strategies correlate with certain clusters of psychosocial traits, many of which facilitate the successful enactment of each strategy. For example, faster strategists tend to be opportunistic in that they take more risks, display more aggression, and desire immediate gratification for short-term benefits. Slower strategists, on the other hand, tend to be long-term planners who take fewer risks, display less aggression, and delay gratification for future payoffs (Belsky et al., 2010; Figueredo et al., 2006; Griskevicius, Tybur, Delton, & Robertson, 2011; Nettle, 2010).

Faster strategies are adaptive in ecologies that are dangerous or resource limited, which are often characterized by greater predation, injury, disease, or starvation. Because an organism's expected life span is shorter in such ecologies, it pays more to invest in immediate reproduction instead of long-term planning and investment in long-term relationships, whose benefits may never be realized. If organisms adopt slower strategies in such environments, they run the risk of never reproducing and not getting their genes into future generations. Conversely, when external causes of mortality can be managed, it can be more adaptive to enact a slower strategy by delaying reproduction and investing in future outcomes (Ellis et al., 2009).

Individual differences in life history strategies develop partly in response to a person's early rearing environment, when children are learning about the world very rapidly and may be particularly receptive to incorporating information from their local environments (Belsky et al., 1991, 2010; Chisholm, 1999; Simpson et al., 2011). Early-life environments characterized by higher levels of unpredictability and harshness lead individuals to enact faster strategies by speeding up the timing of their development and sexual maturation (see Ellis, 2004). For example, higher levels of local mortality (death) strongly predict earlier age of having a first child (Griskevicius, Delton, Robertson, & Tybur, 2011; Low, Hazel, Parker, & Welch, 2008; Wilson & Daly, 1997).

## Dimensions of Stress: Harshness Versus Unpredictability

Working within an evolutionary life history framework, Ellis and his colleagues (2009) advanced a model of how different types of environmental conditions encountered early in life affect the development of fast versus slow life history strategies. The Ellis et al. model highlights two basic dimensions of environmental stress: harshness and unpredictability. Rather than hypothesizing additive effects of stress (i.e., that more stress of any type should result in more negative developmental outcomes), their model proposes that harshness and unpredictability may exert unique effects on life history–relevant behaviors in young adulthood.

### Harshness and Unpredictability

According to Ellis et al. (2009), difficult environmental conditions can differ in the extent to which they are harsh and/or unpredictable. *Harshness* refers to age-specific rates of morbidity–mortality in the local environment. In Western societies, harshness is typically indexed by socioeconomic status (SES), given that lower levels of SES are linearly related to nearly all forms of morbidity and mortality (see Adler, Boyce, Chesney, Folkman, & Syme, 1993; Chen, Matthews, & Boyce, 2002; Ellis et al., 2009).

The harsher and poorer an environment is, the higher the rate of morbidity (e.g., illness, injury) and mortality (death) at every age in a society.

*Unpredictability,* in contrast, refers to stochastic changes (fluctuations) in the harshness of environmental conditions across time. Unpredictability is signaled by important changes in the ecology of the family that directly affect parents and/or their children, such as frequent changes in the job status of parents, residential changes, and parental transitions such as divorce and remarriage (e.g., Belsky et al., 2012). According to Ellis et al. (2009), the amount of harshness and unpredictability experienced during childhood should uniquely predict outcomes associated with the enactment of faster or slower life history strategies in adulthood. As illustrated by the Heather and Uma example at the beginning of this article, a harsh childhood environment may produce different outcomes than an unpredictable environment.[1]

Two recent studies attempted to test the effects of environmental unpredictability on behavior (Belsky et al., 2012; Brumbach, Figueredo, & Ellis, 2009). Brumbach et al. (2009) found that greater environmental unpredictability and harshness measured during adolescence (assessed by variables that unconfounded these constructs) independently predicted the adoption of faster life history strategies, such as by being associated with greater deviant social behavior in young adulthood. In a more recent study that is more comparable to ours, Belsky et al. (2012) found that being raised in more unpredictable environments (assessed during the first 5 years of life) forecasts having more sexual partners by age 15, both directly and as mediated through maternal depressive symptoms and maternal sensitivity (which were also assessed during childhood).

Although the study by Belsky et al. (2012) found that unpredictability, but not harshness, directly predicted a larger number of sexual partners by age 15, it assessed only one life history outcome (number of sexual partners) at a rather early point in development (at age 15). Our study builds on the Belsky et al. findings by measuring a wider range of life history measures (sexual debut, number of sexual partners, and various indicators of risk taking) in early adulthood (at age 23) within a high-risk longitudinal sample. We also identify when during development harshness and/or unpredictability have their strongest effects on later life history outcomes, as discussed below.

## Sensitive Periods and Exposure to Unpredictability

At present, we do not know when during development either harsh or unpredictable environments exert their strongest effects on adult life history outcomes. Belsky et al. (2012) found that unpredictability during the first 5 years of life predicts more sexual partners at age 15. This study, however, did not assess whether or how unpredictability experienced later in childhood might influence these outcomes. One possibility consistent with cumulative risk models is that experiencing greater unpredictability across one's entire childhood might produce behaviors associated with faster reproductive strategies in adulthood. For example, experiencing high levels of unpredictability in both early and late childhood might increase the likelihood that individuals engage in risky and deviant behaviors in early adulthood.

An evolutionary life history model suggests a different possibility. Both a growing body of theoretical work (Belsky et al., 1991; Del Giudice & Belsky, 2011; Draper & Harpending, 1982; Simpson & Belsky, 2008) and empirical data (e.g., Belsky et al., 2007; Bereczkei & Csanaky, 1996; Ellis et al., 2003; Quinlan, 2003) suggest that the first 5 years of life may be a sensitive period for environmental influences on the development of life history strategies. During this early-childhood period, children's psychologies may be more attuned to environmental cues indicating the levels of harshness and unpredictability in their local environments, perhaps based on the type and quality of care they are receiving from their parents (Belsky et al., 2012; Chisholm, 1993; Simpson & Belsky, 2008). If so, psychological mechanisms might use this information from the first 5 years of life to calibrate adult life history strategies in evolutionarily adaptive ways. If this premise is true, the effects of harshness and/or unpredictability early in life (before age 5) should predict relevant adult life history outcomes more strongly than harshness and/or unpredictability encountered later in development.

