When You Are Born Matters: The Impact of Date of Birth on Child Cognitive Outcomes in England

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Executive summary

The impact of date of birth on cognitive test scores is well documented across many countries, with the youngest children in each academic year performing more poorly, on average, than the older members of their cohort (see, for example, Bedard and Dhuey (2006) or Puhani and Weber (2005)[1]). However, relatively little is known about the driving forces behind these differences, at least in England; nor does there appear to have been a robust discussion regarding what, if anything, should be done in light of these disparities. We address both of these issues in this report.

Background and research questions

In England, the academic year runs from 1 September to 31 August, so that a child born on 31 August will start school (and sit exams) up to a year earlier than a child born only one day later, on 1 September. Furthermore, as responsibility for determining school admissions policies falls on local, rather than central, authorities, there is considerable geographical variation in terms of length of schooling (and the age at which children start school) amongst the youngest members of each cohort.[2]

In this report, we use this framework to address four specific research questions:

1. ***What is the extent of the August birth penalty across different outcomes, and how does this vary by age (from age 5 to age 18)?*** We begin by simply comparing the cognitive outcomes (and special educational needs status) of August- and September-born children in the same school and school year.

2. We then move on to consider the impact of different school admissions policies on the outcomes of August-born (as well as January-, March- and May-born[3]) children. We do this by comparing children who start school in the September of the academic year in which they turn 5 with others of the same age who, as a result of the admissions policy in place in their local education authority (LEA), start school one or two terms later. ***What is the best admissions policy for summer-born children in terms of cognitive outcomes?***

3. Observed differences between the outcomes of August- and September-born children could be due to a number of factors:

    - **Age of sitting the test (absolute age) effect:** If all children in a particular cohort sit exams on the same day, then those born later in the academic year will always be younger than their peers when taking the tests.

[1] A summary of these papers, and others, can be found in Chapter 2 of this report.

[2] This variation is supported by almost universal compliance with the rules that are in place (despite the fact that children in England do not, by law, need to have started school until the term after they turn 5).

[3] These are children born on the 'wrong' side of other cut-offs introduced by the presence of certain admissions policies. For example, under a policy in which all children start school at the beginning of the term in which they turn 5, a child born on 1 January would start school one term later than a child born only one day earlier, on 31 December.

- **Age of starting school effect:** Perhaps it is not the age at which children sit the test that is important, but the age at which they start school, i.e. it is their 'readiness for school' that matters.
- **Length of schooling effect:** If younger children have experienced fewer terms of schooling prior to the exams than older members of their cohort, then this might explain their poorer academic performance.
- **Age position (relative age) effect:** Under this hypothesis, younger children tend to perform more poorly not because they are the youngest in absolute terms but because they are the youngest relative to others in their year group.

Which of these factors – absolute age, age of starting school, length of schooling, age position – drive differences in cognitive outcomes between August- and September-born children?

4. ***Does the August birth penalty vary across particular subgroups of interest?*** For example, does it differ between children who are eligible for free school meals[4] and those who are not?

We use the answers to these questions to determine whether there is a need for policy intervention and, if so, which options are most appropriate.

Data and methods

We use administrative data on all children in state schools in England to answer these questions. These data comprise test results from the Foundation Stage (sat at age 5), Key Stage 1 (age 7), Key Stage 2 (age 11), Key Stage 3 (age 14), Key Stage 4 (age 16) and Key Stage 5 (age 18), plus some basic background characteristics collected via an annual schools' census. As yet, it is not possible to follow the same individuals from the Foundation Stage all the way through to Key Stage 5, so instead we consider three separate groups, covering the full spectrum of results. These groups are as follows:

- **Group 1**: for a one-in-ten sample of children (born in 1997–98 or 1998–99), we can analyse outcomes at the Foundation Stage (age 5) and Key Stage 1 (age 7);
- **Group 2**: for two cohorts of children (born in 1990–91 or 1991–92), we can analyse outcomes at Key Stage 1 (age 7), Key Stage 2 (age 11) and Key Stage 3 (age 14);
- **Group 3**: for three cohorts of children (born in 1985–86, 1986–87 or 1987–88), we can analyse outcomes at Key Stage 2 (age 11), Key Stage 3 (age 14), Key Stage 4 (age 16) and Key Stage 5 (age 18).

