Title

The Extent and Specificity of Relative Age Effects on Mental Health and Functioning in Early Adolescence

Journal

Journal of Adolescent Health, 57(5)

ISSN

1054-139X

Authors

Patalay, Praveetha
Belsky, Jay
Fonagy, Peter
et al.

Publication Date

2015-11-01

DOI

10.1016/j.jadohealth.2015.07.012

Peer reviewed

Journal of Adolescent Health xxx (2015) 1–7

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Original article

The Extent and Specificity of Relative Age Effects on Mental Health and Functioning in Early Adolescence

Praveetha Patalay, Ph.D. [a,b,*], Jay Belsky, Ph.D. [c], Peter Fonagy, Ph.D. [a], Panos Vostanis, M.B., M.D. [d], Neil Humphrey, Ph.D. [e], Jessica Deighton, Ph.D. [b], and Miranda Wolpert, D.Clin.Psy. [b]

[a] *Clinical, Educational and Health Psychology, University College London, London, United Kingdom*
[b] *Evidence Based Practice Unit, University College London and Anna Freud Centre, London, United Kingdom*
[c] *Department of Human Ecology, University of California, Davis, Davis, California*
[d] *Greenwood Institute of Child Health, University of Leicester, Leicester, United Kingdom*
[e] *Manchester Institute of Education, University of Manchester, Manchester, United Kingdom*

Article history: Received May 11, 2015; Accepted July 23, 2015
Keywords: Age within cohort; Relative age; Well-being; Children; School

A B S T R A C T

Purpose: Although extensive evidence indicates that being younger within a school cohort is associated with poorer academic functioning, much less is known about such relative age effects (RAEs) for mental health - the focus of the current investigation.
Methods: Data from 23,379 11- to 13-year-olds attending state-maintained secondary schools in England were analyzed to investigate RAEs on mental health measured using the Strengths and Difficulties Questionnaire. Participants were grouped into oldest, middle, and youngest thirds of their academic year based on their month of birth relative to their cohort. Hierarchical linear regression analysis evaluated RAEs and gender- or deprivation-related moderation of such effects.
Results: Relatively younger adolescents had significantly more emotional symptoms and peer problems compared with relatively older individuals in a year group, although effect sizes were small. These effects were not moderated by gender or deprivation. Impact of mental health difficulties on other aspects of functioning was also greater among relatively younger children. Larger RAEs are observed in the younger cohort (11–12 years) compared with those in the 12- to 13-year-olds, thereby indicating that RAEs might attenuate with age.
Conclusions: Being relatively younger than classmates is associated with increased internalizing symptoms, poorer peer relationships, and higher impact of mental health difficulties on functioning at school and home. The findings support wider inclusion of relative age in understanding mental health difficulties and its inclusion as a potential risk factor in studies investigating the development of psychopathology, especially for internalizing symptoms. Possible mechanisms of the effects detected are discussed.

IMPLICATIONS AND CONTRIBUTION

This study demonstrates relative age effects on mental health for emotional difficulties and peer problems, which are not moderated by gender or deprivation, but which appear to undermine other aspects of functioning. Although relative age effects are small, from the perspective of multiple risks, they merit consideration as a contributing factor in the development of internalizing symptoms.

Some children in a school year group are older than their classmates and some younger. This is the result of the use of calendar month cutoffs for the selection of cohorts into a year group. For instance, September 1st is used as the cutoff for school entry in England, meaning that those born in late August will be nearly one year younger than many of their classmates born in

Conflicts of Interest: The authors have no conflicts of interest to report.

* Address correspondence to: Praveetha Patalay, Ph.D., Evidence Based Practice Unit, University College London and Anna Freud Centre, 21 Maresfield Gardens, London NW3 5SD, United Kingdom.
E-mail address: praveetha.patalay.11@ucl.ac.uk (P. Patalay).

1054-139X/
http://dx.doi.org/10.1016/j.jadohealth.2015.07.012

September, the previous year. The term relative age effects (RAEs) is one of several used to describe the bias that disadvantages the youngest children in a given cohort. Although the effects of relative age on learning and school performance have been extensively researched [1–3], with evidence indicating that younger children are more at risk of poorer grades and of being identified as having special educational needs such as learning disorders [4,5], much less RAE research has addressed mental health outcomes.

