BMJ Public Health

Systemic review of the relative age effect in Scottish schooling: a public health imperative for policy reform and equity

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To cite: Stuart A, Lynch T, Hamilton X, *et al*. Systemic review of the relative age effect in Scottish schooling: a public health imperative for policy reform and equity. *BMJ Public Health* 2026;**4**:e003676. doi:10.1136/bmjph-2025-003676

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/bmjph-2025-003676).

Received 30 July 2025
Accepted 18 February 2026

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ABSTRACT

Objectives The relative age effect (RAE) is where an individual's age relative to their age-banded cohort influences various outcomes and has a globally observed pattern impacting health, academic performance and psychosocial development. Scotland's unique school commencement laws have resulted in extended schooling cohorts spanning up to 19 months, thus exacerbating RAE and subsequently widening health inequities. This research synthesises evidence to delineate the public health problem posed by RAE in the Scottish educational context and proposes evidence-based policy interventions.

Design A comprehensive policy brief methodology was employed, integrating a systematic literature review with extensive stakeholder engagement and detailed analysis of local data, including Scottish Government statistics.

Data sources Web of Science and EBSCOhost databases were searched, along with Scottish Government statistics.

Eligibility criteria Population, Intervention, Comparator, Outcome, Study Design frameworks and targeted search terms were used for study selection.

Data extraction and synthesis Ethical approval was obtained, and Sex and Gender Equity in Research and patient and public involvement considerations were integrated.

Results Analysis of Scottish data reveals increasing school entry deferral rates, particularly among children born in January and February. Furthermore, the trend appears to be influenced by government funding for additional childcare. This deferral appears to disproportionately favour white ethnic backgrounds, boys and higher socioeconomic strata, widening inequities. More so, RAE is associated with increased physical injury rates, adverse mental health outcomes (anxiety, depression, suicide), higher incidence of learning disabilities, diminished academic attainment and reduced psychosocial development (lower self-esteem and fewer leadership opportunities). Extended 19-month cohorts, such as the one offered in the Scottish education system, are predicted to amplify these disadvantages.

Conclusions The existence of extended 19-month schooling cohorts in Scotland represents a significant, yet under-recognised, public health issue. This structural anomaly perpetuates and exacerbates existing inequities in child development and well-being. A strategic realignment of default school entry with the legally stipulated age, complemented by multi-faceted RAE-mitigation strategies,

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The relative age effect (RAE) is a well-established phenomenon where children born earlier in an age-banded cohort generally outperform their younger peers.
⇒ RAE is evidenced in research across academic, athletic and psychosocial domains.
⇒ Scotland's school commencement system is distinctive internationally, permitting an age spread of up to 19 months within a single school cohort.

WHAT THIS STUDY ADDS

⇒ This study systematically synthesises existing evidence, demonstrating that Scotland's extended 19-month schooling cohorts intensify the negative public health and equity impacts associated with RAE.
⇒ It reveals that increasing school entry deferral rates in Scotland are disproportionately exercised by white, male and higher socioeconomic status groups, actively widening pre-existing inequalities.
⇒ The research establishes that the customary early school commencement age is a misrepresentation of Scots Law, and formally adopting the legal default commencement age presents a viable, funded and piloted solution to compress these extended cohorts.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study provides a robust evidence base for policymakers in Scotland to formally adopt the legal school commencement age as the default, which would effectively reduce the age spread within cohorts and promote greater equity.
⇒ It stresses the necessity for a multilevel, mutually supportive strategy, encompassing RAE education, implementation across physical learning (with a focus on physical education and sports) and age-adjusted assessments, to mitigate residual RAE and address the challenges posed by legacy cohorts.
⇒ Lastly, it calls for urgent, targeted research within Scotland to quantify the direct health effects of extended cohorts and evaluate the impact of the proposed interventions.

offers a pragmatic, evidence-based and equitable pathway to improve holistic child health and developmental outcomes across the Scottish population.

INTRODUCTION

Global context and public health significance of the relative age effect

The relative age effect (RAE) describes consistent advantages and disadvantages experienced by individuals based on their age relative to others within an age-banded cohort. This phenomenon is extensively documented, particularly in sports, where older children in a cohort are preferentially selected and tend to outperform younger counterparts.[1] However, RAE's influence extends beyond sports, impacting critical areas such as learning disabilities, including attention deficit hyperactivity disorder (ADHD)[2]; mental health, with associations to anxiety, depression and suicide[3]; physical injury rates[4] and long-term career opportunities[5] and earnings.[6] It also affects participation in sports and physical activities across the lifespan,[7 8] academic attainment[9–12] and academic streaming.[13 14]

The global prevalence of RAE underscores its profound public health significance. With over 1.3 billion children attending school worldwide in 2020[15 16] and over 700 000 children in Scotland alone,[17] RAE is a pervasive issue theoretically affecting every individual at some point. Direct health effects, though often subtle individually, accumulate across large populations, while indirect impacts through academic attainment, physical activity and earnings further compound its influence on health trajectories. This complex interplay suggests that relative age may function as a new and underappreciated determinant of health, operating across all levels of the socio-ecological model.[18] This perspective broadens the scope of responsibility for addressing RAE beyond educational or sporting bodies, positioning it as a fundamental public health concern demanding systemic interventions.

The breadth of RAE's negative impacts is substantial. Studies link it to increased anxiety, depression, lower self-esteem and suicide.[19 20] In relation to learning, RAE is associated with higher rates of ADHD diagnoses, with some research suggesting a 'medicalisation of immaturity' where younger children are more likely to be diagnosed.[2] Physical injury rates are higher for relatively younger children, and their participation in sports and physical activities tends to be lower, a trend that can persist throughout life.[4] Academically, RAE leads to significant disparities in attainment and streaming, with older children consistently outperforming their younger peers, an advantage that can translate into better career opportunities and higher lifetime earnings.[1 13] These initial advantages or disadvantages can accumulate over time through mechanisms such as the 'Matthew effect' (where initial advantage accumulates), the 'Pygmalion effect' (where educator expectations reinforce success or failure) and the 'Galatea effect' (where self-belief drives attainment), collectively setting life course trajectories early in primary school.[1 21] Table 1 summarises the varying strength of RAE across different domains, evidenced in research.

Specific problem in Scotland: extended 19-month schooling cohorts and their exacerbation of RAE

A salient feature of the Scottish educational system is that while schools appear to be organised into 13 sequential 12-month cohorts, they are, in practice, composed of 13 overlapping cohorts that can extend up to 19 months. This extended age spread within a single class significantly amplifies the developmental differences between the oldest and youngest children, making the RAE more pronounced.

The legal framework for school commencement in Scotland, the Education (Scotland) Act 1980, stipulates that a child must commence education in August after turning 5.[22] However, a provision within the Act permits earlier commencement if a child turns five before a 'latest appropriate date', which has customarily become the last day of February.[22] This custom has, over time, become the de facto default, leading to a situation where commencing school at the legally mandated age (August after turning five) is paradoxically framed as 'deferral'.[23] This framing creates a systemic anomaly where the legal norm is perceived as an exception.

