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Fathers' parental involvement and accessibility as predictors of daughters' age of menarche: Testing the life history theory (LHT-P) in a non-WEIRD context

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Abstract

This study examined whether fathers' parental involvement level and their accessibility have any effects on the age at which their daughters experience menarche in a non-western, educated, industrialized, rich, and democratic (non-WEIRD) population. We noted the current debates on the use and application of the LHT framework in explaining human variations in life histories and adopted the recommendations. Thus, while being sensitive to the use of LHT in human variations, we aimed to adopt the framework and hypothesized that high father parental involvement and accessibility would significantly cue for late age at menarche. We sampled women aged between 18 and 56 purposefully and conveniently from multiple sites in Botswana, using multiple data collection platforms in a cross-sectional study. Preliminary analysis revealed that age of menarche increases with access to (i.e., presence of) a biological father but decreases with access to a stepfather while being raised in a female-headed household is associated with reduced father's parental involvement for female children. Further analysis using stepwise regression revealed that access to (i.e., presence of) a stepfather in a female child's life leads to early menarche. Given that early menarche is associated with adverse physical and mental health outcomes for female adults and access to a biological father increases fathers' parental involvement, we conclude that dual or co-parenting may offer more developmental advantages to female children than access to a stepfather Thus, parents should strive to create family dynamics that will promote biological father involvement, where available and possible, in raising female children.

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Introduction

Reaching menarche is an important milestone marking a developmental stage that readies a girl for subsequent reproduction (Santrock, 2018). A relationship between the ages at menarche, first sex, marriage, and first birth has been observed in diverse cultures (Day, et al., 2016; Lawn et al., 2020: Udry & Cliquet, 1982; Matsumoto & Juang, 2013). The timing of menarche and how it sets a pace for subsequent reproductive course is explained in many ways (Ibitoye et al., 2017). Udry and Cliquet (1982) suggest that, biologically, hormones released during puberty are responsible for increasing libido, hence earlier puberty may lead to earlier engagement in sexual intercourse, which may result in earlier pregnancies, and earlier marriages. Girls who mature early may develop secondary sexual characteristics which may have a role in attracting males' attention earlier (Santrock, 2018). As a result, they may engage in sexual intercourse earlier (Udry & Cliquet, 1982).

The timing of menarche relates to reproductive and public health, and therefore, it is important to understand the factors involved. Females who reach menarche early are more likely to have cardiovascular health issues, experience teenage pregnancy which also associates with further risks such as higher chances of breast cancer, experiencing earlier menopause as well as increased chances of cervical cancer later in life (Bubach et al., 2021; Goldberg et al., 2020; Prentice & Viner, 2013; Louie et al., 2009; Udry & Cliquet, 1982). Early 'maturers' are more likely to engage in problematic behaviours such as promiscuity and substance abuse; are prone to mood disorders (e.g., depression), anxiety, suicidal behaviours; and may exhibit lower self-control than their counterparts (Laube & Fuhrmann, 2020; Lee, 2021; Capsi & Moffitt, 1991; Bucci & Staff, 2020).

Research has frequently focused on an array of factors with potential effects on age at menarche, including genetic factors (e.g., Comings et al., 2002; Barbado et al., 2017), household economy (e.g., Burris & Wiley 2021; Quinlan, 2001), quality of the family unit relationship, supportive parenting, and mother-daughter affection (Aghaee et al., 2020: Ellis et al., 1999). Many studies have revealed that females with absent and uninvolved biological fathers reach maturity earlier than their counterparts with their biological fathers present in their lives (e.g., Gaml-Sørensen et al., 2021; Hehman & Salmon, 2021: Ellis et al., 2003; Chisholm et al., 1993). Both early and recent views show that biological father's absence has significant effect on pubertal timing in girls (Gaml-Sørensen et al., 2021; Drapper & Happending, 1989). Some evolutionary frameworks are used to explain this observed difference, particularly pointing to early childhood environments as sensitive periods. Early paternal investment in girls has been found to influence menarche timing (Drapper & Happending, 1989). The life history framework has been widely adopted in explaining the observed differences in menarche timing in relation to paternal involvement. It is explained that when girls lack either mere paternal presence or involvement, they 'cue' men in general as unpredictable and, therefore, a need to trade somatic development for reproductive development arises. Subsequently, reproductive development is accelerated, starting with early menarche. Girls who reach menarche are, in essence, ready for reproduction sooner than their peers brought up in biological father-involved households.

