

Intelligence and Age at First Intercourse: Cause or Confound?

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Abstract

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Anecdotal evidence from the popular media, such as MTV's reality television franchise, *16 and Pregnant*, suggests that teenage promiscuity is on the rise. Academic evidence confirms such anecdotes; age at first intercourse (AFI) is indeed declining and has so for some time (Bozon, 2003; Finer, 2007). Early age at first intercourse is associated with a plethora of negative downstream consequences, including lower education attainment (Wellings et al., 2001; Harden, 2012), failure to meet education and career goals (Halpern, Joyner, Udry, & Suchindran, 2000), increased risk of teenage pregnancy (Leitenberg & Saltzman, 2000; Wellings et al., 2001), and increased rates of sexually transmitted infections (Kaestle, Halpern, Miller, & Ford, 2005). Moreover, beyond the obvious benefit of avoiding the aforementioned negative outcomes, delaying AFI is associated with greater relationship satisfaction, perception of increased attractiveness, and higher household income (Harden, 2012). Because the aforementioned consequences are severe and long-reaching, psychology has begun to explore potential causal mechanisms of early AFI. Indeed, the field has found a consistent correlate in the literature – intelligence.

Higher levels of intelligence are positively associated with delaying first intercourse (Woodward, Fergusson, & Horwood, 2001; Paul, Fitzjohn, Herbison, & Dickson, 2000; Halpern et al., 2000; Mott, 1983). Specifically, it seems that intelligent individuals delay intercourse to “safeguard” their futures (Kirby, 2002; Manlove, 1998; Raffaelli & Crockett, 2003). They perceive the risks associated with early intercourse, (e.g., pregnancy, STIs) to have career-shattering outcomes (Halpern et al., 2000; Harden & Mendle, 2011). Although this correlate holds promise – much of the field has treated this finding as causal and non-spurious. Yet, there is a fundamental confound in the existing literature that makes it impossible to infer causality.

Practically, all of the AFI-intelligence literature has used between family analyses. In all such analyses, gene and environmental influences, such as education and maternal intelligence are hopelessly confounded (See Harden, 2014). By ignoring such confounds, results are uninterpretable and risk misattributions of causality (Rowe & Rodgers, 1997;

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in fact, it looks like shows such as this
one reduce rates of teen
pregnancy...(Kearney & Levine, 2014)

Rutter, 2007). Indeed, both intelligence and AFI are highly heritable and have sizeable shared environmental variances (Harden & Mendle, 2011; Harden, 2014; Plomin & Spinath, 2004). Thus, we need to critically evaluate whether intelligence is a cause of AFI or merely a theoretically attractive confound.

Cause or Confound?

There are numerous theories on the motivations behind adolescents initiation of first intercourse (See Rodgers, 1996 for a review).

****MORE ON MOTIVES OF AFI. USE SOCIAL INFLUENCES/CONSEQUENCES AS TRANSITION TO INTELLIGENCE AS A CAUSAL MECHANISM****

Intelligence as the Cause

We've previously mentioned that the short-term risks of early AFI are overwhelming negative, whereas the rewards for delay are equally positive. These consequences extend into adulthood – early AFI is associated with adult delinquency (Harden, Mendle, Hill, Turkheimer, & Emery, 2008), anti-social behaviour, and substance abuse (Boislard & Poulin, 2011), while those who delayed had higher household incomes in adulthood (Harden, 2012). It is intuitively appealing to believe that intelligent individuals are more likely to observe this high risk, low reward tradeoff, and act upon such observations by delaying intercourse. Accordingly, intelligent individuals perceive the consequences of early AFI to have career-shattering outcomes (Halpern et al., 2000; Harden & Mendle, 2011).

Indeed, the literature is consistent with this theory. Those with higher educational goals delay their first intercourse (Boislard & Poulin, 2011; Schvaneveldt, Miller, Berry, & Lee, 2001), while those who had previously reported higher goals, but engaged in early sexual intercourse reduced their goals (Schvaneveldt et al., 2001). Beyond academic goals, those with a greater affinity for risk and those who perceive benefits from teen-pregnancy are more likely to engage in risky sexual activities (Raffaelli &

Crockett, 2003). A greater understanding of the risks associated with sexual intercourse, such as HIV transmission, is also associated with delayed AFI (C. Mathews et al., 2009).

Smarter adolescents are more likely to report delayed intercourse (Woodward et al., 2001; Paul et al., 2000; Halpern et al., 2000; Mott, 1983). Beyond intercourse, smarter individuals appear to postpone all sexual/romantic activity Halpern et al. (2000). Such blanket delays may be a proactive attempt to avoid first intercourse precursors.

Intelligence as a Confound

However, there is an equally valid family of explanations in which intelligence is not the driver of the AFI-intelligence relationship. It could be that family-level influences such as SES, maternal intelligence drive the relationship. Indeed many such findings that link intelligence with various outcomes are the product of misattributing between family confounds to individual level predictors. The relationship between birth order and intelligence is a classic example of this misattribution. INSERT THREE SENTENCE SUMMARY(See Rodgers, Cleveland, van den Oord, & Rowe, 2000). The link between intelligence and AFI could also be the product of individual level confounds that are highly correlated with both intelligence and AFI.

- family level factors (ses, mother education, use mother intelligence as a transition)
 - Disadvantaged Backgrounds are assoicated with both lower levels of intelligence and eariler AFI.
 - * poverty
 - * larger family
 - * lower SES
 - * being on welfare
 - Parental Characteristics
 - * parental education
 - * parental intelligence
- alternative individual level factors (genes, education, persality)

substantive confounds

statistical confounds

, use to transition to explaining between and within family findings. If a result is truly causal, then findings from between family analyses will be replicated by within family results. If said replication fails, then the characteristic cannot be a direct cause of the effect. That isn't to say intelligence isn't a distal cause – any many of the AFI-intelligence theories suggest that risk perception is an essential element . However, being intelligent in and of itself does not cause changes in AFI

Between vs. Within Family Analyses

Therefore, in order to determine whether the link between intelligence and AFI is causal, we need to find a way to untangle the between family influences from the within family (ie causal) influences. One of the fundamental challenges in psychological research is evaluating causal hypotheses that are either situation driven or person driven. Randomized experiments are particularly effective at determining causality for situational hypotheses because random assignment controls for genetic and environmental confounds across repeated trials. However, some situation driven explanations, such as maternal influence, cannot be ethically evaluated via randomized experiment. Moreover, evaluating person-driven hypotheses are comparably problematic, as random assignment of person characteristics (e.g., personality) isn't feasible (see West, 2009). Traditional alternatives to evaluating such hypotheses tend to focus upon between-family longitudinal studies, where potential confounds are included as covariates.

However, the between-family covariate approach cannot control for systematically confounded genetic characteristics and environmental influences. The approach can result in misattributions of causality, as the misattributed cause might sufficiently covary with the true cause. Indeed, poverty and individual differences covary with genes and environment, to such a degree that between family analyses are fundamentally biased (Rowe & Rodgers, 1997). Yet, the covariate approach has been the primary

method used to evaluate the causal mechanism behind the AFI-intelligence relationship.

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Instead, quasi-experimental designs can be used; such designs support causal inference without random assignment. Sibling-based quasi-experimental models are particularly effective at incorporating genetic and environmental design elements. However, such models are underused in psychology (Rodgers *et al*, 2001), tend to focus on environmental confounds and do not naturally incorporate varying levels of relatedness.

Traditional sibling comparison models often rely on rare events (i.e., twins) or advanced methodology (e.g., propensity score matching, multilevel modeling). As an alternative, we have adapted Kenny's reciprocal standard dyad model (Kenny, Mohr, & Levesque, 2001; Kenny, Kashy, & Cook, 2006). Our adaptation controls for gene and shared environmental influences within a simple regression framework, by taking the difference between the two siblings

Prior Within Family Analyses

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Current Study

- We wanted to know whether the Harden & Mendle (2011) results would hold using a different design and data set.
- We examined the relationship between AFI and Intelligence using siblings and their children from a multigenerational nationally representative sample.
- Specifically, we addressed the following questions:
 - Does intelligence (mother or child) predict child AFI, after controlling for gene and environmental confounds?
 - Is this relationship consistent between- and within-families?

To summarize, the current study examines the relationship between intelligence and age at first intercourse, using siblings and their children from a multigenerational

nationally representative sample. This examination extends the intelligence literature in several key ways. We

1. tested whether the relationship between intelligence and age at first intercourse was consistent using between and within family analyses;
2. evaluated the alternative explanation that maternal intelligence influences child AFI; and
3. whether these effects would replicate using earlier measures of intelligence.

We made the following predictions, based upon recent meta-analyses XX and findings from Harden and Mendle:

- 1.
- 2.
- 3.

