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Protective Factors for Youth Confronting Economic Hardship: Current Challenges and Future Avenues in Resilience Research

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Abstract

Economic hardship during childhood is associated with worse mental and physical health across the lifespan. Over the past decade, interdisciplinary research has started to elucidate the behavioral and biological pathways that underlie these disparities, and identify protective factors that mitigate against their occurrence. In this integrative review we describe these advances, highlight remaining gaps in knowledge, and outline a research agenda for psychologists. This article has three aims. First, we consider the evolving psychobiological literature on protective factors, and conclude that supportive relationships can mitigate against the physical health problems often associated with economic hardship. Second, we discuss recent empirical developments in health psychology, public health, and the biological sciences, which reveal trade-offs associated with adaptation and challenge our conception of what it means to be resilient. Finally, we outline a research agenda that attempts to integrate existing knowledge on health disparities with these newer challenges in order to inform both policy and practice for youth experiencing economic hardship.

Keywords

socioeconomic status; children; physical health; mental health; resilience

Roughly 21% of American children live below the federal poverty level, defined by the government as earning $24,300 annually for a family of four (Jiang, Granja, & Koball, 2017). An even larger number of children (43%) grow up in low-income families, which are defined as earning less than twice the poverty level (Jiang et al., 2017), an amount that is also estimated to be inadequate for meeting the basic needs of a family with children including housing, child care, food, health care, transportation, daily necessities, and taxes (Gould, Tanyell, & Kimball, 2015). Nevertheless, growing up in a low-income family is the norm for many American children, especially if they are members of racial and ethnic minority groups. Indeed, 63% of African American and 61% of Hispanic children meet the low-income definition.

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Children contending with economic hardship show worse outcomes in multiple domains, including education, mental health, and criminal justice system involvement (Coster, Heimer, & Wittrock, 2006; Duncan & Murnane, 2011; Goodman, Slap, & Huang, 2003). A less studied correlate of childhood hardship is physical health problems, which are the main focus in the current review. Fast-accumulating evidence from health psychology, developmental psychology, and epidemiology reveals that low childhood socioeconomic status (SES) is linked to higher rates of morbidity and mortality from multiple conditions across the lifespan (Adler, 2013; Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010; Galobardes, Smith, & Lynch, 2006; Goodman et al., 2003; Hertzman & Boyce, 2010; G. E. Miller, Chen, & Parker, 2011; Repetti, Taylor, & Seeman, 2002). These health disparities begin at birth, with marked SES differences in preterm delivery, growth restriction, and infant mortality, and continue through childhood, where they manifest in common pediatric conditions like obesity, injury, and asthma (Braveman et al., 2010; Schreier & Chen, 2013). They also persist into adulthood, during which childhood SES forecasts higher rates of coronary heart disease, stroke, and premature mortality, independently of adult SES (Galobardes et al., 2006).

However, the pathways leading from low SES to poor health and the protective factors that might alter these pathways and improve health trajectories for economically disadvantaged youth are only beginning to be understood. In recent decades, psychological research has begun to illuminate several of these pathways and protective factors. This analysis focuses on these protective factors that could reduce SES-based health disparities, and has three primary goals. First, we describe and assess the evolving psychobiological literature on psychosocial protective factors for the physical health and well-being of youth confronting economic hardship. Second, we discuss recent empirical developments in health psychology, public health, and biological sciences, which reveal trade-offs associated with adaptation and challenge our conception of what it means to be resilient. Finally, we outline a research agenda that attempts to integrate existing knowledge with these newer challenges, and inform both policy and practice for youth experiencing economic hardship. To contextualize research on resilience under economic hardship, we begin with a very brief introduction to our current understanding of the pathways between low SES and poor health.

Pathways from Economic Hardship to Lifespan Health Problems

Extensive research has documented a gradient in health outcomes by SES, such that for most - though not all - outcomes those in higher SES strata enjoy better health (Adler et al.,1994). SES is a multidimensional construct that is frequently defined in psychology as a combination of three objective indicators: income, education, and occupational status (APA Task Force on Socioeconomic Status, 2007). Increasingly, it has also been conceptualized in more complex ways that include subjective social status (individuals' perception of where they stand on the social ladder), household- and neighborhood-level indices of SES, the intersections between SES and race or ethnicity, combinations of childhood and adult SES, as well as fluctuations in SES over time (Adler, 2013). Importantly, the SES-health gradient is observed across varying operationalizations of SES and is not simply a reflection of racial and ethnic disparities in health (Braveman et al., 2010). It is the case that for many health indicators, African Americans show worse outcomes compared to Whites, and do so at each

level of income or education (Braveman et al., 2010). But even **within** populations of Whites - and African Americans - health outcomes generally pattern by SES.

