

Life History, Fertility, and Short-Term Mating Motivation

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Abstract

The current research examines the impact of women's early-life socioeconomic status (SES; used as a proxy measure of life history strategy), relationship status, and ovulatory cycle phase on their desire for short-term mating. Results revealed that during the periovulatory phase (i.e., the high-fertility phase of the monthly ovulatory cycle), single women from low SES environments expressed an increased desire for short-term mating, whereas the opposite was found for single women from high SES environments. No such pattern was found for partnered women. These results suggest that one's early-life environment and relationship status may play a key role in how women respond to internal fertility cues, providing important new insights into factors that may moderate ovulatory shifts in mating behavior. Results provide some of the first evidence that one's developmental history may alter the expression of ovulatory cycle adaptations.

Keywords

life history theory, ovulation, mating, relationship status, short-term mating

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Unintended pregnancies pose a problem in the United States and across the globe. Approximately, half of the pregnancies in the United States are unintended, with 2.8 million unintended pregnancies occurring in 2011 alone (Finer & Zolna, 2014, 2016). Although the problem of unplanned pregnancy is something that affects women across *all* levels of social strata, the burden of unplanned pregnancies is one that disproportionately affects unmarried, low-income women (Finer & Zolna, 2016). For instance, the unintended pregnancy rate for women with incomes below the federal poverty line is more than 5 times the rate for higher income women. Much of the research examining the link between low socioeconomic status (SES) and unintended pregnancy has focused on factors such as use of, access to, and attitudes about contraceptives (Ayoola, Zandee, Johnson, & Pennings, 2014; Dehlendorf, Rodriguez, Levy, Borrero, & Steinauer, 2010; Frost, Lindberg, & Finer, 2012; Garbers, Meserve, Kottke, Hatcher, & Chiasson, 2013). Although these factors undoubtedly contribute to the association between low SES and unintended pregnancy, we propose that this relationship could potentially reflect the contingent expression of life history strategy responses to internal cues of fertility. That is, single women from lower SES backgrounds may be prompted

to pursue short-term sexual behavior at high fertility to expedite reproductive goals.

The current research examines the link between fertility, relationship status, and the expression of life history strategies. Specifically, we predicted that during the periovulatory phase, single women from lower SES childhood environments would report an increased desire for short-term mating—a shift that would facilitate earlier reproduction. Conversely, we predicted that single women from higher SES environments would exhibit a decreased desire for short-term mating during the periovulatory phase—a shift that would prevent earlier reproduction. No such effect was predicted for partnered women, as

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their reproductive timing goals can be met without needing to engage in short-term mating (Dinh, Pinsorf, Gangestad, & Haselton, 2017; Durante, Li, & Haselton, 2008).

Life History Theory

Life history theory is an evolutionary biological framework used to predict how and when organisms will allocate effort to the various demands of survival and reproduction across the life span (Kaplan & Gangestad, 2005; Stearns, 1992). Because energy and somatic resources are inherently limited, life history theory predicts that organisms face important trade-offs in how they allocate these resources to life tasks, such as growth, maintenance, reproduction, and parental care. Because resources that are spent developing one life component cannot be spent simultaneously on another, each organism must “choose” how to invest these resources in order to advance one life component at the expense of others (Ellis, Figueredo, Brumbach, & Schlomer, 2009). How and when organisms resolve these trade-offs constitutes their *life history strategy*.

Theory and research on human life history strategies suggest that people adjust their investment strategies based on specific features present in their early childhood environments (Belsky, Steinberg, & Draper, 1991; Kuzawa, McDade, Adair, & Lee, 2010). For example, early-life environments characterized by high levels of psychosocial stress and unpredictability (e.g., growing up in homes with financial insecurity or inconsistent parental investment) promote resource allocation decisions consistent with “faster” life history strategies (Belsky, Houts, & Fearon, 2010; Ellis, 2004). Faster life history strategies are characterized by expedited physiological and sexual development (e.g., pubertal timing and age at menarche), preparing the individual for earlier reproduction if ecological conditions remain harsh (Chisholm et al., 1993; Ellis, 2004; Ellis et al., 2009; Ellis & Essex, 2007). This pattern is particularly evident in wealthier societies where the poor have access to adequate nutrition and health care; lower SES women do not have the metabolic resources necessary to devote to expedited sexual development in societies with severe social class disparities in standards of living (for a discussion, see, e.g., Ellis, 2004; Ellis & Essex, 2007; James-Todd, Tehranifar, Rich-Edwards, Titievsky, & Terry, 2010). Early-life environments that are more benign and predictable, on the other hand, tend to encourage slower life history strategies characterized by a prolonged developmental period, rendering the individuals better able to compete for resources as adults (Ellis et al., 2009; Kaplan & Gangestad, 2005).

A growing body of research in humans has found evidence that early-life SES plays a role in calibrating life history strategies, having a lasting impact on behavioral patterns present in adulthood (see also Mittal & Griskevicius, 2014; Mittal, Griskevicius, Simpson, Sung & Young, 2015). For example, childhood SES has been found to impact how individuals respond to ecological stressors such as violence (Griskevicius, Delton, Robertson, & Tybur, 2011a) and resource scarcity (Griskevicius, Tybur, Delton, & Robertson, 2011b; Hill,

DelPriore, Rodeheffer, & Butterfield, 2014), as well as internal stressors such as hunger (Hill, Prokosch, DelPriore, Kramer, & Griskevicius, 2016; Proffitt Leyva & Hill, 2018). In particular, this research finds that individuals from lower SES childhood environments respond to ecological stressors such as violence by desiring to reproduce sooner, a faster life history strategy characteristic (Griskevicius, Tybur, Delton, & Robertson, 2011b). Conversely, those from higher SES environments respond to these cues by wanting to delay reproduction, a characteristic of a slower life history strategy. Because individual differences in life history strategy are characterized by delayed versus accelerated reproductive effort, hormonally regulated cues to conception likelihood should also prompt psychological changes that promote one’s developmentally sensitized life history strategy.

