

RESEARCH ARTICLE

Early menarche and its relationship to paternal migrant work among middle-school-aged students in China

Bingzheng Zhang^{1,†}, Ting Yu^{1,†}, Qiuxing Chen¹, Kaye Wellings², Theresa M. Oniffrey³, Junrui Ma¹, Limin Huang¹, Suiqiong Fan¹, Lu Ma¹, Rui Li¹ and Yuliang Zou^{1*}

¹Department of Health Management, Wuhan University School of Health Sciences, Wuhan, China, ²Department of Social and Environmental Health Research, London School of Hygiene and Tropical Medicine, London, UK and ³Cerus Consulting, LLC, Winston-Salem, NC, USA

*Corresponding author. Email: zouyl@whu.edu.cn

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Abstract

Associations have been shown between father's absence and menarcheal age, but most studies have focused on absence resulting from divorce, abandonment or death. Little research has been conducted to evaluate the effect on menarcheal age of paternal absence through migrant work. In a sample of 400 middle school students, this study examined the association between paternal migrant work and menarcheal age against a backdrop of extensive rural-to-urban migration in China. Data were collected through a self-reported questionnaire, including social-demographic characteristics, aspects of family relationships, information about father's migrant work and age at menarche. After adjusting for BMI, parent marital status and perceived relationship with mother, lower self-perceived quality of father–daughter relationship (both 'father present, relationship poor' and 'father absent, relationship poor') and lower frequency of contact with the father were associated with higher odds for early menarche. These findings suggest that the assumption that father's absence for work influences the timing of menarche needs to be examined in the context of the quality of the father–daughter relationship and paternal care, which appear to play a critical role in the timing of menarche. These findings also emphasize the importance of enhancing paternal involvement and improving father–daughter relationships in the development of appropriate reproductive strategy in daughters.

Keywords: Paternal migrant work; Paternal investment; Menarche

Introduction

Age at menarche is a salient milestone in the life course (Ellis, 2004; Tither & Ellis, 2008). Recent evidence has suggested a global trend towards earlier menarche (Lehmann *et al.*, 2010; Morris *et al.*, 2011; Lee *et al.*, 2016; Meng *et al.*, 2017). There is evidence that early-maturing females are at risk of various negative behaviours and health outcomes, including psychological problems (Copeland *et al.*, 2010; Blumenthal *et al.*, 2011), substance abuse (Costello *et al.*, 2007; Copeland *et al.*, 2010), earlier sexual activity (Downing & Bellis, 2009; Copeland *et al.*, 2010; Glynn *et al.*, 2010), gestational diabetes mellitus (Chen *et al.*, 2016) and cardiovascular disease (Ley *et al.*, 2017).

Rearing circumstances that girls experience have been shown to affect female reproductive strategies (Belsky *et al.*, 1991; Ellis & Garber, 2000; Quinlan, 2003; Webster *et al.*, 2014). According to Draper and Harpending (Draper & Harpending, 1982; Draper & Harpending, 1988), humans have evolved to be sensitive to their early life experiences and adaptively calibrate

[†]These authors contributed equally to this work.

different reproductive strategies that can determine their reproductive potential. Specifically, girls reared in father-absent homes during childhood are hypothesized to view paternal investment as non-essential for their reproductive success, and may thus engage in sexual activity earlier, be less discriminative in forming sexual relationships and form unstable pair bonds. In contrast, girls from father-present homes may perceive paternal investment as crucial for reproduction and develop in a manner that slows the onset of sexual experience, be more reticent in forming sexual relationships and have relatively durable pair-bonds. Belsky *et al.* (1991) proposed a distinctive theory integrating diverse development phenomena, including contextual stress, childrearing patterns, psychological development, pubertal timing and sociosexual orientation. Father absence and other kinds of context stressors (e.g. limited financial resource, marital discord and stressful life events) that would undermine parental well-being and family relationships are hypothesized to foster a negative parenting practice, subsequently make girls more prone to establish insecure attachment with parents, have a mistrustful view of the world and experience psychological and behavioural problems. Such developments may accelerate pubertal maturation and, subsequently, lead to increased precocious sexuality and a more unrestricted sociosexual orientation characterized by unstable pair-bonds and limited parental investment. Ellis (2004) also argued that the timing of puberty is part of a developmental strategy that conditionally co-ordinates the length of childhood in response to the value of the quality of family environment. A low-quality family environment may be a cue that parental investment is unstable, and/or continued somatic investments will not pay off, and this may therefore result in accelerated puberty among girls. Conversely, girls may adaptively delay puberty when they detect that parental investment is stable and closely associated with higher reproductive success in high-quality family environments.