Several recent psychobiological theories of how SES "gets under the skin" to affect health have converged on the notion that the differential activation of stress-mediating systems may be a key pathway, and thus possibly an intervention target. Although describing each theory is beyond the scope of this review, the most relevant formulations include *allostatic load theory* (Seeman, Epel, Gruenewald, Karlamangla, & McEwen, 2010); *biological embedding theory* (Hertzman & Boyce, 2010; Hertzman, 1999; G. E. Miller, Chen, et al., 2011); *the risky families model* (Repetti et al., 2002); *the multiple risk exposure model of childhood poverty* (Evans & Kim, 2010); and *neurocognitive models* (Hackman, Farah, & Meaney, 2010; McEwen & Gianaros, 2010; Taylor, 2010).

Other relevant theories focus on behavioral adaptations to economic hardship, such as greater reactivity to present conditions and a tendency to not delay gratification according to the *experiential canalization model* (Blair & Raver, 2012); reduced investment in marital and parent-child relationships according to the *family stress model* (Conger, Conger, & Martin, 2010); and shifts in life history strategies such as earlier reproduction, which would maximize evolutionary fitness in adverse environments according to the *adaptive calibration model* (Del Giudice, Ellis, & Shirtcliff, 2011). Together, these models and their accompanying evidence suggest a complex picture that challenges pure "deficit" models of how children develop under economic hardship. Instead, it is becoming increasingly clear that some low-income children are resilient and do not show poor health outcomes (Chen & Miller, 2013). Furthermore, children's behavior may have adaptive value in the environment in which it develops. As examples, not delaying gratification is adaptive when resources are scarce or their availability is unpredictable and hypervigilance increases survival in dangerous settings, despite the costs of overgeneralizing it to safer contexts. Additionally, some of the adaptations can be considered socially desirable. For instance, low-income children exhibit higher levels of altruistic and charitable behavior compared to their wealthy counterparts (J. G. Miller, Kahle, & Hastings, 2015), perhaps due to perceiving greater interdependence with others or empathizing more with others' needs (Piff & Robinson, 2017). Thus, it appears that *experience canalizes* behavior (Blair & Raver, 2012), leading to "developmental trade-offs" that involve both gains and losses (Blair & Raver, 2012, p. 312). We suggest that while these adaptations yield "gains" in particular ecological settings, they impose costs, too, which are reflected in disparities in academic performance, mental health, and physical health. As we discuss later, understanding the nature of these trade-offs is essential if psychologists are to design effective interventions and provide useful policy recommendations.

Protective Factors against Childhood Economic Hardship

Despite the well-established evidence that children growing up poor are more vulnerable to lifespan physical illness, some poor children remain in good health despite the odds (Chen & Miller, 2013). This was illustrated in a study in which adults were exposed to a rhinovirus and then monitored in quarantine for emergence of the common cold (Cohen, Doyle, Turner, Alper, & Skoner, 2004). Participants who had experienced low childhood SES were more

likely to become infected with the virus and show cold symptoms compared to those who grew up in high-SES homes. However, despite this greater risk, 50% of those growing up in low-SES conditions did not get sick. These findings raise questions about the factors that may protect the health of children confronting economic hardship.

