Reproductive Behavior and Personality Traits of the Five Factor Model

MARKUS JOKELA[1]*, ALEXANDRA ALVERGNE[2], THOMAS V. POLLET[3] and VIRPI LUMMAA[4]

[1]*Department of Psychology, Institute of Behavioural Sciences, University of Helsinki and Väestöliitto, Helsinki, Finland*
[2]*Department of Anthropology, University College London, London, UK*
[3]*Evolutionary Social Psychology, University of Groningen, Groningen, Netherlands*
[4]*Department of Animal and Plant Sciences, University of Sheffield, Sheffield, UK*

Abstract: We examined associations between Five Factor Model personality traits and various outcomes of reproductive behavior in a sample of 15 729 women and men from the Wisconsin Longitudinal Study (WLS) and Midlife Development in the United States (MIDUS) survey. Personality and reproductive history was self-reported in adulthood (mean age: 53 years). High extraversion, high openness to experience, and low neuroticism were associated with larger number of children in both sexes, while high agreeableness and low conscientiousness correlated with larger offspring number in women only. These associations were independent of marital status. There were also more specific associations between personality and timing of childbearing. The findings demonstrate that personality traits of the Five Factor Model are systematically associated with multiple reproductive outcomes. Copyright © 2011 John Wiley & Sons, Ltd.

INTRODUCTION

Whether or not to have children is often considered to be one of the most important decisions in life. With the modernization of societies, childbearing has become increasingly detached from biological necessities and social pressures of earlier times (Miller, 1992; Potts, 1997; van de Kaa, 2001). Reliable birth control can be used to disconnect sex and reproduction and the main purpose of marriage is no longer considered to be bearing and raising children (Taylor, Funk, & Clark, 2007). In response to weakening biological and social pressures, fertility decisions may become more dependent on individual preferences and dispositions, such as personality traits. These dispositions could also affect the degree of family planning. Although fertility behavior is often considered through theoretical frameworks postulating preferences and intentions, less predictable determinants often affect childbearing. For instance, nearly one-third of all births in the 1990's United States were unplanned (Henshaw, 1998).

The individualization of fertility decision is connected with the broader themes of demographic transition and population dynamics, especially with the causes of declining fertility rates in developed countries over the last century (Borgerhoff Mulder, 1998; Hirschman, 1994; Kirk, 1996; Mace, 2000; Soares, 2005). One strand of theories has emphasized the role of individual choices in changing fertility patterns, while others have attributed a primary role to social and cultural changes (Newson, Postmes, Lea, & Webley, 2005). Adding to the complexity of modern fertility patterns, the most recent evidence suggests that the previously observed fertility decline may be reversing in highly developed countries (Myrskylä, Kohler, & Billari, 2009). Despite the potential importance of individual characteristics in influencing demographic fertility trends, the psychology of childbearing has remained largely an unstudied topic.

Personality and having children

Emerging evidence suggests that personality differences may be related to childbearing in modern Western societies. In a large sample of Finnish young adults, sociability predicted higher probability of becoming a parent but was less important in predicting the probability of having children after the first child (Jokela, Kivimäki, Elovainio, & Keltikangas-Järvinen, 2009). The opposite effect was observed for negative emotionality, which did not predict parenthood but decreased the likelihood of having more than one child. Thus, sociable people might find parenthood more rewarding but this preference may not have as strong effect on later births. Negative emotionality, on the other hand, is correlated with high-stress sensitivity, which may explain why individuals with high emotionality are less likely to have large families.

Another study with the same sample investigated associations between temperament traits of the Temperament and Character Inventory (TCI; Cloninger, Svrakic, & Przybeck, 1993) and childbearing from adolescence to

*Correspondence to: Markus Jokela, Department of Psychology, Institute of Behavioural Sciences, University of Helsinki, Helsinki, P. O. Box 9, FIN-00014, Finland. E-mail: markus.jokela@helsinki.fi

adulthood (Jokela, Hintsa, Hintsanen, & Keltikangas-Järvinen, 2010). High-novelty seeking, low-harm avoidance, high-reward dependence, and low persistence all independently increased the probability of having children, suggesting that childbearing is influenced by multiple temperament dimensions. In addition, there was a positive association between leadership personality, a subscale of type-A personality, in adolescence and adult childbearing probability in men and women (Jokela & Keltikangas-Järvinen, 2009). The finding suggests that personality traits related to status seeking may increase offspring number in men and women. This is in agreement with two studies in American women (Elder & Macinnis, 1983; Roberts & Bogg, 2004) showing that social responsibility and need for achievement, respectively, are positively associated with number of children.

In a sample of Dutch women, mothers were more agreeable and extraverted than women with no children (Dijkstra & Barelds, 2009), while high-childhood neuroticism was negatively related to the likelihood of becoming a parent in a sample of German women and men (Reis, Dörnte, & von der Lippe, 2011). Two studies reported no associations between having children and extraversion (Nettle, 2005) and measures of childhood temperament (Mealey & Segal, 1993). Eaves, Martin, Heath, Hewitt, and Neale (1990) observed no linear associations of extraversion and neuroticism with number of offspring in women, but there was an interaction effect between the traits, so that a combination of high neuroticism and low extraversion or low neuroticism and high extraversion were associated with larger offspring number.

While these studies suggest a role for personality differences in determining fertility behavior, many important issues remain to be addressed. To date, there have been no studies of childbearing examining all the traits of the Five Factor Model, which is one of the most comprehensive and widely used personality models (Digman, 1990; John, Naumann, & Soto, 2008; McCrae & John, 1992). A broader conceptualization of reproductive outcomes beyond the number of children, in turn, should also provide more detailed understanding of personality–fertility associations. The purpose of the present study was to advance previous research on these fronts by examining how personality traits of the Five Factor Model are associated with different aspects of reproductive behavior in a large sample of American women and men.

Reproductive outcomes

The overall probability of having children and number of children assessed in studies cited above are obviously important reproductive outcomes. However, other aspects of reproductive behavior need to be examined in order to better understand how personality becomes associated with total number of children. Timing of marriage, time from first marriage to first birth, age at first child, time between consecutive births (interbirth interval), and the length of reproductive lifespan (time between first and last child) are

some of the most important components of life-course reproductive patterns.

