

Original Article

Early Psychosocial Stress Predicts Extra-pair Copulations

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Abstract: Cheating on a mate, known as an extra-pair copulation (EPC), is considered unacceptable by most individuals. Nonetheless many individuals engage in such risky behaviors. Because individuals with high, as opposed to low, levels of early psychosocial stress are more risk prone and more likely to engage in opportunistic matings, we predicted that individuals reporting EPCs, one of many types of opportunistic mating (e.g., one-night stand, consecutive short-term relationships etc), have higher levels of early psychosocial stress than those who do not. Two types of EPCs were examined: EPC-self (EPC-S), having sex with someone other than one's mate, and EPC-other (EPC-O), having sex with someone else's mate. In a sample of 229 women and 161 men, significantly higher levels of early psychosocial stress were found amongst those reporting an EPC-S than those reporting none, irrespective of EPC-Os. Furthermore, the more EPC-Ss men, but not women, reported the higher their early psychosocial stress. Early psychosocial stress was not associated with EPC-Os irrespective of EPC-Ss. Participants were also classified into one of four groups (no EPCs, EPC-O only, EPC-S only, or EPC-S&O) which significantly interacted with early psychosocial stress. Results are discussed from adaptationist and mechanist perspectives and why early psychosocial stress was higher in individuals reporting EPC-Ss irrespective of EPC-Os, but not EPC-Os irrespective of EPC-Ss, than those not reporting the EPC of interest.

Keywords: genetic benefits, gratification, opportunistic mating, risk-taking.

Introduction

Extra-pair copulations (EPCs) are defined as having a sexual relationship with someone other than a pair-bonded mate (i.e., a spouse or a boy/girlfriend). There are two types of EPCs: EPC-self (EPC-S), which is having a sexual relationship with someone

other than one's currently pair-bonded mate (i.e., he/she is having an affair) and EPC-other (EPC-O), which is having a sexual relationship with someone who is already in a pair-bonded relationship (i.e., he/she is the person someone is having an affair with). Furthermore, individuals can also simultaneously engage in an EPC-S and an EPC-O.

Although 68 – 83% of people disapprove of having extramarital sexual relationships (Medora and Burton, 1981; Singh, Walton, and Williams, 1976; Thornton and Young-DeMarco, 2001; Weis and Slosnerick, 1981; Wiederman, 1997) their occurrence is still quite common (see Table 1.). Furthermore 6% of British women reported that their last copulation was an EPC (Bellis and Baker, 1990). The inconsistencies between attitudes and behaviors about EPCs raises the question as to why individuals engage in such behavior despite these negative views. From an evolutionary perspective the answer may be different depending on the individual's gender. Males may engage in EPCs to increase offspring quantity by using EPCs as another form of short-term mating, whereas females may engage in EPCs to increase offspring quality by mating with males of superior genetic quality (Hrды, 1981; Jennions and Petrie, 2000) while obtaining direct benefits from a pair-bonded mate (Smith, 1984). However, it must be kept in mind that females may also obtain direct benefits from an EPC (i.e., protection, food, monetary rewards) (Smith, 1984). Evidence for the idea that females may engage in EPCs to obtain genetic benefits comes from the animal literature (e.g., Hasselquist, Bensch, and von Schantz, 1996; Kempenaers, Verheyen, van den Broeck, Burke, van Broeckhoven, and Dhondt, 1992). For example, great reed warbler females pair-bonded with low genetic quality mates engaged in EPCs with neighboring high genetic quality males, indicated by their larger song repertoires, presumably to obtain genetic benefits for their offspring such as increased offspring survival, which is positively associated with large song repertoires (Hasselquist et al., 1996).

Researchers have not only examined extra-pair relationships in animals, but have also looked at extra-pair relationships in humans via self-report data. Women not using oral/hormonal contraceptives report greater sexual interest in extra-pair men and fantasize more about them than their pair-bonded mate when conception is likely, near ovulation, than when conception is unlikely, during the luteal phase of their menstrual cycle (Gangestad, Thornhill, and Garver, 2002). Furthermore, women are more sensitive to indicators of genetic quality around ovulation (Johnston, Hagel, Franklin, Fink, and Grammer, 2001; Penton-Voak and Perrett, 2000; Penton-Voak, Perrett, Castles, Kobayashi, Burt, Murray, et al., 1999; but see also Koehler, Rhodes, and Simmons, 2002; Koehler, Rhodes, Simmons, and Zebrowitz, 2006), are more likely to engage in EPCs around ovulation and are less likely to use contraception during EPCs than in-pair matings (Bellis and Baker, 1990). Men with high, as opposed to low, symmetry, a trait conjectured to signal genetic quality (Møller and Swaddle, 1997; Thornhill and Gangestad, 1999), are also more likely to report having been an EPC partner (Gangestad and Thornhill, 1997). Taken together, these findings are consistent with the idea that women may engage in EPC-Ss to obtain genetic benefits from another mate while obtaining direct benefits from a pair-bonded mate. Furthermore, the genetic diversity hypothesis, which suggests that mating with multiple mates increases the genetic diversity of offspring, has also been put forward as a possible explanation as to why males and females might engage in EPCs with multiple mates (Kempenaers, Congdon, Boag, and Robertson, 1999; Smith, 1984; Yasui, 1998).

