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Dysgenic fertility for intelligence and education in Taiwan

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ABSTRACT

This study investigated the current trend of dysgenic fertility in Taiwan. Data on 680 adults aged 35 to 90 years from the Taiwan WAIS-IV norming sample and 980 children aged 2.5 to 7 years from the Taiwan WPPSI-IV norming sample were examined to investigate the relationships between intelligence, education, and fertility. Results revealed that education and intelligence were negatively correlated with fertility, and that the correlations were stronger for females. The genotypic intelligence is estimated to decline by approximately 1.19 IQ points per generation and the decline is much stronger for the younger adult cohort (1.46 IQ points) than for the older adult cohort (1.02 IQ points).

1. Introduction

Eighty years ago, Runquist (1936) reported a secular increase in intelligence. In the decades that followed, numerous studies reported similar findings across various samples and countries (Lynn, 2013). In 1984, Flynn (1984) reported an average gain of 0.3 IQ points per year based on his examination of 18 U.S. studies from 1932 to 1978. This approximately 3-point-per-decade average increase in IQ has been confirmed by recent meta-analyses (Pietschnig & Voracek, 2015; Trahan, Stuebing, Fletcher, & Hiscock, 2014). Additionally, on the basis of 271 independent samples from 31 countries over more than one century (1909–2013), Pietschnig and Voracek (2015) reported that IQ gains vary according to domain, are stronger for adults than for children, and have decreased in recent decades.

The Flynn effect is currently slowing. Many studies have reported an increase in IQ; for example, reports from the United States (Flynn, 2012; Flynn & Weiss, 2007), the Commonwealth of Dominica (Meisenberg, Lawless, Lambert, & Newton, 2005, 2006), Germany, and Korea have continued to show gains. However, recent evidence has begun to reveal that the Flynn effect has reversed in a few countries (Dutton, van der Linden, & Lynn, 2016). Static or declining trends have been observed in Great Britain, France, Netherlands, Australia, Estonia, and some Scandinavian nations like Finland, Norway and Denmark (Cotton et al., 2005; Dutton & Lynn, 2013, 2015; Flynn, 2012; Lynn, 2009; Ronnlund, Carlstedt, Bloomstedt, Nilsson, & Weinehall, 2013; Shayer, Ginsburg & Coe, 2007; Shayer & Ginsburg, 2009; Shayer, Ginsburg, & Coe, 2007; Sundet, Barlaug, & Torjussen, 2004; Teasdale & Owen, 2000, 2005, 2008; Woodley & Meisenberg, 2013). The average intelligence in a number of economically developed countries is declining (Lynn, 2011; Meisenberg & Woodley, 2013).

One suggested cause of the negative Flynn effect is the so-called process of dysgenic fertility (Dutton & Lynn, 2015; Lynn, 2011). For example, Woodley of Menie (2015) investigated the decline of *g* across nine US and UK studies, and estimated a loss of 0.39 points per decade due to selection, a loss of 0.84 points per decade due to mutation accumulation and a total dysgenic loss of 1.23 points per decade. Dutton, van der Linden, and Lynn (2016) proposed that "a phenotypic increase in IQ may have largely overshadowed a possible genotypic decline in IQ and that the latter is only more recently starting to show up in several representative datasets" (p. 167).

The majority of research on the secular trend of intelligence has come from the United States, Great Britain, and other countries in Europe. There have also been some studies for East Asia. Wang, Fuerst, and Ren (2016) reported evidence for dysgenic fertility in the People's Republic of China. They estimated a fluid intelligence loss from 1971 to 2000 due to dysgenic fertility at 0.75 points after correction for the reliability and validity of the measures. For Taiwan, an IQ gain in children was estimated as 2.45 IQ points per decade over the years 1997–2007 (Chen, Liao, Chen, Chen, & Lynn, 2013). Chen, Chen, Liao, and Chen (2013) estimated the decline of genotypic intelligence as 0.82 to 1.33 IQ points per generation but this estimate was based on a small adult sample of 73. The objective of the present paper is to report a

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further study of the secular trend of intelligence in Taiwan.

2. Method

2.1. Adults: the Taiwan WAIS-IV norming sample

We first analyzed data for 680 adults aged 35–90 years from the Taiwan WAIS-IV standardization sample that was stratified to match the 2013 census for gender, level of education and geographical region (Wechsler, 2015). The mean full-scale IQ (FSIQ) was 99.8 (SD = 15.1), and the mean age was 66.4 years (SD = 15.5). The Taiwan version of the WAIS-IV has ten core subtests: Vocabulary, Similarities, Information, Block Design, Matrix Reasoning, Visual Puzzle, Digit Span, Letter-Number Sequencing, Symbol Search, and Coding. Internal consistency reliability is 0.98 for FSIQ (Wechsler, 2015). Correlation and part correlation methodologies were used to investigate the associations among FSIQ, educational attainment[1], and a self-reported number of children.

2.2. Young children: the Taiwan WPPSI-IV norming sample

The Taiwan WPPSI-IV standardization sample (Wechsler, 2013) consisted of 924 children aged 2.5–7 years. It was stratified to match the 2012 census for gender, parents' education level, and geographical region. The overall mean FSIQ was 100.0 (SD = 15.0). The mean age was 4.95 years (SD = 1.59). The Taiwan version of the WPPSI-IV has five core subtests in FSIQ for ages 2.5–4 (Receptive Vocabulary, Information, Block Design, Matrix Reasoning, and Picture Memory) and six core subtests in FSIQ for ages 4–7 (Information, Similarities, Block Design, Matrix Reasoning, Picture Memory, and Bug Search). Internal consistency reliability for FSIQ is 0.95 and 0.96 for the younger and older age bands, respectively, with an overall average of 0.96 (Wechsler, 2013). Correlation methodologies were used to investigate the associations among FSIQ, parents' education[1], and a self-reported number of siblings.