Factors Promoting Psychological Resilience

Resilience has been defined as positive adaptation despite adversity, and is thought to be a dynamic process that reflects multiple transactions between environmental conditions and individual characteristics leading to successful outcomes and not simply a trait of the individual (Cicchetti, 2013; Luthar, Crossman, & Small, 2015; Masten & Narayan, 2012; Rutter, 2012). Classic theories and the first waves of empirical research on psychological resilience among poor children have focused on protective factors that explain unexpectedly positive mental health or school outcomes (Garmezy, 1991; Luthar et al., 2015; Masten, 2001, 2007; Rutter, 2012; Werner, 2005). Positive, close relationships appear to be a cornerstone of positive adaptation despite adversity. In early childhood, caregivers who are sensitive and responsive, set limits, and maintain stable families are a foundational asset for developmental processes, as shown by many longitudinal studies in multiple countries (Luthar et al., 2015; Masten, 2001; Werner, 2005). Later in development, emotionally supportive peers, teachers, role models, and romantic partners can buffer against the strains and stresses of economic hardship (Luthar et al., 2015; Rutter, 2012). Outside the family, cohesive neighborhood communities and organizations such as churches and youth clubs that reward children for competence and participation can also serve as protective factors (Garmezy, 1991; Werner, 2005). Schools with supportive climates, effective classroom management, and positive teacher expectations can promote children's academic achievement and offset environmental adversities (Garmezy, 1991; Luthar et al., 2015).

At the individual level, a number of personal characteristics have also been associated with resilience, and many of these characteristics are themselves shaped by children's proximal and distal social environments. Children exhibiting resilience tend to have some combination of the following: active, sociable temperaments that respond positively to others, curiosity and intelligence, self-esteem, an internal locus of control, effective interpersonal and communication skills, achievement motivation related to school or other special talents, a belief system or a sense of meaning in life, strong self-control, and coping skills (Garmezy, 1991; Luthar et al., 2015; Masten & Narayan, 2012; Rutter, 2012; Werner, 2005).

Caveats.—Although some children exhibit resilient functioning, research has also revealed limits to resilience. For instance, children who appear successfully adjusted at one time point can have a break-down in functioning at later stages or in new life circumstances (Cicchetti, 2013; Luthar et al., 2015). Furthermore, children who appear resilient in one psychological domain may not show resilience across multiple domains. An intensely debated issue in current research is how common resilience is (Galatzer-Levy & Bonanno, 2016; Infurna & Luthar, 2016). Because investigators have idiosyncratic definitions of resilience and use different statistical approaches, the literature contains radically different prevalence estimates (Galatzer-Levy & Bonanno, 2016; Infurna & Luthar, 2016). Further complicating the issue is the number of domains considered (e.g., mental health, physical health). For

instance, one study revealed prevalence estimates of 16% to 56% depending on the outcome considered, but only 5% if five domains were considered to classify participants as resilient (Infurna & Luthar, 2017). Including physical health as a facet of resilience is raising novel questions about what it means to be resilient, a topic we turn to next.

Factors Promoting Resilience to Health Problems

In the past decade, research in health psychology has begun examining similar processes and factors that might promote children's physical health resilience, which could be defined as exhibiting positive indicators of physical health despite adversity. Some protective factors have been linked to both psychological and physical well-being, such as supportive caregivers and role models. Other factors, such as self-control, appear to have divergent effects for mental and physical health, as we discuss in more depth below.

Many of the health problems linked to childhood economic hardship (e.g., coronary heart disease, stroke, diabetes) can take decades to develop and to begin to manifest clinically. However, resilience to these health problems can be studied early in development by tracking intermediate biological processes that are known to contribute to disease progression. For instance, studies have examined indices of stress system functioning (HPA axis, autonomic, cardiovascular), as well as multi-system composite measures of allostatic load. Additional interest has been dedicated to markers of future cardiovascular and metabolic health problems, including systemic inflammation, elevated blood pressure, insulin resistance, obesity, and health compromising behaviors (e.g., smoking). A few studies have assessed more specific markers of disease severity (e.g., asthma impairment) or novel epigenetic markers of cellular aging.

Consistent with findings on psychological resilience, observational studies have consistently revealed what seem to be protective influences of early-life supportive relationships, especially parental warmth. Many of these studies have methodological limitations, including cross-sectional designs, inadequate control for earlier health problems, and/or retrospective accounts of early caregiving, raising questions about the veridicality of reports. Nevertheless, their results consistently suggest a scenario whereby early-life maternal warmth operates as a buffer, weakening the usual association between economic hardship and outcomes including allostatic load in adolescence (Evans, Kim, Ting, Tesher, & Shannis, 2007), pro-inflammatory signaling in adulthood (Chen, Miller, Kobor, & Cole, 2011), and risk of metabolic syndrome in middle and old age (G. E. Miller, Lachman, et al., 2011). Similarly, in prospective studies of adolescents, perceived emotional support from parents, peers, and mentors has emerged as a buffer against the cardiometabolic risks associated with neighborhood poverty (Brody, Lei, Chen, & Miller, 2014). Among disadvantaged racial and ethnic minority youth, parent support and a positive racial identity both act as buffers, weakening the association between exposure to racial discrimination and disease-relevant biomarkers including low-grade inflammation and immune cell aging (Brody, Miller, Yu, Beach, & Chen, 2016; Brody, Yu, Miller, & Chen, 2015).