Methods

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Design

We adapted Kenny and colleagues (2001; 2006) reciprocal standard dyad model.

$$Y_{i\Delta} = \beta_0 + \beta_1 \bar{Y}_i + \beta_2 \bar{X}_i + \beta_3 X_{i\Delta}$$

where

$$Y_{i1} = \max(Y_{ij}); Y_{i2} = \min(Y_{ij}); Y_{i\Delta} = Y_{i1} - Y_{i2}; X_{i\Delta} = X_{i1} - X_{i2}$$

In this model, the relative difference in outcomes (Y_{Δ}) is predicted from the mean level of the outcome (Y_{mean}), the mean level of the predictor (X_{mean}), and the between-sibling predictor difference (X_{Δ}). The mean levels support causal inference through at least partial control for genes and shared environment. Therefore, we simultaneously evaluate the individual difference (X_{Δ}) and the joint contribution of

genes and shared environment (Y_{mean} & X_{mean}). Preliminary applications have given estimates consistent with the literature (Garrison, Hadd, & Rodgers, 2015; Rodgers, Garrison, & Hadd, 2014).

Sample

The National Longitudinal Survey of Youth 1979 (NLSY79) is a nationally representative household probability sample, jointly sponsored by the US Department of Labor and US Department of Defense. In 1980, 12,686 adolescents were surveyed from 8,770 households on a battery of measures. The initial survey consisted of three subsamples:

- a cross-sectional probability sample of 6,111 non-institutionalized adolescents residing in the United States on December 31st of 1978,
- an over-sampled civilian subsample of 5,295 racial minorities and disadvantaged whites, and
- a representative sample of 1,280 youths serving in the US Military on September 30th, 1978.

In the civilian samples, subjects' birthdates ranged from January 1, 1957 to December 31, 1964, and were between the ages of 14 and 21 on 31st of 1978, whereas military subject's birthdates ranged from January 1, 1957 to December 31, 1961, and were likewise between 17 and 21 years old. Participants were surveyed annually until 1994, and then surveyed biannually to the present day. Two waves of planned attrition occurred. After the 1984 interview, all but 201 randomly selected members of the military sample were dropped. After the 1990 interview, all 1,643 disadvantaged whites from the oversample were dropped. More information, such as the data and documentation can be found on the Bureau of Labor Statistics (BLS) website: <http://www.bls.gov/nls/nlsy79.htm>.

In 1986, the biological children of the female NLSY79 participants were surveyed, resulting in the NLSY79 Children and Young Adults (NLSY79-CYA) survey. These 11,512 participants are also surveyed on a biannual basis. Accordingly, participants in

the NLSY79 will be periodically referred to as the Generation 1 (Gen1) sample, whereas the NLSY79-CYA will be referred to as the Generation 2 (Gen2) sample.

Tetrads

Mother-Child-Aunt-Nibling (MCAN) tetrads were created using the NLSY Kinship Links (Rodgers et al., 2015) and supporting R package (Beasley et al., 2015). The oldest two female kin (Mother, Aunt) were selected from each household; additional female Gen1 kin were excluded. Three tetrad designs were employed, in which the genders of Gen2 were the defining feature:

- Mother-Daughter-Aunt-Niece (MDAN) included the oldest female child from each of the sisters,
- Mother-Son-Aunt-Nephew (MSAN) included the oldest male child from each of the sisters, and
- Mother-Child-Aunt-Nibling (MCAN) included the first born child from each of the sisters.

All outcomes were standardized by gender prior to tetrad creation. Table

table_{afiracegender} reports descriptive statistics for all variables used throughout this paper by whether the respondent has a sibling in the sample.

Age at First Intercourse

Over the life-time of the NLSY-CYA survey, participants were surveyed about their AFI. The exact phrasing of the question varied by administration. Between 1988 and 2000, subjects were asked for age, year, and month of first intercourse. After 2000, subjects were only asked their age. The reason for this change is unknown. However, the first author suspects that the change had to do with the fact that the modal response for month was consistently: “Don’t Know”. Indeed, only 1147 subjects reported a viable month of first intercourse. Regardless, we calculated AFI as follows, using SAS (citation). First, we transformed year of first intercourse into age. If subjects reported both age and year within the same survey, we averaged the age scores. Across all survey years, we identified the minimum AFI and maximum AFI for each subject.

Then we took the average of those two scores. Given that the expected AFI of a subject \neq the reported AFI, we added 1 to the Maximum AFI. Therefore, if the subject only reported one instance of AFI, their AFI would now reflect their expected AFI. For example, a subject who reports AFI at 16 could be 16 years and 1 day old OR 16 years and 364 days old. Thus the expected value for 16 is in fact 16.5. We calculated AFI in this manner because we wished to include the maximum amount of information without ignoring the expected value problem with self-reported age. Using this method, the average AFI was 16.01 years (sd = 2.30; n = 6288).

After transforming all AFI scores, we recoded all impossibles AFIs as missing. We considered a score to be impossible if the reported AFI that exceeded participant’s age at time of survey ($\overline{\text{AFI}} = 15.99$, sd = 2.30, n = 6235). Next, we excluded all AFIs below age 12 (16.14, sd = 2.10, n = 6087). Finally we excluded subjects who reported AFI prior to menstruation (16.16, sd = 2.09, n = 6047). We excluded those below age 12 because those responses likely are the result of misunderstanding or non-consensual sexual activity, while we excluded those with premenstrual AFI because of we were only interested in post-pubescent sexual activity. AFI varied by gender and race. Most notably, women reported AFIs that were 6 months later than men, and black men reported the lowest AFI (15 yrs). See Table *table_{afi_race_gender}for a complete breakdown*.

Taking the average of all AFIs (without addressing expected value), results in 15.49 (sd equal 2.30; n equal 6288). Adding in expected value of .5 changes this value to 15.99. Pretty much indistinguishable.)

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Measures

Generation 1

The Armed Services Vocational Aptitude Battery (ASVAB; Form 8A; Palmer, Hartke, Ree, Welsh, & Valentine Jr, 1988) was administered to Gen1 participants during the summer and fall of 1980 (U.S. Department of Defense, 1982), and was used to establish national norms for the Department of Defense (Waters, Laurence, Camara, & Green, 1987). The Armed Forces Qualification Test (AFQT) is derived from the ASVAB, and used as a measure of general trainability (Maier & Sims, 1986). It is a

composite of four subscales: Arithmetic Reasoning (AR; 30 items), Math Knowledge (MK; 25 items), Paragraph Comprehension (PC; 15 items), and Word Knowledge (WK; 35 items). Arithmetic Reasoning targets the ability to solve word problems. Math Knowledge also tests quantitative ability, by assessing knowledge of high school level mathematics, with special emphasis on algebra, fractions, and geometry. The remaining subscales focus on verbal ability, and are sometimes referred to as the Verbal Composite (VE). Specifically, Word Knowledge tests the subjects' knowledge of the meaning of words within a given context, whereas Paragraph Comprehension targets a subject's ability to understand the meanings of paragraphs. Other administrations of the pencil and paper ASVAB reveal that all the AFQT subscales have high internal consistency ($\alpha_{AR} = .91$; $\alpha_{WK} = .92$; $\alpha_{PC} = .81$; $\alpha_{MK} = .87$; Kass, Mitchell, Grafton, & Wing, 1982)

Methods of calculating the AFQT have varied throughout the ASVAB's administrative lifetime (Mayberry & Hiatt, 1992). For pencil and paper administrations, standard scores were created for each of the subscale scores ($\bar{x} = 50$, $sd = 10$), and then combined into a standard score. Then, the AFQT standard score is derived from the following formula:

$$AFQT = AR + MK + 2VE, \quad (1)$$

$$\text{where } VE = PC + WK. \quad (2)$$

This score is then converted into a percentile, which determines an applicant's basic qualification for enlistment. All applicants must earn a score at or above the 10th percentile (Defense Manpower Data Center, 2012). Each branch has its own minimum score, ranging from 31 to 36 (U.S. Department of the Army, 2013; U.S. Coast Guard, 2004), and each branch uses different linear combinations of these subtests to determine an applicant's eligibility for speciality positions. Additionally, multiple researchers have used the AFQT standard score as a proxy for general intelligence (g) (Herrnstein & Murray, 1994; Der, Batty, & Deary, 2009). Indeed, the military has found that the AFQT correlated 0.8 with the Wechsler Adult Intelligence Scale (WAIS; McGrevy, Knouse, & Thompson, 1974). Moreover, the AFQT consistently predicts outcomes traditionally associated with intelligence (See Welsh, Kucinkas, & Curran,

1990), including grades (Wilbourn, Valentine Jr, & Ree, 1984; J. J. Mathews, 1977).

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Generation 2

Administration of ability measures has varied considerably across the lifecourse of the NLSY-CYA survey (See Table 2.12 from Center for Human Resources Research, 2009 for a summary). However, the vast majority of subjects have completed the following test batteries:

- Peabody Individual Achievement Test (PIAT; Dunn & Markwardt, 1970):
 - Math Subtest (84 items),
 - Reading Recognition Subtest (84 items),
 - Reading Comprehension Subtest (84 items),
- The Peabody Picture Vocabulary Test-Revised (PPVT-R; Form L; Dunn & Dunn, 1981; 175 items), and
- Wechsler Intelligence Scales for Children-Revised (WISC-R; Wechsler, 1974) Digit Span Subscale (28 items).