Fathers may be absent from the home for various reasons. Although a considerable number of empirical studies have found father absence to be associated with earlier menarche of daughters, the majority of them primarily focused on fathers' absence occasioned by divorce, abandonment or death, which results in the diminution or discontinuation of paternal care (Quinlan, 2003; Romans *et al.*, 2003; Tither & Ellis, 2008; Bogaert, 2008; Webster *et al.*, 2014; Jean *et al.*, 2011). Little research, however, has been carried out to evaluate the potential effect of paternal migrant work on menarche age. Father absence due to labour migration may be less likely to be stigmatized in the way that divorce or desertion often is (Shenk *et al.*, 2013). In addition, those fathers may bring more parental investment and provide a higher-quality parenting environment through sending remittances and maintaining contact with their children (Shenk *et al.*, 2013; Su *et al.*, 2013), suggesting that father's absence may exert different influences on life history trajectories according to the reasons for absence. In rural Matlab in Bangladesh, where labour out-migration is common among men, Shenk *et al.* (2013) examined the effects of different father-absent conditions (divorce, death and migrant work) on women, and they found that daughters whose fathers were migrant labourers or dead had older ages at marriage and first birth, whereas daughters of divorced fathers had younger ages at those reproductive events compared with father-present women.

Since the 1980s, there has been large-scale labour migration from rural to urban areas in China, influenced by the rapid growth of the economy. According to a survey conducted by the China Women's Federation (China Women's Federation, 2013), there were over 61 million children aged 17 years or younger with parental migrant workers in rural areas in 2010, accounting for approximately 22% of the total child population. Although additional income brought home by migrant parents can improve children's education and health status (Shenk *et al.*, 2013; Meng & Yamauchi, 2017), a decrement in parental care, support and communication may exert a deleterious influence on their reproductive development (Draper & Harpending, 1988; Belsky *et al.*, 1991; Ellis *et al.*, 1999). As a consequence, it is timely to explore the relationship between paternal migrant work and early menarche in China. In the present study, the association between paternal migrant work and age at menarche among middle-school-aged females was examined, against the background of extensive rural-to-urban migration in China.

Methods

Between December 2014 and February 2015, a cross-sectional study was conducted among female students aged 11–17 years in two middle schools in Baofeng County, China. Baofeng County occupies around 722 km² and had a population of approximately 517,000 in 2013 (General Information of Baofeng County, 2017). It is located in the mid-west of Henan Province – one of the largest labour-exporting provinces in China. Labour migration is also common in Baofeng County, and approximately 12,000 children were left behind at home due to parental migration in 2013 (Zheng *et al.*, 2015). All students at school ($n=503$) and their caregivers received written information and were invited to an information meeting. In total, 96.4% of the students ($n=485$) and their caregivers consented to participate in the study. Students completed a self-report questionnaire in a private room during the school day.

Survey variables relevant to the research questions included social-demographic characteristics, information about the parents, extent of paternal migrant work and age at menarche. Social-demographic characteristics included registered residence (rural, urban), whether the participant was the only child in the family, perceived family economic status (poor, moderate, good), family structure and size, sibling numbers and height and body weight of the adolescent girls. Parents' information included marital status (married, divorced or dead), perceived quality of the marital relationship (low, fair, high), education level and perceived quality of relationship with parents. Paternal migrant work was measured by asking whether the participant's father had ever lived away from home for work before (yes, no) and the participant's age when this first happened, frequency of meeting during paternal separation (once a month, twice a year, less regularly), frequency of communication during paternal separation (once a week, once a month, less than once a month) and caregiver (mother, grandparents, other caregivers). Age at menarche was measured by asking whether menstruation had begun, and if so, the date of the first menstrual period (in months).

Age at menarche of female students was categorized using cut-offs derived from the China Puberty Research Collaboration for urban and rural Chinese adolescents (Sun *et al.*, 2012). Since some aspects of ill health could potentially impact upon age at menarche, 29 participants who had ever had a serious disease (e.g. congenital heart disease, chronic respiratory disease, endocrine disease) were excluded. Fifty-six participants who provided incomplete information on menarcheal age were also excluded.

