Childhood IQ and marriage by mid-life: the Scottish Mental Survey 1932 and the Midspan studies

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Summary

The study examined the influence of IQ at age 11 years on marital status by mid-adulthood. The combined databases of the Scottish Mental Survey 1932 and the Midspan studies provided data from 883 subjects. With regard to IQ at age 11, there was an interaction between sex and marital status by mid-adulthood ($p=0.0001$). Women who had ever married achieved mean lower childhood IQ scores than women who had never married ($p<0.001$). Conversely, there was a trend for men who had ever married to achieve higher childhood IQ scores than men who had never married ($p=0.07$). In men, the odds ratio of ever marrying was 1.35 (95% CI 0.98 – 1.86; $p=0.07$) for each standard deviation increase in childhood IQ. Among women, the odds ratio of ever marrying by mid-life was 0.42 (95% CI 0.27 – 0.64; $p=0.0001$) for each standard deviation increase in childhood IQ. Mid-life social class had a similar association with marriage, with women in more professional jobs and men in more manual jobs being less likely to have ever married by mid-life. Adjustment for the effects of mid-life social class and height on the association between childhood IQ and later marriage, and vice versa, attenuated the effects somewhat, but suggested that IQ, height and social class acted partly independently.

Keywords: childhood IQ; social class; height; sex; marital status; cohort; Scotland

Introduction

According to evidence from the National Longitudinal Survey of Youth in the USA, people who achieve higher psychometric intelligence test scores in late adolescence are more likely to marry in the following decade or so (Herrnstein & Murray, 1994). There is also evidence to suggest that men in higher socio-economic positions are more likely to marry than men in lower socio-economic positions (Marmot, Davey Smith, Stansfeld, Patel, North, Head, White, Brunner, Feeney, 1991; Emslie, Hunt & Macintyre, 1999). This association may be reversed in women. The Whitehall II study of men and women working in the British Civil Service found that men in higher occupational grades were significantly more likely to be ever married or cohabiting (89%) than men in lower grades, but only 59% of women in the highest grade jobs ever married (Marmot et al, 1991). Similar findings were obtained in another study which found that 93% of male managers ever married or cohabited whereas only 57% of female managers ever married or cohabited (Emslie et al, 1999).

Psychometric intelligence and social position are moderately correlated (Neisser, Boodoo, Bouchard, Boykin, Brody, Ceci, Halpern, Loehlin, Perloff, Sternberg & Urbina, 1996). Higher psychometric intelligence possibly facilitates marriage via the mediating effect on social position. Other studies show that birthweight and adult height are associated with marital status (Ben-Shlomo, Davey Smith, Shipley & Marmot, 1993; Frankel, Elwood, Sweetnam, Yarnell & Davey Smith, 1996; Vågerö & Modin, 2002), and may be a marker of other aspects of a person's background such as genetic or intra-uterine factors, or early environmental influences. Height is associated with intelligence, and is an indicator of perceived physical attractiveness (Macintyre & West, 1991). In the present study, we investigate whether mental ability at age 11 years is associated with marital status in mid-adulthood in a cohort of people who were born in 1921. We also investigate possible sex

differences in the association between psychometric intelligence and marriage, and examine whether any relationship between childhood IQ and marriage is accounted for by, or acts independently of, adult social class and height.

Method

Psychometric intelligence data at age 11 years were obtained from the Scottish Mental Survey 1932 (SMS1932). Socio-demographic data, including marital status, were obtained from the Midspan prospective cohort studies conducted in the 1970s. The detailed procedures used to link participants who took part in these two large Scottish studies were described in full elsewhere (Hart, Deary, Taylor, MacKinnon, Davey Smith, Whalley, Wilson, Hole & Starr, 2003).

The SMS1932 tested mental ability, using a version of the Moray House Test (MHT), in almost all 1921-born children attending school in Scotland on the 1st June 1932 (Scottish Council for Research in Education [SCRE], 1933). The test is referred to in the original publication as the "Verbal Test" and has a maximum score of 76 (SCRE, 1933). The total number of children who sat the Moray House Test (MHT) was 87,498 (44,210 boys and 43,288 girls). The MHT scores were corrected for age at testing and converted to IQ-type scores (mean 100, SD 15) (Hart et al, 2003).