The outcomes we consider are standardised average point score[5] (for all but Key Stage 5), whether the child has reached the expected level at a particular Key Stage (for all but the Foundation Stage), whether they have achieved above the expected level at a particular Key

[4] This can be thought of as a proxy for low family income.

[5] This is normalised to have mean 0 and standard deviation 1, thus allowing comparison across groups.

Figure 1. Mean standardised average point score at Key Stage 1, Key Stage 2 and Key Stage 3 for Group 2, by date of birth and cohort

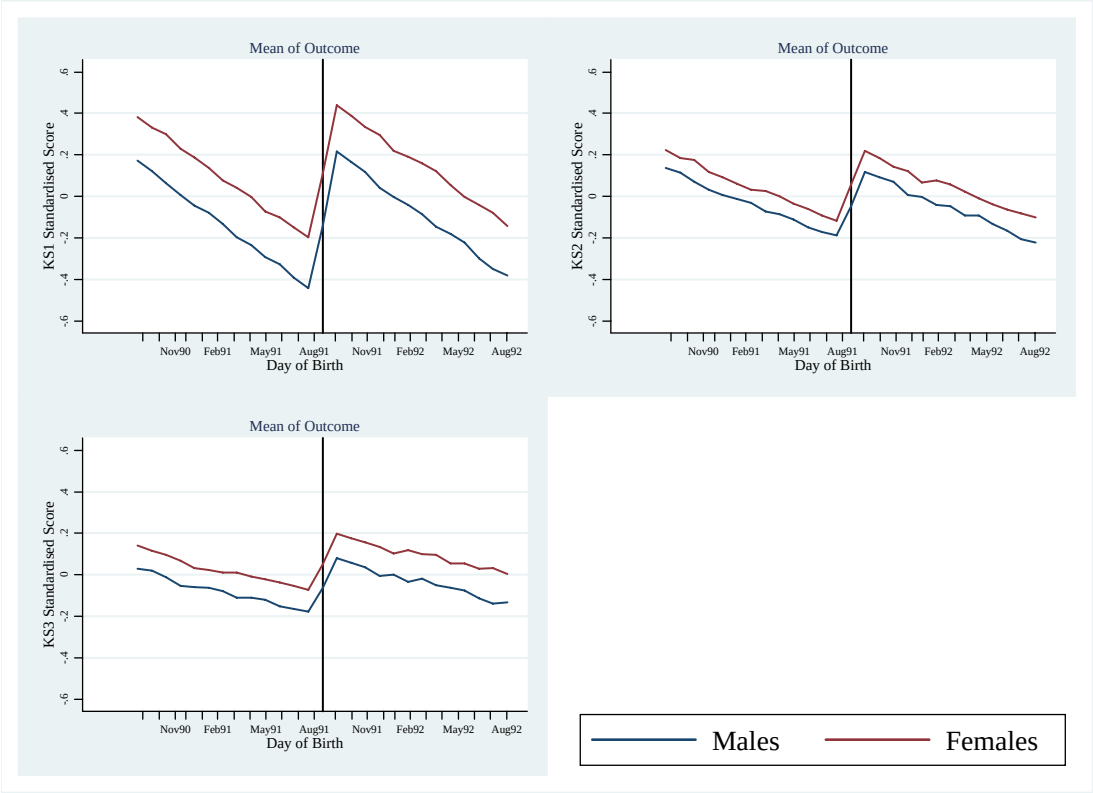
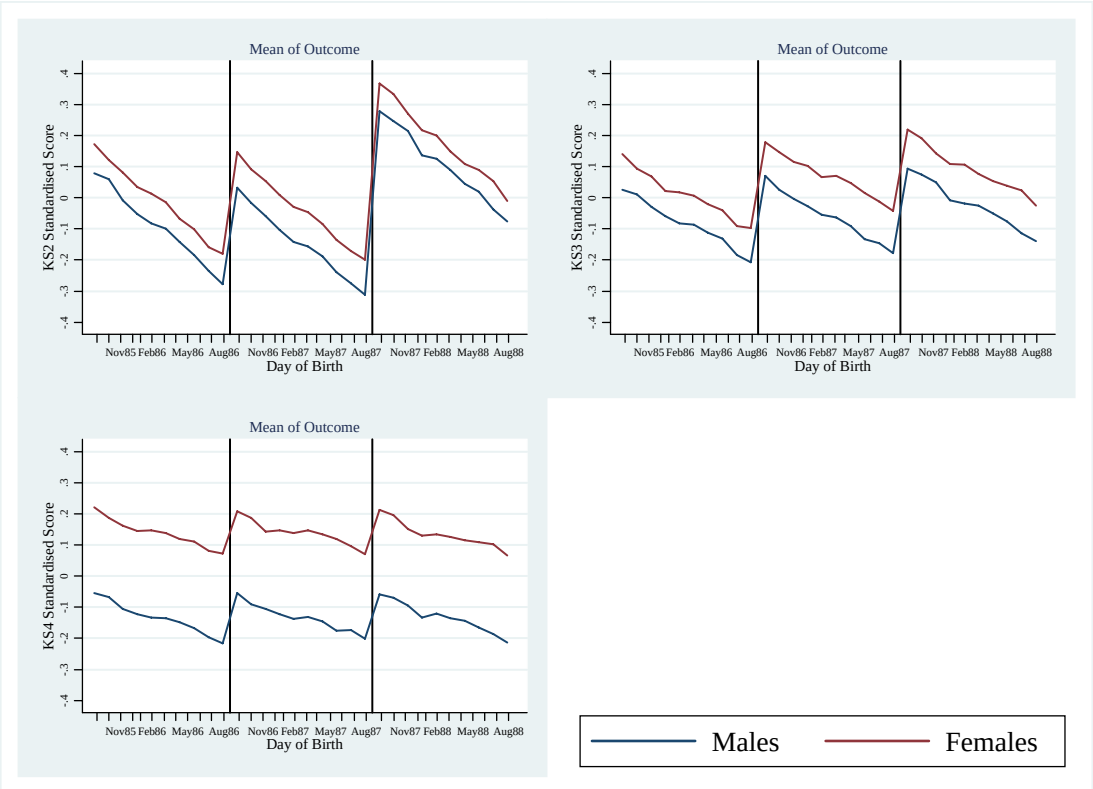


