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Intelligence in childhood and risk of psychological distress in adulthood: The 1958 National Child Development Survey and the 1970 British Cohort Study

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ABSTRACT

Lower cognitive ability is a risk factor for some forms of severe psychiatric disorder, but it is unclear whether it influences risk of psychological distress due to anxiety or the milder forms of depression. The participants in the present study were members of two British birth national birth cohorts, the 1958 National Child Development Survey ($n = 6369$) and the 1970 British Cohort Study ($n = 6074$). We examined the association between general cognitive ability (intelligence) measured at age 10 (1970 cohort) and 11 years (1958 cohort) and high levels of psychological distress at age 30 (1970 cohort) or 33 years (1958 cohort), defined as a score of 7 or more on the Malaise Inventory. In both cohorts, participants with higher intelligence in childhood had a reduced risk of psychological distress. In sex-adjusted analyses, a standard deviation (15 points) increase in IQ score was associated with a 39% reduction in psychological distress in the 1958 cohort and a 23% reduction in the 1970 cohort [odds ratios (95% confidence intervals) were 0.61 (0.56, 0.68) and 0.77 (0.72, 0.83), respectively]. These associations were only slightly attenuated by further adjustment for potential confounding factors in childhood, including birth weight, parental social class, material circumstances, parental death, separation or divorce, and behaviour problems, and for potential mediating factors in adulthood, educational attainment and current social class. Intelligence in childhood is a risk factor for psychological distress due to anxiety and the milder forms of depression in young adults. Understanding the mechanisms underlying this association may help inform methods of prevention.

1. Introduction

There is growing evidence that people of lower cognitive ability may be at higher risk of mental health problems. Lower scores on psychometric tests of intelligence in childhood or adolescence are associated with an increased likelihood of having contact with psychiatric services (Walker, McConville, Hunter, Deary, & Whalley, 2002) and of being admitted to hospital for psychiatric care (Batty, Mortensen, & Osler, 2005). These observations, coupled with findings linking lower intelligence in early life with higher risk of schizophrenia (David, Malmberg, Brandt, Allebeck, & Lewis, 1997; Gunnell, Harrison, Rasmussen, Fouskakis, & Tynelius, 2002; Osler, Lawlor, & Nordentoft, 2007; Zammit et al., 2004), psychotic depression (Zammit et al., 2004), and other non-affective psychoses (Zammit et al., 2004), provide strong indications that cognitive ability is a risk factor for severe forms of psychiatric disorder requiring specialist care.

Symptoms of psychological distress due to mild depression and/or anxiety are common in general population samples (Singleton, Bumpstead, O'Brien, Lee, & Meltzer, 2001; Kessler & Wang, 2008). In the UK, for example, a recent national survey of psychiatric morbidity carried out among individuals living in private households found that 29% of the sample reported sleep problems, 19% said they were worried, 11% depressed, and 9% had somatic complaints (Singleton et al., 2001). Whether intelligence is a risk factor for such milder forms of psychological

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distress is uncertain. Most relevant studies have examined anxiety and depression as separate outcomes. In a follow-up of the National Collaborative Perinatal Project when participants were in their mid-thirties, a standard deviation increase in IQ at age seven was associated with a 50% reduction in lifetime risk of generalized anxiety disorder (Martin et al., 2007). In the Christchurch Health and Development Study, higher childhood IQ was linked with a lower risk of anxiety disorders overall (generalized anxiety disorder, phobias and panic disorder) in adolescence or early adulthood, but the relation was severely attenuated after adjustment for family instability and socio-economic disadvantage in childhood (Fergusson, Horwood, & Ridder, 2005). No association was found in this study between childhood intelligence and risk of major depression (Fergusson et al., 2005), though in the National Survey of Health and Development, also known as the 1946 birth cohort, higher cognitive ability in childhood—based on a latent trait derived from scores on tests of verbal and non-verbal ability and educational test scores—was associated with lower risk of affective disorder at interview at ages 36 and 43 (van Os, Jones, Lewis, Wadsworth, & Murray, 1997). Although not entirely consistent, these findings suggest that risk of both anxiety and depression may be increased in people of lower intelligence. Further evidence of this comes from a follow-up study of male US veterans where for a SD decrease in intelligence in early adulthood, risk of having major depression or generalized anxiety disorder in mid life was increased by 32% and 43% respectively (Gale et al., 2008).

