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The EPICure Study: Academic attainment and special educational needs in extremely preterm children at 11 years

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Abstract

Aim. To assess academic attainment and special educational needs (SEN) in extremely preterm (EP) children in middle childhood.

Methods. Of 307 EP (≤25 weeks) survivors born in the UK and Ireland in 1995, 219 (71%) were re-assessed at 11 years, with a comparison group of 153 classmates born at term, using standardised tests of cognitive ability and academic attainment and teacher reports of school performance and special educational needs (SEN). Multiple imputation was used to correct for selective dropout.

Results. EP children had significantly lower scores than classmates for cognitive ability (-20 points; 95%CI: -23,-17), reading (-18 points; -22,-15) and mathematics (-27 points; -31,-23). Twenty-nine (13%) EP children attended special school. In mainstream schools, 105 (57%) EP children had SEN (OR: 10; 6, 18) and 103 (55%) required SEN resource provision (OR: 10; 5, 18). Teachers rated 50% of EP children with attainment below the average range compared with 5% of classmates (OR: 18; CI: 8, 41). EP children who are entered for mainstream education an academic year early due to preterm birth had similar academic attainment but required more SEN support (OR: 2; 1.1,3.8).

Conclusions. EP survivors remain at high risk for learning impairments and poor academic attainment in middle childhood. A significant proportion require full-time specialist education and over half of those attending mainstream schools require additional health or educational resources in order to access the national curriculum. The prevalence and impact of SEN is likely to increase as these children approach the transition to secondary school.

(249 words)

Population-based studies have consistently shown that extremely preterm (EP) or extremely low birthweight (ELBW) children are at risk for functional disabilities later in life.(1-3) Cognitive impairment is the most prevalent disability at school age(1) and contributes to the excess of learning impairment and poor academic attainment in these populations, even among children without serious disability or cerebral palsy (CP)(1, 4-12). Although an underlying global cognitive deficit may account for much of the educational underachievement observed, differences in IQ scores do not account for all the learning difficulties in these children.(10, 13, 14)

Studies have shown that EP and ELBW children are more likely to require special school placement, repeat a school year (if applicable), have special educational needs (SEN) and to receive learning support than their term counterparts.(6, 7, 15-20) The prevalence of SEN and SEN resource provision provides an important measure of the totality of the functional deficit in this population. However, information regarding SEN resource utilisation in EP children is currently lacking.

We have studied educational outcomes in a whole population of EP children at 11 years of age. Firstly, we assessed general and specific academic attainment and the prevalence of learning impairment. Secondly, we investigated whether academic attainment and educational outcome is explained by a general cognitive deficit. Finally, we investigated educational outcomes for EP children entering compulsory education an academic year earlier than if they had been born at term.

Participants

The derivation of the study population has been described previously.(21) Of 307 survivors at 11 years, 11 (4%) were resident outside the UK, the parents of 18 (6%) refused consent and 57 (19%) did not respond to invitations to participate. Thus, 219 (71%) EP children were assessed at 11 years (Median age: 131m; range: 121m-145m).

At the previous 6-year follow-up, for each EP child in mainstream school we identified a classmate born at term matched for age, sex and ethnic group. Of 160 classmates evaluated at 6 years, 110 (69%) were re-assessed at 11 years. We selected 43 new comparator children using the same methodology(1) to replace those now at a different school to the EP child or those declining participation. Thus a comparison group of 153 classmates was evaluated at 11 years of age (Median age: 131m; range 117m-147m).

Method

Parents and children were given information leaflets and parents provided informed consent for their child's participation. Three psychologists blind to study group allocation assessed children in schools, or at home or hospital (13%) if a school visit was not permitted. Study psychologists simultaneously scored the battery of standardised tests administered to non-study children prior to commencing EPICure study assessments and achieved excellent inter-rater reliability: >95% agreement across test items for both standardised measures. The study was approved by the Southampton and South West Hampshire Research Ethics Committee.

Measures

Cognitive ability was assessed using the Kaufman-Assessment Battery for Children (K-ABC)(22). A Mental Processing Composite (MPC) score of 39 was allocated to 16 children who did not participate in testing with severe cognitive deficit. Two children who did not complete the K-ABC because of blindness and behavioural problems were classified with normal cognition based on teacher report. Academic attainment was assessed using the Wechsler Individual Achievement Test 2nd Edition (WIAT-II UK) for reading and maths.(23) A score of 39 was allocated to 18 children with severe cognitive deficit. Reading (n=7) and maths (n=4) scores were not substituted for children who failed to complete the test for other reasons (communication difficulties, behavioural issues, blindness). Given the secular drift in IQ scores over time,(24, 25) cognitive and learning impairment was classified into 4 categories according to conventional SD-banded cut-offs (none > -1SD; mild -1SD to -2SD; moderate -2SD to -3SD; severe < -3SD) using the mean and SD of the comparison group for each standardised test. A further test assessed intuitive mathematics (e.g. estimating numbers of dots, lengths of lines).(26, 27) Scores ranged 0-11 with higher scores indicating better performance.