Only five investigations have focused on RAEs in mental health–related outcomes. An early study valuating the impact of relative age on youth suicide, found that younger Canadian students within the cohort were more likely to have committed suicide during adolescence [6]. A second investigation examined referral to psychological services in Northern Ireland, with results showing that younger children within the cohort were overrepresented in referrals to psychological services [7]. Two studies in British children aged 5–15 years [8] and 3–13 years [9] researched the impact of relative age on the Strengths and Difficulties Questionnaire (SDQ) total difficulties score observing that younger children within cohorts had more difficulties overall. Their analyses also indicate that the negative impact of relative age decreases with age [9]. Finally, Lien et al. [10] documented RAEs on specific domains of mental health at the end of secondary schooling (aged 15–16 years) in a Norwegian sample and they found younger children manifesting fewer emotional difficulties and greater peer problems. Consideration of moderating effects of gender revealed, however, that younger girls had fewer depressive symptoms than their older classmates, whereas younger boys had more peer problems [10]. No effects were observed for externalizing symptoms, hyperactivity, and prosocial behavior, highlighting the relevance of investigating whether relative age is associated with specific types of psychopathology symptoms [10].

A focus on the moderating role of gender—and also deprivation—in the Lien et al. work builds on such a focus in prior RAE research on academic outcomes [11–13], some of which highlights RAEs in educational outcomes moderated by both gender (e.g., RAEs larger in boys [10]) and deprivation (e.g., RAEs larger in higher socioeconomic status [SES] [10]). Although the effect of gender and deprivation on mental health is well documented [14], it remains unclear whether these factors moderate RAEs in the case of mental health. Thus, the research reported herein investigates the moderating effects of gender and deprivation on mental health–related RAEs in early adolescence.

Cognitive and mental health RAEs indicate that the negative effect of being relatively younger within cohort decreases as children get older [9,15]. Therefore, even within the narrow age range examined in this report, we assess RAEs separately in two consecutive cohorts to assess whether they attenuate with age.

Studying mental health–related RAEs is important because mental health difficulties can impact on many areas of life. Lien et al. [10] highlighted the importance of considering *downstream* or *knock-on* effects of mental health RAEs on aspects of childhood and adolescent functioning, such as home life, classroom behavior, and friendships. Such potential derivative effects of mental health–related RAEs are thus also a focus of the research reported herein.

Thus, the current research evaluates RAEs on five domains of childhood mental health (hyperactivity, conduct, emotional and peer problems, as well as prosocial behavior) and on the self-reported impact of these mental health difficulties on functioning in a large school-based sample of 11–13 years old secondary school students in England. In addition, gender and deprivation are examined as potential moderators, and RAEs are investigated separately by cohort. Based on the work already cited, it was predicted that younger adolescents in a cohort would experience greater total difficulties than other children, although no specific predictions were advanced with regard to specific problem areas given the limited existing literature on RAEs and specific types of difficulties.

Method

Participants

Students from Year 7 (aged 11–12 years) and Year 8 (aged 12–13 years) in the English school system completed questionnaires as part of a wider study of mental health in schools [16]. A total of 23,477 (73% response rate) students from 210 secondary schools participated in the wider study. Nonparticipation was mainly because of absenteeism followed by nonconsent (~1%). A small proportion (.4%, n = 93) of students were excluded from the current report, as they were outliers in terms of year or month of birth and the year group of their school (born a year or two earlier or later than the rest of their cohort). A further five individuals were excluded because they did not complete sufficient items in the measures used in this research.

The remaining 23,379 participants (Year 7, N = 15,362; Year 8, N = 8,017) comprising the analysis sample were born between September 1996 and August 1998 (age range = 11.25–13.17, mean age = 12.05, standard deviation [*SD*] = .56). Just about half, 50.4% (N = 11,780) were female. The majority, 76.3% were classified as being white followed by 9% Asian, 5.9% black, 3.9% mixed ethnic background, 1.1% other ethnic groups, and for 3.9% ethnicity information was unavailable. A total of 19.2% (N = 4,489) were eligible for free school meals (FSM)—a proxy for deprivation [17]. Relative to the country [16], the analysis sample had higher proportions of ethnic minorities (24% vs. 18%) and individuals eligible for free school meals (19% vs. 13%).