Fertility and the Expression of Life History Strategies

The human ovulatory cycle spans, on average, 28 days. During this time, there are only approximately 7 days in which a woman is fertile and can become pregnant. This period occurs mid-cycle and is known as the *periovulatory* phase of the cycle. Because women can only reproduce during periods of high fertility (i.e., near ovulation), women’s mating effort is strongly tied to shifts in fertility across the monthly ovulatory cycle. For example, near ovulation, women experience increased sexual desire (Bullivant et al., 2004; Dawson, Suschinsky, & Lalumiere, 2012). Women also experience greater interest in attending social events (Haselton & Gangestad, 2006), paying more attention to men (Anderson et al., 2010), enhancing their appearance (Durante, Griskevicius, Hill, Perilloux, & Li, 2011; Haselton et al., 2007), and showing more skin (Durante et al., 2008). Women’s mate preferences also change across the ovulatory cycle such that, at high fertility, women experience increased preference for and attraction toward men with characteristics indicative of high genetic quality (Gangestad, Garver-Apgar, Simpson, & Cousins, 2007; Gildersleeve, Haselton, & Fales, 2014). However, the state of this research is somewhat inconclusive. For example, some studies have failed to find fertility shifts in women’s preference for characteristics such as facial masculinity (Jones et al., 2018a; Peters, Simmons, Rhodes, 2009).

Given that one of the key trade-offs in one’s life history pathway is the trade-off between more immediate versus delayed reproduction, internal cues of conception risk should impact women’s mating psychology differently depending on their developmental history. Specifically, women from low childhood SES environments should exhibit psychological and behavioral shifts that are consistent with a faster life history strategy, increasing mating effort at times when conception is possible. Conversely, women from higher childhood SES environments should exhibit psychological and behavioral shifts consistent with decreased mating effort at times when conception is possible. Supporting this hypothesis, research finds that partnered women from low SES environments

experience an increase in attraction to their current partner at high fertility (Dinh et al., 2017).

Relationship Status and Fertility-Dependent Shifts in Short-Term Mating Desires

Given that ovulation is a time in the cycle marked by increased mating effort, the specific ways that ovulation based increases in mating effort manifest themselves in women's behavior is also expected to be moderated in important ways by women's relationship status. This view is supported by existing research. For example, research finds that ovulatory effects are stronger for single than partnered women when it comes to mate attraction behaviors (Durante et al., 2008; Schwarz & Hassebrauk, 2008). In one study, researchers assessed women's outfit choices at both high and low fertility by instructing them to imagine that they were going to a social gathering that would be attended by a lot of single, attractive people (Durante et al., 2008). Concurrently, they were given a paper doll and asked to draw an outfit that they would wear to the party. The results showed that, at high fertility, single women preferred clothing that revealed more skin, an effect not found in partnered women. Moreover, at high fertility, single, but not partnered, women report an increased desire to visit places where mating opportunities are likely to be available, such as nightclubs (Schwarz & Hassebrauk, 2008). This research suggests that single women may exhibit stronger mate attraction behaviors than partnered women at high fertility.

Others find that relationship status-based differences in the impact of internal cues to ovulation are further moderated by the quality of women's romantic relationships. For example, research finds that partnered women are differently impacted by ovulation depending on their partner's sexual attractiveness (Larson, Pillsworth, & Haselton, 2012; Larson, Haselton, Gildersleeve, & Pillsworth, 2013; Pillsworth & Haselton, 2006a), whereby those having less desirable partners reported less commitment to their partners at high fertility compared to low (Larson et al., 2013). Others find that partnered women experience greater extra-pair desire if they are weakly attached to their partner and greater in-pair sexual desire if they are strongly attached (Durante, Eastwick, Finkel, Gangestad, & Simpson, 2016; Eastwick & Finkel, 2012; Larson et al., 2012; Pillsworth & Haselton, 2006a). Together, this body of research suggests that the impact of ovulatory cues on women's mating behaviors are highly situationally specific, varying as a function of the potential fitness payoffs associated with mate-seeking versus investing effort in one's existing partner (for review, see Pillsworth & Haselton, 2006b).

The Current Research

Here, we build on prior research by examining the relationship between life history strategy (measured via childhood SES as in Griskevicius et al., 2013; Griskevicius, Delton, Robertson, & Tybur, 2011a), relationship status, cyclic fertility, and short-term mating motivations in women. Given the importance of a

woman's ovulatory cycle in regulating sexual motivations and behavior (Thornhill & Gangestad, 2008), it is expected that women sensitized to faster versus slower life history strategies should respond differently to the hormonal fluctuations that regulate fertility. Specifically, for women who grew up in more unpredictable, lower SES environments, ovulation should prompt psychological shifts that encourage behaviors consistent with faster life history strategies and more immediate reproductive goals. Conversely, for women who grew up in more predictable, higher SES environments, ovulation should prompt psychological shifts that encourage behaviors consistent with slower life history strategies and delayed reproductive goals.

Moreover, we expected these shifts to be manifest in different ways depending on a woman's relationship status. Although partnered women can expedite reproductive goals by engaging in sexual behavior with their existing partners, single women do not have this as an option. Single women can only expedite reproductive goals by increasing their willingness to engage in short-term sexual behaviors. Accordingly, the hormonal fluctuations associated with high fertility across the cycle may lead single women from lower childhood SES environments to pursue short-term sexual opportunities as a means of helping meet the expedited reproductive strategies favored among those with faster life history strategies. Conversely, single women from higher SES childhood environments may avoid short-term sexual behavior at high fertility as a means of helping ensure pregnancy prevention, consistent with their slower life history strategy.

We tested the relationship between childhood SES, relationship status, and internal fertility cues in two studies. In our first study, we used a between-subjects design to examine the impact of fertility, life history strategy, and relationship status on women's short-term mating motivations. In our second study, we sought to examine the hypothesized shift in short-term mating desires by using a more rigorous within-subjects experimental design, in which women's short-term mating motives were assessed at both high fertility (0–48 hr before the release of a mature ovum, indicating a woman is fertile, as verified using over-the-counter luteinizing hormone [LH] tests) and at low fertility (approximately 1 week after ovulation has occurred and women are no longer fertile). Using a within-subjects design thus allows us to determine whether women do experience a fertility-dependent shift in short-term mating desires.