Two-hundred females had not menstruated at the time of interview. Thus, the event-history analysis, which can take into account both subjects who had experienced menarche and those who had not, was chosen to identify the potential correlates of early menarche. Females who had not menstruated at the time of the survey were categorized into the censored group. In females who had menstruated ($n=200$), those with a menarcheal age less than or equal to the lower quartile menarcheal age (11 years 6 months) of Chinese girls were categorized into the early menarche group and the remaining into the censored group. The Kaplan–Meier method was used to evaluate the associations between experience of early menarche and health-related characteristics, demographic variables, parental characteristics, perceived relationship with parents and frequency of contacting father during paternal separation. Cox proportional hazards survival regression was performed to calculate the adjusted hazard ratios (aHRs) and 95% confidence intervals (95% CI) for the association between 'perceived relationship with father', 'frequency of phone contact with father' and early menarche respectively, and BMI, parents' marital status and relationship with mother were entered as potential confounders on the basis of previous research (Quinlan, 2003; Jean *et al.*, 2011). All analyses were performed using IBM SPSS Statistics 20.0 (IBM, Inc., New York).

Results

In total, 400 participants with a mean age of 13.18 years were included in the final analyses. Of these, 75 (18.8%) had experienced early menarche. The majority of participants resided in rural

areas and most had one or more siblings. Over half (59.0%) reported that their fathers had ever lived away from home for purposes of work.

In the bivariate analysis of the health-related and demographic variables included in the analysis, no variable was found to be associated with menarcheal age. Among the variables relating to parental characteristics, notably, no consistent trend was seen in the association between menarcheal age and either father's absence for work, nor the age at which this first occurred. Menarcheal age was, however, significantly associated with the perceived quality of the parental relationship with the daughter. Compared with girls who reported early menarche, girls who started menarche at an older age perceived a better relationship with their fathers. The only other variable seen to be significantly associated with menarcheal age was the frequency of phone contact. Girls with non-early menarche were more likely to report a higher frequency of phone contact with the father relative to those who began menarche at an earlier age (Table 1).

After adjusting for BMI, parent marital status and relationship with mother, the perceived quality of the relationship with the father remained significantly associated with early menarche. Compared with those whose fathers were present but the relationship was good, the adjusted odds for early menarche were higher among participants with both 'father present, relationship poor' (aHR=3.73, 95% CI: 1.67–8.31) and 'father absent, relationship poor' (aHR= 2.62, 95%CI: 1.22–5.66). Compared with girls whose phone contact with their absent father was less than once a week, the adjusted odds for early menarcheal age were lower among girls whose phone contact with their absent father was more frequent (aHR=0.17, 95% CI: 0.04–0.71), but the odds were not significantly altered among girls whose fathers were present (Table 2). Perceived relationship with mother was not associated with early menarcheal age after controlling for BMI, parent marital status and perceived relationship or frequency of phone contact with father.

Discussion

This study of the association between paternal migrant work and menarcheal age in China found that, after taking account of other variables associated with early menarche, daughters' perceived relationship with their father, and their contact with their father, remained statistically associated with when they began menstruating, irrespective of whether the father was absent for work, which was not independently associated with menarcheal age, suggesting that the quality of the father–daughter relationship plays a more critical role in female reproductive development than does absence for work. The findings of this study run counter to those of a large body of research, which indicates that girls reared in households where fathers are absent reach menarche earlier than their peers reared in intact homes (Quinlan, 2003; Romans *et al.*, 2003; Bogaert, 2008; Tither & Ellis, 2008; Jean *et al.*, 2011). This discrepancy may in part be attributed to the different reasons of father absence. Most previous studies focused primarily on the father's absence resulting from divorce, abandonment or death, which may have a stronger effect than that due to paternal migrant work. Father's absence for work may be less stigmatized in the way that divorce/abandonment often is (Shenk *et al.*, 2013), and those fathers may still be involved with their families and continue parental investment through sending remittances, maintaining contact via the telephone and visiting home on holidays (Shenk *et al.*, 2013; Su *et al.*, 2013; Meng & Yamauchi, 2017). These financial and emotional connections accompanied by labour migration may reduce the psychosocial stress caused by paternal absence, and ultimately reduce the negative effect on pubertal maturation of daughters. In line with this research, Shenk *et al.* (2013) also found that women who experienced father absence for work during their childhood tended to have slower life history trajectories, including older age at marriage and first birth, relative to those with divorced/deserted fathers.