## The Current Study

To our knowledge, no study to date has repeatedly assessed markers of harshness and unpredictability from before birth (prenatally) into adolescence (age 16) prospectively to predict life history outcomes in early adulthood (age 23) that include age of sexual debut, number of sexual partners, and multiple indicators of risk taking and criminality. Furthermore, no study has examined how exposure to harshness or unpredictability early in childhood (ages 0–5) versus later in childhood (ages 6–16) influences adult life history outcomes. The current longitudinal study addresses and fills these gaps in our knowledge.

The MLSRA has followed approximately 165 individuals and their birth mothers from before they were born into early adulthood (Sroufe et al., 2005). This sample has several features that make it ideally suited for testing whether and how exposure to different amounts of harshness and unpredictability at different points in childhood are related to sexual behavior and psychosocial functioning in early adulthood. The longitudinal participants in the MLSRA were born to mothers who were recruited at free public health clinics in Minneapolis, Minnesota, in 1975–1976. Many participants, therefore, have been exposed to a variety of different life stressors that have varied in their intensity and duration, both during childhood and into adulthood.

## Study Overview

Using the MLSRA longitudinal sample, we tested how exposure to harshness and unpredictability both early in childhood (ages 0–5) and later in childhood (ages 6–16) predicted five outcomes when participants were 23 years old. Following established practices (Belsky et al., 2012; Ellis et al., 2009), harshness was assessed by SES calculated from information obtained from mothers' interviews, both early in their child's life (at three time points under the age of 5) and later in their child's life (at five time points between ages 6 and 16). Unpredictability was assessed via coders'

[1] The Ellis et al. (2009) evolutionary model does not predict whether higher levels of harshness and/or unpredictability should be differentially related to specific life history outcomes such as sexual debut or number of sexual partners. Recent studies that have measured these two variables, however, have found more direct effects for unpredictability than for harshness in predicting adolescent sexual outcomes (Belsky et al., 2012).

ratings of measures that indexed changes in mothers' employment status, residence, and cohabitation patterns, both early in their child's life (at five time points under the age of 5) and later in development (at five time points between ages 6 and 16).

The five outcome measures were chosen because they reflect two major components of life history strategies. The first two outcomes involved sexual behavior. Because faster life history strategies are associated with earlier sexual activity and more sexual partners (Ellis et al., 2009; Kaplan & Gangestad, 2005), we examined (a) the age of first sexual intercourse (sexual debut) and (b) the number of lifetime sexual partners reported by participants at age 23. The second set of outcome measures were markers of deviant tendencies associated with risky behaviors. Because faster life history strategies are defined by the adoption of more opportunistic, risky, and short-term views of life, we assessed each participant's level of (c) aggression, (d) delinquency, and (e) ties to criminal activities. Aggression and delinquency were reported by each participant when she or he was 23 years old. The extent of involvement in criminal activities/behavior was rated by coders from an interview with each participant when she or he was age 23.

## Predictions

We derived two broad sets of predictions from life history theory (Kaplan & Gangestad, 2005; Roff, 2002), the Ellis et al. (2009) model, and the most recent (and directly comparable) study examining how harshness and unpredictability are linked to later sexual behavior in adolescence (Belsky et al., 2012):

> *Prediction 1:* Exposure to unpredictable environments in childhood should uniquely predict faster life history outcomes independently of harsh environments. Specifically, higher unpredictability should be related to earlier age at first sexual intercourse (sexual debut), more sexual partners, and higher levels of aggression, delinquency, and ties to criminal activities at age 23.
>
> *Prediction 2:* Exposure to unpredictable environments in early childhood (ages 0–5) should have a stronger effect on faster life history strategies in early adulthood than exposure to unpredictable environments in later childhood (ages 6–16). That is, greater unpredictability during the first 5 years of life should uniquely predict earlier sexual debut, more sexual partners, and higher levels of aggression, delinquency, and ties to criminal activities.

# Method

The data came from the MLSRA (Sroufe et al., 2005).

## Participants

Before the longitudinal participants were born, 267 pregnant mothers ($M_{age}$ = 20.6 years, age range: 12–34 years) were recruited into the study. Approximately 50 mothers dropped out or moved away during the first 2 years of the project. Since that time, there has been relatively little attrition.

Although there is considerable variability in the SES of the current participants, the mothers originally recruited for the study were lower in SES at the start of the project. Sixty percent of them, for example, had fewer than 12 years of formal education when the project started. Because of their lower SES, the lives of these mothers and their children contained more instability and life stress than many longitudinal samples. Frequent and extensive data collection, the use of multiple methods, and reliance on multiple informants have provided excellent and very detailed information about the life circumstances and functioning of each child (i.e., each longitudinal participant). The current analyses focus on participants and their mothers for whom we had complete developmental histories until the participant was 23 years old ($N$ = 162; 85 males, 77 females). The $t$ tests indicated no differences between the attrition group and this sample (which is now the primary MLSRA sample) in terms of mothers' original SES, age, marital status, or education level.

## Childhood Predictor Variables

We operationalized and measured harshness and unpredictability with items recommended by Ellis et al. (2009) and used in recent studies that have examined how harshness and unpredictability are prospectively related to adolescent outcomes (e.g., Belsky et al., 2012).

**Harshness.** Harshness was assessed by SES. For the early-childhood harshness measure (ages 0–5), SES was assessed at three time points: prenatally (just before each mother's child [the longitudinal participant] was born) and then when the child was 42 months old and 54 months old. SES was assessed by household income, mother's educational attainment, and the revised version of the Duncan Socioeconomic Index (SEI; Duncan, 1961; Stevens & Featherman, 1981), which assessed participants' occupational prestige.

