Executive Function in Adolescence: Family Risk Factors and the Meditational Role of Self-Regulation in Early Childhood
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Aims and background
Self-regulation and executive function reflect mental processes that enable goal-directed behavior in order to plan and manage everyday activities, set priorities, and resist impulsive actions. Diverse research focused on the development of self-regulation and executive function indicates that early exposure to social and economic disadvantage and chronic stress have negative consequences on children’s abilities to exercise requisite emotional and cognitive control that enable children to become successful learners across the school years.

There are few longitudinal studies that have tracked the influence of early self-regulation skills on executive function in adolescence. Using path analysis, this study examines the direct effects of early childhood and family risk factors on executive function at 14 years. It examine if these effects are mediated by measures of self-regulation in early childhood.

Methodology
The analyses use data from Growing Up in Australia: The Longitudinal Study of Australian Children (LSAC). This nationally representative study funded by the Australian Government is tracking the development of 10,000 children in two cohorts. Data have been collected biennially since 2004. Fieldwork and data collection include home interviews with parents and children, direct child assessments, and teacher questionnaires. These analyses use data for 4983 children recruited for the Kindergarten Cohort. The sampling frame for LSAC was derived from the national health insurance database. At Wave 1 data collection, the mean age of the children in the Kindergarten Cohort was 4.74 years (SD = 2.65); 50.9% were male; 3.8% were Indigenous children; and 12.5% of families used a language other than English at home. In these analyses, data from three waves of data collection are used when children were aged 4 years, 6 years, and 14 years.

Measures
Child Outcome Measure: Direct assessment of executive function (EF) was completed when children were 14 years using a computerized battery from Cogstate with three tasks: Identification Task (visual attention / choice reaction time); One-Back Task (working memory); and Groton Maze Task (spatial memory, impulse control, and inhibition). A composite score for EF was derived using Cogstate procedures.

Predictors: Child and family variables from parent interview data, when the child was 4 years of age, are included in the analyses: Family socio-economic position; history of parental depression (1 item), self-reported parenting anger (4-items); and child behavior problems (3-items: sleep problems; emotional dysregulation; and hyperactivity).

Mediators: Early self-regulation was assessed with two measures: Attentional regulation at 4 years (parent report on a 4-item persistence subscale from the Australian Temperament Scales), with a 6-point response scale (α = .78); Approaches to Learning at 6 years by teacher report on a 6-item scale adapted from the Social Skills Rating Scale and used in ECLS-K, with a 4-point response scale (α = .92).
Control variables: Child variables included child gender, Indigenous status, non-English home language, and expressive vocabulary measured with an LSAC-designed short form of the PPVT; and child age at time of EF measurement.

Analytic Strategy: Path analysis was conducted using Mplus (Version 7) to test direct and indirect effects of early childhood risk factors at 4 years on EF at 14 years. Model 1 examined direct effects; Model 2 included the control variables; and Model 3 included the mediation variables for self-regulation measured at 4 years and 6 years. Estimation method used was maximum likelihood. Missing data were fully imputed in Mplus.

Results

Model 1 estimated direct effects of early childhood risk factors at 4 years on EF at 14 years. This model was ‘just identified’ and accounted for 2.8% of variance. Higher socio-economic position was associated with better performance on EF and more child behavior problems were associated with poorer EF performance. History of parent depression and parenting anger were not significantly associated with EF.

Model 2 estimated direct effects of early childhood risk factors at 4 years on EF at 14 years, controlling for child factors (gender, child age, Indigenous status, non-English home language, expressive vocabulary). This model was ‘just identified’ and accounted for 5.2% of variance. Associations between socio-economic position and child behavior problems and EF, identified in Model 1, remained significant, although effects were attenuated.

Model 3 estimated effects of early childhood risk factors at 4 years on EF at 14 years and the indirect effects of the mediating variables of attentional regulation at 4 years and approaches to learning at 6 years, controlling for child factors. The model had satisfactory fit with a $\chi^2 (6) = 54.92, p<.000$, RMSEA = 0.04, CFI = 0.96, TLI = 0.78, and SRMR = 0.02. Overall, the model accounted for 10.2% of variance in EF. Better attentional regulation skills at 4 years and more positive approaches to learning at 6 years were associated with better performance on EF. Associations between socio-economic position and child behavior problems and EF were fully mediated through the self-regulation pathways.

Conclusions

This study explored pathways between child and family risk factors and self-regulation in early childhood and executive function in adolescence. Family socio-economic position and child behavior problems in early childhood impacted on executive functioning in adolescence. These effects were mediated through the self-regulation measures. The findings are not unexpected, given various research efforts in other national contexts. However, they provide important evidence for the Australian context about the influence of early child and family risk variables on the development of executive functioning in adolescence.

Differences between at-risk and more-advantaged children in early self-regulation lead to larger gaps in executive function across the school years that are likely to impact on school engagement and achievement. The case can be made that more support is needed for early learning opportunities, especially for disadvantaged children, through the provision of evidence-based parenting programs for families with young children as well as through universal preschool education. A major focus in programs on children’s self-regulatory skills has important potential to reduce inequalities in early school learning. Importantly, teachers in early childhood programs need to build young children’s self-regulation capacities for emotional and cognitive control in classroom contexts.