Although individual item level data was available for all of the aforementioned tests, conducting a unidimensional 2-PL is not a viable means of estimating general ability because of the nature of test construction and administration. The PIATs and PPVT-R were administered to subjects in an adaptive manner. The starting items on the PIAT Math and PVVT-R were determined by age, whereas the starting items for the remaining PIAT subtests were determined based on PIAT Math performance. Moreover, administration of a given test were terminated when a subject reached a “ceiling.” For example, testing was terminated for the PIAT Math if a subject incorrectly answered 5 of the most recent 7 questions (See Baker, Keck, Mott, & Quinlan, 1993 for a thorough overview of NLSY-CYA test administration protocols). In essence, this administration procedure results in a tremendous amount of non-randomly missing data.

Although the administration created non-randomly missing data, the standard scores of the PVVT-R, PIATs, and WISC-R Digit Span themselves are valid and very

reliable assessments of cognitive ability (Mott & Baker, 1995). Accordingly, we elected to use the standard scores of all the Gen2 ability measures already mentioned. However, subjects were surveyed on a biannual basis. Thus we could not use cognitive tests at a given age. Instead, we aggregated scores across a 4 year window, and targeted ages 9 and 10. We targeted 9.5 because all cognitive tests were administered within the 8–11 age window, we wanted to maximize the number of subjects with viable ability scores, and we wanted to ensure temporal precedence with respect to AFI. In the case of missing subtests, we allowed age 11 scores to replace age 9 scores, and age 8 scores to replace age 10 scores. By employing a 4 year window, all subjects had an equal chance of replacing the primary test administration. Our replacement strategy ensured that the average age of testing matched the average of our targeted ages.

In order to confirm the validity of this method, we replicated all age 9.5 ability analyses using ages 10.5 and 11.5. These replications can be found in the Appendices A and B, respectively. Appendix A begins on page 30 and appendix B begins on page 38.

Measurement. A unidimensional confirmatory factor analytic model was run in Mplus 7.3 (Muthén & Muthén, 2014), and used a robust maximum likelihood estimator (MLR). There were 8,254 useable observations in 3,742 clusters. A single factor solution fit the model decently (RMSEA = .101, $p(\text{RMSEA} < .05) = 0$; CFI = .973; TLI = .946, SRMR = .027). Table

table_{gen2measurement} contains a full summary of the model fit statistics, and Table table_{g2loading} contains the factor loadings.

Results

We examined the relationship between AFI and intelligence using two designs:

between and within families. The between family analyses report the relationships between the average AFI and various measures of ability. The within family analyses attempt to replicate the between family findings by testing whether differences in AFI can be explained by differences in various measures of ability. If there is a causal relationship between intelligence and AFI then differences in AFI will be significantly associated with differences in ability. If the relationship is the result of between family

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confounds, such as shared environmental influences, then differences in AFI will not be significantly associated with differences in ability, and accordingly, AFI cannot be caused by intelligence.

Between Family Analyses

First, we examined the between family results. We tested whether the family average of Gen2 AFI could be predicted by the family averages of Gen1 ability and of Gen2 ability. We evaluated the influences both independently and simultaneously. All ability scores have been standardized by generation ($\bar{g} = 0$, $sd = 1$), prior to averaging by household. AFI scores have been standardized by gender ($\overline{AFI} = 0$, $sd = 1$), prior to averaging by household.

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Mean Gen1 Intelligence → Mean Gen2 AFI. Gen1 sister averages of standardized AFQT scores were used to predict Gen2 averages of gender standardized AFI. Table

*table_{Mean_{Mom}Intelligence_{Mean_{Child}AFI}}*₉ displays the results by Gen2 linking. The Mixed model reports the averages of the firstborns of each sex (n = 342), the Daughters model reports the averages of the firstborn girls (n = 264), and the Sons model reports the averages of the firstborn sons (n = 282). All three models reveal similar results. A one unit increase in the average standardized intelligence of the childrens' mothers predicted ≈ .013 increase in average Gen2 AFI. The adjusted R² varied slightly by Gen2 linking (Mixed = .087, Daughters = .097, Sons = .103).

Mean Gen2 Intelligence → Mean Gen2 AFI. Gen2 cousin averages of standardized ability scores were used to predict Gen2 averages of gender standardized AFI. Table

*table_{Mean_{Child}Intelligence_{Mean_{Child}AFI}}*₉ displays the results by Gen2 linking. The Mixed model reports the averages of the firstborns of each sex (n = 344), the Daughters model reports the averages of the firstborn girls (n = 267), and the Sons model reports the averages of the firstborn sons (n = 283). All three models reveal similar results. A one unit increase in the average standardized intelligence of the children predicted ≈ .075 increase in average Gen2 AFI. The adjusted R² varied slightly by Gen2 linking (Mixed = .014, Daughters = .016, Sons = .009).

Mean Joint Intelligence → Mean Gen2 AFI. Results from the Gen1 sister averages of standardized AFQT scores and Gen2 cousin averages of standardized ability scores predictions of Gen2 averages of gender standardized AFI are displayed in Table *table_{MeanJointIntelligenceMeanChildAFI}*. Again, three models based on Gen2 linking are displayed : *Mixed* ($n= 337$), *Daughters* ($n= 260$), and *theSons* ($n= 278$). All three models reveal similar results. Gen1 intelligence was significantly associated with Gen2 AFI ($p< .01$), while Gen2 intelligence was not significantly associated with Gen2 AFI. A one unit increase in the average standardized intelligence of the child resulted in a .014 increase in average Gen2 AFI. The adjusted R^2 varied slightly by Gen2 linking (Mixed = .086, Daughters = .097, Sons = .100), but each were practically identical to the Mean Gen1 Intelligence models.

Within Family Analyses

We attempted to replicate the between family analyse reported in the previous subsection, using within family analyses. Using the discordant sibling model, we predicted the differences in Gen2 AFI as a function of differences in intelligence, controlling for means of the outcomes and predictors. We ran three series of models, where we examined the individual and then joint influence of Gen1 intelligence and Gen2 intelligence. Moreover, within each series we included three Gen2 linking variants, just as we did in the between family analyses: Mixed model reports the differences of the first borns of each sister, the Daughters model reports the differences of the first born girls,, and the Sons model reports the differences of the first born sons.

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Dif Gen1 Intelligence → Dif Gen2 AFI. Gen1 sister differences in standardized AFQT scores were used to predict Gen2 differences of gender standardized AFI, controlling for Gen1 sister averages of standardized AFQT scores and Gen2 averages of gender standardized AFI. Table *table_{DifMomIntelligenceDifChildAFI}* displays the results by Gen2 linking. The Mixed model reports the averages and differences of the first borns ($n= 336$), the Daughters model reports the averages and differences of the first born girls ($n= 258$), and the Sons model reports the averages and differences of the first born sons ($n= 278$). All three models reveal similar results. Gen2 averages of gender standardized AFI were significant predictors of Gen2 differences in gender standardized AFI. A one unit increase in the difference in Gen1 intelligence resulted in a .014 increase in average Gen2 AFI. The adjusted R^2 varied slightly by Gen2 linking (Mixed = .086, Daughters = .097, Sons = .100), but each were practically identical to the Mean Gen1 Intelligence models.

.01), across all three linking methods. A one unit increase in the average gender standardized AFI predicted \approx 0.34 increase in average Gen2 AFI difference, controlling for all over variables in the model.

In the Sons model, the Gen1 sister average of standardized AFQT scores was a significant predictor of differences in Gen2 AFI ($p < .01$). A one unit increase in the average standardized intelligence of the children's mothers predicted \approx .0083 decrease in the AFI difference between siblings. All other variables were not significant, including all kin difference variables. The adjusted R^2 varied slightly by Gen2 linking (Mixed = .066, Daughters = .072, Sons = .106).

Dif Gen2 Intelligence \rightarrow Dif Gen2 AFI. Gen2 cousin differences in standardized ability scores were used to predict Gen2 differences of gender standardized AFI, controlling for Gen2 cousin averages of standardized ability scores and gender standardized AFI. Table

table $_{Dif_Kid_{Intelligence}}_{Dif_{Child_{AFI}}}$ displays the results by Gen2 linking. The Mixed model reports the averages and differences of the firstborn (n = 291), the Daughters model reports the averages and differences of the firstborn girls (n = 223), and the Sons model reports the averages and differences of the firstborn sons (n = 238). All three models reveal similar results. Gen2 averages of gender standardized AFI were significant predictors of Gen2 differences in gender standardized AFI, across all three linking methods. A one unit increase in the average gender standardized AFI predicted \approx 0.38 increase in average Gen2 AFI difference, controlling for all over variables in the model.

In the Sons model, the Gen2 cousin average of standardized ability scores was a significant predictor of differences in Gen2 AFI ($p < .05$). A one unit increase in the average standardized intelligence of the children predicted \approx .107 decrease in the AFI difference between siblings. All other variables were not significant, including all kin difference variables. The adjusted R^2 varied slightly by Gen2 linking (Mixed = .103, Daughters = .121, Sons = .132).