The two Midspan studies were the Collaborative Study of employees in 27 work places in the west and central regions of that part of Scotland lying between the Firth of Clyde and Firth of Forth (Davey Smith, Hart, Hole, MacKinnon, Gillis, Watt, Blane & Hawthorne, 1998), and the Renfrew/Paisley General Population Study conducted on middle-aged adults in the 1970s (Hawthorne, Watt, Hart, Hole, Davey Smith & Gillis, 1995). Participants in both studies

completed an extensive screening questionnaire and attended a physical examination (Hart et al, 2003). A response rate of 79% in Renfrew and 78% in Paisley was achieved. Marital status was classified on the basis of self-reports which asked participants to indicate whether they had ever married and remained so, had remained single, were now widowed, or "other" at the time of Midspan screening when aged about 50. Those whose marital status was defined as "other" (N = 9) were excluded because it was not possible to determine if they had ever been married. Responses were categorised as "ever-married" if they had married at any time before the Midspan interview, even though their status might not have been married at that point. They were classed as "never-married" if they had not married at any time before the interview. Social class was coded according to the Registrar General's Classification (General Register Office, 1966) for self-reported occupation at the time of initial interview. Height (cm) recorded at the Midspan physical examination. Participants with missing social class data (N = 13) or with missing height data (N = 1) were excluded.

The SMS1932 tested almost everyone born in 1921 and at school in Scotland in 1932. Some participants in the Midspan studies were born in 1921 and had IQ data available from age 11 years. Ethical permission to link the Midspan and SMS1932 studies was obtained from the Multi-Centre Research Ethics Committee for Scotland. We exactly matched 938 (75%) participants from the two Midspan studies with an MHT score at age 11 (Hart et al, 2003). Of those matched there were only 33 women from the Collaborative Study, mostly from two workplaces. In total, 75% of the Collaborative Study women had ever married. This contrasts with 90% ever married Renfrew/Paisley women, 94% ever married Collaborative Study men, and 92% ever married Renfrew/Paisley men. The women in the Collaborative Study were excluded from the present study because they were not as representative as the Collaborative Study men or the Renfrew/Paisley men and women.

Data were analysed using SPSS for Windows (version 11.0). A general linear model tested relationships between IQ, sex and marital status. Sex and marital status (ever-married or never-married) were entered as fixed factors with age-adjusted childhood mental ability at 11 years as a covariate. The analysis was repeated with height as the dependent variable. Chi square test (χ^2) tested associations between social class and marriage. Relationships between childhood IQ, adult social class, and height were examined using Pearson's or Spearman's correlations as appropriate. Logistic regression analysis was used to examine relationships between age 11 IQ and social class and marital status at the time of the Midspan studies. Marital status was the outcome (ever-married or never-married), and standardised IQ scores (adjusted for age in days at the time of testing) at age 11 or occupational social class was entered as the independent variable. Logistic regression analysis was repeated to determine whether any IQ-marriage relationship or social class-marriage relationship was reduced after adjustment for occupational social class or IQ, respectively. The analyses were repeated replacing social class with height.

Results

Analyses were conducted on participants with complete data on all variables (N = 883; 547 men, 336 women). Table 1 shows the marital status of the Midspan participants at midlife (ever-married or never-married) according to childhood IQ scores and adult height for the whole sample, and for men and women separately. A higher proportion of men (93.1%) than women (90.2%) had ever married. Men who were ever married at the time of screening had higher childhood IQ scores than men who were never married, but this relationship was not significant at the .05 level. Conversely, women who had ever married had significantly lower childhood IQ scores than women who had never married. The relationship between childhood IQ scores and marital status at midlife was greater in women than men. With respect to IQ at age 11, there was a significant interaction

between sex and marital status (ever-married or never-married) in adulthood, F (1, 879) = 17.91, p = 0.0001.

