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Predictors of academic attainments of young people with Down's syndrome

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Abstract

Background Earlier studies of young people with Down's syndrome have investigated a relatively limited range of variables which may influence their academic attainment. The relative strength of such influences and how they may vary during the school career, has also been under-researched.

Aims The aim of the paper is to identify the contemporary and antecedent predictors of the level of academic attainment achieved by a representative sample of young people with Down's syndrome.

Sample The paper reports data from three studies of 71 young people with Down's syndrome and their families. Mean IQ at the time of the first study (t1) was 40.4. Mean chronological age was 9 years at t1, 14 at t2, and 21 at t3, when all the young people had left school.

Methods The outcome measure was the 58-item Academic Attainments Index (AAI), comprising three sub-scales covering reading, writing and numeracy. Predictors of the outcome were derived from questionnaires and interviews from tutors, mothers and fathers. A path analysis approach was used to investigate the pattern of predictors of the outcome over the three studies.

Results Factors predicting greater progress in this measure between t2 and t3 were lower chronologi-

cal age and attendance at mainstream school. Progress from t1 to t2 was also associated with attendance at mainstream school, as well as with higher t1 mental age, mother's practical coping style and higher child attentiveness. Background factors predicting higher t1 AAI scores were higher mental age, attendance at mainstream school and father's internal locus of control. The path analysis model predicted 48% of the variance in t3 outcome scores. Severity of intellectual impairment was by far the most significant predictor.

Conclusion Limitations to the study include evidence of attrition bias towards more able children, and the need to obtain the t3 outcome measure from tutors for some young people and parents for others. Parents may have over-estimated abilities. Results are broadly in agreement with other studies, and confirm the pattern reported earlier with this group. Mainstream school attendance had a modest beneficial effect on AAI scores throughout the school career of the children, independently of level of intellectual disability. Identification of predictors of attainment levels and of improvement over time may help parents, teachers and other professionals involved with families of children and young people with Down's syndrome optimise the attainment of such skills.

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Keywords Down's syndrome, education, families, longitudinal analysis

Lay summary

Schooling for children with Down's syndrome has changed dramatically in the last 20 years. But there continues to be much debate over which is better for most children with Down's syndrome – mainstream or special education. Our study took a wide view of what factors may help children achieve their full potential in reading, writing and number work. Type of school attended was one obvious factor, but we also looked at family factors and child characteristics, including severity of learning disability.

The 71 families involved represent a good cross-section of child disability levels and family situations. Only a minority of the children in these families went to mainstream schools, and some of these later moved to special school for secondary education. By looking at their progress at three different ages – roughly 9, 14 and 21 – we were able to identify what factors helped – or hindered – the children's academic progress at each stage.

When the children were younger (age 9), progress was strongly determined by severity of learning disability – as expected. But we also found that children tended to do better if their fathers felt they had some control over things affecting their lives – irrespective of the severity of learning disability. Mainstream schooling was also helpful.

At age 14, though level of learning disability was still the most important predictor of progress, we also found children whose mothers took a practical approach to problem solving did better. The child's ability to sustain attention in class was also helpful, as was mainstream schooling. By age 21 (having left school), we found that those who had some mainstream education showed greater progress, as did the younger members of the group.

We hope that awareness of the long-term but modest beneficial effect of mainstream schooling and of the other factors that we identified as encouraging academic progress will assist parents, teachers and others to help children with Down's syndrome achieve their potential.

Background

In the last 20 years educational policies in England relating to children with intellectual disabilities (IDs) have undergone considerable change. The

1981 and 1996 Education Acts, the Special Education Needs (SEN) and Disability Act 2001, and the Education and Inspections Act 2006, strengthened the right of children with special educational needs to be educated in mainstream schools, taking into account parental wishes, the suitability for the child's educational needs, and any possible impact on the education of other children and the efficient use of resources. A recent embodiment of this policy in England is the *Every Child Matters: Change for Children* programme (DfES, 2004) which aims to place a new emphasis on integrating services around children and young people, early identification and effective support for SEN children with additional needs, and participation by children and young people themselves. However, inclusion remains a matter of heated debate in the UK among parents, politicians and educationalists. One of its most distinguished proponents, Dame Mary Warnock, has revised her earlier position on inclusion in mainstream schooling because of the unacceptable experiences of some pupils with SEN due to bullying by other pupils, and suggested the policy needed a rethink (The Observer, 14 May 2006).