Teachers in mainstream schools rated each child's performance in 7 subjects (English, maths, science, technology, geography, information technology (IT) and history). Scores were summed to yield a Total Academic Attainment Score (TAAS;

range 1 to 5)(28) which was used to classify performance below the average range (TAAS <2.5).

Teachers were asked to identify children with SEN, defined in the educational context as those with learning difficulties or disabilities that make it harder for them to learn or access education than most children of the same age, and were also asked to detail any SEN support the child received. The UK educational system adopts a 3-stage approach to the provision of SEN resources that can culminate in a "Statement" - a legal document outlining a child's SEN and what provision must be made within the school and from external bodies. Statements are awarded to children in special schools and to those in mainstream schools with complex needs typically requiring multi-agency support. (Data relating to grade retention were not recorded as the UK adopts an age-based educational system in which school year repetition is rare.)

Parental socio-economic status (SES) was classified into four categories (SES-I: Professional/Managerial; SES-II: Intermediate; SES-III: Routine/Manual; SES-IV: Long-term unemployed/Never worked) using the UK National Statistics Socio-Economic Classification system.(29)

Statistical analyses

Data were double-entered, verified for accuracy and analysed using SPSS (SJ, EH). Differences between groups in standardised test scores were analysed using independent samples t-tests or one-way analysis of variance as appropriate. Differences in standardised test scores between EP and comparison children were also adjusted for SES, and WIAT-II^{UK} test scores were adjusted for general cognitive ability using multivariate regression. Estimation of the prevalence of serious cognitive (MPC <82) and learning (reading <74; maths <69) impairment and SEN in the whole cohort was done using multiple imputation to account for selective dropout.(30) Variables used to predict 11 year outcomes were those independently and statistically significantly ($p<0.05$) associated with cognitive outcomes at discharge, 2.5 or 6 years.

Results

Loss to follow-up

EP children lost to follow-up at 11 years (n=88) were more likely to be of non-white ethnic origin, have unemployed parents, lower cognitive test scores and more frequent cognitive impairment at 2.5 and 6y of age than those assessed (n=219) (Supplemental Table s1).

Cognitive ability

EP children had significantly lower MPC scores than classmates (Table 1). Mean MPC was 82.9 (SD: 21.2) at 23w, 79.6 (SD: 20.8) at 24w and 86.1 (SD: 15.3) at 25w. In the EP group boys had significantly lower scores than girls (-8 points; 95%CI: -13,-3). There was no sex difference among classmates. Excluding children with substituted scores, EP children had a mean MPC score 16.8 points (-19, -14) lower than classmates. This group difference was -15.7 points in children for whom SES data were available (EP=169; classmates=135), and adjustment for SES reduced this by 0.2 points (-15.5 points; -18.2,-12.8). EP children also had lower scores than classmates for both sequential and simultaneous processing, the largest deficit being in simultaneous processing (Table 1). EP children were more likely to have a relative deficit in simultaneous compared with sequential processing than their classmates (72.; 3.2,16.1).(22)

INSERT TABLE 1

40% of EP children had serious cognitive impairment (MPC <-2SD) compared with 1.3% classmates (OR:50; 12,206; Table 2).[1] Among EP children, boys were more likely to have serious impairment than girls (2.1; 1.2,3.7) but the prevalence of impairment was not significantly different for children born 23/24w (45%) and 25w (36%) (1.48; 0.9,2.6). Using multiple imputation to correct for selective loss to follow-up of children with functional difficulties, the estimated proportion of EP children with serious cognitive impairment rose to 45% (95%CI: 38,52).

INSERT TABLE 2

Academic attainment

[1] Using K-ABC test data, 13.7% (95%CI: 9.5%,19.1%) of EP had serious cognitive impairment compared with no classmates. Adjusting for loss to follow-up, the estimated proportion rose to 17.4% (12.4%,22.4%).

EP children had significantly lower reading and maths scores than classmates (Table 1). EP boys had significantly lower scores than EP girls in reading (-7 points; -1,-13) but not in maths (-4 points; -1,10). No sex difference was found among classmates. Excluding children in whom severe cognitive impairment precluded test use (n =17), EP children had a mean deficit of 15 points (-18, -12) in reading and 25 points (-28, -21) in maths. Adjusting for SES in those with data available reduced the reading and maths deficits by only 0.5 and 0.3 points respectively. There were significant interaction effects of EP and MPC on both reading and maths with EP children having increasingly lower scores at lower MPC values than classmates. When adjusting for MPC, a significant effect of EP remained for maths (-8.1; -11.3, -4.8) but not for reading (-2.5; -5.5, 0.5).