Bearing in mind that both men and women can benefit by engaging in EPCs raises the question as to why more individuals do not engage in such behavior. As with most behaviors accompanied with a benefit there is also a cost. In the case of EPCs individuals are faced with the cost of being discovered by their pair-bonded mate which could lead to the dissolution of their relationship or in extreme cases could lead to spousal homicide because of sexual jealousy, which is more commonly inflicted by men than women (Chimbos, 1998; Daly and Wilson, 1988; Daly, Wilson, and Weghorst, 1982; Serran and Firestone, 2004).

Table 1. Prevalence of EPCs reported by women and men.

Study	Location	Sample characteristics	Period	Type of EPC	Gender	N	Age (years)	EPC prevalence
Essock-Vitale & McGuire, 1988 Johnson et al., 2001	Los Angeles, CA Britain	General population General population	Lifetime Last 12 months	Extra-marital sex Concurrent relationship	Female	283	35 – 45	23.0%
					Female	6399	16 – 24	15.2%
							25 – 34	7.6%
							35 – 44	6.7%
							16 – 44	9.0%
Kinsey et al., 1948	U.S.A.	General population	Lifetime	Extra-marital sex	Male	4762	16 – 24	20.8%
							25 – 34	15.3%
							35 – 44	9.8%
							16 – 44	14.6%
							16 – 20	35.4%
							21 – 25	24.4%
							26 – 30	26.0%
							31 – 35	28.4%
							36 – 40	27.8%
							41 – 45	23.5%
Kinsey et al., 1953	U.S.A.	General population	Lifetime	Extra-marital sex	Female	6927	46 – 50	25.2%
							51 – 55	22.3%
							56 – 60	22.1%
							16 – 20	6.0%
							21 – 25	9.0%
							26 – 30	14.0%
							31 – 35	17.0%
							36 – 40	17.0%
							41 – 45	16.0%
							46 – 50	11.0%
Pietropinto & Simenauer, 1977	U.S.A.	General population	Lifetime	Concurrent relationship	Male	4066	51 – 55	6.0%
							56 – 60	4.0%
							18 – 29	53.7%
							30 – 39	51.1%
							40 – 54	50.8%
							55 – 65	37.0%
Simmons et al., 2004	Australia	Mainly students	Lifetime	Concurrent relationship	Female	194	18 – 65	49.0%
							18 – 24	13.0%
							25 – 50	46.0%
							17 – 51	22.2%
							18 – 24	20.0%
Spira et al., 1992	France	General population			Male	222	25 – 50	44.0%
							17 – 51	27.9%
							18 – 24	5.0%
							35 – 49	51.7%
							18 – 24	6.9%
Wiederman, 1997	U.S.A.	General population	Lifetime	Extra-marital sex	Female	1288	35 – 49	33.7%
							20 – 29	10.9%
							30 – 39	14.2%
							40 – 49	19.3%
							50 – 59	10.9%
							60 – 69	7.6%
							≥70	0.5%
							≥20	11.6%
					Male	884	20 – 29	14.9%
							30 – 39	14.3%
							40 – 49	29.3%
							50 – 59	28.7%
							60 – 69	34.0%
							≥70	13.2%
							≥20	22.7%

Given that EPCs are risky and that not all individuals engage in such behaviors raises the question whether some individuals are simply more likely to engage in risky behavior in general. The answer is yes, because previous research has shown that psychosocial stress during childhood and/or adolescence is associated with risky behaviors such as tobacco, alcohol and illicit drug use (Chen, Dunne, and Han, 2006; Felitti et al., 1998; Moran, Vuchinich, and Hall, 2004; Rodgers et al., 2004; Stock, Bell, Boyer, and Connell, 1997; Zierler et al., 1991), driving while intoxicated (Rodgers et al., 2004), pathological gambling (Petry and Steinberg, 2005), risky sexual behavior (e.g., less frequent contraception use [Hill, Ross, and Low, 1997; Mosher and Bachrach, 1987; Stock et al., 1997], engaging in sexual activity at a younger age, with more partners and after a shorter duration of meeting their partner [Testa, VanZile-Tamsen, and Livingstone, 2005], exchanging sex for money or drugs [Parillo, Freeman, Collier, and Young, 2001]), as well as getting involved in fights and truancy from school (Berezkei and Csanaky, 1996). Furthermore, individuals with high, as opposed to low, levels of early psychosocial stress are hypothesized to engage in more opportunistic matings such as EPCs (Belsky, Steinberg and Draper, 1991; Draper and Harpending, 1982, 1988).

But what theories can explain why some individuals are more likely to engage in risky behaviors such as EPCs than others? Life history theory together with the psychology of time preference may help answer this question (see Figure 1.). We will firstly examine the answer to this question from the perspective of life history theory although the two theories are highly intertwined.

