National Foundation for Educational Research

International thematic probe:

The influence of relative age on learner attainment and development

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INCA International Review of Curriculum and Assessment Frameworks Internet Archive

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Executive Summary

This rapid review of research evidence was commissioned by the Qualifications and Curriculum Authority (QCA) to investigate the issue of relative age in the international context. The review set out to examine three questions:

1. To what extent does the age of learners relative to other pupils in their year group affect their attainment and development?
2. Does this relative age affect the attainment and development of some groups or types of learners more than others?
3. Do certain educational policies and practices, particularly those relating to curriculum and assessment, mediate the effect of relative age on attainment and development?

Main findings

The review findings are drawn from 18 research studies published from 2000 to 2008 and carried out in Australia, Chile, the United Kingdom and the USA together with further information supplied by international contacts in 13 countries and states. All of the studies found evidence of statistically significant effects for relative age (comparing the youngest to the oldest in the year group). Key findings on the extent of the relative age effect are:

- Pupils who are younger in the year group do less well in attainment tests (commonly measured subjects are maths, reading, writing and average attainment across subjects).
- Studies conducted in the USA and Chile found that children who are younger in the year group are more frequently retained (meaning that they have to repeat a year of schooling).
- Evidence from the United Kingdom and the USA shows that relatively younger children are more frequently identified as having special educational needs.
- Evidence from two British studies found a statistically significantly higher incidence of psychopathology and referral to psychiatric support services among relatively younger children.
- Relative age effects for attainment are quite large (effect sizes of up to 0.8) for young children, measured soon after they start school. There is a smaller relative age difference among older primary children but the difference remains ‘educationally significant’ throughout primary school. At secondary stage, the difference is still apparent but is usually not educationally significant (i.e. effect sizes are typically below 0.25).
- There was limited evidence to establish whether relative age particularly affects the attainment and development of certain groups of learners. The available evidence suggests that the effects of gender, economic

deprivation, ethnicity and relative age operate independently of one another.

- There was limited direct evidence to support particular educational policies and practices in reducing relative age effects, apart from the adoption of age standardised tests.

Conclusions and Implications

The most obvious explanation for relative age effects is that assessment results are not adjusted to take account of the fact that children are younger or older when taking the test. Other explanations that could contribute to this effect are: age in relation to peers (age position effect) and age on starting school. A child's age position could contribute to poor performance and even psychological problems if younger children cannot access a curriculum aimed at older children, if they experience failure or stress, or compare themselves unfavourably to their older classmates. Age on starting school could contribute to relative age effects if younger children find it harder to adjust to the transition or to meet the requirements of a formal curriculum.

Another possible explanation for relative age effects is length of schooling (in a system where children enter school at different points during the year, according to their date of birth). The review found that evidence for different lengths of schooling contributing to the magnitude of relative age effects was inconclusive. Even though length of schooling could possibly contribute to the differences in outcomes, it could not be the main reason for relative age effects because these are found in groups of children who all entered school at the same time.

The review rejected the hypothesis that children who are younger in the year group suffer from developmental delay or brain injury due to pre-natal exposure to seasonal illness or environmental deficit. This explanation was undermined by clear evidence that children who are born at the same time of the year in countries with similar seasonal conditions, have better or worse outcomes according to whether they are younger or older in relation to the school year. This means that relative age effects are most likely to be caused by the educational system, rather than by any inherent characteristics for children who are born at certain times of the year.

The strategies identified as most likely to help reduce relative age effects are:

- **Assessment:** use age standardised tests; enter children for assessment when ready. It is likely that the use of age standardised tests would remove the relative age effect in academic achievement entirely (as has been demonstrated in Northern Ireland) and could reduce effects for other outcomes (such as SEN identification and psychiatric problems).
- **Curriculum:** ensure that the curriculum is appropriate for relatively younger children, especially in the early years of schooling when relative age differences are greatest.

- **Pedagogy:** use developmentally appropriate pedagogy, especially in the early years of schooling. Ensure teachers are aware of relative age effects and that they know which children are the youngest in the class; enable younger children to have leadership opportunities and encourage them to value their own achievements rather than to compare their progress with that of older classmates.
- **Referral for special needs and psychiatric support:** monitor referral rates for the relative age effects; review the identification process to avoid relative age being mistaken for developmental delay; raise awareness of this issue among those responsible for decision-making.

The practices of deferring entry for children not considered to be ‘ready’ for school or requiring children to repeat a year are not recommended for addressing relative age effects.

The evidence suggests that the Government’s attention should be focused on ensuring developmentally appropriate and positive experiences for relatively younger children in the primary school and also on ensuring that the process for identifying children with special educational needs takes account of relative age. This, together with taking account of relative age effects in assessment results, would help to ensure that that differences in children’s birth dates do not become a continuing source of disadvantage for children and young people.

About the review

This rapid review sought national and international research evidence on relative age effects, published in English between 2000 – 2008. Searches of social science and education databases yielded 92 items which appeared to fit the parameters. The team attempted to obtain the full text of 29 most relevant items, 18 of which were included in the review.

An email enquiry was sent to contacts in all of the countries covered by the INCA Archive[1], 13 of whom replied. The email outlined the findings of the literature review and asked contacts about any research in their country/state which either supported or refuted the findings. Contacts were also asked for information on any strategies or policies which may have been implemented to counteract the relative age effect and of any evidence of their impact.

Because this review was carried out in a period of four months, there are inevitable limitations on the completeness of the evidence base and the depth of analysis carried out.

[1] In addition to the INCA Archive, a contact in Chile was provided by the Qualifications and Curriculum Authority.

1. Introduction

1.1 Purpose and policy context

As part of its commitment to building the evidence base for the curriculum in England, the Qualifications and Curriculum Authority (QCA) has commissioned the National Foundation for Educational Research (NFER) to investigate the issue of relative age in the international context. The NFER is undertaking this through a rapid review of international literature, followed by a request for information to international contacts, asking them to clarify and supplement the international research evidence.

In January 2008, The Secretary of State for Education wrote to Sir Jim Rose, asking him to lead an independent review of the primary curriculum (DCSF, 2008). The letter stated:

> *Entry to primary school can be problematic for summer-born children. For example, summer-born children are up to a year younger than their classmates when they sit tests at the end of each key stage. This can affect their performance right though school up to the age of 16. I would like our review to give particular consideration to how we can design the curriculum to improve outcomes for summer-born children.*

This rapid review was commissioned to contribute to the review of the primary curriculum. It focuses on the impact of relative age on learners' attainment and development at school. The term 'relative age' refers to the age of children within a given school year group. In England, this is commonly referred to as the 'summer-born' effect, because children who are the youngest in the school year-group are born in the summer months, with their birthdays falling in the summer term of the academic year (May to August birth dates).

The key questions for the rapid review are:

1. To what extent does the age of learners relative to other pupils in their year group affect their attainment and development?
2. Does this relative age affect the attainment and development of some groups or types of learners more than others?
3. Do certain educational policies and practices, particularly those relating to curriculum and assessment, mediate the effect of relative age on attainment and development?

Features of the school system and environment of particular interest in relation to their impact on relative age effects included: school starting age, structure, curriculum organisation, and teaching and learning. Outcome measures of particular interest were pupil attainment and personal development. The review included children in the early years, primary and secondary education, with a particular focus on primary schooling.

1.2 Rapid review process

This review was completed during August to December 2008. It included national and international literature, written in English, published during the period from January 2000 to July 2008. It involved systematic searches of: the Applied Social Sciences Index and Abstracts (ASSIA) database; the Australian Education Index; the British Education Internet Resource Catalogue (BEIRC); the British Education Index; CERUK Plus; ChildData; Educational Resources Information Center (ERIC); the International Bibliography of the Social Sciences (IBSS); and the PsycInfo database. (Further information on the search strategy is provided in Appendix 1.) The review parameters included research and policy information (published articles, reports and unpublished material such as conference papers). It focused on primary education (children aged four to 11 years), but included secondary and early years education, where relevant.

The search results were first screened to ensure that they fit within the date parameters and did not contain duplicates. The review team then prioritised the results, to identify the items of most relevance to the review questions (based on the information provided in the abstracts). This was done independently by two members of the review team. In addition to considering the relevance of each item, the team also took into consideration the country of origin. Items from countries not already represented in the selection were given a higher priority, because of the interest in including examples from a range of countries with different educational systems and structures.

The team obtained a full copy of the priority items for further appraisal and prepared summaries of their findings in relation to the review questions. The team also checked the references cited in these studies to see whether they identified any further material of interest to the review that had not been found in the database searches. Some of the research papers were highly technical in nature, so the team referred certain papers to NFER's statisticians who helped to check the quality and interpretation of statistical analyses. All the evidence cited in this review has passed basic checks of research quality.

A second phase of the review involved collecting further information from international contacts (see Section 2.3).

1.3 Extent and coverage of the evidence base

The review identified 92 items of literature which appeared to fit the review parameters (on the basis of information provided in the abstracts), 29 of which were identified as being highly relevant to the research questions. The research team found that much of the literature identified in the keyword searches was not directly relevant to the review because it focused on the effect of the school starting age, rather than on a child's age relative to other students in the year group. The team attempted to obtain all of the 29 most relevant items. We were unable to obtain six items: four (Bishop, 2008; Fleischman, 2007; Schrage, 2007 and Yesil-Dagli, 2006) because they were dissertations, which the British Library was unable to obtain. The other two were not available even though they were published articles. Chow (2007) was published in an Australian journal, which would not have arrived in sufficient time to be included in the review. Greenwood and Ayre (2005) was not included because the British Library was unable to obtain the article.

Of the 23 items obtained, five were rejected after reading the full text. Three of these were rejected because they did not address the research questions: Blake and Finch (2000), Kavkler (2000), Tymms *et al.* (2000). Two articles (Kawaguchi, 2006 and Plug, 2001) both analysed the effects of relative age on outcomes for young people and adults once they had left compulsory education: these items were rejected because they did not report any outcomes for young people in primary or secondary education, as specified in the review parameters.

The total number of research studies identified in the literature searches and included in this review is 18. They comprise studies carried out in Australia, Chile, the United Kingdom and the USA. Additional evidence was supplied by contacts in13 countries/states.

1.4 Review limitations

This was a rapid review of literature, conducted in a period of just two months. The review has a number of limitations which affect the completeness of the evidence base and the depth of the analysis carried out.

- The review focused on national and international literature dating from the period 2000–2008 and available in English only. A range of database searches was conducted but there are other databases and websites that could have been searched. No hand searches were carried out.
- The review was carried out in a very short timescale, and therefore allowed limited time to obtain and assess material. As noted above, a small amount of material could not be included because it was not possible to obtain it in time.
- While all of the summaries of research were checked by another member of the team for coherence and completeness, there was insufficient time and resources to carry out independent checks of the accuracy of all of the summaries.

1.5 Possible explanations for season of birth effects

The season of birth effect, whereby UK children born in the autumn months perform best and children born in the summer months perform least well at school, has been recognised for many years. It has been identified as a source of inequality and many recommendations have been put forward for actions that should be taken to address relative age effects. In order to make rational decisions about which actions to take it is important to understand more about the nature of the phenomenon and why it occurs.

A number of possible causes of season of birth effects have been identified, the most common of which are set out below.