Sixty-four (30%) EP children and 3 (2%) classmates had serious impairment in reading (OR: 22; CI: 6.6,70) (Table 2). Serious impairment was marginally more common in EP boys than girls (1.7; 0.9,3,0). Ninety-four (44%) EP children and 2 (1.3%) classmates had serious impairment in maths (59; 14, 243). Using multiple imputation to correct for selective loss to follow-up, the estimated proportion of EP children with serious impairment in reading rose to 33% (27, 40) and to 50% (44, 56) in maths.

Teacher questionnaires were returned for 200 (91%) EP children and 146 (95%) classmates. EP children in mainstream school had significantly poorer performance than classmates in all subjects rated, and 50% were classified with attainment below the average range compared with 5% of classmates (OR:18; 8,41).

Special Educational Needs (SEN)

SEN data were obtained for 215 (98%) EP children and 152 (99%) classmates. Twenty nine (13%) EP children attended a special school and were more likely to be boys (OR: 3.6; CI: 1.5,8.6). Many more EP children than classmates had academic or behavioural SEN and utilised SEN provision, both overall and among those in mainstream schools only (Table 3). EP boys were more likely to have SEN and to utilise SEN provision than girls (Table 3). Among classmates, boys were more likely to have SEN (3.8; 1.3,11.5) and marginally more likely to require SEN resources (2.8; 0.99, 8.1) (p=0.052). Using multiple imputation to account for loss to follow-up, the estimated proportion of EP children with SEN and those utilising SEN support rose to 66% (60, 72) and 64% (58, 70)

INSERT TABLE 3

Overall, EP children in mainstream schools utilised SEN resources more than classmates (OR 10; CI: 6, 18) (Figure 1). The services most commonly used by EP children compared with classmates were educational psychologists (12; 2,95), one-to-one support (10; 4,26) and small group provision (9; 5,16). EP children in receipt of SEN provision had lower MPC scores than EP children who did not receive support (-15.9 points; -19.1,-12.7). For those EP children requiring SEN provision, 57% utilised one resource, 24% used two, 11% used three and 8% utilised four or more types of resources. In contrast, only 12% of classmates required two forms of support.

INSERT FIGURE 1

There were more EP children in receipt of support in mainstream schools than were identified by teachers as having academic or behavioural SEN (n=13): 10 received minimal support (e.g., "Year 6 Booster classes", "programme for accelerated learning", "help with spelling", "lunchtime maths help"). Of the remaining 3 children, 1 had an Outreach teacher for hearing impairment, 1 a classroom assistant due to visual and hearing impairment and 1 an Occupational Therapist; all 3 were on the Local Authority Register for children with SEN. When the category for presence of SEN is extended to include these 13 children, 114 (61%) EP children and 21 (14%) classmates in mainstream schools had SEN (OR: 9.9; CI: 5.7, 17.1); this rises to 67% when children in special schools are included (12.4; 7.2, 21.3).

Statements of SEN

Seventy-two (34%) EP children had a Statement of SEN compared with 1 (0.7%) classmate (OR: 76; CI: 10,552); this rose to 39% (33,45) using multiple imputation to estimate prevalence in the full cohort. In mainstream schools, 43 (23%) EP children had a statement (46; 6,339) (Table 3).[2] Among EP children for whom Statement data were available, of those with MPC<70 (n=28) 22 were in a special

[2] Results exclude Ireland. Scotland adopts a similar process to England and Wales and data are therefore included. The prevalence of statements in England & Wales was not significantly different in the full cohort (35% EP vs 0.8% classmates; OR: 70; CI: 10, 512) and in mainstream schools (25% EP vs 0.8% classmates; OR 43; 6, 320).

school and 7 in a mainstream school and all had a Statement; among the children with MPC≥70, having a Statement was independently associated with MPC, reading scores and CP. However, once maths and SES were included in the model both MPC and reading scores were no longer significant. After adjustment for each other, for those with MPC≥70 the OR for having a Statement for a ten point increase in maths score was 0.42 (0.30,0.59), for having CP 7.1 (1.8,27) and for SES Class IV 9.9 (2.1,47).

Early school entry

A sub-group of 68 (36%) EP children in mainstream school had dates of birth and gestational ages that would have placed them in an earlier academic year than if they had delivered at term (23w n=4, 22%; 24w n=24, 40%; 25w n=40, 36%). There were no significant differences in standardised test scores for these children compared with the remainder of the EP cohort. However, more children entered for school a year early had SEN, statements and a greater proportion utilised SEN resources than the rest of the EP children (Table 4).