Only one study has so far examined the relation between intelligence in childhood and scores on a measure assessing symptoms of both anxiety and non-psychotic depression: in a follow-up survey of the National Survey of Health and Development, women who had scored lower on a measure of general cognitive ability in childhood were more likely to get higher scores on the General Health Questionnaire at age 53, but no such association was seen in men (Hatch et al., 2007).

We used data from two other, nationally representative but substantially larger British birth cohorts—the 1958 National Child Development Survey and the 1970 British Cohort Study—to investigate the relation between intelligence in childhood and risk of psychological distress, as defined by high scores on the Malaise Inventory, a measure of symptoms of anxiety and depression (Rutter, Tizard, & Whitmore, 1970; Rodgers, Pickles, Power, Collishaw, & Maughan, 1999). The serial data collection on cohort members since birth enables us to examine the role of several other risk factors in early life that could potentially confound any association between childhood intelligence and subsequent psychological distress, including fetal growth (Gale & Martyn, 2004; Colman, Ploubidis, Wadsworth, Jones, & Croudace, 2007), socioeconomic circumstances (Schoon, Sacker, & Bartley, 2003) behavioural adjustment (Clark, Rodgers, Caldwell, Power, & Stansfeld, 2007) and family disruption (Sigle-Rushton, Hobcraft, & Kiernan, 2005). The use of two cohorts who were assessed for cognitive ability and psychological distress at similar ages allows us to test the consistency of the relation between these factors.

2. Methods

The National Child Development Study (1958 cohort) and the 1970 British Cohort Study (1970 cohort) each comprise over 17,000 live births in Great Britain between the 3rd and 9th March 1958 and the 5th and 11th April 1970, respectively (Elliott & Shepherd, 2006; Power & Elliott, 2006). Data on birth weight was obtained from midwives or extracted from medical records. The cohorts have subsequently been followed-up at regular intervals. For follow-ups in childhood, both cohorts were augmented with immigrants to Britain born in the target weeks.

2.1. Cognitive ability in childhood

Cognitive ability of the 1958 cohort was assessed at school when the children were aged 11 years using a general ability test, devised by the National Foundation for Educational Research in England and Wales (Douglas, 1964). The test consisted of 40 verbal and 40 non-verbal items and was administered by teachers. Scores from this test correlate strongly with scores on a test of verbal ability used to select 11-year-old children for secondary school ($r = 0.93$) suggesting a high degree of validity (Douglas, 1964). Mental ability of the 1970 cohort was assessed at school when the children were aged 10 years using a modified version of the British Ability Scales (Elliott, Murray, & Pearson, 1978). These scales consisted of four tests: word definitions and word similarities which were used to measure verbal ability, and recall of digits and matrices which were used to measure non-verbal ability.

We carried out a principal components analysis (PCA) of the positively correlated scores from the four tests used in the 1970 cohort in order to test for the presence of a general cognitive ability factor (Carroll, 1993). Examination of the scree slope suggested the presence of a dominant component. The first unrotated factor accounted for 56% of the total variance among the four tests. The loading of each of the tests on the first unrotated factor was 0.46 for matrices, 0.40 for digit recall, 0.79 for word definitions and 0.79 for word similarities. We saved scores for each participant based on the first unrotated factor from the factor analysis.

For ease of interpretation when comparing cognitive ability scores according to other characteristics we transformed scores into IQ equivalents, giving the scores in each cohort a mean of 100 and standard deviation (SD) of 15.

2.2. Psychological distress in adulthood

Rutter's Malaise Inventory was used to assess symptoms of anxiety and depression when the 1958 cohort were aged 33 and when the 1970 cohort were aged 30 (Rutter et al., 1970). This inventory is a 24-item self-completion scale developed from the psychiatric subscales of the Cornell Medical Index and designed for use in research where resources do not permit the use of detailed diagnostic interview. The items cover emotional disturbance and associated somatic symptoms. For example, 'Do you often feel depressed?' 'Do you feel tired most of the time?' 'Are you easily upset or irritated?' 'Do you often have bad headaches?' Each item requires a 'yes' or 'no' response, and each 'yes' response is given a score of one. Most evaluations of the psychometric properties of the Malaise Inventory support the notion that it represents a single underlying factor of distress (Hirst, 1983; Hirst & Bradshaw, 1983; McGee, Williams, & Silva, 1986), although one study suggested that there were two separate psychological and somatic dimensions (Grant, Nolan, & Ellis, 1990). When we subjected all 24 items of the Inventory

