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Sex Differences in Subjective Estimates of Non-Paternity Rates in Austria

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Abstract The determination of paternity is important due to the possibility of cuckoldry and the subsequent squandering of male reproductive effort. Men may be attuned to prevalence rates of cuckoldry in the local environment to assess risk. However, women may have an enhanced ability to assess paternity and may have superior insight into women's sexual infidelity. Accordingly, this study examined subjective estimates of human non-paternity (HNP), the discrepancy between social/legal versus genetic paternity. The hypothesis was that women would provide higher estimates of HNP than men. A sex difference in the hypothesized direction was observed across four community samples of Austrian adults (totalling 763 men and 795 women), with women overall providing higher HNP estimates than men (14.5% vs. 9.1%). Furthermore, key demographic variables impacted HNP estimates for both sexes: individuals who were unmarried, childless, currently unpartnered, or currently in a romantic relationship of a shorter duration provided higher HNP estimates than their counterparts, thus suggesting that such estimates might be attuned to mating effort and strategies, as well as relationship quality and investment.

Keywords Paternity certainty · Sex differences · Subjective estimates · Infidelity · Mate selection

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Introduction

Evolutionary meta-theories predict the occurrence of human non-paternity (HNP), which is the discrepancy between social/legal paternity and genetic paternity (e.g., Symons, 1979). HNP is a consequence of the fact that the sexes have evolved asymmetrically. Men are never certain of their genetic relatedness to a putative offspring, whereas there is no doubt regarding genetic maternity because women conceive internally. Given that ancestral males were always at some risk of cuckoldry, there have evolved several methods for men to determine paternity. Although one might expect physical similarity to be the most useful, it is not, for at least two reasons. First, paternal certainty is manipulated by mothers and mothers' relatives, such that these individuals comment on the paternal resemblance of a neonate, even when there was no apparent resemblance (Daly & Wilson, 1982; McLain, Setters, Moulton, & Pratt, 2000). Second, there is an absence of phenotypic cues to establish paternity certainty; it is easier for people to identify a resemblance between mothers and children than between fathers and children (e.g., Bredart & French, 1999; but see Christenfeld & Hill, 1995).

Due to ethical constraints, it is not possible to obtain a representative sample for a genetic study of HNP. However, one can rely upon non-genetic estimates as a proxy for actual HNP rates. For example, using ratings of emotional closeness, HNP is estimated to be 12.6% (Russell & Wells, 1987) versus 13–20% when measured using discriminative solicitude by kin (Gaulin, McBurney, & Brakeman-Wartell, 1997). Sykes and Irven (2000) obtained a lower HNP of 1.3% when using the frequency of the surname Sykes and genotyping of the Y chromosome. Similarly, one could estimate HNP from rates of extra-pair copulations, arguing that to have a child whose genetic father is not the same as the legal/social father, a woman must commit infidelity (excluding the rare situation of rape). In their large-scale study in Britain, Wellings, Fields, Johnson, and Wadsworth (1994) found that 10.1% of married or cohabiting women reported having heterosexual relations with two or more concurrent partners in the previous 12 months. Similarly, Bellis and Baker (1990) obtained estimates of 6.9–13.8% in the reported frequency of extra-pair sex of respondents to a national magazine survey.

Genetic studies that examine HNP are either not representative of the general population or report only incidental findings. For example, Neel and Weiss (1975) studied the Yanomamo and found approximately 9% of children did not belong to their assigned genetic sibship. Low HNP estimates from genetic studies of paternity testing have been obtained by Brock and Shrimpton (1991; 1.4% in England for testing of cystic fibrosis carrier status), Sasse, Müller, Chakraborty, and Ott (1994; 0.8% using Mendelian inconsistency analyses for 1,607 Swiss children undergoing genetic paternity testing), and Ashton (1980; 2.3% in Hawaii in a heritability study of cognitive abilities). In contrast, Cerda-Flores, Barton, Marty-Gonzalez, Rivas, and Chakraborty (1999) found HNP to be 11.8%, based on genetic exclusions using blood group markers.