Study 1: Life History, Fertility, Relationship Status, and Short-Term Mating Motivations

Study 1 aimed to assess whether women's short-term mating motives vary as a function of fertility, relationship status, and childhood SES, our proxy measure of life history strategy. To this end, following recommendations made by Gangestad and colleagues (2016), we recruited a broad sample of women and estimated fertility using the reverse cycle day (RCD) method to predict the day of ovulation for each participant. We have

theorized that the fertility-regulated shift in short-term mating motives is rooted in women's life history trade-off between investing in current versus future reproduction. If so, the interactive effect of fertility and life history strategy should be strongest for single women and weakest for women in committed relationships for whom the reproductive goal of obtaining a mate has already been achieved (Thornhill & Gangestad, 2008).

Method

Participants

We recruited 595 heterosexual women living in the United States via an Internet hosting site (MTurk). Participants were compensated with a small monetary payment. All participants reported regular monthly menstrual cycles and indicated that they were not on hormonal contraception. Following previous research (Durante et al., 2008), 95 women who reported having been diagnosed with an endocrine or hormonal disorder (e.g., overactive thyroid, polycystic ovarian syndrome, pituitary disorder) and those who were not certain of the start date of their last menstrual period or the previous menstrual period (i.e., a 5 or lower on a 9-point scale assessing certainty) were excluded from analyses. Thus, the final sample consisted of 500 women (mean age of 30.31 years, standard deviation [*SD*] = 5.67, range = 19–44).

Assessing fertility

To estimate fertility, we obtained from participants (1) the start date of their last menstrual period and the previous menstrual period, (2) the expected start date of their next menstrual period, and (3) the typical length of their menstrual cycle. Participants also reported how certain they were about the start date of their last menstrual period (9-point scale; 1 = *not at all*, 5 = *somewhat*, and 9 = *completely*). We then used the RCD method to predict the day of ovulation for each participant (Gangestad et al., 2016; Haselton & Gangestad, 2006). Following recommendations on the most valid methods for estimating fertility in cross-sectional data (Gangestad et al., 2015, 2016), we calculated each woman's conception probability corresponding to the estimated day of the cycle when each woman completed the survey (Wilcox, Dunson, Weinberg, Trussell & Baird, 2001), with higher values indicating higher fertility (higher conception probability). Each participant was assigned a value from 0 to .09, with higher values indicating higher fertility (e.g., increased conception probability). Conception probability was mean centered prior to analysis.

Short-term mating motives. Short-term mating motives were estimated via the reported probability (0–100%) of engaging in a one-night stand (after Durante & Li, 2009). Firstly, all participants read the following instructions: "We would like you to indicate the likelihood that the event will occur. Please indicate a percentage in increments that best corresponds to your

estimate of the probabilities of occurrence for the event." Participants then responded to the following item: "You have a one-night stand (one-night sexual affair)." Participants indicated the perceived probability that this event would occur using a slider ranging from 0% to 100%.

Childhood SES. As a measure of life history strategy, we included items assessing childhood SES, using 2 items from previous research (Griskevicius et al., 2013; Griskevicius et al., 2011a). Participants reported their agreement with these statements: "My family usually had enough money for things when I was growing up" and "My family struggled financially when I was growing up", on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*). Items were coded, so that higher values corresponded with higher childhood SES, and items were averaged to create a mean composite of childhood SES ($\alpha = .85$). The composite was mean centered prior to analyses.

Relationship status. Participants also indicated their relationship status by answering yes or no to a single item: "Are you currently in a committed relationship with one partner?" (single: $n = 93$; partnered: $n = 407$).

Results and Discussion

A regression model revealed a Fertility \times Childhood SES (mean centered) \times Relationship Status (dummy coded) three-way interaction on short-term mating motives, $B = -232.48$, $t(492) = -3.19$, $p < .002$, Cohen's $d = -.285$. Among single women, there was a significant two-way interaction between conception probability and childhood SES, $B = -180.21$, $t(492) = -2.66$, $p < .01$, Cohen's $d = -.238$. Specifically, single women with low childhood SES (-1 *SD*) reported increased short-term mating probability as levels of conception likelihood increased, $M_{\text{high}} = 27.69\%$ versus $M_{\text{low}} = 13.81\%$; $B = -220.38$, $t(492) = -2.18$, $p < .05$, Cohen's $d = -.195$. Conversely, single women with high childhood SES ($+1$ *SD*) reported decreased short-term mating motives at high versus low levels of conception probability, $M_{\text{high}} = 23.64\%$ versus $M_{\text{low}} = 37.70\%$; $B = 217.64$, $t(492) = 1.94$, $p = .05$, Cohen's $d = .174$; see Figure 1. For women in a relationship, there was not a significant two-way interaction between conception probability and childhood SES, $B = 52.28$, $t(492) = 1.95$, $p > .05$. Specifically, there was no evidence of an effect of conception probability on short-term motivations either at low childhood SES (-1 *SD*), $M_{\text{high}} = 8.61\%$ versus $M_{\text{low}} = 11.92\%$; $B = 75.15$, $t(492) = 1.53$, $p > .12$, or at high childhood SES for partnered women ($+1$ *SD*), $M_{\text{high}} = 10.15\%$ versus $M_{\text{low}} = 5.35\%$; $B = -51.92$, $t(492) = -1.15$, $p > .25$.

