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Associations between family size and offspring education depend on aspects of parental personality

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ABSTRACT

Personality traits have been associated with fertility rates, but little is known how parental personality is associated with trade-offs between family size and offspring outcomes. Using the Wisconsin Longitudinal Study ($n = 5422$ parents with 17,253 adult biological offspring), we examined whether parental personality traits assessed with the Five Factor Model (extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience) modified associations between family size (measured as offspring number and birth order) and offspring education. Compared to low parental neuroticism, high parental neuroticism was associated with stronger trade-off between number of offspring and offspring educational achievement. High parental openness to experience, in turn, was associated with higher educational achievement of early-born offspring but not of later-born offspring. These personality-dependent differences in trade-offs between family size and offspring outcomes may help to explain why some personality dimensions are associated with low fertility rates.

1. Introduction

Personality differences are correlated with reproductive success in humans (Alvergne, Jokela, & Lummaa, 2010; Berg, Rotkirch, Väisänen, & Jokela, 2013; Hutteman, Bleidorn, Penke, & Denissen, 2013; Jokela & Keltikangas-Järvinen, 2009; Jokela, Kivimaki, Elovainio, & Keltikangas-Jarvinen, 2009) as well as in a variety of non-human animals, including baboons (Seyfarth, Silk, & Cheney, 2012), sheep (Réale, Martin, Coltman, Poissant, & Festa-Bianchet, 2009), and common lizards (Cote, Dreiss, & Clobert, 2008), among others (Biro & Stamps, 2008; Smith & Blumstein, 2008). For example, sociable and extraverted people are more likely to have children than non-sociable and introverted people (Jokela, Alvergne, Pollet, & Lummaa, 2011; Jokela, Hintsa, Hintsanen, & Keltikangas-Järvinen, 2010). Of the other higher-order Five Factor Model personality traits, low neuroticism and low openness to experience have been associated with higher offspring number in both sexes, while high agreeableness and low conscientiousness have been associated with higher fertility rates especially in women (Jokela, 2012; Jokela et al., 2011). These associations have also been shown using partly the same data as used in the present study (Jokela, 2012; Jokela et al., 2011).

In species with parental care, parents face a trade-off between the number of offspring and the amount of resources available for each offspring (Lack, 1947). Given that human offspring are extremely dependent on parental care and parental investment in the offspring's development (Kramer, 2010), many behavioral ecologists have argued that trade-offs between offspring quantity and "quality" may be relevant in understanding human fertility patterns (Borgerhoff and Mulder, 1998, 2000; Kaplan, 1996; Lawson & Mace, 2009, 2010, 2011). Parental investment of individuals with good resources is less affected by trade-offs between quantity and quality of offspring, so they can afford to have many offspring without the quality of offspring substantially decreasing. For parents with limited resources, it may be more optimal to constrain the number of offspring in order to maximize the success of each individual offspring. The benefits of such constrained reproduction have been demonstrated in some pre-industrial human populations (Gillespie, Russell, & Lummaa, 2008; Meij et al., 2009; Strassmann & Gillespie, 2002). Economists have argued for similar trade-offs between family size and parental investment (Becker, 1981; Van Bavel, 2006). Supporting these arguments, large

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family size in contemporary humans has been shown to correlate with poorer cognitive development (Downey, 2001) and lower educational achievement (Jaeger, 2008) of offspring, among other adverse outcomes. This may reflect the dilution of limited parental resources (Downey, 2001) as well as the risks of sibling competition (Lawson & Mace, 2008).

If parental personality traits determine, in part, how much offspring success decreases with increasing offspring quantity, this could indicate that lower fertility rates associated with certain personality traits reflect an adaptive strategy against decreasing offspring quality. In other words, some personality traits may reflect parental psychological and social resources that influence offspring outcomes, and different individuals have such personality-dependent resources in different degrees. It is also possible that parents with high resources avoid having many offspring in order to transmit their high resources to few offspring undivided rather than having to distribute smaller resources to multiple offspring.

In the present study, we examined whether the trade-offs between family size and offspring educational achievement are dependent on parental personality traits. We hypothesized that personality traits associated with lower reproductive rates are also associated with stronger trade-offs between offspring quantity and quality, thereby favoring lower fertility rates with these traits. We therefore hypothesized that a large family size combined with parent's high neuroticism, high openness to experience, or low extraversion would have negative consequences for offspring educational achievement. We hypothesized a similar trade-off for women's low agreeableness and high conscientiousness, as these traits have been associated with lower fertility rates particularly in women (Jokela, 2012; Jokela et al., 2011). This was examined by testing for the interaction effects between parental personality traits and family size in predicting offspring education, which estimates whether the strength of offspring quantity–quality trade-off is dependent on parental personality.