to principal components analysis, examination of the scree slope suggested the presence of a single factor in each cohort. The Cronbach alpha for the 24 items in these data was 0.80 in the 33-year-old 1958 cohort and 0.90 in the 30-year-old 1970 cohort. The distribution of scores in each cohort was strongly negatively skewed and unsuitable for analysis as a continuous variable. A score of 7 or more on the Malaise Inventory has been shown to identify cases of clinically diagnosed depression with 73% sensitivity and 81% specificity (Rodgers et al., 1999). We therefore used this cut-point to indicate the presence of psychological distress.

2.3. Behaviour problems in childhood

Information on behaviour problems at age 10 (1970 cohort) and age 11 (1958 cohort) was collected from mothers using the Rutter Parental 'A' Scale of Behaviour Disorder (Rutter et al., 1970). This consists of 19 items. Response options to these items differed in the two studies. For the follow-up of the 1958 cohort, mothers were given three response options for each item 'No, never', 'Yes, sometimes, or 'Yes, frequently', which were scored 0, 1, 2, respectively. For the follow-up of the 1970 cohort, mothers indicated their level of agreement by bisecting a line, which was coded into a 100-point scale ranging from 'Does not apply' to 'Certainly applies'.

We subjected the mothers' responses to these 19 items to PCA. In the data from the 1958 cohort, the scree slope suggested the presence of two factors after oblique rotation (direct oblimin), which accounted for 29.3% of the total variance. High loading items (>0.50) were retained and the two extracted factors were labelled 'Anti-social behaviour' and 'Anxiety'. Cronbach alpha for these were 0.64 and 0.54 respectively. Factor composite scores were computed by regression. The correlation between these two factors was 0.20. In the data for the 1970 cohort—where, as described above, responses were measured on a much wider scale—the scree slope suggested the presence of three factors after oblique rotation (direct oblimin), which accounted for 40.8% of the total variance. High loading items (>0.50) were retained and the three extracted factors were labelled 'Anti-social behaviour', 'Anxiety' and 'Attention problems'. Cronbach alpha for these were 0.78, 0.62 and 0.70 respectively. Factor composite scores were computed by regression. Correlation coefficients between these factor scores were: $r = 0.21$ (Attention problems and Anxiety), $r = 0.29$ (Anxiety and Anti-social behaviour), and $r = 0.39$ (Anti-social behaviour and Attention problems).

2.4. Material circumstances in childhood

Information on housing tenure, household crowding (number of persons per room), receipt of state benefits, and whether the household shared basic amenities (use of bathroom, (separate) lavatory or hot water supply) was collected during interview with the parents. We used these data to calculate a score for level of material disadvantage in childhood (Schoon et al., 2003), giving one point for the presence of each of the following: the family did not own their home, the household was over-crowded (one or more person per room), the household had no access or had to share access to one or more of three basic amenities (hot water, use of a bathroom, and lavatory), or they had received state benefits because of financial need in the last year (child benefit and retirement pensions were excluded). Scores ranged from 0 to 4, with a higher score indicating greater material disadvantage.

2.5. Social class in childhood

Data on parental occupation were collected when the 1958 cohort were aged 11 years and the 1970 cohort were aged 10 years. Parental social class was based on father's current or most recent occupation, or mother's occupation if no father was present and information on mother's occupation was available, and categorized according to the Registrar General's classification (Office of Population Censuses and Surveys, 1980). A six-point scale was used: 1 professional, 2 managerial/technical, 3 skilled non-manual, 4 skilled manual, 5 semi-skilled and 6 unskilled. For ease of interpretation the scores were reversed, so that a high score represents the highest level of skill and prestige.

2.6. Family disruption during childhood

Information about the occurrence of parental divorce, separation or death was collected during interviews with parents or guardians. We used these data to construct a binary variable indicating whether or not the participants had experienced such an event by the time of the cognitive ability testing.