We observed that several studies on the link between involvement of biological fathers and timing of menarche are mostly conducted in the WEIRD context, framed within the LHT, which predicts a fast life history for females who did not experience paternal involvement (Sear et al., 2019; Belsky et al., 1991; Ellis, 2004). There is emerging evidence showing a different pattern of biological father effects on timing of menarche in non-WEIRD context (Sear et al., 2019). As a result, the current study considered this relationship in a non-WEIRD context, with unique family and socialization structures compared to the WEIRD contexts. We considered how other common forms of father role players such as stepfathers, and other male relatives (grandfathers, uncles) influence menarche timing.

Life history theory-psychology (LHT-P)

Developed by evolutionary biologists and ecologists, life history theory (LHT) explains how natural selection acts on species average traits over evolutionary timelines due to different ecologies (Nettle & Frankenhuis, 2020). LHT suggests that the core components of fitness, time and resources are limited; therefore, trade-offs are involved in allocating resources to important life tasks (i.e., maintenance of bodily growth or reproduction). These tasks are both aimed at the survival of the living organism by maintaining itself (somatic effort) or passing on its genes to the next generation (reproductive effort) (Buss, 2009; Kaplan & Gangestad, 2005). In essence, somatic effort implies a strategic allocation of energy and resources to maintain the fitness of the living organism for longer survival whereas reproductive effort is concerned about the strategic allocation of the living organism's energy and resources in making several copies of its genes for future existence (Workman & Reader, 2004). Natural selection acts on life history traits favouring traits that maximize fitness. A mediation of trade-offs between somatic and reproductive efforts is needed to nurture ultimate fitness, since traits involved in either of the two are mostly opposing each other. For example, diverting energy and resources to maintaining self-fitness may delay reproduction (Kaplan & Gangestad, 2005). As a result, different ecologies with different resources will select for divergent patterns of life history traits, resulting in genetic differences (Nettle & Frankenhuis, 2020). As an extreme example of this trade-off, reproduction may be achieved at the cost of existence. For example, some male spiders of the orb-weaving genus allow the female they have mated with to eat them, and thus somatic efforts are ceased for reproduction's sake (Foellmer & Fairbairn, 2003).

The LHT model has been loosely adopted to explain intra-species variations other than *Homo Sapiens* (Sear, 2020; Nettle & Frankenhuis, 2020). This has recently been questioned and recommendations have been offered to incorporate the LHT in explaining human variations, with a push to conduct more empirical research that will help to build theoretical models (e.g., Sear, 2020; Nettle & Frankenhuis, 2020; Frankenhuis &

Nettle, 2020). When loosely used, trade-offs have been adapted to explain covariations of individuals within species lifespan development course in place of evolutionary course between species where it was initially used. We, therefore, adopt Nettle and Frankenhuis' (2020) term life history theory-psychology (LHT-P) as suggested to refer to a separate model of LHT explaining human variations.

Unique early socialization environments in non-WEIRD contexts

In non-WEIRD settings, early childhood environments consist of different (but not deficient) family models and arrangements including unique household compositions (Oppong, 2023; Oppong et al., 2022; Scheidecker, Boyette et al., 2023; Scheidecker, Chaudhary et al., 2022; Scheidecker, Chaudhary et al., 2023; Scheidecker, Oppong et al., 2021; Sear et al., 2019). There are notable instances of communal raising of children, set-ups with related male figures other than the biological father, as well as other unrelated males who are intimately involved with the mother who may assume the fathering role (see Scheidecker, Boyette et al., 2023). Studies have explored these kinds of environments in relation to life history courses. For example, studies suggest that a mother's involvement with unrelated males can accelerate pubertal timing (Mendle et al., 2006; Ellis & Garber, 2000). It has also been suggested that the daughter remains potentially exposed to pheromones of their mother's partners who are unrelated males (Ellis & Garber, 2000). In such cases, this hastened maturation is seen as preparing the younger female to mate. Using a non-WEIRD context, we aimed to test the LHT-P. We expected that females' age at menarche would be influenced by paternal involvement and accessibility. An absent or uninvolved biological father is thought to cue for the unpredictability of potential future sexual companions (Kaplan & Gangestad, 2005). Thus, the female in such an environment cues it as an unpredictable and will more likely choose to expend energy in developing secondary sexual characteristics faster and reach menarche faster as fitness energy is diverted to offspring production. In this case, the life course of menarche is hastened as resources are shifted from rapid growth and development to prepare for reproduction by developing secondary sexual characteristics (Belsky, 2012; Kaplan & Gangestad, 2005). In essence, this study also responds to the call to end epistemic exclusion in early childhood development (ECD) science (Scheidecker, Tekola et al., 2023) by providing evidence that basic science research in ECD from non-WEIRD settings exists that should not be ignored by global ECD.