Dif Joint Intelligence \rightarrow Dif Gen2 AFI. Gen1 sister differences in standardized AFQT scores and Gen2 cousin differences in standardized ability scores were used to predict Gen2 differences of gender standardized AFI, controlling for Gen1

sister averages of standardized AFQT scores, Gen2 cousin averages of standardized ability scores, and Gen2 cousin averages of gender standardized AFI. Table

table_{DiffJointIntelligenceDiffChildAFI} displays the results by Gen2 linking. The Mixed model reports the averages and differences of the firstborns (n=285), the Daughters model reports the averages and differences of the firstborn girls (n=217), and the Sons model reports the averages and differences of the firstborn sons (n=235). All three models reveal similar results. Gen2 averages of gender standardized AFI were significant predictors of Gen2 differences in gender standardized AFI (Mixed = .01), across all three linking methods. A one unit increase in the average gender standardized AFI predicted \approx 0.38 increase in average Gen2 AFI difference, controlling for all over variables in the model.

All other variables were not significant, including all kin difference variables. The adjusted R² varied slightly by Gen2 linking (Mixed = .090, Daughters = .105, Sons = .131).

Discussion

Tables

Descriptive Statistics

Table 1

Gen1 Summary Statistics by Sibling Status.

| Has Sibling in NLSY? | | | | | | |
|----------------------|-------|-------------------|---------|-----------------|------|------|
| | | Mean ₃ | | Sd ₂ | | |
| | | 0 | 1 | | 0 | 1 |
| Mother Age at Birth | 23.31 | 22.595 | 23.949 | 5.49 | 5.16 | 5.69 |
| Standardized AFQT | 0.00 | 0.108 | − 0.088 | 1.09 | 1.07 | 1.10 |
| AFI | 17.84 | 17.796 | 17.870 | 2.33 | 2.27 | 2.39 |

Table 2

Gen2 Summary Statistics by Sibling Status.

| Has Sibling in NLSY? | | | | | | |
|----------------------------|---------|-------------------|----------|-----------------|------|-------|
| | | Mean ₃ | | Sd ₂ | | |
| | | 0 | 1 | | 0 | 1 |
| Year Born | 1985.73 | 1986.160 | 1985.679 | 26.99 | 6.62 | 28.39 |
| Standardized Ability Score | 0.00 | 0.275 | − 0.023 | 1.00 | 0.89 | 1.01 |
| AFI | 16.16 | 16.052 | 16.173 | 2.10 | 2.09 | 2.10 |

Table 3

Gen2 AFI by Gender, Race, and GenderxRace.

| | | | AFI | |
|--------|-------------|------------------------------|-------------------|-----------------|
| | | | Mean ₃ | Sd ₂ |
| MALE | RACE | | 16.16 | 2.10 |
| | | MALE | 15.88 | 2.15 |
| | | FEMALE | 16.47 | 1.99 |
| | | HISPANIC | 16.22 | 2.14 |
| | | BLACK | 15.66 | 2.01 |
| | | NON-BLACK, NON-HISPANIC | 16.57 | 2.05 |
| | GENDERxRACE | MALE HISPANIC | 15.92 | 2.16 |
| | | MALE BLACK | 15.04 | 1.96 |
| | | MALE NON-BLACK, NON-HISPANIC | 16.54 | 2.06 |
| | | MALE FEMALE | 16.60 | 2.05 |
| FEMALE | RACE | HISPANIC | 16.60 | 2.05 |
| | | BLACK | 16.26 | 1.88 |
| | | NON-BLACK, NON-HISPANIC | 16.61 | 2.05 |

Table 4

Gen2 Measurement Model.

| | g at Age 9.5 |
|--------------------------------|--------------|
| Estimator | MLR |
| Observations | 8254 |
| Parameters | 15 |
| ChiSqM_Value | 423 |
| ChiSqM_DF | 5 |
| ChiSqM_PValue | 0 |
| ChiSqBaseline_PValue | 0 |
| LL | -142896 |
| UnrestrictedLL | -142653 |
| LLCorrectionFactor | 1.44 |
| UnrestrictedLLCorrectionFactor | 1.37 |
| CFI | 0.973 |
| TLI | 0.946 |
| AIC | 285821 |
| BIC | 285927 |
| aBIC | 285879 |
| RMSEA_Estimate | 0.101 |
| RMSEA_90CI_LB | 0.093 |
| RMSEA_90CI_UB | 0.109 |
| RMSEA_pLT05 | 0 |
| SRMR | 0.027 |
| AICC | 285821 |

Table 5

Gen2 Factor Loadings.

| | Test | Estimate | S.E. | Est./S.E. | P.Value |
|---|-------|----------|-------|-----------|---------|
| 1 | DIGIT | 0.530 | 0.010 | 52.400 | 0 |
| 2 | MATH | 0.720 | 0.007 | 98.100 | 0 |
| 3 | RECOG | 0.871 | 0.005 | 184.000 | 0 |
| 4 | COMP | 0.855 | 0.006 | 154.000 | 0 |
| 5 | PPVT | 0.695 | 0.010 | 68.800 | 0 |

Between Family Analyses

Table 6

Mean Gen1 Intelligence → Mean Gen2 AFI

| | Dependent variable: | | |
|-------------------------|-------------------------------|-------------------------------|-------------------------------|
| | Mean Gen2 AFI | | |
| | Mixed | Daughters | Sons |
| Gen1 Intel | 0.012*** (0.008, 0.017) | 0.013*** (0.009, 0.018) | 0.014*** (0.009, 0.019) |
| Constant | −0.754*** (−1.010, −0.500) | −0.801*** (−1.090, −0.513) | −0.856*** (−1.140, −0.569) |
| Observations | 342 | 264 | 282 |
| R ² | 0.090 | 0.101 | 0.106 |
| Adjusted R ² | 0.087 | 0.097 | 0.103 |
| Residual Std. Error | 0.700 (df = 340) | 0.703 (df = 262) | 0.691 (df = 280) |
| F Statistic | 33.500*** (df = 1; 340) | 29.400*** (df = 1; 262) | 33.200*** (df = 1; 280) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 7

Mean Gen2 Intelligence → Mean Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|----------------------------|---------------------------|---------------------------|
| | Mean Gen2 AFI | | |
| | Mixed | Daughters | Sons |
| Gen2 Intel | 0.077** (0.014, 0.140) | 0.086** (0.013, 0.159) | 0.066* (−0.004, 0.135) |
| Constant | −0.021 (−0.100, 0.057) | −0.020 (−0.109, 0.070) | −0.039 (−0.125, 0.047) |
| Observations | 344 | 267 | 283 |
| R ² | 0.016 | 0.020 | 0.012 |
| Adjusted R ² | 0.014 | 0.016 | 0.009 |
| Residual Std. Error | 0.739 (df = 342) | 0.744 (df = 265) | 0.732 (df = 281) |
| F Statistic | 5.700** (df = 1; 342) | 5.320** (df = 1; 265) | 3.430* (df = 1; 281) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 8

Mean Joint Intelligence → Mean Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|-------------------------------|-------------------------------|-------------------------------|
| | Mean Gen2 AFI | | |
| | Mixed | Daughters | Sons |
| Gen1 Intel | 0.013*** (0.008, 0.017) | 0.014*** (0.008, 0.019) | 0.015*** (0.009, 0.020) |
| Gen2 Intel | −0.002 (−0.070, 0.066) | −0.0002 (−0.077, 0.077) | −0.015 (−0.089, 0.060) |
| Constant | −0.766*** (−1.050, −0.482) | −0.814*** (−1.130, −0.497) | −0.892*** (−1.220, −0.568) |
| Observations | 337 | 260 | 278 |
| R ² | 0.091 | 0.104 | 0.107 |
| Adjusted R ² | 0.086 | 0.097 | 0.100 |
| Residual Std. Error | 0.704 (df = 334) | 0.706 (df = 257) | 0.695 (df = 275) |
| F Statistic | 16.700*** (df = 2; 334) | 14.900*** (df = 2; 257) | 16.500*** (df = 2; 275) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Within Family Analyses

Table 9

Dif Gen1 Intelligence → Dif Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|----------------------------|----------------------------|-------------------------------|
| | Gen2 AFI Differences | | |
| | Mixed | Daughters | Sons |
| AFIKIDmean | 0.303*** (0.187, 0.419) | 0.328*** (0.192, 0.465) | 0.376*** (0.251, 0.501) |
| INTMOMmean | −0.003 (−0.007, 0.002) | −0.002 (−0.008, 0.004) | −0.008*** (−0.013, −0.003) |
| INTMOMdiff | 0.001 (−0.003, 0.006) | 0.001 (−0.005, 0.006) | 0.0003 (−0.005, 0.005) |
| Constant | 1.180*** (0.893, 1.470) | 1.180*** (0.838, 1.520) | 1.500*** (1.180, 1.830) |
| Observations | 336 | 258 | 278 |
| R ² | 0.074 | 0.083 | 0.116 |
| Adjusted R ² | 0.066 | 0.072 | 0.106 |
| Residual Std. Error | 0.757 (df = 332) | 0.780 (df = 254) | 0.734 (df = 274) |
| F Statistic | 8.830*** (df = 3; 332) | 7.640*** (df = 3; 254) | 12.000*** (df = 3; 274) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 10