Timing of first marriage and childbirth represent the beginning of the reproductive lifespan. Marriage is a strong predictor of childbearing, although an increasing proportion of children are born outside of marriage (National Center for Health Statistics, 1998). Timing of first child often closely follows timing of first marriage, but individuals vary in how quickly their marriage turns into parenthood, i.e., when they have their first child. Age at first child, in turn, has considerable long-term consequences for population dynamics even if all individuals had only one child. In a family line in which everyone reproduced at age 30, a parent would become a grand-parent at age 60. In another family line in which everyone reproduced at age 20, a parent would already be a great-grand-parent at age 60.

In contemporary societies, the difference between individuals who remain without children and who become parents is an increasingly important division with respect to childbearing, as the proportion of adults with no children has been increasing (Dye, 2008). The same personality characteristics that lead people to become parents may continue to influence childbearing behavior in a similar fashion beyond the first child, yet it is equally possible that the influence of these characteristics changes with parity, i.e., the number of children already born. Individuals also vary in how soon they have another child after the previous child's birth (interbirth interval) which determines their personal fertility rate. Finally, some individuals may have all their children within a short period of time, whereas, others may stretch their reproductive lifespan (the difference between age at first and last childbirth) over many decades.

Family formation and the Five Factor Model

When considering the reproductive outcomes discussed above, it is easy to understand that personality differences may enter the stage at different points in people's reproductive lifespan. Here we provide a selective review of how the traits of the Five Factor Model – extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience – may be associated with childbearing.

Extraversion is a central personality trait in social behavior. Sociable, outgoing, and spontaneous individuals are more likely to make friends and to fall in love than introverts (Neyer & Asendorpf, 2001). High extraversion correlates with higher mating motivation (Schmitt & Shackelford, 2008) and predicts greater success in finding sex partners and spouses (Nettle, 2005). Sociability has also been shown to increase the probability of becoming a parent (Jokela et al., 2009). Shyness, in turn, appears to postpone transition to marriage and parenthood, particularly in men (Caspi, Elder, & Bem, 1988; Kerr, Lambert, & Bern, 1996). These correlates of extraversion are likely to lead to larger number of children.

Neuroticism reflects a general tendency to experience negative emotions, such as anxiety, and to become easily distressed. Neuroticism has been associated with difficulties in social relationships, such as lower relationship quality and

interpersonal negativity in marriage (Karney & Bradbury, 1997; McNulty, 2008). Given the importance of marriage and romantic relationships for childbearing, the negative influence of neuroticism on marital interaction might be expected to hinder family formation. Moreover, neuroticism has been associated with childbearing intentions. In a sample of German adolescents and young adults, individuals with high neuroticism had higher decisional ambivalence toward the idea of becoming a parent (Pinquart, Stotzka, & Silbereisen, 2008). Such decisional ambivalence may lead to postponement of parenthood as well as having fewer children (Jokela et al., 2009).

Agreeable individuals tend to be empathic, caring, and co-operative, so it is expected that high agreeableness is associated with a higher childbearing propensity. In the Finnish study cited above, individuals with high-reward dependence (a trait lining up with the agreeableness dimension but also with extraversion; (Jokela & Keltikangas-Järvinen, in press) were more likely to have children (Jokela et al., 2010). The authors suggested that these individuals may consider parenthood more rewarding and fulfilling than individuals with low-reward dependence. Individuals characterized by high nurturance and affiliation have been shown to perceive childbearing more positively than those with low nurturance and affiliation (Miller, 1992). Moreover, individuals with high agreeableness appear to have less decisional ambivalence toward parenthood (Pinquart et al., 2008), suggesting that childbearing decisions are easier to highly agreeable people. Kindness and considerateness are also among the most desired characteristics people seek in potential spouses (Buss & Barnes, 1986; Li, Bailey, Kenrick, & Linsenmeier, 2002), which might contribute to a positive association between agreeableness and childbearing.

Conscientiousness is a trait assessing goal orientation, achievement seeking, perseverance, and self-discipline. Among other outcomes, it is important in predicting motivation to pursue career success (Judge & Ilies, 2002), although findings are somewhat inconsistent (Boudreau & Boswell, 2001; Bozionelos, 2004; Gelissen & de Graaf, 2006; Roberts & Bogg, 2004). The conflict between family and career may lead career-oriented people, women in particular, to delay childbearing or to remain without children. Jokela et al. (2010) showed high persistence, a trait closely related to conscientiousness, to decrease the probability of having children in women as well as in men, independently of education. By contrast, other studies have reported a positive association between conscientiousness and number of children in women (Dijkstra & Barelds, 2009; Roberts & Bogg, 2004). High-achievement orientation was related to larger number of children in women who set high value to family life but not in those valuing career more than family (Elder & Macinnis, 1983), suggesting that achievement-seeking might become expressed as a larger family size (see also Jokela & Keltikangas-Järvinen, 2009). Thus, further data are needed to clarify the inconsistencies pertaining to conscientiousness.

Finally, openness to experience reflects the flexibility of social attitudes and world views, and the cognitive and esthetic sensitivity to internal and external stimuli. There are at least two reasons to expect high openness to experience to decrease childbearing propensity. First, high openness to experience correlates with cognitive ability and educational achievement (Wainwright, Wright, Luciano, Geffen, & Martin, 2008), both of which are associated with postponement of childbearing and lower number of children (Hopcroft, 2006; Retherford & Sewell, 1989; Skirbekk, 2008), especially in women. Second, high openness to experience correlates with non-traditional attitudes and values (McCrae, 1996; Van Hiel & Mervielde, 2004), and people with non-traditional family values are less likely to have children than those with more traditional perceptions of family life (Holton, Fisher, & Rowe, 2009; Kaufman, 2000; but see Puur, Olah, Tazi-Preve, & Dorbritz, 2008). These value orientations might further contribute to a negative association between openness to experience and childbearing.

Present study

We examined how personality traits of the Five Factor Model were associated with different reproductive outcomes in a large sample of American men and women ($n = 15\,729$). First, we assessed whether personality correlated with the probability and timing of marriage and parenthood. Second, we fitted a series of models predicting the birth of the first through the fifth child to examine whether personality traits were differently associated with transition to parenthood (first child) compared to later births. Third, we examined how personality traits were associated with the total number of children, and to what extent these associations were explained by timing of first marriage, becoming a parent versus remaining without children, and timing of first birth. Fourth, we investigated whether personality traits were related to the time interval between first marriage and first birth, the time interval between consecutive children, and the length of individual's reproductive lifespan.