Men who had ever married were significantly taller than never-married men. The opposite relationship was found in women, women of shorter stature were significantly more likely to be ever married than women of taller stature. With respect to adult height there was an interaction between sex and marital status (ever-married or never-married) in adulthood, F (1, 879) = 8.07, p = 0.005. There was a significant Pearson's correlation between childhood IQ and adult height for men (r = 0.26, p = 0.0001) and women (r = 0.18, p = 0.001).

Table 2 shows the occupational social class of those participants who had ever married or never married at midlife, and separately for males and females. Among men, there was a significant association between occupational social class and marriage (p = 0.021). Men in more professional classes were more likely to be married. In women the association between occupational social class and marriage was also significant (p = 0.001). Women in more professional classes were less likely to be married. Men of higher occupational social class were taller (Spearman's *rho* = -0.25, p < 0.0001) and had better childhood IQ scores (Spearman's *rho* = -0.43, p < 0.0001) than men of poorer occupational social class. Women of higher occupational social class had better childhood IQ scores than women of lower occupational social class (Spearman's *rho* = -0.33, p < 0.0001). There was no significant association between occupational social class and height in women (Spearman's *rho* = -0.02, p = 0.71).

Logistic regression analysis examined the relationship between childhood IQ and marital status (expressed as odds ratios), and the mediating effect of occupational social class (Table 3). Separate

analyses were conducted for men and women. In men, the odds ratio of marrying was 1.35 (95% CI 0.98 – 1.86; $p = 0.066$) for each 1 standard deviation increase in childhood IQ score and 1.33 (95% CI 1.01 – 1.75; $p = 0.044$) for each higher social class category. After adjustment for social class, the relationship between childhood IQ and marital status was attenuated (odds ratio 1.21; 95% CI 0.85 – 1.73) and non significant. After adjustment for childhood IQ the odds of marrying were reduced to 1.25 (95% CI 0.92-1.68) for each higher social class category, and no longer significant.

In women, the odds ratio of marrying by mid-life was 0.42 (95% CI 0.27 to 0.64; $p = 0.0001$) for each 1 standard deviation increase in childhood IQ score, and 0.58 (0.43 to 0.78; $p = 0.0001$) for each higher social class category. The relationship between childhood IQ and marital status was attenuated after adjustment for occupational social class (odds ratio 0.50; 95% CI 0.32 – 0.78), but remained statistically significant ($p = 0.002$). Similarly, the association between social class and marital status was attenuated (odds ratio 0.67; 95% CI 0.49 – 0.92) but remained significant after adjustment for childhood IQ ($p = 0.015$). Women with lower childhood IQ scores and lower occupational social class were more likely to marry.

Table 4 shows the relationship between adult height and marital status, and examines whether adult height had a mediating effect on the association between childhood IQ and marital status. In men, the odds ratio of marrying by midlife was 1.39 (95% CI 1.00 – 1.94, $p = 0.051$) for each 1 standard deviation increase in adult height (1 standard deviation = 9.1 centimetres). Adjustment for childhood IQ resulted in attenuation of the association between height and marital status (odds ratio 1.32; 95% CI 0.93 – 1.86). Similarly, the association between childhood IQ and marital status was attenuated after adjustment for adult height (odds ratio 1.27; 95% CI 0.91 – 1.77).

In women, the odds of marrying were 0.64 (95% CI 0.43 – 0.96, $p = 0.029$) for each 1 standard deviation increase in adult height. After adjustment for childhood IQ, the association between height and marriage was attenuated (odds ratio 0.72; 95% CI 0.47 – 1.09) and became non-significant ($p = 0.12$). Adjustment for height in adulthood resulted in a small attenuation in the association between childhood IQ and marital status (odds ratio 0.44; 95% CI 0.28 – 0.68, $p < 0.0001$).