The origins of this customary cut-off date and its default adoption remain unrecorded, indicating a historical oversight rather than a deliberate policy decision.[24] This lack of clear rationale for the customary practice, combined with the subsequent introduction of government funding for an additional year of childcare for children who 'defer' (initially for January-February born children from 2014, then extended to August-February born from 2023), has inadvertently fuelled increasing rates of deferral.[23] While seemingly offering a positive 'choice' to parents, this system has, in fact, compounded the RAE by extending cohorts and, critically, has widened existing inequities due to differential demographic uptake of deferral. The 'choice' to defer, while empowering for some, has become a mechanism for the effective maintenance of inequality, allowing well-resourced groups to secure further advantage for their children, thereby disadvantaging others.

Rationale for investigating and proposing policy interventions

To date, no specific research has been conducted in Scotland on the direct health effects of these extended cohorts. However, studies in similar populations have consistently evidenced worse academic and developmental outcomes for relatively younger children, girls, those from deprived communities and minority ethnicities within extended cohorts.

These negative correlations with health for a significant portion of the population, coupled with a disproportionate impact on already disadvantaged groups, elevate RAE to a significant yet underappreciated public

Table 1 Summary of strength of relative age effect

Area of health	Selected evidence	Statistically significant	Strength of effect	Comment
Physical injury	Stracciolini *et al*, 2016[4]	Yes	Moderate	Approx. 2000 childhood injuries studied.
Mental ill health	Goodman et al, 2003[47]; Reijneveld *et al*, 2006[64]; Root *et al*, 2019[20]	Yes	Small but consistent	12-month cohorts. Goodman *et al*[47] was a large study based in the UK.
Psychosocial development (multiple components including behaviour, risky behaviour, well-being, suicide, diagnosis with a mental health condition and leadership).	Rose and Barlow, 2024[54]	Yes for most	Small	A complex systematic review and meta-analysis showing consistent but small negative effect.
Suicide	Thompson *et al*, 1999,[48] Matsubayashi and Ueda, 2015[19]	Yes	Small	Consistent finding.
Learning disabilities	Brault *et al*, 2022[2]; Holland and Sayal, 2019[49]; Fleming *et al*, 2022[31]; SIMBA, 2023[63]	Yes	Moderate	Brault and Fleming's studies suggest medicalisation of immaturity. Holland and Sayal: Systematic Review (SR) showing higher ADHD in younger children. SIMBA SR showing ADHD diagnoses is retained.
Academic attainment	Bedard and Dhuey, 2006[51]; Sharp *et al*, 2009[12]; Herbst and Strawinski, 2016[52]; Doyle *et al*, 2017[10]; Oterhals *et al*, 2023[13]; Jenkins and Fortner, 2024[11]	Yes	Large	Bedard and Dhuey: Global evidence of persistence of effect. Sharp: International thematic probe (SR). Large effect at primary school–reducing across secondary but note plausible path dependence established. Herbst and Strawinski: Older outperform in writing and maths. Doyle: Discrimination and wasted talent appear to be calculable. Oterhals: academic streaming. Jenkins and Fortner: benefit reading and maths.
Physical activity participation	Malm *et al*, 2019[8]; Jakobsson *et al*, 2021[50]	Yes	Large/unknown	Malm: SR for health benefits of PA showed large effect on health of participation and data showed reduced participation in relatively young; Jakobsson: SR sport participation related to future PA.

ADHD, attention deficit hyperactivity disorder; PA, physical activity; SIMBA, Synergy for the Influence of the Month of Birth in ADHD.

health issue in Scotland. Given the systemic nature of the problem, a comprehensive investigation and the proposal of evidence-based policy interventions are imperative to address these inequities and improve public health outcomes.

MATERIALS AND METHODS

Study design

This article is derived from a comprehensive policy brief that employed an integrated methodology, combining a systematic literature review with extensive stakeholder engagement and detailed local data analysis. This multi-faceted approach was purposefully selected to provide a robust, evidence-based understanding of the complex public health problem posed by the RAE within Scottish schooling cohorts, thereby informing actionable policy recommendations.

Systematic review process

The systematic review formed a foundational component of this investigation, designed to identify and synthesise

Table 2 PICOS framework for extended cohorts

Element	Specification
P–Population	Children and young people of school age
I–Intervention	Deferral; Cohorting greater than 12-month cohorts (by month, quarter or half)
C–Comparator	Oldest of cohort vs youngest of cohorts
O–Outcome	Academic attainment, lifetime earnings, leadership opportunities, health
S–Study design	Not case studies

Adapted from Schardt *et al*.[65]

evidence relevant to the RAE and its public health implications.

Research question

Does the school commencement system in Scotland exacerbate the RAE, widen health inequities and negatively affect health?

Population, Intervention, Comparator, Outcome, Study Design framework

To ensure a comprehensive and targeted search, the Population, Intervention, Comparator, Outcome, Study Design framework was adapted and applied twice: once for 'Extended Cohorts' (table 2) and once for 'RAE', acknowledging the distinct nature of these two interacting issues.

Search strategy, terms and databases

The search strategy (online supplemental file 1) incorporated terms derived from initial local evidence gathering, augmented by insights gained from stakeholder interactions. These included: 'relative age effect', 'redshirt*' or 'defer*', 'academ*', 'health*', 'leader*', 'opportunit*', 'wellbeing', 'kindergarten', 'particip*' and 'domin*'. Global evidence was systematically searched across two primary databases: Web of Science, selected for its broad coverage of health-related research, and EBSCOhost, chosen for its extensive collection of education-related research.

Inclusion and exclusion criteria

Inclusion criteria focused on studies involving children and young people of school age, examining the impacts of RAE on academic attainment, lifetime earnings, leadership opportunities and health outcomes. Given the overwhelming volume of sport-related studies, a specific restriction was applied: only systematic reviews (SRs) pertaining to sport were included to ensure generalisability and maintain the focus on broader public health implications. Exclusion criteria were kept broad to avoid inadvertently missing relevant evidence, but included papers published before 1990, those for which full text was unavailable or not in English, and non-SR sport-specific studies.

Screening and quality assessment

The screening process and quality assessment followed a rigorous protocol. All search results were collated in Covidence[25] on the 17 May 2024, and duplicates were automatically and manually removed. Titles and abstracts were then screened for relevance, leading to the exclusion of irrelevant papers. Full texts of the remaining articles were retrieved, and a final assessment for eligibility, applicability and quality was conducted. Data from all included studies were systematically extracted, capturing essential details such as reference, title, methodology, context, aim, comparison, outcome and results. The PRISMA flow diagram (figure 1) illustrates the systematic review process. No artificial intelligence tools were used in any stage of the screening or data extraction process.

Risk of bias assessment

The risk of bias in included studies was assessed using the ROBINS-I (Risk Of Bias In Non-randomised Studies - of Interventions) tool.[26] ROBINS-I evaluates seven domains of bias: (1) confounding, (2) selection of participants, (3) classification of interventions, (4) deviations from intended interventions, (5) missing data, (6) measurement of outcomes and (7) selection of reported results. Two reviewers independently assessed each study, with disagreements resolved through consensus discussion. Risk of bias judgements were categorised as low, moderate, serious, critical or no information for each domain and overall. Results were visualised using robvis-compatible formats.[27]

Approach to local data analysis and stakeholder engagement

Beyond the systematic literature review, the methodology incorporated a detailed analysis of local data and extensive stakeholder engagement to provide a comprehensive understanding of the Scottish context. Local evidence was sought through targeted searches on Web of Science and EBSCOhost, complemented by investigations into grey literature and official stakeholder websites. This process was instrumental in identifying open-source data and potential stakeholders' perspectives. Data was collected through email correspondence, telephone calls, face-to-face meetings, website searches and document requests. The term 'redshirt', commonly used for deferral in the USA and elsewhere, was identified through these local searches, which subsequently aided in identifying relevant international research.