Dif Gen2 Intelligence → Dif Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|----------------------------|----------------------------|------------------------------|
| | Gen2 AFI Differences | | |
| | Mixed | Daughters | Sons |
| AFIKIDmean | 0.357*** (0.239, 0.475) | 0.395*** (0.259, 0.531) | 0.398*** (0.269, 0.527) |
| Int_Mean | −0.064 (−0.142, 0.014) | −0.069 (−0.160, 0.021) | −0.107** (−0.193, −0.021) |
| Intdiff | 0.029 (−0.018, 0.075) | 0.035 (−0.019, 0.089) | 0.009 (−0.041, 0.059) |
| Constant | 1.050*** (0.962, 1.140) | 1.070*** (0.970, 1.180) | 1.070*** (0.970, 1.160) |
| Observations | 291 | 223 | 238 |
| R ² | 0.112 | 0.133 | 0.143 |
| Adjusted R ² | 0.103 | 0.121 | 0.132 |
| Residual Std. Error | 0.769 (df = 287) | 0.787 (df = 219) | 0.753 (df = 234) |
| F Statistic | 12.100*** (df = 3; 287) | 11.200*** (df = 3; 219) | 13.000*** (df = 3; 234) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 11

Dif Joint Intelligence → Dif Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|----------------------------|----------------------------|----------------------------|
| | Gen2 AFI Differences | | |
| | Mixed | Daughters | Sons |
| AFIKIDmean | 0.345*** (0.221, 0.469) | 0.379*** (0.234, 0.524) | 0.428*** (0.293, 0.562) |
| Int_Mean | −0.064 (−0.153, 0.024) | −0.071 (−0.174, 0.032) | −0.068 (−0.164, 0.028) |
| INTMOMmean | 0.001 (−0.005, 0.007) | 0.001 (−0.006, 0.008) | −0.005 (−0.012, 0.001) |
| Intdiff | 0.025 (−0.023, 0.073) | 0.034 (−0.022, 0.090) | 0.007 (−0.044, 0.058) |
| INTMOMdiff | 0.001 (−0.004, 0.006) | −0.001 (−0.007, 0.005) | 0.001 (−0.005, 0.006) |
| Constant | 0.999*** (0.642, 1.360) | 1.010*** (0.591, 1.430) | 1.370*** (0.975, 1.770) |
| Observations | 285 | 217 | 235 |
| R ² | 0.106 | 0.125 | 0.150 |
| Adjusted R ² | 0.090 | 0.105 | 0.131 |
| Residual Std. Error | 0.774 (df = 279) | 0.795 (df = 211) | 0.754 (df = 229) |
| F Statistic | 6.610*** (df = 5; 279) | 6.040*** (df = 5; 211) | 8.080*** (df = 5; 229) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Figures

Figure 1. Comparable Between Family and Within Family Effects

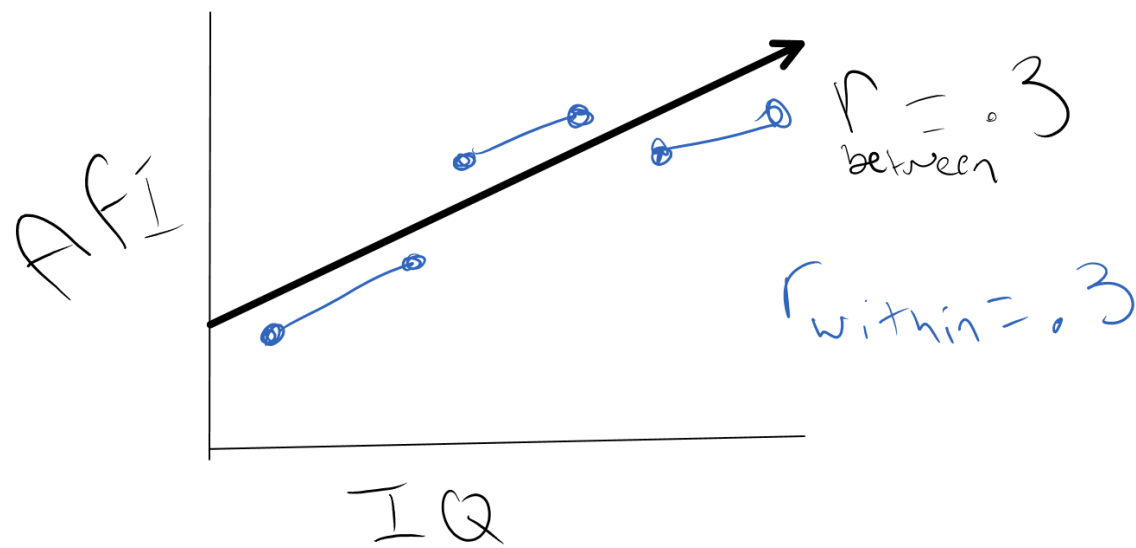
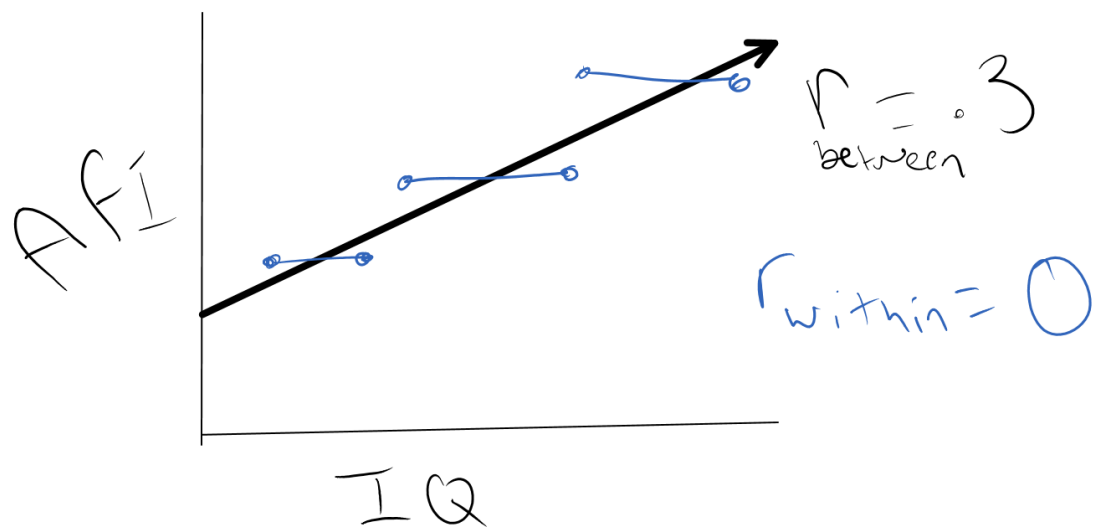


Figure 2. Unequal Between Family and Within Family Effects



Appendix A
Age 10.5 Replication

Table A1

Gen2 Measurement Model.

| g at Age 10.5 | |
|--------------------------------|---------|
| Estimator | MLR |
| Observations | 8143 |
| Parameters | 15 |
| ChiSqM_Value | 404 |
| ChiSqM_DF | 5 |
| ChiSqM_PValue | 0 |
| ChiSqBaseline_PValue | 0 |
| LL | -143535 |
| UnrestrictedLL | -143304 |
| LLCorrectionFactor | 1.48 |
| UnrestrictedLLCorrectionFactor | 1.4 |
| CFI | 0.974 |
| TLI | 0.947 |
| AIC | 287100 |
| BIC | 287205 |
| aBIC | 287158 |
| RMSEA_Estimate | 0.099 |
| RMSEA_90CI_LB | 0.091 |
| RMSEA_90CI_UB | 0.107 |
| RMSEA_pLT05 | 0 |
| SRMR | 0.024 |
| AICC | 287100 |

Table A2

Gen2 Factor Loadings.

| | Test | Estimate | S.E. | Est./S.E. | P Value |
|---|-------|----------|-------|-----------|---------|
| 1 | DIGIT | 0.547 | 0.010 | 54.400 | 0 |
| 2 | MATH | 0.731 | 0.007 | 97.900 | 0 |
| 3 | RECOG | 0.852 | 0.005 | 168.000 | 0 |
| 4 | COMP | 0.848 | 0.006 | 149.000 | 0 |
| 5 | PPVT | 0.743 | 0.009 | 81.400 | 0 |