- **Pre-natal effects**: this explanation suggests that children born in the summer are affected by seasonal conditions (such as low temperatures and lack of sunlight) and illnesses (such as influenza) which are more prevalent in the winter months when they are in the early stages of pre-natal development. It is thought that this could result in brain damage or developmental delay.
- **Age at testing** (absolute age effects): this explanation holds that season of birth effects are an artefact of the assessment system. Children who are youngest in the year group are also youngest and therefore least mature when tested. If all children were tested at the same age, this hypothesis suggests that apparent differences in attainment would disappear.
- **Age in relation to peers** (age position effects): this suggests that being oldest in the class gives children an advantage because they are more developmentally mature, receive more positive feedback from teachers and assume a 'leadership' position; whereas the reverse is true for the youngest children in the class. Younger children may compare themselves with older classmates, leading to feelings of inadequacy, with resulting damage to their feelings of competency and self worth.
- **Age on starting school**: developmental differences are greatest when children are young. This explanation suggests that age on starting school may be important because the youngest children are least able to cope with the demands of a 'formal' curriculum, and are more likely to experience stress and failure.
- **Length of schooling effects**: if the admission system has more than one entry point during the year (e.g. termly or biannual entry), younger children are usually admitted last and therefore receive less schooling than their older peers. Less exposure to learning may lead to poorer performance in school assessments.

The rest of this report considers the research evidence and identifies which of these explanations is best supported by the evidence.

2. Review Findings

This part of the report considers the evidence from 18 studies in relation to the questions set for the review. Summaries of each study are provided at the end of this report.

2.1 To what extent does the age of learners relative to other pupils in their year group affect their attainment and development?

Seventeen of the 18 studies looked for relative age effects and all of them found evidence of such effects. (The exception was the study by Datar, 2006, which focused on the impact of delaying entry to school, taking account of relative age, rather than presenting direct evidence of relative age effects). The 17 studies included children of different ages and used a variety of outcome measures, falling into five main categories: school attainment (typically literacy and numeracy tests); intelligence tests; progress through education (grade retention and college entrance); special educational needs identification; and mental health.

Thirteen studies included measures of **attainment,** and twelve of them found evidence of relative age effects. The study that did not do so was Cascio and Schanzenbach (2007), although the authors concluded that age effects were contributing to children's achievement scores at grade 8 (age 13 to 14 years). In addition, one study (Gledhill *et al*., 2002) found no evidence of relative age effects in age standardised[2] tests of reading and spelling. However, the most common finding was that children who were the oldest in the year group out-performed the youngest in the year group in all or most measures (including maths/numeracy, reading, phonics, writing, general knowledge and average attainment across a range of subjects). There were mixed results for science, with one study (Daniels *et al*., 2000) finding no relative age effects[3], whereas two others found evidence of a relative age effect for science (Moon, 2003; McEwan and Shapiro, 2008). The two studies that used intelligence tests as an outcome measure (Gledhill *et al*., 2002 and Lawlor *et al*., 2006) found no evidence of a relative age effect.

Evidence on **progress through the education system** was provided by three studies from the USA and Chile (Cascio and Schanzenbach, 2007 and Martin *et al*., 2004; McEwan and Shapiro, 2008). All found that children who were younger in their grade were more frequently retained (meaning that they had to repeat a year of schooling). Cascio and Schanzenbach (2007) also considered whether secondary students applied for college entrance, but found no significant differences between relatively older and younger students on this measure.

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[2] The results of age standardised tests are adjusted to take account of a person's age when taking the test, which has the effect of compensating younger entrants.

[3] See also Schagen (2008) in Section 2.3, which found no evidence of age effects in science results.

Seven studies investigated the influence of relative age effects in **special educational needs** (SEN) identification (Crawford *et al*., 2007; Gledhill *et al*., 2002; Martin *et al*., 2004; Polizzi *et al*., 2007; Wilson, 2000) and one included a measure of children's behaviour (Menet *et al*., 2000). All found evidence of statistically significant relative age effects, with the youngest children in the year group being more frequently identified as having SEN or poor behaviour.

Finally, two studies investigated **mental health** indicators. Both found evidence of significant relative age effects in measures of psychopathology and psychiatric disorders (Goodman *et al*., 2003) and referrals to psychiatric support services (Menet *et al*., 2000).

2.1.1 How big is the effect and how long does it last?

It can be difficult to answer the question 'How big is the relative age effect?' when attempting to synthesise evidence from different studies. Few studies provide information about the extent of the effect in relation to the influence of other factors and/or consider its persistence over time.

Many studies use tests of statistical significance, which are useful in indicating the probability that a given difference could be the result of chance, but are less helpful in judging the extent of an effect because they are influenced by the sample size (it is possible for a small effect to achieve statistical significance in a large sample or a large effect to fail to achieve statistical significance because the sample is small). An effect size is a useful means of making comparisons to be made across studies. An effect size represents the difference found by dividing the observed difference between two groups by the standard deviation of the scores in the relevant population. An effect size of 1 is equivalent to a difference of one standard deviation in the outcome. A useful rule of thumb in considering the importance of a given value is that an effect size of 0.25 or more is likely to represent a finding which is of educational, as well as statistical significance (Gray *et al*., 1990, Slavin and Fashola, 1998). The US What Works Clearinghouse[4], which provides a highly regarded resource of evidence of 'what works' in education, also sets an effect size of at least 0.25 as the minimum level indicating that an educational intervention has an impact and that is worth consideration for wider adoption.

The evidence suggests that the difference between relatively younger and older children is educationally significant at an early age (for example, when children start school) but becomes progressively smaller as children grow older. This trend was evident across the studies and was found in two studies which reported results for both primary and secondary age-groups (Crawford *et al*., 2007; Oshima and Domaleski, 2006). On the other hand, McEwan and Shapiro (2008) found larger relative age difference among 14-year-olds than ten-year-olds, although their study used entirely different samples and measures to consider relative age effects in children of different ages.

[4] See http://ies.ed.gov/ncee/wwc/

Oshima and Domaleski (2006) studied academic performance in a US sample of approximately 115,000 children. Results indicated much larger effect sizes for relative age differences among younger children. Kindergarten (age five) effect sizes were 0.38 for reading, 0.55 for maths and 0.50 for general knowledge. Differences between relatively older and younger students in reading and maths were statistically significant for grades 1 – 5 (ages 6 to 11), but not for grades 6-8 (ages 11 – 14). The authors comment that the most statistically significant predictors of positive reading and maths attainment across all age ranges were ethnicity (which explained 10-15 per cent of the variance in scores), followed by relative age (which explained seven per cent of the variance) and gender (which explained one per cent).

A similar trend for relative age effects to be larger in the early years of schooling was found in a study of English national curriculum test results by Crawford *et al*. (2007). Effect sizes were at an 'educationally significant' level during primary education (Foundation Stage, key stages 1 and 2), but not at secondary school levels (key stages 3 and 4). This is shown in Figure 1 below.

Figure 1. Difference in performance between August-and September-born children by key stage results in England

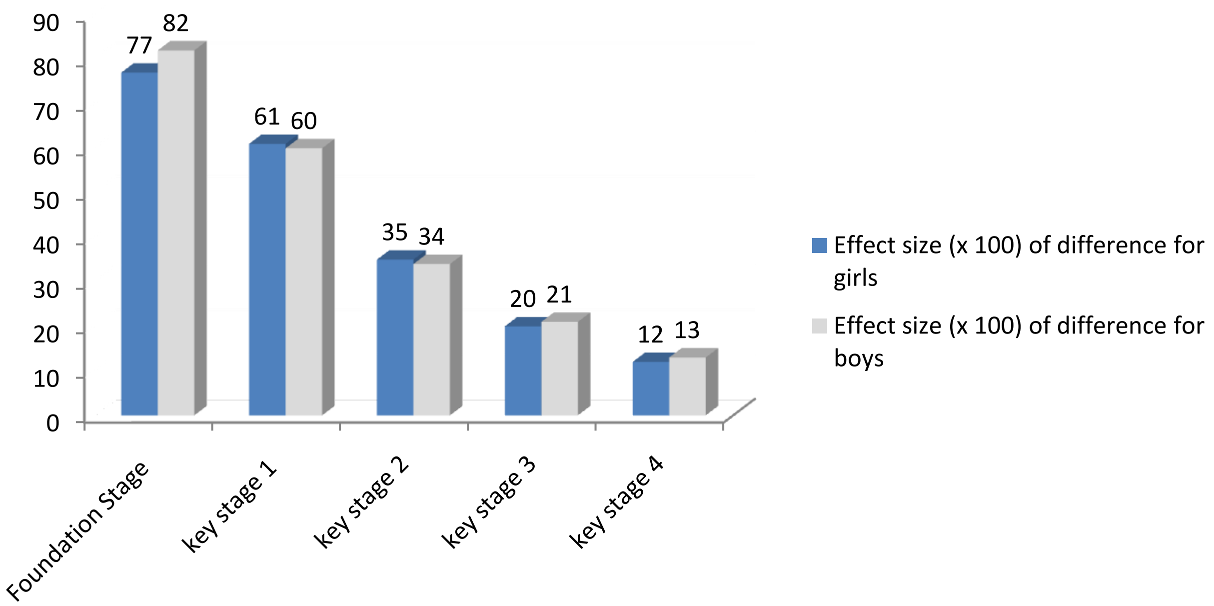

Figure 1 is derived from the study by Crawford *et al*. (2007). It contains information from several large national datasets recording pupils' background characteristics and test performance at different key stages. The bars represent the average difference in results achieved by September- and August-born children from three different cohorts. The figure shows a similar pattern for boys and girls. The difference between children who are youngest and oldest in the year group is largest in the Foundation Stage (age four to five) and is still large at key stage 1 (age six to seven). At key stage 2 (age ten to 11), the effect size is much smaller, but is still large enough to be considered educationally significant. However in secondary school, although the differences are statistically significant, they are not large enough to be considered educationally significant.

The evidence suggests that relative age effects could have a considerable impact on children's life chances in different educational systems. For example, a study conducted in Georgia, USA, by Martin *et al*. (2004) found effect sizes ranging from 0.21 to 0.28. Summer-born children (June to August) were more likely to be 'overage' for their grade. This was due to academic 'redshirting' (parents holding their child out from starting school for a year) or grade retention (children repeating a year). The authors went on to point out that 25 per cent of the summer-born group were overage for their grade and another five to ten per cent were placed in classes for children with specific learning disabilities.

Other studies gave some insight into the strength of relationship between relative age and outcomes associated with SEN status and mental health. For example, Gledhill *et al*. (2002) found that 23 per cent of British summer-borns were classified as having SEN, compared with 17 per cent of spring-borns and 15 per cent of autumn-borns.

2.2 Does relative age affect the attainment and development of some groups or types of learners more than others?

We know that certain background characteristics are associated with better or poorer progress at school. For example, children from economically disadvantaged families are less likely to achieve well at school, and the achievement of girls differs from that of boys. The question for this review is whether there is evidence that younger children with particular characteristics do less well (i.e. is there a 'multiplier' effect for relatively younger children)?

Five of the studies investigated the influence of family and individual characteristics (namely ethnicity, economic deprivation and gender) on outcomes for children who were younger within the year group. Results of these investigations, taken together, provided no consistent evidence that relative age effects had more impact on certain groups of young people.

Two of the studies found indications of different relative age effects among groups with certain characteristics. Cascio and Schanzenbach, (2007) found that younger children from economically deprived backgrounds were less likely to take college entry exams and Martin *et al.* (2004) found a stronger correlation between relative age and being diagnosed with specific learning difficulties for boys than girls.

Three of the studies found no evidence of differential relative age effects. Wilson (2000) found that summer-born boys were not at a greater risk of being diagnosed as having SEN than summer-born girls and Crawford *et al*. (2007) found no evidence of significant relative age effects for gender or ethnicity. Daniels *et al*. (2000) concluded that effects of relative age, length of schooling, gender and socioeconomic status operate independently of one another.