Procedure

Computer-based surveys were completed by pupils within the normal school day. All students in a particular year group (Year 7 or 8) in the school were eligible to participate. Information was sent to parents before data collection giving parents the opportunity to opt their child out from participating in the study. In addition, participants had the research explained to them (in writing and orally) and were afforded the opportunity to decline participation. Student demographic information was obtained from linking records to the National Pupil Database, which is a nationally held data set with school-related data on all pupils in England. The institutional research ethics committee of University College London reviewed the study and approved the data collection.

Measures

Relative age. Information about the month and year of birth for all participants was available via school records through the national pupil database. Based on their month and year of birth, they were divided into three relative age groupings, following the strategy of evaluating RAEs used by others [8,10] as follows: (1) oldest, born September–December (N = 7,837);

(2) middle, born January–April (N = 7,676); and (3) youngest, born May–August (N = 7,866).

Mental health. The SDQ [18] is used here as a measure of mental health and related difficulties (e.g., peer problems). This measure was selected as it is widely used in research on young people and affords comparisons with previous RAE studies that relied on this measure [8,10]. The SDQ is a 25-item self-report measure consisting of the following five 5-item subscales: hyperactivity, emotional symptoms, conduct problems, peer problems, and prosocial behavior. In the current sample, alpha estimates were hyperactivity, .73; emotional symptoms, .72; conduct problems, .66; peer problems, .61; and prosocial behavior, .69, indicating that some of the scales have poor internal consistency, which is not an uncommon finding with this measure [19]. The four difficulty scales (emotional, peer, conduct, and hyperactivity) are summed to create a total difficulties score. The scales have threshold scores to indicate clinical levels of problems (scoring and threshold details are available on http://www.sdqinfo.org).

Impact. The impact supplement of the SDQ assesses whether mental health problems affect other areas of the young person's functioning. The supplement starts with the question "Overall, do you think that you have difficulties in one or more of the following areas: emotions, concentration, behavior, or being able to get on with other people?" And in the case of an affirmative response, participants answer five items (one concerning distress and four concerning impact on home life, friendships, classroom learning, and leisure activities) which are summed to create a total impact score. A negative response to the initial item about presence versus absence of difficulties results in a total impact score of zero. In the current sample, 187 participants (.8% of total sample) did not complete the items of the impact supplement.

Gender and socioeconomic status. Gender was recorded and coded as 0 = male and 1 = female. As in other school-based research [17], socioeconomic deprivation was coded in terms of eligibility for free school meals (0 = not eligible for FSM and 1 = eligible).

Analytic approach

First, descriptive analysis presents demographic data across the three relative age groups, and preliminary analysis to examine group differences in sociodemographic characteristics is carried out. Mean scores and proportions above the clinical threshold are presented for each of the mental health subdomains, total difficulties, and impact for each relative age grouping. To examine the contribution of relative age as a predictor of mental health difficulties, *hierarchical multiple regression models* were constructed to examine these effects across all outcomes (the mental health subscales, total difficulties score, and impact score). In each model, gender and SES (and their interaction) were included in the first step of analysis, followed by relative age in the second step (dummy coded with the oldest third as the reference category). In the third and final step, the interactions between gender and relative age and SES and relative age were included to investigate possible moderation effects. In addition, whenever significant RAEs were detected, secondary analyses were conducted separately by year group (Year 7 or 8) to illuminate any effect of age in moderating RAE effects.

Results

Descriptive statistics for the study variables are included in Table 1. Evaluation of group differences on key sociodemographic characteristics of interest in this study revealed no significant differences in gender proportions (χ^2 (2) = 1.43, p = .49) and deprivation (proportion eligible for FSM, χ^2 (2) = 1.22, p = .54).