Briefly, life history theory is the study of life cycles and life history traits (e.g., age at maturation, age at first birth, longevity etc) in the context of evolutionary ecology (e.g., Hill and Kaplan, 1999; Stearns, 1989, 1992). Importantly, life history theory is concerned with trade-offs individuals face amongst components of fitness. Because resources are always limited resources used for one task (e.g., somatic functions) cannot be utilized for another function (e.g., reproduction) and thus trade-offs arise. The most dominating trade-off individual's face is that between current and future reproduction. Thus, in environments of high risk and uncertainty (i.e., mortality rates are high) the optimal reproductive strategy is to reproduce as early and as often as possible (i.e., a quantitative reproductive approach), which would be adaptive to minimize the probability of lineage extinction, whereas the opposite is optimal in environments of low risk and uncertainty (i.e., a qualitative reproductive approach). Consistent with this view, Draper and Harpending (1982) theorized that father-absent, but not father-present, children learn that unstable paternal care is appropriate (males) / that paternal care is unimportant (females) and will thus follow a developmental trajectory indicative of a quantitative, as opposed to a qualitative, reproductive style. A few years later Belsky et al. (1991) extended Draper and Harpending's theory by focusing on a more generalized view of a child's upbringing, specifically attachment behavior. They proposed that children learn about the availability and predictability of resources within their environment, others' trustworthiness, and the stability of close interpersonal relationships during their first 5 to 7 years of life. Specifically, they proposed that those reared in an environment where resources are scarce and unpredictable are thought to follow a quantitative reproductive strategy by speeding up biological maturation and forming short-term rather than long-term heterosexual relationships, whereas those reared in environments where resources are available and predictable are thought to follow a qualitative reproductive strategy by delaying biological

maturation and forming enduring pair-bonds. Chisholm (1993) reinterpreted Belsky et al.'s theory in terms of early psychosocial stress from a life history theory perspective about the effect of local mortality rates. He suggested that children perceive information about local mortality rates such that those reared in environments of high, but not those in environments of low, mortality will follow a developmental path indicative of a quantitative reproductive strategy to minimize the chances of lineage extinction. A few years later Ellis and colleagues (Ellis, 2004, 2005; Ellis et al., 2003; Ellis, McFadyen-Ketchum, Dodge, Pettit, and Bates, 1999) suggested that paternal parental investment is important above and beyond all early psychosocial stressors (i.e., sexual abuse, quality of family life) in determining the developmental path individuals will follow. In sum, given that Draper and Harpending, Belsky et al., Chisholm and Ellis theorized that individuals who have experienced early psychosocial stress are likely to pursue a quantitative reproductive strategy suggests that these individuals may be more likely to engage in EPCs, a type of opportunistic mating, leading to an increase in offspring especially amongst men.

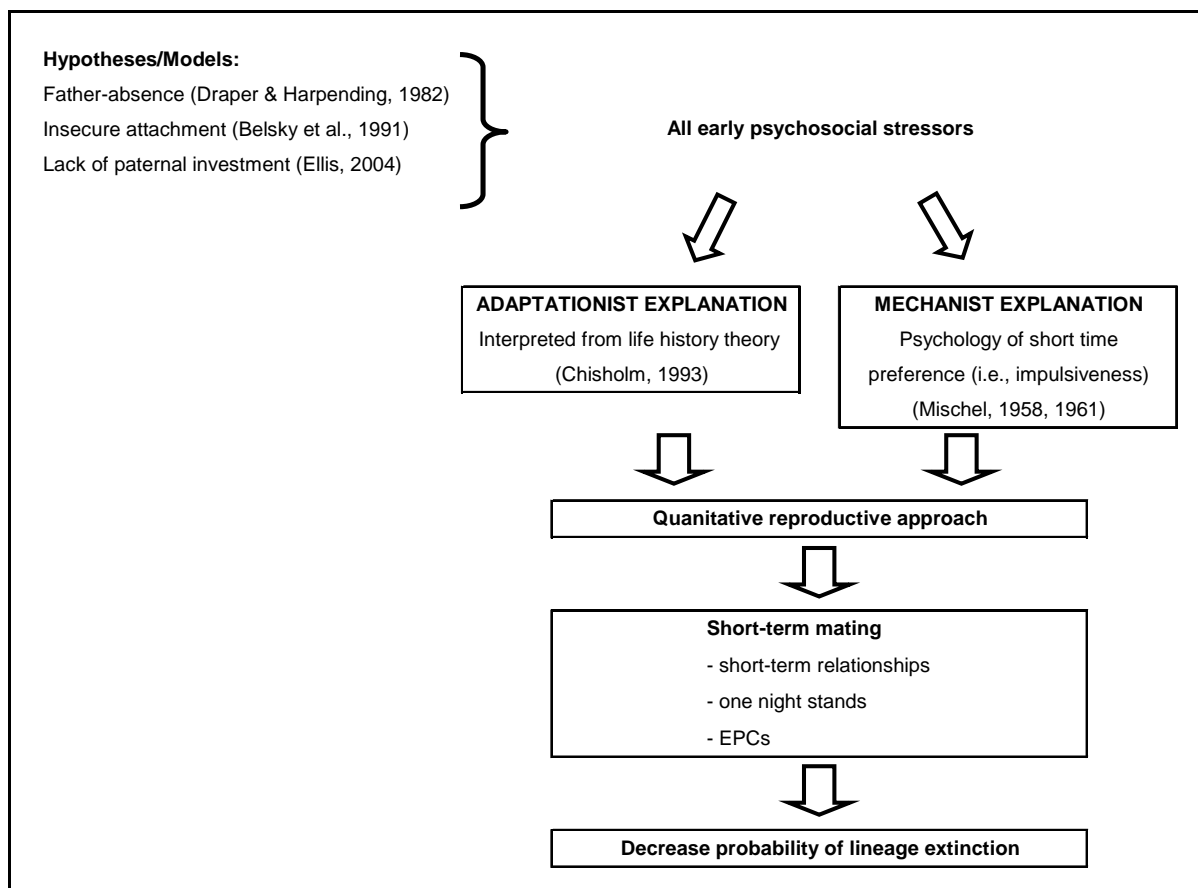
The psychology of time preference, which is also known as intertemporal choice, impulsiveness, delayed gratification, self-control, impatience and discount rates (Chisholm, 1999a, 1999b; Lancaster, 1994), can also explain EPC behavior, together with life history theory. Briefly, according to the psychology of time preference individuals in environments of high risk and uncertainty (i.e., those with early psychosocial stress) are less likely to delay gratification and thus take smaller immediate rewards in favor of larger delayed rewards because in risky and uncertain environments there is the possibility that the larger delayed reward may never be obtained. Mischel (1958, 1961) examined the delay of reinforcement father-present and father-absent young children preferred and found that father-absent children were more likely to favor receiving a smaller immediate reward instead of a delayed larger reward than father-present children. From the perspective of the psychology of time preference, EPC activity may be more likely in those with high, as opposed to low, levels of early psychosocial stress because they are more impulsive in general.