These observations raise questions about the psychobiological characteristics that supportive early caregiving instantiates. Research on early-life attachment patterns has shown that receiving sensitive, responsive, and consistent caregiving teaches children that they live in a

safe, predictable environment where their needs will be met (Sroufe, Egeland, Carlson, & Collins, 2005). Children who receive this type of care show dampened stress responses when their parents are present (for a review, see Hostinar, Sullivan, & Gunnar, 2014). Conversely, children experiencing insensitive or abusive care are more likely to show patterns of cognitive processing and social-emotional development that suggests they are hypervigilant to threat (Cicchetti & Valentino, 2007; Dodge & Pettit, 2003; Pollak, 2008). In turn, frequent activations of threat-response systems like the HPA axis, autonomic nervous system, and the immune system are known to contribute to pathogenic processes involved in cardiovascular and metabolic diseases via multiple mechanisms (G. E. Miller, Chen, et al., 2011). Consistent with the role of dampened threat responsivity as a protective factor, one study found that low childhood SES was associated with higher rates of metabolic syndrome in adulthood. However, these excess risks were not apparent for low-SES participants who had relatively low threat vigilance (Hostinar, Ross, Chan, Chen, & Miller, 2017).

While most of these findings on buffering via supportive relationships are correlational, results from several randomized intervention studies strengthen confidence in their causal structure. For instance, a recent randomized trial showed that a family-oriented intervention implemented with a disadvantaged sample of 11-year-old African American youth from the rural Southern United States reduced their inflammation levels 8 years later. The effects were partially mediated by improvements in parenting (G. E. Miller, Brody, Yu, & Chen, 2014). Additionally, a recent review discussed interventions that aimed to improve the social environment for children experiencing adversity (primarily through parent training) and that assessed HPA axis functioning as an outcome (Slopen, McLaughlin, & Shonkoff, 2014). The review showed that the majority of these parenting interventions were able to improve cortisol regulation in children experiencing adversity, compared to various comparison groups.

Finally, there is an emerging literature on the role of self-regulation skills in resilience to health problems, but the findings are mixed and appear to depend on the facet of the construct assessed and the population studied. One potentially beneficial set of self-regulation skills has been called “shift-and-persist”, which consists of the emotion regulation strategy of reappraising current stressors more positively (shifting), while simultaneously persisting with an optimistic focus on the future (Chen & Miller, 2012, p. 135). Among low-SES children, greater use of shift-and-persist strategies was associated with lower levels of asthma-related inflammation at baseline and less asthma impairment 6 months later (Chen, Strunk, et al., 2011). Similarly, in middle-aged adults who had experienced low childhood SES, shift-and-persist strategies were associated with lower allostatic load scores (Chen, Miller, Lachman, Gruenewald, & Seeman, 2012). Consistent with these results, one study found that better self-regulation skills were associated with fewer chronic respiratory symptoms among school-aged homeless children (Barnes et al., 2017).

Other findings on self-regulation are less encouraging. In one study, self-regulation skills assessed through a delay of gratification task at age 9 did not moderate the association between poverty and allostatic load, even though it predicted better adult working memory (Evans & Fuller-Rowell, 2013). Additional studies have found that low-SES African American adolescents exhibiting high levels of self-control might even show *worse* physical

health (Brody et al., 2013; G. E. Miller, Yu, Chen, & Brody, 2015), as discussed below (section on “skin-deep” resilience).