A critical component of the local data analysis involved scrutinising official open-source data on deferral rates provided by Scottish Government Statistics.[23] This analysis revealed the patterns and demographic characteristics of deferral in Scotland. Furthermore, a critical appraisal was conducted on the evidence presented by the 'Give Them Time' lobby group, which had successfully advocated for automatic government funding for an additional year of childcare for deferred children.[28] This appraisal highlighted that while the lobby's argument was framed around 'school readiness', the higher-quality

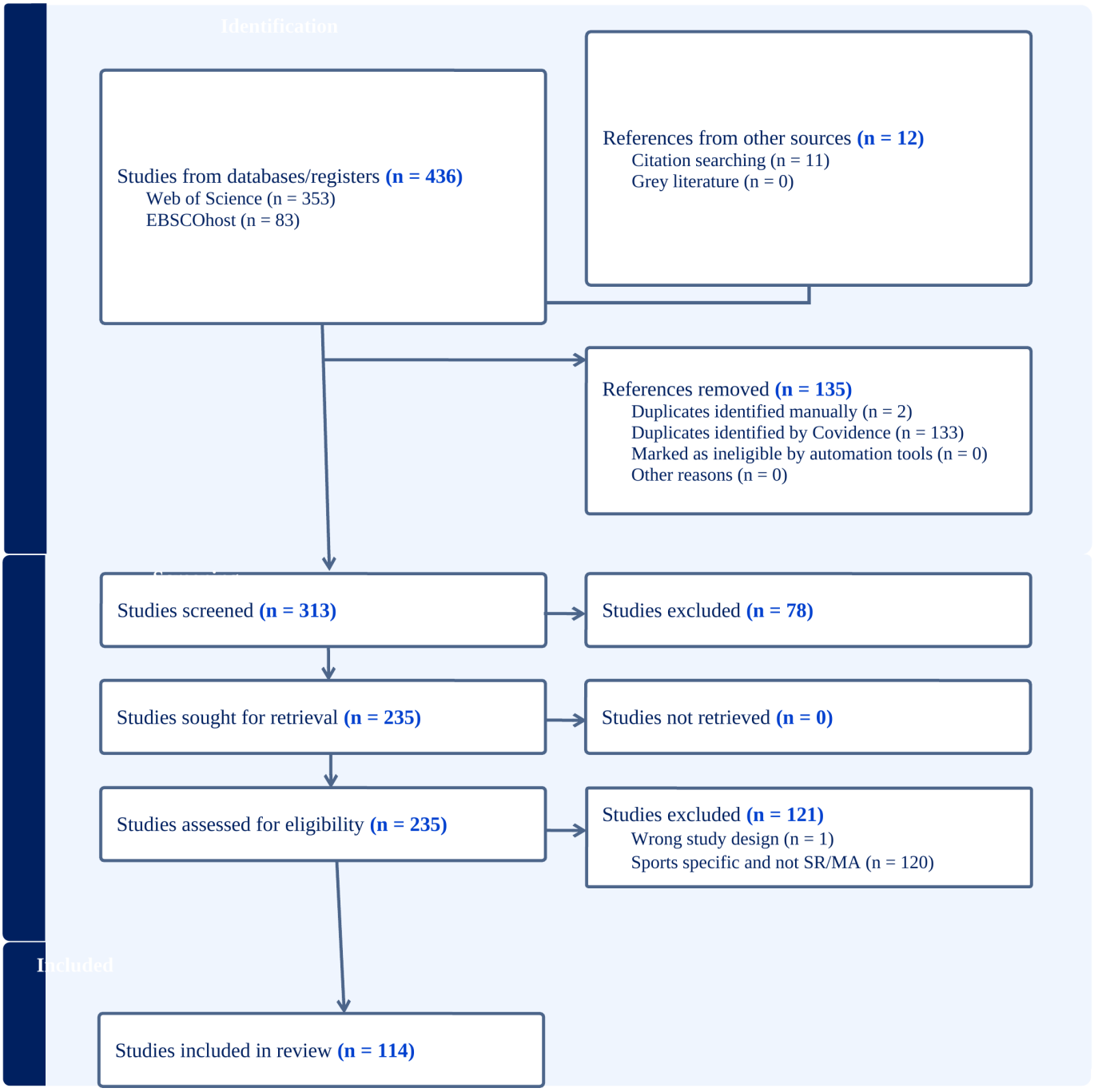

Figure 1 PRISMA flow diagram. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; SR/MA, systematic review/meta-analysis.

evidence they presented predominantly concerned the harms of RAE in 12-month cohorts, with 'school readiness' claims largely based on sources such as grey literature, social media and commercial websites, rather than robust empirical research. This highlights a widespread lack of awareness among stakeholders regarding the origins, inequities and negative effects of extended cohorts, which within the system is referred to as 'pluralistic blindness'.

To gain diverse perspectives and insights into the feasibility and applicability of potential policy options, extensive stakeholder engagement was undertaken. This involved consultations with a wide range of individuals and organisations, including Scottish Government officials (including Members of the Scottish Parliament, Directorate of Education), Education Scotland, sport governing bodies (including Scottish Rugby Union), educational associations (including Association of Directors of Education), trade unions (including Educational Institute of Scotland), headteachers and teachers (from Scotland and New South Wales (NSW), Australia), PE teachers, sport coaches and health professionals (including Community and Adolescent Mental Health Team, Paediatric Emergency Department). The National

Records of Scotland was also consulted to clarify the historical basis of school commencement dates.[29] This multifaceted engagement provided crucial qualitative data on prevailing attitudes, potential barriers and facilitating factors for policy implementation.

The researcher ensured methodological rigour through systematic peer consultation and supervisory oversight. Experienced researchers and academic colleagues provided a critical review of the study design, statistical analyses and interpretation of findings. This process involved regular discussions of analytical decisions, verification of statistical procedures and comprehensive proofreading of research reports. All data management and analysis protocols were documented to ensure transparency and reproducibility, and sensitivity analyses were conducted to confirm the robustness of key findings.

Sex and Gender Equity in Research statement

This study acknowledges the critical importance of sex and gender in understanding the RAE. The demographic analysis of deferral rates explicitly notes that boys are more likely to be deferred than girls.[30] The discussion also explores the potential for RAE to interact with gender in academic and psychosocial outcomes, including the influence of societal perceptions, such as the concept of 'hegemonic masculinity' on deferral decisions. Where sex and/or gender information was not available in the source data (eg, for August–December born children in pilot deferral areas), this limitation is explicitly noted. The study strives to adhere to Sex and Gender Equity in Research guidelines by reporting available sex and gender information and discussing its implications for RAE.