The policy of greater inclusion through mainstreaming was based on growing research evidence of the advantages of integration. An early study by Casey *et al.* (1988) of 36 4–10-year-old children with Down's syndrome reported that numeracy scores were significantly higher in mainstream schools compared with special schools, and that there was a non-significant trend to more of the mainstream children being classed as readers. Laws *et al.* (2000) compared 22 children with Down's syndrome in mainstream schooling with 22 in special schools, and found a higher proportion of readers in mainstream schools. Bochner *et al.* (2001), in a study of 30 18–26 year olds with Down's syndrome living in New South Wales, also reported that those who had attended an integrated school setting had higher reading scores. More recently, Buckley *et al.* (2006) found large gains in expressive language and literacy skills for 18 teenagers with Down's syndrome educated in mainstream classroom compared with 28 educated in special schools.

Longitudinal studies of cohorts of children with IDs have indicated some of the other factors which

may influence achievement in school (Buckley & Sachs 1987; Shepperdson 1994; Beadle-Brown *et al.* 2000, 2006; Carr 2000). In the UK, Shepperdson (1994) and Carr (2000) found evidence that girls achieved higher levels of academic attainment than boys. Rynders *et al.* (1997), in a US study of 171 individuals in the age range of 5 to 18 plus, report that girls were better at reading but not maths or spelling. However, some studies have covered a limited range of academic abilities (Nye *et al.* 1995; Buckley *et al.* 1996) and failed to use measures appropriate to the wide range of abilities found among children with Down's syndrome (Sloper & Turner 1994). Others relate to relatively small numbers, limiting the level of analysis possible and the generalisability of findings.

Three longitudinal studies report on the pattern of progress in the abilities of young people with Down's syndrome up to adulthood. Shepperdson (1994) found that teenagers with higher scores in reading and numeracy tended to show above-average improvement in scores up to adulthood. Carr (2000) tested score changes on language, reading and number tests for 41 young adults with Down's syndrome between the ages of 21 and 30, but did not confirm Shepperdson's results. Turner & Alborz (2003) report continued progress among lower scorers on tests of reading, writing and numeracy up to and beyond school-leaving. However, none of these studies report factors which predict progress into adulthood.

This paper investigates factors which predict academic abilities throughout and beyond the school career, building on earlier work with the same group of families. Sloper *et al.* (1990) examined factors relating to the academic attainments of 117 children with Down's syndrome of primary school age, using a teacher-completed checklist of reading, writing and numeracy skills. These authors report higher mental age, mainstream schooling, female gender, higher chronological age and fathers' scores on a measure of locus of control (internal rather than external locus of control) predicted higher academic attainment scores in a multiple regression analysis. Sloper & Turner (1994) repeated the study with the same cohort of children ($n = 106$) at mean age 14, employing a path analysis approach to identify factors which predicted scores at both points in time and change over time. Predictors found to be

significant in the model were mental age, academic ability scores at mean age of 9, excitability scores, mainstream schooling and mothers' practical coping style.

Method

The hypotheses tested in this analysis, based on earlier studies with this cohort and a review of the literature (Sloper & Turner 1994), are as follows:

- Progress in academic abilities will be strongly predicted by level of cognitive development assessed early in the child's school career.
 - Independently of level of disability, mainstream schooling will be associated with higher attainment.
 - Lack of socio-economic resources will be predictive of poorer outcome.
 - Child health and aspects of child and parental personality will impact on academic attainments.
- These hypotheses are tested by constructing a path analysis model to examine the extent to which academic attainment post-school is explained by relevant predictors.

Participants

The paper is based on data from three studies with the Manchester Down's Syndrome Cohort (Sloper *et al.* 1988; Sloper & Turner 1994; Turner & Alborz 2000, 2003). The original Cohort of 181 families of children with Down's syndrome born between 1973 and 1980 represented approximately 90% of all such births in the Greater Manchester area over this period (Cunningham 1986). Attrition of the sample by deaths, moves, non-contacts and refusals resulted in numbers in the studies falling from 123 in the 1986 study, to 106 in the 1991 study, and to 90 in 2000. The abilities of the young people range from moderate to profound levels of ID, and their families represent a broad and representative range of demographic and socio-economic characteristics (Sloper *et al.* 1990).

Seventy-four young people had valid academic ability scores at all three points in time (originally 117 in 1986). When assessed at time 1 (t1) (mean age 9), 19% (14) of these 74 had IQ scores between 50 and 70, indicating moderate ID; 78% (57) had scores over 20 up to 50, corresponding to severe

ID, and 3% (2) had IQ scores of 20 or below, corresponding to profound ID. These last two children were excluded from the analysis on the grounds that their AAI scores remained below 4 throughout the period of study, and their inclusion tended to distort relationships predicting level and progress in academic attainments in the majority of the young people. One other child's IQ score was not measured and was also excluded, leaving 71 young people in the present study, with IDs ranging from moderate to severe.