2.3 Do certain educational policies and practices, particularly those relating to curriculum and assessment, mediate the effect of relative age on attainment and development?

Although research into relative age effects is useful in identifying the existence and extent of this phenomenon, it is less helpful in identifying evidence about strategies to reduce or remove the effect.

One policy-related issue that was addressed in two of the studies was the influence of **length of schooling** on relative age effects. In a system of termly entry to school (three intakes, at the beginning of each school term) or biannual (two points of entry, usually in the autumn and spring terms) and termly entry (three entry points a year). Crawford *et al.* (2007) found evidence of a small, short-lived advantage at for younger children who started school in September rather than later in the school year. The difference was evident in key stage 1, but not in results obtained by older children. Daniels *et al.* (2000) found no difference in attainment at key stage 1 for summer-borns who started school in September compared with those who started school one or two terms later.

The second phase of the study aimed to gather further information on the policies and strategies used in other countries, together with their impact on the relative age effect. The review team sought information from international contacts, both those in countries identified in the rapid review and others for which no evidence had been identified (because this may have been an indication that these countries had effective strategies in place). This work took place during October and November 2008.

The NFER team emailed contacts in 26 countries and states, representing all of the contributors to the INCA Archive[5], plus Chile (because one of the recent research studies identified in the literature review had originated in Chile). Contacts were asked for information about the nature and extent of relative age effects in their country/region and whether they had any policies or strategies in place that had the effect of reducing relative age effects.

The countries and states included in this phase were:

Australia – Queensland*
Australia – Tasmania*
Australia – Victoria*
Canada – Alberta*

[5] INCA is QCA's International Review of Curriculum and Assessment Frameworks Internet Archive at www.inca.org.uk. It is managed and updated by the International Information Unit at the National Foundation for Educational Research (NFER). INCA provides descriptions of government policy on education for 20 countries (three of which are federal, so information is collected from nine states – three in each country). It focuses on curriculum, assessment and initial teacher training frameworks for pre-school, primary, lower secondary and upper secondary education in schools (3-19 age range).

* In some countries with federal systems, the information provided relates to the education system at sub-national (state) level.

Canada – British Columbia*
Canada – Ontario*
Canada – Saskatchewan*
Chile
France
Germany
Hungary
Ireland
Italy
Japan
Korea
New Zealand
Northern Ireland
Scotland
Singapore
Spain
Sweden
Switzerland
The Netherlands
USA – Kentucky
USA – Maryland
Wales.

The team received responses from contacts in 13 countries/states (Australia – Queensland, Australia – Victoria, Canada – British Colombia, Chile, Germany, Italy, Japan, New Zealand, Northern Ireland, Switzerland, The Netherlands, USA – Kentucky and Wales). Several of the respondents expressed an interest in this study, but few supplied evidence of relative age effects in their countries.

Further information about relative age effects was provided by Queensland – Australia; New Zealand; and Japan.

In **Queensland**, the results of an evaluation of alternative pre-school programmes (Thorpe *et al*., n.d.) included some analysis of relative age effects. A total of 1831 children were assessed just after entry to the preparatory year (most of the children in the sample were aged from four to five years). The assessments measured children's attainment in five domains (social-emotional, communication, literacy, numeracy and motor development). In addition, teachers were asked to rate how well the children in their class had settled into school. Older children had statistically significantly higher scores in numeracy, literacy and motor development, but there were no age-related differences for social-emotional behaviour, communication skills or settling into school.

In **New Zealand**[6], the school year matches the calendar year: schools open around the end of January and close in mid December. Children are admitted to school by chronological age, rather than at a particular point in the school year. Although children do not have to attend

[6] This section was amended in 2012, following comments from Geraldine McDonald, who supplied additional information on the New Zealand school system.

school before the age of six they are permitted to enter at age five and most do so on their fifth birthday or shortly after. The names of the levels of schooling have altered over the years but they are now called Years. There is no formal reception class and children enter Year 1 throughout the year. For administrative purposes children who enter after 1 July are classified as Year 0 and Year 1 the following January. Schools may organise a 'New Entrants group' from which children are filtered out into more advanced groups.

At the end of their second year of schooling children generally progress to Year 3 having been at school for between 1½ to 2 ½ years. Children are promoted at the end of the year but the cut-off point for promotion is 1 July (which is mid-year). However, schools generally establish an earlier cut-off date to create a group of mid-year entrants who are born in June, May or April and are the youngest in the year group. Some are retained for a further year and a very few born in August or September may be accelerated. The selection process generally involves the parents and because promotion or retention past that point is virtually automatic, it establishes the year groups for subsequent years.

The Ministry of Education carried out some additional regression analysis of age effects within the national data collected for international comparative studies of reading, maths and science (Schagen, 2008). The Progress in International Reading Literacy Study (PIRLS) was designed to measure trends in literacy achievement at the middle primary level. The Trends in International Mathematics and Science Study (TIMSS) was designed to measure trends in science and mathematics achievement at the middle primary and lower secondary levels. Nearly 6,300 Year 5 New Zealand pupils from 243 schools took part in the main survey of PIRLS at the end of 2005. The TIMSS study took place in November 2006 and involved around 6000 Year 5 students in New Zealand.

Schagen (2008) carried out a regression analysis of the reading (PIRLS 2005), maths (TIMSS 2006) and science (TIMMS 2006) results. The analysis took account of certain key factors known to influence attainment (gender, books in the home), as well as 11 indicators for birth month (February to December, with January as the comparison).

Results of this analysis showed that birth month had a significant effect on children's reading and maths scores, with older children tending to have higher attainment. For reading, children with a July birthday (the oldest in the class) were significantly more likely to achieve the highest reading scores. For mathematics, children with birthdays in June through to November were significantly more likely to achieve the highest scores (children with July to November birthdates would be expected to be among the oldest in the class). Children born in February were significantly more likely to have the lowest maths scores. No significant age effects were found for science. The most likely explanation for the observed trends in the reading and maths results is that they reflect the children's age when tested. Further statistical models were fitted which included both birth month and age. This revealed a few instances where birth month was significantly related to attainment, even controlling for age on testing. There were positive effects for children born in July for reading and for children born from June to November for mathematics. There was a negative effect for children born in February in mathematics. There is no obvious explanation for these additional effects.

In **Japan**, the school year starts on April 1st and ends on March 31st. As the cut-off date is April 1st, children born on 2nd April are the oldest in the year group. Children born in the three months from January to April are known as the 'haya-umare' (early born). The phenomenon of relative age effects is well known in Japan, with parents of early-born children concerned about possible educational disadvantages. Japanese early childhood practitioners are aware of the influence of age on children's social and physical development (Abe *et al*., 1998). Enrolment in private and national junior high schools (which depends on performance in entrance examinations) has shown evidence of an advantage for students born in April. Research by Kawaguchi (2006) found a slight disadvantage for early-born children throughout their compulsory education. Kawaguchi and Mori (2007) found evidence of relative age effects in the Japanese national results from TIMMS in 1995 and 1999; and PISA in 2003.

Evidence on international policy

Most of our contacts provided no information about policies to address relative age effects. However, the respondent from **Northern Ireland** pointed out that the results of the Transfer Procedure Test (used to select pupils for grammar school entrance) are age-adjusted to remove relative age differences in performance, and that an evaluation of the test results shows the age adjustment to have ensured a fairly even distribution of successful candidates with different birth months (Gardner and Cowan, 2000).

Three of the international representatives (from the Netherlands, Germany and Switzerland) mentioned school entry policies and the practice of allowing early entry for some (often older children), holding back children not considered to be ready to start school and/or requiring children to repeat a year. Their information is summarised below.

In **the Netherlands**, most children enter the educational system at the age of four (attendance is compulsory at age five). Children therefore spend up to two years in kindergarten before progressing to primary school at age six. The Education Inspectorate has evaluated the success of keeping children of four or five years old in kindergarten for an additional year if they seemed too immature to enter primary school. The policy was not found to be effective, as children still appeared to have the same developmental issues after their extra year in kindergarten. Schools can decide whether to ask children to repeat a year if they fail to attain the required level. This affects about two per cent of the primary school population in the Netherlands (the effectiveness of this policy has not been evaluated).

Similarly, in **Germany**, the main issue of interest is 'school maturity' rather than relative age. Compulsory schooling starts on the 1st of August for children who have reached their 6th birthday by a qualifying date. Following recommendations from the Standing Conference of Ministers of Education and Cultural Affairs in 1997, the Länder were able to set the qualifying date between 30th June and 30th September. Children whose sixth birthday falls between 1 July and 31 December (i.e. those who are relatively older) may be permitted to start school early at their parents' request, provided they have reached the required level of physical and mental maturity.

The aim of the early entry policy was to reduce the number of children starting school later than their classmates and to encourage parents to send their children to school as early as possible. Research comparing children who started school early with those who started at the normal time showed two contradictory findings. More ‘early starters’ had to repeat a grade before the end of compulsory schooling (at age 16). On the other hand, more normal than early starters were considered ‘unsuited’ for academic secondary school (Gymnasium) by their primary school teachers.

In 2003, another policy was adopted in Germany to enable all children to progress automatically from the first to the second grade in primary school. The purpose of this policy was to give children longer to adapt to the demands of school and to avoid having to repeat a year so soon after starting school.

In **Switzerland**, the effects of starting school earlier were investigated using the 2003 PISA dataset of mathematics results. Students who started school half a year earlier were found to have performed less well in mathematics at the end of compulsory school.

In addition to the specific answers given above, three contacts (in Australia – Victoria; Germany, and the Netherlands) stated that their current educational policy emphasises the importance of understanding and responding to the needs of each individual child.

Table 1 provides a summary of policy recommendations drawn from research and/or based on the information provided by our international contacts.

Summary of policy recommendations to reduce relative age effects

Table 1 Summary of policy recommendations and related evidence

Recommendation	Evidence
Age standardisation of test results	Widely recommended. Gledhill *et al*. (2002) found no relative age differences when using age standardised tests. In Northern Ireland, the results of the Transfer Procedure Test (11 plus) are age-adjusted to remove relative age differences in performance.
Later/earlier entry to formal education	Small positive effects of later entry to school were found by Datar (2006). Contradictory effects of early starting for relatively older children were reported in Germany; negative associations between early starting and mathematics attainment were reported in Switzerland[7].
Equalising length of schooling for all children in the year group	Mixed results reported. Crawford *et al.* (2007) found a small, short-lived advantage for younger children who started school in September. Daniels *et al.* (2000) found no difference for summer-borns who started school either later than or at the same time as their classmates.
Deferring school entry by a year for relatively younger children so they join the next year group[8]	Lincove and Painter (2006) found no benefit from younger children deferring entry to school by a year, although there appeared to be benefits for black children. In the Netherlands, holding back children from starting school was found to be ineffective in helping children to mature.
Schools with more than one form entry could divide the year group to form classes of relatively 'older' or 'younger' children	No evidence of effectiveness
Differentiated (personalised) curriculum for younger children	Widely recommended but no evidence of effectiveness
Raising teacher awareness of relative age effects	Widely recommended but no evidence of effectiveness
Improved systems for SEN and mental health identification	No evidence of effectiveness

7 There is an extensive literature on age of starting school that was not examined for this study because it did not include an analysis of relative age effects.

8 Katz (2000) found the evidence to be inconclusive for benefits of 'academic redshirting' (parents withholding their children from starting school for a year).

3. Conclusion and Implications

This rapid review has considered recent evidence on relative age effects and has found widespread evidence from Australia, Chile, Japan, New Zealand, the United Kingdom and the USA, that children who are younger in the year-group perform less well at school.