Discussion

Women with higher IQ scores in childhood were significantly less likely to marry than women with lower childhood IQ scores. This reverse pattern was seen in men. The results are consistent with those of previous studies which have shown that men who marry are more likely to have a higher socio-economic status (Marmot et al, 1991; Emslie et al, 1999) and taller stature (Ben-Shlomo et al, 1993) than men who do not marry. The reverse was found in women. Those women with higher childhood IQ scores showed a dramatic decline in marriage prospects.

The 1971 UK census of Great Britain was conducted when this sample was age 50 years, by which age most of those who would marry would have done so, and shows that 83% of men and 88% of women aged over 19 had ever married. Marriage rates among the study sample were slightly higher than in the general population. The social class distribution of marital status in this Midspan subsample is not dissimilar from the entire Midspan population. However, the Midspan Collaborative (work-place) sample is censored by complex mechanisms and cannot be assumed representative of a general population sample. The following considerations should be acknowledged when interpreting the results: (1) survival to study epoch at age about 55 years or migration are influenced by childhood intelligence;

(2) certain groups within the population may be under-represented, such as those people who were unemployed and people with common mental and/or physical illnesses, which may also be associated with failure to marry, and (3) this is a generation shaped by World War II and the survivors may not be typical of other UK birth cohorts. For example, social circumstances prevailing in central Scotland at the time meant that the women in the present study would have been most likely to marry in the early 1940s (in their early 20s). However, during World War II marriage rates fell and unmarried women were often tied to their parents' homes by social obligation and duty to care.

In the present subsample drawn from the Midspan sample, there were significant sex differences in the association between childhood IQ and marital status in adulthood. One explanation for the observed sex differences in childhood IQ and marital status in adulthood could be that women who spent longer in education and focused on furthering a career during early adulthood, delayed getting married, with some never marrying. A different mechanism might explain the reversed trend among males, which indicates that men with lower IQs are likely to be disadvantaged in competing for marriage partners (Kenrick, Sadalla, Groth & Trost, 1990). When asked to rate how desirable different qualities were in a potential marriage partner, women valued qualities that tended to lead to financial resources such as ambition, industriousness, education and social status much more than men did (Buss, 2000). IQ may also serve as a marker of childhood social circumstances and educational attainment, which in turn influence social pathways leading to marriage or non-marriage. In another study, when asked to report on minimal levels of acceptability for intelligence in different types of relationships women were found to be significantly more discriminating than men (Kenrick et al, 1990). The findings of the present study are generally consistent with evolutionary logic (Ellis, 2001; Miller, 2000). The theory of social stratification asserts that human females, like

other mammalian species, have evolved mating preferences that are biased towards males who are competent in provisioning resources (Ellis, 2001). According to Miller's 'sexual selection' hypothesis (Miller, 2000) intelligence functions as a major heritable component of biological 'fitness'. In other words, traits such as intelligence are hypothesised to have evolved through sexual selection to function as 'fitness indicators' that reveal 'good' genes and health. This may partly explain why men with higher IQ scores in childhood tended to marry more often than men with lower childhood IQ scores.

The finding that IQ in early life appears to be associated with likelihood to marry or not is important because factors in childhood may determine a person's marital status in adulthood, which may in turn influence their future health and mortality. For example, a classic paper by Gove (1973) suggested that mortality rates among the unmarried are greater than those of the married. However, there are important sex differences. Being married appears to be more advantageous to men than women. In other studies, indicators of family background, such as height and birthweight, have been associated with marriage (Vagero & Modin, 2002; Frankel et al, 1996). The findings of the present study and those of a previous investigation by Ben-Shlomo et al (1993) show that single men were of shorter stature than married men, but there was no significant association between height and social class in women. However, in an investigation of the entire Renfrew/Paisley study population an association between height and social class in women was found (Davey Smith, Hart, Upton, Hole, Gillis, Watt & Hawthorne, 2000). Our results show that, in women and men, the association between childhood IQ and marital status is partly, but not fully, explained by adult occupational position and height.