2. Materials and methods

2.1. Participants

Participants were 5422 men (n = 2471) and women (n = 2951) from the Wisconsin Longitudinal Study (http://www.ssc.wisc.edu/wlsresearch/), a study that has followed a random sample of 10,317 individuals born between 1937 and 1940 and who graduated from Wisconsin high schools in 1957 (Wollmering, 2007). After the 1957 baseline, survey data have collected from the participants or their parents in 1964, 1975, 1993/4, and 2003/5. The WLS sample is broadly representative of white, non-Hispanic American men and women who have completed at least a high school education (among Americans aged 50–54 in 1990 and 1991, approximately 66% were non-Hispanic white persons who completed at least 12 years of schooling). It is estimated that about 75% of Wisconsin youth graduated from high school in the late 1950s – everyone in the primary WLS sample graduated from high school. The present study used data from the 1993/4 and 2003/5 follow-up. Data were collected first via a telephone interview after which a questionnaire was mailed to the participants. Informed consent was obtained at the beginning of the telephone interview. All instruments and operations were approved by the Institutional Review Board of the University of Wisconsin-Madison. In the 1993/4 follow-up, personality data were available for 6763 participants. Of these participants, 5422 reported having at least one biological child aged 18 years or older for whom data on education were available, and these individuals were included in the present study. Data on offspring's own children (i.e., grandchildren) were not available.

2.2. Measures

Parental personality data were collected via mail questionnaire including a 29-item Big Five Inventory (BFI) assessment in the 1993/4 follow-up (John, Donahue, & Kentle, 1991; John, Naumann, & Soto, 2008). Participants were asked whether they agreed or disagreed that certain personality descriptions fitted themselves, rated on a six-point scale (1 = disagree strongly, 6 = agree strongly). The internal consistency estimates (Cronbach's alpha) were 0.76 for *extraversion* (5 items including: talkative, reserved, full of energy, tends to be quiet, generates a lot of enthusiasm), 0.78 *neuroticism* (6 items including: can be tense, is emotionally stable, not easily upset, worries a lot, remains calm in tense situations, gets nervous easily), 0.69 for *agreeableness* (6 items including: tends to find fault with others, is sometimes rude to others, is generally trusting, can be cold and aloof, is considerate to almost everyone, likes to cooperate with others), 0.64 for *conscientiousness* (6 items including: does a thorough job, is a reliable worker, tends to be disorganized, is lazy at times, does things efficiently, is easily distracted), and 0.61 for *openness to experience* (6 items including: prefers the conventional and traditional, prefers work that is routine and simple, values artistic and aesthetic experiences, has an active imagination, wants things to be simple and clear-cut, is sophisticated in art, music, or literature). The original BFI and its shortened versions have been shown to have good psychometric properties, such as test–retest correlations and correlations with other inventories of the Five Factor Model (John et al., 1991, 2008; Rammstedt & John, 2007; Soto & John, 2009). All personality traits were used as standardized variables in the analyses (mean = 0, standard deviation = 1).

Family size was conceptualized as (a) number of children in the family and (b) birth order of the offspring. Birth order of offspring was included to measure the effects of the number of older siblings in the family. While family size is the same for all children in the same family, birth order varies between siblings. Birth order effects can therefore be examined by comparing siblings within the same family. Such within-family comparisons are not confounded by family-level variables, such as parental socioeconomic status, because these family-level variables are common to all siblings in the same family.

Offspring education was determined from the family roster filled by the parents in both the 1993/4 and 2003/5 follow-up phases. The participants reported some details of their children, including children's birth year and educational achievement measured as the years of schooling with a range of 0 to 20 (0 = none, 12 = high school graduate, 20 = post-doctorate education). While all offspring were included in the calculation of family size irrespective of their age, offspring education was assessed only among the participants' biological children who were at least 18 years of age (n = 17,253 offspring).

Parental socioeconomic status (SES) was measured with a composite score of *education* (highest educational qualifications reported by the participants on a 20-point scale indicating years of schooling; 12 = high school graduate, 20 = post-doctorate education), *financial assets* (total net worth of the participant and his/her spouse) and *occupational status* (measured on the 1970 Duncan Socioeconomic Index scale) reported by the participants in the 1992/3 follow-up. The three variables were first standardized (mean = 0, standard deviation = 1) and a composite SES scale was then created as the mean of the three standardized values.

2.3. Statistical analysis

Random-intercept multilevel linear regression was used to examine whether parental personality traits predicted offspring education (i.e., main effects), and whether the associations