Though father's absence has been proposed to be associated with a poor father–daughter relationship, limited studies examining the impact of father's absence on pubertal timing have directly

Table 1. Bivariate analyses of characteristics associated with early menarche^a

Characteristic	Early menarche <i>n</i> (%)	Censored <i>n</i> (%)	χ^2	<i>p</i> -value
BMI				
Normal	65 (91.5%)	288 (95.0%)	1.577	0.209
Overweight/obese	6 (8.5%)	15 (5.0%)		
Registered residence				
Rural	73 (97.3%)	309 (98.7%)	1.574	0.210
Urban	2 (2.7%)	4 (1.3%)		
Number of family members				
<3	3 (4.2%)	12 (3.8%)	0.222	0.895
3–4	31 (43.1%)	142 (45.5%)		
≥5	38 (52.8%)	158 (50.6%)		
Sibling numbers				
0	3 (4.1%)	14 (4.4%)	0.328	0.849
1	39 (52.7%)	156 (48.8%)		
≥2	32 (43.2%)	150 (46.9%)		
Family economic status				
Lower	32 (42.7%)	121 (37.8%)	1.495	0.474
Moderate	39 (52.0%)	188 (58.8%)		
Higher	4 (5.3%)	11 (3.4%)		
Paternal education level				
Secondary or lower	65 (87.8%)	271 (83.9%)	0.458	0.499
High school or higher	9 (12.2%)	52 (16.1%)		
Maternal education level				
Secondary or lower	69 (92.0%)	281 (87.0%)	1.252	0.263
High school or higher	6 (8.0%)	42 (13.0%)		
Parent marital status				
Married	66 (88.0%)	302 (93.5%)	3.193	0.074
Divorced/widowed	9 (12.0%)	21 (6.5%)		
Parent marital quality				
Low	5 (6.8%)	13 (4.1%)	1.213	0.545
Fair	19 (26.0%)	91 (28.6%)		
High	49 (67.1%)	214 (67.3%)		
Father absent for work				
Yes	43 (57.3%)	193 (59.4%)	0.182	0.670
No	32 (42.7%)	132 (40.6%)		
Daughter's age at father's 1st absence for work				
Father present	32 (44.4%)	132 (41.8%)	3.275	0.194

(Continued)

Table 1. (Continued)

Characteristic	Early menarche <i>n</i> (%)	Censored <i>n</i> (%)	χ^2	<i>p</i> -value
≥5 years	19 (26.4%)	116 (36.7%)		
<5 years	21 (29.2%)	68 (21.5%)		
Relationship with father				
Father present, relationship moderate/good	21 (28.4%)	120 (37.2%)	23.158	<0.001
Father present, relationship poor	10 (13.5%)	12 (3.7%)		
Father absent, relationship moderate/good	31 (41.9%)	168 (52.0%)		
Father absent, relationship poor	12 (16.2%)	23 (7.1%)		
Caregivers				
Father present	32 (42.7%)	132 (40.6%)	3.254	0.197
Father absent, caregiver: mother	24 (32.0%)	135 (41.5%)		
Father absent, caregiver: grandparents/other	19 (25.3%)	58 (17.8%)		
Frequency of meeting with father				
Father present	32 (42.7%)	132 (40.7%)	1.522	0.467
Father absent, met twice a year or more	30 (40.0%)	150 (46.3%)		
Father absent, met less than twice a year	13 (17.3%)	42 (13.0%)		
Frequency of phone contact with father				
Father present	32 (42.7%)	132 (40.7%)	8.425	0.015
Father absent, phone contact ≥once a week	2 (2.7%)	50 (15.4%)		
Father absent, phone contact <once a week	41 (54.7%)	142 (43.8%)		
Relationship with mother				
Poor	10 (13.5%)	22 (6.9%)	3.773	0.052
Moderate/good	64 (86.5%)	296 (93.1%)		

^aUsing the Kaplan–Meier method.