Patient and public involvement

Patient and public involvement, as defined by the Guidance for Reporting Involvement of Patients and the Public (GRIPP2) reporting checklist, was not directly undertaken in the research process of the original policy brief. The study primarily involved a systematic review of existing academic literature and an analysis of publicly available governmental and grey literature data. However, extensive stakeholder engagement was a core component of the methodology. This engagement included direct consultation with parents (as stakeholders and through analysis of lobby group activities) and educators, providing valuable insights into their perspectives, concerns and experiences regarding school readiness, deferral practices and the RAE. The policy recommendations formulated are directly aimed at improving public health outcomes for children and their families.

RESULTS

Prevalence and demographic patterns of school entry deferral in Scotland

The analysis of local data reveals a clear and increasing trend in the practice of deferring school entry in Scotland. Official figures from 2018 demonstrated a rising deferral rate, particularly for children born in January and February, a pattern that intensified following the introduction of government funding for additional childcare in 2014.[23] This trend has continued, with summary statistics from 2023 indicating a 22% increase in applications for funded deferral between 2022 and 2023.[23] These rates significantly exceed those observed in other parts of the UK, which hover around 1.5%,[31] and are also higher than in areas studied in the USA.[32–34]

Pilot schemes, which extended automatic funding for deferral to August–December born children in addition to the January–February cohort, have resulted in exceptionally high deferral rates in the pilot areas.[35–39] For instance, Shetland recorded a staggering 98% deferral rate for January–February born children.[17]

A critical finding is the pronounced demographic inequity in deferral uptake. Deferral is more prevalent among children whose birthdays are closer to the customary cut-off date (28/29 February), but also disproportionately among boys, white ethnicities and those from higher socioeconomic status (SES) backgrounds (figure 2), as measured by the Scottish Index of Multiple Deprivation.[36 40] While socioeconomic uptake has shown some equalisation in pilot areas for August–December born children, it continues to favour wealthier families for January–February born children.[36] This demographic bias mirrors international trends observed in the USA,[41 42] Korea[43] and NSW, Australia.[44] The historical context further illuminates this pattern, with deferral initially being a practice undertaken by affluent Scottish boys in the 1960s.[34]

The increasing rates of deferral, coupled with their demographically biased uptake, reveal a concerning dynamic: deferral, while framed as a 'choice', functions as a mechanism for entrenched inequality.[31] It allows privileged groups to secure an advantage for their children, inadvertently creating systemic disadvantage for others. This occurs because the underlying motivation for deferral is not primarily 'school readiness', as often presented, but rather a desire to gain or maintain an advantage, or to avoid a perceived disadvantage. This perpetuates what has been termed 'Effective Maintenance of Inequality', where existing disparities are reinforced through seemingly neutral policy provisions.[45 46]

Synthesis of evidence on health, academic and psychosocial disadvantages associated with being relatively younger or within extended cohorts

The evidence consistently demonstrates that being relatively younger within a schooling cohort is detrimental across multiple domains.

Health impacts

RAE is associated with increased rates of physical injuries.[4] In terms of mental health, studies indicate a small but consistent negative effect, linking RAE to anxiety, depression and even suicide.[19 20 47 48] A significant finding is the link between RAE and learning disabilities, particularly

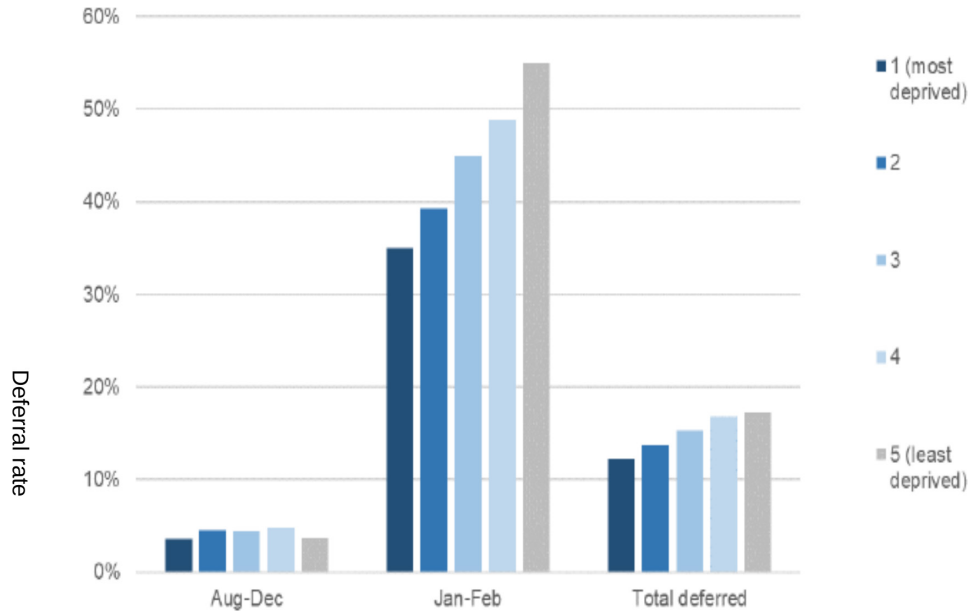

Figure 2 Deferral rates by birth month, sex, ethnicity and socioeconomic status (SIMD quintile) in Scotland (2018). Source: Scottish Government Statistics, 2020.[35] SIMD, Scottish Index of Multiple Deprivation.

ADHD, where younger children in a cohort are more frequently diagnosed.[31 48 49] This has led to the concept of 'medicalisation of immaturity', where developmental differences due to relative age are misinterpreted as clinical conditions.[2 31] Furthermore, relatively younger individuals exhibit reduced participation in sports and physical activities, a trend that can persist throughout their lifespan, impacting long-term health behaviours.[8 50]

Academic disadvantages

RAE exerts a large and persistent impact on academic attainment and streaming.[12 51 52] Younger children consistently score lower in academic subjects and are more likely to be streamed into less academic pathways.[13] This initial disadvantage tends to compound over time, establishing a trajectory that can affect educational and career opportunities for years to come.[53]

Psychosocial disadvantages

Beyond academic and physical outcomes, RAE negatively influences psychosocial development. It is associated with reduced self-esteem, impacts popularity among adolescents and limits leadership opportunities.[54] Younger adolescents may also exhibit different social behaviours, such as e-format reliance and having fewer friends.[54]

The unique 19-month age spread within Scottish cohorts is predicted to amplify these negative effects. Intuitively, a greater age differential between the oldest and youngest children in a class means a proportionally larger difference in physical, emotional and cognitive maturity, making it more challenging for educators. Concerns about 'school readiness' increase pressure to defer, further widening the cohort. The psychological phenomena of 'Matthew', 'Pygmalion' and 'Galatea' effects further explain how these initial advantages and disadvantages, stemming from relative age, can accumulate and reinforce life course trajectories from early primary school onwards.

Summary of identified viable policy options

The systematic review process yielded 436 initial results, which were refined to 101 relevant articles after rigorous screening and quality assessment. From these, seventeen studies proposed a total of 58 solutions to address RAE, many of which were similar or overlapping. Common recommendations emerging from the literature included providing additional support to disadvantaged children, rotating cut-off dates, educating coaches and teachers about RAE, delaying academic streaming and implementing tighter age grouping within cohorts. Notably, none of the reviewed studies recommended extending cohorts.

