ELSEVIER

Evolution and Human Behavior 22 (2001) 329–334

Evolution and Human Behavior

Why father absence might precipitate early menarche The role of polygyny

Satoshi Kanazawa

Department of Sociology, Indiana University of Pennsylvania, Indiana, PA 15705-1087, USA

Received 6 February 2001; accepted 7 May 2001

Abstract

An evolutionary model of conditional reproductive strategies argues that girls whose fathers are absent or make little parental investment experience early puberty. However, such a conditional strategy cannot be adaptive unless the absence of the girl's father at the microlevel is predictive of some recurrent feature of the macrosocial system and early puberty is advantageous in the system. I argue that father absence is indicative of the degree of polygyny (simultaneous and serial) in society. Polygyny of both kinds creates a shortage of women in reproductive age, and thus, early puberty will be advantageous. Available comparative data indicate that the degree of polygyny is associated with a decrease in the mean age of menarche across societies, as is the divorce rate, a presumptive index of serial polygyny, in strictly monogamous societies.

Keywords: Dads–Cads; Conditional reproductive strategies; Divorce

An evolutionary model of conditional reproductive strategies (Belsky, Steinberg, & Draper, 1991; Draper & Harpending, 1982, 1988) explains the timing of girls' puberty in terms of the presence or absence of their fathers and how much parental investment they make (the amount of *time* and *effort* they spend with their daughters). The model argues that the presence or absence of a girl's father during childhood provides a predictive cue for the local participation of males in biparental care and hence for the amount of paternal investment that she can expect from her own partner later in life. The human female has therefore evolved a facultative (conditional) response to this cue such that she matures earlier if her father is absent during her childhood than if he is present. While there has been considerable

E-mail address: kanazawa@grove.iup.edu (S. Kanazawa).

1090-5138/01/$ – see front matter
PII: S1090-5138(01)00073-3

empirical support for this model (Ellis, McFadyen-Ketchum, Dodge, Pettit, & Bates, 1999; Hetherington, 1972; Jones, Leeton, McLeod, & Wood, 1972; Moffitt, Caspi, Belsky, & Silva, 1992; Surbey, 1990; Wierson, Long, & Forehand, 1993), the theoretical rationale for why girls should respond to father absence by maturing early has never been apparent.

Assume that 50% of men in a society comprises "cads" and the other 50% "dads" (Draper & Harpending, 1982, 1988). Further assume that there is no inherited tendency for girls to mate with one kind or the other; daughters of women who mated with cads are no more likely to mate with cads than those of women who mated with dads. (If there is such a heritable tendency, which is possible, then the reproductive strategies become *alternative*, not conditional (Ellis et al., 1999, pp. 396–397).) In this situation, if girls from father-absent homes experience early puberty and adopt a more promiscuous reproductive strategy (mating without long-term commitment), then their strategy will be just as likely to be maladaptive as to be adaptive because they will be just as likely to mate with a dad as with a cad. The same is true of girls from father-present homes. If they delay their puberty and avoid sexual promiscuity, their strategy will be just as likely to be maladaptive as to be adaptive because they will be just as likely to mate with a cad as with a dad. Under such circumstances, any evolved tendency to take cues from the mating situations of their mothers, as is posited by the model, will not be selected.

In order for such an evolved psychological mechanism to emerge, there has to be *a statistical association* between the mothers' and the daughters' choices of mates, *in the absence of genetic transmission of preference for dads or cads.* Daughters from father-absent homes must be more likely to mate with cads, and daughters from father-present homes must be more likely to mate with dads. What can create such intergenerational continuation in mating patterns?

I argue that what accounts for such intergenerational continuity is the institution of marriage. Under the polygynous institution of marriage, fathers are married to several wives simultaneously and are therefore spread thin, relative to monogamous fathers. While men in polygynous marriages are usually wealthier than those in monogamous marriages or mateless men (Borgerhoff Mulder, 1990; Kanazawa & Still, 1999), they have no more time or energy; even the wealthiest polygynist has only 24 hours a day. Thus, ceteris paribus, fathers in polygynous marriages can invest far less time and effort in each of their children than fathers in monogamous marriages. Polygyny therefore induces father absence.