Of these 71, 41 (58%) were male and 30 (42%) female. Their mean chronological age was 9 years 2 months (SD 20.0 months) at t1, 13 years, 8 months (SD 19.6 months) at t2, and 21 years 0 months (SD 15.5 months) at t3. The youngest at t3 was aged 19 years 1 month, and the oldest 26 years 3 months.

At t2, the 71 young people were attending 42 different schools across Greater Manchester in the North West of England. The increasing placement of children with ID in mainstream schooling in the 1990s (Cuckle 1997) came too late to affect the majority of the children in the current study, who completed their secondary education between 1996 and 2000. At t3, 62% (44) had ended their secondary education at a Severe Learning Difficulties (SLD) school, 23% (16) at a Moderate Learning Difficulties (MLD) school and 17% (11) at a mainstream school. Thirteen per cent (9) attended mainstream schools throughout the period covered by the three studies, and 24% (17) had attended a mainstream school at one or more of the data points. The proportion in mainstream schooling is similar to the figure of 15% of 14 year olds reported by Cuckle (1997). Twenty-nine per cent (18) left school at age 16 or 17, 66% (41) at age 18 or 19 and 5% (3) at age 20 (missing: 9). Ninety per cent (56) went on to further education (missing: 9) and 81% (50) were still in further education at t3.

Measures

The Academic Attainments Index (AAI) was developed specifically for use with this sample (Sloper *et al.* 1990), and was based on the measure devised by Lorenz (Lorenz *et al.* 1985). It was developed in response to the lack of standardised measures reflecting the range of abilities that could

be expected in children with Down's syndrome. For example, only 17% of the Manchester Cohort children achieved a Spar Reading Test score (Sloper *et al.* 1990). The Index is a criterion-referenced 58-item assessment with three separate sub-scales (reading, writing and numeracy). Examples of scale items are 'reads and follows a line of instructions'; 'writes own name and address'; 'does simple division sums'. It was designed for completion by the teacher who could best assess the child's ability.

Lorenz *et al.* (1985), describing the development of the measure, argue that items reflect a graded sequence of skills, in that none of the 115 children tested passed a higher item while failing a lower. This provides strong support for the assumption that cumulative scores are an appropriate measure of skill level. Results from two small-scale studies which used the measure with schoolchildren with Down's syndrome established the reliability and validity of the measure (Philps 1993; Nye *et al.* 1995), and demonstrated that it may be particularly suitable in assessing children who do not perform well in test situations.

As some of the young people were not in tertiary education at t3, parents were asked to complete the checklist themselves if it was not possible to identify a tutor with relevant current knowledge of the young person's ability. 31 scores were derived from tutors' report; 35 from parents' report; and 5 from a combination of the two, where a particular sub-scale (reading, writing or numeracy) obtained from a tutor contained more than 10% of missing items. T3 AAI was measured at a mean of 3.0 years after school-leaving (SD 1.57 years).

In all three studies, respondents were asked to select one of three responses to each item: 'can do', 'can do with help', 'can't do', and were provided with instructions to guide their choice. In order that the measure more closely represented independent skills achieved by the start of adult life, only 'can do' responses were scored. The measure therefore has a possible range of 0–58. The t3 AAI score treated as the dependent variable in this analysis contained 43 different values and approximated to the normal distribution (skewness = 0.59, SE of skewness = 0.285). However, it cannot be assumed that the AAI is truly interval in nature, in that a 1-point change in the lower end of the scale is necessarily equivalent to a 1-point change at the upper.

Predictor measures

The mental age of the children was assessed at t1 using the McCarthy Test of Children's Abilities (McCarthy 1972) or the Bayley Scale of Infant Development (Bayley 1969). Attentiveness–Distractibility was measured through the Attention–Distraction and Inhibition–Excitation Classroom Assessment Scale (ADIECAS) teacher-completed checklist (Evans & Hogg 1984). The selection of parental measures was guided by the transactional model of family adaptation, which argues that outcomes may be influenced both by stressors and resources acting on and between family members. Parental locus of control was measured on the Brief Locus of Control Scale (Lumpkin 1983). Measures of practical coping and wishful thinking coping were extracted from a factor analysis of the Ways of Coping Questionnaire (Revised) (Folkman & Lazarus 1985; Vitaliano *et al.* 1987), and family cohesion from the relevant sub-scale of the Family Environment Scale (Moos & Moos 1981). Social support was covered by the Inventory of Parent Experiences (Crnic & Greenberg 1983) and the quality of the marital relationship in two parent families by the Measure of Marital Satisfaction (Kelso *et al.* 1984). Parental stress was measured by The Malaise Inventory (Rutter *et al.* 1970), and neuroticism by the Eysenck Personality Inventory (Eysenck & Eysenck 1964). All these measures were investigated for their psychometric properties and validity of use with families with a child with disability before the t1 study (Sloper *et al.* 1988), and were repeated in the two subsequent studies.