Based on the evidence synthesis and an assessment of feasibility and applicability within the Scottish context, several viable policy options were identified to address both the extended cohorts and the residual RAE:

- Policy option 1: Adopting the legal commencement age as default. This is the primary recommendation for addressing extended cohorts, aiming to realign school entry with the Education (Scotland) Act 1980.[22]
- Policy option 2: Education on RAE at all levels. This involves disseminating scientific knowledge about RAE to parents, educators and sports providers to raise awareness and correct unconscious biases.
- Policy option 3: Age-adjusted scoring in primary school and formative exams. This proposes using age-adjusted metrics to track children's development against predicted performance levels, particularly in primary school.

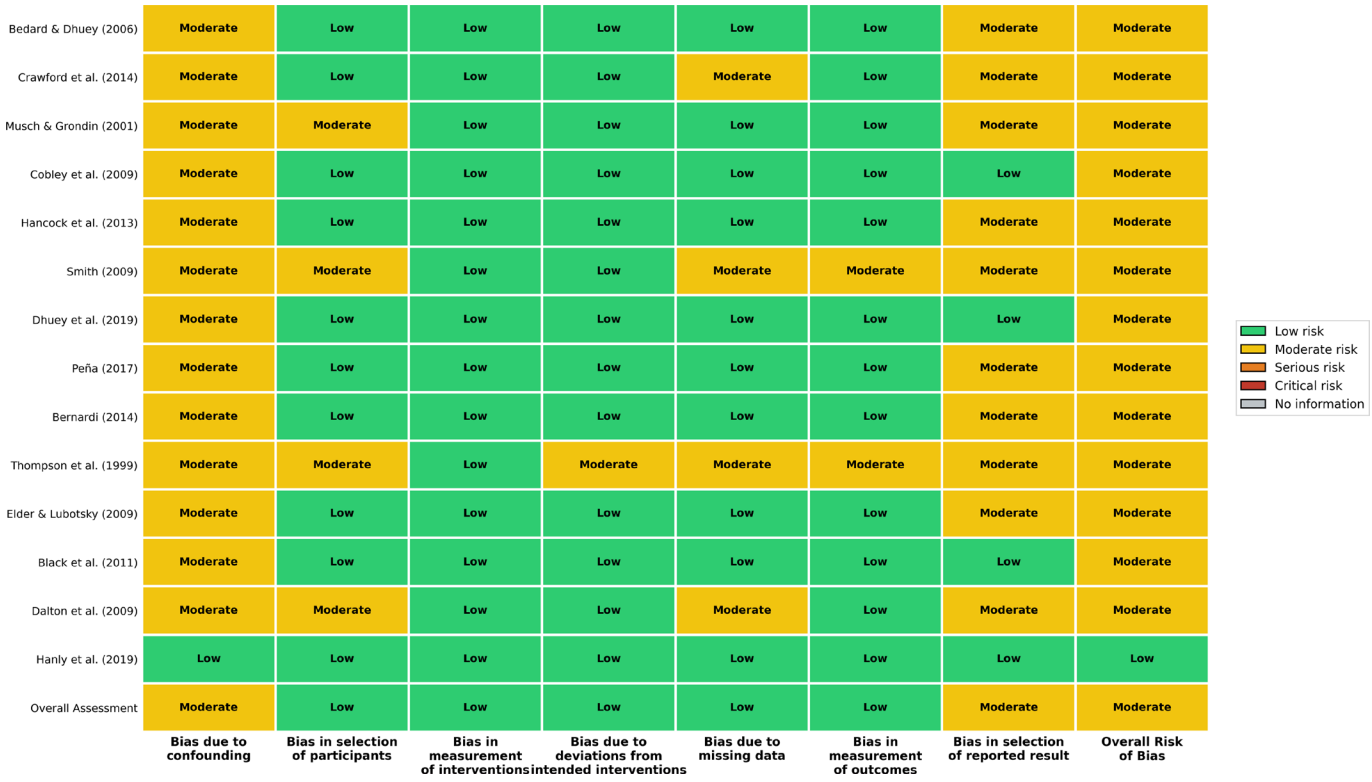

Figure 3 Risk of Bias Assessment–Relative Age Effect Studies (ROBINS-I Framework).

- Policy option 4: Measures limited to physical education (PE) and school-based sports. This focuses on implementing interventions within PE and school sports settings to challenge RAE, such as reduced age-spread categories, quotas or biometric-based grouping.

Several other options were considered but deemed non-viable due to impracticality, ethical concerns or unaffordability within the current state sector. These included skeletal or dental age assessments (unworkable), rotating cut-off dates (unworkable in school settings), preventing advancement (a legal provision) and smaller class sizes (effective but currently unaffordable).

Risk of bias in included studies

Risk of bias assessment was completed for all 14 included studies (figure 3). Overall, one study (7.1%) was judged to be at low risk of bias,[44] while 13 studies (92.9%) demonstrated moderate risk. No studies were rated as having serious or critical risk of bias.

Domain-specific findings revealed that classification of interventions showed the lowest risk, with all studies (100%) rated as low risk. This reflects the objective nature of birth date measurement. Selection of participants and measurement of outcomes also demonstrated predominantly low risk (85.7% of studies for each domain), attributable to the use of large administrative datasets and objective outcome measures.

Consistency of findings across studies, large sample sizes, objective outcome measurement for key variables and biological plausibility of the RAE provide confidence in the review conclusions. The evidence quality is judged to be adequate for informing policy decisions while highlighting the need for Scottish-specific research using population-level administrative data.

DISCUSSION

Interpretation of findings in the broader public health context, comparing with international evidence

The findings from this analysis position Scotland's school commencement system as a notable outlier when compared with most international norms. The customary 19-month schooling cohorts, coupled with increasing rates of deferral, exacerbate the well-documented RAE, intensifying its negative impacts across health,[4 19 20 47 48] academic[12 51–53] and psychosocial[54] domains. This aligns with extensive international evidence demonstrating the pervasive and detrimental effects of RAE on academic attainment, mental health and physical development across various educational systems.

The demographic bias observed in deferral uptake in Scotland, favouring white, male and higher SES groups, is not unique but mirrors trends seen internationally, particularly in countries like the USA, Korea and NSW, Australia.[41–44] This consistent pattern reveals a critical dynamic: the 'choice' to defer, while presented as an empowering option for parents, has, at a population level, generated systemic harm and inequality.[6 46 55] This is a paradox where an individual decision, influenced by socio-economic factors and access to information, aggregates to perpetuate disadvantage for others. The historical

context of deferral in Scotland, initiated by affluent families, further illustrates how a practice, seemingly benign, can become a tool for maintaining privilege.[24]

Pluralistic blindness has significant implications. This unawareness allowed a lobby group to successfully advocate for funding for deferral by conflating 'school readiness' with the harms of RAE, demonstrating how incomplete understanding can shape policy in unintended ways.[28] This situation highlights that the concept of 'school readiness' is largely a construct of the educational 'setting' rather than an inherent characteristic of the child. This understanding illustrates that interventions should focus on adapting the system to be age-appropriate for all children, rather than relying on individual parental choices that can inadvertently perpetuate inequities. Therefore, public health interventions must critically examine seemingly benign individual choices when they aggregate to population-level harms, advocating for equitable defaults rather than relying on choices influenced by socioeconomic disparities.