Figure 2. Mean standardised average point score at Key Stage 2, Key Stage 3 and Key Stage 4 for Group 3, by date of birth and cohort



Stage (for Key Stage 1, Key Stage 2 and Key Stage 3 only) and special educational needs status.[6] For all three groups, we restrict our sample to individuals for whom all outcomes are observed in the expected year.

Figures 1 and 2 motivate our work, by showing how the raw standardised average point score varies by date of birth and cohort, for Groups 2 and 3 respectively.[7] From the graphs, it is clear that the outcomes for August-born children are always lower than those for September-born children. This gap steadily decreases between age 7 (Key Stage 1) and age 16 (Key Stage 4), but remains evident even at the end of compulsory schooling, so that it may potentially be affecting decisions over whether to stay on at school beyond age 16.

These are just the raw differences, however, whilst most of our methodological approaches involve making comparisons between August- and September-born children[8] within schools, controlling for all observed characteristics that might affect cognitive outcomes.[9] As long as we capture observed differences between August- and September-born children within a particular school – and assuming that the remaining unobserved characteristics of students at the school, plus the effectiveness of the school, do not vary by age – we will difference out the impact of this (assumed) unobserved fixed effect and obtain an estimate of the causal impact of being born in August (rather than September) on cognitive outcomes.

Furthermore, in considering our third research question, we have to assume in addition that our observed individual characteristics are sufficiently rich to allow us to compare children across schools and local education authorities (in which different admissions policies are employed). This assumption appears to be warranted, as the estimates obtained from this model are very similar to those obtained from the models that compare individuals within schools, which suggests that our results are likely to be robust to model choice.

Key findings

The key findings across our four research questions are summarised below.

1. What is the extent of the August birth penalty across different outcomes, and how does this vary by age (from age 5 to age 18)?

This question is discussed at length in Chapter 5 of this report; the main results indicate that there is evidence of a significant August birth penalty in all outcomes and at every age for children in English state schools.

In terms of standardised average point scores and the proportion of children achieving the expected level, this penalty is largest when a child first enters school; it declines over time, but is still significant at ages 16 and 18, when students are making decisions about

[6] This is observed at age 5 for Group 1, age 11 for Group 2 and age 16 for Group 3.

[7] We do not use Key Stage 5 standardised average point score, because we only observe this information for individuals who remain in state schools for post-compulsory provision (a highly selected sample).