Results of the hierarchical linear regressions, presented in Table 2, revealed significant main effects of gender and

Table 1
Descriptive statistics of key variables by relative age grouping

	Oldest (September–December born)	Middle (December–April born)	Youngest (May–August born)	Total sample
Gender				
% Female	50.9	50.1	50.1	50.4
SES				
% FSM eligible	20	19.9	19.3	19.7
Hyperactivity				
Scale score	3.84 (2.39)	3.82 (2.36)	3.84 (2.85)	3.83 (2.37)
Clinical %	23.5	22.9	23.0	23.1
Conduct problems				
Scale score	2.10 (1.96)	2.11 (1.95)	2.11 (1.94)	2.10 (1.95)
Clinical %	22.3	22.2	22.5	22.3
Emotional symptoms				
Scale score	2.60 (2.20)	2.69 (2.21)	2.78 (2.24)	2.69 (2.22)
Clinical	11.0	11.3	12.2	11.5
Peer problems				
Scale score	1.82 (1.76)	1.95 (1.83)	2.03 (1.84)	1.93 (1.81)
Clinical %	15.8	18.4	19.8	18
Prosocial behavior				
Scale score	7.42 (1.94)	7.48 (1.92)	7.46 (1.91)	7.45 (1.92)
Clinical %	17.0	16.1	16.7	16.6
Total difficulties				
Scale score	10.36 (5.96)	10.57 (5.95)	10.76 (6.03)	10.56 (5.98)
Clinical %	19.0	20.3	21.7	20.3
Total impact				
Scale score	.78 (1.79)	.82 (1.82)	.88 (1.87)	.83 (1.83)
Clinical %	24.3	25.7	26.9	25.7

SES = socioeconomic status.

Table 2
Hierarchical multiple regression analyses predicting mental health, functioning, and impact outcomes

Variable	Hyperactivity		Conduct problems		Emotional symptoms		Peer problems		Prosocial behavior		Total difficulties		Total impact	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1	.022**		.068**		.022**		.017**		.078**		.026**		.014**	
Gender		−.13**		−.22**		.14**		−.09**		.27**		−.10**		−.07**
SES		.08**		.15**		.05**		.09**		−.07**		.13**		.09**
Gender*SES		−.01		−.03*		.00		.00		.02		−.01		−.02
Step 2	.000		.000		.001**		.003**		.000		.001**		.001*	
Gender		−.13**		−.22**		.14**		−.09**		.27**		−.10**		−.07**
SES		.08**		.15**		.05**		.09**		−.07**		.13**		.09**
Gender*SES		−.01		−.03*		.00		.00		.02		−.01		−.02
Relative age (middle)		−.01		.00		.02*		.04**		.02		.02		.01
Relative age (youngest)		−.00		.00		.04**		.06**		.01		.03**		.03**
Step 3	.000		.000		.000		.000		.000		.000		.000	
Gender		−.13**		−.22**		.15**		−.09**		.27**		−.10**		−.05**
SES		.09**		.15**		.06**		.08**		−.09**		.13**		.10**
Gender*SES		−.01		−.03*		.00		.00		.02		−.01		−.02
Relative age (middle)		−.00		.00		.03*		.05**		.01		.03		.03*
Relative age (youngest)		−.00		.00		.04**		.05**		.01		.03*		.04**
Relative age (middle)*gender		.00		.00		−.01		−.02		−.01		−.01		−.02
Relative age (middle)*SES		−.00		−.01		−.02		−.00		.02		−.01		−.01
Relative age (youngest)*gender		.01		.01		−.01		−.00		−.01		.01		−.02
Relative age (youngest)*SES		−.01		−.00		.01		.02		.02		.00		−.01
Total R^2	.022**		.068**		.024**		.020**		.078**		.027**		.015**	

SES = socioeconomic status.
*$p < .01$; **$p < .001$.