To create a measure of early-childhood harshness (ages 0–5), we computed SES-based $z$ scores of available items within each assessment period. These values were then transformed to $t$ scores (i.e., $M$ = 50, $SD$ = 10) to remove negative values, which generated positively scaled scores. We then aggregated (averaged) these scores across all three assessments, adjusting for the total number of assessments completed by each mother.[2] The composite of early-childhood harshness had acceptable internal consistency, given the nature of this measure and the small number of items on which it is based ($\alpha$ = .60). For later-childhood harshness (ages 6–16), SES was assessed with the same items at five time points: Grades 1, 2, 3, and 6, and when participants were age 16. We computed SES-based $z$ scores of available SES-relevant items within each assessment period, which were then transformed to $t$ scores. We then aggregated (averaged) these scores across all five assessments, adjusting for the number of assessments completed by each mother. The composite of later-childhood harshness was internally consistent ($\alpha$ = .93). Higher scores on both the early and late harshness indexes reflect lower SES.[3]

There was a reasonable and similar amount of variation in both the early and late SES-based measures in the sample (see Table 1).

[2] Information on each measure was not collected at every time point between ages 0 and 5. Prenatal SES was calculated based on mothers' SEI, income, and education scores. Forty-two-month SES was calculated based on mothers' SEI and education scores. Fifty-four-month SES was calculated based on mothers' SEI scores.

[3] Information on each measure was not collected at every time point between ages 6 and 16. Grade 1 and Grade 2 SES was calculated based on mothers' SEI and education scores. The other assessments between ages 6 and 16 were based on mothers' SEI, income, and education scores.

Table 1
*Means, Standard Deviations, and Tests of Gender Differences Among All Predictors and Outcome Measures*

| Variable | Full sample | | Males | | Females | | |
|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | Gender difference (*t*) |
| Early harshness (age 0–5) | 50.83 | 8.21 | 51.70 | 9.50 | 49.87 | 6.43 | 1.42 |
| Early unpredictability (age 0–5) | 1.52 | 1.13 | 1.40 | 1.14 | 1.65 | 1.11 | −1.38 |
| Later harshness (age 6–16) | 50.64 | 8.81 | 50.84 | 9.15 | 50.44 | 8.48 | 0.29 |
| Later unpredictability (age 6–16) | 1.41 | 1.08 | 1.32 | 1.03 | 1.51 | 1.13 | −1.13 |
| Number of sexual partners | 3.04 | 1.42 | 3.28 | 1.51 | 2.76 | 1.27 | 2.29* |
| Aggressive behavior | 3.79 | 3.55 | 3.67 | 3.43 | 3.94 | 3.69 | −0.51 |
| Delinquent behavior | 2.18 | 2.46 | 2.65 | 2.59 | 1.69 | 2.22 | 2.50* |
| Criminal behavior | 0.84 | 1.71 | 0.84 | 1.86 | 0.84 | 1.54 | −0.03 |
| Age at first sex | 15.70 | 2.46 | 15.80 | 2.74 | 15.59 | 2.13 | 0.53 |

*Note*. *N*s range from 151 to 162, depending on the variable. Number of sexual partners was coded on a 6-point scale (where 1 = 1 partner, 2 = 2–5 partners, 3 = 6–10 partners, 4 = 11–20 partners, 5 = 21–25 partners, and 6 = more than 25 partners).
* $p < .05$.

For example, the mean level of mothers' formal education, assessed between the prenatal period to when their children were age 16, was 12.35 years (minimum = 6 years, maximum = 18 years, *SD* = 1.77 years). When their children were 16, the mean monthly household income was $2,542 (minimum = $457, maximum = $7,828, *SD* = $1,499). It is important to note that the MLSRA participants began life with mothers who were below the poverty line. Some of them remained lower in SES into adulthood, and others became middle class (or, in a few cases, upper middle class) in adulthood.

**Unpredictability.** Early-childhood unpredictability (ages 0–5) was assessed by three measures of mothers' coder-rated life stress stemming from three sources: (a) changes in employment status during the prior year (i.e., period of unemployment), (b) changes in residence during the prior year (e.g., moving to a different house/apartment), and (c) changes in cohabitation status during the prior year (e.g., whether and how often male romantic partners moved in or out of the house/apartment). Very similar markers of unpredictability have been used in past research (e.g., Belsky et al., 2012). These three items come from the Life Events Schedule (LES; Egeland, Breitenbucher, & Rosenberg, 1980), which was adapted for use with our sample from Cochrane and Robertson's (1973) Life Events Inventory. These three items were measured at five time points early in childhood (when each child was 12, 18, 48, 54, and 64 months old) and at five time points later in childhood (at Grades 1, 2, 3, and 6, and at age 16). Trained coders read each mother's interview responses to these three items and then rated the total number of stressful events mentioned and the intensity of disruption associated with each item on the following scale: 0 (*no disruption due to changing life event*), 1 (*some disruption*), 2 (*much disruption*), 3 (*severe disruption*). The interrater reliabilities for each item were all above .90.

To create a scale of early-childhood unpredictability (ages 0–5), scores on the three items were first summed within each early assessment period and then aggregated (averaged) over the first five time points (when children were between 12 and 64 months old), adjusting for the number of assessments completed by each mother within that period. The composite of early-childhood unpredictability had acceptable internal consistency, given the nature of this measure and the small number of items on which it is based ($\alpha = .59$). To create a scale of later-childhood unpredictability (ages 6–16), the same set of rated items were first summed within each later assessment period and then aggregated (averaged) across the next five time points (between first grade and age 16), adjusting for the number of assessments completed by each mother within that period. The composite of later-childhood unpredictability also had acceptable internal consistency ($\alpha = .54$). Higher scores on these indexes reflect greater unpredictability. Compared to participants in other longitudinal samples, our participants probably experienced a greater amount of unpredictability during their childhoods.

## Age 23 Outcome Measures

Two sets of outcome measures—sexual behavior and markers of risky behavior—representing important features of life history strategies were assessed when longitudinal participants were 23 years old.