Between Family Analyses

Table A3

Mean Gen1 Intelligence → Mean Gen2 AFI

| | Dependent variable: | | |
|-------------------------|-------------------------------|-------------------------------|-------------------------------|
| | Mixed | Mean AFI Daughters | Sons |
| Gen1 Intel | 0.012*** (0.008, 0.017) | 0.013*** (0.009, 0.018) | 0.014*** (0.009, 0.019) |
| Constant | −0.754*** (−1.010, −0.500) | −0.801*** (−1.090, −0.513) | −0.856*** (−1.140, −0.569) |
| Observations | 342 | 264 | 282 |
| R ² | 0.090 | 0.101 | 0.106 |
| Adjusted R ² | 0.087 | 0.097 | 0.103 |
| Residual Std. Error | 0.700 (df = 340) | 0.703 (df = 262) | 0.691 (df = 280) |
| F Statistic | 33.500*** (df = 1; 340) | 29.400*** (df = 1; 262) | 33.200*** (df = 1; 280) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table A4

Mean Gen2 Intelligence → Mean Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|----------------------------|----------------------------|----------------------------|
| | Mean AFI | | |
| | Mixed | Daughters | Sons |
| Gen2 Intel | 0.098*** (0.039, 0.157) | 0.105*** (0.036, 0.173) | 0.088*** (0.022, 0.153) |
| Constant | −0.015 (−0.093, 0.062) | −0.015 (−0.104, 0.074) | −0.031 (−0.117, 0.054) |
| Observations | 345 | 267 | 283 |
| R ² | 0.030 | 0.033 | 0.024 |
| Adjusted R ² | 0.027 | 0.029 | 0.021 |
| Residual Std. Error | 0.734 (df = 343) | 0.739 (df = 265) | 0.728 (df = 281) |
| F Statistic | 10.500*** (df = 1; 343) | 8.990*** (df = 1; 265) | 6.910*** (df = 1; 281) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table A5

Mean Joint Intelligence → Mean Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|-------------------------------|-------------------------------|-------------------------------|
| | Mean AFI | | |
| | Mixed | Daughters | Sons |
| INTMOMmean | 0.012*** (0.007, 0.017) | 0.013*** (0.007, 0.018) | 0.014*** (0.008, 0.019) |
| Int_Mean | 0.021 (−0.046, 0.088) | 0.018 (−0.058, 0.094) | 0.008 (−0.066, 0.082) |
| Constant | −0.714*** (−1.010, −0.418) | −0.771*** (−1.100, −0.440) | −0.844*** (−1.180, −0.506) |
| Observations | 338 | 260 | 278 |
| R ² | 0.092 | 0.103 | 0.107 |
| Adjusted R ² | 0.086 | 0.096 | 0.101 |
| Residual Std. Error | 0.703 (df = 335) | 0.707 (df = 257) | 0.695 (df = 275) |
| F Statistic | 16.900*** (df = 2; 335) | 14.700*** (df = 2; 257) | 16.500*** (df = 2; 275) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Within Family Analyses

Table A6

Dif Gen1 Intelligence → Dif Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|----------------------------|----------------------------|-------------------------------|
| | Gen2 AFI Differences | | |
| | Mixed | Daughters | Sons |
| AFIKIDmean | 0.303*** (0.187, 0.419) | 0.328*** (0.192, 0.465) | 0.376*** (0.251, 0.501) |
| INTMOMmean | −0.003 (−0.007, 0.002) | −0.002 (−0.008, 0.004) | −0.008*** (−0.013, −0.003) |
| INTMOMdiff | 0.001 (−0.003, 0.006) | 0.001 (−0.005, 0.006) | 0.0003 (−0.005, 0.005) |
| Constant | 1.180*** (0.893, 1.470) | 1.180*** (0.838, 1.520) | 1.500*** (1.180, 1.830) |
| Observations | 336 | 258 | 278 |
| R ² | 0.074 | 0.083 | 0.116 |
| Adjusted R ² | 0.066 | 0.072 | 0.106 |
| Residual Std. Error | 0.757 (df = 332) | 0.780 (df = 254) | 0.734 (df = 274) |
| F Statistic | 8.830*** (df = 3; 332) | 7.640*** (df = 3; 254) | 12.000*** (df = 3; 274) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table A7

Dif Gen2 Intelligence → Dif Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|------------------------------|------------------------------|-------------------------------|
| | Gen2 AFI Differences | | |
| | Mixed | Daughters | Sons |
| AFIKIDmean | 0.326*** (0.208, 0.444) | 0.366*** (0.228, 0.504) | 0.357*** (0.227, 0.486) |
| Int_Mean | −0.079** (−0.151, −0.008) | −0.088** (−0.173, −0.003) | −0.111*** (−0.190, −0.032) |
| Intdiff | 0.024 (−0.020, 0.068) | 0.023 (−0.029, 0.074) | 0.002 (−0.044, 0.048) |
| Constant | 1.040*** (0.951, 1.130) | 1.060*** (0.959, 1.170) | 1.050*** (0.957, 1.150) |
| Observations | 287 | 219 | 234 |
| R ² | 0.100 | 0.118 | 0.125 |
| Adjusted R ² | 0.091 | 0.105 | 0.114 |
| Residual Std. Error | 0.756 (df = 283) | 0.778 (df = 215) | 0.738 (df = 230) |
| F Statistic | 10.500*** (df = 3; 283) | 9.570*** (df = 3; 215) | 11.000*** (df = 3; 230) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table A8

Dif Joint Intelligence → Dif Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|----------------------------|----------------------------|-------------------------------|
| | Gen2 AFI Differences | | |
| | Mixed | Daughters | Sons |
| AFIKIDmean | 0.315*** (0.191, 0.438) | 0.347*** (0.202, 0.493) | 0.388*** (0.255, 0.521) |
| Int_Mean | −0.077* (−0.161, 0.007) | −0.088* (−0.187, 0.011) | −0.059 (−0.150, 0.032) |
| INTMOMmean | 0.0002 (−0.006, 0.006) | 0.001 (−0.007, 0.008) | −0.007** (−0.013, −0.0001) |
| Intdiff | 0.018 (−0.028, 0.063) | 0.021 (−0.033, 0.074) | 0.000003 (−0.047, 0.047) |
| INTMOMdiff | 0.002 (−0.004, 0.007) | −0.001 (−0.008, 0.005) | 0.002 (−0.004, 0.007) |
| Constant | 1.020*** (0.656, 1.380) | 1.020*** (0.597, 1.440) | 1.440*** (1.040, 1.840) |
| Observations | 282 | 214 | 232 |
| R ² | 0.094 | 0.109 | 0.138 |
| Adjusted R ² | 0.077 | 0.087 | 0.119 |
| Residual Std. Error | 0.759 (df = 276) | 0.783 (df = 208) | 0.735 (df = 226) |
| F Statistic | 5.710*** (df = 5; 276) | 5.080*** (df = 5; 208) | 7.260*** (df = 5; 226) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Appendix B
Age 11.5 Replication

Table B1

Gen2 Measurement Model.

| g at Age 11.5 | |
|--------------------------------|---------|
| Estimator | MLR |
| Observations | 7970 |
| Parameters | 15 |
| ChiSqM_Value | 273 |
| ChiSqM_DF | 5 |
| ChiSqM_PValue | 0 |
| ChiSqBaseline_PValue | 0 |
| LL | -140683 |
| UnrestrictedLL | -140524 |
| LLCorrectionFactor | 1.47 |
| UnrestrictedLLCorrectionFactor | 1.39 |
| CFI | 0.982 |
| TLI | 0.963 |
| AIC | 281396 |
| BIC | 281501 |
| aBIC | 281453 |
| RMSEA_Estimate | 0.082 |
| RMSEA_90CI_LB | 0.074 |
| RMSEA_90CI_UB | 0.09 |
| RMSEA_pLT05 | 0 |
| SRMR | 0.02 |
| AICC | 281396 |

Table B2

Gen2 Factor Loadings.

| | Test | Estimate | S.E. | Est./S.E. | P.Value |
|---|-------|----------|-------|-----------|---------|
| 1 | DIGIT | 0.551 | 0.010 | 53.500 | 0 |
| 2 | MATH | 0.744 | 0.007 | 102.000 | 0 |
| 3 | RECOG | 0.837 | 0.005 | 153.000 | 0 |
| 4 | COMP | 0.843 | 0.006 | 148.000 | 0 |
| 5 | PPVT | 0.751 | 0.009 | 83.500 | 0 |

Between Family Analyses

Table B3

Mean Gen1 Intelligence → Mean Gen2 AFI

| | Dependent variable: | | |
|-------------------------|-------------------------------|-------------------------------|-------------------------------|
| | Mixed | Mean AFI Daughters | Sons |
| Gen1 Intel | 0.012*** (0.008, 0.017) | 0.013*** (0.009, 0.018) | 0.014*** (0.009, 0.019) |
| Constant | −0.754*** (−1.010, −0.500) | −0.801*** (−1.090, −0.513) | −0.856*** (−1.140, −0.569) |
| Observations | 342 | 264 | 282 |
| R ² | 0.090 | 0.101 | 0.106 |
| Adjusted R ² | 0.087 | 0.097 | 0.103 |
| Residual Std. Error | 0.700 (df = 340) | 0.703 (df = 262) | 0.691 (df = 280) |
| F Statistic | 33.500*** (df = 1; 340) | 29.400*** (df = 1; 262) | 33.200*** (df = 1; 280) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table B4