There is strong evidence for an educationally significant relative age effect among young children (at the beginning of primary school), particularly in reading, writing and maths. The size of the effect appears to diminish with age, although it is still apparent throughout primary school. A few studies find statistically significant relative age effects in young people of secondary school age, though these differences are not usually large enough to be considered educationally significant. There is little evidence to suggest that relative age effects impact on the attainment of certain groups of learners more than others.

Perhaps less widely recognised is the finding that children who are younger in the year group are disproportionately identified as having special educational needs. The evidence suggests that this is likely to be due to mis-identification (due to a failure to take proper account of developmental differences) rather than the actual needs of the children and young people concerned. This is clearly a matter of concern, not just for younger children but also for relatively older children whose support needs may not be adequately recognised.

Two studies (Goodman *et al*., 2003; Menet *et al*., 2000) provided evidence that children who are younger in the year group have a higher incidence of mental ill health and referral to mental health services. In the study by Goodman *et al*. (2003) researchers used data collected in 1999 on a nationally representative sample of over 10,000 British five- to 15-year-olds. They found that relatively younger children had greater levels of psychopathology symptoms and psychiatric disorders. It is difficult to identify the causes of this relationship between relative age and mental health, although it could possibly be due to relatively younger children experiencing greater stress and lower attainment at school. However, as the authors point out, this phenomenon could have important implications for public health:

> *More than 8 million children aged 5-15 live in Britain, of whom approximately 750000 probably have a psychiatric disorder. Around 60,000 of these cases of child psychiatric disorder might be prevented if the youngest and middle children in a school year were at no more risk than the oldest children.*
>
> Goodman *et al*. (2003) p. 4

This review has enabled us to consider some of the most popular explanations given for relative age effects.

- **Pre-natal effects**: this explanation was not supported by the evidence. Relative age effects followed the pattern of the academic year, not the seasons. Children who were born at the same time of year and whose mothers experienced similar climatic conditions during their pre-natal development, had better or worse results according to their age in relation to the academic year (see Goodman *et al*., 2003; Lawlor *et al*., 2006; Menet *et al*., 2000).

- **Age at testing**: this appears to be a likely explanation of relative age effects (i.e. that the test results of younger children simply reflect the fact that they are less mature when they took the test). Use of age-adjusted assessments can reduce or remove the impact of relative age on test scores (Gledhill *et al*., 2002; Gardner and Cowan, 2000)
- **Age in relation to peers**: this explanation is neither confirmed nor ruled out by the evidence. It is possible that age position effect could contribute to low self-esteem and stress among younger children, but there is no direct evidence for this in the literature examined in the review.
- **Age on starting school**: One study (Datar, 2006) suggested that relatively younger children received an academic advantage from starting school at a later age. But the evidence is not clear cut on the effects of starting formal education at a younger or older age. (There is a large body of research into the effects of age on starting school, which was not examined as part of this review, because of our specific focus on relative age effects.) Children's experience of the transition as well as the curriculum and pedagogy offered, are likely to be important contributory factors.
- **Length of schooling effects**: Again, the evidence on the effect of younger children starting school later (and therefore having less schooling than their peer group) is not conclusive, suggesting either a small negative effect (Crawford *et al*., 2007) or no effect (Daniels *et al*., 2000) on children's attainment. It is clear that length of schooling could not be the main cause of the phenomenon because relative age effects exist where all children in the year group start school together and have the same length of schooling.

It was difficult to find direct evidence of the effectiveness of different policies in reducing the impact of relative age effects. However, the adoption of age standardised tests has been shown to be effective in removing age effects in 11 plus tests in Northern Ireland (Gardner and Cowan, 2000). Adopting a policy of equalising length of schooling for all children (i.e. through annual entry to school) appears to have little impact on relative age effects. Evidence from the Netherlands suggests that deferring entry to school appears to be ineffective in improving children's outcomes (although again, there is a large body of literature on this subject which was not examined in this review because it did not focus on relative age effects).

The following recommendations to address relative age effects are supported by this review, either because there is direct evidence of effectiveness, or because the recommended strategy is well placed to address the most likely causes of relative age differences.

- **Assessment:** use age standardised tests; encourage use of age conversion calculations for non-age standardised tests; enter children for assessment when ready.
- **Curriculum:** ensure that the curriculum is appropriate for relatively younger children, especially in the early years of primary school; encourage personalisation/differentiation to enable younger children to access the curriculum

at an appropriate level; reduce sources of failure/stress for relatively younger children.

- **Pedagogy:** adopt a developmentally appropriate pedagogy for relatively younger children, especially in the early stages of education. Ensure teachers are aware of relative age effects and that they know which children are the youngest in the class (e.g. by putting the class register in birth date order); enable younger children to have leadership opportunities and encourage them to value their own achievements rather than to compare their progress with that of older classmates.
- **Referral for SEN and psychiatric support:** monitor referral rates for relative age effects; review the identification process to ensure that a normal rate of development among younger children is not mistakenly identified as indicating a learning difficulty or psychiatric condition; use standardised assessments rather than relying exclusively on referrals; raise awareness of this issue among support services and professional groups.

The evidence **does not support** the effectiveness of the following policies as a response to relative age effects:

- **deferred entry to school** (relatively younger children starting school a year later)
- **retention** (requiring children to repeat a year after they have started school).

The evidence suggests that the Government's attention should be focused on ensuring appropriate and positive experiences for relatively younger children in the primary school and also on the process for identifying children with special educational needs so that differences in children's birth dates do not become a source of continuing disadvantage for children and young people.

4. Summaries of Evidence

This section contains summaries of each of the 18 studies included in the literature review. The following table shows the review questions addressed by each of the studies. The review questions are:

1. To what extent does the age of learners relative to other pupils in their year group affect their attainment and development?
2. Does this relative age affect the attainment and development of some groups or types of learners more than others?
3. Do certain educational policies and practices, particularly those relating to curriculum and assessment, mediate the effect of relative age on attainment and development?

Table 2 Key to the research summaries

Research study		Review Question		
		1	2	3
1.	Boardman (2006)	●		●
2.	Cascio and Schanzenbach (2007)	●	●	
3.	Crawford *et al*. (2007)	●	●	●
4.	Daniels *et al*. (2000)	●	●	●
5.	Datar (2006)		●	●
6.	Dunsmuir and Blatchford (2004)	●		●
7.	Gledhill *et al*. (2002)	●	●	●
8.	Goodman *et al*. (2003)	●	●	●
9.	Lawlor *et al*. (2006)	●	●	
10.	Lincove and Painter (2006)	●	●	●
11.	Martin *et al*. (2004)	●	●	●
12.	McEwan and Shapiro (2008)	●		●
13.	Menet *et al*. (2000)	●		●
14.	Moon (2003)	●		●
15.	Oshima and Domaleski (2006)	●		●
16.	Polizzi *et al*. (2007)	●	●	●
17.	Wallingford and Prout (2000)	●	●	●
18.	Wilson (2000)	●	●	●

Boardman, M. (2006). 'The impact of age and gender on prep children's academic achievement', *Australian Journal of Early Childhood*, **31**, 4, 1–6.

This study addressed the impact of relative age and gender on the academic achievement of five- and six-year-olds in Tasmania. Performance Indicators of Primary Schools (PIPS) testing for maths, reading and phonics was carried out on children at the start of their first year in Preparatory[9]. Children in the study were between 5.00 and 6.03 years on January 1st 2004.

The study focused on the attainment of the youngest children in the class (aged 5.0) relative to the oldest (aged 6.03) using state representative data for a sample of 884 children from 38 primary and district high schools across three education districts. Attainment in relation to gender was analysed independently of relative age (and is therefore not relevant for the purposes of this review). Research methods involved an analysis of assessment data from PIPS, obtained through teacher questionnaires, and included information on pupil characteristics, such as age and gender. Focus-group interviews were held with 15 teachers to discuss trends in PIPS data analysis.

The **key finding** was that children aged 5.00-5.03 had the lowest mean PIPS score across three PIPS outcomes relative to their older peers. The difference in maths scores were statistically significant for children aged 5.00-5.03 (32.14) and 5.07-5.09 (36.05) with a significance level of $p = 0.002$, and for children aged 5.00-5.03 and 5.10-6.00 (35.89) with a result of $p = 0.006$. For reading, a significant difference at probability level (p) = 0.05 was found between children aged 5.00-5.03 (42.74) and 5.10-6.00 (50.76). Phonics results for children between 5.00-5.03 (10.83) and 5.10 - 6.00 (12.78) were statistically significantly different with a result of $p = 0.046$. The mean score averaged across all three PIPS outcomes was statistically significantly different for children aged 5.00-5.03 (83.37) and 5.07-5.09 (94.97) with a result of $p = 0.045$.

Qualitative data from the focus-groups reinforced the PIPS findings. Teachers stated that the youngest children (born in October and November) were not performing as well as older children due to developmental differences caused by relative age. Teachers felt that PIPS questions and tasks were designed in a way which younger children were less likely to understand. Teachers also found that children who were younger found it difficult to cope with the academic demands of the Prep curriculum. The author recommends changes to the curriculum to include more play-based learning activities that are more suited to the needs of younger learners.

[9] Preparatory is the first year of compulsory schooling in Tasmania. Children are generally aged between 5.0 and 6.0 years old on January 1st when they start school. The academic term commonly begins in late January/early February.

Cascio, E. and Schanzenbach, D. (2007). *First in the Class? Age and the Education Production Function* (NBER Working Paper No. 13663). Cambridge, MA: National Bureau of Economic Research.

The study estimates the effects of relative age on children's academic performance, using data obtained from Project Student-Teacher Achievement Ratio (STAR), which was designed to study the effects of class size on children's achievement. In 1985, kindergarten students (aged 5/6) and teachers in 79 Tennessee[10] schools were randomly assigned to three classes within their schools: small (13-17 children); regular (22-25 students) and regular with a full-time teaching assistant.

The cohort remained in one of the three class types until third grade (aged 8/9), after which they were returned to standard class sizes (the authors do not give precise details of the sample size, although outcomes data is presented on between 4,400 and 6,200 pupils). Only children for whom background characteristics including date of birth, ethnicity, gender, eligible for FSM were available were included in the sample. The study also recorded class data, such as the proportion of those with similar kindergarten classmates (average age, fraction Black, fraction female and fraction eligible for FSM) and teacher characteristics (experience, education and race).

Outcome variables were measured by tests administered to the Project STAR sample from kindergarten through to high school. At the end of kindergarten (spring 1986), children were assessed using the Stanford Achievement Test and children from grades five to eight were tested on the Comprehensive Test of Basic Skills (children in the sample would have completed eighth grade in spring 1994). Both tests are multiple choice tests with reading and maths elements: they are not age-standardised. The final outcome variable was an indicator of whether the sample took their ACT or Scholastic Aptitude Test (SAT) college entrance exams in 1999, some 12 to 13 years later. ACT and SAT are not age standardised.

Key findings revealed no statistically significant differences in assessment scores between the youngest children in the class relative to their peers, irrespective of the size of the class. A child's age position (rank order within class) was not clearly related to their test performance. The authors conclude that both absolute age and age-position contributed to, but did not fully explain the persistence of test score differences in grade 8 (13- to 14-year-olds). Age position was, however, related to their risk of grade retention, with the youngest children more likely to be retained.

