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Children's Physical Resilience Outcomes: Meta-Analysis of Vulnerability and Protective Factors

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Purpose: Resilience has generally been understood as positive coping and adaptation despite stress and adversity and as a buffer against stress. Researchers examining resilience have typically focused on children's psychological resilience because of the well-established impact of stress on children's mental health. However, although it has also been well-established that high levels of stress can impact children's physical health, their physical health has received little attention in resilience research.
Eligibility criteria: Articles were selected for review if they (1) had a variable that was in some way a measure of physical health in response to a psychosocial stressor; (2) had participants who were children or adolescents within the age range of 4–18 years; and (3) were a peer-reviewed, empirical study.
Sample: Two random-effect meta-analyses were conducted with a sample of 12,772 participants across 14 studies to determine the influence of protective and vulnerability factors on children's physical health in adverse experiences.
Results: Protective factors had a moderate effect and vulnerability factors had a small–moderate effect on health measures across domains of physiological, sleep behavior, and overall health. The type of health measure moderated the effect size for vulnerability factors, but not for protective factors.
Conclusions: These findings suggest that protective factors may be associated with an environment that encourages children to thrive, as apparent by their physical health.
Implications: The results of this review and meta-analysis can be used to guide the methodological design of future studies on childhood resilience and to inform clinical practice with children and adolescents.

Stress is a common experience that affects both psychological and physiological outcomes (Gunnar & Quevedo, 2007) and can have a detrimental impact on children's development and overall well-being. Stress in childhood can contribute to behavior problems (Calkins, Blandon, Williford, & Keane, 2007), anxiety and depression (Essex et al., 2011), immune functioning (McEwen & Gianaros, 2010), social–emotional development (Taylor, Lerner, Sage, Lehman, & Seeman, 2004), and cognitive development (Danese & McEwen, 2012). In contrast, childhood resilience is understood as positive coping or adaptation despite stress and adversity (Masten, 2014; Rutter, 2013), and as a buffer against stress (Ungar, Ghazinour, & Richter, 2013). For this reason, fostering children's resilience is of particular interest to parents, clinicians, and other professionals working with children.

Stress has a central role in the study of resilience; to be resilient, one must have experienced stress or adversity. To experience stress, an individual first perceives an event or stimulus as stressful at which point the body responds physiologically, for example by elevating cortisol levels,

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until the stimulus has ceased. One of the main concerns about stress and adversity is that the physiological response to stress can be detrimental when elevated over a prolonged period (Shonkoff et al., 2012). McEwen (2006) referred to the physiological effects of stress as allostatic load, which is a way of measuring the impact of chronic and toxic stress on different systems in the body. Despite the fact that experiencing high levels of stress with few psychosocial supports has a well-established detrimental impact on children's mental *and* physical health (Shonkoff et al., 2012), resilience research has typically focused on mental health. Children's physical health, for example, fewer symptoms of illness or a well-regulated stress response, are also evidence of their resilience to adverse circumstances but have been understudied.

There are many different factors that affect children's resilience outcomes, and these factors can be protective by supporting positive outcomes (Masten & Obradovic, 2006), or they can increase vulnerability by enhancing the impact of stress or adversity (Masten & Obradovic, 2006). For example, one of the factors that influences whether an individual will experience resilient outcomes is their perception of the stressor itself (Epel et al., 2004; Keller et al., 2012). This is likely because children who do not perceive an event or stimulus as stressful do not have the same psychological or physiological reaction as those who perceive the stressor as more of a threat (McEwen, 2006). Thus, the perception of a stressor is one of many possible factors that moderates the effect between stress and resilience outcomes.

Previous research findings have identified several other individual- and family-level protective factors that have been associated with psychological resilience, such as higher autonomy, better social skills, and greater impulse control (Werner & Smith, 1982); high self-worth (Copeland-Linder, Lambert, Yi-Fu, & Ialongo, 2011); and parents' relational stability (Cortina et al., 2013). These protective factors may create a positive environment, both within the child and around the child, where the adversity that the child experiences becomes a buffer that directly contributes to their growth because the positive environment around them allows them to thrive. Conversely, children may cope or adapt well despite vulnerability factors and adverse circumstances, which is still resilience. Furthermore, it is possible that the strength of protective factors may encourage children to thrive (e.g., Lerner, Brentano, Dowling, & Anderson, 2002) rather than simply cope. Given that children's physical health is relevant for their well-being and development, there is a need to synthesize and analyze the relation between stress, mediating protective and vulnerability factors, and physical health resilience to establish an overall effect among studies and explain any variance between study effects. This review and meta-analysis addresses this need.

Resilience as a Multi-System Construct

Briefly defined, resilience is the ability to cope with and adapt to stress and adversity (Cicchetti & Rogosch, 2009). It has been conceptualized in three different ways: as a combination of personality traits, as multiple interacting developmental processes that must be measured over time, and as a cross-sectional outcome that suggests that the individual has positively adapted to the environment (Masten & Obradovic, 2006). Although stress and adverse environments can negatively influence health and development, not all children who experience stress will suffer these negative outcomes (Dupre & George, 2011). There are many outcomes after experiencing stress, referred to as multifinality of outcomes (Cicchetti & Blender, 2006), which is the essence of resilience. The different factors that affect children's resilience can be protective by supporting positive outcomes, or they can be detrimental by enhancing the impact of stress or adversity (Masten & Obradovic, 2006).

Again, resilience research has generally focused on children's mental health after a stressor. However, mental health alone may not accurately depict a child's overall level of functioning, and may result in mis- and under-identification of children who would benefit from intervention support. For example, Brody, Yu, Chen, Miller, et al. (2013) found that psychological resilience was not always indicative of physiological resilience in a sample of adolescents who had experienced adversity. Specifically, they found that some adolescents were resilient when using observational or self-report measures of psychological coping, but that these same adolescents had high measures of allostatic load. These findings suggest that the adolescents had poor physical health outcomes related to adversity, despite the fact that their mental health outcomes did not suggest that they were struggling, nor did these outcomes suggest that they were not coping well.

Role of Environment on Children's Resilience

A further area of research interest for fostering children's resilience is to identify proximal factors that contribute to or detract from children's overall resilience. Given that children's environments have a substantial influence on their psychological and physical health (e.g., Cohen, Janicki-Deverts, Chen, & Matthews, 2010; Danese & McEwen, 2012; Hostinar, Stellern, Schaefer, Carlson, & Gunnar, 2012), they may also influence children's resilience. A better understanding of these environmental influences comes from Bronfenbrenner's multi-level perspective of development (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006) that includes the individual, and the interactions between the individual and other proximal influences such as family, friends, and school. These levels interact with each other to influence children's development and overall well-being, and provide a context for situating protective and vulnerability factors that may be associated with children's physical health resilience.

Problem

Overall, the existing findings on stress and resilience highlight the need to consider resilience as a multi-system construct to provide composite information about children's resilient responses after stress (i.e., psychological/physiological