Reliability and validity of the Academic Attainments Index

The AAI reading, writing and number checklists were examined for appropriateness for use with an adult group. Both the reading (top item: 'reads books, magazines for pleasure' and writing (top item: 'writes using imagination, creative writing') checklists were felt to cover a level of proficiency adequate for most demands on members of society generally. The numeracy checklists ended with simple multiplication and division, and it was decided that higher skills should be covered. Five items were added, based on ability levels in the

British Ability Scales (i.e. more difficult multiplication and division, adding decimals, subtracting fractions, percentages) (Elliot 1983). In the event none of the young people were reported as being able to complete these new items unaided. The original 58-item maximum scale was therefore retained.

Internal consistency reliability for the three sub-scales across the three studies was high, varying between 0.91 and 0.98 (Cronbach Alpha coefficients), and there is no evidence that scores obtained from teachers, tutors or parents were less reliable in these terms. T3 AAI tutor scores correlated with t2 AAI teacher scores at $r = 0.84$, $P = 0.01$, $n = 36$; and t3 AAI parent scores correlated with t2 AAI teacher scores at $r = 0.74$, $P = 0.001$, $n = 73$ (no parent scores were obtained in earlier studies). The possibility of bias from use of parental report was investigated prior to main data collection by obtaining contemporaneous teacher and parent reports for those still at school at that time (see Turner & Alborz 2003, Appendix B). No evidence of bias was found. Such overall agreement between parents and tutors regarding skills was also reported by Beadle-Brown *et al.* (2000) in their study of children with severe ID.

However, in the event mean t3 AAI tutor scores were found to be lower than mean t3 parent scores (or tutor/parent combined): (mean AAI score, tutor report: 26.5, SD = 12.4, $n = 31$; mean AAI score, parental or parent/tutor combined report: 32.8 SD = 14.3, $n = 40$: $t = 1.92$, $P = 0.06$, d.f. = 69). This does not necessarily indicate bias. Lower scores from tutors may reflect lack of opportunity to assess these skills (missing values were more frequent among tutors' responses). As Pueschel & Hopmann (1993) point out, it is possible that people with Down's syndrome may exhibit setting-related variability in their communication skills. Further, to check whether parents' AAI scores reflected a positive bias in assessing their sons' and daughters' ability, a measure of socially desirability response bias was used. There was no relationship between t3 AAI scores derived from parents and their Marlowe-Crowne Social Desirability scale scores obtained contemporaneously ($r = 0.08$, $P = 0.63$, $n = 40$).

The longitudinal data were examined for evidence of the 'survivor effect' (where attrition tends to be higher among the less able) reported by Carr (2000) and Beadle-Brown *et al.* (2000). Mean t1

AAI scores for the 75 young people with t3 AAI scores (14.25, SD = 10.12) were higher than the mean t1 scores (10.12, SD = 9.21) for the 24 with no t3 AAI score, although the difference was not statistically significant ($t = 1.78$, $P = 0.08$, d.f. = 97). Further details of the measure's reliability and validity are given in Turner and Alborz (2003).

Method

Path analysis was used to investigate direct relationships between independent variables measured at t1 to t3, and the dependent variable – t3 AAI scores. Path analysis is an extension of multiple regression, resulting in the identification of potentially causal paths from predictor to dependent variable, both directly and through intermediary variables. It involves regression for each variable in the model as a dependant of others identified by the model as predictors. Regression weights may be compared with the observed correlation matrix for the variables (Davis 1985).

In order to identify which variables showed a significant relationship with t3 AAI scores controlled for t2 AAI scores, a series of bivariate analyses was conducted. Variables shown by this method to have a significant association with the outcome were then tested against each other in a further multiple regression analysis. This two-stage process was repeated for t2 controlled for t1 scores, and for t1 AAI scores controlled for t1 mental age. However, an exception was made to this procedure for mainstream educational experience, given the importance of this variable in the ongoing debate on educational provision for pupils with IDs. This variable was therefore entered in all three analyses.

A number of predictor variables are *exogenous* i.e. have no predictors in the mode – for example, demographic and socio-economic variables such as child and parental age, child gender, parental educational

level and socio-economic group (SEG). Mental age was measured only at t1, and is preferred to IQ in this analysis as it provides a more direct measure of basic cognitive ability, important to the child's functioning in the school setting. Measures of personality – child excitability/attentiveness, and parental neuroticism are examples – are contemporaneous to the outcome, as causal effect of the outcome on the predictor is considered unlikely though not impossible. While some of these variables are open to change over time (e.g. parental stress), many were found to be remarkably stable. Other variables may act as mediators, predicting the outcome or other predictors, while themselves being predicted by other, causally prior variables. Mainstream schooling is an example.