Taken together, the ideas that individuals with high, as opposed to low, levels of early psychosocial stress are more likely to engage in impulsive and risky behaviors, that there is some risk involved in engaging in EPCs, and that early psychosocial stress is theoretically positively associated with opportunistic mating, suggests that individuals who report EPCs may have higher levels of early psychosocial stress than those who do not. Thus, the first aim of our study was to examine this possibility by comparing early psychosocial stress scores of individuals that reported no EPCs to those that reported at least one EPC-S and at least one EPC-O. Our second aim was to examine the relationship between the number of EPC partners individuals report and their level of early psychosocial stress to determine whether those with higher, as opposed to lower, levels of early psychosocial stress engage in such risky behaviors more often. Specifically, we hypothesized that the higher individuals' early psychosocial stress scores the more EPC-S/EPC-O partners they will report.

Allowing for the possibility that individuals could have engaged in both an EPC-O and an EPC-S either simultaneously or consecutively, we also classified participants into one of four groups: (1) no EPCs reported; (2) EPC-O only reported; (3) EPC-S only reported; and (4) both EPC-S and EPC-O (here after referred to as EPC-S&O) reported. On the view that having engaged in any type of EPC (i.e., groups 2 – 4) is more risky than

not, we predicted that individuals belonging to EPC groups 2 – 4 would have higher levels of early psychosocial stress than those who have not engaged in an EPC. On the view that engaging in an EPC-S might be more risky than engaging in an EPC-O, given that in an EPC-S one's own pair-bonded relationship is at stake should one be discovered, we hypothesized that individuals reporting an EPC-S only would have higher levels of early psychosocial stress than those reporting an EPC-O only. Furthermore, considering that individuals who are in the EPC-S&O category would have engaged in an EPC-S, which may be the riskier of the two types of EPCs, we hypothesized that individuals reporting both types of EPCs will have higher levels of early psychosocial stress than those reporting an EPC-O only but should not differ from those reporting an EPC-S only because having an EPC-O should add nothing to the risk of having an EPC-S. All analyses were conducted separately for women and men because the reasons (not necessarily conscious) for engaging in an EPC may be different depending on an individual's gender.

Figure 1. Outcomes of early psychosocial stress from adaptationist and mechanist perspectives. See text for details.



Materials and Methods

Participants

The participants were part of a larger study which investigated the relationship between early psychosocial stress and life history traits, sexual behavior and mate choice who were recruited from university communities (The University of Queensland: $N = 292$; The University of Western Australia: $N = 192$; Curtin University of Technology: $N = 132$), from the general community via advertisements mailed to various Western Australian medical centers ($N = 1$), among family friends ($N = 5$), work colleagues ($N = 19$), by word of mouth by participants ($N = 79$), by placing questionnaires at an annual University of Western Australia Expo in September 2005 ($N = 19$) and from sources unknown ($N = 19$)¹. All participants were given the opportunity to enter a draw to win one of ten \$50 personal checks as compensation for their time. Questionnaires were returned by 326 women and 233 men. Women ($N = 229$) and men ($N = 161$) who fulfilled the following criteria were included in our study: heterosexual, sexually active, at least 18 years of age and no known fertility problems. These women and men had a mean age of 28.3 years ($SD = 10.7$; range = 18 – 64 years) and 26.8 years ($SD = 9.6$; range = 18 – 64 years) respectively.

Procedure

Extra-pair copulations. Participants were asked whether they had engaged in an EPC-S and an EPC-O. EPC-Ss were assessed by asking participants whether they had ever had sex with someone while they themselves were in a relationship with someone else (i.e., they had an affair) and if so with how many individuals. EPC-Os were assessed by asking participants whether they had ever had sex with someone they knew was involved in a relationship with someone else (i.e., the individual they had sex with was having an affair with them) and if so with how many individuals.