Elaboration on the recommended policy options as evidence-based interventions for public health improvement

The recommended policy options represent a multilevel, mutually supportive strategy designed to address both the structural issue of extended cohorts and the pervasive effects of RAE.

Policy option 1: adopting the legal commencement age as default

This foundational intervention directly aligns with the Education (Scotland) Act 1980, correcting a long-standing misrepresentation of the law.[24] By shifting the default school entry age to 5 years old, it is anticipated to increase the average age of school entry across the population, which is expected to lead to higher national academic attainment, as older children generally perform better in exams.[53 56] A narrower age differential within cohorts (from 19 months to 12 months) will significantly ease the task for educators in creating age-appropriate learning environments, as the spread of abilities and maturity levels will be reduced. This change will also facilitate more predictable pupil number planning for schools and local authorities, enhancing international comparability, simplifying transitions for migrant families and enabling fairer comparisons of academic attainment and safer international competition in sports and academics. From an equity perspective, this process is inherently more equitable as it removes the inadvertent early commencement that disproportionately affects girls, children from lower socio-economic groups and ethnic minorities/migrants, thereby benefiting historically disadvantaged groups. The feasibility of this option is high, as it is legally compliant, funding for additional childcare is already agreed on, and successful pilot schemes have demonstrated that existing resources can manage the transition.

Policy option 2: education on RAE at all levels

This intervention is considered essential for raising awareness and correcting unconscious biases among all stakeholders. It involves summarising scientific knowledge of RAE for parents, educators and sports providers. While raising awareness alone has shown limited effect in highly competitive sporting environments in Scotland, the academic setting is less overtly competitive, and stakeholder feedback suggests receptiveness to such information. This option is assessed as cost-effective, with expenses minimised by integrating it into existing routine training and information dissemination pathways.

Policy option 3: age-adjusted scoring in primary school and formative exams

This involves implementing age-adjusted metrics to track children's development against predicted performance levels, similar to how growth charts are used in health. The proposal is to extend and deepen into the school curriculum specific standardised expectation guidance (including years and months). This has been implemented by UK standardised assessments in mathematics and English, an example is the assessments designed by GL Assessments[57] (including cognitive assessments (CAT4), well-being (PASS), mathematics and English) and Hachette Learning (formerly Hodder Education).[58] Also, identified as imperative historically in the UK Stepping Stones (Early Years Foundation Stage Framework).[59 60] The primary benefit is to allow children to recognise their progress against parameters that account for their chronological age, preventing the artificial creation of 'winners' and 'losers' based solely on relative age.[53 61] This intervention aims to promote equity by providing a more accurate reflection of a child's actual performance, especially for the relatively younger. While requiring an initial investment for data collection, statistical model generation and ongoing maintenance, it is considered a cost-effective means of recognising true potential in the long term.

Policy option 4: measures limited to PE and school-based sports

This intervention targets RAE in PE and school sports, where the physical advantages conferred by being relatively older are most evident and extensively researched. The disadvantages experienced in sporting contexts are believed to transfer to other aspects of a child's life, including leadership opportunities and self-esteem, often mediated by height-based dominance.[1 21] Therefore, altering the school-based sport and PE experience can foster healthy behaviours and preserve opportunities for disadvantaged groups. Interventions include: ensuring children compete in events at swimming, athletics and cross-country competitions in their correct age group rather than their year level cohort; simple reduced age-spread categories for teams; quotas for internal competitions, and the use of biometrics (eg, height for basketball, weight for rugby). The intended benefit is to disrupt perception biases (self, coach, parents and teacher) in

a highly influential setting, promoting lifelong physical activity and preserving opportunities for disadvantaged groups.[9] This is expected to create a more equitable environment, particularly benefiting multiple disadvantaged groups such as those from lower SES, minority ethnicities and girls in sporting contexts.[9] The main cost is the time required for planning and organising banded activities, which can be minimised through frequent, intermittent implementation and enacting quality PE using qualified teachers.[62] The combination of these policies is designed to be mutually supportive and reinforcing. Online supplemental table 1 summarises the recommended policy options, their intended benefits and equity impacts.

Analysis of implementation barriers and facilitators, including social and political considerations

Successful implementation of these policies requires a nuanced understanding of potential barriers and facilitators across various levels, from individual recipients to broader social and political systems.

Barriers to implementation

- Recipient (parent) perceptions: A significant barrier is the apparent collective unawareness among parents of the potential harms associated with extended cohorts, coupled with a prevailing positive view of deferral, particularly for boys.[23 24] Higher SES groups, who currently benefit most from deferral, may also actively resist changes to maintain their advantage.
- Provider (teacher) perceptions: Educators often exhibit a similar lack of awareness regarding the harms of extended cohorts and RAE.
- Stakeholder perceptions: Other key stakeholders frequently express concerns about the potential loss of 'Scottish characteristics', including 'choice', if the school system aligns more closely with international norms, especially the National Curriculum of England.
- Systemic constraints: The inherent inertia within a large educational system poses a challenge for widespread change.
- Social and political constraints: Ideological beliefs regarding 'choice' and 'Scottishness' can impede implementation.[17 24 37] Influential lobby groups may perceive the policy as a threat to their existing advantages.[63]

Facilitators for implementation

- Legal alignment: A significant facilitator is that the proposed default school commencement age directly aligns with existing Scots Law.[22]
- Existing funding and pilot success: Key financial barriers, particularly for additional childcare, have already been addressed (c.f. p. 9).[23] Successful pilot schemes have provided crucial reassurance that existing resources can effectively manage the transition.[37]
- Improved outcomes: The expected improvements in academic attainment, enhanced equity and the creation of easier age-appropriate learning environments are strong facilitators.
- Strategic reframing: 'Deferral' can be represented as 'commencing in line with the law', and 'choice' can be redefined as the option for 'advancement'.
- International alignment: Highlighting alignment with culturally and climatically similar Scandinavian nations can be a positive framing.[7]

The proposed policy options are complementary and mutually supportive, requiring a cross-level and unified strategy for successful implementation. Online supplemental figure 1 illustrates this multi-level implementation strategy (GIRFEC is an acronym for Getting It Right For Every Child).

Limitations of the original research and the evidence base

Several limitations were identified in the original research that forms the basis of this study. A primary limitation is the scarcity of directly applicable local (Scottish) evidence specifically on the health effects of extended cohorts. This gap may stem from a historical lack of awareness regarding the potential harms associated with RAE and extended cohorts within the Scottish context.

The evidence base itself presented challenges, with a risk of conflation and lack of clarity in analysis due to the complex interplay of concerns over 'school readiness', RAE and learning disabilities within the literature, particularly in grey literature. This was further complicated by the interaction of RAE and extended cohorts in Scotland, necessitating separate analyses before developing a unified solution.

The systematic review on RAE in Scottish schooling acknowledges confounding as a critical issue, particularly SES, gender and ethnicity. Based on references cited, some studies employed rigorous methods which addressed confounding. However, the narrative synthesis format provided limited explicit detail on how individual studies controlled confounding.