The transactional model adopted at the onset of the series of studies with the Manchester Cohort suggests that measures relating to individual parents as well as to the family as a whole may predict outcome for the young people. However, not all families consist of two parents, and not all parents that were present supplied data.

By t3, nine of the 71 families in this analysis did not contain the original father, and one did not contain the mother. A further 11 fathers who were present did not complete a t3 questionnaire. However, exploratory analyses have indicated that overall results are generally unaffected by missing data. Therefore, we have chosen a simple method of single imputation. Results from a logistic regression with mainstream schooling as the dependent variable are reported.

Results

Table 1 shows the AAI scores at the time of each of the three studies, correlations (Pearson correlation) and *t*-tests on differences (increase) between proximal scores.

AAI score at	<i>n</i>	Range	Mean (SD)	<i>r</i>	<i>t</i> -test (d.f.)
t1	71	3–50	14.41 (10.16)	}0.79**	}11.87** (70)
t2	71	4–54	24.96 (12.07)		
t3	71	3–58	30.04 (13.76)		

Table 1 Academic Attainments Index (AAI) scores at t1, t2, t3

** Statistically significant at $P = 0.001$ level (two-tailed).

	t1 AAI	t2 AAI	t3 AAI
Child variables			
Mental age	$P < 0.001$	$P < 0.001$	$P < 0.001$
Chronological age	$P < 0.05$	NS	NS
Female gender	$P < 0.001$	$P < 0.001$	$P < 0.001$
Poor health index	NS	NS	NS
Psychiatric symptoms (t3 only)			NS
Attentiveness	NS	$P < 0.01$	NS
Mainstream school experience	$P < 0.001$	$P < 0.001$	$P < 0.001$
Years since school leaving (t3 only)			NS
Currently on FE course (t3 only)			$P < 0.05$
Family variables			
Non-manual SEG	NS	$P < 0.05$	$P < 0.01$
Single parent	NS	NS	NS
Parental variables			
Higher education – mother	$P < 0.05$	$P < 0.01$	$P < 0.01$
Higher education – father	NS	NS	NS
Practical coping – mother	NS	NS	$P < 0.05$
Practical coping – father	NS	NS	NS
Wishful thinking coping – mother	$P < 0.05$	NS	NS
Wishful thinking coping – father	$P < 0.05$	NS	NS
Internal locus of control – mother	NS	NS	NS
Internal locus of control – father	$P < 0.01$	$P < 0.05$	NS
High stress – mother	$P < 0.01$	NS	NS
High stress – father	NS	$P < 0.05$	$P < 0.05$
Family cohesion – mother	NS	NS	$P < 0.01$
Family cohesion – father	$P < 0.01$	NS	NS
Marital relationship – mother	NS	NS	NS
Amount of social support – mother	NS	NS	NS
Amount of social support – father	NS	NS	NS

FE, further education; NS, not significant; SEG, socio-economic group.

Table 2 Predictors of **Academic Attainments Index** (AAI) scores at t1, t2, t3: bivariate analyses

Table 2 shows significance levels of bivariate analyses of the predictor variable against the t1, t2 and t3 outcome.

The first step in the path analysis was to identify predictors with a significant relationship with AAI scores, controlling for earlier AAI scores. Table 3 shows which predictors were tested in this way and the results of the bivariate tests.

The relationships shown in Tables 2 and 3 were generally in the expected direction, with a tendency for stronger associations for predictors derived from mothers' questionnaires. Table 3 shows that t1 mental age scores failed to show a significant association with t3 AAI scores once controlled for t2 AAI scores. It also reveals that neither mother's nor father's educational level had any significant direct impact on progress after t1. These variables were

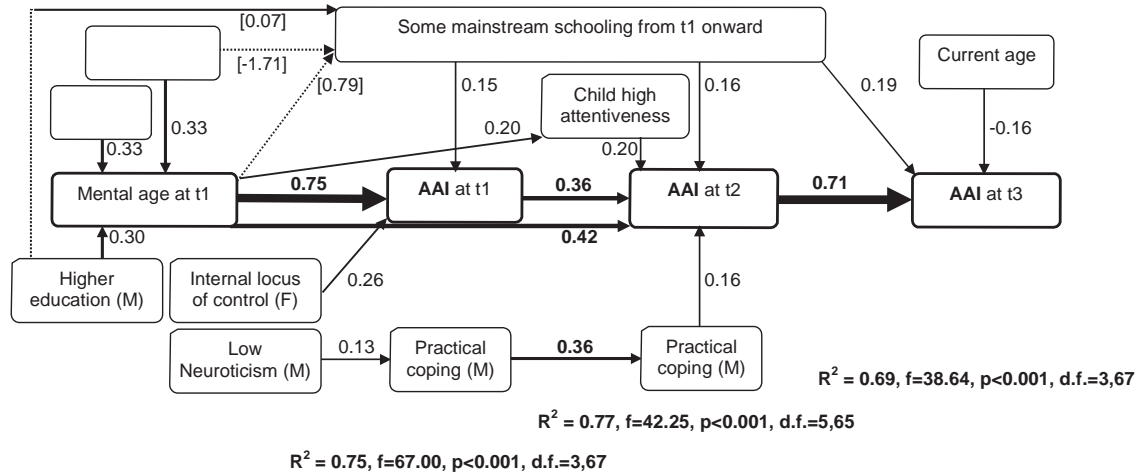
therefore not included in the multivariate regression analyses of t2 and t3 outcome.