Early psychosocial stress. Early psychosocial stress was assessed by asking participants to indicate the frequency/occurrence of any of the following stresses between the ages of 0 and 7 years: psychological abuse (three questions), physical abuse (two questions), sexual abuse (by household members: four questions; by non-household members: four questions), father's or father figure's abuse of mother (four questions), substance abuse by household members (two questions), household member imprisonment (one question), the presence of mentally ill/suicidal household members (two questions), the occurrence of parental divorce/separation (one question) (taken from Anda, Chapman, Felitti, Edwards, Williamson, Croft, et al., 2002; Dietz, Spitz, Anda, Williamson, McMahon, Santelli, et al., 1999; Dong, Anda, Dube, Giles, and Felitti, 2003; Dong, Anda, Felitti, Dube, Williamson, Thompson, et al., 2004; Felitti et al., 1998); the death of various family members (mother, father, siblings, other family members living with the participant), absence of the mother "for what seemed like a long time", and absence of the father "for what seemed like a long time" (taken from Chisholm, 1999a). Unlike previous studies (e.g., Anda et al., 2002), the distinction between abuse by household and non-household members was made because the effects of sexual abuse are more severe if the

¹ Some participants did not indicate where they heard about the study during the recruitment procedure.

abuser was close to the child (e.g., father) than less close (Kendall-Tackett, Williams, and Finkelhor, 1993). Participants were also asked to completed nine 7-point ratings scales (taken from Kim and Smith, 1998a, 1998b) about self-mother (with “self” pertaining to themselves), self-father, mother-father relationships and the general quality of family life between birth and up to and including age 7 years. These ages were chosen to reflect Belsky et al.’s (1991) proposed sensitive period for attachment formation. Participants also had the option of checking “not applicable” to items that did not apply to them (e.g., absence of siblings).

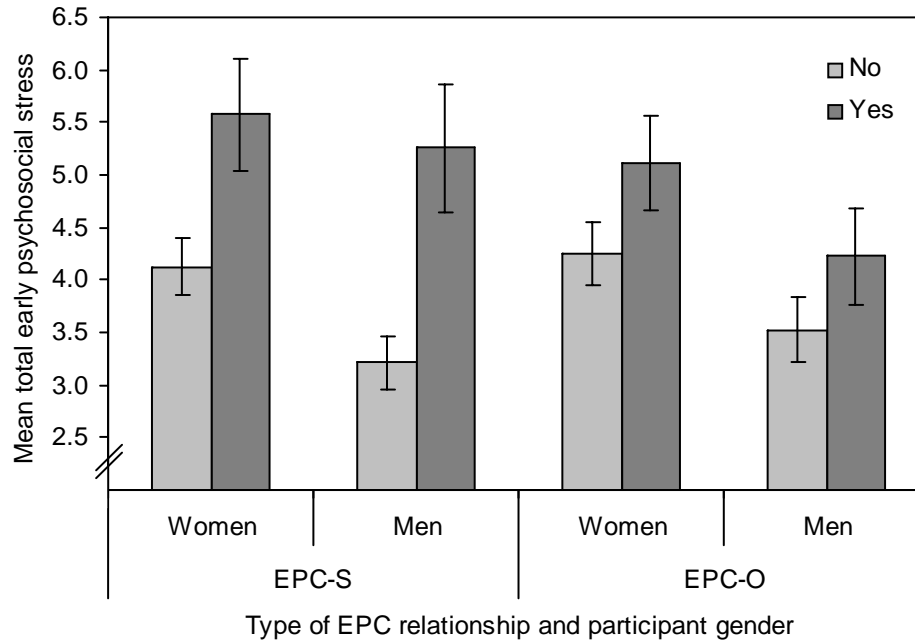
Blank responses to any items used to assess early psychosocial stress were coded as lack of exposure to the item of interest, which was the most conservative option so that any potential findings cannot be attributed to falsely classifying participants as being exposed to a certain stressor. Participants who reported anything but a “never” response, with the exception of blank responses, for questions about psychological abuse, physical abuse, sexual abuse (household), sexual abuse (non-household), and violence towards mother were given a score of 1 per category whereas “never” responses for all questions within a category were scored as 0 for that category. The presence of substance abuse, mental illness, criminal activity, parental divorce/separation, death of mother, death of father, death of sibling, death of a family member, separation from mother, and separation from father, all of which were assessed via one question with the exception of substance abuse and mental illness were given a score of 1 per category whereas the absence of events including non-applicable questions (e.g., not having a father and therefore not responding to questions referring to a father) were scored as 0. For the nine rating scales, ratings below 4 were scored as 1 (i.e., the presence of psychosocial stress), whereas ratings between 4 and 7, including non-applicable responses, were scored as 0. These scores per category/rating were then summed so that participants could obtain a maximum early psychosocial stress score of 24, indicating that they had been exposed to at least one form of stress per category/rating.

Results

Early psychosocial stress scores ranged from 0 to 18 in women ($M = 4.49$, $SD = 3.78$) and 0 to 17 in men ($M = 3.76$, $SD = 3.21$) when the scoring technique of assigning a score of 1 per exposed category and 0 per unexposed category was applied. Just under 10% of participants (Women: 10.0%; Men: 11.8%) reported no early psychosocial stresses at all (i.e., a score of 0).

Fifty-seven women and 43 men reported an EPC-S and 64 women and 53 men reported an EPC-O. As can be seen in figure 2, women and men who reported an EPC-S experienced significantly higher levels of total early psychosocial stress than those who did not report an EPC-S, $t_{227} = 2.54$, $p = .006$ and $t_{159} = 3.71$, $p \leq .001$ respectively (both one-tailed). Individuals who reported an EPC-O also had higher levels of total early psychosocial stress than those did not report an EPC-O, but these differences did not reach significance in women, $t_{227} = 1.55$, $p = .061$, nor in men, $t_{159} = 1.30$, $p = .098$ (both one-tailed).