Caveats.—It is important to note that many of these presumptive buffers of hardship are themselves affected by hardship. For instance, we discussed evidence that sensitive parenting attenuates the association between low childhood SES and poor health outcomes. However, economic contractions increase the prevalence of harsh parenting (Lee, Brooks-Gunn, McLanahan, Notterman, & Garfinkel, 2013) and child maltreatment (Brooks-Gunn, Schneider, & Waldfogel, 2013). Similarly, self-regulation has emerged as a protective factor for the mental health of low-SES youth. But many studies also suggest that economic hardship interferes with the development of these characteristics. For instance, one longitudinal study following children from birth showed that higher chronicity of family poverty was associated with proportionally lower child self-regulation as early as age four (Raver, Blair, & Willoughby, 2013). These associations between low SES and reduced performance on self-regulation tasks continue to be observed across childhood and into adolescence (Evans & English, 2002; Hackman, Gallop, Evans, & Farah, 2015). This suggests that these buffers may be weakened under the most adverse conditions.

Another caveat is that while the benefits of nurturing parenting or self-regulation might be obvious, there are many causal pathways to suboptimal parenting or to self-regulation failure. Parental addiction, depression, and family conflict may require different intervention approaches (Luthar & Eisenberg, 2017; see articles in the Special Section organized by these editors in the journal *Child Development* for examples of such tailored interventions).

Finally, another caveat is that even though psychologists have traditionally focused on parenting or other behavioral interventions as solutions, the uptake and effectiveness of these interventions may be limited if parents’ basic needs for food and a safe home are not met first. For instance, it is increasingly clear that food insecurity does not only predispose to physical health problems, but it is robustly linked to worse mental health status in adults and behavior problems in children (Jones, 2017). In 2016, approximately 16.5% of families with children in the U.S. were food-insecure according to the U.S. Department of Agriculture (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2017), thus this is a pervasive problem that could undermine the uptake of behavioral interventions and, if addressed, could result in numerous beneficial outcomes.

The Challenges of Integrating Research on Psychological and Physical Health Resilience

Findings documenting better health outcomes for low-income youth who have access to protective factors are certainly promising. However, recent discoveries in public health and the biological sciences are raising challenges to the integration of research on psychological and physical health resilience. Next we discuss three major challenges and propose some future avenues for finding solutions to these challenges.

A common language.—One potential challenge preventing the current integration of research on psychological and physical health resilience is the lack of a common language and common taxonomy for protective factors. Historically, children’s academic success, mental health, and physical health have been studied along parallel tracks, and this is

reflected in diverging scientific constructs used to explain these phenomena. For instance, in psychology the term “buffer” is used to mean any protective factor or moderator of the effects of adversity, whereas in stress biology “buffer” has a more narrow meaning as a factor that reduces physiological stress reactivity (Kiyokawa & Hennessy, 2018). In developmental psychology, terms like “turning points” (Rutter, 2012) or “windows of opportunity” refer to major life changes that offer chances for altering developmental trajectories for the better. It is unclear what the corresponding biological processes might be, but arguably the concepts of behavioral and neural plasticity might be helpful to link up with these constructs (McEwen, Gray, & Nasca, 2015). We believe that adopting a common language focused on the *process of adaptation* and the protective factors that promote it would help advance research in this area.

Future avenues.: To spur efforts to develop a common language on protective factors, we consolidate prior literature on resilience from developmental psychology (Garmezy, 1991; Luthar et al., 2015; Masten & Narayan, 2012; Rutter, 2012) and neuroscience/stress biology (Lyons, Parker, Katz, & Schatzberg, 2009; McEwen et al., 2015), and define a set of protective factors based on their timing and their hypothesized mechanism of action in relation to the onset of a specific stressor. Although prior literature has often defined such protective factors in terms of statistical methods of detection (e.g., interaction versus main effects) and has often called for more research on underlying mechanisms (Cicchetti, 2013; Luthar et al., 2015; Masten, 2007), we believe the way to move forward with this research agenda is to think of these factors in terms of the underlying *neurobiological* mechanisms they engage over time as adaptation efforts proceed. Below we provide examples of how these protective factors might operate to promote adaptation, drawing upon both human and non-human animal research (see Figure 1 for an illustration of the temporal dimension of adaptation, which shows when each factor acts).

Inoculating factors (Lyons et al., 2009; Rutter, 2012) occur before stressor onset and “steel” or “immunize” us by dampening stress responses to future adversity. One such inoculation protocol was developed for squirrel monkeys and consisted of brief intermittent separations from the mother during the juvenile period. This mild exposure to stressors was associated with resilience later in development, as indicated by lower levels of anxiety, cortisol, and increased exploration of novel environments (Lyons et al., 2009). There is some emerging evidence from humans that early-life exposure to brief and mild stressors might similarly inoculate us against exaggerated later stress reactivity (Koss & Gunnar, 2017). In monkeys, differential myelination of the prefrontal cortex as a result of successful prior coping with stress appears to be one of several promising neurobiological mechanisms worth exploring (Lyons et al., 2009), but more research is needed in humans.