Results also revealed a significant main effect of relationship status, $B = 16.70$, $t(492) = 6.67$, $p < .001$, Cohen's $d = .596$, such that single women reported greater short-term motivations ($M = 25.34\%$, $SD = 30.99\%$) than partnered women ($M = 8.86\%$, $SD = 19.24\%$). There was also a significant two-way

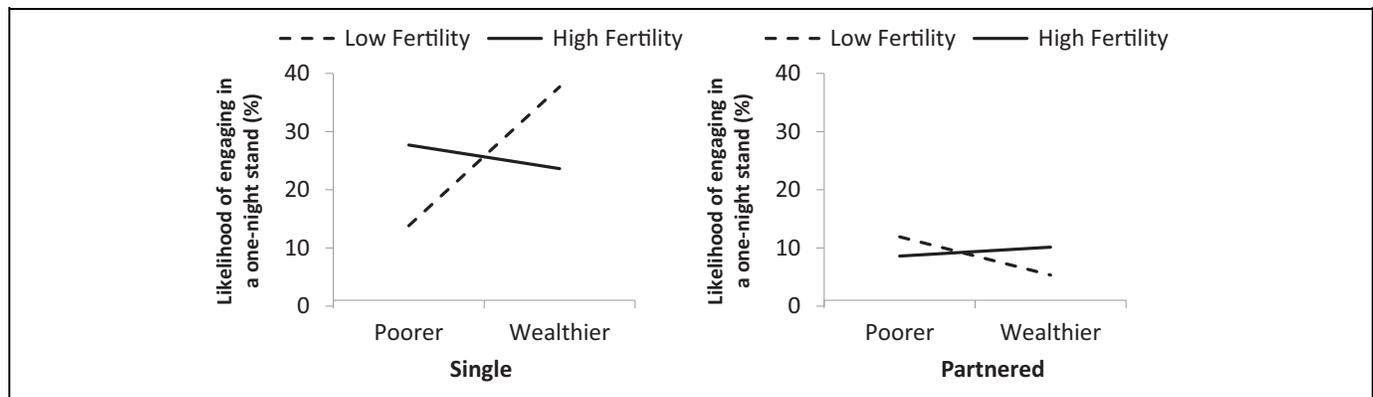


Figure 1. Likelihood of engaging in a one-night stand as a function of fertility, childhood socioeconomic status, and relationship status (Study 1).

interaction between childhood SES and relationship status, $B = 5.12$, $t(492) = 2.38$, $p = .018$, Cohen's $d = .213$, such that single women reported increased short-term mating probability as their childhood SES increased, $M_{\text{high SES}} = 30.49\%$ versus $M_{\text{low SES}} = 19.84\%$; $p = .026$, Cohen's $d = .199$, but partnered women reported similar short-term mating probability regardless of childhood SES ($M_{\text{high SES}} = 7.68\%$ vs. $M_{\text{low SES}} = 10.02\%$; $p > .27$). However, this two-way interaction was qualified by the predicted three-way interaction between these variables with fertility status, making it necessary to be cautious in the interpretation of this result. No other significant effects were found ($ps > .71$).

Consistent with our hypothesis, these results show that, at high fertility, single women from low childhood SES environments (i.e., faster life history strategists) report increased desire for short-term mating. This pattern was not found for single women from high childhood SES environments (i.e., slower life history strategists) or partnered women. Such results indicate that fertility-regulated shifts in short-term mating motives may be rooted in women's life history trade-off between investing in current versus future reproduction. While the results of Study 1 provide initial support for our hypothesis, these results are not without important limitations. Namely, the total sample of single women is relatively small, especially given the specifications for adequate power laid out by Gangestad and colleagues (2016). As such, these results should be treated somewhat cautiously. We sought to address this concern in Study 2, by running a more powerful within-subjects design and collecting a more equal sample of single and paired women.

Study 2: Replication in Within-Subjects Study

The goal of Study 2 was to conceptually replicate the effect found in Study 1 using a more rigorous approach. Specifically, whereas Study 1 utilized a between-subjects design, Study 2 used a within-subjects design, obtaining measurements for each participant twice: at both low and high levels of fertility. Having such repeated measurements is crucial to investigate how fertility and childhood SES jointly determine the

hypothesized *shift* in short-term mating motives as women go from low to high periods of fertility.

Method

Participants

We recruited 86 heterosexual female students at a large public university in the United States as part of a larger study on fertility, relationship status, and decision-making. Women participated in return for either course credit or USD\$30. Fifteen participants were eliminated because they either did not complete all dependent measures or we were not able to confirm ovulation. Thus, data for 71 women were used for analyses (mean age of 22.27 years, $SD = 5.18$, range = 17–49).

Assessing Fertility

Women who were *not* on hormonal contraceptives (e.g., the pill, the patch, vaginal ring, hormonal IUD) were recruited to participate in the study via e-mail and campus flyers. Women were told that the study was about relationships, decision-making, and health. Women who qualified for the study (i.e., reported not taking hormonal contraceptives) received a link to a survey that asked them to report their cycle information. Specifically, women reported (1) the start date of their last menstrual period and the previous menstrual period, (2) the expected start date of their next menstrual period, and (3) the typical length of their menstrual cycle. Based on this information, women were scheduled to come into the lab for two experimental sessions—one on an expected high-fertility day and one on an expected low-fertility day; 60.6% completed high-fertility testing first and 39.4% completed low-fertility testing first. Similar to previous studies that have utilized this type of within-subject methodology (e.g., Durante et al., 2011; Gangestad, Thornhill, & Garver, 2002; Pillsworth & Haselton 2006b), no order effects were found when “high- versus low-fertility testing first” (dummy coded) was entered into the model ($ps > .34$). Furthermore, the pattern reported in the results remains significant when controlling for order of testing session.

To determine the high-fertility testing session date, women completed over-the-counter urine applicator tests (www.medix.com) that detect the surge in LH that occurs just prior to ovulation. The first urine test was scheduled 2 days before the expected day of ovulation. If an LH surge was not detected, women came back each day until an LH surge was detected or seven tests had been completed. Once the LH surge was detected, participants completed high-fertility testing on that day or the following day, if possible. All participants completed their high-fertility session on the day of their LH surge or over the 2 days following the LH surge. None of the participants identified the research hypotheses or determined that the urine test was being used to detect ovulation. Low-fertility sessions were scheduled 7 days or more after the LH surge (if high-fertility testing took place first) or at least 3 days before the expected onset of their menstrual periods (if low-fertility testing took place first).

Short-Term Mating Motives

To measure short-term mating motives, women estimated the probability (0–100%) they would engage in a one-night stand (same as Study 1) at both fertility sessions.