[8] Or between February- and March-born children, December- and January-born children or April- and May-born children.

[9] Details of these variables can be found in Section 3.1.4. They include ethnicity, free school meals status (a proxy for low family income), whether English is the child's first language and a variety of local neighbourhood characteristics.

employment and/or future study. For example, at the Foundation Stage (age 5), August-born girls (boys) score, on average, 0.768 (0.817) standard deviations lower than September-born girls (boys); this penalty has fallen to 0.609 (0.602)[10] standard deviations by Key Stage 1, to 0.351 (0.337)[11] standard deviations at Key Stage 2, to 0.204 (0.212)[12] standard deviations at Key Stage 3 and to 0.116 (0.131) standard deviations at Key Stage 4.

Furthermore, August-born girls (boys) are, on average, 26.4 (24.9) percentage points[13] less likely to reach the expected level than September-born girls (boys) at Key Stage 1, 14.4 (13.9) percentage points[14] less likely to reach the expected level at Key Stage 2, 8.3 (9.1) percentage points[15] less likely to reach the expected level at Key Stage 3, 5.5 (6.1) percentage points less likely to reach the expected level at Key Stage 4 (as measured at age 16) and 2.0 (1.7) percentage points less likely to reach the expected level at Key Stage 5 (via an academic route). The expected level at Key Stage 4 is equivalent to being awarded five GCSEs at grades A*–C. Given that many further education institutions require students to have achieved at least this standard in order to admit them, this potentially means that August-born girls (boys) could be, on average, 5.5 (6.1) percentage points less likely (than September-born girls (boys)) to remain in education beyond age 16, simply because of the month in which they were born.

Interestingly, once attainment of Level 2 (Key Stage 4) and Level 3 (Key Stage 5) vocational qualifications (by age 18) is taken into account, the August birth penalty decreases – to 0.5 (1.4) percentage points for girls (boys) at Level 2 and to 0.9 (1.6) percentage points at Level 3. However, given that non-academic Level 2 qualifications have been found to be poorly rewarded in the labour market (see, for example, Dearden, McGranahan and Sianesi (2004)), these disparities remain concerning.

There is not such a clear pattern over time in terms of differences between the proportion of August- and September-born children who are recorded as having statemented (i.e. more severe) or non-statemented (i.e. less severe) special educational needs. At age 5 (when children are in their first year of school), very few have been diagnosed with special educational needs, so differences according to month of birth are small and generally insignificant. The largest August birth penalties for this outcome are evident at age 11, after which they appear to fall back somewhat by age 16. At age 11, August-born girls are 0.4 percentage points (25 per cent) more likely to have statemented special educational needs and 8.1 percentage points (72 per cent) more likely to have non-statemented special educational needs; the corresponding figures for boys are 0.6 percentage points (14 per cent) and 9.4 percentage points (46 per cent).

[10] These have been calculated by averaging the August birth penalties found at Key Stage 1 for Groups 1 and 2.

[11] These have been calculated by averaging the August birth penalties found at Key Stage 2 for Groups 2 and 3.

[12] These have been calculated by averaging the August birth penalties found at Key Stage 3 for Groups 2 and 3.

[13] These have been calculated by averaging the August birth penalties found at Key Stage 1 for Groups 1 and 2.

[14] These have been calculated by averaging the August birth penalties found at Key Stage 2 for Groups 2 and 3.

[15] These have been calculated by averaging the August birth penalties found at Key Stage 3 for Groups 2 and 3.

2. What is the best admissions policy for summer-born children in terms of cognitive outcomes?

Our findings on this question (discussed in Chapter 6 of this report) suggest that admissions policies do matter, at least for early cognitive outcomes. In general, August-born children are slightly better off (and certainly no worse off) if they start school in the September of the academic year in which they turn 5 (rather than in the January or the April, as happens in some local education authorities). Furthermore, this is likely to be of greater benefit to girls than to boys.

For example, in terms of the proportions achieving the expected level, August-born girls (boys) who receive two terms less schooling (or, equivalently, start school when they are seven months older) than other August-born children face an additional penalty of 3.8 (2.4) percentage points at Key Stage 1, 2.5 (0.2) percentage points at Key Stage 2 and 2.4 (0.3) percentage points at Key Stage 3. These differences are all significant for girls but only significant at Key Stage 1 for boys, and there are no significant differences[16] by admissions policy area at either Key Stage 4 or Key Stage 5.[17]

These findings suggest that the August birth penalty is not being driven by differences in admissions policies, which leads us nicely on to our third research question.