2.7. Current social class and educational attainment

Data on occupation and academic or vocational qualifications were collected for each cohort at the time they completed the Malaise Inventory. Social class was based on current or most recent occupation and categorized according to the Registrar General's classification (Office of Population Censuses and Surveys, 1990) using a six-point scale as described above for parental social class. As before, the scores were reversed for ease of interpretation, so that a high score represents the highest level of skill and prestige. Academic and vocational qualifications (National Vocational Qualifications (NVQ) or equivalent) were grouped into six categories reflecting increasing attainment: no qualifications, CSE/NVQ level 1 and equivalent, O-levels/NVQ level 2 and equivalent, A-levels/NVQ level 3 and equivalent, degree or diploma/NVQ level 4 and equivalent, and higher degree/NVQ level 5.

2.8. Analytical samples

In total, 15,606 members of the 1958 cohort were believed eligible to take part in the follow-up survey when they were aged 33 years (members who had died, emigrated or refused further follow-up were excluded from the target sample). Of 11,413 people interviewed during the follow-up, 6369 (56%) had complete data on intelligence at age 11, Malaise score at age 33 and the covariates described above. Of 15,823 members of the 1970 cohort believed eligible to take part in the follow-up survey when they were aged 30 years, 11,261 were interviewed, of whom 6074 (54%) had complete data on intelligence at age 10, Malaise score at age 33 and the covariates. In both cohorts, those excluded from analysis in the present study due to incomplete data had a slightly lower mean IQ score in the childhood tests of cognitive ability: mean

(SD) IQ score in the participants compared to the non-participants was 102.8 (14.2) *vs* 98.0 (15.3) in the 1958 cohort and 101.8 (14.5) *vs* 98.0 (15.3) in the 1970 cohort (both $p<0.001$).

2.9. Statistical analysis

We used correlation coefficients to examine the relation between IQ scores and characteristics of the participants. Spearman correlations were used instead of Pearson correlations for characteristics that were categorical or had a skewed distribution. Point bi-serial correlations were used for binary variables. We defined the presence of high levels of psychological distress as a score of 7 or over on the Malaise Inventory (Rodgers et al., 1999). We used binary logistic regression to examine risk of psychological distress per unit change in each of the covariates. In these analyses, birth weight and behaviour problem scores are expressed as standard deviation (SD) scores. We then used binary logistic regression to examine risk of psychological distress per SD increase in childhood IQ score, with separate adjustment for each of the covariates. Risk is expressed in terms of odds ratios. An odds ratio greater than 1.0 indicates that the predictor variable is associated with an increase in the rate at which the outcome occurs, whereas an odds ratio below this value is evidence of a decrease. For example, an odds ratio of 1.30 means that there is a 30% increase in the prevalence of the outcome per unit of measurement in the predictor; and an odds ratio of 0.70 means that there is a 30% decrease in the prevalence per unit of measurement in the predictor. If the 95% confidence intervals do not span 1.0 (unity) then the relationship is statistically significant at the conventional level ($p<.05$). Results are shown for each cohort separately.

3. Results

The prevalence of psychological distress, as defined by a score of 7 or more on the Malaise Inventory, was markedly higher in the 1970 cohort at age 30 than in the 1958 cohort at age 33: 15.9% *vs* 8.1%. This difference between the cohorts was evident in both women and men.

Table 1 shows the correlations between childhood IQ scores in the two cohorts according to characteristics in early life and adulthood, and the unadjusted odds ratios for psychological distress at age 30 (1970 cohort) or age 33 (1958 cohort) according to these characteristics. Higher IQ scores in childhood were associated with lower total scores on the Malaise Inventory in both cohorts: the correlation coefficients were −0.18 in the 1958 cohort and −0.11 in the 1970 cohort. In both cohorts, IQ scores were lower in participants who had weighed less at birth, in those whose parents were employed in manual, less skilled occupations, in those who experienced greater material disadvantage in childhood, in those with higher scores for behaviour problems in childhood and in those who had experienced family disruption in the form of parental divorce, separation or death by the time their cognitive ability was assessed. Childhood IQ scores were lower in participants who were currently employed in manual, less skilled occupations, and in those with poorer educational attainment. Although the relation between IQ and score for each type of childhood behaviour problem (anti-social behaviour, anxiety and attention difficulties) was statistically significant, IQ was more strongly associated with scores for anti-social behaviour and attention difficulties than it was with anxiety in childhood, though it is likely that these associations are underestimates owing to the non-perfect reliability of the variables being correlated. In general, the magnitude of the associations between childhood IQ and all these characteristics was similar in the two cohorts, though IQ was more strongly associated with psychological distress in the 1958 cohort than in the 1970 cohort (p for interaction term <0.001).