Childhood SES

The childhood SES measure was administered at both fertility sessions. The measure was a composite of the same 2 items used in Study 1 (high fertility, $\alpha = .78$; low fertility, $\alpha = .75$; composite $\alpha = .80$).

Relationship Status

To assess relationship status, we asked participants “What is your current romantic relationship status?” Options included: 1. Not dating/romantically involved with anyone, 2. Dating/Involved with more than one partner, 3. Dating/involved with only one partner, 4. Engaged, 5. Living with my partner, 6. Married, and 7. Other. If women reported being in a committed relationship with one partner, they indicated the length of this relationship in months. Women were coded as single if they chose options 1, 2, or 7 ($n = 35$) and partnered if they chose other options ($n = 36$).

Results and Discussion

Short-term mating motivation was examined using a repeated-measures analysis of variance with fertility (high vs. low) as a repeated factor, childhood SES (mean-centered) as a continuous control variable, and relationship status (dummy coded) as a between-subject factor. As expected, there was a three-way interaction between fertility (high vs. low), childhood SES, and relationship status, $F(1, 67) = 4.25, p = .043, \eta^2 = .06$. We found no evidence of a main effect of fertility, $F(1, 67) = 1.94, p > .16$, or relationship status, $F(1, 67) = 2.62, p > .11$. We also did not find evidence of an interaction between fertility and childhood SES, $F(1, 67) = 3.69, p > .05$, or an interaction

between fertility and relationship status, $F(1, 67) = .35, p > .55$. However, there was a significant main effect of childhood SES, $F(1, 67) = 9.42, p = .003, \eta^2 = .123$, such that short-term mating motives increased as childhood SES decreased ($B = -3.45$). There was also a significant two-way interaction between childhood SES and relationship status, $F(1, 67) = 10.86, p = .002, \eta^2 = .139$, such that single women reported increased short-term mating motives as their childhood SES decreased, $B = -7.26, t(67) = -4.56, p < .001$, Cohen’s $d = -1.083$; $M_{\text{high SES}} = -1.78\%$ versus $M_{\text{low SES}} = 13.21\%$, but partnered women reported similar short-term mating probability regardless of childhood SES, $B = .26, t(67) = .16, p > .87$; $M_{\text{high SES}} = 2.18\%$ versus $M_{\text{low SES}} = 1.64\%$.

To more fully examine the significant three-way interaction, we ran a hierarchical linear model with fertility status (high or low fertility) as a Level 1 factor and participant as a Level 2 factor. Relationship status (dummy coded) was included as a fixed factor and childhood SES was included as a covariate. Childhood SES scores were zero centered, so that the results would be estimated at the mean levels of childhood SES. Simple effects analogs were run recentering childhood SES at 1 SD below the mean and 1 SD above the mean. This allows for an estimation of the effects among women with low levels of childhood SES and among women with high levels of childhood SES. Single women with low childhood SES ($-1 SD$) reported increased short-term mating probability as conception probability increased, $M_{\text{high}} = 17.83\%$ versus $M_{\text{low}} = 8.95\%$; $F(1, 133) = 6.33, p = .013$, Cohen’s $d = 3.56$. Conversely, single women with high childhood SES ($+1 SD$) reported decreased short-term mating motives as conception probability increased, $M_{\text{high}} = -5.52\%$ versus $M_{\text{low}} = .63\%$; $B = 217.64, F(1, 133) = 2.32, p = .13$; see Figure 2. For women in a relationship, there was no evidence of an effect of conception probability on short-term motivations either at low childhood SES ($-1 SD$), $M_{\text{high}} = 2.17\%$ versus $M_{\text{low}} = .97\%$; $F < 1, p > .77$, or at high childhood SES for partnered women ($+1 SD$), $M_{\text{high}} = 2.75\%$ versus $M_{\text{low}} = 1.81\%$; $F < 1, p > .79$.

Together, these results suggest that childhood SES and women’s current relationship status moderate the changes in short-term mating motives that women experience as they move from low to high periods of fertility. Specifically, a shift in short-term mating motives at high versus low fertility was most evident for single women who were from low childhood SES environments (i.e., those who were sensitized to a faster life history strategy).

General Discussion

Unintended pregnancies disproportionately occur among low-income, unmarried women. In the current research, we examined whether this relationship could potentially reflect the contingent expression of life history strategy responses to internal cues of fertility. Specifically, we assessed whether women might differentially experience fertility-regulated shifts in short-term mating probability based on their childhood SES—a proxy for their life history pathway—and relationship

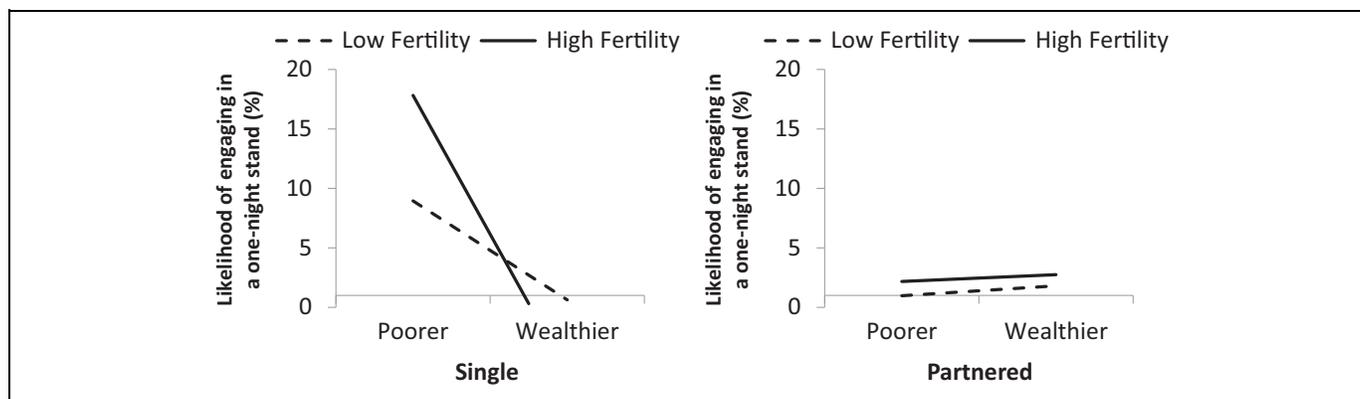


Figure 2. Likelihood of engaging in a one-night stand (high minus low fertility) as a function of childhood socioeconomic status and relationship status (Study 2).

