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Protective Role of Executive Function Skills in High-Risk Environments

Amanda J. Wenzel, BA, Megan R. Gunnar, PhD

University of Minnesota, USA

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Introduction

Recently, the field of resilience has begun to focus on the protective role of executive functions in the school success of children facing adversity. Executive function, also termed cognitive control, describes goal-directed abilities to control thought, behaviour and emotions.[1] These skills can be seen in the ability to retain information in working memory, sustain or shift attention, inhibit automatic responses to perform an instructed or goal-directed action, and delay gratification.

EF skills develop rapidly in the preschool period[2] and are thought to provide a foundation for cognitive and behavioural school readiness.[3] In the classroom, executive function skills may manifest as the ability to pay attention, follow instructions, wait one's turn, and remember rules. These skills have shown particular importance for children exposed to early life stress, with recent research suggesting that executive function skills predict resilient school and peer functioning above and beyond intelligence level.[4,5,6,7]

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Although these skills are protective for high-risk children, the development of executive function skills is vulnerable to exposure to trauma and chronic stress.[8] Children from various adverse backgrounds (e.g., homeless/highly mobile, poverty, early institutionalism, maltreatment, etc.) tend to have deficits in executive function.[6,7,9,10,11] Taken together, these findings suggest a need to lower chronic stress exposure and target building executive function skills through intervention and prevention efforts with children.

Subject

High-risk youth with more developed executive function skills show better cognitive and behavioural school readiness and performance.[3,12] These skills appear to enable children to navigate their constantly changing environment,[9,13] which may be especially key for children developing in chaotic environments.

However, recent research has shown that children exposed to high levels of adversity may be less prepared to succeed in school, in part due to deficits in executive function skills.[6,7,9,10,11] These deficits may undermine children's abilities to succeed in academics and develop positive peer and teacher relationships.[12,14,15] This may have long-term implications for school success given that the achievement gap tends to persist and even widen throughout the school years.[16,17]

Given evidence that executive function skills are malleable to intervention and children who demonstrate poorer initial performance make greater gains,[18] recent efforts to improve high-risk children's transition to school have targeted building executive function skills prior to kindergarten.[4,19] Furthermore, research suggests that executive function skills are responsive to intervention across the school years.[18]

Problems

Studying the protective role of executive function presents several challenges. First, there are few measures capable of fully capturing executive function abilities for children who are experiencing delays in the development of these skills. Since exposure to chronic early life stress has been linked with impaired executive function skills in some children,[8] it is critical to be able to measure a wide range in functioning to fully capture the variability in these skills.

Current interventions to improve executive function skills employ a variety of methods including training, classroom curriculum, or physical activity.[18] Though these programs suggest executive

function skills are malleable, they also show varied success in skill improvements.[20,21,22,23,24] Programs that utilize computer-based training show promise in enhancing executive function skills; however, improvements are specific to the domain trained (e.g., working memory) and do not seem to expand to other areas of executive function more generally.[18]

Other programs designed to boost executive function skills integrate executive function activities into the daily lives of children, such as the preschool curriculum Tools of the Mind.[25] Throughout this curriculum, children are encouraged to utilize private speech or visual reminders (e.g., a picture of an ear to remind them that they need to listen or pay attention) to develop inhibitory control skills. Initial findings suggested children in these classrooms develop better executive function skills.[26] However, recent studies have failed to replicate these findings,[27] suggesting possible challenges with the curriculum or fidelity of implementation.

Key Research Questions

Developmental studies designed to understand the protective role of executive function often address the following questions:

1. What is the mechanism through which executive function prepares children for school success?
2. What helps foster executive function skills in young children experiencing delays?
3. What helps protect these skills from chronic stress?

Recent Research Results

Research consistently indicates that children with more developed executive function skills prior to kindergarten experience greater school success.[6,7] For academic achievement, these skills may scaffold language and mathematic success.[12] In fact, in a low-income sample of children, researchers have found that executive function skills prior to kindergarten predict growth in both numeracy and literacy skills across the kindergarten year.[12] A successful transition to school may be particularly critical for children who have faced high levels of adversity and may be at risk for poorer school performance.

In addition to providing a cognitive foundation for learning, executive function skills may also support academic success by promoting appropriate classroom behaviour.[3] Many kindergarten teachers report that it is more important for children to control themselves in the classroom,

follow directions, and not be disruptive than it is to know the alphabet or how to count to 20.[3] This suggests that teachers may find children with better executive function skills to be more teachable than children who are more distracted and prone to disruption.[3]

Furthermore, executive function skills may promote the development of positive teacher and peer relationships.[28] Studies suggest that there is overlap between the development of executive function and Theory of Mind (ToM), which is the ability to identify that others' desires and knowledge differ from one's own. These skills are associated with lower levels of aggression, better problem solving skills, and positive social skills.[29,30] Additionally, the ability to delay gratification may be linked with children's ability to regulate frustration and stress.[31,32]

Research Gaps

Currently, there is limited research on the effectiveness of interventions to boost executive function skills with very high-risk children. When developing interventions for these children, it may be critical to consider that children from a variety of adverse backgrounds may consistently demonstrate impairments in executive function.[6,7,9,10,11] Nevertheless, it will be important to remember that intervention needs and responses of children with different experiences may differ. For children currently experiencing chronic stress (e.g., homeless/highly mobile), it is unclear whether it is feasible to target executive function skills without first reducing stress and building coping skills. Future research will be needed to learn how best to tailor interventions to account for the needs of different children.

Conclusions

Studies consistently suggest that exposure to trauma or chronic early life stress may impair the development of executive function skills.[6,7,9,10,11] These skills appear to provide the foundation for school readiness through cognition and behaviour.[3,12] Children with better executive function skills may be more teachable.[3] Indeed, in a high-risk sample, children with better executive function skills at the beginning of kindergarten showed greater gains in literacy and numeracy than children with poorer initial skills.[12] Considering there is evidence that the achievement gap persists and may even widen across the school years,[16,17] it is critical that high-risk children begin school with as successful of a start as possible.

For this reason, there has been increased attention to interventions that promote executive function. Although there is evidence that executive function is malleable,[18,33] few interventions

have attempted to boost skills in children currently experiencing toxic levels of stress. Efforts to design interventions that promote executive function in these children may need to address current levels of stress exposure and simultaneously work to reduce these to gain maximum benefit.

Implications for Parents, Services and Policy

Research to date underscores the importance of executive function skills for school success, especially for children living in high-risk environments. Programs designed to boost executive function have shown success across multiple levels, including school curriculum, computer-based training, and even physical activities, like martial arts.[18,33,34] Similar to computer-based training, parents may be able to promote these skills with games that require turn-taking, attention skills, and memory. Furthermore, sensitive caregiving may promote these skills by shielding children from some of the chaos they are experiencing.[35]

Executive function skills also have been successfully targeted through school-based curriculum in preschool[26] and Head Start classrooms.[4,34] Experimental evidence suggests early childhood classrooms, like Head Start, can successfully build executive function skills by providing more self-regulatory support in a classroom (e.g., implementing clear rules and routines, redirecting or rewarding children's behaviour).[34] Increasing attention to executive function skills in early childhood programs may reduce the achievement gap that is apparent before school begins and persists throughout the school years.

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