There was no relationship between gender and age effects for outcomes at grade 8. But there was a relationship between eligibility for FSM and relative age, with fewer such children taking college entrance exams. For example, free lunch recipients who were in the youngest 25 per cent in their kindergarten classes were 8.4 percentage

[10] In autumn 1985, the academic year in Tennessee began on September 1st and children could start kindergarten if they were five before September 30th. Therefore, children born on September 30th would be the oldest in the class and those born on October 1st would be the youngest.

points less likely to take the ACT or SAT. The authors state that the reasons for this are unclear but speculate that disadvantaged children do not receive sufficient educational ‘investments’ to compensate for the negative effect of being relatively young in the class when they start school.

Crawford, C., Dearden, L. and Meghir, C. (2007). *When You Are Born Matters: the Impact of Date of Birth on Child Cognitive Outcomes in England*. London: The Institute for Fiscal Studies [online]. Available: http://www.ifs.org.uk//docs/born_matters_report.pdf [3 December, 2008].

This study focused on the impact of children's date of birth on cognitive outcomes in England. The authors set out to establish whether differences between August- and September-born children are due to the following effects: absolute age, age of starting school, length of schooling or relative age.

The study analysed data for three cohorts of children who were born in the following academic years: 1997 – 1999 (Group 1); 1990 – 1992 (Group 2) and 1985 – 1988 (Group 3). The project tracked a sample of children from the Foundation Stage (age 5) to Key stage 5 (age 18). For Group 1, a one-in-ten sample of children aged from 5 to 7 was chosen (girls, n = 45,842 and boys, n = 47,908). The ages of Groups 2 and 3 ranged from seven to18, and sample sizes were: Group 2 girls, n = 543,378 and boys, n = 565,376 and for Group 3 girls, n = 736,386 and boys, n = 748,879. The data comprised key stage assessment results for all children in state schools in England.

Key findings showed that in the Foundation Stage, August-born girls (boys) were 0.768 (0.817) standard deviations below September-born girls (boys). For key stage 1, the difference decreased to 0.609 (0.602) and to 0.351(0.337) by key stage 2. At key stage 3, standard deviations were 0.204 (0.212); and 0.116 (0.131) at key stage 4. After controlling for all observable differences which may affect the outcome of August- compared to September-born children, the study found the most significant differences were connected to date of birth.

Children who spent longer in the reception year (September start) did slightly better than those with less time (January or April start dates). However, these differences did not persist beyond KS1.

The study analysed the August birth effect in a number of subgroups, including gender, children eligible for FSM, those living in high deprivation areas, children with SEN, and those from different ethnic groups (Black, Black Caribbean, White British, Pakistani and Bangladeshi). The authors found no statistically significant differences for boys or girls for August-born children relative to September-born children. In terms of FSM status, both September-born children who were eligible for FSM and those who were not eligible scored higher than August-born children, across all cohorts. A higher proportion of August-born children were recorded as having SEN. At Foundation Stage, the difference was statistically significant at the five per cent level for girls but was not statistically significantly different for boys. Across the remaining cohorts, higher proportions of August-born boys and girls had SEN status than September-born boys and girls, with differences significant at the one per cent level. The authors found no statistically significant differences across the ethnic groups for August-born children relative to September-born children.

The authors conclude that their study provides evidence in support of a relative age effect on attainment and SEN status. In most cases, August-born children, regardless of their characteristics, face the same disadvantage relative to September-born children. For this reason, policies aimed at mediating the effects of the August birth effects should benefit all subgroups equally. Policy recommendations include raising teacher awareness of relative age effects so that teachers can differentiate their teaching for children of different ages, age normalisation of test results, testing when ready and adopting more flexible nursery and school starting dates to ensure that August-born children reach the same expected outcomes as September-born children.

Daniels, S., Shorrocks-Taylor, D. and Redfern, E. (2000). ‘Can starting summer–born children earlier at infant school improve their national curriculum results?’ *Oxford Review of Education*, **26**, 2, 207–220.

The article reports on the effects of the age-position of children in their class and considers whether any advantage can be gained by increasing the length of schooling. The study focuses on the results of key stage 1 assessments of two datasets used in the 1991 and 1992 Evaluation of National Curriculum Assessment at key stage 1. Subject assessments were English (reading), English (writing), number and science. They drew a nationally representative sample of seven-year-olds across England of 2500 children in 1991 and 1800 children in 1992, with an equal representation of boys and girls across both samples, for whom data was collected over two years. Data was analysed using multilevel modelling, testing the hypothesis that attainment for summer-born children with seven terms of schooling were significantly different for those with nine terms of schooling. The effects of gender and socioeconomic status were also analysed.

Key findings for the 1991 cohort were that the length of schooling (either seven or nine terms) had no statistically significant effects for summer-borns on any of the four measures. Analysis for children’s age in days showed statistically significant effects for English reading and writing. For reading (writing), the significance level was $p<.05$ ($p<.01$), indicating that older summer born children performed better than younger summer born children. Across the socio-economic group, differences were also statistically significant across all four measures at $p<.001$ level, indicating that summer-born children with a higher socio-economic status outperformed those from a lower socio-economic status. The gender difference was only statistically significant for English (writing), indicating that summer-born girls performed better than summer-born boys.

For the 1992 cohort, there were no statistically significant differences for number of terms attended. For English (reading), children’s age had a statistically significant impact ($p< 0.05$) indicating that older children outperformed their younger peers. Across the socio-economic group, there were significant differences for English reading ($p< 0.001$), writing ($p< 0.05$) and number (0.063, $p< 0.05$), which were all in favour of children from higher socio-economic backgrounds. The difference for gender was only statistically significant for English reading and writing ($p< 0.05$ and $p< 0.01$ respectively), again indicating that summer-born girls scored higher than summer-born boys.

The authors conclude that effects of relative age, length of schooling, gender and socioeconomic status operate independently. The authors do not offer policy recommendations because their sample included children from a number of schools and local authorities with differing admission policies and teaching approaches.

Datar, A. (2006). 'Does delaying kindergarten entrance give children a head start?' *Economics of Education Review*, **25**, 1, 43–62.

This study set out to consider whether school entrance age affects children's attainment and progress in the first two years at school. The researcher used data from the Early Childhood Longitudinal Study – Kindergarten Class which drew a nationally representative cohort of children from about 1,000 US kindergartens in the autumn and spring of the 1998 to 1999 school year. Data was collected at kindergarten entry and again at the end of two years in school (Grade 1). Outcome measures were scores on reading and maths tests (it is not stated whether these are age standardised). The analysis included results for about 13,700 children for maths and 13,000 children for reading. The study focused on children's age in months and their age on entry to kindergarten. The analysis took a variety of child and family variables into account such as race, gender, disability status, number of siblings, mother's education, language spoken at home and poverty status.

In the USA, kindergarten entrance age is determined by each state. The most common compulsory age at which children must be in kindergarten was six. However, there was considerable variation between states, with the entrance age ranging from five in eight states (Arkansas, Delaware, District of Columbia, Maryland, New Mexico, Oklahoma, South Carolina and Virginia) to eight in two states (Pennsylvania and Washington). Parents could also exercise choice over when their children started school. Boys, children from 'white' ethnic backgrounds and children with disabilities were more likely to start kindergarten at an older age. Children from poor families and from families with lower maternal education were more likely to start kindergarten at a younger age.

Key findings showed that children starting kindergarten one year later made greater progress during the first two years at school. The analysis used statistical modelling to remove any effects of being relatively older or younger in the year group. (The author suggests that previous studies using less sophisticated statistical analysis may have underestimated the effects of starting school later.) This study found that children who entered school at an older age made statistically significantly greater progress in reading, taking relative age into account ($p<0.001$). Children who were not disabled made greater progress in both maths and reading when they started school at a later age. Children from poor families and girls also made greater progress in maths when they started school later. Children from non-poor backgrounds, disabled children, non-disabled children and boys made greater progress in reading when they started school at a later age (all these results were statistically significant at the $p<0.05$). The author concludes that the effects of delayed kindergarten entrance by one year are relatively small (effect size of between 0.07 and 0.10), but may be important for later progress, given that early test scores have been shown to predict later academic success. She acknowledges that the study does not establish the impact of a later school starting age after the first two years in school and discusses the possible consequences of setting a later kindergarten starting age (including the increased economic burden on families).

Dunsmuir, S. and Blatchford, P. (2004). 'Predictors of writing competence in 4 to 7 year old children', *British Journal of Educational Psychology*, **74**, 3, 461–483.

This study addresses factors at home and school that influence children's writing attainment in England. Home background variables included socioeconomic status, parental education and whether writing materials were available at home. Assessment measures collected at school entry were based on language (British Picture Vocabulary Scale, Wechsler Pre-school and Primary Scale of Intelligence – Revised and British Ability Scales Verbal Fluency Subtest), knowledge about literacy (Concepts about Print Test and the Letter Identification Test) and measures of writing (British Ability Scales Copying Subtest). Assessment data gathered at KS1 children were linked to National Curriculum writing objectives. Longitudinal data for a sample of 60 children aged four to seven were obtained from four participating project schools, which were selected for variability. The children were divided into season of birth groups, which also related to the term they started school: summer (entry in 1993, 40 per cent), autumn (entry in 1993, 35 per cent) and spring (entry in 1994, 25 per cent).

Methods included semi-structured interviews, questionnaires, structured observation, literacy assessments and analysis of writing samples. Child characteristics such as gender, socio-economic status and family size, birth order, parents' occupation, qualification and employment status and previous childcare arrangements were all used as variables. These variables were regressed against variables including home writing activities, number of materials at home, parental assessment of child's writing ability, parent models and questionnaires.

Key findings showed a statistically significant relationship between season of birth and writing at age seven. Summer-born children had lower attainment than others in the same year group ($p<0.01$), while outcomes for spring-born children were not significantly different from others.

The authors point out that, because schools admitted children into year 1 in the school term after their fifth birthday, summer-born children in this study were youngest in the year group and they had experienced less schooling than those born in the autumn. They acknowledge that schools had begun to introduce policies, such as using age-adjusted tests, which should help teachers to take account of children's developmental levels when making judgements about their performance.

Gledhill, J., Ford, T. and Goodman, R. (2002). ‘Does season of birth matter? The relationship between age within the school year (season of birth) and educational difficulties among a representative general population sample of children and adolescents (aged 5-15) in Great Britain’, *Research in Education,* **68**, 41–47.

The study aimed to examine the relationship between season of birth, special educational needs, learning difficulties and performance on age-standardised tests of IQ, reading and spelling. Data for a representative sample of 8,036 young people aged 5-15 years was collected in 1999 as part of the Mental Health of Children and Adolescents in Great Britain survey. Methods comprised face-to-face interviews and self-report questionnaires completed by parents, teachers and children over 11 years. The sample was categorised into three groups by season of birth: autumn (September-December); spring (January-April); and summer (May-August). Socio-demographic measures were age, gender, ethnicity (White, Black, Indian, Bangladeshi, Pakistani and ‘other’), socioeconomic class (defined by occupation of the head of household), special educational needs (SEN) classification based on the Code of Practice (1994) levels 1-5 and additionally, specific learning difficulties for five per cent of children with the largest difference between predicted and attained levels.

Key findings revealed that a significantly higher proportion of summer-born children (23 per cent) were classified as having SEN, compared to autumn-born (15 per cent) and spring-born children (17 per cent). These differences were significant at $p<0.0001$ level. Summer-born children were also statistically significantly more likely to be diagnosed at levels 1-3 ($p<0.001$) and 4-5 ($p=0.03$) of the SEN Code of Practice. There were no significant season of birth differences found for the age-standardised measures of children’s IQ, reading ability, spelling ability or learning difficulties. There were also no significant season of birth differences across any of the socio-demographic characteristics.