In contrast, *stress buffers* can be defined as factors that dampen stress responses and the negative impact of adverse circumstances while they are occurring (Kiyokawa & Hennessy, 2018). Across many mammalian species including humans, the presence or assistance of a conspecific can dampen stress responses as shown through experimental protocols (Hostinar et al., 2014; Kiyokawa & Hennessy, 2018). To date, most human studies on stress buffers have been conducted with adults and children from low-risk environments (Hostinar et al., 2014). The neurobiological circuits involved in dampening stress responses are increasingly

being revealed in both nonhuman animals (Kiyokawa & Hennessy, 2018) and in humans (Hostinar et al., 2014), and appear to involve different processes depending on developmental stage, though more research is needed to fully characterize these processes. Another important future direction would to be to identify various subtypes of stress buffers based on the stage of the stress response within which they operate. Researchers could test which buffers work best during the initial cognitive appraisal stage, versus the active coping stage, versus the recovery phase that occurs towards the end of a stress response.

Once the stressor has subsided, *repair factors* begin to act. Repair factors can be defined as factors that restore aspects of biological or psychological functioning and promote faster recovery from stressful events. For instance, there is some emerging evidence that the negative effects of stress activation on the body can be contained and minimized after the fact by physical exercise and dietary factors such as antioxidants in fruits and vegetables (Kiecolt-Glaser, 2010). Very little is known about such repair/recovery factors in children and adolescents, particularly those exposed to socioeconomic disadvantage. This is an important area of future research.

Compensatory factors can begin to act after the repair stage is completed and can counterbalance effects of adversity that may be persistent. They have been conceptualized as additive influences that are independent from the effects of adversity and provide alternative resources to assist with adaptation (Masten, 2001). For instance, cultural resilience (understood as a measure of retaining one's culture despite outside challenges) can act as a compensatory factor for the effects of racial discrimination on stress levels in First Nations communities in Canada (Spence, Wells, Graham, & George, 2016). More research is needed to examine such compensatory factors for children confronting economic adversity, and how cultural representations affect stress appraisals and downstream physiological processes.

Another useful concept is that of *windows of opportunity,* or "turning points" in development (Rutter, 2012), which refers to major life changes that afford chances for improved outcomes, often long after the experience of adversity. This likely occurs through processes of behavioral flexibility and neural plasticity (McEwen et al., 2015), though more research is needed to understand what allows some individuals to retain their capacity for change and adaptability (McEwen et al., 2015). Pursuit of higher education, new career opportunities, psychotherapy, and marriage to a supportive spouse from a high-functioning family are some examples of such opportunities which can radically alter trajectories for the better, even after prior exposure to significant economic adversity (Rutter, 2012).

Finally, *promotive factors* have been defined as predictors of positive outcomes under both low-risk and high-risk conditions (Masten & Narayan, 2012). That is, they provide continuous benefits for everyone and they act before, during and after stress exposure and irrespective of general life circumstances. Warm, supportive relationships can be thought of as one such factor, which is not only beneficial for low-income children, but also a basic ingredient of healthy development for middle-class and high-SES children (Luthar et al., 2015).

As we reviewed above, sensitive parenting is the best characterized protective factor for health problems in low-SES children, but we understand little about how it operates. While the best parents probably serve all of the above functions (they inoculate, buffer, repair, etc.), each of these effects likely has different underlying mechanisms and more research is needed to fully describe their roles. This will require a combination of experimental studies and multi-wave, process-oriented longitudinal investigations that can tease apart various streams of parental influence on child physiology and health.