INSERT TABLE 4

Discussion

After initial anxieties regarding survival during the neonatal period, parents are increasingly concerned with how well their child is likely to get on at school and what kind of support may be needed for their child to realise his or her potential. We found that EP birth places children at high risk for cognitive and learning deficits affecting their schooling in middle childhood. Up to 44% had a serious impairment in the core subjects of reading and maths, and 50% had performance below the average range expected for their age across the full spectrum of subjects studied. EP children also had a thirteen times increased risk of SEN requiring additional learning support and were 77 times more likely to have an Educational Statement at 11 years of age.

Such a high prevalence of cognitive deficits in EP/ELBW survivors is a robust finding,(1, 2, 31-33). Although we have reported a higher prevalence than other population-based studies, we included only extremely immature births in whom a higher level of impairment would be expected given the gestational age-related gradient in cognitive function.(34-36) Furthermore, we classified impairment relative to the performance of the comparison group which yields higher rates but reflects reality as children are compared with the peers against whom they are judged in school.(25, 37)

Comparable with our findings, other studies have shown that EP and ELBW survivors have poorer academic attainment than their term peers on teacher's ratings (6, 11) and standardised tests (2, 5, 7, 11, 15), with rates of serious impairment up to 50%.(19, 38) We also confirm maths as an area of specific difficulty in half of this population when loss to follow-up is accounted for.(1, 6, 7, 11) In contrast the deficits in reading scores were no longer evident after adjustment for general cognitive ability.(10, 11, 14, 31) Thus some learning difficulty associated with EP birth, particularly in language and reading, can be accounted for by a general cognitive impairment whilst mathematical difficulties appear to be a specific deficit. It has been suggested that this pattern of findings is largely indicative of a disruption to global brain development and imaging studies have provided confirmatory evidence of reduced cortical volume, size and complexity in preterm populations.(39, 40) The neuropsychological deficit appears to worse in simultaneous rather than sequential processing of complex information.(1, 14) Specific deficits in maths skills may be a result of more specific impairment of regional brain areas.(41) Such abilities are related to working memory, executive function, attentional control, perceptual and visuo-spatial skills, which are also selectively impaired in preterm populations.(13, 42, 43) Interventions targeted at enhancing executive control and motor function may therefore attenuate the effects of prematurity on educational outcomes. Furthermore, behavioural and emotional problems(44, 45) may impact on scholastic performance in this population and may be amenable to intervention.

The impact of extreme prematurity is most evident in that two thirds have academic and behavioural SEN, compared with 11% of classmates and 24% in England.(46) The lower prevalence of special school placements than in other EP/ELBW populations (19, 32, 38) reflects the UK policy for integration of children with SEN in mainstream schools. Indeed, 36% of EP children in mainstream school had serious functional neurodevelopmental disability.(47) SEN were not confined to those with severe disability as a further 21% of EP children in mainstream schools had SEN. The prevalence of Educational Statements was remarkably high in this population: 1/3 of all EP children, and almost 1/4 of EP children in mainstream schools, compared with 2.3% in England.(46) The marked increase reflects the greater severity and complexity of learning support required, including physical and medical therapies, as indicated by the greater variety of special SEN services utilised in this population.

Most often SEN support comprised small group tuition or one-to-one support, but EP children also utilised services from a range of allied health professionals that were rarely accessed by classmates. EP children were also more likely to require support provided by external agencies and to require multiple support services impacting further upon the cost to schools and the local government for the education of these children. However, we have not investigated severity of SEN, and, whilst the vast majority of those with SEN are in receipt of some degree of provision, this support may be insufficient(6, 32) and some may also receive additional professional help at home that we have not recorded.

Schools in the UK adopt an age-based educational system. Local authorities vary in their policies for entry into nursery (preschool) and virtually all of this cohort will have started preschool in the academic year in which they reach 5 years. Entry to formal schooling is compulsory in the term after the child's 5th birthday. As such, children will vary in age and length of schooling on admission. Children whose date of birth (DOB) and expected date of delivery (EDD) cross the cut-off date for school entry (1st September) will ultimately be entered an academic year earlier than if they had been born at term. Concern is frequently expressed regarding educational outcomes for these children as the disadvantage already conferred by summer birth, due to age and length of preschool education (48, 49), may be compounded by premature school entry – a disparity that is never rectified throughout schooling.