**Age of first sexual intercourse (sexual debut) and number of sexual partners.** At age 23, participants reported the age at which they first had sexual intercourse (sexual debut). Only six of the participants in the sample reported not having had sexual intercourse by age 23, meaning that more than 96% of the sample was sexually experienced. These six participants were not included in the analyses reported below, given that the age of first sexual intercourse and the number of sexual partners were core outcome measures. The age of first sexual intercourse was assessed by an adapted item from the Adult Health Survey (Blum, Resnick, & Bergeisen, 1989). Self-reported responses to the age of first sexual intercourse were made on an 11-point scale, where 11 = age 11 or earlier, 12 = age 12, 13 = age 13, 14 = age 14, 15 = age 15, 16 = age 16, 17 = age 17, 18 = age 18, 19 = age 19, and 20 = age 20 or older.

Participants also reported the total number of different partners with whom they had sexual intercourse by age 23 (i.e., their total lifetime sexual partners) on an item from the Adult Health Survey adapted by Blum et al. (1989). Responses were made on a 6-point scale, where 1 = one partner, 2 = two to five partners, 3 = six to 10 partners, 4 = 11–20 partners, 5 = 21–25 partners, and 6 = 26 or more partners. Of those who had engaged in sexual intercourse

by age 23, 9.2% reported having had sexual intercourse with one partner, 37.3% with two to five sexual partners, 19% with six to 10 partners, 19% with 11 to 20 partners, 6.5% with 21 to 25 partners, and 9.2% with 26 or more partners.

Because earlier sexual debut and more sexual partners are both markers of faster life history strategies, these measures should—and did—correlate negatively ($r_{overall} = -.50$, $r_{female} = -.53$, $r_{male} = -.51$, all $ps < .001$).

**Delinquent, aggressive, and criminal behaviors.** When participants were 23 years old, they completed the Young Adult Self-Report (YASR; Achenbach, 1997). The YASR is a widely used and standardized measure that assesses behavioral and emotional problems in young adults. It contains multiple items on which participants rated how true each item was of them on a 3-point scale, where 0 = *not true,* 1 = *somewhat or sometimes true,* and 2 = *very true or often true*. The Delinquent Behavior subscale of the YASR assesses behaviors such as lying/cheating, breaking rules, setting fires, stealing, and substance (drug) use. The Aggressive Behavior subscale measures behaviors such as jealousy, teasing, attacking, arguing, and being mean to others. Both scales capture many of the behaviors described in the conduct disorder category of the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., American Psychiatric Association, 1994; see also Achenbach & Ruffle, 2000).

Because aggression and delinquency should both be markers of faster life history strategies, these two measures should—and did—correlate positively ($r_{overall} = .57$, $r_{female} = .50$, $r_{male} = .68$, all $ps < .001$).

The extent to which participants were involved in (or associated with) criminal behavior and related activities at age 23 was assessed by their coder-rated life stress stemming from three sources within the past year: (a) the participant and/or his or her immediate family members being convicted of legal violations (e.g., speeding, DWI, parking tickets, assaults, drug possession, theft, prostitution, rape), (b) the participant and/or his or her immediate family members being sentenced to jail, and (c) the participant getting into debt beyond his or her means of repayment, sometimes resulting in repossessions or legal actions. These three items come from the LES (Egeland et al., 1980). Trained coders reviewed each participant's interview responses to these items and then rated the total number of stressful events mentioned, along with the intensity of disruption associated with each one, on a scale ranging from 0 (*no disruption due to changing life event*) to 3 (*severe disruption*). The interrater reliability (intraclass correlation) for this scale was .97. Scores from the three items were then summed to create an index of association with criminal activity/behavior.

# Results

## Descriptive Statistics

Table 1 reports means, standard deviations, and tests for gender differences for all the predictor variables and dependent variables in the study. Males reported having a larger number of sexual partners and engaging in more delinquent behaviors at age 23 than females did, but there were no other gender differences. The mean age of sexual debut (first sexual intercourse) in the sample was approximately 15.70 years ($M = 15.80$ years for males, $M = 15.59$ years for females). The mean number of sexual partners in the sample was approximately six, with males reporting approximately seven partners and females reporting approximately five partners on average. The mean levels of aggression and delinquency in the sample were similar to nonrisk samples (full sample means were 3.79 for aggression and 2.18 for delinquency; see Achenbach, 1997). For criminal activity/behavior, the sample mean score was 0.84, which is relatively low given the possible scale range.

Out of the nine variables, only one significant gender interaction emerged (see the regression analyses reported below). Because gender did not interact for the vast majority of variables, Table 2 reports the correlations between all of the variables collapsed across gender. The early-life measure of unpredictability (assessed by mother reports during the first 5 years of each participant's life) was significantly correlated with total number of sexual partners, scores on the Achenbach aggression and delinquency scales, and scores on the criminal behavior scale when participants were 23 years old. Neither the early-childhood harshness nor the later-childhood harshness or later-childhood unpredictability measures were significantly correlated with any of the age 23 outcomes.

## Data Analysis Strategy

We tested our predictions in two ways. First, we conducted two multiple regression analyses for each of the age 23 outcome measures. For each outcome measure, one regression examined the unique influence of early-childhood (ages 0–5) harshness and unpredictability, while the other regression examined the unique

Table 2
*Correlations Among All Predictors and Outcome Measures*

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Early harshness | — | | | | | | | | |
| 2. Early unpredictability | .31** | — | | | | | | | |
| 3. Later harshness | .67*** | .21** | — | | | | | | |
| 4. Later unpredictability | .28** | .42** | .42** | — | | | | | |
| 5. Number of sexual partners | .07 | .16* | .06 | .06 | — | | | | |
| 6. Aggressive behavior | .10 | .16* | .09 | −.02 | .23** | — | | | |
| 7. Delinquent behavior | .01 | .16* | .02 | −.08 | .27** | .57*** | — | | |
| 8. Criminal behavior | .13† | .40** | .07 | .08 | .25** | .29** | .39** | — | |
| 9. Age at first sex | −.16† | −.14† | −.05 | −.10 | −.50*** | −.12 | −.14† | −.24** | — |

*Note*. *N*s range from 151 to 162.
† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

influence of later-childhood (ages 6–16) harshness and unpredictability. All regressions also included each participant's gender (coded −1 if male, 1 if female) plus all two-way interactions.