Although there is variation in estimates of HNP, the estimate of 10% consistently appears in the literature when the sample is not one that is highly selective, even when various methods are employed. One approach that remains unexplored, however, is to examine lay persons' beliefs (subjective estimates) regarding HNP rates. These estimates reflect individuals' assessments based on their knowledge and opinion (Ayton & Wright, 1994) and, hence, the perception of HNP risk in the current environment. An individual may ascertain the level of HNP from a wide array of sources, such as from conversations with friends and family about infidelity, and the prevalence of advertisements for DNA paternity testing. Therefore, subjective estimates of HNP may reflect an unconscious awareness of cuckoldry risk, which may be important for assessing reproductive success. Furthermore, our study is novel in that we collected subjective estimates from community samples, rather than from university students (e.g., Experiment 1 in McLain et al., 2000), to gain insight into widely held beliefs about HNP prevalence.

Due to a sex difference in insight into women's sexual infidelity and rates of cuckoldry, we hypothesized that women would provide subjective estimates of HNP rates that are in agreement with previous studies (i.e., approximately 10%). A woman has 100% certainty that she is genetically related to a child. Also, she has knowledge of all the possible genetic fathers with whom she has had sexual intercourse. A man usually does not have this information to help establish paternity so there is always the possibility that a given child is not genetically his own.

Research indicates that women go to great lengths to keep their sexual infidelities secretive, especially from their regular partners (Buss, 1994, 2000). The fact that HNP occurs suggests men are not always able to detect women's infidelity, and that women have evolved the ability to hide their infidelity while exploiting paternal investment. Because women's infidelities often may be unknown to their regular partners, most men have no reason to doubt their genetic relatedness to offspring produced by their partners. There is additional research indicating that women and their genetic relatives offer manipulative comments about the physical similarity (and hence genetic relatedness) of an infant to its social father (Daly & Wilson, 1982; Regalski & Gaulin, 1993). The combined effects of these social psychological forces may be that men usually do not seriously doubt their genetic relatedness to putative offspring. Indeed, a man's default assumption may be that he is the genetic father of a child produced by his regular partner. Thus, we hypothesized men would provide lower estimates of HNP relative to women.

We are aware that some lines of evidence regarding men's evolved sexual psychology theoretically could be utilized to posit a reverse hypothesis (i.e., that men would provide higher, rather than lower, HNP estimates than women). For example, men's concerns about cuckoldry and uncertainty of own paternity, their overestimation of women's interest in short-term mating, and their sensitivity (i.e., overperception bias) to the possibility of their partner's sexual infidelity could all be congruent with men's subjective HNP estimates. However, the logic of our hypothesis for the direction of the sex effect expected for HNP estimates, as set out above, remains more plausible.

Method

Participants

A total of 1,558 participants (763 men and 795 women) volunteered to participate in this research. Participants were drawn from four distinct, multipurpose investigations. Sample 1 (477 men and 477 women) was collected in Carinthia (the southernmost Austrian state), whereas samples 2 (102 men and 142 women) and 4 (103 men and 100 women) were collected in and near Vienna. Sample 3 (81 men and 76 women) was collected in Vienna (the 1.7 million-inhabitant capital, located in the eastern part of the country). Participants' mean age (and *SD*) for Samples 1–4 were 27.4 (6.6), 30.8 (7.7), 27.0 (6.6), and 28.1 (8.0) years, respectively.

Procedure

We implemented a HNP estimate item in surveys addressing intimate relationship issues, which were administered in four Austrian community samples. To maximize external validity and to examine the effects of ecologic variation, the surveys were administered in locations that were geographically, economically, and culturally distinct. Following a community-sample procedure (Voracek, 2001), several university-aged male and female research assistants approached potential participants in a variety of public locations.

Measures

Across surveys, the instruction for the HNP estimate item read as follows (note that the language of this study was German and instructions are translated here as close as possible to the original wording): "Non-paternity in humans is a fact of social and sexual life. Sometimes a woman's official mate (the legal/social father of her child) is not actually the genetic/biological father of this child—unbeknownst to him. What is your personal belief, i.e., what is the current rate of non-paternity in Austria? Please give a specific frequency estimate in the form of…per 1,000 children." We asked the question in terms of frequencies to eliminate any cognitive biases due to frame effects (Cosmides & Tooby, 1996). Apart from asking about sex and age, respondents were also queried as to whether they were currently in a romantic relationship (and, if yes, the length of their current relationship in months), if they were married, and if they had children.