When outcomes for EP children who would have entered mainstream school a year early were compared to the rest of the EP cohort there were no significant differences in mean age-standardised scores; similarly there were no significant differences between summer born and non-summer born classmates on these measures and neither did we find significant differences in WIAT-II^{UK} raw scores or on non-standardised tests. However, EP children entered for school a year early had more SEN and Educational Statements. The additional support and resources utilised by these children may thus have contributed to their comparable academic attainment and if academic attainment is the outcome of concern then early school entry does not appear to disadvantage EP children. It may be advantageous to delay school entry, and to adopt admission rules based on corrected age, as these children may then require less SEN provision, with personal and social advantages of attenuating the impact of delayed cognitive and psychomotor development, emotional immaturity and social difficulties that are associated with EP birth.(44, 50) A preschool curriculum that emphasises language and social development, play and exploration may be more developmentally appropriate for EP children at this age. Although these data provide some preliminary results, more systematic investigation is required that is designed to study the impact of premature school entry.

We did not recruit comparison children for those in special schools and it may therefore be argued that impairment was overestimated in this study. However, we do not believe we have a high-achieving comparison group as classmates performed as would be expected in the normal population on standardised measures. We have also compared educational outcomes to current national statistics where possible. The small effects of SES on outcomes were expected as the selection of classmates typically adjusts for these factors. It is more likely that we have underestimated impairment in this population given the selective loss to follow-up of children with serious cognitive deficits and functional disability. Multiple imputation was used to account for selective dropout on educational outcomes. Using these techniques, the prevalence of cognitive impairment rose to 45% and the prevalence of those with SEN to 66%.

In summary, we identified a high prevalence of learning deficits that impacted significantly upon the school performance and educational needs of EP children. By 11 years of age, around 60% of EP children require additional support in school and 1/3 have an Educational Statement indicative of complex SEN. The impact of these impairments is likely to increase over time (19, 46, 51) and existing difficulties may be exacerbated in secondary school when cognitive demands increase in parallel with progressively complex academic studies. The cost to society of extreme prematurity lies increasingly within the sphere of education(52) as these children grow older and approach the transition to secondary school.

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Conflict of Interest

None declared. All authors declare that the answer to the questions on your competing interest form are all No and therefore have nothing to declare. All researchers are independent of the funding body.

What is already known on this topic

• Very preterm children are at high risk for cognitive impairment and have poorer school performance than their term peers.

• Many children will enter school an academic year early due to preterm birth.

• The effect of early school entry on educational outcomes has not yet been investigated.

What this study adds

• Extremely preterm children are at high risk for learning difficulties and poor academic attainment at 11 years of age, particularly in mathematics.

• Almost two thirds of them require additional support in school.

• Children who enter school an academic year early due to extremely preterm birth have comparable academic attainment but require more special needs support.

Website

www.epicure.ac.uk

Table 1. Mean (SD) scores for standardised tests of cognitive ability (K-ABC) and academic attainment (WIAT-II^{UK}) in extremely preterm children and classmates at 11 years.

Test		Classmates			Extremely preterm			Mean difference
		n	Mean	(SD)	n	Mean	(SD)	(95% CI)
K-ABC	**MPC**	**153**	**104.1**	**(11.1)**	**217**	**83.7**	**18.0**	**-20 (-23 to -17)**
	Simultaneous processing	153	104.9	(11.9)	201	86.7	(13.5)	-18 (-21 to -15)
	Sequential processing	153	101.9	(11.5)	201	91.5	(13.4)	-10 (-13 to -8)
WIAT-II^{UK}	**Reading**	**153**	**98.5**	**(11.6)**	**212**	**80.2**	**(20.3)**	**-18 (-21 to -15)**
	Word reading	153	99.6	(12.1)	199	86.3	(17.3)	-13 (-16 to -10)
	Reading comprehension	153	100.6	(11.6)	195	85.9	(18.3)	-15 (-18 to -12)
	Pseudoword decoding	153	99.7	(11.3)	199	68.7	(15.6	-13 (-16 to -10)
WIAT-II^{UK}	**Maths**	**153**	**98.5**	**(15.0)**	**215**	**71.2**	**(20.9)**	**-27 (-31 to -24)**
	Numerical Operations	153	98.0	(15.5)	199	75.6	(18.4)	-22 (-26 to -19)
	Mathematical Reasoning	153	99.7	(12.0)	198	78.2	(18.1)	-21 (-25 to -18)
Maths estimation test		**152**	**6.6**	**(1.9)**	**198**	**4.4**	**(2.0)**	**-2.2 (-1.7 to -2.6)**

K-ABC and WIAT-II^{UK} scales yield standardised scores with Mean 100, SD 15. Scores for maths estimation range 0 to 11.

Table 2: Severity of cognitive and learning impairments in extremely preterm children and classmates at 11 years.