deprivation in the case of all outcomes. Specifically, girls scored higher than boys on emotional symptoms and prosocial behavior and lower than boys on hyperactivity, conduct, and peer problems. Deprivation was associated with more difficulties in all areas of mental health and with impact. With regard to the primary focus of inquiry, RAEs, these proved significantly related to the outcomes only in the case of emotional symptoms, peer problems, total difficulties, and total impact. Comparing the youngest third to the oldest third of students indicates that the youngest third report significantly more symptoms for the emotional (β = .04; 95% confidence interval [CI], .03–.06) and peer problem (β = .06; 95% CI, .04–.07), subscales and total difficulties (β = .03; 95% CI, .02–.05), and total impact (β = .03; 95% CI, .01–.04). The standardized coefficients for relative age comparing the middle third to the oldest children in a year group indicate significantly more symptoms for both the emotional (β = .02; 95% CI, .01–.04) and peer related difficulties (β = .04; 95% CI, .02–.05) in the middle third of the cohort. Inclusion of interactions between relative age and gender and deprivation in Step 3 did not significantly improve the model for any of the mental health and impact indicators (all $\Delta R^2 = .000$).

Analyses conducted separately in the two year groups to illuminate any age-moderated RAE effects are presented in Table 3. Results indicate that RAEs are more prominent in the younger group, aged 11–12 years, than in the cohort aged 12–13 years. The difference is especially striking for emotional symptoms where RAEs are entirely absent in the older cohort.

Discussion

Mental health difficulties are highly prevalent in young people. Understanding risk and protective factors associated with developing symptoms is of practical importance [20]. Thus, the present study aimed to determine if being younger within school cohorts adversely affected subdomains of mental health in early adolescence, a previously unexplored research question. Toward this end, we took advantage of a large school-based data set of children aged 11–13 years in 210 secondary schools in England.

The RAE results on SDQ total difficulties are in line with previous findings [8,9], who reported that total difficulties are highest in the youngest third of students in a cohort. However, when it came to considering particular types of problems in the current inquiry, the mental health disadvantage evident in younger children only emerged in the case of emotional symptoms and peer problems and not for conduct problems, hyperactivity, or prosocial behavior. Apparently, then, relative age only played a role in children's affect, thereby resulting in higher risk of internalizing symptoms, which includes

Table 3
Regression analysis predicting relative age effects for emotional symptoms, peer problems, and impact separately in the two cohorts

	Year 7 sample			Year 8 sample		
	Emotional symptoms, B (SE)	Peer problems, B (SE)	Impact, B (SE)	Emotional symptoms, B (SE)	Peer problems, B (SE)	Impact, B (SE)
Gender	.56** (.04)	−.33** (.03)	−.31** (.03)	.75** (.05)	−.31** (.04)	−.15** (.04)
SES	.33** (.04)	.44** (.04)	.46** (.04)	.19* (.06)	.34** (.05)	.32** (.05)
Relative age (middle)	.16** (.04)	.17** (.04)	.08 (.04)	.00 (.06)	.10 (.05)	.00 (.04)
Relative age (youngest)	.26** (.04)	.28** (.04)	.16** (.04)	.09 (.06)	.12* (.05)	.01 (.04)

SE = standard error; SES = socioeconomic status.
*$p < .01$; **$p < .001$.

symptoms of anxiety and depression. This impact of relative age could have longer-term consequences as symptoms in childhood and adolescence are a precursor for adult depression and psychopathology [21].

It is important to note that the detected RAEs proved to be small effects in terms of effect size, although at the population level still confer significant risk. The relevance is made clearer when we observe the proportions of young people with clinical levels of problems based on relative age groupings—based on the clinical threshold scores of the scales, there is a 1.2% difference between youngest and oldest students (12.2% vs. 11%) for emotional problems and a 4% (19.8% vs. 15.8%) for peer problems. The discrepancy is even more marked when considering only the younger cohort in the study, where a 2.2%, 4.7%, and 3.5% difference in clinical cases between the youngest third and oldest third is observed for, respectively, emotional symptoms, peer problems, and impact. The results support suggestions that youngest members of the cohort might have more difficulty being accepted by their peers [10], which is consistent with evidence indicating that they are much more likely to be bullied than other children [9]. Conceivably, difficulties in reading, communication and attainment that are experienced by younger students, especially in the earlier years in school, might have an adverse impact on their socialization within their peer group [22,23].