Figure 2. Mean total early psychosocial stress as a function of the presence (no vs. yes) of EPC-S and EPC-O relationships, irrespective of EPC-Os and EPC-Ss respectively, in women and in men. *SE* bars are shown.



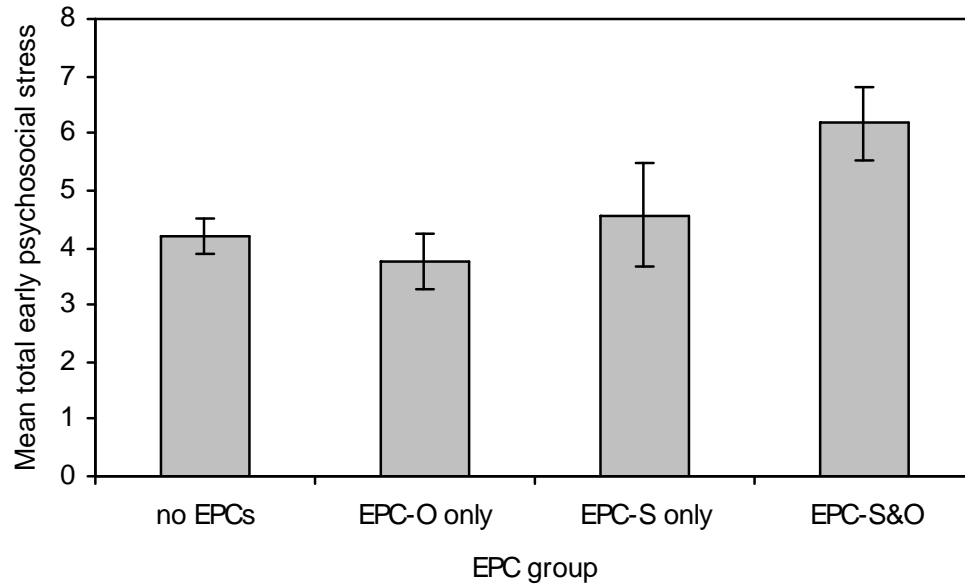
Women reported a mean of 1.83 EPC-Ss ($SD = 1.69$, range = 1 – 8, $N = 53$) and a mean of 1.90 EPC-Os ($SD = 2.33$, range = 1 – 13, $N = 60$), whereas men reported a mean of 1.57 EPC-Ss ($SD = 0.74$, range = 1 – 4, $N = 42$) and a mean of 1.35 EPC-Os ($SD = 0.72$, range = 1 – 5, $N = 49$)². Women's total early psychosocial stress scores were not significantly correlated with the number of EPC-Ss reported, ($r = -0.05$, $p = .370$, one-tailed) nor to the number of EPC-Os reported ($r = 0.19$, $p = .068$, one-tailed). Men's total early psychosocial stress scores correlated significantly with the number of EPC-Ss reported ($r = 0.40$, $p = .004$, one-tailed). On the other hand, like women, men's total early psychosocial stress scores and the number of EPC-Os reported were not significantly correlated ($r = 0.09$, $p = .262$, one-tailed).

Considering that individuals can engage in an EPC-S and an EPC-O simultaneously or consecutively we also assessed the relationship between early psychosocial stress and EPCs by classifying participants into four groups: (1) no EPCs (Women: $N = 144$; Men: $N = 95$); (2) EPC-O only (Women: $N = 28$; Men: $N = 23$); (3) EPC-S only (Women: $N = 21$; Men: $N = 13$); and (4) EPC-S&O (Women: $N = 36$; Men: $N = 30$). Separate ANOVAs with EPC group as a between subjects factor were separately conducted on women's and men's early psychosocial stress scores with six planned comparisons (see Table 2. and Figure 3. for details). Early psychosocial stress was significantly affected by EPC group for women ($F_{3,225} = 3.09$, $p = .028$) and for men ($F_{3,157} = 5.81$, $p = .001$).

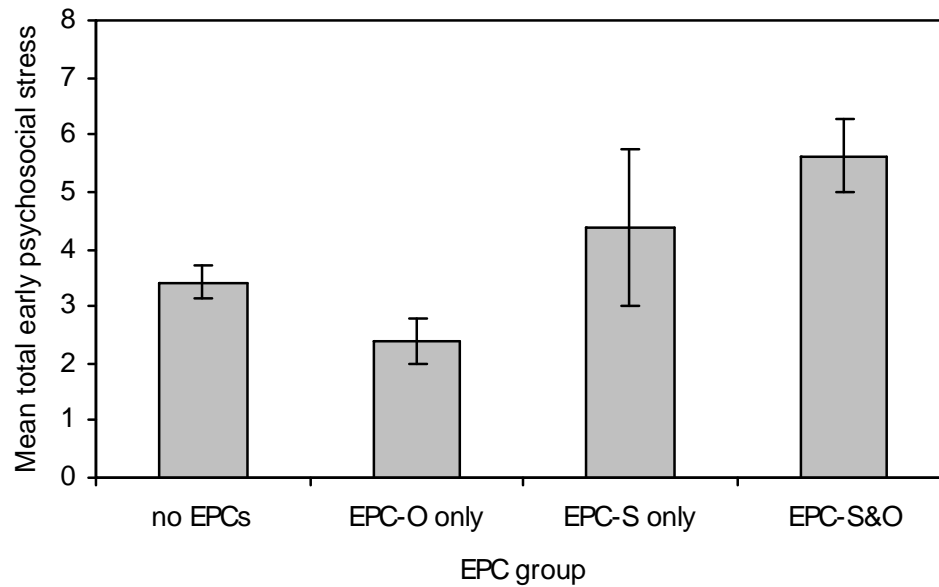
² The number of EPC-S and EPC-O relationships were not reported by all participants.

