

RESILIENCE

The Role of Physiological Reactivity in Understanding Resilience Processes in Children's Development

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Introduction

Stress and adversity affect children in different ways. Some children exhibit negative outcomes when exposed to difficult environments, while others overcome challenges. For decades, researchers have studied this variability of developmental outcomes in hopes to identify processes that enable some children to demonstrate resilience or positive adaptation in the face of adversity.¹⁻³ Most recently, researchers have turned to examining resilience processes across multiple levels of analysis, from children's neurobiological sensitivity to the effects of neighbourhoods they are raised in. By investigating biological processes, researchers can shed more light on how adversity gets "under the skin" and why some children are more susceptible to both positive and negative environmental effects than others.

Research Context

When exposed to various types of challenges and stressors, children’s bodies react with a set of highly integrated, physiological responses that include changes in heart rate, breathing and stress hormones, referred to as physiological reactivity. By studying differences in children’s physiological reactivity, researchers are helping us understand the dynamic interplay between contextual adversity, biology and behavioural adaptation. Individual differences in children’s physiological reactivity are complex and dynamic because they can be shaped by early experience, can change over time and their effect on adaptation can vary across different contexts and in response to different challenges.

Current research has focused on two systems of the body that are activated when children face challenging or stressful situations. The first system responds with a fast-acting repertoire of biobehavioural changes, known as the “*fight or flight response*”, and can also help the body recover from a state of arousal and regulate it back to *homeostasis*. The second system is slow-acting and prepares the body for chronic exposure to stress by suppressing systems that do not promote immediate coping and increasing available energy to deal with stress.⁴ These systems’ responses can be measured using various noninvasive measures such as cardiac readings or hormone levels collected from saliva samples.⁵

Key Research Questions

Researchers studying how physiological reactivity is associated with resilience are tackling the following key questions:

1. How do early experiences and the environment shape children’s physiological reactivity?
2. How do children’s physiological reactivity and the environment interact dynamically to explain differences in adaptation and resilience?
3. How do children’s self-regulation skills affect the association between the physiological reactivity and adaptation?

Recent Research Results and Gaps

Physiological reactivity as an index of adversity exposure

Resilience researchers theorize that differences in children’s adaptive functioning after experiencing adversity are related to changes in their physiological reactivity.⁶ Research has found that exposure to adversity can result in a dysregulated stress response (i.e., too high or too

low). Studies examining this association have typically shown that in contexts of early insensitive or abusive parenting, children develop heightened physiological reactivity to stress.⁷⁻¹¹ Early experiences of fear may sensitize children's systems to react more readily to future threatening situations by heightening their stress response.^{12,13} This heightened physiological response can be protective in situations of immediate threat, but it has also been linked to increased susceptibility to psychopathology such as depression or anxiety.^{11,14} This association provides evidence of the biological embedding of adversity, a hypothesis which states that early exposure to negative environments will affect the central nervous system in ways that adversely affect children's cognitive, social and behavioural development.¹⁵ As such, physiological reactivity may be indicative of how children are functioning when exposed to early or chronic adversity.

Interestingly, researchers have also posited that early exposure to some degree of psychological or physiological stress may promote positive adaptation by preparing children to more effectively deal with future exposure to adversity. This stress-inoculation hypothesis adopts the metaphor of a vaccine to describe how children who are exposed to a limited amount of stress early on may develop dampened physiological reactivity over time, making them less susceptible to stressful experiences in later life. Most evidence supporting this hypothesis has been found in research with animals. For example, infant monkeys who experienced stress in a form of brief, early separations from their mothers showed less physiological reactivity, lower levels of anxiety, higher cognitive skills and more curiosity when presented with a novel situation.¹⁶

While we do not have empirical evidence that this association between stress and adaptation functions similarly for children, it was recently proposed that resilience may emerge from infants' every day experiences with normative stressors, such as a parent misreading an infant cue or demand, rather than from experiences of overcoming extreme adversity, such as harsh parenting.¹⁷ More research needs to be conducted with children to support this hypothesis and to better understand whether stress-inoculation occurs in contexts of low, moderate, or high levels of adversity exposure.⁶ Future studies could examine the physiological reactivity profiles infants develop when exposed to varying degrees of maternal sensitivity, and how their physiological reactivity is associated with adaptation in later life.

Physiological reactivity as a marker of susceptibility to environmental influences

Physiological reactivity has been conceptualized as a marker of susceptibility to contextual influences. Applying evolutionary principles, researchers have theorized that children who show

heightened physiological or behavioural reactivity are more sensitive to both positive and negative environments than their peers who exhibit lower reactivity, “for better and for worse:” high physiological reactivity may be maladaptive in contexts of adversity, but healthy and promotive in contexts of nurturance and protection.^{18,19} For example, in a community sample of kindergarten children, researchers found that high physiological reactivity exacerbated risk for children who were exposed to high levels of family adversity such as marital conflict, maternal depression, harsh parenting and financial stress. Conversely, in the context of low family adversity, high physiological reactivity promoted adaptive functioning such as better school competence and more prosocial behaviour.²⁰

While many studies have demonstrated the association between low reactivity and better adjustment in the context of adversity, we should not assume that only low reactivity is associated with resilience.⁶ There is evidence that high physiological reactivity may be protective for children who are exposed to interpersonal conflict,²¹ highlighting the plasticity of children’s physiological reactivity and the importance of examining under what conditions high or low reactivity has a buffering effect against adversity.⁶

Since resilience often emerges over time from the combination of both positive and negative influences, future studies should aim to identify when high physiological reactivity promotes adaptation in high risk children.⁶ To accomplish this, studies must also include measures of positive environmental influences as well as positive indices of adaptive functioning. Highly reactive children may be more susceptible to prosocial peer groups, positive parenting, as well as preventative intervention programs which may inform future educational and social policies aimed at improving the lives of at-risk youth.⁶

Self-regulation, physiological reactivity and adaptation

Researchers are beginning to examine the role of children’s executive functioning skills in self-regulating physiological arousal during stressful or challenging situations. Traditional approaches of measuring physiological reactivity tend to oversimplify the dynamic nature of children’s physiological response to a stressful situation. By examining the entire trajectory of children’s reactivity and subsequent recovery from that arousal, researchers may be able to determine whether all children in high-risk contexts show similar levels of arousal, and whether resilient children demonstrate a faster physiological recovery, indicative of better self-regulation strategies. Supporting this argument, past studies have linked moderate levels of physiological

arousal to better self-regulatory skills in children.^{22,23} Although exposure to high levels of environmental adversity may predispose most children to develop highly sensitive physiological profiles, resilient children may also develop self-regulatory skills that produce fast and efficient recovery from that arousal. Examining how different aspects of physiological reactivity and self-regulation work together will be a significant next step to understanding how physiological reactivity relates to developmental resilience.⁶

Conclusion and Implications

Resilience researchers have made significant advances in linking physiological reactivity to both adversity exposure and adaptive functioning. This work has highlighted the importance of examining how the biological embedding of adversity affects children and how the environment and children's physiological responses interact dynamically to predict developmental outcomes. These associations may help researchers and practitioners understand why certain interventions work for some children but not for others and may help to better target services. By examining the association between physiological reactivity and self-regulatory skills, we may be better able to understand the resilience process for children who exhibit high physiological reactivity. Importantly, we must always remember that resilience is a dynamic process. Future work must examine how physiological reactivity is affected by and interacts with the environment longitudinally, to understand how differences in timing, level and chronicity of adversity exposure affect resilience over time.

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