Furthermore, the abundance of evidence relating to RAE in sports contexts posed a risk of diverting focus from the core public health implications of relative age within a cohort. To mitigate this, a strict inclusion criterion was applied, limiting sport-related evidence to systematic reviews only. While necessary to maintain emphasis on health, this approach might have inadvertently excluded valuable transferable information and insights from other sport-related studies. Lastly, current research into RAE in Scotland is complicated by the inability to precisely determine a child's age relative to their cohort for those born between August and February in existing data.

CONCLUSIONS

Summary of key implications for current policy and practice in Scotland

The analysis presented here highlights several critical implications for current policy and practice within the Scottish educational system. Foremost, the prevailing customary school commencement age, which allows for children to start school in August if they turn four before March, is a misrepresentation of the Education (Scotland) Act 1980.[22] The law explicitly directs commencement in August after turning five. This discrepancy has led to inconsistent messaging within educational organisations and requires urgent correction to align practice with the legal framework.

The increasing rates of deferral, driven by a desire to mitigate the disadvantages associated with being relatively younger, are inadvertently widening existing demographic inequities. This practice, while framed as 'choice', has disproportionately benefited white, male and higher SES groups, creating cohorts composed disproportionately of younger, female, poorer and minority ethnic children. The RAE, exacerbated by these extended 19-month cohorts, is an under-recognised determinant of health, which research suggests contributes to physical injuries, mental ill health, learning disabilities and reduced academic attainment and life opportunities.

The proposed policy package, which includes formally adopting the legal commencement age as the default, implementing RAE education at all levels, introducing age-adjusted scoring in primary school and formative exams, and applying targeted measures within PE and school-based sports, offers a feasible, funded and equitable solution. The fortuitous alignment of existing legal provisions, secured funding for additional childcare and successful pilot schemes creates a unique window of opportunity to transition to a more equitable system without major resource disruptions.

Recommendations for future research to address identified gaps

To further strengthen the evidence base and inform ongoing policy development, several areas for future research in Scotland are recommended:

- Quantitative studies: There is an urgent need for targeted quantitative studies to precisely measure the direct health effects of RAE in extended cohorts within Scotland. This includes research on physical injuries, mental health outcomes (eg, in Community and Adolescent Mental Health Services settings), and detailed analyses of academic attainment and participation in PE and school sport.
- Qualitative studies: Complementary qualitative studies are essential to explore the lived experiences and perceptions of children, parents, teachers and coaches regarding RAE and deferral. This would provide valuable insights into the social and psychological impacts of the current system and the proposed changes.
- Longitudinal studies: Scotland is ideally positioned to conduct longitudinal studies, which are crucial for tracking the long-term impacts of RAE and the effectiveness of interventions over time, as suggested by international research. Comparative studies with other UK nations could also yield valuable insights.
- Data collection recommendation: To enable robust quantification of the RAE and support future research efforts in Scottish cohorts, it is strongly recommended that a child's age within their school cohort be systematically recorded. This data point should be captured in addition to their date of birth at all health contacts, academic tracking points and when conducting research, including studies involving adults. This standardised data collection would significantly enhance the ability to monitor the prevalence and impact of RAE and evaluate the effectiveness of policy interventions.

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Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval The foundational policy brief from which this research article is derived received ethical approval from the University of Edinburgh Usher Institute Ethics Group (UM24365). Hence, the research project posed no reasonably foreseeable human ethical risks, conforming to the principles of the Declaration of Helsinki.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request.