In both cohorts, risk of psychological distress was greater in women, in participants from more disadvantaged backgrounds in childhood—as indicated by parental social class or material circumstances—in those with higher scores for

Table 1
Correlations in the two cohorts between IQ score at age 10 or 11 years and childhood or adult characteristics, and odds ratios (95% CI) for psychological distress at age 30 or 33 according to those characteristics (1958 cohort, $n=6369$, 1970 cohort, $n=6074$).

Characteristics	Correlation with IQ [a]		Odds ratio (95% CI) for psychological distress per unit change in characteristic	
	1958 cohort	1970 cohort	1958 cohort	1970 cohort
			No. (%) of cases = 516 (8.1)	No. (%) of cases = 968 (15.9)
Malaise Inventory score	−0.18	−0.11	–	–
Potential confounding or mediating variables				
Sex	0.07	−0.04 [b]	2.14 (1.77, 2.60)	1.53 (1.33, 1.77)
Birthweight, SD score	0.11	0.12	0.92 (0.84, 1.01)	0.90 (0.84, 0.96)
Parental social class [c]	0.25	0.29	0.89 (0.85, 0.93)	0.85 (0.81, 0.90)
Material disadvantage in childhood	−0.28	−0.27	1.30 (1.21, 1.42)	1.25 (1.17, 1.38)
Anti-social behaviour, SD score	−0.19	−0.19	1.30 (1.19, 1.42)	1.18 (1.11, 1.26)
Anxiety, SD score	−0.02 [d]	−0.03 [d]	1.24 (1.14, 1.36)	1.25 (1.17, 1.34)
Attention difficulties, SD score	–	−0.15	–	1.15 (1.08, 1.23)
Parental divorce or death	−0.05	−0.07	1.75 (1.19, 2.59)	1.40 (1.15, 1.71)
Educational attainment	0.50	0.42	0.73 (0.69, 0.77)	0.82 (0.77, 0.86)
Current social class [c]	0.30	0.36	0.83 (0.78, 0.90)	0.83 (0.78, 0.88)

[a] All correlations are statistically significant at $p<0.001$ unless otherwise indicated.
[b] $p<0.01$.
[c] Parental and current social classes are coded on a 6-point scale such that higher scores indicate more professional and skilled occupations.
[d] $p\leq 0.05$.

Table 2
Odds ratios (95% CI) for psychological distress in the 1958 cohort at age 33 and in the 1970 cohort at age 30 for a standard deviation increase in childhood IQ, adjusted for sex and with further separate adjustment for other covariates[a] (1958 cohort, $n = 6369$, 1970 cohort, $n = 6074$).

Adjustments	Odds ratios (95% CI)	
	1958 cohort	1970 cohort
	No. (%) of cases = 516 (8.1)	No. (%) of cases = 968 (15.9)
Sex	0.61 (0.56, 0.68)	0.77 (0.72, 0.83)
Sex plus each of the following adjustments		
Birthweight	0.60 (0.55, 0.67)	0.78 (0.72, 0.83)
Parental social class	0.63 (0.57, 0.69)	0.80 (0.74, 0.86)
Material disadvantage in childhood	0.65 (0.59, 0.72)	0.81 (0.75, 0.87)
Anti-social behaviour in childhood	0.65 (0.59, 0.71)	0.79 (0.73, 0.85)
Anxiety in childhood	0.62 (0.56, 0.68)	0.78 (0.73, 0.84)
Attention difficulties in childhood	–	0.79 (0.73, 0.85)
Parental divorce or death	0.62 (0.56, 0.68)	0.77 (0.72, 0.83)
Current social class	0.65 (0.59, 0.72)	0.82 (0.76, 0.88)
Educational attainment	0.73 (0.66, 0.82)	0.84 (0.77, 0.91)

[a] Other covariates include birthweight, parental social class, material disadvantage in childhood, anti-social behaviour in childhood, anxiety in childhood, attention difficulties in childhood, parental divorce or death, current social class and educational attainment.

behaviour problems in childhood, in those who had experienced parental divorce, separation or death in childhood, and in those who had lower levels of educational attainment (Table 1). In both cohorts, risk of psychological distress was increased in men and women who were in a lower social class currently. Participants who had been heavier at birth tended to have a slightly lower risk of psychological distress, but this association was statistically significant in the 1970 cohort only. Poorer educational attainment and being female were more strongly predictive of distress in the older cohort (p for interaction terms <0.001 and 0.009 respectively.