The relationship between childhood IQ and marital status was attenuated and no longer statistically significant after adjustment for adult social class in both men and women. However, controlling for adult social class based on adult social status may be an "over-control". Adult social class is partly determined by childhood IQ, which is associated with social mobility. Therefore, controlling for adult social class removes IQ relevant variance. In future studies it is important to investigate the effects of childhood social class, in addition to adult social class, on marital status.

Marital status is related to a person's emotional well-being and mortality (Gove, 1973; Clark & Oswald, 2002; Ben-Shlomo et al, 1993; Modin, 2003). One mechanism of the association between marital status and health, particularly in men, may reflect that people with poorer health are less likely to marry (Goldman, 1993). This selection might occur through lifestyle factors such as alcohol consumption and cigarette smoking, socio-economic factors, genetic factors, or environmental factors in early life. Alternatively, risk factors for poor health and premature mortality such as smoking, high cholesterol, and alcohol consumption have been shown to vary according to marital status (Ben-Shlomo et al, 1993; Modin, 2003). The healthier lifestyle that tends to accompany marriage may be protective in helping married people to maintain good health.

A limitation of the present study is the historical nature of the study. We do not know whether the IQ-marriage associations for men and women are specific to the present cohort or if marriage prospects for women with a higher childhood IQ have improved over the years. To address this directly is not possible, but the Scottish census contains relevant data that were used in a new analysis performed for this report (General Register Office for Scotland, 2001). The data is presented in Appendix 1. Using social class as a surrogate for IQ, the same

patterns emerge for men and women particularly in the middle age ranges. Fewer women with a high social class were ever married whereas the opposite was found for men.

One implication of the present findings is that the health-protective effects of marriage might contribute to the association between childhood IQ and age at death (Whalley & Deary, 2001). In future investigations, it is important to discover whether marital status in adulthood can account for variance in the link between a person's cognitive ability in early life and their subsequent health status in adulthood.

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Table 1: Mean and standard deviation (n) childhood IQ and adult height (cm) according to marital status at midlife (N = 883)

	Ever married	Never married	Significance (*p*)
Age 11 IQ			
All	100.1 ± 14.9 (812)	102.2 ± 16.5 (71)	0.249
Men	101.6 ± 15.2 (509)	96.8 ± 15.8 (38)	0.066
Women	97.5 ± 13.9 (303)	108.4 ± 15.2 (33)	0.0001*
Height			
All	166.0 ± 9.2 (812)	164.6 ± 7.7 (71)	0.221
Men	171.1 ± 6.9 (509)	168.8 ± 7.0 (38)	0.050*
Women	157.6 ± 5.8 (303)	159.9 ± 5.6 (33)	0.030*

* Significant difference between means

Table 2: Number of people (%) who had ever married or never married according to adult social class (N = 883)

	All			Men			Women		
	Ever married	Never married	*P	Ever married	Never married	*P	Ever married	Never married	*P
Adult social class									
I and II	189 (91.7)	17 (8.3)		146 (97.3)	4 (2.7)		43 (76.8)	13 (23.2)	
IIIN	142 (87.7)	20 (12.3)		57 (86.4)	9 (13.6)		85 (88.5)	11 (11.5)	
IIIM	250 (93.1)	17 (6.9)		197 (93.4)	14 (6.6)		53 (94.6)	3 (5.4)	
IV and V	231 (93.1)	17 (6.9)	0.135	109 (90.8)	11 (9.1)	0.021	122 (95.3)	6 (4.7)	0.001

* Chi-square test for differences

Table 3: Predictors of the chances (and 95% confidence intervals) of marrying according to childhood IQ and adult social class.