3. Which of these factors – absolute age, age of starting school, length of schooling, age position – drive differences in cognitive outcomes between August- and September-born children?

The results of our work on this question (discussed in Chapter 7 of this report) suggest that the major reason why August-born children perform significantly worse than September-born children in the Key Stage tests is simply that they are almost a year younger when they sit them. Whilst, as we saw above, August-born children do benefit from starting school earlier rather than later (for example, in the September, rather than the January or the April, of their reception year), this makes only a modest positive contribution to test scores and only at early Key Stages. Age position effects are generally not important.[18] Clearly, other policy options are needed in order to eliminate the August birth penalty.

4. Does the August birth penalty vary across particular subgroups of interest?

This issue is discussed in Chapter 8 of this report. We considered comparisons across a number of subgroups: students who are eligible for free school meals (a proxy for low family income) vs. students who are not;[19] students who live in one of the 20 per cent most deprived

[16] At conventional levels (5 per cent or below), and in terms of the proportion of individuals reaching the expected level at each Key Stage.

[17] The additional penalties for August-born children who receive one term less schooling (or, equivalently, start school when they are four months older) than other August-born children are generally smaller than the effects for August-born children who receive two terms less schooling; further, they do not persist beyond Key Stage 2 for either girls or boys.

[18] The age position effect also has a small (and sometimes significant) additional negative impact on the test scores of August-born children (usually in earlier Key Stages), but its magnitude is dwarfed by that of the absolute age (age of sitting the test) effect.

[19] We present the results of this comparison in Chapter 8. Results for other subgroups are available from the authors on request.

Super Output Areas (SOAs)[20] vs. students who do not; students of Black Caribbean ethnic origin vs. students of White British ethnic origin; students of Black ethnic origin vs. students of White British ethnic origin; and students of Pakistani or Bangladeshi ethnic origin vs. students of White British ethnic origin.

Whilst there are some significant differences in terms of the magnitude of the August birth penalty for children who are and are not eligible for free school meals (discussed in Chapter 8), perhaps the most important finding is the lack of significant differences amongst the majority of subgroups considered. This suggests that, in most cases, August-born children, regardless of observable characteristics, face the same disadvantage (in terms of cognitive outcomes) relative to September-born children. This suggests that policy options (discussed below) do not need to be tailored to the needs of particular subgroups: in theory, all August-born children should benefit from the suggestions that we make.

Policy options and conclusions

It is clear from the results presented in this report that cognitive outcomes are affected by date of birth: a child born in September will, on average, perform significantly better in academic tests than a child born in August, simply because they start school (and sit the tests) up to a year later.

Our work suggests that these differences arise predominantly because August-born children are almost a year younger than September-born children when they sit the tests. Further, these disparities remain significant at ages 16 and 18, so that date of birth may be influencing decisions over whether to stay in education or to leave school and enter the labour market. This cannot be optimal from either an efficiency or equity perspective, and it seems clear to us that some form of policy change is necessary to ensure that this inequity does not continue.

In Chapter 9, we suggest a number of policy options that might help overcome this date-of-birth penalty. In our opinion, the most viable of these are the following:

1. Age normalisation of test results

Perhaps the easiest and most effective solution would be to explicitly recognise that attainment differs by month of birth and accordingly age normalise Key Stage test results (including results used to generate school league tables and those used to sort children into classes on the basis of ability[21]). The aim, using this approach, would be to ensure that the proportion of students reaching a particular grade at a particular Key Stage does not vary by month of birth. The argument in favour of this option is that somebody always has to be the youngest, and no policy is going to get around this fact; what one needs to ensure instead is that being the youngest does not unnecessarily penalise students who get the 'unlucky' summer birth draw.

Of course, age normalisation cannot continue for ever. At the point at which students leave the education system – for example, to enter the labour market – it is important that test

[20] A Super Output Area comprises approximately 1,500 households.