Although our study was largely exploratory with several personality traits and reproductive outcomes, we had a priori hypotheses for some of the associations. We hypothesized that number of children is positively associated with high extraversion and agreeableness, and negatively associated with neuroticism, conscientiousness, and openness to experience. Based on previous findings (Jokela et al., 2009), we expected extraversion to be more important for the transition to parenthood than for later births and the opposite pattern for neuroticism. We also expected high extraversion to lead to younger age at first marriage and parenthood, because extraverts have a higher propensity of engaging in romantic relationships (Asendorpf & Wilpers, 1998; Nettle, 2005; Neyer & Voigt, 2004). As low neuroticism and high agreeableness are associated with low ambivalence toward parenthood (Pinquart et al., 2008), we hypothesized that these characteristics predict earlier timing of childbearing, a shorter time period between first marriage and parenthood, and shorter interbirth intervals. Given the previously established correlations between conscientiousness and achievement motivation (Judge & Ilies, 2002), and between

openness to experience and educational attainment (Wainwright et al., 2008), we hypothesized that these two personality traits are associated with postponed childbearing and higher probability of having no children. To assess the role of socioeconomic status in these associations, we included participant's own education and parental socioeconomic status as covariates.

Fifth and finally, we examined the relationship between personality, marriage, and childbearing to investigate whether personality is associated with childbearing when marital status is taken into account, and to replicate a previously reported interaction effect in the Finnish study (Jokela et al., 2010) in which high-novelty seeking (a trait reflecting sensation seeking and sensitivity to novel stimuli) decreased the overall childbearing propensity in the total sample and in married individuals, but increased the probability of having children outside marriage/cohabitation. The authors suggested that people with high-novelty seeking may have non-traditional family structures or that they are more likely to have unintended children outside stable relationships than individuals with low-novelty seeking. We attempted to replicate this analysis with personality traits of the Five Factor Model. We hypothesized that extraversion and openness to experience, traits conceptually related to novelty seeking, increase the probability of having children outside marriage.

METHODS

The participants were pooled from two separate studies, the Wisconsin Longitudinal Study (WLS; $n = 10\,737$) and the Midlife Development in the United States (MIDUS; $n = 4992$) survey, with a total number of 15 729 participants. Only individuals aged 35 or more were included, so that participants who were too young would not confound the results. The number of participants varied across different statistical models due to missing data on relevant variables.

Wisconsin longitudinal study

The ongoing WLS (Wollmering, 2007) (http://www.ssc.wisc.edu/wlsresearch/) has followed a random sample of 10 317 participants (5326 women, 4991 men) who were born between 1937 and 1940 and who graduated from Wisconsin high schools in 1957. After baseline data collection in 1957, survey data have been collected from the participants or their parents in 1964, 1975, 1992/3, and 2003/5. The present study used data from the 1993 follow-up. 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 (Wollmering, 2007). The present sample included graduates who had data on personality and fertility history at the 1992/3 data collection wave

($n = 6763$). In addition to the main sample of the 1957 high-school graduates, the WLS has also collected data on a selected sibling of a sample of the graduates (Hauser, Sewell, & Clarridge, 1982). Excluding 20 individuals younger than 35 years of age, data were available for 3974 siblings.

Personality data were collected via mail questionnaire including a 29-item Big Five Inventory (BFI; John, Donahue, & Kentle, 1991; John et al., 2008). Participants were asked whether they agreed or disagreed that certain personality descriptions fitted themselves (rated on a six-point scale, 1 = disagree strongly, and 6 = agree strongly). The Cronbach's alpha reliabilities were 0.76 in graduates/0.65 in siblings for *extraversion* (talkative; reserved; full of energy; tends to be quiet; generates a lot of enthusiasm), 0.78/0.63 for *neuroticism* (can be tense; is emotionally stable, not easily upset; worries a lot; remains calm in tense situations; gets nervous easily), 0.69/0.70 for *agreeableness* (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), 0.64/0.70 for *conscientiousness* (does a thorough job; is a reliable worker; tends to be disorganized; is lazy at times; does things efficiently; is easily distracted), and 0.61/0.70 for *openness to experience* (prefers the conventional, traditional; prefers work that is routine and simple; values artistic, aesthetic experiences; has an active imagination; wants things to be simple and clear-cut; is sophisticated in art, music, or literature).

Education was determined on the basis of years of education (ranging from 0 = none to 20 = postdoctorate education, with value 12 indicating high-school graduation). Age-specific *marital history* was constructed from the participants' reports of their marriages and divorces (reported with 1 year's accuracy) and fertility history from children's birth years. Up to five marriages and divorces were reported for graduates, and up to four marriages and divorces for siblings. *Parental socioeconomic status* was assessed on the basis of a factor-weighted composite score of father's years of schooling, mother's years of schooling, father's occupational status, and average parental income in 1957.

Midlife development in the United States

The MacArthur Foundation Survey of MIDUS is based on a nationally representative random-digit-dial sample of non-institutionalized, English-speaking adults, aged 25–74 years, selected from working telephone banks in the coterminous United States in 1995–1996 (Brim et al., 2007; Ryff et al., 2006). The original sample ($n = 7108$) includes main respondents ($n = 3487$), their siblings ($n = 950$), a city oversample ($n = 757$), and a twin subsample ($n = 1914$). Data were collected in a telephone interview and with a mail questionnaire. There were 6261 participants with data on measures used in the present study, but 1267 individuals were excluded because they were younger than 35 years of age, leaving 4992 eligible participants.