In addition to analyzing the effects of early-childhood (ages 0–5) and later-childhood (ages 6–16) harshness and unpredictability separately, we also conducted a second, more stringent analysis. For this second method, we entered all four predictors simultaneously in a multiple regression analysis predicting each age 23 outcome measure. This allowed us to ascertain whether harshness or unpredictability experienced at earlier versus later periods of development exerted unique (independent) effects on each age 23 outcome measure.

## Multiple Regression Analyses

The results of the multiple regression analyses for each dependent measure are reported below. Analyses were run separately on the early (ages 0–5) harshness and unpredictability predictor variables and then on the late (ages 6–16) harshness and unpredictability predictors.

**Number of sexual partners.** The first set of analyses examined the total number of lifetime sexual partners that each participant reported at age 23. As shown on the left side of Table 3 (Model 1), for the analysis examining the early harshness and unpredictability measures (ages 0–5), two significant effects emerged. First, as discussed above, males reported having more lifetime sexual partners than females did ($\beta = -.22$, $p < .01$). More importantly, as hypothesized, participants who were exposed to more unpredictable environments early in life (ages 0–5) reported more sexual partners by age 23 than did those exposed to less unpredictable early environments ($\beta = .23$, $p < .05$), statistically controlling for early-life (ages 0–5) harshness scores. None of the two-way interactions were significant, including those involving gender. Hence, these effects held for both females and males.

The late (ages 6–16) harshness and unpredictability measures did not significantly predict the number of lifetime sexual partners (see the Model 2 results on the right side of Table 3).

**Aggressive behavior.** The second set of analyses examined the level of aggression reported by each participant at age 23 on the Achenbach aggression scale. As shown on the left side of Table 4 (Model 1), for the analysis examining the early harshness and unpredictability measures (ages 0–5), only one significant effect was found. Participants exposed to more unpredictable environments early in life (ages 0–5) had higher aggression scores at age 23 ($\beta = .19$, $p < .05$), statistically controlling for early-life (ages 0–5) harshness. None of the two-way interactions were significant.

The late (ages 6–16) harshness and unpredictability measures did not predict aggressive behavior at age 23 (see the Model 2 results on the right side of Table 4).

**Delinquent behavior.** The third set of analyses examined the level of delinquency reported by each participant at age 23 on the Achenbach delinquency scale. As shown on the left side of Table 5 (Model 1), for the analysis examining the early harshness and unpredictability measures (ages 0–5), two significant effects emerged. First, as discussed in the descriptive statistics section earlier, males reported engaging in more delinquent behaviors than females did ($\beta = -.22$, $p < .01$). Second, participants exposed to more unpredictable environments early in life (ages 0–5) reported higher delinquency scores at age 23 ($\beta = .22$, $p < .05$), statistically controlling for early-life (ages 0–5) harshness. None of the two-way interactions were significant.

The late (ages 6–16) harshness and unpredictability measures did not predict delinquent behavior at age 23 (see the Model 2 results on the right side of Table 5).

**Criminal activities/behavior.** The fourth set of analyses examined the amount of legal problems due to ties with criminal activities/behavior that each participant reported, based on a coder-rated interview when each participant was 23 years old. As shown on the left side of Table 6 (Model 1), for the analysis examining the early harshness and unpredictability measures (ages 0–5), one significant effect emerged. Participants exposed to more unpredictable environments early in life (ages 0–5) had more problems with the law due to criminal activities at age 23 ($\beta = .38$, $p < .001$), statistically controlling for early-life (ages 0–5) harshness. None of the two-way interactions were significant.

The late (ages 6–16) harshness and unpredictability measures did not significantly predict criminal activities/behavior at age 23 (see the Model 2 results on the right side of Table 6), though there was a marginally significant Gender × Harshness interaction.

**Age at first sex.** The fifth set of analyses examined sexual debut (i.e., the age when each participant first had sexual intercourse), reported by participants when they were age 23. As shown on the left side of Table 7 (Model 1), for the analysis examining the early harshness and unpredictability measures (ages 0–5), one

Table 3
*Regression Analysis Predicting Number of Sexual Partners*

| | Model 1[a] (age 0–5) | | | Model 2[b] (age 6–16) | | |
|---|---|---|---|---|---|---|
| Variable | *B* | *SE B* | β | *B* | *SE B* | β |
| Gender | −.31 | .12 | −.22** | −.25 | .12 | −.18* |
| Harshness | −.01 | .02 | −.08 | .01 | .02 | .02 |
| Unpredictability | .28 | .11 | .23* | −.06 | .12 | .05 |
| Gender × Harshness | .01 | .02 | .04 | −.01 | .01 | −.03 |
| Gender × Unpredictability | −.09 | .10 | −.07 | −.09 | .10 | −.08 |
| Harshness × Unpredictability | −.03 | .02 | −.18 | .00 | .01 | .00 |
| $R^2$ | | .09 | | | .05 | |

[a] $N = 152$. [b] $N = 151$.
* $p < .05$. ** $p < .01$.

Table 4
*Regression Analysis Predicting Aggressive Behavior*

| Variable | Model 1[a] (age 0–5) | | | Model 2[b] (age 6–16) | | |
|---|---|---|---|---|---|---|
| | *B* | *SE B* | β | *B* | *SE B* | β |
| Gender | .04 | .29 | .01 | .13 | .30 | .04 |
| Harshness | .01 | .04 | .02 | .04 | .04 | .11 |
| Unpredictability | .57 | .27 | .19* | −.21 | .30 | −.06 |
| Gender × Harshness | .04 | .04 | .11 | .00 | .04 | .00 |
| Gender × Unpredictability | .11 | .25 | .04 | .12 | .26 | .04 |
| Harshness × Unpredictability | −.04 | .04 | −.10 | −.02 | .03 | −.05 |
| $R^2$ | | .04 | | | .02 | |

[a] $N = 158$. [b] $N = 157$.
* $p < .05$.

marginally significant main effect and two significant interactions were found. Participants exposed to more unpredictable early-life environments had first sex at a slightly younger age than did those exposed to more predictable early environments ($\beta = -.15$, $p < .10$), statistically controlling for early-life harshness scores.