Mean Gen2 Intelligence → Mean Gen2 AFI

| | Dependent variable: | | |
|-------------------------|----------------------------|----------------------------|----------------------------|
| | Mixed | Mean AFI Daughters | Sons |
| Gen2 Intel | 0.104*** (0.044, 0.163) | 0.117*** (0.047, 0.187) | 0.091*** (0.027, 0.156) |
| Constant | −0.016 (−0.094, 0.062) | −0.007 (−0.097, 0.083) | −0.035 (−0.121, 0.050) |
| Observations | 339 | 262 | 278 |
| R ² | 0.034 | 0.040 | 0.027 |
| Adjusted R ² | 0.031 | 0.036 | 0.023 |
| Residual Std. Error | 0.729 (df = 337) | 0.738 (df = 260) | 0.721 (df = 276) |
| F Statistic | 11.700*** (df = 1; 337) | 10.700*** (df = 1; 260) | 7.650*** (df = 1; 276) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table B5

Mean Joint Intelligence → Mean Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|-------------------------------|-------------------------------|-------------------------------|
| | Mean AFI | | |
| | Mixed | Daughters | Sons |
| INTMOMmean | 0.012*** (0.007, 0.017) | 0.013*** (0.007, 0.018) | 0.014*** (0.008, 0.020) |
| Int_Mean | 0.010 (−0.060, 0.079) | 0.017 (−0.064, 0.099) | −0.006 (−0.081, 0.070) |
| Constant | −0.722*** (−1.030, −0.416) | −0.751*** (−1.100, −0.401) | −0.861*** (−1.210, −0.511) |
| Observations | 333 | 255 | 274 |
| R ² | 0.087 | 0.098 | 0.103 |
| Adjusted R ² | 0.082 | 0.091 | 0.096 |
| Residual Std. Error | 0.705 (df = 330) | 0.709 (df = 252) | 0.696 (df = 271) |
| F Statistic | 15.800*** (df = 2; 330) | 13.800*** (df = 2; 252) | 15.600*** (df = 2; 271) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Within Family Analyses

Table B6

Dif Gen1 Intelligence → Dif Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|----------------------------|----------------------------|-------------------------------|
| | Gen2 AFI Differences | | |
| | Mixed | Daughters | Sons |
| AFIKIDmean | 0.303*** (0.187, 0.419) | 0.328*** (0.192, 0.465) | 0.376*** (0.251, 0.501) |
| INTMOMmean | −0.003 (−0.007, 0.002) | −0.002 (−0.008, 0.004) | −0.008*** (−0.013, −0.003) |
| INTMOMdiff | 0.001 (−0.003, 0.006) | 0.001 (−0.005, 0.006) | 0.0003 (−0.005, 0.005) |
| Constant | 1.180*** (0.893, 1.470) | 1.180*** (0.838, 1.520) | 1.500*** (1.180, 1.830) |
| Observations | 336 | 258 | 278 |
| R ² | 0.074 | 0.083 | 0.116 |
| Adjusted R ² | 0.066 | 0.072 | 0.106 |
| Residual Std. Error | 0.757 (df = 332) | 0.780 (df = 254) | 0.734 (df = 274) |
| F Statistic | 8.830*** (df = 3; 332) | 7.640*** (df = 3; 254) | 12.000*** (df = 3; 274) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table B7

Dif Gen2 Intelligence → Dif Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|-------------------------------|-------------------------------|-------------------------------|
| | Gen2 AFI Differences | | |
| | Mixed | Daughters | Sons |
| AFIKIDmean | 0.344*** (0.225, 0.463) | 0.369*** (0.232, 0.506) | 0.382*** (0.251, 0.512) |
| Int_Mean | −0.097*** (−0.168, −0.026) | −0.120*** (−0.205, −0.035) | −0.130*** (−0.207, −0.052) |
| Intdiff | 0.037 (−0.007, 0.081) | 0.034 (−0.016, 0.084) | 0.015 (−0.032, 0.062) |
| Constant | 1.050*** (0.962, 1.140) | 1.070*** (0.963, 1.170) | 1.080*** (0.979, 1.170) |
| Observations | 286 | 223 | 230 |
| R ² | 0.117 | 0.131 | 0.149 |
| Adjusted R ² | 0.108 | 0.119 | 0.138 |
| Residual Std. Error | 0.751 (df = 282) | 0.773 (df = 219) | 0.734 (df = 226) |
| F Statistic | 12.500*** (df = 3; 282) | 11.000*** (df = 3; 219) | 13.200*** (df = 3; 226) |

Note:

*p<0.1; **p<0.05; ***p<0.01

Table B8

Dif Joint Intelligence → Dif Gen2 AFI

| | <i>Dependent variable:</i> | | |
|-------------------------|------------------------------|------------------------------|-------------------------------|
| | Gen2 AFI Differences | | |
| | Mixed | Daughters | Sons |
| AFIKIDmean | 0.328*** (0.203, 0.452) | 0.339*** (0.194, 0.483) | 0.417*** (0.282, 0.552) |
| Int_Mean | −0.098** (−0.184, −0.013) | −0.131** (−0.234, −0.029) | −0.071 (−0.163, 0.021) |
| INTMOMmean | 0.001 (−0.005, 0.007) | 0.002 (−0.005, 0.010) | −0.007** (−0.014, −0.0001) |
| Intdiff | 0.034 (−0.011, 0.080) | 0.037 (−0.016, 0.089) | 0.012 (−0.036, 0.059) |
| INTMOMdiff | 0.002 (−0.004, 0.007) | −0.002 (−0.008, 0.005) | 0.001 (−0.004, 0.007) |
| Constant | 0.984*** (0.615, 1.350) | 0.925*** (0.489, 1.360) | 1.470*** (1.060, 1.890) |
| Observations | 278 | 215 | 226 |
| R ² | 0.112 | 0.125 | 0.162 |
| Adjusted R ² | 0.096 | 0.104 | 0.143 |
| Residual Std. Error | 0.751 (df = 272) | 0.775 (df = 209) | 0.727 (df = 220) |
| F Statistic | 6.860*** (df = 5; 272) | 5.970*** (df = 5; 209) | 8.500*** (df = 5; 220) |

Note:

*p<0.1; **p<0.05; ***p<0.01

References

- Baker, P. C., Keck, C. K., Mott, F. L., & Quinlan, S. V. (1993). *NLSY Child Handbook, Revised Edition: A Guide to the 1986-1990 NLSY Child Data*. Columbus, Ohio: The Ohio State University, Center for Human Resource Research.
- Beasley, W. H., Rodgers, J. L., Bard, D. E., Hunter, M., Garrison, S. M., & Meredith, K. M. (2015). *NlsyLinks: Utilities and kinship information for research with the NLSY*. Retrieved from <http://liveoak.github.io/NlsyLinks/>
- Boislard, P. M. A., & Poulin, F. (2011). Individual, familial, friends-related and contextual predictors of early sexual intercourse. *Journal of adolescence*, 34(2), 289–300.
- Bozon, M. (2003). At what age do women and men have their first sexual intercourse? World comparisons and recent trends. *Population and Societies*(391), 1–4.
- Center for Human Resources Research. (2009). *NLSY79 CHILD YOUNG ADULT DATA USERS GUIDE: A Guide to the 1986 - 2006 Child Data 1994 - 2006 Young Adult Data*. Bureau of Labor Statistics, U.S. Department of Labor. Retrieved from <https://www.nlsinfo.org/pub/usersvc/Child-Young-Adult/2006ChildYA-DataUsersGuide.pdf>
- Defense Manpower Data Center. (2012). *ASVAB Technical Bulletin No. 4 PP-ASVAB Forms 23-27* (Tech. Rep. No. 4).
- Der, G., Batty, G. D., & Deary, I. J. (2009). Intelligence The association between IQ in adolescence and a range of health outcomes at 40 in the 1979 US National Longitudinal Study of Youth. *Intelligence*, 37(6), 573–580. doi: 10.1016/j.intell.2008.12.002
- Dunn, L. M., & Dunn, L. M. (1981). *Peabody Picture Vocabulary Test-Revised: PPVT-R*. American Guidance Service.
- Dunn, L. M., & Markwardt, F. C. (1970). *Peabody individual achievement test*. American Guidance Service.
- Finer, L. B. (2007). Trends in premarital sex in the United States, 1954–2003. *Public Health Reports*, 122(1), 73.
- Garrison, S. M., Hadd, A. R., & Rodgers, J. L. (2015). Impact of adolescent conscientiousness and intelligence on health at middle age: A sibling comparison