Domain of impairment	**Classmates**	**Extremely preterm**		
	All	**Boys**	**Girls**	**All**
	(n = 153)			
General cognitive ability	(n = 153)	(n = 101)	(n = 118)	(n = 219)
No impairment	129 (84.3%)	23 (22.8%)	46 (39.0%)	69 (31.5%)
Mild impairment	22 (14.4%)	28 (27.7%)	35 (29.7%)	63 (28.8%)
Moderate impairment	2 (1.3%)	27 (26.7%)	28 (23.7%)	55 (25.1%)
Severe impairment	0 (0.0%)	23 (22.8%)	9 (7.6%)	32 (14.6%)
Reading	(n = 153)	(n = 97)	(n = 115)	(n = 212)
No impairment	136 (88.9%)	40 (41.2%)	62 (53.9%)	102 (48.1%)
Mild impairment	14 (9.2%)	22 (22.7%)	24 (20.9%)	46 (21.7%)
Moderate impairment	3 (2.0%)	10 (10.3%)	13 (11.3%)	23 (10.8%)
Severe impairment	0 (0.0%)	25 (25.8%)	16 (13.9%)	41 (19.3%)
Maths	(n = 153)	(n = 99)	(n = 116)	(n = 215)
No impairment	132 (86.3%)	29 (29.3%)	36 (31.0%)	65 (30.2%)
Mild impairment	19 (12.4%)	23 (23.2%)	33 (28.4%)	56 (26.0%)
Moderate impairment	2 (1.3%)	15 (15.2%)	27 (23.3%)	42 (19.5%)
Severe impairment	0 (0%)	32 (32.3%)	20 (17.2%)	52 (24.2%)

Impairment is classified relative to the Mean SD of classmates on each scale. No impairment = scores ≥ -1SD, mild impairment = scores -1 to -2 SD, moderate impairment = scores -2 to -3 SD and severe impairment = scores – 3 SD.

Table 3. Special educational needs (SEN) in extremely preterm children and classmates at 11 years.

	Classmates (n = 152)		Extremely preterm (n = 215)		Odds Ratio (95% CI)
	n	%	n	%	
Academic or behavioural SEN	**17**	**(11%)**	**134**	**(62%)**	**13.1 (7.4 to 23.3)**
Boys	12	(19%)	76	(77%)	
Girls	5	(6%)	58	(50%)	
Risk for EP boys versus girls					3.3 (1.8 to 6.0)
Utilises SEN resources[†]	**17**	**(11%)**	**132**	**(61%)**	**12.6 (7.1 to 22.4)**
Boys	11	(17%)	73	(74%)	
Girls	6	(6.8)	59	(51%)	
Risk for EP boys versus girls					2.7 (1.5 to 4.8)
Educational Statement*	**1**	**(0.7%)**	**72**	**(34%)**	**77 (10.6 to 562)**
Boys	1	(1.6%)	43	(44%)	
Girls	0	(0%)	29	(25%)	
Risk for EP boys versus girls					2.4 (1.3 to 4.3)

MAINSTREAM SCHOOLS ONLY

	(n = 152)		(n = 186)		
Academic or behavioural SEN	**17**	**(11%)**	**105**	**(57%)**	**10.3 (5.8 to 18.4)**
Boys	12	(19%)	55	(71%)	
Girls	5	(6%)	50	(46%)	
Risk for EP boys versus girls					2.8 (1.5 to 5.1)
Utilises SEN resources	**17**	**(11%)**	**103**	**(55%)**	**9.9 (5.5 to 17.6)**
Boys	11	(17%)	52	(67%)	
Girls	6	(7)	51	(47%)	
Risk for EP boys versus girls					2.2 (1.2 to 4.1)
Educational Statement*	**1**	**(0.7%)**	**43**	**(23%)**	**46 (6.3 to 339)**
Boys	1	(1.6%)	22	(29%)	
Girls	0	(0%)	21	(19%)	
Risk for EP boys versus girls					1.7 (0.8 to 3.4)

[†] SEN provision refers to the number of children utilising at least one SEN resource (listed in Figure 1). * Data for the prevalence of educational statements excludes children in Ireland.

Table 4. Educational outcomes for extremely preterm children in mainstream schools who were entered in the appropriate school year (n = 122) compared with those that would have been entered for a school a year earlier than if they were born at term (n = 68).