The authors conclude that the reading and spelling ability of summer born children were as expected for their age, as were outcomes for those born in autumn and spring, thus a higher incidence of SEN referrals amongst summer born children indicates that teacher expectations may inappropriately influence SEN assessments. The authors recommend changes to classroom practice to mediate the effects of the high number of summer-born children diagnosed with SEN, including grouping children in classes based on terms of birth and arranging the register in order of date of birth, to increase teachers’ awareness of season of birth effects.

Goodman, R., Gledhill, J. and Ford, T. (2003). 'Child psychiatric disorder and relative age within school year: cross sectional survey of large population sample', *British Medical Journal*, **327**, 7413, 472–475.

This study considers the relationship between relative age and psychopathology, testing the hypothesis that the youngest children within the school year are more at risk of developing emotional and behavioural problems. Data collected in 1999 produced a nationally representative sample of 10,438 children from Britain (England, Scotland[11] and Wales) aged five to 15 years old. Methods included a cross sectional survey utilising validated strengths and difficulties psychopathology questionnaires which were completed by parents, teachers and 11- to 15-year-olds and psychiatric diagnosis based on a clinical review of interview data with young people aged 11 to 15 and their parents(it is not clear how many young people in the sample were in the 11- to 15-year-old age range). Children were categorised by birth month in relation to the school terms for England and Wales: autumn (September to December), spring (January to April) and summer (May to August); and for Scotland into the oldest third (March to June), middle third (July to October) and the youngest third (November to February). Socio-demographic characteristics such as gender, ethnic group, socioeconomic status and family type were also included in the analysis.

Key findings were that the youngest children in the school year had statistically significantly higher symptom scores and a higher proportion were judged as suffering from psychiatric disorders. For teacher and parent reports, the relative age results indicated significant differences at $p<0.0001$. For self reported difficulties, differences were significant at $p<0.05$. Relative age was found to be an independent risk factor for psychiatric disorder after controlling for socio-demographic characteristics. Similar relative age differences were found when Scottish data was compared with English/Welsh data. However, when comparing months of birth, Scottish children born in January/February (who were the youngest in the class) were more disadvantaged than English/Welsh children born in the same months, who performed at an average level. The authors suggest that this indicates a relative age effect, (because the Scottish children were the youngest in the year group, whereas the English children were in the middle of the year group) as opposed to a purely 'seasonal' effect (because both groups were born in the same months of the year).

The authors conclude that their study provides 'robust' evidence of a link between relative age and mental health. They suggest that being youngest in the class is stressful for children. While there is a fairly 'weak' effect on an individual's mental health (for example, compared to the impact of family discord or adverse life events), it could prove important for public health. For example, if all British children had the same risk of psychopathology as that identified among the oldest in the year group, around 60,000 cases of child psychiatric disorder might be prevented. They

[11] In 1999 in Scotland the academic year began in August and children who were born between March and August started compulsory schooling in the academic year during which they became five. Children who were born between September and February started school in the August preceding their fifth birthday or their parents could defer school entry for one year.

recommend age grouping within classes, greater teacher awareness of relative age effects (e.g. calling the register in birth order) and relative age streaming within year groups. They point to the policy in New Zealand of allowing young children to progress from a preparatory class to primary school when ready and to the Scottish system whereby parents can choose to defer entry for younger children who do not seem ready for school. They recommend further evaluation (Randomised Control Trials) of the impact of allowing the youngest children experiencing difficulties to repeat the academic year or allowing deferred school entry.

Lawlor, D.A., Clark, H., Ronalds, G. and Leon, D.A. (2006). 'Season of birth and childhood intelligence: findings from the Aberdeen children of the 1950s cohort study', *British Journal of Educational Psychology*, **76**, 3, 481–499.

This study aimed to determine whether childhood intelligence and school performance are affected by season of birth. The research considered two hypotheses for season of birth effects: the impact of school entry policy and seasonally patterned prenatal exposure to factors such as outdoor temperature, maternal nutrition and infection causing lasting damage to intelligence.

The dataset comprised 12,150 individuals who were born in Scotland[12] between 1950 and 1956, attended one of 52 schools in Aberdeen and participated in the Aberdeen Child Development Survey of 1981. Measures of childhood intelligence were recorded at age seven, using Moray House Picture Intelligence tests, which measured perception and pictorial differences. At age nine, participants' reading ability was measured using Schonell and Adams Essential Intelligence tests. At 11, children were assessed using Moray House tests of verbal reasoning, arithmetic and English. Prenatal data records were also analysed and included detailed information such as individuals' birth weight, gestational age, gender, social class (defined by father's occupation), maternal age at the time of the child's birth and birth order. The analysis controlled for a number of covariates including gender, socioeconomic status, birth weight and temperature at different gestational periods.

Key findings showed that children born between September and December (the youngest in the age group at the time) had the lowest mean scores in reading and arithmetic relative to those born between February and April. There were statistically significant age effects in reading at age nine ($p= 0.002$) and arithmetic at age 11 ($p= .05$). No significant month of birth associations were found for any of the remaining intelligence tests, for season of birth patterned exposure to factors such as temperature/infection, or for any of the other covariates analysed.

The authors conclude that any variation in childhood intelligence is weak and largely explained by age at entry to school and relative age.

[12] In Aberdeen in 1960 the academic year started in August and there were three (termly) entry points. Children born between April and the end of August started school in August (with the possibility of September- and October-born children also joining in order to increase class sizes). Children born between September and December were admitted in January (in Scotland, parents could allow children born between January and March to be admitted in January also) and in April all remaining children born between January and March were admitted to existing classes.

Lincove, J.A. and Painter, G. (2006). 'Does the age that children start kindergarten matter? Evidence of long-term educational and social outcomes', *Education Evaluation and Policy Analysis*, **28**, 153–179 [online]. Available: http://www-rcf.usc.edu/~gpainter/Season%20of%20Birth%2009_04.pdf [29 September, 2008].

This study examined the long-term effects of age at school entry. The study used data from the US National Educational Longitudinal Study of 1988, which provided pupil and family characteristics, assessment and employment information for students in the eighth grade (13-14) to the age of 26 (at the time the report was written). The dataset was selected from an original sample of 1,000 schools, from which 25,000 children in the eighth grade were surveyed. Follow-up surveys were conducted in 1990, 1992, 1994 and 2000. A random sample of 15,273 of the original sample participated in the 2000 survey. Survey data was collected from students, parents and schools. Each student's age at school entry was categorised into three seasons of birth. These comprised the 'young' group (n=2794) with summer birthdates in June, July or August of 1974/75 who started kindergarten shortly after their fifth birthday; the 'older' group (n=2535) who had winter birthdates in December, January or February of 1972/73/74 and started kindergarten at approximately five and a half years old and the redshirted[13] group (n=227) who had summer birthdates 1973/74 and started school one year later than the other two groups. The analysis included variables such as socio-economic status, ethnicity, parental education, family income and occupational status. Measures of long-term outcomes were based on standardised eighth grade assessments (not age standardised), behavioural problems, having a child out of wedlock, non-completion of high school, attending college and salary in 1999.

Key findings were that younger children were statistically significantly more likely to repeat kindergarten ($p<0.001$) and grades 1-8 ($p<0.001$) compared to the older group. There were no significant differences in academic outcomes comparing summer borns who were redshirted (those that began kindergarten at age 6) and summer borns who started kindergarten at age 5. Younger children who started school in the expected year group were more likely to repeat kindergarten but redshirted children were more likely to repeat grades 1-8.

Black and Hispanic children in the younger age-group performed statistically significantly less well than their counterparts in the older age group ($p<0.01$ and $p<0.05$ respectively). The youngest Black children performed significantly less well than their counterparts in the redshirted group ($p<0.10$) but there were no significant differences for Hispanic children.

Based on the results of results of the study, the authors conclude that there are no benefits to deferring kindergarten entry by a year, as this will not necessarily increase the academic attainment of relatively young children in the longer-term.

[13] The term 'Redshirting' is used in the USA to refer to the practice of postponing a child's entrance into school by a year to allow extra time for developmental growth. This usually applies to children whose birthdates are close to the cut-off date for school entrance and who would normally be among the youngest in the class. These children usually join the next year's kindergarten cohort, where they become amongst the oldest in the class.

Martin, R.P., Foels, P., Clanton, G. and Moon, K. (2004). 'Season of birth is related to child retention rates, achievement, and rate of diagnosis of specific LD', *Journal of Learning Disabilities*, **37**, 4, 307–317.

This study focuses on the association between season of birth and children's attainment, and explores the hypothesis that children who are born in the summer months are more likely to be diagnosed with specific learning difficulties (SLD) compared to those born at other times of the year. The sample comprised 2,768 children (2,007 boys and 761 girls) born between September 1st 1984 and August 31st 1990; children were in grades four (ages 9/10) to nine (ages 14/15) at the time of data collection. The sample was selected from 28 county school systems in northeast Georgia, USA and was representative of adjoining counties. Data for children diagnosed with SLD was obtained from all 28 schools during 2000-2001 and included the following background characteristics: gender, ethnicity, date of birth and SLD diagnosis. The SLD sample only included children who self-identified as European Americans, as other ethnicities were proportionally too low across the SLD sample to meet the requirements of the research design. General achievement across the schools was measured using fifth grade (ages ten to 11) test scores, assessed using the Iowa Test of Basic Skills (ITBS). This test is not age standardised. Children's achievement data were obtained from the spring 2000 achievement testing in Georgia which covers vocabulary, reading, mathematics, and science. Data analysis was used to differentiate the effects of grade retention and academic 'redshirting' when determining season of birth effects.

Key findings indicate that children who were born in June, July and August were statistically significantly more likely to be overage for their grade when compared to children born during other months of the year, indicating 'redshirting' or grade retention ($p < 0.0001$). Across all outcomes, children born in June, July and August scored statistically significantly lower than those born in September, October and November ($p < 0.05$). Achievement scores across all outcomes were measured both excluding and including overage children. Effect sizes when overage children were excluded ranged from 0.12 to 0.17 standard deviations, $p < 0.001$; when they were included, effects sizes ranged from 0.21 to 0.28, $p < 0.0001$.

Compared with the population of children in the area, the sample of children with SLD had a higher proportion born June and August and a lower proportion born in September to May. Children born in June to August were statistically significantly more likely to be diagnosed with SLD ($p < 0.001$). Correlations between relative age (birth month) and SLD diagnosis were highest in Grade 8 (0.78). The correlation between relative age and SLD diagnosis was generally higher for boys than for girls.

The authors conclude that there are clear consequences of being born in July to August, with about 25 per cent of children being retained or redshirted and another five to ten per cent being placed in classes for children with SLD. They suggest that the most likely explanation is one of maturity: i.e. that younger children perform less well and are at greater risk of being diagnosed as having SLD because they are less mature. The authors recommend two school entry points, one in August and one in January, with relatively younger children starting school in January. However, they suggest that further research and consideration of the implications of such a system would be necessary before implementation.

McEwan, P. and Shapiro, J. (2008). ‘The benefits of delayed primary school enrollment: discontinuity estimates using exact birth dates’, *Journal of Human Resources*, **43**, 1, 1–29.

This study examines the effects of delayed school entry on students in Chile and explores the effects of enrolment age and season of birth effects on student outcomes. In Chile, the school year begins on March 1st, and the most common enrolment cut-off date is July 1st. Children who are six on or after the cut-off date have to delay enrolment until the following year. The sample was obtained from three data sources: firstly, a sample of 1,013,081 children in the first grade (aged 6/7) was obtained from six annual surveys conducted from 1998-2003. Data included children’s’ date of birth, gender, level of maternal education and nutritional status. Secondly, a representative sample of 144,047 fourth grade students (aged 9/10) was obtained from a 2002 national census, and their test scores in maths and Spanish were analysed. Finally, a nationally representative sample of 5,582 eighth grade students (aged 13/14) was obtained using data from the 1999 Trends in Mathematics and Science Study (TIMSS), which comprised students’ maths and science scores.

