

EXECUTIVE FUNCTIONS

Socioeconomic Status and the Development of Executive Function

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January 2013

Introduction

Emerging research points to a relationship between childhood socioeconomic status and executive function performance. As both socioeconomic status and executive function are strongly and independently correlated with academic and health outcomes, an understanding of their interrelationship may have the potential to inform interventions designed to reduce disparities and promote healthy development for all children.

Subject

Socioeconomic status, a measure of social standing that typically includes income, education and occupation, has been linked to a wide array of life outcomes, ranging from cognitive ability and academic achievement to physical and mental health.¹⁻⁵ Understanding the pathways by which childhood socioeconomic status influences life outcomes is a question of critical importance to education and public health, particularly as global economic trends force more families into poverty.⁶

Current knowledge of socioeconomic status and child development indicates that children from higher-socioeconomic status families display better executive function – the ability to actively direct, control and regulate thoughts and behaviour – than children from low-socioeconomic status families. As executive function has been shown to predict school achievement^{7,8} and is also associated with mental health outcomes,⁹⁻¹³ it is possible that it may partially mediate the well-established link between socioeconomic status and academic achievement.

Problems

Research on this topic faces certain methodological challenges, resulting in part from the broad and sometimes ambiguous nature of the terms “executive function” and “socioeconomic status.” “Executive function” refers to

the higher-order processes such as inhibitory control, working memory, and attentional flexibility that govern goal-directed behaviour. This wide range of abilities can be operationalized by many different valid tasks, such as computerized cognitive tasks or parental reports of children's behaviour.¹⁴ Likewise, "socioeconomic status" is a broad construct that may be measured in various ways.¹⁵ Furthermore, it cannot be experimentally manipulated, making it difficult to disentangle genetic and environmental effects, as well as the individual contributions of the various conditions of poverty (e.g., increased family stress, reduced cognitive stimulation, worse nutrition, crowding and poor environmental conditions).^{16,17} The difficulty of establishing causality in the relationship between socioeconomic status and executive function points to the need for large, well-designed, cautiously interpreted studies.

Research Context

Most studies of socioeconomic status and executive function have examined behavioural performance on developmentally appropriate executive function tasks, although a few recent studies¹⁸⁻²⁰ have, instead, used electrophysiological measure *prefrontal cortical* function. Executive function development has been investigated using both cross-sectional studies and large-scale longitudinal studies, such as the NICHD (National Institute of Child Health and Human Development) Study of Early Childcare and the Family Life Project. Many mediation studies use home-visit measures, such as the HOME inventory²¹ or observations of parent-child interactions during free or structured play.²²

Key Research Questions

1. What is the relationship between childhood socioeconomic status and executive function development?
2. What environmental factors mediate the relationship between socioeconomic status and executive function?

Recent Research Results

What is the relationship between socioeconomic status and executive function performance?

Research indicates that socioeconomic status influences neurocognitive systems unevenly. In a recent set of studies,²³⁻²⁵ kindergarteners, first graders, and middle schoolers of varying socioeconomic status took batteries of tasks assessing independent cognitive systems, including executive function, memory, language, and visuospatial cognition. Language abilities and executive function – particularly the domains of working memory and cognitive control – were among the most strongly affected.

Socioeconomic status disparities in executive function have been documented across a large age range, from infancy²⁶ through late childhood.²⁷ Studies have consistently found that higher socioeconomic status is associated with better executive function performance across different measures of socioeconomic status (such as family income-to-needs ratio or maternal education) and across different measures of executive function (such as working memory and inhibitory control).²⁸⁻³²

Executive function is supported by a region of the brain called the prefrontal cortex, which undergoes a long period of post-natal development,³³ and thus may be particularly susceptible to influences of childhood experience. Researchers have used event-related potentials (ERPs), which measure brain activity via electrodes placed on the scalp, to examine socioeconomic differences in neural processing in the prefrontal cortex. Two ERP studies

^{18,20} compared neural measures of selective attention across socioeconomic groups. In both cases, there were no differences on task performance, but neural processing evidence indicated that children from low-socioeconomic status attended more to irrelevant stimuli than did their high-socioeconomic status counterparts.

What factors mediate the relationship between socioeconomic status and executive functions?

Many environmental factors – such as stress, cognitive stimulation in the home, prenatal environment and nutrition – have been shown to vary along socioeconomic lines.^{16,17} Any of these factors could contribute to socioeconomic disparities in executive function. Recent research has attempted to isolate environmental factors that mediate the socioeconomic status-executive function relationship. These mediating factors may inform interventions targeting socioeconomic status disparities in executive function and other cognitive and behavioural outcomes.

Several studies have found evidence that different aspects of the early family environment influence the development of executive function. For example, the quality of parent-child interactions, particularly during infancy, has been found to mediate socioeconomic status effects on executive function at 36 months of age.²² Additionally, infants' stress levels (measured by salivary *cortisol*) partially explained the effect of positive parenting on executive function, suggesting that parenting may affect it by shaping children's stress responses.²⁸ Other studies indicate that parent support of child autonomy,³⁴ parent scaffolding by non-intrusive help and guidance and family chaos^{35,36} are important predictors of early childhood executive function.

Research Gaps

- The trajectory of executive function disparities is largely unknown. Socioeconomic status effects could grow over time, for example if they compound throughout development. Conversely, they could remain constant, or they could diminish, for example if counteracted by formal education.
- Research to date suggests that executive function development may be particularly susceptible to environmental influences in the years between infancy and preschool, but the exact timing and nature of this possible sensitive period awaits further research.
- It is difficult to disentangle the role that genetic and environmental factors play in the development of executive function, and the causal nature of the relationship between socioeconomic status and executive function has not yet been fully established. One way to establish causality in this relationship is to study outcomes of interventions that change factors of the childhood environment.
- While executive function differences are hypothesized to at least partly account for disparities in academic achievement, the extent to which interventions improving executive function will lead to improvements in other life outcomes merits further investigation.

Conclusions

Evidence points to a clear association between childhood socioeconomic status and executive function performance. This association appears to be mediated by aspects of the family environment, particularly factors involving the quality of the parent-child relationship and its ability to buffer stress. Research in this area is in its early stages, and studies currently underway will further our understanding of the nature of the socioeconomic

status-executive function relationship and the environmental factors that contribute to it.

It is important to note that the existence of socioeconomic status-related differences in executive function and brain function does not in any way imply that these differences are innate or unchangeable. The brain is a highly plastic organ; in fact, an emerging body of research demonstrates that the neural correlates of cognition can be changed by environmental experience.³⁷ We hope that elucidating socioeconomic status effects on cognitive development will allow interventions to target more specific cognitive processes and environmental factors, ultimately helping to reduce socioeconomic disparities.

Implications

Social policies designed to reduce socioeconomic status disparities have traditionally targeted either socioeconomic status itself or broad achievement outcomes. Research discussed in this article reveals additional targets: factors that mediate the relationship between socioeconomic status and executive function (e.g., the home environment), and executive function itself.

An emerging body of research³⁸ indicates that interventions can improve executive function in children. Successful interventions include training software, games, yoga and meditation, sports participation and specialized classroom curricula; lower-income children are among those who show the largest improvements.

In what ways can policies and services address the root causes of the socioeconomic status-executive function gap? Because the home environment has lasting effects on development, policies that address children's broader environments – rather than those that focus solely on school and child care settings – may be helpful. In particular, mediation studies point to the need for programs and interventions that reduce parental stress and increase children's access to cognitively stimulating activities and resources.³⁹

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