status. Given that women can only reproduce at a high fertility (near ovulation), we predicted that women's sexual behaviors at high fertility may be altered in a manner that promotes or prevents reproduction as a function of their life history pathways. Although previous research finds that women have shifts in desire for short-term sexual behavior near ovulation (Gangestad et al., 2002; Gangestad, Thornhill & Garver-Apgar, 2010; Pillsworth, Haselton, & Buss, 2004), some research has failed to find such effects (Jones et al., 2018b). Individual differences in life history may be an overlooked factor that affects how ovulatory cycle adaptations are expressed. Using both between (Study 1) and within (Study 2) designs, the results of the current research demonstrate that fertility was associated with different effects on women's mating psychology depending on childhood SES—a proxy for their life history strategy—and relationship status. These results were consistent with our hypothesis that hormonally regulated cues to conception likelihood prompt psychological changes in-line with women's developmentally sensitized life history. That is, at high fertility, women from low childhood SES environments (who were presumed to follow a faster life history strategy) reported increased probability of short-term mating. Conversely, women from high childhood SES environments (presumed slower life history strategists) reported decreased probability of short-term mating at high fertility. Moreover, this pattern reliably differed as a function of women's relationship status.

It may be worthwhile to note that a two-way interaction between relationship status and childhood SES on short-term mating probability emerged in both of our studies. However, the pattern of this interaction differed between Studies 1 and 2. That is, in Study 1, single women reported increased short-term mating probability as their childhood SES increased, whereas the opposite pattern was found in Study 2 (i.e., single women reported increased short-term mating probability as their childhood SES decreased). Because of the disparate nature of this interaction across the current studies, it is important to treat these results with caution. Importantly, both of these interactions were qualified by the proposed three-way interaction

between relationship status, childhood SES, and conception likelihood.

Because single women have more to gain from fertility-regulated trade-offs in reproductive effort (e.g., increased openness to short-term sex) compared to women in committed relationships who already have a secure partner, we predicted that single women from low childhood SES environments (i.e., presumed faster life history strategists) should exhibit increased likelihood of short-term mating as conception likelihood increased. Consistent with our prediction, the effect emerged for single women; partnered women did not demonstrate fertility-contingent shifts in short-term mating likelihood. Further, our results are consistent with prior research demonstrating that partnered women do not experience shifts in short-term mating desire dependent on life history strategy (Dinh et al., 2017).

In addition to lending initial support for the hypothesis that women's short-term mating likelihood may vary as a function of their fertility and developmentally sensitized life history strategies, the current research highlights that this relationship differs based on whether women are partnered or single. Indeed, other research has shown that single women engage in more mate attraction effort at high fertility, such as wearing clothing that reveals more skin (Durante et al., 2008; Schwarz & Hassebrauk, 2008). Diverging effects of fertility on short-term mating motivations emerged only for single women sensitized to faster versus slower life history strategies. That is, at high fertility, single women developmentally sensitized to faster life history strategies reported increased probability of engaging in a one-night stand. While this pattern was initially found in Study 1, it is particularly important that we replicated this effect in Study 2, which utilized a more powerful within-subjects design. Thus, these results suggest that relationship status and developmental history may be an important consideration in ovulatory cycle research, as women's responses to internal fertility cues may diverge in important ways depending on their life history pathway as well as current relationship status.

While the current research poses as an important first step in establishing a relationship between fertility, life history strategies, and relationship status to predict women's likelihood of engaging in short-term mating behaviors, it is not without limitations. One important limitation arises from the relatively small sample size of single women in Study 1 ($n = 93$). The small sample size may raise concerns about adequate statistical power and thus the generalizability of the results. Future studies seeking to examine how relationship status impacts cyclical fertility shifts dependent on an individual's developmentally sensitized life history strategy should collect larger sample sizes to address this issue.

Another limitation lies in our operationalization of life history strategy. That is, we did not include measures directly assessing life history strategy. Rather, based on past research showing that childhood SES serves as a marker of early-life experience with harshness and unpredictability (for review, see Chen & Miller, 2012), we used childhood SES as a proxy measure. Moreover, our childhood SES measure only assessed subjective perceptions of family income, while SES is often operationalized via education as well as income (Adler et al., 1994). In future research, this limitation could be addressed by including additional measures of SES, as well as measures that directly assess individual differences in life history strategy (i.e., the mini-K; Figueredo et al., 2006). Additionally, we only included 1 item measuring self-reported likelihood of engaging in short-term mating behavior. Future research may benefit from including multiple measures of short-term mating intentions to provide a more accurate picture of this relationship. Further, it is possible that partnered women across our samples may have reported a lower likelihood of short-term mating due to demand characteristics. Future studies could address this potential issue by using behavioral measures that assess implicit desire for short-term mating, such as an approach-avoidance task. Despite these limitations, the current research poses an important first step in establishing how fertility regulated cues interact with women's developmentally sensitized life history strategies and current relationship status to influence short-term mating behavior. As such, this research may help elucidate the mechanisms of seemingly maladaptive patterns of behavior, such as the prevalence of unintended pregnancies among poor, unmarried women.