Key findings show that children who were older in the year group (July to December birthdates) had a statistically significantly lower probability of being retained in kindergarten, compared to those who were younger (January to June birthdates). The difference was approximately one percentage point – relative to the overall mean baseline of 2.8 per cent retentions ($p<0.01$). Fourth grade attainment results showed that relatively older students had higher maths test scores by 0.29 standard deviations and higher language scores by 0.38 standard deviations, both of which are statistically significant ($p<0.01$). In the eighth grade, relatively older students had an increase of 0.43 standard deviations in their maths test scores and 0.72 standard deviations in science, both of which were statistically significant ($p<0.01$).

The authors conclude that their findings may be due to absolute or relative age effects. If findings are due to age-at-test results, they suggest that increasing the enrolment age would increase test scores as children would be older when tested, although they may not necessarily learn more. On the other hand, if relative age is accepted as the cause of the findings, changing the cut-off dates would redistribute achievement, without overall gains. They suggest that intervention policies which assess children’s school readiness in preschool, such as interventions to improve early nutrition, would benefit children from disadvantaged backgrounds (whose families are more likely delay enrolment due to malnourishment or stunted growth). This could offer greater long-term effects and improved attainment which may avoid the need to mandate a later school starting age.

Menet, F., Eakin, J., Stuart, M. and Rafferty, H. (2000). 'Month of birth and effect on literacy, behaviour and referral to psychological service', *Educational Psychology in Practice*, **16**, 2, 225–234.

The authors studied the effects of month of birth on children's literacy, behaviour, and propensity for psychological referrals in a primary school cohort in Northern Ireland[14]. They wanted to establish whether the youngest children performed less well relative to their older classmates. The sample included children from Years 1, 3 and 5 (ages four to nine) and analysed school assessment data and psychological referral lists. Psychological referral lists comprised 695 new referrals from the preceding year. Data for 108 May/June- and July/August-born children across the sample were studied (the authors do not indicate the date the study took place).

Key findings for the Year 1 sample (ages four to five) May/June-born children (the youngest in the year-group) were that these children scored significantly lower in literacy and behaviour mean scores than July/August-born children. Statistically significant effects for letter recognition, word recognition and behaviour scores were $p< 0.008$, $p< 0.002$ and $p<0.000$ respectively. Findings for the Year 3 and 5 samples (ages 6-9) were similar, with May/June-born children obtaining the lowest mean scores relative to July/August-born children. Statistically significant effects for reading, spelling and behaviour scores were $p< 0.001$, $p< 0.01$ and $p<0.0001$ respectively. Psychological referral analysis showed that the number of referrals increased towards the May/June birth date. The number of referrals for May/June- and July/August-born children were significantly different from the expected numbers ($p<0.05$).

The authors recommend a number of strategies to help mediate the relative age effects and raise attainment of the youngest children in the class. Recommendations for policy and practice include age normalisation of test results, age grouping within classes, a developmentally appropriate curriculum, smaller classes in Year 1 and small group support, greater teacher awareness and training, parental involvement and a wider availability of psychological services resulting in early intervention.

[14] Primary schools in Northern Ireland have a single entry point. Children who reach the age of four on or before 1 July start compulsory schooling on 1 September that year. Children who reach the age of four after 1 July would not begin compulsory schooling until the following year. Therefore, children born in May and June will be the youngest in the class and those born in July and August will be the oldest.

Moon, S. (2003). ‘Birth date and pupil attainment’, *Education Today*, **53**, 4, 28–33.

This small scale study assesses whether season of birth affected the GCSE attainment of a cohort of 308 Year 11 pupils within the same school in England (the author does not indicate where in England the study took place). Pupils’ birth dates were used to categorise the pupils into autumn (September to December), spring (January to April) or summer (May to August) terms of birth. Pupils sat their GCSEs in 2000 and assessment data from 1999/2000 was used to classify pupils based on Cognitive Ability Test scores. Analysis of variance was used to identify statistically significant differences between pupils of the same cognitive ability with a relative age variable. Analysis included GCSE results across all subjects and for English, maths and science.

Key findings across all GCSE subjects showed no statistically significant differences between pupils across the three terms of birth. However, for English, maths and science, there were small differences between children with autumn and summer birthdates which were statistically significant at the 0.1 per cent level. For English (maths and science) summer-born pupils scored 0.5 (0.6 and 0.5) average points below autumn-born pupils.

The author makes the following policy recommendations to counteract the season of birth effect: adopt a curriculum tailored to the development of summer-born children, use age normalisation of test results and attempt greater alignment between primary and secondary schools to ensure that summer-born children at risk of underachievement are identified throughout their school career.

Oshima, T.C. and Domaleski, C.S. (2006). ‘Academic performance gap between summer-birthday and fall-birthday children in grades K-8’, *Journal of Educational Research*, **99**, 4, 212–217.

This study reports on the differences in academic performance between children with summer (June, July and August) and autumn birthdays (September, October and November). The study used data from the US Early Childhood Longitudinal Study of the Kindergarten Class of 1998-99 to produce a sample of children aged five and six; 3,862 of whom had summer and 2,693 had autumn birthdays. A different sample for grades 1-8 was randomly selected from a state-wide pool of non-age standardised tests administered in 2002, comprising 3,000 students (ages six to 14). Methods included analysis of students’ reading, maths and general knowledge scores (with the addition of approaches to learning, self-control and social interaction variables for kindergarten students). Gender and ethnicity were also included as variables.

Key findings showed that older kindergarten children had a higher mean score relative to younger kindergarten children with effect sizes of 0.38 for reading, 0.55 for mathematics and 0.50 for general knowledge. Children with autumn birthdays had higher reading and maths mean scores than children with summer birthdays, across all grades and all results were statistically significant from kindergarten through to fifth grade at $p < 0.001$ (ages five to 11). Differences in mean scores were not significantly different for grades 6-8 (ages 11-14). The most statistically significant predictors of positive reading and maths attainment across all age ranges at $p < 0.001$ were ethnicity (which explained 10-15 per cent), followed by relative age (seven per cent) and gender (one per cent).

The authors conclude that before parents choose to defer school entry of children with summer-birthdays by a year, a number of issues need to be taken into account, including whether children learn from older peers, whether the child may be affected by not performing as well as their older peers, and the child’s gender and reading ability.

Polizzi, N., Martin, R.P. and Dombrowski, S.C. (2007). 'Season of birth of students receiving special education services under a diagnosis of emotional and behavioural disorder', *School Psychology Quarterly*, **22**, 1, 44–57.

This study explored the hypothesis that a disproportionate number of US children who receive special education services for emotional or behavioural disorders (EBD) are born during late spring and summer, compared to other times of the year. The authors also investigated whether seasonal birth rate effects followed cyclical patterns over a ten year period. The sample comprised 8,578 children who were born between September 1st 1983 and August 31st 1994 and were all receiving special education services for EBD disorders. Data was obtained from 44 counties in Georgia and included each pupil's date of birth, gender, grade and special education status. The sample consisted of European American (61 per cent) and African American (39 per cent) children only and was representative of the northeast Georgia region.

Key findings from a comparison of monthly birth rates between the sample and for the population in the state of Georgia as a whole revealed that fewer than expected children receiving special education were born in September and October. For African Americans receiving special education, a higher number than expected were born in May to August and for European Americans receiving special education, a higher proportion than expected were born in May, June and August. The authors do not report on gender effects.

The authors conclude that their results are open to interpretation. If relative age is accepted as a hypothesis, this may indicate that summer-born children are over diagnosed for EBD. However, if pre-natal factors causing brain injury or developmental delay is accepted as a hypothesis, autumn school cut-off dates disadvantage summer-born children further. In order to mediate the season of birth effects the authors recommend early identification of children who are born in the summer months and may be at risk, biannual cut-off dates for school entry, greater awareness of relative age effects by teachers and improved information sharing between parents, teachers and psychologists on childrens pre-natal history.

Wallingford, E.L. and Prout, H.T. (2000). ‘The relationship of season of birth and special education referral’, *Psychology in the Schools*, **37**, 4, 379–387.

The purpose of this study was to establish whether children with summer birthdates, who were the youngest in their grades, were significantly overrepresented in the number of special educational needs (SEN) referrals. The sample comprised 1,222 SEN referrals for a 1995-96 cohort of children from kindergarten to fifth grade (aged 5-14) in a south-eastern state in the USA (the author does not indicate exactly where the study took place). The number of SEN referrals received was analysed and compared with the expected number of referrals for a control group of 16,379 children within the same age range, across the state. Pupil characteristics were obtained from referral data and children were categorised based on their season of birth. The youngest students in the grade had birthdates from June to September (months 6-9); the oldest children in the grade had birthdates from October to January (months 10-1) and the middle group of children had birthdates from February to May (months 2-5). Children were divided into three age groups by birth date parameters; kindergarten and first grade (ages 5-7); second and third grade (ages 8-9); and fourth and fifth grade (aged 10 and over). Outcome measures were season of birth, gender and age at referral.

Key findings were that children in the five to seven age-group had significantly more SEN referrals than expected, compared to the other two age groups. The number of actual referrals for the youngest children (months 6-9) was greater than expected (significant at $p < 0.0042$ level) across all outcome measures. For the five to seven-year-old age group overall and for boys, differences were significant at $p < 0.0001$ and for girls differences were significant at the $p < 0.0011$ level. No significant differences were found for children in the two older age groups.

The authors conclude that there is more than one factor inherent in the referral process, including teachers’ failure to take sufficient account of primary-age children’s rates of development which leads to unrealistic expectations of younger children’s academic achievement level. To reduce the overrepresentation of SEN referrals for children who are younger relative to their peers, the authors recommend an evaluation of the current SEN referral process, pre-referral intervention strategies and greater caution by teachers when referring young children for special education.

Wilson, G. (2000). ‘The effects of season of birth, sex and cognitive abilities on the assessment of special educational needs’, *Educational Psychology*, **20**, 2, 153–166.

This small scale study explores the correlation between season of birth, gender and cognitive abilities of children with special education needs (SEN) in an 11-18 comprehensive school in England (1225 pupils). The sample comprised 178 pupils from Years 7 to 11 (aged 11-16) who were classified according to the SEN Code of Practice 1994 on a scale of 1-5 in 1997. The sample was categorised into three season of birth groups: autumn (September to December), spring (January to April) and summer (May to August). Statistical modelling was used to analyse SEN categorisations in relation to outcomes on the Cognitive Abilities Test (CAT).

Key findings showed that autumn-born children were under-represented in SEN classifications. Overall in Years 7 to 11, ten per cent of autumn-born children had SEN, relative to 17 per cent of both spring- and summer-born children. Season of birth effects for spring and summer-born children were both statistically significant ($p<0.01$). Across each year group, statistically significantly more boys were diagnosed with SEN compared to girls ($p<0.001$). However, the findings indicated that summer-born boys were at no statistically significantly greater risk of being diagnosed with SEN compared to summer-born girls. As expected, CAT scores for pupils with SEN were lower than those attained by pupils who were not classified as having SEN (the author does not indicate whether this is a statistically significant difference). When associated with season of birth, mean CAT scores (prior to age adjustment) for summer-born children with SEN (88.5) were actually slightly higher than those for autumn-born children with SEN (87.1), indicating that the number of summer-born children diagnosed with SEN cannot be explained by differences in cognitive abilities for different birth groups.