Figure 3. Mean total early psychosocial stress as a function of EPC group for a) women and b) men. *SE* bars are shown.

a)



b)



Planned comparisons show that individuals who reported both types of EPCs had significantly higher levels of early psychosocial stress than those that reported no EPCs and those that reported an EPC-O only (see Table 2.). Men that reported an EPC-O only had significantly lower levels of early psychosocial stress than those that reported an EPC-S only. No other planned comparisons were significant.

Table 2. Planned comparisons of total early psychosocial stress scores between EPC groups for women and men. All *t*-tests are one-tailed.

Planned comparisons	Women <i>t</i> (225)	Men <i>t</i> (157)
No EPCs vs. EPC-O	0.59 <i>p</i> = .279	1.42 <i>p</i> = .078
No EPCs vs. EPC-S	0.42 <i>p</i> = .335	1.07 <i>p</i> = .143
No EPCs vs. EPC-S&O	2.83 <i>p</i> = .002	3.45 <i>p</i> ≤ .001
EPC-S vs. EPC-O	0.76 <i>p</i> = .223	1.87 <i>p</i> = .032
EPC-S&O vs. EPC-O	2.57 <i>p</i> = .005	3.80 <i>p</i> ≤ .001
EPC-S&O vs. EPC-S	1.56 <i>p</i> = .060	1.22 <i>p</i> = .112

Discussion

The percentage of individuals who engaged in an EPC-S (Women: 24.9%; Men: 26.7%) was remarkably similar to that previously reported amongst predominately Australian university students (Women: 22.2%; Men: 27.9%; Simmons, Firman, Rhodes, and Peters, 2004), suggesting that the level of EPC activity reported within our study is within normal limits given the sample examined.

As predicted, we found that individuals who reported an EPC-S, irrespective of EPC-Os, had significantly higher levels of early psychosocial stress than those that did not. Similar results were obtained when we compared those reporting an EPC-O to those reporting none, irrespective of EPC-S relationships, but this difference did not reach significance. Finding higher levels of early psychosocial stress amongst those reporting an EPC-S than those reporting none can be interpreted from an adaptationist perspective. On this view, higher levels of early psychosocial stress were associated with EPC-Ss because women with high, as opposed to low, levels of early psychosocial stress may be more inclined to cheat on their pair-bonded mate in order to obtain genetic or other benefits for their offspring (e.g., Hrdy, 1981; Jennions and Petrie, 2000) or to increase the genetic diversity of their offspring via having multiple mates (e.g., Kempenaers et al., 1999; Smith, 1984; Yasui, 1998), thus decreasing the chances of lineage extinction, while obtaining resources from a pair-bonded mate. Similarly, men with high, as opposed to low, levels of early psychosocial stress may be more likely to pursue extra-pair matings to obtain more

mating opportunities (e.g., Belsky et al., 1991; Draper and Harpending, 1982, 1988) which would be adaptive to increase the chances of passing copies of one's genes on to the next generation. Furthermore, mating with multiple women also increases the genetic diversity of a man's offspring which furthermore would increase the chances that copies of his genes will survive into subsequent generations.

However, an adaptationist explanation is not the only account which could explain the differences in early psychosocial stress scores between those who have and have not engaged in an EPC-S. From a mechanist point of view, individuals with high, as opposed to low, levels of early psychosocial stress are more inclined to take sexual risks (e.g., Hill et al., 1997) because of the immediate rewards of possibly feeling loved and the gratification associated with risk-taking in general which may outweigh the costs associated with the activity (i.e., the pair-bonded mate finding out), especially if living in an environment of perceived high risk and uncertainty. Thus, it is possible that higher levels of early psychosocial stress were found amongst those reporting an EPC-S than those reporting none because these individuals are more impulsive and seek the gratification of taking risks which is associated with high levels of early psychosocial stress. However, it must be noted that this mechanist explanation does not oppose the adaptationist explanation.

Not only are men with high levels of early psychosocial stress more likely to cheat on their current mate, possibly to increase their mating success, which may function as an adaptation to minimize the chances of lineage extinction, our results also show that the higher their levels of early psychosocial stress the more EPC-S partners they had, thus minimizing their chances of lineage extinction even further. On the other hand, early psychosocial stress was not associated with the number of EPC-S partners women had. Perhaps there was no significant relationship between women's early psychosocial stress scores and their number of EPC-S partners because of their restricted reproductive capabilities (i.e., they can only have one offspring at a time, are not always fertile, and are obligated to more parental investment) – i.e., more matings for women does not necessarily mean more offspring, whereas men's reproductive potentials are less restricted and they are only limited by the availability of fertile women (i.e., they can potentially impregnate many women resulting in many offspring within a short period).