Results

Across the four samples, the hypothesized sex difference emerged. A 2 × 4 analysis of variance (ANOVA) was conducted, with sex and location as the between-subject factors. This analysis revealed a main effect of sex, $F(1, 1550) = 26.80$, $p < .001$, that was of small size ($\eta_p^2 = .017$), whereas the effect of location was not significant, $F(3, 1550) < 1$, as was the interaction of sex and location $F(3, 1550) = 1.68$, $p = .17$. Across the four samples combined, women provided higher estimates of HNP than men, $M = 144.6$ ($SD = 153.6$) versus $M = 90.9$ ($SD = 98.7$), respectively.

The results of tests for sex differences (based on independent-groups *t* tests) in HNP estimates within individual samples (1–4) are displayed in Table 1. Across the four surveys, women's mean HNP estimates invariably were higher than those of men. This sex effect was of small-to-medium size and statistically significant in Samples 1, 2, and 4 (Cohen $d = -0.47$, -0.35, and -0.40), whereas of small size and statistically not significant in Sample 3 ($d = -0.16$).

Further analysis, based on the four samples combined suggested that demographic variables available from the surveys were significant correlates of HNP estimates among both men and women. In particular, younger individuals provided higher HNP estimates than elder ones (Pearson $r = -.13$ and $-.18$ for men and women; $ps < .001$), as did unmarried individuals compared with married ones (men: $r = -.09, p < .05$; women: $r = -.15, p < .001$), and childless individuals compared with parents ($r = -.08$ and $-.09$ for men and women; $ps < .05$). Women who were currently romantically uninvolved provided higher HNP estimates than those who were partnered ($r = -.07$, $p < .05$), but this was not the case among men ($r = -.02$), and the length of the current relationship was a negative correlate of HNP estimates for both sexes ($r = -.13$ and $-.16$ for men and women, $ps < .001$).

Table 1 Sex differences in subjective non-paternity estimates (number of children out of 1,000)

	Men		Women		*t*	*p*	*d*
	M	*SD*	*M*	*SD*			
Sample 1 ($n = 947$)	86.5	98.2	150.4	165.6	−7.25	<.001	−0.47
Sample 2 ($n = 244$)	93.1	96.7	134.6	132.9	−2.69	.008	−0.35
Sample 3 ($n = 157$)	112.2	105.4	129.9	114.2	−1.01	.32	−0.16
Sample 4 ($n = 203$)	92.4	97.0	142.0	147.7	−2.84	.005	−0.40
Total (combined $n = 1{,}558$)	90.9	98.7	144.6	153.6	−8.17	<.001	−0.41

Note: $t = t$ test statistic, along with associated *p* value (two-tailed); $d =$ Cohen's *d* effect-size metric (male mean minus female mean, divided through the square root of the weighted mean of the group variances)

Discussion

We proposed a sex difference in subjective estimates of HNP, such that women were expected to provide higher assessments of HNP than men, due to their greater insight into women's sexual infidelity. A sex difference in the hypothesized direction was observed across four surveys, with women overall providing higher HNP estimates than men (14.5% vs. 9.1% in the combined sample). Furthermore, key demographic variables impacted HNP estimates for both sexes: individuals who were unmarried, childless, romantically uninvolved, or in a romantic relationship of a shorter duration provided higher HNP estimates than their counterparts, suggesting that such estimates might be attuned to mating effort and strategies, and to relationship quality and investment.

Although there was a significant sex difference in prevalence estimates in the combined sample and across three of the four individual surveys, both sexes' subjective HNP estimates were around 10% to 15% (i.e., around 100–150 per 1,000 children). This estimated rate of HNP is more in accord with indirect HNP estimates than with genetic HNP data for a comparable population (Switzerland: 0.8%; Sasse et al., 1994). Because the genetic data were obtained from a non-random clinical sample, it is possible that the indirect data reflect a more accurate prevalence rate. However, due to evolved strategies of suspicion and vigilance with regards to infidelity, it is possible that the indirect data reflect a higher rate of non-paternity than that which actually occurs.