	Appropriate school entry			Early school entry			Mean difference
	n	**Mean**	**(SD)**	**n**	**Mean**	**(SD)**	**(95% CI)**
K-ABC: MPC	122	88.9	12.3	66	87.2	15.0	-1.7 (-5.7 to 2.3)
WIAT-II^{UK}: Reading	122	84.9	15.4	65	84.5	18.3	-0.3 (-5.3 to 4.6)
WIAT-II^{UK}: Maths	122	75.9	18.1	65	74.4	20.4	-1.5 (-7.3 to 4.2)
Maths estimation	121	4.7	1.9	63	4.6	2.1	-0.1 (-0.7 to 0.5)
		n	**%**		**n**	**%**	**OR (95% CI)**
Cognitive impairment		37	(30%)		22	(32%)	1.1 (0.6 to 2.1)
Impairment in reading		25	(21%)		16	(25%)	1.3 (0.6 to 2.6)
Impairment in maths		40	(33%)		26	(40%)	1.4 (0.7 to 2.6)
< average attainment (teacher)		46	(46%)		31	(56%)	1.5 (0.8 to 2.9)
Academic / behavioural SEN		60	(50%)		45	(67%)	2.0 (1.1 to 3.8)
Utilises SEN resources		59	(50%)		44	(66%)	1.9 (1.0 to 3.6)
Educational statement		21	(18%)		22	(33%)	2.3 (1.2 to 4.6)

K-ABC and WIAT-II^{UK} scales yield standardised scores with Mean 100, SD 15. Scores for maths estimation range 0 to 11. Impairment refers to serious impairment (moderate and severe impairment combined). Teacher rated academic attainment refers to total TAAS scores used to classify overall attainment below the national age-expected average. Data for educational statements exclude children in Ireland.

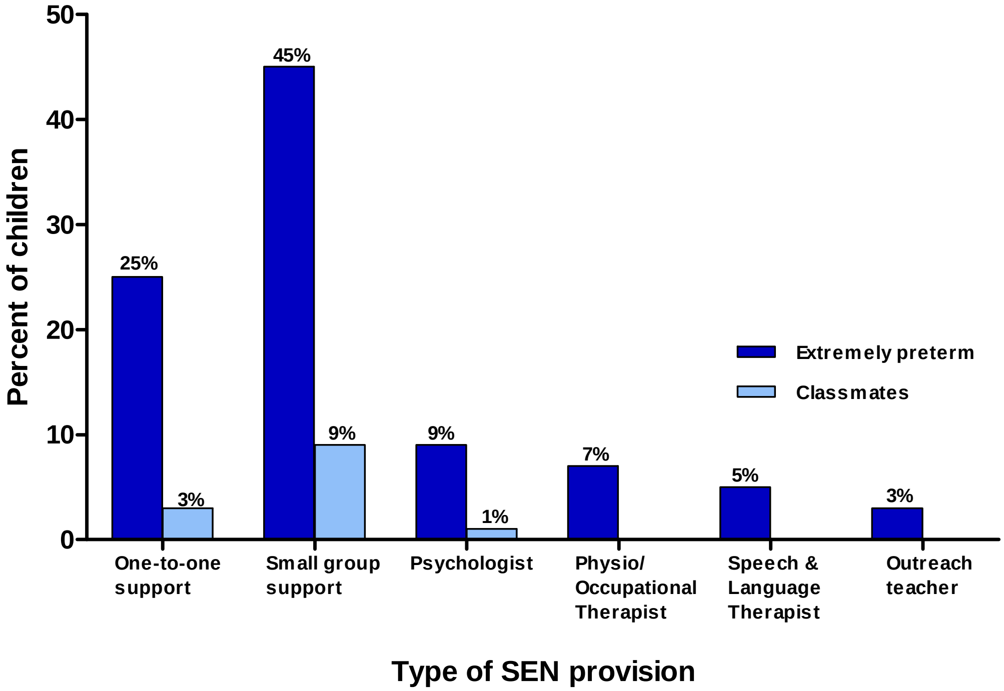
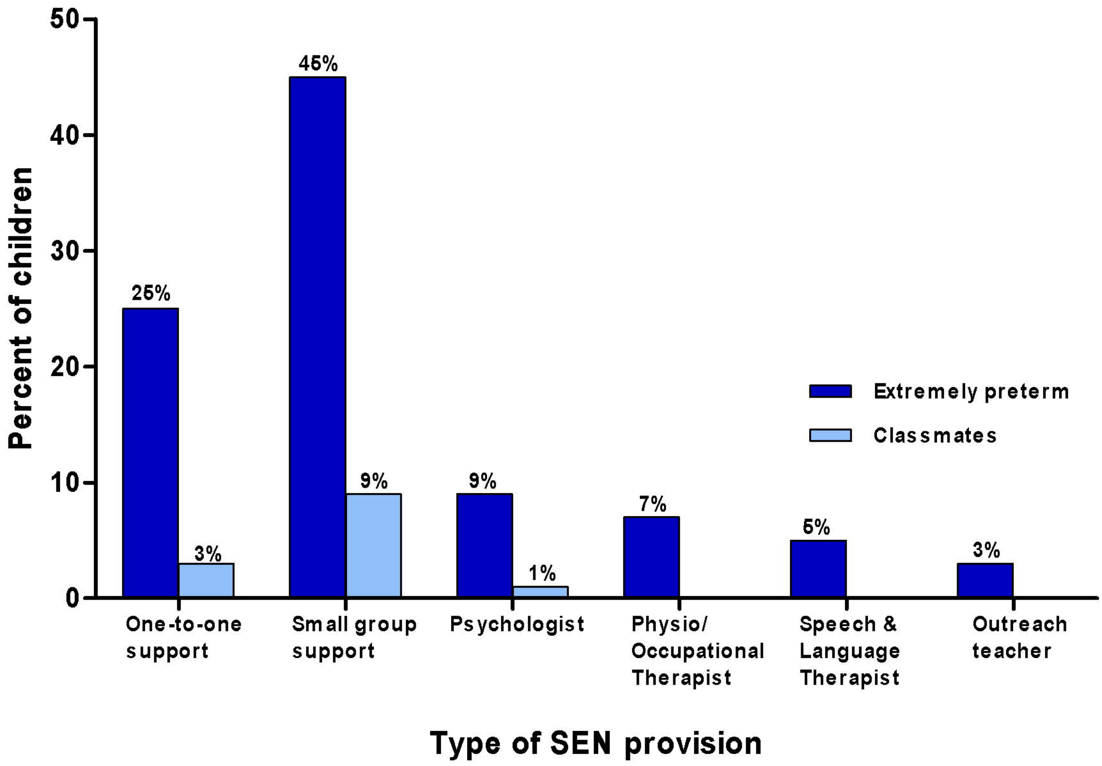


