Paula Sheppard and Rebecca Sear

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FATHER ABSENCE PREDICTS AGE AT SEXUAL MATURITY AND REPRODUCTIVE TIMING IN BRITISH MEN

Paula Sheppard[1]*
Rebecca Sear[2]

[1]Institute of Social Psychology, London School of Economics, Houghton Street, London, WC2A 2AE, UK
[2]Department of Anthropology, Durham University, Durham, DH1 3LE, UK

*corresponding author: p.j.sheppard@lse.ac.uk

SUMMARY

Despite the widespread assumption that paternal investment is substantial in our species, previous studies have shown mixed results in relation to the impact of fathers on both offspring survival and reproductive outcomes. Using data from a large representative sample of British men, we tested whether father absence is associated with the timing of reproduction-related events among boys, while controlling for various cues denoting early childhood adversity. We further tested whether the loss of the father at different childhood stages matters so as to assess whether early-life is the most important period or if effects can be seen during later childhood. The results show that father absence before age seven is associated with early reproduction, while father absence between ages 11 and 16 only is associated with delayed voice-breaking (a proxy for puberty), even after adjusting for other factors denoting childhood adversity. We conclude that fathers do exert an influence on male reproductive outcomes, independently of other childhood adversities, and that these effects are sensitive to the timing of father absence.

Keywords: fathers, paternal investment, male puberty, voice-breaking, reproduction, childhood

1. INTRODUCTION

Compared with other mammals, human fathers invest heavily in their offspring [1]. A tenacious theory in evolutionary anthropology is that fathers are essential providers of resources for their mates and highly dependent offspring and that this leads to stable nuclear families[2]. Empirical evidence, however, does not always support this view; fathers are often reported to have little if any positive effect on infant survival or health [3], and evolutionary anthropologists have more recently suggested that women draw upon other individuals such as grandmothers and their older children for help in raising viable offspring [4, 5]. It is possible, however, that fathers benefit older offspring by positively affecting their reproductive outcomes.

Research on the influence of fathers on reproductive outcomes has mainly focused on girls within a developed world context and generally shows that father absence accelerates life events: fatherless daughters tend to mature earlier [6-9], fare poorly academically [10] and reproduce earlier [11, 12] than girls from two-parent families. This is usually attributed to the life history theory (LHT) tenet that sub-optimal conditions in early life are cues to a shortened life expectancy and so, assuming that father absence is indicative of a stressed childhood environment, early reproduction is the optimal strategy [13, 14]. These studies often do not however separate father absence from general childhood adversity and so do not necessarily show that father absence itself is significant for reproductive timing. A handful of studies have reported similar findings for males in Western populations showing father absence to be associated with younger ages at puberty [8] and parenthood [15]; in contrast to studies among forager populations which generally find that father absence is more likely to result in the delaying of male reproduction [16, 17] or to have no effect at all [18].

This study aims to disentangle these two alternative (although not necessarily mutually exclusive) explanations for father absence effects by determining whether fathers exert an

independent influence on offspring outcomes or if father absence may simply be an indicator of a sub-optimal environment. We do this by developing models that examine the association between father absence and the timing of reproduction-related outcomes, controlling for other factors representing cues to a deficient early environment. We also separate father absence into three age groups in order to isolate early childhood factors (argued to be crucial time influencing life history strategy [7]) from later childhood stages.

2. MATERIAL AND METHODS

We used data from the UK National Child Development Study (NCDS), to examine the association between father absence and timing of voice-breaking (a proxy for puberty), marriage, reproduction, and intended ages for both of these (some evidence shows that childhood adversity is also related to female teenagers' intentions for timing of marriage and childbearing [12]).

The NCDS is an ongoing survey of all British children born in the first week of March 1958 providing an array of information on socio-economic, health and family circumstances over time[19]. We use data from five waves: birth, age seven, 11, 16 and 23 because information about early life conditions as well as the timing of reproductive events can be captured by this age (n=9,596). There is a substantial amount of missing data in the NCDS and so multiple imputations for missing data were performed [20]. Binomial logit models were fitted to estimate the odds ratios for the timing of each life event in relation to father absence at different times during childhood, adjusting for other early childhood factors. Father absence is defined as having no natural father in the household at age seven, or the father becoming missing from the household between ages seven and 11, or between ages 11 and 16; the reference category included children whose natural father resided in the household up to age 16. Table 1 shows the proportions of boys who had experienced these events.

The variables denoting a sub-optimal early environment are: Breastfed for less than one month, more than two household moves, separated from mother for more than one month, and father's social class at birth. These particular variables have all been shown to have an accelerating effect on female reproductive outcomes in this cohort [14]. We also control for birth weight and body mass index (BMI) at age seven. Among girls BMI is known to be associated with early pubertal maturation [21, 22] and birth weight with early reproduction [12]. Among boys, some evidence shows that BMI at age five is correlated with pubertal maturation [22, 23] and that birth weight may also be important [24].