measured the quality of the relationship between father and daughter. In the present study, both father absence and perceived relationship with father were tested, and these findings support the hypothesis that quality of fathers' investment is a more important feature of the early-life environment relative to daughters' menarcheal age (Ellis *et al.*, 1999). Ellis *et al.* (1999) also found that, even in two-parent homes, more time spent by the father in child care and a positive father–daughter relationship during childhood predicted later pubertal time in daughters. On the other hand, lower quality of paternal care was associated with earlier ideal age for parenthood (Nettle & Cockerill, 2010), younger age at first pregnancy (Nettle *et al.*, 2011) and higher likelihood of risky sexual behaviour (Ellis *et al.*, 2012). This finding suggests that the assumption that father's absence for work influences the timing of menarche needs to be examined in the context of the quality of the father–daughter relationship and paternal care. Quality of paternal investment during early life is hypothesized to be a cue to determine the appropriate timing for somatic and reproductive investments (Ellis, 2004). When girls detect that the quality of the paternal investment is stable and reliable, and continued somatic investments will pay off and favour greater reproductive success, they are hypothesized to develop in a manner that favours somatic growth and the development of delayed reproductive maturity. Conversely, girls whose early environment experiences are characterized by low-quality paternal investment may move more quickly from somatic growth to

Table 2. Adjusted association between perceived relationship with father, frequency of phone contact with father and perceived relationship with mother and early menarche^a

Characteristic	Model 1		Model 2	
	Hazard Ratio (95% CI)	<i>p</i> -value	Hazard Ratio (95% CI)	<i>p</i> -value
Relationship with father				
Father present, relationship moderate/good (Ref.)				
Father present, relationship poor	3.73 (1.67–8.31)	0.001		
Father absent, relationship moderate/good	1.12 (0.63–1.98)	0.696		
Father absent, relationship poor	2.62 (1.22–5.66)	0.014		
Frequency of phone contact with father				
Father absent phone contact <once a week (Ref.)				
Father absent, phone contact ≥once a week			0.17 (0.04–0.71)	0.015
Father present			0.80 (0.49–1.30)	0.368
Relationship with mother				
Poor (Ref.)				
Moderate/good	0.95 (0.44–2.09)	0.906	0.70 (0.32–1.50)	0.356

^aAdjusted for BMI and parent marital status.

reproductive investments, and this will result in the earlier onset of puberty and reproductive maturity (Ellis *et al.*, 1999; Ellis, 2004). Although the Belsky *et al.* (1991) theory expanded the predictors of daughters' reproductive strategy from father-absence into a more general stressful experience, it does not make a specific distinction between the influence of fathers and mothers on daughters' pubertal timing. In the present study, perceived relationship with mother was not associated with earlier menarche age, either in the bivariate or the multivariate analysis. In line with the approaches of Draper and Harpending (1982) and Ellis (2004), this finding suggests that the quality of the father–daughter relationship may be more influential than that of the mother–daughter relationship in shaping puberty maturation.

Several limitations should be considered when interpreting these results. First, the cross-sectional survey could not infer casual relationships or their directionality. Just as being away from home may plausibly impact negatively on their relationship with their daughter, it could equally be the case that fathers with less involvement and a poorer relationship with their daughters were less averse to being away from home for work. Second, the present study failed to control mothers' menarche age, and heritable reproductive strategies might confound these findings. Third, the size of the sample was relatively small, and had it been larger, some of the relationships observed may have emerged as significant.

This study was conducted in only one area of China, and the findings cannot be assumed to be generalizable to the whole country. However, if replicated in a larger study, they have important implications for policy and practice. Early menarche is an indicator, not only of reproductive potential, but of mental and physical well-being (Ellis, 2004; Downing & Bellis, 2009; Copeland *et al.*, 2010; Blumenthal *et al.*, 2011). In particular, they demonstrate the importance of improving father–daughter relationships, enhancing the involvement of fathers and increasing their contact whilst away for the well-being of 'left-behind' daughters. Public education campaigns might usefully draw the attention, not only of fathers, but also members of the wider family, to this issue.

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Conflicts of Interest. The authors have no conflict of interest to declare.

Ethical Approval. Ethical approval for the study was provided from the Ethics Committee of the School of Public Health, Wuhan University, China. All participants and their guardians received verbal and written explanations regarding the study procedures, and when they agreed, they signed the informed consent form.

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