- approach. In *16th annual meeting of the society for personality and social psychology*. Long Beach, CA.
- Halpern, C. T., Joyner, K., Udry, J. R., & Suchindran, C. (2000). Smart teens don't have sex (or kiss much either). *Journal of Adolescent Health, 26*(3), 213–225.
- Harden, K. P. (2012). True Love Waits? A Sibling-Comparison Study of Age at First Sexual Intercourse and Romantic Relationships in Young Adulthood. *Psychological Science, 23*(11), 1324–36. doi: 10.1177/0956797612442550
- Harden, K. P. (2014). Genetic influences on adolescent sexual behavior: Why genes matter for environmentally oriented researchers. *Psychological bulletin, 140*(2), 434.
- Harden, K. P., & Mendle, J. (2011). Why don't smart teens have sex? A behavioral genetic approach. *Child development, 82*(4), 1327–1344.
- Harden, K. P., Mendle, J., Hill, J. E., Turkheimer, E., & Emery, R. E. (2008). Rethinking timing of first sex and delinquency. *Journal of Youth and Adolescence, 37*(4), 373–385.
- Herrnstein, R. J., & Murray, C. (1994). The bell curve: The reshaping of American life by differences in intelligence. *New York: Free*.
- Kaestle, C. E., Halpern, C. T., Miller, W. C., & Ford, C. A. (2005). Young age at first sexual intercourse and sexually transmitted infections in adolescents and young adults. *American Journal of Epidemiology, 161*(8), 774–780.
- Kass, R. A., Mitchell, K. J., Grafton, F. C., & Wing, H. (1982). *Factor Structure of the Armed Services Vocational APTITUDE BATTERY (ASVAB), Forms 8, 9, and 10: 1981 ARMY APPLICANT SAMPLE* (Tech. Rep.). US Army Research Institute for the Behavioral and Social Sciences.
- Kearney, M. S., & Levine, P. B. (2014, January). Media Influences on Social Outcomes: The Impact of MTV's 16 and Pregnant on Teen Childbearing. Retrieved from <http://www.nber.org/papers/w19795>
- Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. Guilford Press.
- Kenny, D. A., Mohr, C. D., & Levesque, M. J. (2001). A social relations variance partitioning of dyadic behavior. *Psychological Bulletin, 127*(1), 128.
- Kirby, D. (2002). Effective approaches to reducing adolescent unprotected sex, pregnancy, and childbearing. *Journal of sex research, 39*(1), 51–57.

- Leitenberg, H., & Saltzman, H. (2000). A Statewide Survey of Age at First Intercourse for Adolescent Females and Age of Their Male Partners: Relation to Other Risk Behaviors and Statutory Rape Implications. *Archives of Sexual Behavior*, 29(3), 203–215. doi: 10.1023/A:1001920212732
- Maier, M. H., & Sims, W. H. (1986). *The ASVAB score scales: 1980 and World War II* (Tech. Rep.). Alexandria, VA: Center for Naval Analyses.
- Manlove, J. (1998). The influence of high school dropout and school disengagement on the risk of school-age pregnancy. *Journal of Research on Adolescence*, 8(2), 187–220.
- Mathews, C., Aarø, L. E., Flisher, A. J., Mukoma, W., Wubs, A. G., & Schaalma, H. (2009). Predictors of early first sexual intercourse among adolescents in Cape Town, South Africa. *Health Education Research*, 24(1), 1–10.
- Mathews, J. J. (1977). *Analysis Aptitude Test for Selection of Airmen for the Radio Communications Analysis Specialist Course: Development and Validation* (Tech. Rep.). Brooks Air Force Base, Texas: Air Force Human Resources Lab.
- Mayberry, P. W., & Hiatt, C. M. (1992). *Computing AFQT Scores from Historical Data* (Tech. Rep.). DTIC Document.
- McGrevy, D. F., Knouse, S. B., & Thompson, R. A. (1974). *Relationships among an individual intelligence test and two air force screening and selection tests* (Tech. Rep.). DTIC Document.
- Mott, F. L. (1983). Early fertility behavior among American youth: Evidence from the 1982 national longitudinal surveys of labor force behavior of youth. In *America public health association meetings, dallas*.
- Mott, F. L., & Baker, P. C. (1995). *The NLSY children 1992: Description and evaluation*. Center for Human Resource Research, Ohio State University.
- Muthén, L. K., & Muthén, B. O. (2014). *Mplus*.
- Palmer, P., Hartke, D. D., Ree, M. J., Welsh, J. R., & Valentine Jr, L. D. (1988). *Armed Services Vocational Aptitude Battery (ASVAB): Alternate Forms Reliability (Forms 8, 9, 10, and 11)*. (Tech. Rep.). DTIC Document.
- Paul, C., Fitzjohn, J., Herbison, P., & Dickson, N. (2000, August). The determinants of sexual intercourse before age 16. *Journal of Adolescent Health*, 27(2), 136–147. doi: 10.1016/S1054-139X(99)00095-6

Plomin, R., & Spinath, F. M. (2004). Intelligence: genetics, genes, and genomics.

Journal of personality and social psychology, 86(1), 112.

Raffaelli, M., & Crockett, L. J. (2003). Sexual risk taking in adolescence: the role of self-regulation and attraction to risk. *Developmental psychology*, 39(6), 1036.

Rodgers, J. L. (1996). Sexual transitions in adolescence. In J. A. Graber,

J. Brooks-Gunn, & A. C. Petersen (Eds.), *Transitions through adolescence:*

Interpersonal domains and context (pp. 85–110). Mahwah, New Jersey.

Rodgers, J. L., Beasley, W. H., Bard, D. E., Meredith, K. M., Hunter, M., Johnson,

A. B., . . . Rowe, D. C. (2015). *The NLSYKinship Links: Using the NLSY79 and*

NLSY-Children Data to Conduct Genetically-Informed and Family-Oriented

Research.

Rodgers, J. L., Cleveland, H. H., van den Oord, E., & Rowe, D. C. (2000). Resolving

the debate over birth order, family size, and intelligence. *American Psychologist*,

55(6), 599–612. Retrieved from

<http://doi.apa.org/getdoi.cfm?doi=10.1037/0003-066X.55.6.599> doi:

10.1037//0003-066X.55.6.599

Rodgers, J. L., Garrison, S. M., & Hadd, A. R. (2014). *Intelligence and Fertility in the*

NLSY79Respondents: Children of Siblings and Biometrical Models. Charlottesville,

VA.

Rowe, D. C., & Rodgers, J. L. (1997). Poverty and Behavior : Are Environmental

Measures Nature and Nurture ? *Developmental Review*, 17(3), 358–375. doi:

DOI10.1006/drev.1997.0434

Rutter, M. (2007). Proceeding from observed correlation to causal inference: the use of

natural experiments. *Perspectives on Psychological Science*, 2(4), 377–395. doi:

10.1111/j.1745-6916.2007.00050.x

Savage, D. S., & Freeman, M. J. (2009). *16 and Pregnant*. MTV.

Schvaneveldt, P. L., Miller, B. C., Berry, E. H., & Lee, T. R. (2001). Academic goals,

achievement, and age at first sexual intercourse: Longitudinal, bidirectional

influences. *Adolescence*, 36(144), 767.

U.S. Coast Guard. (2004). *Armed Services Vocational Aptitude Battery (ASVAB)*

renorming. (Tech. Rep.). U.S. Department of Homeland Security.

- U.S. Department of Defense. (1982). *Profile of American Youth: 1980 nationwide administration of the Armed Services Vocational Aptitude Battery*. Washington, DC: Office of the Assistant Secretary of Defense (Manpower, Installations and Logistics).
- U.S. Department of the Army. (2013). *Pocket Recruiter Guide*. Fort Knox, KY: Government Printing Agency.
- Waters, B. K., Laurence, J. H., Camara, W. J., & Green, B. F. (1987). *Personnel enlistment and classification procedures in the US military*. National Academy Press.
- Wechsler, D. (1974). *Manual for the Wechsler intelligence scale for children, revised*. Psychological Corporation.
- Wellings, K., Nanchahal, K., Macdowall, W., McManus, S., Erens, B., Mercer, C. H., . . . Field, J. (2001, December). Sexual behaviour in Britain: Early heterosexual experience. *Lancet*, 358(9296), 1843–1850. doi: 10.1016/S0140-6736(01)06885-4
- Welsh, J. R., Kucinkas, S. K., & Curran, L. T. (1990). *Armed Services Vocational Aptitude Battery (ASVAB: Integrative Review of Validity Studies* (Tech. Rep.). Brooks Air Force Base, Texas: Manpower and Personnel Division Air Force Human Resources Laboratory.
- West, S. G. (2009). Alternatives to randomized experiments. *Current Directions in Psychological Science*, 18(5), 299–304.
- Wilbourn, J., Valentine Jr, L. D., & Ree, M. J. (1984). *Relationship of the Armed Services Vocational Aptitude Battery (ASVAB) Forms 8, 9, and 10 to Air Force Technical School Final Grades* (Tech. Rep.). Brooks Air Force Base, Texas: Manpower and Personnel Division.
- Woodward, L., Fergusson, D. M., & Horwood, L. J. (2001). Risk Factors and Life Processes Associated with Teenage Pregnancy: Results of a Prospective Study From Birth to 20 Years. *Journal of Marriage and Family*, 63(4), 1170–1184. doi: 10.1111/j.1741-3737.2001.01170.x