The author discusses a number of factors which may contribute to season of birth differences, including age on entry to primary school, the suitability of the curriculum for the youngest children in the year group and teacher expectations and assessments. He concludes that the inconsistencies found between the estimated ability of summer-born children compared to their actual ability may be indicative of inappropriate teacher referrals for SEN, which may not take sufficient account of the developmental differences between the youngest children in a year group relative to their peers.

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Appendix 1 Search Strategy

The following section provides information on the keywords and search strategy for each database searched. All searches were conducted by information specialists at NFER. The databases were searched in the order: BEI, AEI, ERIC, BEIRC, ASSIA, CERUK Plus, PsycINFO, ChildData and IBSS. The keywords used in the searches, together with a brief description of each of the databases searched, are outlined below. The following conventions have been used: (ft) denotes that free-text search terms were used and * denotes a truncation of terms.

Searches were conducted for national and international literature, written in English and published during the period from January 2000 to July 2008.

Table 3: Overview of searches

Source	Items found	Items selected for consideration
Databases		
Applied Social Sciences Index and Abstracts (ASSIA)	333	4
Australian Education Index (AEI)	165	23
British Education Index (BEI)	243	17
ChildData	40	9
Education Resources Information Center (ERIC)	309	36
International Bibliography of the Social Sciences (IBSS)	107	1
PsycINFO	608	21
Internet databases/portals		
British Education Internet Resource Catalogue (BEIRC)	22	0
CERUK Plus	42	2

Applied Social Sciences Index and Abstracts (ASSIA)

(searched via CSA 03/09/08)

ASSIA is an index of articles from over 500 international English language social science journals.

#1	school and entry	#8	birth and season
#2	school and entrance	#9	age and difference*
#3	entry and age	#10	school* or preschool* or class* or grade*
#4	entrance and age	#11	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8
#5	summer and born	#12	#9 and #10
#6	date and birth	#13	#11 or #12
#7	starting and school		

(all ft)

Australian Education Index (AEI)

(searched via Dialog 29/08/08)

AEI is Australia's largest source of education information covering reports, books, journal articles, online resources, conference papers and book chapters.

#1	age differences	#8	date and birth (ft)
#2	age grade placement	#9	late birthday (ft)
#3	school readiness	#10	birthday and effect* (ft)
#4	learning readiness	#11	preschool* or school* or curriculum (ft)
#5	school entrance age	#12	#1 and #11
#6	relative age (ft)	#13	#2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10
#7	seasonal and effect* (ft)	#14	#12 or #13

British Education Index (BEI)

(searched via Dialog 28/08/08)

BEI provides information on research, policy and practice in education and training in the UK. Sources include over 300 journals, mostly published in the UK, plus other material including reports, series and conference papers.

#1	age differences	#10	summer and born (ft)
#2	age grade placement	#11	season and birth (ft)
#3	enrolment trends	#12	date and birth (ft)
#4	school entrance age	#13	birthdate (ft)
#5	school readiness	#14	school* or curriculum or preschool* (ft)
#6	early admission	#15	#1 and #14
#7	learning readiness	#16	#2 or #3 ………or #13
#8	relative age (ft)	#17	#15 or #16
#9	rising five* (ft)		

British Education Internet Resource Catalogue (BEIRC)

(searched 02/09/08)

The British Education Internet Resource Catalogue is a freely accessible database of information about professionally evaluated and described internet sites which support educational research, policy and practice.

#1	Learning readiness or age grade placement or pupil placement or age differences or early admission or acceleration: education or school entrance age or school readiness

CERUK Plus

(searched 04/09/08)

The CERUK Plus database provides access to information about current and recently completed research, PhD level work and practitioner research in the field of education and children's services.

#1	Age factor or season of birth or school entrance age or school readiness

ChildData

(searched 05/09/08)

ChildData is the National Children's Bureau database, containing details of around 35,000 books, reports and journal articles about children and young people.

#1	relative age (ft)
#2	summer and born (ft)
#3	season and birth (ft)
#4	birth and month (ft)
#5	early entry (ft)
#6	age and grade (ft)
#7	age (ft)
#8	starting school or starting preschool
#9	#7 and #8
#10	#1 or #2 or #3 or #4 or #5 or #6 or #7
#11	#9 or #10

Education Resources Information Center (ERIC)

(searched via Dialog 01/09/08)

ERIC is sponsored by the United States Department of Education and is the largest education database in the world. Coverage includes research documents, journal articles, technical reports, program descriptions and evaluations and curricula material.

#1	age group placement
#2	school entrance age
#3	relative age (ft)
#4	summer and born (ft)
#5	season and birth (ft)
#6	school and starting and age (ft)
#7	age (ft)
#8	school readiness
#9	#7 and #8
#10	#1 or #2 or #3 or #4 or #5 or #6
#11	#9 or #10

International Bibliography of the Social Sciences (IBSS)

(searched via EBSCOhost 18/09/08)

The International Bibliography of the Social Sciences (IBSS), produced by the London School of Economics and Political Science, includes over 2.5 million references to journal articles, books, reviews and selected chapters. It focuses mainly on the four core social science disciplines - anthropology, economics, politics and sociology - but it also covers a range of interdisciplinary subjects. IBSS is especially strong on international material with over 50 per cent of journals published outside the US or UK.

#1	season and birth	#8	classroom* or class
#2	birth and date	#9	school* or preschool*
#3	starting and school and age	#10	#8 or #9
#4	summer and born	#11	#1 or #2 or #3 or #4 or #5 or #6
#5	school readiness	#12	#7 and #10
#6	relative age	#13	#11 or #12
#7	age difference*		

(All ft)

PsycINFO

(searched via Silverplatter 05/09/08)

The PsycINFO database is produced by the American Psychological Association (APA).

It contains references to the psychological literature, including articles from over 1,300 journals in psychology and related fields, chapters and books, dissertations and technical reports.

#1	seasonal variations	#9	birth and month (ft)
#2	birth and month* (ft)	#10	classroom* or class or classes (ft)
#3	early admission (ft)	#11	school* or preschool* (ft)
#4	relative age (ft)	#12	pupil* or student* or grade*
#5	summer and born (ft)	#13	#10 or #11 or #12
#6	season and birth (ft)	#14	#1 or #2 ………. or #9
#7	age and entry (ft)	#15	#13 and #14
#8	age and grade (ft)		

Appendix 2 Country Context for the Countries Reviewed

For each of the countries/states for which highly relevant research articles were identified, NFER information colleagues provided the research team with a brief contextual summary. This provides information on the organisation of year groups/ phases and of the school year for the country/federal state concerned. These contextual ‘fiches’ follow.

Chile

Year/Grade	Approximate age range
Year 1	**6-7**
Year 2	**7-8**
Year 3	**8-9**
Year 4	**9-10**
Year 5	**10-11**
Year 6	**11-12**
Year 7	**12-13**
Year 8	**13-14**
Year 9	14-15
Year 10	15-16
Year 11	16-17
Year 12	17-18

Bold=compulsory

General Basic Education (*Educación general básica – EGB*) is compulsory for eight years from age 6 to age 14. All children aged 6 on the 31st March of the relevant year start school. *EGB* is divided into two cycles, each of four years.

The school year runs from the 1 March to the 31st December.

Source: World Data on Education: Chile 6th Edition 2006/07. Online: http://www.ibe.unesco.org/en/access-by-country/latin-america-and-the-caribbean/chile/profile-of-education.html

Country Context: Georgia (USA)

Year/Grade	Approximate age range
Kindergarten	5-6
Grade 1	**6-7**
Grade 2	**7-8**
Grade 3	**8-9**
Grade 4	**9-10**
Grade 5	**10-11**
Grade 6	**11-12**
Grade 7	**12-13**
Grade 8	**13-14**
Grade 9	**14-15**
Grade 10	**15-16**
Grade 11	16-17
Grade 12	17-18

Bold = compulsory

Georgia law requires that students attend a public or private school or a home study programme from their sixth to their sixteenth birthdays. Public kindergarten is available in every school system, but is not mandatory.

A child must be five years old on or before September 1 to enter a public kindergarten. The child must be six years old on or before September 1 to enter first grade (Year 1). School systems must verify age before enrolment.

Individual school districts are responsible for setting the annual school calendar. Georgia law sets a requirement of 180 school days for students and 190 days for teachers (the 180 student teaching days, plus 10 training days). In most districts, the school year runs from August to June and consists of three 12-week terms, with two or more weeks' break at Christmas and in the spring, and 10/12 weeks in the summer. There are usually no mid-term breaks, other than days for national holidays.

Country Context: Northern Ireland

Year Group	Age range	Key stage	Phase
	0-3		Pre-school and nursery education
	3-4		Pre-school and nursery education
Year 1	**4-5**	**Foundation stage**	**Primary**
Year 2	**5-6**	**Foundation stage**	**Primary**
Year 3	**6-7**	**Key stage 1**	**Primary**
Year 4	**7-8**	**Key stage 1**	**Primary**
Year 5	**8-9**	**Key stage 2**	**Primary**
Year 6	**9-10**	**Key stage 2**	**Primary**
Year 7	**10-11**	**Key stage 2**	**Primary**
Year 8	**11-12**	**Key stage 3**	**Secondary**
Year 9	**12-13**	**Key stage 3**	**Secondary**
Year 10	**13-14**	**Key stage 3**	**Secondary**
Year 11	**14-15**	**Key stage 4**	**Secondary**
Year 12	**15-16**	**Key stage 4**	**Secondary**
Year 13	16-17		
Year 14	17-18		

Bold = **compulsory**

A child who reaches the age of four on or before 1 July must start full-time education on 1 September of that year. The compulsory school starting age in Northern Ireland was lowered from five to four years in 1989 because it was thought that all children would benefit from spending a total of 12 full years at school (seven years at primary school and five at secondary school).

Prior to the 1998/99 school year, some schools which had sufficient places available, also enrolled four-year-olds whose birthdays fell after 1 July (that is, children who had not reached compulsory school age) in primary education. Since September 1999, this practice has only been allowed to continue in schools already using it. Schools which did not have this as an existing policy are no longer permitted to introduce a policy of admitting children under compulsory school age, even in instances where there is surplus capacity.

Schools in Northern Ireland are required to be in operation for 200 days a year and the school year runs from the beginning of September to the end of the following June, with eight weeks' summer break and approximately two weeks at Christmas and Easter.

Country Context: Tasmania (Australia)

Year/Grade	Age range
Year 0 (known as Preparatory or Kindergarten)	**5-6**
Year 1	**6-7**
Year 2	**7-8**
Year 3	**8-9**
Year 4	**9-10**
Year 5	**10-11**
Year 6	**11-12**
Year 7	**12-13**
Year 8	**13-14**
Year 9	**14-15**
Year 10	**15-16**
Year 11	16-17
Year 12	17-18

Bold = **compulsory**

In Tasmania, the Preparatory Year (5- to 6-year-olds) is compulsory and the school leaving age is 16. Legislation introduced in January 2008 introduced additional requirements which mean that, after leaving Year 10 (at around age 16), young people must continue in education or training for two years or until they turn 17.

The school year in Australia is generally organised around four terms and begins in late January/early February; the annual five- to six-week summer holiday is in December and January. Exceptionally, in Tasmania, there are three main terms in school education. Term one runs from February to late May/early June. This term is followed by a 10-day (two-week) holiday. There is also a 10-day (half-term) break for Easter in the middle of the first term. Term two runs from June to September and is followed by a 10-day holiday; and term three commences in late September and ends just before Christmas.