Even in strictly monogamous societies, wealthy men of high status can still practice serial polygyny by leaving wives past reproductive age (and their children) and marrying successively younger women. In strictly monogamous societies, divorce and the consequent serial polygyny therefore induce father absence. I contend that father absence at the microlevel (experienced by girls in their homes) is an indicator of the degree of polygyny (whether simultaneous or serial) in society at the macrolevel. The more polygynous the society is, the more likely father absence is.

Polygyny of either kind creates a shortage of women in reproductive age. Under strict monogamy, all adult males are already mated with adult females (Kanazawa & Still, 1999), and the only males available to pubertal females for mating are other pubertal or prepubertal males. Young males are not in a position to start their reproductive careers until after they accumulate sufficient resources to invest in their offspring. Under strict monogamy, a

12-year-old girl who goes through puberty cannot marry a 12-year-old (or even 18-year-old) boy, so there is no incentive for her to mature early.

In contrast, under polygyny, adult males who are already mated can mate again, either by taking on additional wives (in the case of simultaneous polygyny) or by divorcing their post-reproductive wives and marrying successively younger wives (in the case of serial polygyny). Thus, a 12-year-old girl in a polygynous society who has gone through puberty can be mated to a 40-year-old polygynist or divorcé whereas her agemate who has not gone through puberty cannot. So girls who mature early are at a reproductive advantage under polygyny. Women in polygynous societies on average marry older men than do women in monogamous societies. In my data (see below), there is a significant correlation between the degree of polygyny and the mean age difference between grooms and brides across all societies ($r = .3361$, $P < .001$; $n = 108$). The mean age difference is 3.0 in largely monogamous societies, and 4.5 in largely polygynous societies ($t = 4.18$, $P < .001$).

I believe this is why father absence and lack of parental investment by the father, which function as microlevel indicators of the macrolevel degree of polygyny, lead to early puberty. If my thesis is correct, then, across all societies, the degree of (simultaneous) polygyny should decrease the mean age of menarche among girls. Furthermore, among strictly monogamous societies (where simultaneous polygyny is not allowed), the rates of divorce (which functions as an indicator of the degree of serial polygyny) should also decrease the mean age of menarche among girls. I will subject these two hypotheses to empirical test with available comparative data.

For the dependent variable, I use the mean age of menarche in Eveleth and Tanner's (1990) comprehensive review of human growth. One of their chapters is devoted to rate of maturation, and their Table 10 (pp. 162–165) lists 117 samples taken from studies on the age of menarche conducted throughout the world. For each sample, Eveleth and Tanner list the mean and standard error of the age of menarche and the year of the study. I use samples as the units of analysis in the following analyses.

For a measure of the degree of simultaneous polygyny, I rely on the *Encyclopedia of World Cultures* (Levinson, 1991–1995). The measure varies continuously from 0 (monogamy is the rule and is widespread) to 3 (polygyny is the rule and is widespread) (see Kanazawa & Still, 1999 for the details of the construction of this variable). For a measure of serial polygyny in strictly monogamous countries, I use the annual rate of divorce (the number of divorce per 1000 inhabitants) available from published sources (The Economist, 1990; United Nations, 1992). Because my hypothesis predicts the direction of the effects of these two variables upon the age of menarche, I adopt an α level (the criterion of statistical significance) of 0.10.

Because human physical development in general, and the age of menarche in particular, are strongly affected by economic welfare of the society and nutritional conditions of the people, I control for the general health and welfare of the population in the multivariate analyses. First, I include GDP per capita as a measure of the general economic development of the nations. Second, in order to measure the welfare of women specifically, I include the percentage of women in society who are literate. This is admittedly a very oblique measure of women's nutritional conditions, but better and more precise measures are not widely available for a large number of nations.

In order to assess any worldwide trend toward earlier puberty, discussed both in popular media (Lemonick, 2000) and scholarly work (Herman-Giddens et al., 1997), I include the year of the study as a control variable. Finally, since the rates of physical maturation and development are known to differ by race (Harlan, Harlan, & Grillo, 1980; Rowe & Rodgers, 1994), I enter two dummy variables for predominantly black and Asian samples, with predominantly white samples as the reference category.