This discrepancy in prevalence arising from different sources should be the topic of future research. One way to clarify this discrepancy would be to solicit participation from women with children and ask them to anonymously report their reproductive history with respect to HNP. Perhaps this type of investigation would yield more accurate HNP estimates, as well as providing information about the prevalence of HNP over the lifespan. A second method would be to secure historical hospital files of blood-typed newborns and their parents to determine HNP. An informally reported finding from the 1940s (cited by Diamond, 1991, 2003) indicates that this approach is promising. The genetic transmission of blood type was examined by typing newborns, mothers, and fathers in the Blood Grouping Laboratory near Boston's Children Medical Center. This research revealed an incidental finding of a HNP of approximately 10%.

With regard to the observed cross-sample variation in the magnitude of the sex difference (Table 1), we emphasize that Sample 1 was collected in Carinthia, Samples 2 and 4 in and near Vienna, and Sample 3 in Vienna. Both historically and presently, Carinthia belongs to a small geographic belt, including regions in Upper Austria, Styria, Northern Italy, and Slovenia, which has long been known for notably high rates of out-of-wedlock births and single-parent families (Bauer, 1996). Populations with low socioeconomic status tend to demonstrate higher levels of HNP, whereas high socioeconomic status translates to lower levels of HNP (Baker & Bellis, 1995; Cerda-Flores et al., 1999). The estimates collected from Carinthia, which demonstrated the largest divergence in women's and men's subjective estimates of HNP, may well reflect these sociocultural surroundings. Among our study sites, it is possible that Carinthia has the highest level of HNP. However, the current database was unable to elucidate upon this point further.

The possibility that the sociocultural environment is reflected in the subjective estimates is supported by the sample collected in Vienna. In contrast to Carinthia, Vienna is the urbanized capital city, and the population has comparatively high socioeconomic status. For this sample, there was no significant sex difference in subjective estimates of HNP, confirming the possibility that estimates are related to current sociocultural events. This explanation is further supported by the remaining two samples collected near or in Vienna. Although these samples demonstrated a sex difference, the sexes were less discrepant than for the Carinthia sample, and yet more different than the sample collected solely in Vienna.

The suggestion that HNP rates vary due to sociocultural circumstances is not new to this study. MacIntyre and Sooman (1991) hypothesized that HNP rates "vary between countries, and vary within countries by age group, cultural or ethnic group, region, and age or duration of partnership" (p. 870). To support this claim, they reported the varying levels of multiple sexual partner involvement in relation to female age and relationship status in London, Edinburgh, and Glasgow. MacIntyre and Sooman concluded that the quest for a universal rate of HNP is futile, due to the extent of variation in rates from sociocultural factors. Our findings are consistent with this idea in that subjective HNP estimates varied to some extent, although not significantly, by location within Austria.

Previous research has attempted to estimate HNP using a variety of techniques. However, to the best of our knowledge, no study has examined subjective HNP estimates. We propose that this method might be a fruitful approach for determining people's beliefs about the expected levels of risk for adaptive situations. Specifically, Ayton and Wright (1994) proposed that people intuitively create an expected utility analysis to make decisions and, thus, subjective estimates reflect judgments within a context. When the context influences reproductive decisions, such as whether to make paternal investment, subjective estimates may serve as a proxy measure of HNP. Additionally, we have proposed that this decision-making process is influenced by the current environmental conditions. For example, a man living in Carinthia should, adaptively speaking, make different decisions about paternal investment than a man living in Vienna due to the possibly higher rate of HNP. It would be informative for a future investigation to assess whether men in these two locations have varying levels of paternal investment in offspring due to differences in subjective estimates of HNP rates.

In this context, some limitations of the present research are acknowledged. The current findings were based on a single-item measure, and no control items were administered with this subjective HNP estimate item. For future research, it would be interesting to administer control items (i.e., other frequency estimates, using the same item format) for which no sex effect is expected (e.g., the subjectively estimated infant death rate per 1,000 births). Relatedly, one could administer control items that are topically related and for which a sex difference is also hypothesized (e.g., subjective estimates of rates of sexual infidelity). This procedure would enable a more direct test of the hypothesis that women's higher HNP estimates are due to their more accurate, implicit knowledge of the actual prevalence of sexual infidelity.

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