The initial multiple regression analysis on t3 AAI scores within the path analysis therefore involved the block entry ($P = 0.05$) of t2 AAI scores, chronological age and the three dichotomous variables recording non-manual SEG, experience of mainstream schooling and current further education (FE) attendance. This exploratory analysis resulted in current FE attendance and non-manual SEG failing to reach significance in the model, and so the regression was rerun without these variables. This process was repeated for AAI t2 and t1 scores. Finally, a number of background variables (child gender, age, parental SEG and mother's educational level) were regressed against mental age. Figure 1 shows the resulting path diagram: child and educational variables are

Table 3 Predictors of Academic Attainments Index (AAI) score, controlling for earlier score

Predictor variables	Mean (SD) or %	t1 AAI controlled for mental age t (significance; d.f.)	t2 AAI controlled for t1 AAI t (significance; d.f.)	t3 AAI controlled for t2 AAI t (significance; d.f.)
Child variables				
Mental age	45.3 (9.8)	–	3.80 (0.001; 2.68)	1.02 (0.53, 2.68)
Chronological age	21.0 years (t3)	0.31 (0.75; 2.68)	-1.23 (0.22; 2.68)	-3.50 (0.001; 2.68)
Female gender	58%	2.09 (0.04; 2.68)	1.17 (0.25; 2.68)	-0.63 (0.31; 2.68)
Poor health index	9.09 (5.48) (t3)	-0.25 (0.80; 2.68)	0.12 (0.13; 2.66)	-0.98 (0.33; 2.58)
Psychiatric symptoms (t3 only)	2.66 (2.86) (t3)	–	–	-0.13 (0.90; 2.58)
Attentiveness	3.73 (0.97) (t2)	0.31 (0.76; 2.67)	3.04 (0.003; 2.68)	0.86 (0.41; 2.66)
Mainstream school experience	24%	2.15 (0.035; 2.68)	1.55 (0.13; 2.68)	3.65 (0.001; 2.68)
Years since school leaving (t3 only)	2.96 (1.57) (t3)	–	–	-1.40 (0.17; 2.59)
Currently on FE course (t3 only)	79%	–	–	2.02 (0.048; 2.68)
Family variables				
Non-manual SEG	56% (t1)	0.06 (0.95; 2.68)	1.28 (0.22; 2.68)	1.99 (0.05; 2.67)
Single parent	10% (t3)	0.86 (0.39; 2.68)	-0.38 (0.70; 2.67)	1.15 (0.25; 2.59)
Parental variables				
Higher education – mother	11% (t1)	1.77 (0.08; 2.65)	1.05 (0.30; 2.65)	0.17 (0.86; 2.65)
Higher education – father	18% (t1)	0.50 (0.62; 2.52)	0.27 (0.79; 2.52)	1.07 (0.29; 2.52)
Practical coping – mother	0.22 (0.04) (t1)	2.29 (0.03; 2.59)	2.15 (0.04; 2.68)	1.03 (0.31; 2.55)
Practical coping – father	0.23 (0.04) (t1)	0.72 (0.48; 2.37)	0.60 (0.55; 2.37)	1.15 (0.25; 2.36)
Wishful thinking coping – mother	0.15 (0.03) (t1)	-3.34 (0.001; 2.59)	-0.12 (0.91; 2.68)	0.14 (0.89; 2.55)
Wishful thinking coping – father	0.16 (0.03) (t1)	-0.43 (0.67; 2.37)	-1.69 (0.10; 2.37)	-1.16 (0.25; 2.36)
Internal locus of control – mother	19.98 (2.68) (t1)	1.45 (0.15; 2.63)	0.00 (0.99; 2.64)	-0.94 (0.35; 2.56)
Internal locus of control – father	20.66 (3.13) (t1)	3.26 (0.002; 2.44)	0.27 (0.79; 2.37)	-0.56 (0.61; 2.42)
High stress – mother	4.97 (4.43) (t1)	-2.02 (0.048; 2.65)	-0.77 (0.45; 2.66)	1.16 (0.25; 2.57)
High stress – father	3.42 (3.79) (t1)	0.53 (0.60; 2.40)	-1.67 (0.10; 2.37)	-0.71 (0.48; 2.43)
Family cohesion – mother	7.32 (1.79) (t1)	0.68 (0.50; 2.60)	0.88 (0.38; 2.64)	1.26 (0.22; 2.54)
Family cohesion – father	6.97 (1.85) (t1)	0.78 (0.44; 2.39)	0.79 (0.43; 2.37)	-0.17 (0.87; 2.42)
Marital relationship – mother	1.64 (0.31) (t1)	-0.37 (0.72; 2.60)	0.83 (0.41; 2.57)	0.22 (0.83; 2.58)
Marital relationship – father	1.58 (0.31) (t1)	0.01 (0.99; 2.38)	-0.14 (0.89; 2.36)	-0.15 (0.88; 2.38)
Amount of social support – mother	16.30 (3.13) (t1)	1.93 (0.06; 2.63)	0.56 (0.58; 2.60)	-0.48 (0.88; 2.57)
Amount of social support – father	14.26 (3.63) (t1)	-0.34 (0.73; 2.40)	1.12 (0.27; 2.34)	-1.32 (0.19; 2.42)