Table 1 presents the results of OLS regression analyses. The first column shows that across all countries ($n = 78$ due to listwise deletion of cases for missing data), the degree of simultaneous polygyny has a statistically significantly ($P < .10$) negative effect on the mean age of menarche. Controlling for economic development, general welfare of women, survey year, and the race of the sample, the mean age of menarche is lower among more polygynous societies, and higher among more monogamous societies. This is precisely the pattern predicted from my thesis of father absence as a microlevel indicator of macrolevel degree of simultaneous polygyny. Incidentally, a statistically significantly negative effect of survey year on the mean age of menarche demonstrates that the age of menarche has been declining over the years throughout the world.

The coefficients in the second column show that the mean age of marriage among women has a statistically significantly positive effect on the mean age of menarche. Once again, controlling for the same variables, the lower the mean age of marriage among women, the lower the mean age of menarche. Now I do not claim that the direction of causality is necessarily from the mean age of marriage to the mean age of menarche; it could very well be the reverse. However, the result does indicate that, controlling for relevant variables, women

Table 1
Determinants of mean age of menarche: multivariate model results

	(1)	(2)	(3)
Independent variables			
Polygyny	−0.2859† (0.1700)		
Female mean age of marriage		0.1974† (0.1152)	
Divorce rate			−2.0901 (1.7750)
Control variables			
Economic development	-4.8997^{-5}* (2.3651^{-5})	-1.1699^{-4}** (4.1353^{-5})	-3.3400^{-4} (1.8976^{-4})
Women's welfare	−0.0181** (0.0065)	−0.0063 (0.0060)	0.3785 (0.4059)
Year	−0.0389* (0.0147)	−0.0286† (0.0155)	−0.0045 (0.0274)
Black sample	0.5321 (0.3711)	0.1740 (0.4917)	
Asian sample	0.5780* (0.2769)	0.2456 (0.3066)	
Constant	90.0032 (29.0656)	65.5647 (31.2573)	28.9907 (51.3801)
R^2	0.4425	0.5412	0.7760
Adjusted R^2	0.3918	0.4310	0.6267
n	73	32	11

Standard errors are in parentheses.
† $P < .10$ (two-tailed tests).
* $P < .05$.
** $P < .01$.

tend to marry early if they experience puberty early. This is consistent with my claim that early puberty is beneficial for women in polygynous societies with a shortage of women in reproductive age because post-pubertal girls can then get married earlier.

Finally, among the strictly monogamous societies in my sample ($n = 11$), divorce rate has a negative effect on the mean age of menarche (third column). Controlling for the same variables (except for the race of the samples; all samples in this analysis are white), the rate of divorce decreases the mean age of menarche. Perhaps because of the extremely small sample size, however, the coefficient is not statistically significant ($P = .28$). (Note that none of the coefficients in this equation is statistically significant.) However, the partial relationship between divorce rate and mean age of menarche among these 11 strictly monogamous societies, presented in the partial residual plot (Fig. 1), appears negative. Since divorce often causes father absence, my finding here replicates at the macrolevel the microlevel relationship between father absence and early menarche found in numerous studies cited above, and is consistent with my contention that the institution of marriage sets the level of father absence in society.

The available comparative data therefore seem to support my contention that father absence in the family is a microlevel indicator of the macrolevel degree of polygyny in society. Across all societies, the more polygynous the society is, the lower the mean age of menarche. Among strictly monogamous societies, the higher the divorce rate, the lower the mean age of menarche. From this perspective, the historical trend in the declining age of puberty in the US and other monogamous societies may be attributable to the high degree of