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References

- Adler, N. E., Boyce, T., Chesney, M. A., Cohen, S., Folkman, S., Kahn, R. L., & Syme, S. L. (1994). Socioeconomic status and health: The challenge of the gradient. *American Psychologist*, *49*, 15.
- Anderson, U. S., Perea, E. F., Becker, D. V., Ackerman, J. M., Shapiro, J. R., Neuberg, S. L., & Kenrick, D. T. (2010). I only have eyes for you: Ovulation redirects attention (but not memory) to attractive men. *Journal of Experimental Social Psychology*, *46*, 804–808.
- Ayoola, A. B., Zandee, G. L., Johnson, E., & Pennings, K. (2014). Contraceptive use among low-income women living in medically underserved neighborhoods. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *43*, 455–464.
- Belsky, J., Houts, R. M., & Fearon, R. P. (2010). Infant attachment security and the timing of puberty: Testing an evolutionary hypothesis. *Psychological Science*, *21*, 1195–1201.
- Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development*, *62*, 647–670.
- Bullivant, S. B., Sellergren, S. A., Stern, K., Spencer, N. A., Jacob, S., Mennella, J. A., & McClintock, M. K. (2004). Women's sexual experience during the menstrual cycle: Identification of the sexual phase by noninvasive measurement of luteinizing hormone. *Journal of Sex Research*, *41*, 82–93.
- Chen, E., & Miller, G. E. (2012). "Shift-and-persist" strategies: Why low socioeconomic status isn't always bad for health. *Perspectives on Psychological Science*, *7*, 135–158.
- Chisholm, J. S., Ellison, P. T., Evans, J., Lee, P. C., Lieberman, L. S., Pavlik, Z., . . . Worthman, C. M. (1993). Death, hope, and sex: Life-history theory and the development of reproductive strategies [and comments and reply]. *Current Anthropology*, *34*, 1–24.
- Dawson, S. J., Suschinsky, K. D., & Lalumiere, M. L. (2012). Sexual fantasies and viewing times across the menstrual cycle: A diary study. *Archives of sexual behavior*, *41*, 173–183.
- Dehlendorf, C., Rodriguez, M. I., Levy, K., Borrero, S., & Steinauer, J. (2010). Disparities in family planning. *American Journal of Obstetrics & Gynecology*, *202*, 214–220.
- Dinh, T., Pinosof, D., Gangestad, S. W., & Haselton, M. G. (2017). Cycling on the fast track: Ovulatory shifts in sexual motivation as a proximate mechanism for regulating life history strategies. *Evolution and Human Behavior*, *38*, 685–694.
- Durante, K. M., Eastwick, P. W., Finkel, E. J., Gangestad, S. W., & Simpson, J. A. (2016). Pair-bonded relationships and romantic alternatives: Toward an integration of evolutionary and relationship science perspectives. *Advances in Experimental Social Psychology* *53*, 1–74.
- Durante, K. M., Griskevicius, V., Hill, S. E., Perilloux, C., & Li, N. P. (2011). Ovulation, female competition, and product choice: Hormonal influences on consumer behavior. *Journal of Consumer Research*, *37*, 921–934.
- Durante, K. M., & Li, N. P. (2009). Oestradiol level and opportunistic mating in women. *Biology Letters*, *5*, 179–182.
- Durante, K. M., Li, N. P., & Haselton, M. G. (2008). Changes in women's choice of dress across the ovulatory cycle: Naturalistic and laboratory task-based evidence. *Personality and Social Psychology Bulletin*, *34*, 1451–1460.
- Eastwick, P. W., & Finkel, E. J. (2012). The evolutionary armistice: Attachment bonds moderate the function of ovulatory cycle adaptations. *Personality and Social Psychology Bulletin*, *38*, 174–184.