How could a significant association between early psychosocial stress and an EPC-S, but no significant association between early psychosocial stress and an EPC-O be explained? Perhaps there is more personal risk associated with cheating on a pair-bonded mate than engaging in a sexual relationship with someone who is already in a relationship. Furthermore, individuals living in an environment of perceived high risk and uncertainty (i.e., those with high levels of early psychosocial stress) are more likely to partake in risky behaviors (e.g., Berezkei and Csanaky, 1996; Stock et al., 1997; Zierler et al., 1991) than those living in environments of low risk and uncertainty. Taken together, the ideas that EPC-S relationships are riskier than EPC-O relationships and that individuals with high, as opposed to low, levels of early psychosocial stress are more likely to partake in risky activities suggests that EPC-Os are possibly more generally pursued whereas EPC-Ss are more likely to be restricted to those with high levels of early psychosocial stress. This possibility could explain why early psychosocial stress levels were significantly higher in individuals engaging in EPC-Ss, but not EPC-Os.

Considering that individuals could have reported both an EPC-S as well as an EPC-O we re-examined our results by classifying participants into four groups. The EPC group

participants belonged to significantly interacted with the level of early psychosocial stress they had experienced. As anticipated, our planned comparisons showed that individuals who were in the EPC-S&O group had significantly higher levels of early psychosocial stress than those who reported no EPCs. Considering that early psychosocial stress levels significantly differed between those in the EPC-S&O group and those in the EPC-O only group, but not when compared to the EPC-S only group, suggests that having an EPC-O adds nothing to having had an EPC-S (i.e., being in the EPC-S&O group), the most risky activity. These findings strengthen our earlier explanation as to why we found significantly lower levels of early psychosocial stress scores in those reporting no EPCs than those reporting an EPC-S, but not those reporting an EPC-O, when we simply examined EPC-Ss and EPC-Os irrespective of EPC-Os and EPC-Ss respectively. Furthermore, men, but not women, who were in the EPC-S only group had significantly higher levels of early psychosocial stress than those in the EPC-O only group which is consistent with our prediction. It must also be noted that the smallest groups of participants were those in the EPC-S only groups, suggesting that most who engaged in an EPC-S also engaged in an EPC-O.

Theoretically, it is expected that individuals who did not report an EPC would have the lowest early psychosocial stress scores out of the four groups. However, this was not the case. Men who reported no EPCs had slightly, but not statistically significantly, higher levels of early psychosocial stress than those who reported an EPC-O only. Such a finding may be accounted for by the possibility that early psychosocial stress is not the only factor associated with EPC matings and thus despite having experienced early psychosocial stress some individuals may intentionally refrain from engaging in an EPC for certain reasons (e.g., social, cultural, religious).

Although our study provides insight into the relationship between early psychosocial stress and EPCs which can be explained from an adaptationist as well as a mechanist perspective it is not without limitations. First, individuals could simultaneously engage in an EPC-S and an EPC-O (i.e., a pair-bonded individual cheating with a pair-bonded individual) or consecutively engage in an EPC-S and an EPC-O (i.e., a pair-bonded individual cheating with a non-pair-bonded individual followed by the same individual cheating with a pair-bonded individual while they themselves are no longer pair-bonded). However, our study did not distinguish between these two situations and thus our EPC-S&O group could contain both such situations and even participants showing a mix of the two. Second, we did not distinguish between the type of pair-bond relationship (i.e., steady boy/girlfriend, married) participants or their EPC partners were in while engaging in an EPC. Cheating on or cheating with someone else's spouse, as opposed to a boy/girlfriend, is arguably riskier. Third, given that our study included a few individuals (mostly women) who were most likely of a non-reproductive age and that we did not ask participants to report their own and their partner's age at the time of the EPC it is possible that our data included some individuals that were post-menopausal (or had a post-menopausal EPC partner in the case of men) at the time of the EPC and thus these EPCs may have been more purely for gratification given that it could serve no direct reproductive function. However, when we re-analyzed our data by only including women who were not nearly menopausal or post-menopausal at the time of the questionnaire ($N = 211$) and only included men 45 years of age or younger ($N = 149$) the pattern of results remained unchanged with the exception that the planned comparison between EPC-O only and EPC-S&O was significant

in women. Specifically, reproductively aged women in the EPC-S&O group had higher levels of early psychosocial stress than those in the EPC-S only group. However, despite restricting these analyses to participants of reproductive age we are unable to exclude those who had EPC partners that were not of reproductive age because we have no information about their partners. Given these limitations, future studies may benefit by obtaining information about a participant's relationship status and age, as well as their EPC partner's relationship status and age, at the time of the EPC because the risk of engaging in an EPC and the intention of the EPC (which may not necessarily be conscious) may be different depending on these factors.

Overall our results suggest that individuals reporting an EPC-S have higher levels of early psychosocial stress than those not reporting such a relationship which can be explained from an adaptationist and a mechanist perspective in that these individuals may engage in an EPC to minimize the chances of lineage extinction which is high in environments of high risk and uncertainty and/or as an immediate need to feel loved briefly respectively.

Received 10 December 2006; Final revision received 6 February 2007; Accepted 6 February 2007

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