Table 1: *Descriptions of key variables*

Variable description:	**N (%)**
Father absent by age 7	549 (7.3)
Father absent between ages 7 and 11	157 (2.5)
Father absent between ages 11 and 16	239 (4.6)
Voice broken at age 13 or younger (Mean age: 13.81 years)	1712 (28.8)
Intention for marriage by age 21*	2241 (36.4)
Intention for children by age 21*	810 (13.2)
Married by age 23	2325 (37.1)
Has had at least one child by age 23	1118 (17.9)

* asked of boys at age 16

3. RESULTS

Father absence was found to be associated with pubertal maturation but only if the father became absent during the adolescent period (table 2, figure 1). Father-absent boys were also less likely to have been married by age 23 but the only statistically significant association was for father loss between ages seven and 11. Father absence was not associated with stated intentions to either reproduce or marry; effect sizes were very small, non-significant, and the direction of the effects was inconsistent across all age groups. Father absence was however associated with early reproduction: boys with absent fathers were more likely to have had at least one child by age 23, regardless of the age at which they lost their father, although the only

statistically significant effect was for those who lost their fathers before age seven, suggesting that this might be a particularly influential period (table 2, figure 2). These results hold despite controlling for the variables indicating a sub-optimal childhood environment. As expected, two early environment factors; social class and breastfed for less than one month, are associated with early reproductive outcomes although not for voice-breaking.

Figure 1: Father absence and predicted probabilities of voice breaking by age 13, n=8638
Black bars show father presence and light grey ones, father absence

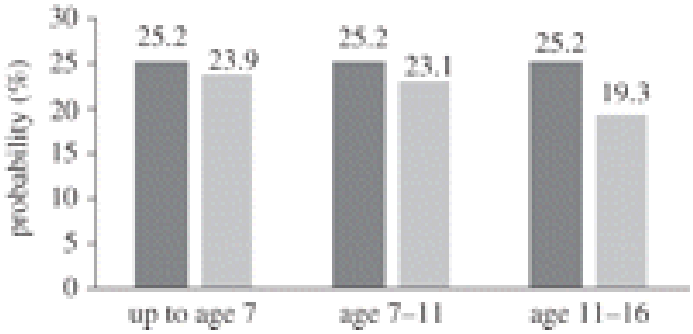

Figure 2: Father absence and predicted probabilities of reproduction by age 23, n=8640
Black bars show father presence and light grey ones, father absence

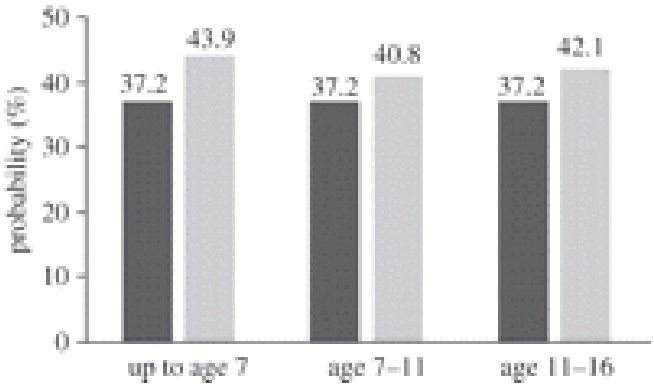

Table 2: *Results from binary logit models showing odds ratios and 95% confidence intervals*