Table 2 shows the odds ratios for psychological distress for a SD increase in childhood IQ. There was no evidence that these associations differed significantly between the sexes, so risk estimates are shown in men and women together, adjusted for sex and then with additional adjustment for each covariate separately. For a SD increase in childhood IQ, the sex-adjusted odds ratios (95% CI) for psychological distress was 0.61 (0.56, 0.68) in the 1958 cohort and 0.77 (0.72, 0.83) in the 1970 cohort. Further separate adjustment for potential confounding factors in early life, namely birth weight, parental social class, material disadvantage, behaviour problems, and family disruption by divorce, separation or death had little attenuating effect on these associations in either cohort. Adjustment for current social class, a possible mediating factor, diminished the association between childhood IQ and psychological distress only slightly in the 1958 cohort, and by not much more in the 1970 cohort. Of all the characteristics examined, educational attainment was most strongly correlated with childhood IQ. Adjustment for this potentially mediating factor had the largest effect, reducing the sex-adjusted odds ratio by 31% in the 1958 cohort and by 30% in the 1970 cohort, but in both cohorts higher childhood intelligence remained associated with a reduced risk of psychological distress.

4. Discussion

In this study of two national birth cohorts born 12 years apart and followed-up in adulthood at around the same age, higher intelligence in childhood was associated with a markedly reduced risk of psychological distress—particularly in the 1958 cohort—that was little attenuated by adjustment for sex and a range of potential confounding and mediating factors.

Previous studies have shown that children with lower intelligence tend to have more evidence of behaviour problems, perhaps particularly those involving conduct problems and attention deficits (Fergusson & Horwood, 1995; Rapport, Scanlan, & Denney, 1999), and that such problems are associated with increased risk of psychiatric disorder in adults (van Os et al., 1997; Caspi, Moffitt, Newman, & Silva, 1996; Moffitt et al., 2007). In both the cohorts studied here, participants with a lower IQ at age 10 or 11 had more evidence of anti-social behaviour and attention problems at that age. There was only a weak association between IQ and anxiety in childhood, but it is likely that the correlations between IQ and all childhood behaviour problems are underestimates because of the imperfect reliability of these variables. Higher scores for any of these problems in childhood were associated with increased later risk of psychological distress, but the fact that adjustment for these had only a little effect suggests that the relation between childhood IQ and psychological distress in adulthood in these data was not concentrated among those participants who had emotional or behavioural problems at the time IQ was assessed.

The prevalence of psychological distress was almost twice as high in the 1970 cohort than in the 1958 cohort. Comparison with other studies is complicated by differences in measures of assessment, but these observations are consistent with findings in the US showing a doubling of depression over the period between the follow-ups of these two cohorts in 1991 and 2000 (Compton, Conway, Stinson, & Grant, 2006), although they fit less closely with UK survey data where the rise in rates of depression or anxiety disorders between 1993 and 2000 among young adults were much less marked (Singleton et al., 2001). Whether the increased prevalence in psychological distress observed in this study reflects a genuine increase in depression or anxiety over time, or merely a greater willingness by the younger cohort to admit such symptoms is uncertain. In an analysis attempting to separate out the influence of age, period and cohort on the prevalence of psychological distress in these two cohorts between the years

1981 and 2000, there was little indication of a period effect, but there was evidence of a significant cohort influence (Sacker & Wiggins, 2002).

The observation that childhood IQ was more strongly predictive of psychological distress in the 1958 cohort than in the 1970 cohort was unexpected. This might reflect differences in the tests used to assess general cognitive ability in childhood. Alternatively, it is possible that as symptoms of psychological distress appear to have become more common over time—or perhaps more readily admitted to—lower intelligence has become a slightly less powerful indicator of risk. There were indications that poorer educational attainment and being female were also less strongly associated with psychological distress in the younger cohort.