Personality was assessed with a questionnaire based on the Five Factor Model, including indicators of extraversion, neuroticism, agreeableness, conscientiousness, and openness

to experience (Johnson & Krueger, 2004; Jokela, 2009a; Lachman & Weaver, 1997). The participants were asked to rate how well different adjectives described them (1 = not at all and 4 = a lot). The trait scales consisted of 4–8 adjectives as follows: *extraversion* (outgoing, friendly, lively, active, talkative; Cronbach's alpha in the present sample $\alpha = 0.74$), *neuroticism* (moody, worrying, nervous, calm [reversed]; $\alpha = 0.71$), *agreeableness* (helpful, warm, caring, soft-hearted, sympathetic; $\alpha = 0.78$), *conscientiousness* (organized, responsible, hardworking, careless [reversed]; $\alpha = 0.51$), and *openness to experience* (creative, imaginative, intelligent, curious, active, broad-minded, sophisticated, adventurous; $\alpha = 0.74$). With the exception of the fairly low reliability of conscientiousness, the reliability estimates indicated acceptable internal consistencies.

Education was reported on a 12-point scale (0 = none, 4 = high school, and 12 = PhD or equivalent higher degree). *Parental socioeconomic status* was determined on the basis of father's (or mother's if data on father was missing) Duncan Socioeconomic Index score.

STATISTICAL ANALYSIS

Linear and logistic regression analysis was used to model continuous and dichotomous outcomes, respectively. Number of children was modeled with linear regression analysis, as it produced essentially the same results as Poisson regression (data not shown) but the coefficients were more intuitive to interpret, and the residuals of these models did not deviate from a normal distribution. Strongly skewed outcome variables were log-transformed. All models were adjusted for sex, age, and study sample (0 = WLS graduates, 1 = WLS siblings, and 2 = MIDUS), and the five personality traits were always mutually adjusted to assess their independent effects. Standard errors were calculated using robust estimator with family clustering to take into account the non-independence of siblings in the WLS and MIDUS samples. Personality scales, educational level, and parental socioeconomic status were all standardized ($M = 0$, $SD = 1$) within the samples before merging the datasets.

The relationship between personality, marriage, and childbearing was assessed using survival analysis, because marital status had to be coded as a time-dependent covariate. We used multi-spell discrete-time survival analysis, which allows one to model several successive events (births) in a single survival analysis model (Willett & Singer, 1995). Detailed marital and fertility histories (i.e., ages of marriages, divorces, remarriages, and births of children) were available for the participants of the WLS, allowing us to examine the probability of having a child when being married versus not being married. Due to lack of data of detailed marriage history, participants of the MIDUS sample were not included in this analysis.

While previous studies of personality and childbearing have found few if any sex differences (Alvergne, Jokela, & Lummaa, 2010; Jokela et al., 2010; Jokela & Keltikangas-Järvinen, 2009; Jokela et al., 2009; Reis et al., 2011), it is reasonable to expect that such differences might exist. Thus,

we fitted all the models in men and women separately in addition to presenting the results for the total sample. Sex differences were tested with sex × personality trait interaction effects, and the sex-specific findings were interpreted only when a statistically significant interaction effect ($p < 0.05$) was present.

RESULTS

Table 1 shows the descriptive statistics for the samples. The MIDUS sample was younger than the WLS samples and thereby had lower mean number of children, but the mean ages at first marriage and first birth were very similar in all cohorts. Younger age at first marriage and childbirth were both associated with a larger number of offspring in men and women (Supplementary Figure S1).

First marriage and parenthood

Extraversion was associated with higher odds of getting married and getting married earlier, particularly in men (Table 2). Individuals with high openness to experience were less likely to get married and also postponed their first marriage. Agreeable people entered their first marriage slightly earlier than non-agreeable people, but agreeableness was related to marriage probability only in women. Table 3 shows the corresponding analysis for the birth of the first child. Again, high extraversion was positively associated with the odds of becoming a parent and becoming a parent earlier whereas high openness to experience had the opposite effect. Agreeableness was associated with higher odds of parenthood in women but not in men, and with earlier timing of parenthood in men and women.

Childbearing by parity

The odds ratios for personality traits predicting parity-specific associations (i.e., predicting probability of having the first, second, third, fourth, and fifth child) are shown in Figure 1 (results for the first birth presented already in Table 3 are also included in Figure 1). Extraversion strongly predicted the birth of the first child but became a weaker predictor of later births. Agreeableness demonstrated a similar association in women. Openness to experience showed the opposite pattern, with high openness being more strongly associated with lower odds of becoming a parent but then less strongly associated with later births. Neuroticism predicted lower odds of childbearing quite consistently across parities but most of these parity-specific associations were not statistically significant. Conscientiousness was associated with lower odds of childbearing particularly after the second child.

Number of Children

High extraversion, low neuroticism, and low openness were associated with larger number of children in both sexes, whereas, high agreeableness and low conscientiousness

Table 1.   Descriptive statistics

	WLS graduates	WLS siblings	MIDUS
Sex			
Male (%)	46.2	46.3	47.9
Female (%)	53.8	53.7	52.1
Age	54.1 (0.5)	53.2 (7.2)	51.1 (10.7)
Education level[†]	13.7 (2.3)	13.8 (2.6)	6.8 (2.5)
Extraversion[†]	22.6 (5.6)	22.3 (5.5)	16.0 (2.8)
Neuroticism[†]	15.8 (5.1)	16.0 (4.8)	9.0 (2.7)
Agreeableness[†]	28.1 (4.8)	27.8 (4.7)	17.4 (2.4)
Conscientiousness[†]	28.8 (4.6)	28.4 (4.5)	13.7 (1.8)
Openness to experience[†]	21.5 (5.2)	21.3 (4.8)	24.1 (4.2)
Number of children	2.66 (1.60)	2.52 (1.76)	2.26 (1.62)
None (%)	11.7	15.1	16.1
One (%)	8.2	9.7	14.1
Two (%)	27.0	28.3	30.4
Three (%)	27.0	23.4	20.9
Four (%)	15.5	12.9	10.6
Five (%)	6.5	5.4	4.6
Six or more (%)	4.2	5.2	3.3
Age at first marriage	22.9 (4.1)	23.1 (4.2)	23.0 (5.0)
Age at first child	24.3 (4.1)	24.9 (4.5)	24.2 (5.2)
Time from marriage to first child (years)	1.98 (2.28)	2.42 (2.67)	2.41 (3.03)
Reproductive lifespan (years)	6.31 (4.20)	6.49 (4.57)	6.57 (4.56)
Average interbirth interval (years)	2.89 (2.29)	3.01 (2.40)	3.28 (2.59)
n	6763	3974	4992

Note: Values are means (and standard deviations) unless indicated otherwise.
[†]Assessed with different measures in WLS and MIDUS samples.