Analysis examining the potential role of gender and deprivation on RAEs failed to provide any evidence of moderation of RAEs by these factors, although as expected, greater deprivation predicted more difficulties across all outcomes. The null moderational results suggest that the effects of relative age are distinct from gendered expressions of psychopathology and that relative age is an independent risk factor in predicting more internalizing symptoms and peer problems for younger children within cohorts. These nongender-related results are notably different from those from the Norwegian study of 15- to 16-year-olds, which only found a significant negative effect of relative age on peer problems in the case of males [10]. Recall, too, Lien et al. [10] finding that only females showed RAEs for emotional symptoms—and then in a direction opposite to that predicted and documented herein (i.e., oldest females had more emotional symptoms than youngest females). The differences in results across these two studies could either be accounted for by the different age groups explored (11–13 years vs. 15–16 years) or be indicative of cross-country differences in practice, whereby relative age mental health risks are more pronounced in England than Norway. If the former were the case, as children move into adolescence and both neurological and biological correlates become more gendered [24], gender-moderated RAEs as observed by Lien et al. could emerge in middle adolescence.

In terms of cohort differences, within the two consecutive cohorts that the present study covers, we observe that RAEs are stronger in the younger cohort aged 11–12 years. This is in line with findings on attainment that suggest the strength of RAEs decrease with age [25]. Developmentally this is not a surprising finding, as at younger ages the developmental differences that a year confers are more marked when compared with during adolescence. This may help to explain the results of Lien et al. [10], who discerned virtually no RAEs for mental health among 15- to 16-year-olds. It can also be expected from the findings of our and Lien et al. that RAEs might be more marked for internalizing symptoms in even younger children than those included in these two studies. Even if this proves to be the case, it is possible that such age-related RAEs could be a function, to some extent, of developmental differences in symptoms.

The results on impact provide fresh insight into the possible mechanisms involved in the relative age disadvantage in a diverse range of domains. So far, because of the bulk of research on RAEs in the school context having focused on educational attainment and learning outcomes [1], explanations regarding such effects have tended to focus on ability grouping and special needs [26]. Although the ability-grouping explanation has received some empirical support recently for learning outcomes [26], it is not clear how it could account for RAEs in the case of mental health and well-being. The current findings that those younger in cohorts report higher impact of their difficulties in functioning at home, in the classroom, and with peers suggest that their ability to cope with their mental health difficulties is lower than that of their older peers. This seems possibly a function of less well developed coping mechanisms resulting from having experienced higher stress through childhood—a possible focus of future inquiry.

The results from the present study suggest many different mechanisms might be leading to RAEs in mental health. One is that problems with peers because of poorer cognitive and social skills in early school years might lead to developing emotional symptoms that impact on relationships in the classroom and home [27]. It is also conceivable that self-esteem plays a role in a self-perpetuating cycle, and research demonstrates that relative younger age adversely affects self-esteem [28]. Consider in this regard the possibility that relatively younger children feel less skilled than relatively older ones and that this undermines their self-esteem, which then makes them feel even less capable, with this negative feedback continuing over time. Alternatively, or additionally, it may be that relatively older children feel more skilled than their younger classmates and this leads them to experience enhanced self-esteem, which becomes part of a similar, even if opposite, self-perpetuating cycle. Longitudinal investigations are necessary to uncover the timeline and sequence of processes involved in developing mental health–related RAEs. There is the possibility that negative consequences beget more negative consequences which leads to a self-perpetuating cycle resulting in lifelong disadvantage [29]. Not inconsistent with this view is evidence that the relative age disadvantage remains evident in postcompulsory education and unemployment in adulthood [30].

Study strengths and limitations

The present study used a large community-based sample and a widely used measure of mental health. Although we found that more of the youngest children within cohorts scored above clinical threshold than older children, the present study was not positioned to determine how this translates into higher risk of diagnosis or need of specialist mental health treatment. However, there is evidence that the SDQ is a fairly reliable public health indicator of clinical need [31], and existing research indicates that disproportionately more of the youngest children in a school cohort are likely to be receiving psychology services and intervention [7] and special educational needs assessment [12,32].