The mechanisms that underlie the link between intelligence and risk of subsequent psychological distress are unclear. One potential explanation is that lower intelligence is acting as a marker of impaired neurodevelopment that itself affects the propensity to symptoms of anxiety and depression (Zammit et al., 2004; Batty et al., 2005). Low birth weight is associated with lower intelligence (Shenkin, Starr, & Deary, 2004), and there is some evidence from longitudinal studies to link it with an increased risk of depression and anxiety (Gale et al., 2004; Colman et al., 2007; Alati et al., 2007), although this is not a consistent finding (Inskip, Dunn, Godfrey, Cooper, & Kendrick, 2008; Osler, Nordentoft, & Andersen, 2005), possibly because birthweight provides a poor summary marker of neurodevelopment during fetal life. Birth weight was only weakly associated with risk of psychological distress in the present study, and adjusting for it had no attenuating effect on the association we found between childhood IQ and later distress.

Another potential explanation for this association might be that individuals with a higher IQ in childhood are less likely to experience socioeconomic disadvantage and its concomitant stresses as adults. Socio-economic disadvantage in adulthood is associated with a high risk of experiencing depression or anxiety (Lorant et al., 2003; Muntaner, Eaton, Miech, & O'Campo, 2004). Because of the difficulty of interpreting the direction of cause and effect in cross-sectional data, we did not adjust for factors such as current financial hardship or unemployment that were assessed at the time participants completed the Malaise Inventory. We did adjust for current social class—although this too might be inappropriate for the same reasons—but control for this had only a very small attenuating effect on the IQ/psychological distress association in either cohort, reducing the sex-adjusted odds ratio by 4% in the 1958 cohort and 22% in the 1970 cohort.

From the perspective of evolutionary psychology, symptoms of anxiety and depression may originally have been adaptive in that they prepared individuals to deal with threatening situations, and thereby increased their chances of surviving and reproducing successfully. Having a large brain or greater intelligence was also adaptive because it enabled individuals to respond flexibly to challenges and to learn from their experiences (Kaplan & Gangestad, 2005). However, being anxious or depressed uses up time and energy which might be put to better use. Perhaps the association between greater propensity to psychological distress and lower intelligence evolved because individuals of higher intelligence found more effective ways of dealing with threats. Thus, it may be that individuals with greater cognitive resources are better able to find a cognitive 'way out' of potentially stressful stimuli or events and this obviates the emotional response, because the stressor has been 'solved'. This, coupled with a tendency to have a more internal locus of control (Gale, Batty, & Deary, 2008), may help to explain why children and adolescents of higher intelligence tend to be more resilient to stress (Masten et al., 1995; Fergusson & Lynskey, 1996), and why higher intelligence is associated with a lower risk of developing post-traumatic stress disorder (Breslau, Lucia, & Alvarado, 2006; Koenen, Moffitt, Poulton, Martin, & Caspi, 2007; Kremen et al., 2007; Gale et al., 2008). Gottesman, in his diathesis-stress model of schizophrenia, suggested that higher intelligence may be protective in those genetically predisposed to the disease, lessening the likelihood of psychotic symptoms (Gottesman, 1991). Greater ability to deal with stressors may underlie the link between higher intelligence and lower risk of psychological distress.

It is also possible that the link between intelligence and psychological distress is genetically mediated. In a study of pre-morbid intelligence and risk of PTSD in twins, the variance in PTSD explained by intelligence was accounted for entirely by common genetic factors (Kremen et al., 2007). Twin studies suggest that common genetic liability explains a large part of the comorbidity between anxiety and depression (Middeldorp, Cath, Van, & Boomsma, 2005; Hettema, 2008).

The strengths of this study include its size, the use of data from two cohorts thus enabling us to test the consistency of the relation between intelligence and subsequent risk of psychological distress, and the detailed data on the participants' early life that allowed us to explore the influence of a range of potentially confounding factors. There are also some limitations. Firstly, our study is restricted to participants in the adult follow-up surveys who had complete data on these early life variables—this represented 56% in the case of the 1958 cohort and 54% in the case of the 1970 cohort. There was evidence that childhood IQ scores were slightly lower among those cohort members who were excluded from our study because of missing data. Secondly, psychological distress was assessed solely by a self-completion scale, the Malaise Inventory. However, this scale has been widely used in general population samples and its effectiveness at identifying psychiatric morbidity has been demonstrated (Rodgers et al., 1999).

The results of this study in two national birth cohorts suggest that lower cognitive ability in childhood is a risk factor for psychological distress due to depression and anxiety in young adults. Understanding the mechanisms underlying this association may help inform methods for reducing the impact of these conditions in the population. Our findings add to the evidence on the importance of intelligence as a predictor of later health (Lubinski & Humphreys, 1997; Gottfredson, 2004).

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