Methods

Research design

We employed a cross-sectional study design by recruiting participants at multiple locations using multiple data collection platforms. We combined the platform of paper-and-pencil administration with an online platform for administering the questionnaire, and we sourced participants in three different locations. The first location was the social media where participants were recruited online by sharing the link to the online survey with women-only Facebook groups in Botswana. In the second location, we recruited women in the university setting comprising female postgraduate students and female domestic services workers (janitors). The last location was the public clinics where we recruited women attending post-natal care clinics in Greater Gaborone, Botswana. Detailed description of research methodology used has been described elsewhere (Thutoemang & Oppong, 2021).

Sample

A total of 252 Batswana women whose ages ranged between 18 to 55 years (M = 39, SD = 6.84) voluntarily took part in this study. However, only 209 responses (82.94%) were used for analysis while 43 had incomplete responses and were, therefore, excluded. The reported age at menarche ranged from 12 to 23 years (M = 15.10, SD = 2.15). Most respondents (53.1%) grew up in villages followed by cities (25.6%) and towns (16.4%) with a few (4.8%) raised on farms (commonly known as lands and cattle posts). Most participants (53.3%) had never been married, 37.1% married, 5.2% cohabiting, and the rest were either divorced, separated, or widowed. Respondents were selected using a blend of both the purposive and convenience sampling methods. Purposive sampling was used to select settings where it was most likely that women or women groups of varying ages and childhood experiences could be found while convenience sampling was used to select women who were available at the time of data collection and were willing to participate in the study. There were no incentives offered for taking part in the study.

Materials and procedures

Participants were recruited in three different settings where diversity of social classes and sociodemographic characteristics could be achieved. Multiple methods of data collection were employed, namely: (1) through the use of Facebook 'closed groups' with women only were targeted and a short message containing the link to the survey was posted, (2) a postgraduate class (a middle-upper class) and female janitors working at the University of Botswana participated by filling in a pencil and paper questionnaire, and (3) other participants were sought from public clinics targeting women who had brought children for monthly routine check-ups. In all platforms, relevant authorities were involved, and gatekeeper's permissions were sought to survey women in all settings. Ethical approval was obtained from the IRB at the University of KwaZulu-Natal in South Africa (where the study was first conceptualized) and the Ministry of Health and Wellness in Botswana (where the data was collected).

Data were collected using the author-constructed, self-report questionnaire including demographics, total fathers' parental involvement level (TFPIS), father's accessibility, as well as age at menarche in chronological years. The questionnaire was available in the national language, *Setswana*. We used back-translation where one person translated the questionnaire into *Setswana,* and another translated them back to English and then reviewed the differences observed.

There are many ways in which fathers' parental involvement can be measured. For example, a father's parental role is often considered in terms of control, monitoring, material resources and support (De Graaf, et al., 2011). In the current study, we constructed the TFPIS that is inclusive of monitoring, control, material resources, and support. We constructed 10 statements about the father's relationship and involvement. Examples of items include "My father helped me with my schoolwork", "My father would pay attention to my grievances", "I felt my father's love", and "My father cared to know my whereabouts". All items were scored on a four (4) point Likert scale with categories coded as follows; 0-Not applicable, 3-Always, 2-Sometimes, and 1-Never. The higher the total sum of the scores of these 10 items (maximum of 30) suggests higher paternal involvement while the least the sum of the scores (minimum of zero [0]) suggests no involvement signifying father figure absence of no involvement from a father. When correlated with each other, items of this scale were highly correlated with inter-item correlations ranges between $\tau = 0.597$ and $\tau = 0.898$ and it yielded a reliability coefficient of $\alpha = 0.965$. The TFPIS scale may be useful to other researchers and future studies should evaluate the validity of the scale. It is worth noting that the TFPIS measuring levels of involvement for any of the males who played the role of fathers in respondents' upbringing.