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REFERENCES

1 Hancock DJ, Adler AL, Côté J. A proposed theoretical model to explain relative age effects in sport. *Eur J Sport Sci* 2013;13:630–7.
2 Brault M-C, Degroote E, Jean M, *et al*. Relative Age Effect in Attention Deficit/Hyperactivity Disorder at Various Stages of the Medicalization Process. *Children (Basel)* 2022;9:889.
3 Broughton T, Langley K, Tilling K, *et al*. Relative age in the school year and risk of mental health problems in childhood, adolescence and young adulthood. *Child Psychology Psychiatry* 2023;64:185–96.
4 Stracciolini A, Levey Friedman H, Casciano R, *et al*. The Relative Age Effect on Youth Sports Injuries. *Med Sci Sports Exerc* 2016;48:1068–74.
5 Du Q, Gao H, Levi MD. The relative-age effect and career success: Evidence from corporate CEOs. *Econ Lett* 2012;117:660–2.
6 Solli IF. Left behind by birth month. *Educ Econ* 2017;25:323–46.
7 Lynch T. Physical Education and Wellbeing: Global and Holistic Approaches to Child Health. London, UK: Palgrave Macmillan, 2019.
8 Malm C, Jakobsson J, Isaksson A. Physical Activity and Sports-Real Health Benefits: A Review with Insight into the Public Health of Sweden. *Sports (Basel)* 2019;7:127.
9 Lynch T. *Physical Education and Wellbeing: Global and Holistic Approaches to Child Health and Academic Learning*. 2nd edn. London, UK: Palgrave Macmillan, 2024.
10 Doyle JR, Bottomley PA, Angell R. Tails of the Travelling Gaussian model and the relative age effect: Tales of age discrimination and wasted talent. *PLoS ONE* 2017;12:e0176206.
11 Jenkins JM, Fortner CK. Forced to Redshirt: Quasi-Experimental Impacts of Delayed Kindergarten Entry. *J Res Educ Eff* 2025;18:447–73.
12 Sharp C, George N, Sargent C, *et al*. International Thematic Probe: The Influence of Relative Age on Learner Attainment and Development. National Foundation for Educational Research, 2009.
13 Oterhals G, Bachmann KE, Bjerke AH, *et al*. The relative age effect shifts students' choice of educational track even within a school system promoting equal opportunities. *Front Psychol* 2022;13:1066264.
14 Schneeweis N, Zweimüller M. Early Tracking and the Misfortune of Being Young. *Scandinavian J Economics* 2014;116:394–428.
15 World Bank. Primary education, pupils. 2019. Available: https://data.worldbank.org/indicator/SE.PRM.ENRL?end=2019&start=2000
16 World Bank. Secondary education, pupils. 2019. Available: https://data.worldbank.org/indicator/SE.SEC.ENRL?end=2019&start=2000
17 Scottish Government Statistics. Summary statistics for schools in Scotland 2023. 2023. Available: https://www.gov.scot/publications/summary-statistics-for-schools-in-scotland-2023/pages/early-learning-and-childcare-elc/
18 Bronfenbrenner U. Ecological Systems Theory. Jessica Kingsley Publishers, 1992:187–249.
19 Matsubayashi T, Ueda M. Relative Age in School and Suicide among Young Individuals in Japan: A Regression Discontinuity Approach. *PLoS ONE* 2015;10:e0135349.
20 Root A, Brown JP, Forbes HJ, *et al*. Association of Relative Age in the School Year With Diagnosis of Intellectual Disability, Attention-Deficit/Hyperactivity Disorder, and Depression. *JAMA Pediatr* 2019;173:1068–75.
21 Campbell T. Stratified at seven: in-class ability grouping and the relative age effect. *British Educational Res J* 2014;40:749–71.
22 Education (Scotland) Act. Section 32". UK Public General Acts 1980 c. 44, Part II, 1980. Available: https://www.legislation.gov.uk/ukpga/1980/44/section/32
23 Scottish Government. Early learning and childcare statistics, 2025. Available: https://www.gov.scot/collections/early-learning-and-childcare-statistics/
24 Davidson E. Letter from directorate for learning (Scotland). 2024.
25 Covidence systematic review software. Covidence (version 2.0). n.d. Available: https://www.covidence.org
26 Sterne JA, Hernán MA, Reeves BC, *et al*. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. *BMJ* 2016;355:i4919.
27 McGuinness LA, Higgins JPT. Risk-of-bias VISualization (robvis): An R package and Shiny web app for visualizing risk-of-bias assessments. *Res Synth Methods* 2021;12:55–61.
28 Give them time. Research on the potential benefit of deferral. 2021. Available: https://drive.google.com/file/d/1Mb4NdqclaLoki6uOI0WHIBjx4g6IkEit/view?pli=1
29 Spencer T. Email from national records of Scotland. 2024.
30 Scottish Government. Growing up in Scotland: early experiences of primary school. 2012. Available: https://www.gov.scot/publications/growing-up-scotland-early-experiences-primary-school/
31 Fleming M, Bandyopadhyay A, McLay JS, *et al*. Age within schoolyear and attention-deficit hyperactivity disorder in Scotland and Wales. *BMC Public Health* 2022;22.
32 Frey N. Retention, social promotion, and academic redshirting: What do we know and need to know. *Remedial Spec Educ* 2005;26:332–46.
33 Huang FL. Investigating the Prevalence of Academic Redshirting Using Population-Level Data. *AERA Open* 2015;1.
34 Lenard MA, Peña PA. Maturity and minorities: the impact of redshirting on achievement gaps. *Educ Econ* 2018;26:593–609.
35 Scottish Government Statistics. Deferred entry to primary school: statistics. 2020. Available: https://www.gov.scot/publications/deferred-entry-primary-school-statistics/pages/2/
36 Scottish Government Statistics. Summary statistics of schools in Scotland. 2020. Available: https://www.gov.scot/publications/summary-statistics-schools-scotland/pages/5/
37 Scottish Government Statistics. Early learning and childcare funding: primary 1 deferral pilot evaluation. 2023. Available: https://www.gov.scot/publications/pilot-evaluation-report-access-funded-early-learning-childcare-eligible-children-defer-entry-primary-1/
38 Cameron MB, Wilson BJ. The effects of chronological age, gender, and delay of entry on academic achievement and retention: Implications for academic redshirting. *Psychol Schs* 1990;27:260–3.
39 Dhuey E, Figlio D, Karbownik K, *et al*. School Starting Age and Cognitive Development. *J Policy Anal Manage* 2019;38:538–78.
40 Albanesi HP. Tilting the playing field: 'Redshirting' kindergarten boys in the US and the competition for hegemonic masculinity. *Gend Educ* 2019;31:240–57.
41 Bassok D, Reardon S. F. Academic Redshirting" in Kindergarten: Prevalence, Patterns, and Implications. *Educ Eval Policy Anal* 2013;35:283–97.
42 Fortner CK, Jenkins JM. Kindergarten redshirting: Motivations and spillovers using census-level data. *Early Child Res Q* 2017;38:44–56.
43 Kim T. Age culture, school-entry cutoff, and the choices of birth month and school-entry timing in South Korea. *J Dem Econ* 2021;87:33–65.
44 Hanly M, Edwards B, Goldfeld S, *et al*. School starting age and child development in a state-wide, population-level cohort of children in their first year of school in New South Wales, Australia. *Early Child Res Q* 2019;48:325–40.
45 Shepard LA. Children not ready to learn? The invalidity of school readiness testing. *Psychol Schs* 1997;34:85–97.
46 Bernardi F. Compensatory Advantage as a Mechanism of Educational Inequality: A Regression Discontinuity Based on Month of Birth. *Sociol Educ* 2014;87:74–88.
47 Goodman R, Gledhill J, Ford T. Child psychiatric disorder and relative age within school year: cross sectional survey of large population sample. *BMJ* 2003;327:472.
48 Thompson AH, Barnsley RH, Dyck RJ. A new factor in youth suicide: the relative age effect. *Can J Psychiatry* 1999;44:82–5.
49 Holland J, Sayal K. Relative age and ADHD symptoms, diagnosis and medication: a systematic review. *Eur Child Adolesc Psychiatry* 2019;28:1417–29.
50 Jakobsson J, Julin AL, Persson G, *et al*. Darwinian Selection Discriminates Young Athletes: the Relative Age Effect in Relation to Sporting Performance. *Sports Med Open* 2021;7:16.
51 Bedard K, Dhuey E. The Persistence of Early Childhood Maturity: International Evidence of Long-Run Age Effects*. *Quarterly Journal of Economics* 2006;121:1437–72.
52 Herbst M, Strawiński P. Early effects of an early start: Evidence from lowering the school starting age in Poland. *Journal of Policy Modeling* 2016;38:256–71.
53 Peña PA. Creating winners and losers: Date of birth, relative age in school, and outcomes in childhood and adulthood. *Econ Educ Rev* 2017;56:152–76.
54 Rose SE, Barlow CM. The impact of relative age effects on psychosocial development: A systematic review. *Br J Educ Psychol* 2024;94:248–81.

55 Stulp G, Buunk AP, Verhulst S, *et al*. Human height is positively related to interpersonal dominance in dyadic interactions. *PLoS One* 2015;10:e0117860.
56 Huertas F, Ballester R, Gines HJ, *et al*. Relative Age Effect in the Sport Environment. Role of Physical Fitness and Cognitive Function in Youth Soccer Players. *Int J Environ Res Public Health* 2019;16:2837.
57 GL Assessments. All assessments, 2025. Available: https://www.gl-assessment.co.uk/assessments/
58 Hachette Learning. Standardised assessments, 2025. Available: https://www.hachettelearning.com/assessment/standardised-assessments
59 Lynch T. Physically educated: developing children's health and well-being through movement and motor skills. In: Garvis S, Pendergast D, eds. *Health & wellbeing in childhood*. Melbourne, Australia: Cambridge, 2017: 77–94.
60 Department for Children, Schools and Families. Statutory Framework for the Early Years Foundation Stage – Setting the Standards for Learning, Development and Care for Children from Birth to Five. Nottingham, UK: Department for Children, Schools and Families, 2008.
61 Kohn A. No Contest: The Case against Competition. Houghton Mifflin Company, 1992.
62 Lynch T, Soukup GJ. "Physical education", "health and physical education", "physical literacy" and "health literacy": Global nomenclature confusion. *Cogent Education* 2016;3:1217820.
63 Gosling CJ, Caparos S, Pinabiaux C, *et al*. Association between relative age at school and persistence of ADHD in prospective studies: an individual participant data meta-analysis. *Lancet Psychiatry* 2023;10:922–33.
64 Reijneveld SA, Wiefferink CH, Brugman E, *et al*. Continuous admission to primary school and mental health problems. *BMC Public Health* 2006;6:145.
65 Schardt C, Adams MB, Owens T, *et al*. Utilization of the PICO framework to improve searching PubMed for clinical questions. *BMC Med Inform Decis Mak* 2007;7:16.