Figure 1. Type of special educational needs (SEN) resources utilised by extremely preterm children and classmates in mainstream schools at 11 years of age.

Table s1. Differences between extremely preterm children assessed and not assessed at 11 years.

Variable		**Assessed** (n = 219)*	**Not assessed** (n = 88)#	**95% CI of difference**	**p**
Male		101 (46%)	48 (55%)	-4 to 21	0.18
White ethnic origin		179 (82%)	57 (65%)	-29 to -6	0.001
Gestational age <25 weeks		93 (42%)	33 (37%)	-17 to 7	0.42
Singleton		157 (72%)	70 (80%)	-3 to 18	0.17
Primigravid		66 (30%)	29 (33%)	-9 to 14	0.65
Supplemental oxygen at 36 weeks		159 (73%)	65 (74%)	-10 to 12	0.86
Chorioamnionitis		47 (22%)	29 (33%)	0 to 22	0.04
Operation for NEC		6 (3%)	6 (7%)	-2 to 10	0.10
Abnormal cerebral ultrasound		36 (17%)	16 (18%)	-8 to 11	0.79
Outcome data available at 2.5 years		(n = 213)	(n = 70)		
BSID-II MDI [Mean (SD)]		83.1 (13.9)	77.0 (14.6)	-10.4 to -1.8	0.005
Serious cognitive impairment (MDI <-2SD)		27/194 (14%)	16/54 (30%)	3 to 29	0.007
Severe composite disability		41 (19%)	23 (33%)	1 to 26	0.018
No disability		117 (55%)	29 (41%)	-27 to 0	0.05
Occupational Status:	Non-manual	64 (32%)	9 (25%)		
	Manual	75 (38%)	7 (19%)		
	Unemployed	55 (27%)	17 (47%)		0.005
Outcome data available at 6 years		(n = 202)	(n = 39)		
K-ABC MPC [Mean (SD)]		83.8 (18.5)	73.1 (20.5)	-17.2 to -4.2	0.001
Serious cognitive impairment (MPC <-2SD)†		73 (36%)	25 (64%)	12 to 44	0.001
Serious composite disability		84 (42%)	26(67%)	9 to 41	0.004

* n=219 for sex and gestational age, n=218 for remaining variables as one child was initially identified at the 11-year follow-up. # n=88 excluding two children who died between the 6-year and 11-year follow-up. † Serious cognitive impairment at 6 years is classified according to the Mean (SD) of the comparison group. BSID-II MDI = Bayley Scales of Infant Development, 2nd Edition, Mental Development Index. K-ABC MPC = Kaufman Assessment Battery for Children, 1st Edition, Mental Processing Composite.


50
40
30
20
10
0
Percent of children
25%
3%
45%
9%
9%
1%
7%
5%
3%
Extremely preterm
Classmates
One-to-one support
Small group support
Psychologist
Physio/ Occupational Therapist
Speech & Language Therapist
Outreach teacher
Type of SEN provision