The present study is also limited by the measures used, the cross-sectional design, and the narrow age range that were the focus of inquiry. Further research would benefit from exploring RAEs in mental health, especially internalizing symptoms and

disorders, at different developmental stages to ascertain the effects of being younger in a cohort through childhood and adolescence. Investigating a wider range of moderators such as family factors and parenting might help understand those children at higher risk of experiencing RAEs. In addition, investigation of RAEs on symptom development in longitudinal data will help illuminate the significance of RAEs as a risk factor for developing mental disorders.

Another limitation of the present study is the use of school year–based cutoffs, which although pertain to all children within schools are not specific to mental health development (whereas RAEs in school attainment are linked with school cutoff dates and sporting achievement to sport cutoff dates). It is possible that setting-specific cutoffs such as for sport teams, might affect the mental health of children involved in these activities, which future research might investigate.

Implications and future directions

Suggested strategies or interventions to prevent or minimize RAEs have mainly been based on effects found for academic attainment and take one of two broad forms as follows: (1) adaptations to the school admission process and system overhauls (e.g., staggered school starting dates, children starting school on a particular birthday irrespective of the school year and month of birth based in-school grouping) and (2) interventions to increase support to reduce or prevent the disadvantage faced by younger individuals in any given cohort (e.g., use of age-standardized tests, increased RAE awareness among teachers and educational psychologists, monitoring referral rates to psychiatric units etc.) [33,34]. There is limited evidence to suggest any of these strategies are effective. Clearly, understanding the domains in which RAEs operate, extent of the impact, and mechanisms underlying RAEs is required to inform the development of interventions and strategies [34]. In regards to mental health difficulties this study begins to provide evidence that only certain domains of mental ill health are affected for younger individuals in cohorts. Further research is necessary in this area to help understand the developmental patterns of RAEs and the mechanisms involved for internalizing and peer problems. Longitudinal data analysis and investigation of potential mediators will be a useful next step to unpack mental health–related RAEs in childhood and adolescence and their later life impacts.

The results of the present study highlight the small yet relevant role that relative age within cohorts might play in the development of young people's internalizing symptoms and peer relationships. This is pertinent given for mental health multiple risk factors can have greater effect cumulatively, hence, even if effects of being younger in cohorts are small, they should be taken into account when considering who is most at risk. The findings support its inclusion as a relevant risk factor more widely in studies of development of psychopathology and school-based mental health intervention research.

Acknowledgments

The authors thank the Department for Children, Schools and Families (now Department for Education), England, for funding the wider research project. The authors are grateful to the members and advisors of the research group involved in the wider project, and the staff and students of participating schools for their contributions to this research.