FE, further education; SEG, socio-economic group.



$R^2 = 0.30, f=9.33, p<0.001, d.f.=3,66$

Figure 1 Academic Attainments Index (AAI) path diagram. Boxes above the centre line represent child or educational variables: those below the centre represent parental variables. Weight of solid arrows is proportional to Beta weights, shown as 0.75, 0.26 etc. Dashed arrows (not proportional) refer to logistic regression of mainstream education. '[']' enclose beta weights measured on log scale as output from logistic regression. M, mothers' variable; F, fathers' variable.

placed about the central lines, and parental predictors below.

Analyses of direct and indirect paths of key variables to t3 AAI score:

1 Mental age: $(0.42 \times 0.71) + (0.75 \times 0.36 \times 0.71) + (0.20 \times 0.20 \times 0.71) = 0.53$ (bivariate correlation: $r = 0.64$)

2 Mainstream school: $(0.15 \times 0.36 \times 0.71) + (0.16 \times 0.71) + 0.19 = 0.34$ (bivariate correlation: $r = 0.55$)

The logistic regression of mainstream schooling identified three predictors: lower child chronological age (Beta = 1.17, $P = 0.001$), higher mental age (Beta = 0.79, $P = 0.008$) and maternal higher education (Beta = 0.07, $P = 0.04$). This regression model predicted 77% of those with mainstream school experience and 92% of those with none (88% prediction overall). Because of the different nature of beta weights in logistic regression analysis the path from mental age through mainstream schooling is not included in path (1) above.

Discussion

It is important to recognise two limitations of the study. First, the attrition of participating family

numbers over 14 years or so may have introduced a 'survivor effect' bias towards more able children. The only recourse which may have reduced this bias would be to attempt to locate families who moved from the North West of England, or offer financial incentives to reward participation. Resource considerations prevented this action.

The second limitation is the necessity of splitting t3 attainment data collection between tutor and parent reports, given that the AAI was designed for teacher completion. The only way that it would have been possible to use teacher report throughout the study while also assessing the young people at the end of their school career would have been to stagger data collection over a minimum of 5 years. While parents tended to rate the young people's attainments higher than did tutors, we are not convinced that this necessarily indicates that some parents inflated their children's scores unrealistically. Pre-study inter-rater reliability checks and the lack of an association with the measure of social desirability support this conclusion.

Although both effects were only of borderline statistical significance, they may have acted in the same direction, i.e. children who remained in the study tended to be more able, and parents may

have assessed their children's attainments more positively than tutors would have. However, there is no evidence for suspecting that the factors which may influence t3 attainment levels would be different as a result of a limited level of attrition bias. Despite losing some of the less able individuals to attrition, 78% of the young people remaining in the study could be described as having severe ID based on their t1 IQ scores.

Results are broadly in agreement with other studies, and confirm the pattern reported earlier with this group (Sloper *et al.* 1990; Sloper & Turner 1994). The path model appears to provide a good indication of the ways in which level of ID and placement in a mainstream school may interact with each other and with other variables in predicting post-school-leaving academic attainment. The overall beta scores for mental age and mainstream schooling within the path model account for the majority of their bivariate relationships with the outcome. The path analysis model predicts 48% of the variance in academic attainment scores at t3.