predicted larger number of children only in women (Table 4, Model A). Adjusting for education and parental socio-economic status had little if any effect on these associations, except that in women the coefficient of openness to experience was attenuated almost by half (Model B). When the number of children was predicted only among participants with at least one child, the regression coefficients of extraversion and openness were attenuated

(Model C). Taking into account whether the participant had ever been married and the age at first marriage (0 = never married, 1 = younger than 20; 2 = 20–21; 3 = 22–23; 4 = 24–27; 5 = 28–35; 6 = older than 35), led to almost similar results (model D) as when the sample was restricted to only those with one child or more. Adjusting for parenthood status and age at first child (0 = no children, 1 = younger than 20; 2 = 20–21; 3 = 22–23; 4 = 24–27;

Table 2.   Predicting first marriage by personality traits

	All	Men	Women
Probability of first marriage[a]			
Extraversion	1.35 (0.05)[‡]	1.53 (0.08)[‡]	1.22 (0.06)[‡]
Neuroticism	0.95 (0.03)	0.90 (0.04)[*]	0.99 (0.05)
Agreeableness	1.03 (0.04)	0.95 (0.05)	1.10 (0.06)[*]
Conscientiousness	1.06 (0.04)	1.09 (0.06)	1.03 (0.05)
Openness to experience	0.77 (0.03)[‡]	0.79 (0.04)[‡]	0.76 (0.04)[‡]
n	15 729	7356	8373
Age at first marriage[b]			
Extraversion	−0.35 (0.04)[‡]	−0.43 (0.06)[‡]	−0.28 (0.05)[‡]
Neuroticism	−0.02 (0.04)	0.04 (0.06)	−0.06 (0.05)
Agreeableness	−0.10 (0.04)[*]	−0.12 (0.06)	−0.07 (0.05)
Conscientiousness	−0.06 (0.04)	−0.10 (0.06)	−0.02 (0.05)
Openness to experience	0.39 (0.04)[‡]	0.35 (0.06)[‡]	0.42 (0.05)[‡]
n	14 665	6835	7830

Note: [a]Probability of first marriage is predicted using logistic regression (odds ratios and their standard errors in parenthesis). Values above (below) 1.00 indicate higher (lower) probability of marriage.
[b]Age at first marriage is predicted using linear regression analysis (β-coefficients and their standard errors in parenthesis). Positive (negative) values indicate older (younger) age at first marriage. Regression coefficients are presented for standardized personality scales ($M = 0$, $SD = 1$). Personality traits are all mutually adjusted in all models. All models further adjust for sex, age, and study sample. Underlined coefficients indicate statistically significant sex differences.
[*]$p < 0.05$, [†]$p < 0.01$, [‡]$p < 0.001$.

Table 3. Predicting the birth of the first child by personality traits

	All	Men	Women
Probability of first child[a]			
Extraversion	1.28 (0.03)[‡]	1.34 (0.05)[‡]	1.23 (0.05)[‡]
Neuroticism	0.96 (0.02)	0.94 (0.03)	0.97 (0.03)
Agreeableness	1.10 (0.03)[‡]	1.01 (0.04)	1.19 (0.05)[‡]
Conscientiousness	0.95 (0.02)[*]	0.98 (0.04)	0.92 (0.03)[*]
Openness to experience	0.74 (0.02)[‡]	0.79 (0.03)[‡]	0.70 (0.03)[‡]
n	15 729	7356	8373
Age at first child[b]			
Extraversion	−0.24 (0.04)[‡]	−0.32 (0.07)[‡]	−0.19 (0.06)[‡]
Neuroticism	−0.04 (0.04)	0.03 (0.06)	−0.10 (0.05)[*]
Agreeableness	−0.12 (0.04)[†]	−0.17 (0.06)[*]	−0.07 (0.05)
Conscientiousness	−0.04 (0.04)	−0.08 (0.06)	0.00 (0.05)
Openness to experience	0.44 (0.04)[‡]	0.47 (0.07)	0.41 (0.05)[‡]
n	13 521	6221	7300

Note: [a]Probability of first child is predicted using logistic regression (odds ratios and their standard errors in parenthesis). Values above (below) 1.00 indicate higher (lower) probability of parenthood.
[b]Age at first child is predicted using linear regression analysis (β-coefficients and their standard errors in parenthesis). Positive (negative) values indicate older (younger) age at parenthood. Regression coefficients are presented for standardized personality scales ($M = 0$, $SD = 1$). Personality traits are all mutually adjusted in all models. All models further adjust for sex, age, and study sample. Underlined coefficients indicate statistically significant sex differences.
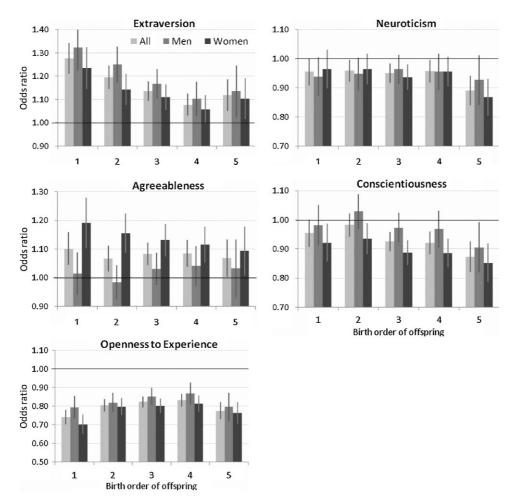[*]$p < 0.05$, [†]$p < 0.01$, [‡]$p < 0.001$.

Figure 1. Parity-specific models of childbirth and personality traits. The bars denote odds ratios of having a child modeled with separate logistic regression models for the first through the fifth offspring, adjusted for sex, age, study sample, and all other personality traits. Odds ratios above (below) 1.00 indicate increased (decreased) odds of having a child. Error bars are 95% confidence intervals. See Table 3 for statistical details for the birth of the first child.