References

[1] Alton A, Massey A. Date of birth and achievement in GCSE and GCE A-level. Educ Res 1998;40:105–9.
[2] Bell JF, Daniels S. Are summer-born children disadvantaged? The birthdate effect in education. Oxford Rev Educ 1990;16:67–80.
[3] Crawford C, Dearden L, Meghir C. When you are born matters: The impact of date of birth on educational outcomes in England. London: Institute for Fiscal Studies; 2010.
[4] Cobley S, McKenna J, Baker J, et al. How pervasive are relative age effects in secondary school education? J Educ Psychol 2009;101:520.
[5] Dhuey E, Lipscomb S. Disabled or young? Relative age and special education diagnoses in schools. Econ Educ Rev 2010;29:857–72.
[6] Thompson AH, Barnsley RH, Dyck RJ. A new factor in youth suicide: The relative age effect. Can J Psychiatry 1999;44:82–5.
[7] Menet F, Eakin J, Stuart M, et al. Month of birth and effect on literacy, behaviour and referral to psychological service. Educ Psychol Pract 2000; 16:225–34.
[8] 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.
[9] Crawford C, Dearden L, Greaves E. Does when you are born matter? The impact of month of birth on children's cognitive and non-cognitive skills in England. London: Institute for Fiscal Studies; 2011.
[10] Lien L, Tambs K, Oppedal B, et al. Is relatively young age within a school year a risk factor for mental health problems and poor school performance? A population-based cross-sectional study of adolescents in Oslo, Norway. BMC Public Health 2005;5:102–9.
[11] Cascio E, Schanzenbach DW. First in the class? Age and the education production function. Cambridge, MA: National Bureau of Economic Research; 2007.
[12] Martin RP, Foels P, Clanton G, et al. Season of birth is related to child retention rates, achievement, and rate of diagnosis of specific LD. J Learn Disabil 2004;37:307–17.
[13] Wilson G. The effects of season of birth, sex and cognitive abilities on the assessment of special educational needs. Educ Psychol 2000;20:153–66.
[14] Green H, McGinnity A, Meltzer H, et al. Mental health of children and young people in Great Britain, 2004. Basingstoke: Hampshire; 2005.
[15] Crawford C, Dearden L, Meghir C. When you are born matters: The impact of date of birth on child cognitive outcomes in England. London: Centre for the Economics of Education, London School of Economics and Political Science; 2007. Report No.: 0853281890.
[16] Wolpert M, Deighton J, Patalay P, et al. Me and my school: Findings from the national evaluation of Targeted Mental Health in Schools. Nottingham: DFE; 2011.
[17] Hobbs G, Vignoles A. Is children's free school meal 'eligibility' a good proxy for family income? Br Educ Res J 2010;36:673–90.
[18] Goodman R, Meltzer H, Bailey V. The strengths and difficulties questionnaire: A pilot study on the validity of the self-report version. Eur Child Adolesc Psychiatry 1998;7:125–30.
[19] Hagquist C. The psychometric properties of the self-reported SDQ–An analysis of Swedish data based on the Rasch model. Pers Indiv Differ 2007; 43:1289–301.
[20] Patel V, Flisher AJ, Hetrick S, et al. Mental health of young people: A global public-health challenge. Lancet 2007;369:1302–13.
[21] Roza S, Hofstra M, van der Ende J, et al. Stable prediction of mood and anxiety disorders based on behavioral and emotional problems in childhood: A 14-year follow-up during childhood, adolescence, and young adulthood. Am J Psychiatry 2003;160:2116–21.
[22] Burleson BR, Applegate JL, Burke JA, et al. Communicative correlates of peer acceptance in childhood. Commun Educ 1986;35:349–61.
[23] Mostow AJ, Izard CE, Fine S, et al. Modeling emotional, cognitive, and behavioral predictors of peer acceptance. Child Dev 2002;73: 1775–87.
[24] Giedd JN, Blumenthal J, Jeffries NO, et al. Brain development during childhood and adolescence: A longitudinal MRI study. Nat Neurosci 1999; 2:861–3.
[25] Crawford C, Dearden L, Meghir C. When you are born matters: The impact of date of birth on educational outcomes in England. London, UK: The Institute of Fiscal Studies; 2010.
[26] Campbell T. In-school ability grouping and the month of birth effect: Preliminary evidence from the Millennium Cohort Study. London: Centre for Longitudinal Studies; 2013.
[27] Howes C. Social-emotional classroom climate in child care, child-teacher relationships and children's second grade peer relations. Soc Dev 2000;9: 191–204.
[28] Thompson AH, Barnsley RH, Battle J. The relative age effect and the development of self-esteem. Educ Res 2004;46:313–20.
[29] Thelen E, Smith LB. Dynamic systems theories. In: Lerner RM, Damon WR, eds. Handbook of Child Psychology: Theoretical Models of Human Development. 6th edition. Hoboken, NJ: Wiley; 2006.

[30] Crawford C, Dearden L, Greaves E. The impact of age within academic year on adult outcomes. London, UK: Institute for Fiscal Studies (IFS); 2013. Working Paper.
[31] Goodman A, Goodman R. Population mean scores predict child mental disorder rates: Validating SDQ prevalence estimators in Britain. J Child Psychol Psychiatry 2011;52:100–8.
[32] Squires G, Humphrey N, Barlow A, et al. The identification of special educational needs and the month of birth: Differential effects of category of need and level of assessment. Eur J Spec Needs Educ 2012; 27:469–81.
[33] Reijneveld SA, Wiefferink CH, Brugman E, et al. Continuous admission to primary school and mental health problems. BMC Public Health 2006;6: 145.
[34] Sharp C, George N, Sargent C, et al. The influence of relative age on learner attainment and development. Slough, UK: National foundation for educational research; 2009.