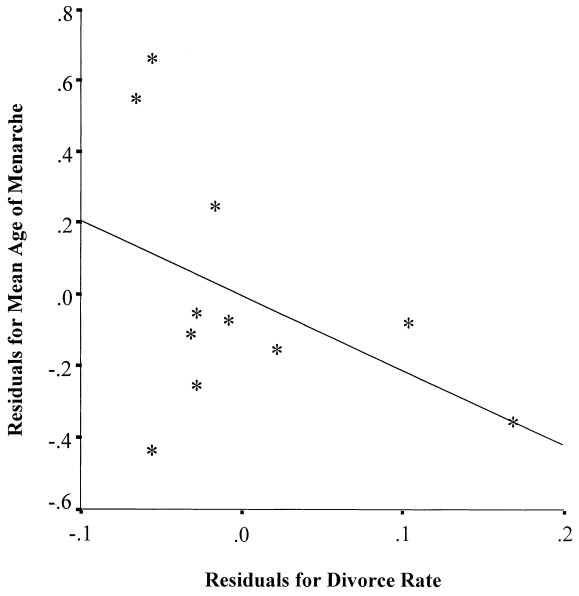

Fig. 1. Partial residual plot of the relationship between divorce rate and mean age of menarche in 11 countries with strict monogamy.

serial polygyny as a result of soaring divorce rates and increasing numbers of single-parent (matrifocal) families.

Acknowledgments

I thank Jay Belsky and Editors for their comments on earlier drafts.

References

Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: an evolutionary theory of socialization. *Child Development*, *62*, 647–670.

Borgerhoff Mulder, M. (1990). Kipsigis women's preferences for wealthy men: evidence for female choice in mammals? *Behavioral Ecology and Sociobiology*, *27*, 255–264.

Draper, P., & Harpending, H. (1982). Father absence and reproductive strategy: an evolutionary perspective. *Journal of Anthropological Research*, *38*, 255–273.

Draper, P., & Harpending, H. (1988). A sociobiological perspective on the development of human reproductive strategies. In: K. B. MacDonald (Ed.), *Sociobiological perspectives on human development* (pp. 340–372). New York: Springer-Verlag.

Ellis, B. J., McFadyen-Ketchum, S., Dodge, K. A., Pettit, G. S., & Bates, J. E. (1999). Quality of early family relationships and individual differences in the timing of pubertal maturation in girls: a longitudinal test of an evolutionary model. *Journal of Personality and Social Psychology*, *77*, 387–401.

Eveleth, P. B., & Tanner, J. M. (1990). *Worldwide variation in human growth* (2nd ed.). Cambridge: Cambridge Univ. Press.

Harlan, W. R., Harlan, E. A., & Grillo, G. P. (1980). Secondary sex characteristics of girls 12 to 17 years of age: the US health examination survey. *Journal of Pediatrics*, *96*, 1074–1078.

Herman-Giddens, M. E., Slora, E. J., Wasserman, R. C., Bourdony, C. J., Bhapkar, M. V., Koch, G. G., & Hasemeier, C. M. (1997). Secondary sexual characteristics and menses in young girls seen in office practice: a study from the pediatric research in office settings network. *Pediatrics*, *99*, 505–512.

Hetherington, E. M. (1972). Effects of father absence on personality development in adolescent daughters. *Developmental Psychology*, *7*, 312–326.

Jones, B., Leeton, J., McLeod, I., & Wood, C. (1972). Factors influencing the age of menarche in a lower socioeconomic group in Melbourne. *Medical Journal of Australia*, *2*, 533–535.

Kanazawa, S., & Still, M. C. (1999). Why monogamy? *Social Forces*, *78*, 25–50.

Lemonick, M. D. (2000). Teens before their time. *Time*, *30*, 66–74 (October).

Levinson, D. (Ed.). (1991–1995). *Encyclopedia of world cultures* (10 volumes). Boston: G.K. Hall.

Moffitt, T. E., Caspi, A., Belsky, J., & Silva, P. A. (1992). Childhood experience and onset of menarche: a test of a sociobiological model. *Child Development*, *63*, 47–58.

Rowe, D. C., & Rodgers, J. L. (1994). A social contagion model of adolescent sexual behavior: explaining race differences. *Social Biology*, *41*, 1–18.

Surbey, M. (1990). Family composition, stress, and human menarche. In: F. Bercovitch, & T. Zeigler (Eds.), *The socioendocrinology of primate reproduction* (pp. 71–97). New York: Liss.

The Economist. (1990). *The economist book of vital statistics*. New York: Times Books.

United Nations. (1992). *Statistical yearbook 1988/89* (37th ed.). New York: United Nations.

Wierson, M., Long, P. J., & Forehand, R. L. (1993). Toward a new understanding of early menarche: the role of environmental stress in pubertal timing. *Adolescence*, *28*, 913–924.