Table 4.   Predicting the number of children by personality traits. Adjusted regression models

	A	B	C	D	E
All (n = 15 729)					
Extraversion	0.12 (0.01)***	0.11 (0.01)***	0.05 (0.01)***	0.05 (0.01)***	0.02 (0.01)
Neuroticism	−0.05 (0.01)***	−0.07 (0.01)***	−0.04 (0.01)***	−0.05 (0.01)***	−0.04 (0.01)***
Agreeableness	0.07 (0.01)***	0.05 (0.01)***	0.05 (0.01)***	0.06 (0.01)***	0.03 (0.01)**
Conscientiousness	−0.06 (0.01)***	−0.06 (0.01)***	−0.06 (0.01)***	−0.08 (0.01)***	−0.05 (0.01)***
Openness to Experience	−0.19 (0.01)***	−0.13 (0.02)***	−0.12 (0.01)***	−0.12 (0.01)***	−0.05 (0.01)***
Men (n = 7356)					
Extraversion	0.15 (0.02)***	0.14 (0.02)***	0.06 (0.02)**	0.06 (0.02)**	0.03 (0.02)*
Neuroticism	−0.04 (0.02)	−0.05 (0.02)*	−0.02 (0.02)	−0.02 (0.02)	−0.01 (0.01)
Agreeableness	0.02 (0.02)	0.01 (0.02)	0.02 (0.02)	0.02 (0.02)	0.00 (0.02)
Conscientiousness	−0.02 (0.02)	−0.02 (0.02)	−0.01 (0.02)	−0.04 (0.02)*	−0.02 (0.01)
Openness to Experience	−0.16 (0.02)***	−0.13 (0.02)***	−0.10 (0.02)***	−0.10 (0.02)***	−0.05 (0.02)**
Women (n = 8373)					
Extraversion	0.10 (0.02)***	0.07 (0.02)***	0.03 (0.02)	0.04 (0.02)*	0.01 (0.02)
Neuroticism	−0.06 (0.02)***	−0.09 (0.02)***	−0.06 (0.02)**	−0.07 (0.02)***	−0.06 (0.01)***
Agreeableness	0.11 (0.02)***	0.08 (0.02)***	0.07 (0.02)***	0.09 (0.02)***	0.06 (0.02)***
Conscientiousness	−0.10 (0.02)***	−0.10 (0.02)***	−0.09 (0.02)***	−0.11 (0.02)***	−0.08 (0.02)***
Openness to Experience	−0.22 (0.02)***	−0.10 (0.02)***	−0.12 (0.02)***	−0.14 (0.02)***	−0.06 (0.02)***

Note: Values are coefficients (and standard errors) of linear regression analysis, presented for standardized personality scales ($M = 0$, $SD = 1$). Positive (negative) values indicate higher (lower) number of children.
Model A adjusts for sex, age, and study sample.
Model B adjusts for model A + education and parental socioeconomic status.
Model C is model A fitted in participants with at least one child ($n = 6233$ in men, 7303 in women).
Model D adjusts for model A + whether ever been married and age at first marriage.
Model E adjusts for model A + whether and at what age first child born.
Underlined coefficients indicate statistically significant sex differences.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

$5 = 28–35$; $6 =$ older than 35) attenuated the coefficient of extraversion almost completely and the coefficient of openness to experience by three fourths. After this adjustment, low neuroticism and conscientiousness, and high agreeableness still predicted larger number of children in women but not in men.

To examine possible non-linear associations between personality and number of children, we categorized all the traits into quintiles and fitted Model A of Table 4 in the total sample with categorical variables (Supplementary Figure S2). There were no quadratic effects for any of the personality traits in the total sample or in sex-specific analyses (data not shown), indicating that intermediate level was not associated with large or small number of children compared to the extremes for any of the personality traits.

Other timing components of childbearing

One standard deviation increase in conscientiousness and openness to experience were related to 2 and 5% longer time, respectively, between first marriage and first child in both sexes (Supplementary Table S1). High neuroticism (in women), conscientiousness, and openness to experience were associated with modestly longer interbirth intervals between consecutive births (1–2% difference per standard deviation difference). High agreeableness, low conscientiousness (in women), and low openness to experience were related to 1–4% longer reproductive time span per standard deviation in the personality trait. In men, a standard deviation

difference in extraversion predicted 3% longer reproductive time span. To examine whether these associations reflected simply the fact that personality traits were associated with number of children (which is naturally associated with the length of reproductive time span), we fitted the model adjusted for number of children (Supplementary Table S1). Low conscientiousness and openness to experience, and high extraversion in men, still predicted longer reproductive time span even when accounting for the number of children born during the time interval. High neuroticism in women emerged as a significant predictor of reproductive life span when adjusted for number of children.

Marital status and childbearing

Of the 25721 children born to the participants, 657 (2.6%; 2.5% in men, 2.3% in women) were born to participants who were not married in the year the child was born, which is only slightly less than that estimated for the White US population at that time based on census data (National Center for Health Statistics, 1998; Ventura, 2009). In married individuals, associations between personality traits and childbearing were very similar to those presented in Table 4, suggesting that personality was associated with childbearing beyond its associations with marital status (Supplementary Table S2). There were three significant interaction effects with marital status. First, in men and women, extraversion predicted childbearing more strongly in non-married (OR = 1.13) than in married (OR = 1.03) individuals, although both

associations were significant. Second, agreeableness in women was associated with childbearing in married (OR = 1.04) women but not in non-married women. Finally, neuroticism in men predicted lower probability of childbearing only among unmarried men (OR = 0.87) but not in married men.

DISCUSSION

The present study of a large American sample demonstrates that personality traits of the Five Factor Model are associated with number of children in adulthood, especially in women. Furthermore, several more specific associations between personality traits and reproductive outcomes were observed.

Trait-specific findings

Extraversion
As hypothesized, extraversion correlated with larger number of children both in men and women. Supporting the hypothesis postulated by Jokela et al. (2009), the effect for extraversion was more pronounced in the association for the birth of the first child but attenuated when predicting later births. Extraverted individuals were more likely to marry and become parents and to have their first child earlier than introverts. These two timing components almost completely explained the positive association between extraversion and total number of children. Thus, earlier timing of parenthood appears to be central in the explaining why extraversion is related to larger number of children.