[21] The idea here would be that children were streamed according to potential (rather than actual) attainment.

results measure *actual* levels of human capital rather than some age-normalised version. For this reason, we argue that age normalisation should only be implemented up to age 14. However, given that there is still evidence of an August birth penalty at age 16 – and that many providers of further education require some minimum level of attainment in order for students to progress – it seems sensible to determine whether a child stays on in education beyond age 16 (and what type of provision they opt for) on the basis of age-normalised scores, to ensure that summer-born children are not penalised.

Details of possible implementation methods, together with the effects of age normalisation on the magnitude of the August birth penalty and school league table rankings, can be found in Section 9.1.1 of this report.

2. Testing when ready

The government has already announced that it is piloting a scheme (the 'Making Good Progress' programme) to introduce greater flexibility into the current testing system. This pilot allows children to sit Key Stage 2 and Key Stage 3 tests in English and maths at twice-yearly sittings, whenever they are ready to take them.[22]

It seems to us that the most sensible way of adapting this scheme to better suit the needs of summer-born children would be to use the age at which they sat (and passed) the Key Stage tests as the outcome. This could also be used in school league tables, by averaging the age at which all children in a particular cohort passed each Key Stage test. Furthermore, if expected levels were also set on this basis, then August-born children (and their parents and teachers) would be given a much clearer picture of their relative position in the ability distribution, conditional on age.

This option alone would not act to reduce the August birth penalty present in Key Stage 4 and Key Stage 5 results – unless behavioural factors (for example, in terms of increased motivation and/or self-belief) improved the performance of currently low-scoring students, including summer-born children, enough to reduce or eliminate this gap. Of course, this policy could be implemented alongside the option of age normalisation of Key Stage 4 outcomes (at least when assessing progression to Key Stage 5, as discussed above).

3. Changes to free nursery provision and flexibility over school starting ages

Every child in England is currently entitled to 12½ hours of free nursery education per week,[23] from the beginning of the term after they turn 3 until the beginning of the term in which they start school. This means that, depending on the admissions policy in place in their area, summer-born children may receive up to two terms less nursery education than their autumn-born counterparts. Given that August-born children are already disadvantaged as a result of being the youngest in their year, it might be sensible to grant them access to free nursery provision from the beginning of the academic *year* in which they turn 3 rather than the beginning of the *term* after they turn 3. Assuming that August-born children are able to benefit from this extra nursery provision (despite being extremely young when they access

[22] See Section 9.1.2 for more details of this pilot programme.

[23] This is due to increase to 15 hours per week in April 2010.

it),[24] this policy may help to reduce the August birth penalty for children across admissions policy areas.

Alternatively, flexibility over the age at which children can start school might also act to reduce the August birth penalty. If this option were to be implemented, then the government would need to think carefully about exactly who would be allowed to decide at what age a particular child started school. Currently, 3- and 4-year-olds who have not yet started school are only entitled to 12½ hours of free nursery provision per week. Thus there may be some concern that if parents are involved in the decision-making process, it is more likely to be middle-class parents who would take advantage of this flexibility: children from more disadvantaged backgrounds, whose parents may need the extra hours of free childcare that school provides to make work affordable, may not benefit. Given these concerns, it seems clear to us that if flexibility over school starting age were to be seriously considered, then full-time nursery provision would need to be offered as an alternative to full-time schooling.

4. Other options

There are also a number of more minor policy changes that could be implemented alongside any of the above options for reform.

The answer to our third research question suggests that if all local education authorities adopted an admissions policy under which all children started school in the September of the academic year in which they turned 5, then the outcomes (at least at the earliest Key Stages) of the youngest members of each cohort would improve (or at least not worsen).

Perhaps more fundamentally, it does not appear that the issue of age and its relationship with test scores features in the current teacher training programme. This means that newly qualified teachers (and possibly, as a consequence, the parents of young children) may not realise how big an impact relative age has on test scores. Raising awareness of this issue seems to be a vital first step towards any potential tailoring of classroom tuition towards children of different ages.[25]

What is clear from this report is that there is a significant inequity that needs to be urgently addressed: August-born children are, on average, being penalised (in terms of cognitive outcomes) simply because of an unlucky birth draw. This is not acceptable on either equity or efficiency grounds, and steps should be taken to eliminate this penalty.

[24] Our results for August-born children at age 5 suggest that this may be plausible.

[25] This may be particularly true for non-statemented special educational needs: greater awareness of the expected performance of August-born children compared with others in their class may reassure parents that their child does not necessarily have special educational needs simply because they are progressing more slowly than their peers.