This marginal main effect, however, was qualified by a significant Gender × Unpredictability interaction ($\beta = .25$, $p < .01$). Simple slopes analyses revealed that, among participants exposed to lower levels of early unpredictability (1 *SD* below the mean), females had first sexual intercourse earlier than males ($\beta = -.70$, $p < .05$). However, for those exposed to greater early unpredictability (1 *SD* above the mean), males had first sexual intercourse at an earlier age than females ($\beta = .57$, $p < .05$).

There also was a significant Harshness × Unpredictability interaction ($\beta = .22$, $p < .05$). Simple slopes analyses revealed that the effect of early harshness on the age of first sexual intercourse was negative for participants exposed to lower levels of early unpredictability (1 *SD* below the mean; $\beta = -.06$, $p < .05$). In contrast, the simple slope for participants exposed to greater early unpredictability (1 *SD* above the mean) was not significantly different from zero ($\beta = .05$, *ns*). In other words, participants who were exposed to less harsh and less unpredictable early environments tended to have first sex at a relatively later age.

For the late (ages 6–16) analysis (see the Model 2 results on the right side of Table 7), one significant Gender × Unpredictability interaction, similar in pattern to the one found for early (ages 0–5) unpredictability (see above), emerged.[4]

## All Harshness and Unpredictability Measures as Simultaneous Predictors

Finally, we conducted the most stringent set of analyses to determine whether the amount of environmental unpredictability experienced at earlier periods of development exerted unique (independent) effects on the age 23 outcome measures, statistically controlling for the level of early harshness, later harshness, and later unpredictability to which participants had been exposed. For each of the dependent measures, the regression analysis contained the same five predictor variables: gender, early (ages 0–5) harshness, later (ages 6–16) harshness, early (ages 0–5) unpredictability, and later (ages 6–16) unpredictability. We ran one regression analysis for each age 23 outcome measure. The results are shown in Table 8.

All of the statistically significant main effects for early (ages 0–5) unpredictability reported above remained significant when both of the later-childhood (ages 6–16) predictors and early harshness (ages 0–5) were statistically controlled. These analyses also revealed that participants who experienced harsher early environments had first sexual intercourse at an earlier age than did others in the sample, which is consistent with both life history theory (Kaplan & Gangestad, 2005; Stearns, 1992) and the Ellis et al. (2009) model. As shown in Table 8, very few of the other predictors were significantly related to the age 23 outcomes (and none were in a patterned way), with many having near-zero effects. Of the predictors that were significant, one of them (unpredictability during later [ages 6–16] childhood) had the opposite effect, predicting fewer delinquent behaviors.[5]

Considered together, these results provide strong evidence that exposure to more unpredictable environments early in life (between ages 0 and 5) prospectively and independently predicts more lifetime sexual partners as well as higher levels of aggression, delinquency, and criminal activity/behavior at age 23. More unpredictable early-life environments, therefore, have a stronger impact on this set of life history outcomes during early adulthood, even when controlling for harshness and unpredictability encountered later in childhood.

## Discussion

Traditional developmental psychopathology models tend to conceptualize stressful environmental contexts as risk factors that cumulatively increase the probability of negative developmental

[4] To determine whether the null results for the late unpredictability measure (assessed between ages 6 and 16) were also nonsignificant when narrower later age ranges of unpredictability were calculated, we divided the ages 6–16 unpredictability variable into two parts: (a) unpredictability during Grades 1–3 (measured at three time points) and (b) unpredictability at Grade 6 and age 16 (measured at two time points). When we entered these two late unpredictability measures separately into regression equations predicting each of the outcome measures, we found null results for both measures. Thus, our null findings for late (ages 6–16) unpredictability are stable and reliable.

[5] Because the zero-order correlation between later unpredictability and delinquency was small and nonsignificant ($r = -.08$), we do not attempt to interpret this effect.

Table 5
*Regression Analysis Predicting Delinquent Behavior*

| | Model 1[a] (age 0–5) | | | Model 2[b] (age 6–16) | | |
|---|---|---|---|---|---|---|
| Variable | *B* | *SE B* | β | *B* | *SE B* | β |
| Gender | −.54 | .20 | −.22** | −.44 | .20 | −.18* |
| Harshness | −.02 | .03 | −.07 | .02 | .03 | .06 |
| Unpredictability | .45 | .19 | .22* | −.24 | .20 | −.11 |
| Gender × Harshness | .02 | .03 | .06 | .02 | .02 | .05 |
| Gender × Unpredictability | −.06 | .17 | −.03 | −.13 | .18 | −.06 |
| Harshness × Unpredictability | −.02 | .03 | −.08 | −.01 | .02 | −.02 |
| $R^2$ | | .08 | | | .05 | |

[a] $N = 158$. [b] $N = 157$.
* $p < .05$. ** $p < .01$.

outcomes. Evolutionary life history models, by comparison, propose that growing up under stressful conditions directs or regulates development toward strategies that are adaptive under stress (see Ellis et al., 2012) and that exposure to different kinds of stressful conditions have distinct effects on the emergence of life history strategies. A recent evolutionary model put forth by Ellis et al. (2009), for example, anticipates that rearing environments can be either harsh and/or unpredictable (fluctuating) and that each dimension may exert unique effects on life history outcomes years later.