The results are in agreement with the prospective Finnish study reporting a positive association between sociability and increased probability of becoming a parent (Jokela et al., 2009). In contrast, a study of Australian women (Eaves et al., 1990) and another study of British women and men (Nettle, 2005) observed no linear association between extraversion and number of children. Large sample sizes may be needed to establish associations between personality and offspring number, and our study allowed the detection of even small associations between personality traits and reproductive behavior. In the twin study (Eaves et al., 1990), the authors identified a complex interaction effect between extraversion and neuroticism on offspring number. We attempted to replicate this effect ($C = E + N + E^2 + N^2 + E \times N$, where C is the number of children, E the extraversion, and N is the neuroticism), but there was no evidence of such an interaction in the present data (all $p > 0.12$ in women and men separately or in the total sample; details not shown).

High extraversion was related to higher probability of having children particularly in women and men who were not married at the time of child's birth. A similar interaction effect was previously reported between marital status and novelty seeking (Jokela et al., 2010). Extraverts have more active romantic and sexual life than introverts (Hoyle, Fejfar, & Miller, 2000; Miller, Lynam, Zimmerman, Logan, Leukefeld, Clayton, 2004; Schmitt & Shackelford, 2008), and women and men with high extraversion have more extra-pair relationships than their introverted counterparts (Nettle,

2005). We suggest that the outgoing and spontaneous behavior associated with extraversion and the short-term sexual relationships following such tendencies (Schmitt & Shackelford, 2008), increases the probability of having unplanned children outside marriage.

Neuroticism
The findings related to neuroticism only partly supported the hypothesis that neuroticism would become more important predictor of reproduction with increasing family size (Jokela et al., 2009). Neuroticism was not associated with the probability or timing of first marriage or first birth (supporting the hypothesis) but there was no evidence for an increasingly strengthening effect with parity (not supporting the hypothesis). Yet high neuroticism was associated with smaller total number of children. Women with high neuroticism also had longer interbirth intervals and they had their children over a longer period of time (taking into account their lower number of children).

Marriage difficulties (Fisher & McNulty, 2008; Jockin, McGue, & Lykken, 1996; Karney & Bradbury, 1997) and feelings of uncertainty concerning parenthood (Pinquart et al., 2008) associated with neuroticism may help to explain why neuroticism is associated with lower number of children. In addition, we hypothesize that individuals with high neuroticism are wary of having children, because they tend to emphasize the worrisome and stressful sides of parenthood. The longer interbirth intervals and longer reproductive time spans in women with high neuroticism can be interpreted to support this explanation; women with high neuroticism may need more time to decide whether or not to have another child.

Agreeableness
Agreeable women were more likely to have children than their less agreeable counterparts. This difference was most pronounced in the first birth and attenuated with parity, thus resembling the pattern observed for extraversion. Unlike extraversion, however, agreeableness predicted greater number of offspring even when the probability and timing of parenthood were taken into account, indicating that these two factors did not explain its association with childbearing. Previous studies have shown temperament and personality traits related to agreeableness (reward dependence, nurturance, and affiliation) to be associated with higher childbearing propensity (Jokela et al., 2010) and with more positive views of having children (Miller, 1992; Pinquart et al., 2008).

Agreeable men got married and had their first child earlier than less agreeable men, but men's agreeableness was not related to the probability of becoming a parent or the number of children. The lack of association between agreeableness and parenthood in men is perhaps the most surprising finding of our study. Kindness, honesty, and being considerate, all related to agreeableness, are among the most highly valued characteristics both sexes reportedly desire in potential partners (Buss, 1989; Buss & Barnes, 1986; Miller, 2007; but see Urbaniak & Kilmann, 2003, 2006). Apparently, the agreeable tendencies of men, or the preferences for these

tendencies in the opposite sex, do not have the same reproductive consequences for men as they have for women.

Conscientiousness

The association between conscientiousness and number of children was also dependent on sex, so that high conscientiousness was associated with lower offspring number in women but not in men. In addition, women with high conscientiousness had a shorter reproductive lifespan even when adjusted for the lower number of children they had, indicating that conscientious women had their children within a shorter period of time than their less conscientious peers. This might be due to the conflicts between career and family that conscientious individuals, women in particular, need to negotiate owing to their higher motivation to pursue socioeconomic achievement (Judge & Ilies, 2002). However, conscientiousness was not associated with postponed transition to parenthood (one of the central mechanisms via which education decreases number of children; (Berrington, 2004; Marini, 1984), and the association was almost completely independent of women's socioeconomic background. In the Young Finns study (Jokela et al., 2010), the negative association between persistence and number of children was also independent of educational level. Thus, conscientiousness appears to be related to lower childbearing propensity via other pathways than socioeconomic status.

Other studies have reported positive associations between conscientiousness-related traits and family size in women (Elder & Macinnis, 1983; Roberts & Bogg, 2004). In a sample of Californian women born in the early 20th century, need for achievement increased number of children only in domestically oriented women but not in career-oriented women (Elder & Macinnis, 1983). In another sample of Californian women, social responsibility decreased the time spent in paid labor force and increased the probability of marriage (Roberts & Bogg, 2004). In a Finnish study, high leadership personality predicted both higher educational level and higher probability of having children in both women and men (Jokela & Keltikangas-Järvinen, 2009). The authors suggested that the Finnish social policies supporting the combination of career advancement and family formation (Ronsen, 2004; Vikat, 2004) may contribute to this association particularly in women. Thus, the reproductive consequences of conscientiousness may depend on personal attitudes and cultural expectations, for which data were not available in the present study, but that they do not appear to represent simply the effects of socioeconomic status.

Openness to experience

Openness to experience was the personality trait with the strongest associations with reproductive behavior, with high openness to experience correlating with lower probability and postponed timing of marriage and transition to parenthood, lower number of children, shorter reproductive lifespan, longer time between first marriage and parenthood, and longer interbirth intervals. Approximately half of the negative association between openness to experience and number of children in women was accounted for by socioeconomic background, with a somewhat more modest attenuation effect in men. In addition to higher educational achievement, the negative association between openness to experience and childbearing may reflect non-traditional family values which decrease childbearing propensity (Holton et al., 2009; Kaufman, 2000).

