Brief report

The developmental course of childhood inattention symptoms uniquely predicts educational attainment: A 16-year longitudinal study

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1. Introduction

Childhood attention deficit hyperactivity disorder (ADHD) predicts a number of functional impairments, including long-term low educational attainment through its inattentive dimension. Inattention symptoms are accompanied by changes in functional impairment, ranging from hyperactivity disorder (ADHD) pre- 

Developmental trajectories have been used to examine the heterogeneous developmental patterns of inattention symptoms. However, developmental trajectory estimation combines information concerning the level (e.g. high) and the functional form (e.g. rising). As such, we do not know whether children in a high rising inattention trajectory had lower educational attainment because they were in a rising trajectory or simply because they had high mean levels of inattention across childhood. We aimed to test whether averaged levels of inattention across childhood and/or the functional form of childhood trajectories of inattention made a significant contribution to early adulthood low educational attainment. We used a new trajectory estimation approach to reanalyze previously published data. Understanding the developmental course of inattention and the associated impairments is a neglected area of study despite potential benefits in terms of basic research – e.g. informing underlying mechanisms – as well as clinical research – e.g. informing the prognosis.

2. Methods

2.1. Participants

The study sample included 2000 participants belonging to the Quebec Longitudinal Study of Kindergarten Children and selected to be representative of the children attending kindergarten in Quebec, Canada H3T 1J7. Tel. 1 514 343 6962.

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French-speaking state schools in the province of Quebec in the 1986–87 and 1987–88 school years (Pingault et al., 2011).

2.2. Measures

2.2.1. Outcome variable

Information about high school graduation was obtained through the Quebec Ministry of Education at age 22 and 23. The measure differentiated between participants who had a high school diploma (coded zero) and participants who did not (coded one).

2.2.2. Childhood inattention

Teachers assessed children’s behaviors yearly between 6 and 12 years with the Social Behavior Questionnaire. Each item was rated on a 3-point scale (0 to 2) that ranged from “never applies” to “frequently applies” (total range: 0–8). The following four items were used to assess inattention: (1) weak capacity for concentration, cannot maintain his/her attention for a long time on the same task, (2) easily distracted, (3) absentmindedness, and (4) gives up easily (Cronbach’s alpha coefficients between 0.85 and 0.90). The Family Socioeconomic Adversity Index included information on family structure (intact or not), parents’ education, parents’ occupational status and parents’ age at birth of the first child (see online supplement).

2.3. Data analysis

We adapted a clustering algorithm designed to estimate non-parametric trajectories: k-means for longitudinal data (Genolini and Falissard, 2010). Briefly, we pre-processed the data for each participant by subtracting his/her average level of inattention across the seven years to each yearly score. As a result, a participant by subtracting his/her average level of inattention for all years will have zero average level of inattention. Therefore, this new approach clusters participants according to the form of their trajectory excluding information about their mean levels (details in online supplement). Finally, a logistic regression was used to examine the link between trajectory membership and graduation failure, while controlling for inattention levels averaged over the 7 years, sex and family adversity.

3. Results

3.1. Inattention trajectories

Three adjusted trajectories resulted from the analysis: a stable trajectory, a fluctuating trajectory and a rising trajectory (see Fig. 1 and online supplement for details and a rationale regarding the number of trajectories).

3.2. Results

The final model included averaged levels of inattention (mean=2.26, S.D.=1.88), trajectory membership, adversity and sex. The averaged levels of inattention across years significantly predicted graduation failure (odds ratio [OR]: 1.78; 95% Confidence Interval [CI]: 1.66–1.91; p < 0.001, corresponding to a 1-point increase in average inattention). Children belonging to the rising trajectory were at higher risk of graduation failure (OR: 1.76; 95% CI: 1.32–2.34; p < 0.001). Conversely, the fluctuating trajectory was not significant (OR: 1.02; 95% CI: 0.77–1.37; p=0.87). For a more intuitive understanding, we estimated expected percentages of graduation failure in the stable and in the rising trajectory, while holding constant the inattention average and the adversity index at their mean (using bootstrap resampling with 1000 simulations). Graduation failure was higher for boys in the rising trajectory (40.0%) than in the stable one (27.7%); the risk ratio was 1.46 (95% CI: 1.20–1.76). Corresponding results for girls were 27.9%, 18.2% and 1.56 (95% CI: 1.23–1.97).

4. Discussion

We aimed to verify whether mean levels of inattention across childhood and/or the form of inattention trajectories made significant contributions to high school graduation failure. Average levels of inattention strongly predicted graduation failure and, independent of these average levels, boys in the rising trajectory were still 46% more likely to fail than boys in the stable trajectory (56% for girls).

The fact that we detected a subgroup of children with rising inattention is coherent with the studies reporting stable or rising inattention levels with age ( Larsson et al., 2011; Willcutt et al., 2012) and with the literature reporting a shift towards a greater proportion of the inattentive subtype with age ( Willcutt et al., 2012).

Children with rising levels of inattention may have specific genetic and/or environmental liabilities. ADHD symptoms, including inattention, are highly heritable ( Larsson et al., 2011). Yet, this does not preclude age-dependent genetic effects i.e. changes in heritability estimates and/or newly developing genetic influences emerging with advancing age ( Franke et al., 2012). Environmental changes like transition to middle school may also play a part in these developmental changes ( Langberg et al., 2008). Our study demonstrated that these putative liabilities manifested by rising levels of inattention were indeed associated with greater long-term impairment.

Due to the nature of the outcome (official graduation records), only one assessment was available, thus preventing us to model changes in the outcome. However, assessments by a different teacher each year over 7 years were available to monitor the development of inattention.

This study showed that increasing inattention during elementary school matter, even when mean levels of inattention are controlled for, providing evidence for the significance of developmental changes in inattention during elementary school. These results emphasize the need to further characterize the specific predictive value of developmental trends in inattention regarding diverse ADHD-related outcomes. In addition, the role of fixed or time-varying factors (e.g., family events) in explaining these developmental trends, and how such trends can be considered in the assessment of inattention, should be further investigated.
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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.psychres.2014.06.022.

References