Using data from the MLSRA (Sroufe et al., 2005), we tested two sets of predictions derived from life history theory (Kaplan & Gangestad, 2005; Stearns, 1992), the Ellis et al. (2009) evolutionary model, and findings from a recent study that examined how harshness and unpredictability forecast sexual behavior in adolescence (Belsky et al., 2012). Specifically, we tested how harshness and unpredictability experienced in early childhood (ages 0–5) and in later childhood (ages 6–16) uniquely predicted sexual and risky behavior at age 23. The findings revealed that the strongest predictor of both sexual and risky behavior at age 23 was exposure to an unpredictable environment during the first 5 years of life. Individuals exposed to more unpredictable, rapidly changing early environments displayed a faster life history strategy at age 23 as indicated by having more sexual partners, having sex at an earlier age (for males only), engaging in more aggression and delinquent behaviors, and being more likely to be associated with criminal activities/behavior. By contrast, exposure to either harsh environments or experiencing unpredictability later in childhood (ages 6–16) did not significantly predict these outcomes at age 23. This specific pattern of findings also held when all of these competing predictor variables were statistically controlled.

The findings of this longitudinal study contribute to the growing literature on how different forms of stress experienced during childhood are systematically linked to major life history outcomes later in life. Perhaps most importantly, the current research confirms that exposure to unpredictable environments during the first 5 years of life has strong and independent links to adult outcomes nearly 20 years later. These findings suggest a developmentally sensitive period for assessing environmental unpredictability during the first 5 years of life. This study also investigated a wider constellation of life history measures than most prior studies have by examining sexual debut, number of lifetime sexual partners, and measures of aggression, delinquency, and ties to criminal activities. In addition, the current study tested predictions derived from the Ellis et al. (2009) evolutionary model in a high-risk sample, which has been advocated by other scholars (see Belsky et al., 2012).

In what follows, we discuss the specific cues that young children are likely to be picking up to gauge the quality of the environments in which they live and the specific variables that may mediate connections between early-life unpredictability and the eventual adoption of fast versus slow adult mating strategies. We conclude by noting some limitations and promising directions for future research.

Table 6
*Regression Analysis Predicting Criminal Behavior*

| | Model 1[a] (age 0–5) | | | Model 2[b] (age 6–16) | | |
|---|---|---|---|---|---|---|
| Variable | *B* | *SE B* | β | *B* | *SE B* | β |
| Gender | −.04 | .13 | −.03 | .01 | .14 | .01 |
| Harshness | .01 | .02 | .04 | .01 | .02 | .05 |
| Unpredictability | .54 | .12 | .38*** | .08 | .14 | .05 |
| Gender × Harshness | −.02 | .02 | −.09 | −.03 | .02 | −.15† |
| Gender × Unpredictability | .02 | .11 | .02 | .00 | .12 | .00 |
| Harshness × Unpredictability | .01 | .02 | .05 | .01 | .02 | .08 |
| $R^2$ | | .17 | | | .04 | |

[a] $N = 160$. [b] $N = 159$.
† $p < .10$. *** $p < .001$.

Table 7
*Regression Analysis Predicting Age at First Sex*

| Variable | Model 1[a] (age 0–5) | | | Model 2[b] (age 6–16) | | |
|---|---|---|---|---|---|---|
| | *B* | *SE B* | β | *B* | *SE B* | β |
| Gender | −.01 | .20 | −.01 | −.18 | .20 | −.07 |
| Harshness | .01 | .03 | .02 | .01 | .03 | .03 |
| Unpredictability | −.31 | .19 | −.15$^{\dagger}$ | −.19 | .21 | −.08 |
| Gender × Harshness | −.02 | .03 | −.07 | .01 | .02 | .02 |
| Gender × Unpredictability | .53 | .17 | .25$^{**}$ | .54 | .18 | .26$^{**}$ |
| Harshness × Unpredictability | .05 | .03 | .22$^{*}$ | .01 | .02 | .03 |
| $R^2$ | | .12 | | | .08 | |

[a] $N = 152$. [b] $N = 151$.
$^{\dagger} p < .10$. $^{*} p < .05$. $^{**} p < .01$.

## What Are Children Picking Up in Their Early Environments?

According to life history theorists (Belsky, 1999; Chisholm, 1993; Simpson & Belsky, 2008), parents are the primary window through which young children assess the quality, nature, and challenges of the wider macroenvironments in which they live. During our ancestral past, local mortality rates probably played a large role in determining the quality of care that children received (Chisholm, 1993). If environments contained sufficient resources and were stable over time (i.e., predictable), children should have received better and more sensitive care along with more parental time, attention, and investment. These (within-family) microenvironments should have instilled in children secure working models of self and others, higher levels of social trust and cooperation, less risk taking to achieve status and popularity with peers, and a longer term, more committed orientation to adult romantic relationships (see Belsky et al., 1991). However, if environments were unstable (i.e., unpredictable), children should have received poorer and less sensitive care as well as less time, attention, and investment from their parents (see Quinlan, 2007). Such microenvironments would have produced insecure working models, lower levels of trust and cooperation, more risk taking designed to elevate status and popularity with peers, and a shorter term, less committed orientation to adult romantic relationships (for reviews of evidence supporting these conjectures, see Belsky, 1999; Ellis et al., 2009; Simpson & Belsky, 2008).

Although we did not examine parenting behavior in the current analyses, recent evidence from both monkeys and humans provides support for these claims. Experimental research on bonnet macaques (*Macaca radiate*) has documented that macaque mothers randomly assigned to variable foraging conditions (in which food is sometimes freely available but at other times very difficult to obtain) engage in less cooperative mutual grooming behavior, are less sensitive and responsive to their infants, and behave more aggressively toward other adults in their troop compared to mothers randomly assigned to more predictable foraging conditions, even harsh ones (Rosenblum & Andrews, 1994; Rosenblum & Paully, 1984). Experimentally induced exposure to unpredictable environments, therefore, undermines maternal functioning and reduces parental investment.