Considering that the non-WEIRD population being studied is characterized by different family setups, we probed paternal involvement and accessibility. To measure accessibility, four (4) items asked of the participants to note the kind of fathers or male figures they had. Participants specified their father role players as either biological, stepfather, other male relatives, or adoptive. To categorize the respondents into "father present" and "father absent" during upbringing, the respondents were asked if they were raised in single female-headed families and were asked to indicate an estimation of time in these three ways, namely: a) almost all the time, b) some of the time, and c) not at all. As a follow up to the former question, upbringing under both biological mother and father was probed and the same answer categories that estimate duration into a) almost all the time, b) some of the time, and c) not at all, were used. It is common in non-WEIRD families to have a male figure who is not necessarily the biological father but who plays the father parental role. We asked participants to clearly define the kind of a male who played the significant role of a father in their lives.

Data analysis

We used IBM SPSS version 25 to analyse the data. A test of normality of the variables was performed using kurtosis and skewness tests before a preliminary analysis was performed using Pearson product-moment correlation. However, no test for normality was performed on the dummy variables because they are assumed not to be continuous and do not qualify for a test of normality. A Pearson product-moment correlation was performed to determine whether there were intercorrelations among the study variables to warrant a regression analysis. It is important to state the dummy variables constitute the measure of fathers' accessibility. Results of the test of normality showed that the variables are normal (see *Table 1*). In addition, we sought to investigate which combination of the independent variables will predict age at menarche. As a result, a stepwise multiple regression was conducted to evaluate whether the independent variables (as presented in Table 1) were necessary to predict age at menarche. The choice of stepwise regression was informed by the need to select the best set of predictors that account for the variance in the dependent variable while the forward selection procedure was used because it "starts with no explanatory variables and then adds variables, one by one, based on which variable is the most statistically significant, until there are no remaining statistically significant variables " (Smith, 2018, p.1). All the level of statistical significance was set at p value less than 0.05.

Results

Relationship among study variables

Table 1 presents preliminary analysis using Pearson Correlation. The total fathers' parental involvement was not related to the age at menarche ($r = -0.06$, $n = 193$, $p > 0.05$). Respondents whose biological fathers played a father role in their lives experienced late menarche ($r = 0.17$, $n = 193$, $p < 0.05$) while those who had stepfathers playing a fatherly role in their lives experienced early menarche ($r = -0.19$, $n = 193$, $p < 0.005$). Those whose biological fathers played the father role experienced low levels of total fathers' parental involvement ($r = -0.66$, $n = 193$, $p < 0.005$) while expectedly, those raised by single mothers also experienced low levels of fathers' parental involvement ($r = -0.68$, $n = 193$, $p < 0.005$). Father role by other male relatives (uncles, grandfather etc.) was found to offer higher levels of total father parental involvement ($r = 0.19$, $n = 193$, $p < 0.005$) and expectedly, where there are both biological parents, the participants experienced higher total fathers' parental involvement ($r = 0.75$ $n = 193$, $p < 0.005$).

Table 1: Results of Inter-correlations among the study variables

	Variable	Age	1	2	3	4	5	6	7
1	Total fathers' parental involvement	-0.06							
2	Dummy1_Biological father	0.17*	-0.66**						
3	Dummy2_Stepfather	-0.19**	-0.03	-0.42**					
4	Dummy3_Adoptive father	0.03	-0.05	-0.08	-0.03				
5	Dummy4_Other male relatives	-0.05	0.19**	-0.50**	-0.16*	-0.03			
6	Raised in female single-headed family	0.01	-0.68**	0.65**	-0.11	0.06	-0.35**		
7	Raised by both parents	-0.05	0.75**	-0.74**	0.07	-0.06	0.41**	0.84**	
	M	15.16	19.06	0.57	0.12	0.01	0.16	2.33	1.75
	SD	2.15	8.85	0.5	0.32	0.07	0.37	0.9	0.87
	Kurtosis	7.39	-0.21					-1.59	-1.48
	Skewness	-0.41	1.11					-0.48	0.54

Note: $n = 193$. Dummy variables represent the accessibility measure. The person who played a father role in the participant's life was represented by four dummy variables with "I never had a male figure in my life" serving as the reference category. Age in the table represents age at menarche.
$^{*}p < 0.05$; $^{**}p < 0.005$

Predictors of age at menarche

At step 1 of the analysis, presence of a stepfather entered the regression equation and was significantly related to age at menarche, $F(1,191) = 7.23$, $p < 0.01$. Thus, consistent with LHT-P, the presence of stepfathers playing a father role in their lives led to an experience of early menarche ($\beta = -0.19$, $p < 0.01$). The multiple correlation coefficient was 0.19, indicating approximately 4% of the variance of the age at menarche could be accounted for by the presence of a stepfather. The other independent variables were found not to be statistically significant and, therefore, were entered into the equation at step 2 of the analysis (see Table 2).