	Odds Ratios	95% Confidence Intervals
VOICE BROKEN AT AGE 13 OR YOUNGER[a]		
Father absent by age 7	0.933	0.755 – 1.153
Father absent between ages 7 and 11	0.891	0.702 – 1.132
Father absent between ages 11 and 16	0.709***	0.605 – 0.832
Breastfed for less than 1 month (ref: >1 month)	0.983	0.879 – 1.099
2 or more household moves (ref: <2 moves)	1.097	0.971 – 1.239
Separated from mother for 1 month or more (ref: < 1month)	0.931	0.730 – 1.187
BMI at age 7	1.083***	1.043 – 1.124
Birth weight in ounces	0.999	0.996 – 1.002
Social class at birth (1=highest, 6=lowest)	0.961	0.914 – 1.010
INTENTION TO MARRY AFTER AGE 21[b]		
Father absent by age 7	1.228	0.953 – 1.583
Father absent between ages 7 and 11	0.991	0.812 – 1.211
Father absent between ages 11 and 16	1.185	0.995 – 1.411
Breastfed for less than 1 month (ref: >1 month)	0.822***	0.746 – 0.907
2 or more household moves (ref: <2 moves)	0.984	0.851 – 1.138
Separated from mother for 1 month or more (ref: < 1 month)	0.968	0.762 – 1.227
BMI at age 7	1.002	0.971 – 1.035
Birth weight in ounces	1.003*	1.000 – 1.007
Social class at birth (1=highest, 6=lowest)	0.793***	0.751 – 0.837
INTENTION FOR CHILDREN BY AGE 21[c]		
Father absent by age 7	0.930	0.684 – 1.266
Father absent between ages 7 and 11	1.057	0.787 – 1.420
Father absent between ages 11 and 16	1.040	0.837 – 1.293
Breastfed for less than 1 month (ref: >1 month)	1.078	0.937 – 1.240
2 or more household moves (ref: <2 moves)	1.048	0.894 – 1.228
Separated from mother for 1 month or more (ref: <1 month)	0.988	0.783 – 1.247
BMI at age 7	1.032	0.981 – 1.085
Birth weight in ounces	0.995	0.990 – 1.000
Social class at birth (1=highest, 6=lowest)	1.267***	1.170 – 1.372
MARRIED BY AGE 23[d]		
Father absent by age 7	0.909	0.724 – 1.142
Father absent between ages 7 and 11	0.796**	0.669 – 0.946
Father absent between ages 11 and 16	0.918	0.774 – 1.088
Breastfed for less than 1 month (ref: >1 month)	1.161**	1.040 – 1.297
2 or more household moves (ref: <2 moves)	1.052	0.907 – 1.220
Separated from mother for 1 month or more (ref: <1 month)	0.867	0.677 – 1.111
BMI at age 7	1.007	0.968 – 1.048
Birth weight in ounces	1.003	0.999 – 1.005
Social class at birth (1=highest, 6=lowest)	1.280***	1.222 – 1.341
HAS AT LEAST ONE CHILD BY AGE 23[e]		
Father absent by age 7	1.319**	1.069 – 1.628
Father absent between ages 7 and 11	1.163	0.817 – 1.654
Father absent between ages 11 and 16	1.227	0.993 – 1.517
Breastfed for less than 1 month (ref: >1 month)	1.292***	1.128 – 1.480
2 or more household moves (ref: <2 moves)	1.189*	1.014 – 1.393
Separated from mother for 1 month or more (ref: <1 month)	0.983	0.744 – 1.299
BMI at age 7	1.041	0.990 – 1.095
Birth weight in ounces	0.999	0.995 – 1.003
Social class at birth (1=highest, 6=lowest)	1.423***	1.350 – 1.499

**** p≤.001*
*** p≤0.01*
** p≤0.05*

Reference category[a] = voice not broken by age 13
Reference category[b] = intention to be married by age 21
Reference category[c] = intention to not have children by age 21
Reference category[d] = not married by age 23
Reference category[e] = no children by age 23

4. DISCUSSION

These findings suggest that father absence is associated with age at sexual maturity and reproduction in boys and that these effects are sensitive to the timing of father absence. Notably, the correlations between father absence and reproductive events are not consistent in their direction. For girls, father absence in developed societies is consistently associated with earlier maturation, earlier onset of sexual activity and earlier first childbirth [8,25]. Here, we show that for boys, father absence is associated with later puberty, later marriage, but earlier reproduction. Males are able to invest in either a mating (desertion) or parenting (commitment) strategy that is unavailable for females who are committed to intensive parental investment, at least among humans. Differences in the direction of the father-absence effects on marriage and reproduction may thus be attributable to the fact that investing in either mating or parenting are viable alternative strategies for males.

Voice-breaking, unlike early reproduction, is not associated with other indicators of early-childhood conditions, reinforcing the suggestion that it is specifically the absence of the father which influences reproductive events. It is possible that the stress of losing a father may have a proximate effect on adolescent hormonal responses and delay puberty [26]. Regarding reproduction, it may be that fathers are able to influence their son's educational attainment [10] thereby delaying starting a family in favour of investing in non-somatic capital. Another possibility is that sons may inherit (genetically or otherwise) their father's non-committal behaviour, as there is some evidence to show that daughters may genetically inherit a tendency for sexual precocity from their fathers [27].

It could also be that the presence of an unrelated male affects male reproductive outcomes and not father absence per se, as has been suggested in other similar studies [15]. We attempted to test for this by comparing single-mother families to those with unrelated male

household heads and found no significant differences between these groups, although sample sizes were small and reported household residents may not necessarily reflect the presence or absence of an unrelated male in the child's life (results in the electronic supplementary material).

Overall, these findings suggest that father absence exerts an influence on male reproductive decisions, even after controlling for other indicators of early life adversity. This study also emphasizes the importance of analysing the role of fathers during both early and later childhood stages, as the effects of father absence on puberty are confined to boys who lost their fathers during adolescence. Although early reproduction appears to be particularly sensitive to father absence in early childhood, we argue that father absence is not simply one component of a sub-optimal childhood environment, because our results are robust to multiple controls denoting unfavourable early conditions, signifying that it is father absence itself that matters. In contrast to traditional societies, where father presence may facilitate marital and reproductive opportunities, father presence in developed world contexts may encourage the acquisition of human capital (such as education) in their sons, and therefore delay reproduction. Further research on the specific mechanisms through which father presence affects children's reproductive timing would be illuminating.

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