- Ellis, B. J. (2004). Timing of pubertal maturation in girls: An integrated life history approach. *Psychological Bulletin*, *130*, 920.
- Ellis, B. J., & Essex, M. J. (2007). Family environments, adrenarche, and sexual maturation: A longitudinal test of a life history model. *Child Development*, *78*, 1799–1817.
- Ellis, B. J., Figueredo, A. J., Brumbach, B. H., & Schlomer, G. L. (2009). Fundamental dimensions of environmental risk: The impact of harsh versus unpredictable environments on the evolution and development of life history strategies. *Human Nature*, *20*, 204–268.
- Figueredo, A. J., Vásquez, G., Brumbach, B. H., Schneider, S. M., Sefcek, J. A., Tal, I. R., . . . Jacobs, W. J. (2006). Consilience and life history theory: From genes to brain to reproductive strategy. *Developmental Review*, *26*, 243–275.
- Finer, L. B., & Zolna, M. R. (2014). Shifts in intended and unintended pregnancies in the United States, 2001–2008. *American Journal of Public Health*, *104*, S43–S48.
- Finer, L. B., & Zolna, M. R. (2016). Declines in unintended pregnancy in the United States, 2008–2011. *New England Journal of Medicine*, *374*, 843–852.
- Frost, J. J., Lindberg, L. D., & Finer, L. B. (2012). Young adults' contraceptive knowledge, norms and attitudes: Associations with risk of unintended pregnancy. *Perspectives on Sexual and Reproductive Health*, *44*, 107–116.
- Gangestad, S. W., Thornhill, R., & Garver-Apgar, C. E. (2015). Women's sexual interests across the ovulatory cycle: Function and phylogeny. In D.M. Buss (Ed.), 2nd Ed. New York: Wiley, *Handbook of evolutionary psychology*.
- Gangestad, S. W., Garver-Apgar, C. E., Simpson, J. A., & Cousins, A. J. (2007). Changes in women's mate preferences across the ovulatory cycle. *Journal of Personality and Social Psychology*, *92*, 151.
- Gangestad, S. W., Haselton, M. G., Welling, L. L., Gildersleeve, K., Pillsworth, E. G., Burriss, R. P., . . . Puts, D. A. (2016). How valid are assessments of conception probability in ovulatory cycle research? Evaluations, recommendations, and theoretical implications. *Evolution and Human Behavior*, *37*, 85–96.
- Gangestad, S. W., Thornhill, R., & Garver, C. E. (2002). Changes in women's sexual interests and their partner's mate-retention tactics across the menstrual cycle: Evidence for shifting conflicts of interest. *Proceedings of the Royal Society of London B: Biological Sciences*, *269*, 975–982.
- Gangestad, S. W., Thornhill, R., & Garver-Apgar, C. E. (2010). Fertility in the cycle predicts women's interest in sexual opportunism. *Evolution and Human Behavior*, *31*, 400–411.
- Garbers, S., Meserve, A., Kottke, M., Hatcher, R., & Chiasson, M. A. (2013). Contraceptive history, unintended pregnancy, and contraceptive method choice among urban low-income women. *Journal of Women's Health*, *22*, 930–937.
- Gildersleeve, K., Haselton, M. G., & Fales, M. R. (2014). Do women's mate preferences change across the ovulatory cycle? A meta-analytic review. *Psychological Bulletin*, *140*, 1205–1259.
- Griskevicius, V., Ackerman, J. M., Cantú, S. M., Delton, A. W., Robertson, T. E., Simpson, J. A., . . . Tybur, J. M. (2013). When the economy falters do people spend or save? Responses to resource scarcity depend on childhood environments. *Psychological Science*, *24*, 197–205.
- Griskevicius, V., Delton, A. W., Robertson, T. E., & Tybur, J. M. (2011a). Environmental contingency in life history strategies: The influence of mortality and socioeconomic status on reproductive timing. *Journal of Personality and Social Psychology*, *100*, 241–254.
- Griskevicius, V., Tybur, J. M., Delton, A. W., & Robertson, T. E. (2011b). The influence of mortality and socioeconomic status on risk and delayed rewards: A life history theory approach. *Journal of Personality and Social Psychology*, *100*, 1015–1026.
- Haselton, M. G., & Gangestad, S. W. (2006). Conditional expression of women's desires and men's mate guarding across the ovulatory cycle. *Hormones and Behavior*, *49*, 509–518.
- Haselton, M. G., Mortezaie, M., Pillsworth, E. G., Bleske-Rechek, A., & Frederick, D. A. (2007). Ovulatory shifts in human female ornamentation: Near ovulation, women dress to impress. *Hormones and Behavior*, *51*, 40–45.
- Hill, S. E., DelPriore, D. J., Rodeheffer, C. D., & Butterfield, M. E. (2014). The effect of ecological harshness on perceptions of the ideal female body size: An experimental life history approach. *Evolution and Human Behavior*, *35*, 148–154.
- Hill, S. E., Prokosch, M. L., DelPriore, D. J., Griskevicius, V., & Kramer, A. (2016). Low childhood socioeconomic status promotes eating in the absence of energy need. *Psychological Science*, *27*, 354–364.
- James-Todd, T., Tehranifar, P., Rich-Edwards, J., Titievsky, L., & Terry, M. B. (2010). The impact of socioeconomic status across early life on age at menarche among a racially diverse population of girls. *Annals of Epidemiology*, *20*, 836–842.
- Jones, B. C., Hahn, A. C., Fisher, C. I., Wang, H., Kandrik, M., Han, C., . . . DeBruine, L. M. (2018a). No compelling evidence that preferences for facial masculinity track changes in women's hormonal status. *Psychological Science*, *29*, 996–1005.
- Jones, B. C., Hahn, A. C., Fisher, C. I., Wang, H., Kandrik, M., & DeBruine, L. M. (2018b). General sexual desire, but not desire for uncommitted sexual relationships, tracks changes in women's hormonal status. *Psychoneuroendocrinology*, *88*, 153–157.
- Kaplan, H. S., & Gangestad, S. W. (2005). Life history theory and evolutionary psychology. In D. M. Buss (Ed.), *The handbook of evolutionary psychology*, pp. 68–95 Hoboken, NJ: Wiley.
- Kuzawa, C. W., McDade, T. W., Adair, L. S., & Lee, N. (2010). Rapid weight gain after birth predicts life history and reproductive strategy in Filipino males. *Proceedings of the National Academy of Sciences*, *107*, 16800–16805.
- Larson, C. M., Haselton, M. G., Gildersleeve, K. A., & Pillsworth, E. G. (2013). Changes in women's feelings about their romantic relationships across the ovulatory cycle. *Hormones and Behavior*, *63*, 128–135.
- Larson, C. M., Pillsworth, E. G., & Haselton, M. G. (2012). Ovulatory shifts in women's attractions to primary partners and other men: Further evidence of the importance of primary partner sexual attractiveness. *PLoS One*, *7*, e44456.
- Mittal, C., & Griskevicius, V. (2014). Sense of control under uncertainty depends on people's childhood environment: A life history theory approach. *Journal of Personality and Social Psychology*, *107*, 621–637.

- Mittal, C., Griskevicius, V., Simpson, J. A., Sung, S., & Young, E. S. (2015). Cognitive adaptations to stressful environments: When childhood adversity enhances adult executive function. *Journal of Personality and Social Psychology, 109*, 604.
- Peters, M., Simmons, L. W., & Rhodes, G. (2009). Preferences across the menstrual cycle for masculinity and symmetry in photographs of male faces and bodies. *PloS One, 4*, e4138.
- Proffitt Leyva, R. P., & Hill, S. E. (2018). Unpredictability, body awareness, and eating in the absence of hunger: A cognitive schemas approach. *Health Psychology, 37*(7), 691.
- Pillsworth, E. G., & Haselton, M. G. (2006a). Male sexual attractiveness predicts differential ovulatory shifts in female extra-pair attraction and male mate retention. *Evolution and Human Behavior, 27*, 247–258.
- Pillsworth, E. G., & Haselton, M. G. (2006b). Women's sexual strategies: The evolution of long-term bonds and extra-pair sex. *Annual Review of Sex Research, 17*, 59–100.
- Pillsworth, E. G., Haselton, M. G., & Buss, D. M. (2004). Ovulatory shifts in female sexual desire. *Journal of Sex Research, 41*, 55–65.
- Schwarz, S., & Hassebrauck, M. (2008). Self-perceived and observed variations in women's attractiveness throughout the menstrual cycle—A diary study. *Evolution and Human Behavior, 29*, 282–288.
- Stearns, S. C. (1992). *The evolution of life histories*. Oxford, England: Oxford University Press.
- Thornhill, R., & Gangestad, S. W. (2008). *The evolutionary biology of human female sexuality*. New York, NY: Oxford University Press.
- Wilcox, A. J., Dunson, D. B., Weinberg, C. R., Trussell, J., & Baird, D. D. (2001). Likelihood of conception with a single act of intercourse: Providing benchmark rates for assessment of post-coital contraceptives. *Contraception, 63*, 211–215.