Study limitations

The main limitation of the present study is the assessment of personality after the participants had already had their children, introducing the possibility of reverse causality (parenthood influencing personality development) which may bias the estimates of personality predicting reproductive outcomes. Parenthood has been associated with personality change (Feldman & Aschenbrenner, 1983; Jokela et al., 2009) and parents with young children have higher psychological distress than their non-parent peers (Demo & Cox, 2000), but it is currently unknown whether these effects have long-lasting consequences for personality development. Temperament and personality traits have been shown to predict childbearing in prospective studies (Jokela et al., 2010; Jokela & Keltikangas-Järvinen, 2009; Jokela et al., 2009), and one of these studies (Jokela et al., 2010) showed no differences in the temperament–childbearing associations when using retrospective versus prospective data, suggesting that retrospective data may not substantially bias personality–childbearing associations. Nevertheless, prospective studies with the Five Factor Model are needed to examine personality traits in predicting later childbearing and parenthood in predicting personality change to directly assess the relative strengths of potential bidirectional associations.

It must also be acknowledged that non-experimental data cannot establish causality with the same certainty as experimental data. The present results suggest that personality–reproduction associations are largely independent of socioeconomic background, but other confounding factors affecting both personality and fertility behavior might introduce spurious associations between personality and childbearing. Prospective data with more extensive measures of covariates and different study designs, such as sibling and twin analyses, are needed to further evaluate the independent contribution of personality characteristics to reproductive behavior.

Plausible mechanisms

There are several plausible psychological and social pathways via which personality may influence reproductive behavior. Personality dispositions may influence how likely and how often individuals encounter opportunities for having children. Sexual behavior and selection into romantic relationships could function as mediators, although the present results suggest that the associations between personality traits and number of children are independent of marital status. However, more specific aspects of romantic relationships, such as marital satisfaction or relationship quality, have been associated with both personality differences (e.g., Karney & Bradbury, 1997) and child-

bearing probability (Jokela, 2010), which may help to explain part of the associations between personality and reproductive outcomes. Personality might also have an effect on reproductive behavior via partner effects, e.g., how the person is perceived as a potential parent by other people.

In addition, individuals have different desires and intentions of having children (Chasiotis, Hofer, & Campos, 2006; Miller, 1994, 1995; Miller & Pasta, 1995), which may be related to personality differences (Miller, 1992; Pinquart et al., 2008). Personality traits may also determine, in part, how accurately individuals reach their desired family size; some individuals will end up having more and others fewer children than they might have intended. Unfortunately, the present samples did not include data on fertility desires and intentions.

Evolutionary personality psychology

The presence of personality variation in human and animal populations has been a topic of lively discussion in evolutionary personality psychology (Buss, 2009; Buss & Greiling, 1999; Penke, Denissen, & Miller, 2007; Reale, Reader, Sol, McDougall, & Dingemanse, 2007). This discussion stems from the general expectation that heritable characteristics associated with reproductive success should be under natural selection and thereby gradually become fixed in the population. Several alternative models have been put forward to explain why we still observed heritable variation in personality traits (Buss, 2009; Keller & Miller, 2006; Penke et al., 2007), many of which assume some form of balance between positive and negative evolutionary consequences of personality traits.

Recent studies have investigated the strength of natural or sexual selection in contemporary humans (Stearns, Byars, Govindaraju, & Ewbank, 2010). The selection differential for traits associated with reproductive success can be expressed with standardized β-coefficients (Kingsolver et al., 2001). As a result of directional selection, one would expect the mean of a trait to change $R = Sh^2$ standard deviations per generation, where R = response to selection, S = selection differential, and h^2 = additive genetic variance (or heritability) of the trait under selection. In the present study, the β-coefficients (selection differentials) were 0.06 in women/0.09 in men for extraversion, $-0.04/-0.02$ for neuroticism, 0.07/0.01 for agreeableness, $-0.06/-0.01$ for conscientiousness, and $-0.13/-0.10$ for openness to experience (unstandardized regression coefficients shown in Model A of Table 4). These estimates are considerably lower than those observed for various morphological and life-history traits in free-ranging non-human animals (median $\beta = 0.16$ based on a review of 63 species; (Kingsolver et al., 2001). However, they are of similar magnitude than those for temperament (Jokela et al., 2010) and physical attractiveness (Jokela, 2009b), and slightly lower than for male wealth (Nettle & Pollet, 2008), reported in earlier studies of contemporary humans.

Thus, current evidence from the present and previous studies suggests that some personality dimensions are favored by natural or sexual selection while others are

selected against, with little or no evidence for advantage for intermediate levels of personality traits. However, with few exceptions (Alvergne et al., 2010), the associations between personality and reproduction in humans have been studied mostly in contemporary Western societies. It is, therefore, unknown whether these results generalize across populations and over time. It is also yet unknown whether personality traits are related to reproductive success because of genetic or environmental effects. Moreover, the estimated selection differentials suggest only weak effects (less than 0.05 standard deviation change per generation), which would take several generations to produce even small effects in the population.

Several researchers have attempted to integrate personality psychology with behavioral ecology and evolutionary life history theory by viewing personality differences as differences in alternative life history strategies (Buunk, Pollet, Klavina, Figueredo, & Dijkstra, 2009; Figueredo, Vasquez, Brumbach, & Schneider, 2004, 2007; Figueredo, Vasquez, Brumbach, Sefcek, Kirsner, & Jacobs, 2005; Nettle & Penke, 2010; Reale et al., 2007). Given that personality traits are associated with reproductive outcomes but yet natural selection has not depleted their genetic variance, one would expect there to be some trade-offs and optimization processes related to such alternative reproductive strategies in other measures of reproductive success (Hill & Kaplan, 1999; Mace, 2000; Nettle, 2005, 2006; Voland, 1998). For instance, in a sample of preindustrial Senegalese women and men (Alvergne et al., 2010), high neuroticism was associated with larger number of offspring in women. Women's high neuroticism was also associated with poor health of offspring, suggesting that, at least in the environmental circumstances characterizing the sample, women's high neuroticism may be related to a trade-off between number and health condition of offspring. Such trade-offs need to be explored further to assess the plausibility of personality traits being related to alternative life history strategies.

CONCLUSION

This is the first study to explore the association between all the Five Factor Model personality traits and multiple indicators of reproductive behavior in a large sample of women and men. The findings demonstrate that personality is systematically associated with a broad range of reproductive outcomes in both sexes, although traits of the Five Factor Model seem to be more broadly related to reproduction in women than in men. Individual differences in psychological dispositions need to be considered in explanatory models of human fertility in contemporary societies.

ACKNOWLEDGMENTS

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