3. Results

3.1. Results based on the adult sample

Table 1 presents the descriptive statistics and correlations between the studied variables and age in the adult sample.

Intelligence and educational attainment were significantly and positively correlated (r = .65, p = .000). The correlation between intelligence and the number of children was −.18 (p = .000), and the correlation between education and the number of children was −.34 (p = .000). Once intelligence was controlled for, the partial correlation between education and the number of children remained statistically significant (r = −.30, p = .000).

The correlation between age and the number of children was .55 (p = .000). Approximately 13.5% of the sample were childless. Compared with adults who had children, adults without children were younger (t = 7.05, p = .000), and had higher educational attainment (t = 3.34, p = .000).

We further investigated the phenomenon according to gender. For women, the correlation between fertility and FSIQ was −.25 (p = .000). The correlation between fertility and education was −.44 (p = .000). When the analysis was controlled for intelligence, the partial correlation between education and the number of children remained significant at −.38 (p = .000). The 14% of women who were childless, compared with those who had children, were younger (t = 5.12, p = .000), higher in educational attainment (t = 5.86, p = .000), and higher in intelligence (t = 2.08, p = .03). For men, the correlation between fertility and IQ was non-significant (r = − .08, p = .138), which was considered as zero in the population. However, the correlation between fertility and education was significant at −.21 (p = .000). The partial correlation between education and the number of children remained −.20 (p = .000) after intelligence was controlled. Approximately 13% of the men were childless. Compared with men who had children, this group was younger (t = −4.85, p = .000), but did not show significant differences in education and intelligence.

The average number of children was 3.16 for adults with an FSIQ less than 84 and 2.29 for adults with an FSIQ higher than 115. The average number of children was 3.42 for adults with the lowest education level (elementary school or lower) and 1.93 for adults with the highest education level (4-year university or college, or higher). The fertility of those with the lowest FSIQ and the fewest years of education, was approximately 1.4 to 1.8 times the rate of those with the highest FSIQ and most years of education.

To estimate the decline of genotypic intelligence[2], we weighted the IQ of the parents by their number of children and assuming that, on average, the mean IQ of the children is the same as that of their parents, the differences between the mean IQ of the sample and that of their children was estimated as 1.67. With the adoption of Jinks and Fulker's (1970) estimate of .71 for the narrow heritability of intelligence[3], the decline of genotypic intelligence is 1.19 IQ points per generation. To examine possible variations between cohorts, we further divided the whole adult sample into two age bands: an older cohort (65 to 90 years) and a younger cohort (35 to 64 years). The differences between the mean IQ of each sample and that of their children were estimated as 1.43 for the older cohort and 2.06 for the younger cohort. The estimated decline of genotypic intelligence was 1.02 IQ points for the older cohort and 1.46 IQ points for the younger cohort.

3.2. Results based on the sample of young children[4]

Intelligence and the educational attainment of both parents were significantly and positively correlated (r = .33 and .31 respectively, p = .000 for both). The correlation between intelligence and the number of siblings was negative (r = −.12, p = .000). The correlation between fathers' education and the number of siblings was −.12 (p = .000), and for mothers it was −.11 (p = .000). In addition, the data showed a positive correlation between children's ages and the number of elder siblings (r = .11, p = .000). Table 2 presents the descriptive statistics and correlations between the studied variables and age in this sample of young children.

4. Discussion

There are five points of interest in the results. First, the results based

[1] Educational attainment was coded on a 1 to 6 scale: 1 = elementary school or lower; 2 = junior high school; 3 = senior high school; 4 = 2-year college; 5 = 4-year university or college; 6 = graduate school or higher.

[2] We used the following formula to estimate the decline of genotypic intelligence (D). $D = (h^2) \times \left[MIQ_P - \left(\frac{\sum (IQ_p \times N_c)}{\sum N_c} \right) \right]$, where h^2 is the heritability of intelligence, MIQ_P is the mean IQ for the group of parents, IQp is the IQ for each parent, Nc is the number of children for each parent, and ΣN_c is the total number of children. The decline of genotypic intelligence for the overall sample was calculated by a) estimating the mean IQ difference between parents and their children, [99.7544 − (176849/1803)] = 1.67, and b) estimating the decline of genotypic intelligence, .71∗1.67 = 1.19.

[3] The heritability of IQ (h^2) increases with age (Bouchard, 2013; Haworth et al., 2010). In childhood, h^2 for IQ is approximately .45, and by late adolescence, h^2 is approximately .75 (Neisser et al., 1996). For adults, this value is between approximately .70 and .80 (Bouchard et al., 1990; Plomin, Pedersen, Lichtenstein, & McClearn, 1994). One of our coauthors personally consulted Prof. Robert Plomin, who agrees that Jinks and Fulker's estimate of .71 is correct.

[4] We present the sibling data for young children only for reference. The data themselves are insufficient for estimating the rate of intelligence decline per generation, and the sibling data have problems attributable to the undersampling of parents with few children and the omission of adults who are childless.