Table 2: Results of stepwise multiple regression predicting age at menarche

Variables		Included	Excluded
		β	β
Dummy2_Stepfather		-0.19*	
Total father parental involvement			-0.06
Dummy1_Biological father			0.1
Dummy3_Adoptive father			0.02
Dummy4_Other male relatives			-0.08
Raised in female single-headed family			-0.01
Raised by both parents			-0.04
R	0.19		
R^2	0.04		
F	7.23*		
Adjusted R^2	0.04		

*$p<0.001$

Discussion

Age of menarche is important as it relates to subsequent life history strategies (Ibitoye et al., 2017). The onset of menarche may similarly have some effects on the later physical as well as psychological development. While the age of menarche is reported to be significantly declining across cultures, the general age at menarche is reported to be around 13 years (Hochberg et al., 2011). In Western European countries and the US, the average age at menarche is around 12-13 years (Culpin et al., 2015; Quinlan, 2003; Parent et al., 2003). The current study sample average age at menarche was 15.16 years which is higher than the WEIRD sample mean. Even though recall bias may influence recalled data, simple socio-demographic data retrieval is accurate up to 50 years later (Berney & Blane, 1997). However, we do not rule out the bias as we argue that recalling dates at which participants experienced menarche may be culturally unimportant in the current sample.

Using the LHT-P, the obtained age at menarche exemplifies a slow life-history trait value. We had expected a faster life history based on the high occurrences of single-parent households as well as high occurrences of other non-biological father figures. Our findings are not in line with the LHT-P as total biological father's paternal involvement and accessibility were expected to increase timing of menarche. We found that total paternal involvement is not related to age at menarche. Our findings of a non-significant relationship between biological fathers' parental involvement and accessibility are also consistent with Sohn's (2017) study and his allusions that paternal presence-menarche relationship is not universal. We note that our non-WEIRD sample does not share many characteristics with other populations studied in WEIRD context. For instance, paternal role in the current sample is performed by many other related father figures (i.e., male figures other than a biological father) as well as stepfathers, also observed by Ntshebe and others (2019). Therefore, LHT-P comes short in explaining these findings. We suggest that the living arrangements observed in our sample, where other male figures assume paternal responsibility, lessen the expectations usually loaded on the biological father in WEIRD context. Therefore, in such households, high levels of paternal involvement may be unimportant in shaping trade-offs as girls may not necessarily pin paternal roles to a biological father. Our findings also showed that other related men who assumed paternal roles were significantly rated as highly involved while biological fathers were reported to exert low levels of involvement. This may be unique to the sample.

We also found that stepfathers' presence predicted early menarche. Although this partially supports the LHT-P model, it remains unclear on the exact mechanisms involved in this covariation as we did not control for other important variables suggested by others (e.g., Barbaro et al., 2020) such as genetics. Expectedly, where there are both biological parents, the participants experienced higher total biological fathers' parental involvement. These findings provide evidence of support of dual parenting as advantageous in terms of increasing total father parental involvement. Even though it could not significantly predict menarche, dual parenting is advantageous for many other factors such as boosting a household income. This may also imply that co-parenting with positive family dynamics, in the case of divorce, may possibly promote optimal developmental outcomes for female children.

Directions for future studies

To the best of our knowledge, the current study is the first of its kind to consider the influence of biological father accessibility and parental involvement on age at menarche in a non-WEIRD such as Botswana. Age at menarche was recorded in years only; future studies could increase accuracy by using age in months. The timing of father absence is an important factor in predicting life history strategies; however, we did not measure such as it is only possible through longitudinal design. Amendments that could improve this study include carrying out a longitudinal study to assess father accessibility as well as father parental involvement over time. Future studies may also control for other important factors such as genetics, nutrition, poverty and social exclusion, and indicators of socioeconomic status since homes with absent fathers also tend to be poor homes (Barbado, 2020; Parke, 2004). It may also be interesting to know the relative influence of the duration of exposure to each father figure has on age at menarche; therefore, we suggest that future studies should include both access and duration of exposure of access (to the different types of father figures) in data collection and analysis.

Conclusion

This current study investigated the influence of fathers' parental involvement and availability on age at menarche. Several observations were made with respect to our sample. The sample displayed trends of slowed life history strategies, although a significant percentage either experienced paternal absence or had a male other than the biological father playing the fatherly role. Stepfather's presence was found to lower the age at menarche. The mere presence of a biological father increased age at menarche while father parental involvement levels were not important in predicting age at menarche.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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