The best current data on humans come from Belsky et al. (2012), who examined whether maternal depressive symptoms (assessed when their children were 4.5 years old) and maternal sensitivity (assessed when their children were 6–8 years old) mediated links between early-life environmental harshness and unpredictability and the number of sexual partners their children reported at age 15. Belsky et al. found a direct link between being raised in unpredictable environments early in life and reporting more sexual partners at 15, as well as mediated effects. Specifically, the association between greater early-life unpredictability and more teen sexual activity was mediated through both maternal depression and maternal sensitivity, such that children who were raised in more unpredictable early environments had mothers who became more depressed and provided less sensitive care later in development, which in turn predicted greater sexual activity in teens. Similar to our results, however, they found no direct links between early-life harshness and adolescent sexual behavior at 15; the connection between early-life harshness and later teen sexual

Table 8
*Regression Analyses of Early and Later Harshness and Unpredictability Predicting Outcome Variables at Age 23*

| Variable | Gender | Harshness early (age 0–5) | Harshness later (age 6–16) | Unpredictability early (age 0–5) | Unpredictability later (age 6–16) |
|---|---|---|---|---|---|
| Age at first sex | −.01 | −.23$^{*}$ | .19 | −.10 | −.09 |
| Number of sexual partners | −.20$^{*}$ | .04 | −.03 | .19$^{*}$ | .00 |
| Aggressive behavior | .03 | .03 | .06 | .18$^{*}$ | −.13 |
| Delinquent behavior | −.20$^{*}$ | −.04 | .04 | .25$^{**}$ | −.19$^{*}$ |
| Criminal behavior | −.04 | .12 | −.13 | .44$^{***}$ | −.06 |

*Note*. $N = 152$–160.
$^{*} p < .05$. $^{**} p < .01$. $^{***} p < .001$.

activity was mediated entirely through maternal depression and maternal sensitivity. These findings are consistent with ours in that only early-life (ages 0–5) unpredictability was directly associated with the number of sexual partners at age 23 in our sample.

Although the nature and quality of early parental caregiving and investment appear to be the primary cue that children use to gauge what their current environments are and what their future environments are likely to be like (Chisholm, 1993; Del Giudice & Belsky, 2012), these early experiences do not lock individuals into a fast versus a slow reproductive pathway for life. The predictability of environments can and does change across the lives of most long-lived species such as humans, and evolutionary pressures should have selected for adaptive developmental plasticity (Ellis, Jackson, & Boyce, 2006; West-Eberhard, 2003). To the extent that environmental pressures and demands change within the lives of people (e.g., shifting from highly predictable to highly unpredictable, then back again), individuals ought to adjust their mating strategies in evolutionarily adaptive ways based on the current ecological conditions (see Gangestad & Simpson, 2000).

## Limitations and Future Directions

The current study has some limitations that must be considered when interpreting these results. First, the MLSRA project started with a sample of birth mothers who were below the poverty line, meaning that all participants started life at risk with regard to SES. Although many mothers and their children escaped poverty in the years following initial recruitment, this sample is more at risk than most other longitudinal samples, including the National Institute of Child Health and Human Development project that was the focus of the Belsky et al. (2012) study. Despite these differences, we found effects for early-life (ages 0–5) unpredictability that conceptually replicate what Belsky et al. found for number of sexual partners at age 15.

Second, to be consistent with prior studies testing harshness and unpredictability, we assessed these constructs with measures similar to those used in past studies. Harshness, for example, was indexed by measures of SES when children were ages 0–5 and 6–16, and unpredictability was indexed by the number of changes in parental employment status, residence moves, and cohabitation patterns at these ages. However, this represents only one way of operationalizing and measuring harshness and unpredictability. Another potentially valid measure of harshness might be the mean level of stress that individuals encounter across these same time points, and another potentially valid measure of unpredictability might be the variation in stress that individuals experience at these time points. Moreover, levels of harshness and unpredictability occurring within the microenvironment (i.e., within the home) may be better and stronger predictors of adult life history outcomes than levels of harshness and unpredictability occurring in the macroenvironment (i.e., outside the home).

Third, severe resource scarcity (e.g., caloric deprivation) and corresponding extreme levels of harshness should shift everyone toward slower mating strategies in adulthood (see Ellis et al., 2009). Hence, it is important to consider the actual levels of harshness to which individuals are exposed, especially early in life, when predicting and evaluating life history outcomes. Our MLSRA sample probably experienced somewhat higher levels of harshness early in life than most other longitudinal samples, but the levels were not extremely high.

Fourth, we focused on general levels of harshness and unpredictability in this study. Different types of stress, however, may be uniquely related to certain types of adult life history outcomes. One prime candidate is morbidity–mortality stress (e.g., stress associated with physical injury, harm, illness, or death), which—especially if encountered early in life—might have particularly strong effects in terms of shunting individuals toward faster mating strategies. Humans also encountered resource-related stress (e.g., having and retaining sufficient resources necessary to survive) as well as interpersonal-related stress (e.g., managing social conflicts, problems, and turmoil) during evolutionary history. Future research needs to measure and model these other types of stress to determine the specific effects they may have on other kinds of life history outcomes for women and men.

Fifth, gene–environment correlations could explain some of our effects. For example, certain individuals may possess genes that lead them to perceive or create harsher and/or more unpredictable environments later in life, which in turn might influence the timing and nature of their sexual or risk-taking behavior in adulthood. If these genes are passed onto their children, similar genetically based reactions—and perhaps similar reproductive tendencies—may be experienced by their offspring (Rowe, 2000).

## Conclusion

An evolutionary life history perspective can appreciably increase and broaden our understanding of how exposure to different dimensions of stress shapes important developmental outcomes later in life. The application of life history thinking not only clarifies and contextualizes why certain experiences or events encountered earlier in life prospectively predict certain developmental outcomes later on; it can also steer researchers toward novel hypotheses not anticipated by traditional theories of social development.

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## Correction to Belsky et al. (2011)

The article "Beyond Cumulative Risk: Distinguishing Harshness and Unpredictability as Determinants of Parenting and Early Life History Strategy," by Jay Belsky, Gabriel L. Schlomer, and Bruce J. Ellis (*Developmental Psychology*, Advance online publication. July 11, 2011. doi:10.1037/a0024454) contained a production-related error. In the fourth paragraph of the Results section, and in the caption for Figure 2, CFI is defined as "confirmatory fit index" when it should be "comparative fit index." All versions of this article have been corrected.

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