	N	Ever-married by childhood IQ	Ever-married by social class	Ever-married by IQ adjusted for social class	Ever-married by social class adjusted for IQ
All	883	0.83 (0.65 – 1.07) (p = 0.15)	0.92 (0.77 – 1.11) (p = 0.38)	0.85 (0.65 – 1.11) (p = 0.23)	0.97 (0.79 – 1.18) (p = 0.75)
Men	547	1.35 (0.98 – 1.86) (p = 0.066)	1.33 (1.01 – 1.75) (p = 0.044)	1.21 (0.85 – 1.73) (p = 0.28)	1.25 (0.92 – 1.68) (p = 0.15)
Women	336	0.42 (0.27 – 0.64) (p = 0.0001)	0.58 (0.43 – 0.78) (p = 0.0001)	0.50 (0.32 – 0.78) (p = 0.002)	0.67 (0.49 – 0.92) (p = 0.015)

Table 4: Predictors of the chances (and 95% confidence intervals) of marrying according to childhood IQ and adult height.

	N	Ever-married by height	Ever-married by height adjusted for IQ	Ever-married by IQ adjusted for height
All	883	1.00 (0.78-1.27) (p = 0.99)	1.04 (0.81-1.34) (p = 0.74)	0.82 (0.64-1.07) (p = 0.14)
Men	547	1.39 (1.00-1.94) (p = 0.051)	1.32 (0.93-1.86) (p = 0.12)	1.27 (0.91-1.77) (p = 0.17)
Women	336	0.64 (0.43-0.96) (p = 0.029)	0.72 (0.47-1.09) (p = 0.12)	0.44 (0.28-0.68) (p = 0.0001)

Appendix 1: Percentage of people ever married by NS-SeC, sex and age among all people aged 16-74 years old in Scotland in 2001 (Data obtained from the General Register Office for Scotland 2001 Census of the Population).

	Age in years											
	16 – 19		20 – 24		25 – 29		30 – 34		35 – 39		40 – 44	
NS-SeC	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	1.9	3.5	5.0	7.2	27.0	30.5	60.7	61.3	79.2	76.0	87.6	82.4
2	1.4	2.9	5.7	10.0	29.3	38.0	61.7	66.5	78.7	80.0	86.9	86.5
3	0.4	1.1	4.1	9.2	25.3	39.6	56.4	69.8	72.9	83.4	80.5	89.0
4	2.9	9.8	8.2	22.1	33.8	52.4	63.5	75.8	78.0	86.8	86.8	91.2
5	0.6	2.6	4.5	9.8	28.9	36.6	60.7	62.6	78.3	80.3	86.1	87.8
6	0.4	1.5	3.9	10.9	22.9	40.4	49.8	68.3	68.4	83.4	78.2	90.5
7	0.4	1.5	3.7	10.3	23.5	36.7	52.0	61.4	70.4	77.6	80.2	86.2
8	0.6	2.9	3.4	16.1	10.2	31.9	19.9	46.4	32.9	61.1	45.0	70.8

Appendix 1 continued.

	Age in years											
	45 – 49		50 – 54		55 – 59		60 – 64		65 – 69		70 – 74	
NS-SeC	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	91.5	85.8	94.0	88.6	95.3	89.1	95.4	86.5	91.6	88.1	86.8	81.8
2	90.6	90.2	92.9	92.1	94.9	92.4	95.4	92.0	96.7	91.4	92.6	86.5
3	85.1	92.0	87.7	93.9	91.5	94.3	92.7	94.2	93.2	93.3	88.2	89.6
4	90.8	94.4	93.3	96.4	94.7	96.9	95.2	96.5	95.0	95.5	93.4	93.3
5	90.5	92.8	92.7	94.9	93.8	95.7	94.7	94.8	93.1	92.7	86.8	93.9
6	83.6	94.2	88.4	96.1	91.2	96.6	92.1	96.5	92.5	93.5	87.2	92.0
7	84.9	92.1	88.2	94.6	90.7	95.8	92.9	96.5	94.6	95.6	92.9	93.6
8	52.6	75.5	59.5	78.6	63.7	82.9	66.0	86.3	54.4	89.9	50.1	90.0

Appendix footnote

NS-SeC

No.	Description
1	Higher manual and professional occupations
2	Lower managerial and professional occupations
3	Intermediate occupations
4	Small employers and own account workers
5	Lower supervisory and technical occupations
6	Semi-routine occupations
7	Routine occupations
8	Never worked and long term unemployed