The analysis supports the hypotheses that while progress in academic attainments is related mainly to level of cognitive development, aspects of the family and school environment also have some influence. Mainstream schooling had some impact throughout and beyond the school years. Child attentiveness and the use of practical coping style by mothers were identified as impacting on level of academic attainments in the school years. The hypothesis that socio-economic resources also predict outcome is given limited support, its effect in the path diagram being through the influence of mother's higher education on placement in mainstream school and child's mental age. Poor child health was not confirmed as predicting outcome in this model.

Mainstream schooling

As expected, the most significant predictor of the outcome was intellectual impairment (as measured by mental age at t1), which acted indirectly through AAI scores at t1 and t2, mainstream school placement and attentiveness. The lack of a direct path from mental age scores to AAI scores at t3 implies that during and after the final years of education those in mainstream schools showed greater

progress than those with similar intellectual abilities in special schools. Mothers who had undertaken higher education were more likely to have their children placed in a mainstream school. With mainstream schooling more widely available for later cohorts of children, it may be that this relationship has changed, but it would be unwise to assume that access to mainstream schooling is now completely unrelated to social advantage. The present study confirms the benefits of mainstreaming identified by earlier studies (Casey *et al.* 1988; Cunningham *et al.* 1998; Laws *et al.* 2000), and we conclude that at least some of the children placed in Special Schools were likely to have achieved higher attainments in mainstream schools. However, the strength of the effect of mainstream schooling is modest, a finding reflecting that of Lindsay's recent review of studies of mainstream schooling i.e. 'where evidence does exist, the balance was only marginally positive' (Lindsay 2007, p. 2).

Despite changes in policy in relation to the inclusion of pupils with IDs in mainstream schools, a survey by the Office for Standards in Education, Children's Services and Skills (Ofsted) (2004) found no increase in the proportion of children with SEN in mainstream schools, or in the range of needs catered for. Ofsted found that while schools were committed to inclusion, few were happy to accept pupils with complex needs. Their findings reflect the complexity of effective inclusion in mainstream settings, where success relied equally on high expectations for achievement for these pupils, committed management and skilled teachers and support staff, coupled with adequate resources in terms of facilities, space and innovative adaptation of the curriculum. The type of facilitation outlined for achieving effective inclusion all pupils with SEN in mainstream schools is likely to be costly in financial terms. These issues along with recent calls to retain Special Schooling may result in a halt to progress on the 'inclusion framework' as defined by recent policy initiatives outlined above. The findings here provide some support for 'mainstreaming' as a positive influence on the achievement of 'academic' skills for some children with Down's syndrome. Of course, 'academic' attainment is not the only measure of success for any child, including those with IDs. The achievements of children will be facilitated by environments 'fit for purpose' and

providing adequate support for pupils' emotional wellbeing (Cooney *et al.* 2006).

Family functioning

Aspects of parental functioning – adopting a practical approach to coping with problems, and attributing control to oneself rather than to external forces – give an indication of the kind of social dynamic involving both mothers and fathers which may maximise the child's potential. In particular, coping styles may be central to family functioning among families of children with disabilities (Knussen & Sloper 1992; Kim *et al.* 2003). While there is evidence that coping styles are relatively stable (Hatton *et al.* 1995), Kim *et al.* (2003) found that a shift towards more problem-based coping by parents of adults with IDs resulted in a reduction in parental distress. Research on imparting coping skills to parents of children with severe IDs by Quine and Wade (1991) also suggests such support can bring positive outcomes. The consistency of coping strategy over time and its relationship with neuroticism in parents of children with IDs is also reported by Gliddens *et al.* (2006).

Sloper *et al.* (1990) discuss the relationship between fathers' locus of control and child academic attainment at length, and suggest that it reflects the effects of the fathers' involvement in their children's education as well as more diverse effects of family climate. Thus children most at danger of under-performing may form part of a family which requires support as a whole rather than to individual members. An emphasis on the whole family is indicated as an important element in policies designed to further the educational attainments of children with IDs.

Conclusion

This longitudinal study suggests that notwithstanding the dominant effect of severity of intellectual impairment, a number of factors within and outside the family may also contribute to higher attainment in reading, writing and numeracy. In particular mainstream schooling for those with less severe disabilities appears to have benefited the children in this study. However, Lindsay reports that despite

increasingly positive attitudes towards inclusion among teachers, there is 'no evidence of acceptance of a policy of total inclusion' (Lindsay 2007, p. 13). Few children with Down's syndrome have autistic spectrum traits or behaviour that can be challenging to manage in a traditional school environment. Nevertheless, such pupils could be open to bullying in the same manner as any other pupil with IDs. While many children with Down's syndrome could benefit academically from mainstream schooling, the extent to which mainstream communities accept and support members with IDs remains an issue.

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