"Skin-deep" resilience.—Another current challenge in resilience research is a phenomenon that has been named "skin-deep" resilience, whereby disadvantaged youth show outward signs of competence, including high levels of self-control, academic excellence, and social success, but later in development evince poor health in biomarker studies (Brody et al., 2013; G. E. Miller et al., 2015). For instance, one longitudinal study of 489 African American youth from the rural South identified a group of low-SES preadolescents who could be considered psychologically resilient because they were rated by their teachers as high on self-control and on scholastic and social competence at ages 11, 12 and 13 years old (Brody et al., 2013). They also exhibited low levels of depressive and externalizing symptomatology at age 19. However, this resilient group also showed the highest allostatic load scores at age 19, as reflected in their high blood pressure, high body mass index, and elevated levels of overnight stress hormones including cortisol, epinephrine, and norepinephrine (Brody et al., 2013). A subsequent follow-up of this cohort further revealed that the resilient individuals who were enrolled in college despite exposure to adolescent neighborhood poverty exhibited better psychosocial outcomes but higher allostatic load at age 20 (Chen, Miller, Brody, & Lei, 2016). Similar results were found in a different cohort of 292 African American youth who were followed from age 17 to 22. For all participants, higher self-control at ages 17-20 predicted better subsequent mental health in multiple domains, ranging from depressive symptoms to substance use to aggressive behavior. But self-control's association with physical health, as measured by epigenetic aging of immune cells, differed according to SES. Among the most disadvantaged youth, self-control was associated with faster cellular aging, reminiscent of the earlier findings on allostatic load. Among the less disadvantaged youth, self-control forecasted slower cellular aging; in other words, it appeared beneficial for both mental and physical health outcomes (G. E. Miller et al., 2015).

These patterns have now been replicated in samples from other geographic regions in the U.S. and with other health outcomes. For instance, an analysis of 9,301 participants from the representative National Longitudinal Study of Adolescent to Adult Health (Add Health) revealed that African American youth from the most disadvantaged backgrounds who showed high levels of striving and perseverance in academic pursuits at age 16 were more likely to suffer from type 2 diabetes at age 29, despite exhibiting better mental health and higher SES compared to their less-striving counterparts (Brody, Yu, Miller, & Chen, 2016). However, this pattern was not observed in the White subsample, where striving was associated with better mental and physical health. Using data from the same cohort, another analysis observed that college completion was associated with lower risk of depression at ages 24-32 for respondents from all racial and ethnic groups. However, the association

between college completion and cardiometabolic risk varied across groups. Among Non-Hispanic Whites, finishing college was associated with lower metabolic syndrome. The same pattern was observed for African- and Hispanic-Americans from middle- and upper-class backgrounds. By contrast, for minority respondents from disadvantaged childhood environments, college completion was associated with **higher** metabolic syndrome rates at ages 24-32 (Gaydosh, Schorpp, Chen, Miller, & Harris, 2018). Similarly, in a study of adults from the metropolitan Pittsburgh area (G. E. Miller, Cohen, Janicki-Deverts, Brody, & Chen, 2016) revealed a "skin-deep" resilience pattern in low-SES African Americans, who showed greater risk of developing upper respiratory infection after exposure to a rhinovirus, but better psychosocial and educational outcomes, if they were high in conscientiousness. Again, this pattern was not evident in Whites (G. E. Miller et al., 2016). Because so far the "skin-deep" resilience pattern has been largely observed in African American samples, with only one study testing for similar patterns in disadvantaged Hispanic young adults (Gaydosh et al., 2018), future research should examine the generalizability of this phenomenon to other racial/ethnic groups. Nevertheless, these findings challenge the view of resilience as an all-or-nothing phenomenon, and suggest a complex pattern of interactions between school functioning, mental health, and physical health that is not necessarily beneficial for minority youth. We suggest some future directions for research that would promote a deeper understanding of these patterns and inform efforts to remediate these trade-offs for high-achieving, psychologically resilient minority youth.

Future avenues.: First, to uncover the explanations for these hidden costs of upward mobility, research needs to incorporate assessments of racial discrimination and stereotype threat that may be triggered or amplified when racial and ethnic minorities achieve successful outcomes. In addition, exploring the unique coping styles and challenges faced by upwardly mobile African Americans and Hispanics compared to Non-Hispanic Whites could shed additional light on these processes. For example, studies show that newly upwardly mobile African Americans face unique challenges such as greater risk of slipping into poverty, living in neighborhoods with higher rates of poverty and violence despite achieving higher SES, and perceiving more obligations to assist relatives who are struggling financially (Hardaway & McLoyd, 2009). Race/ethnicity is a construct associated with numerous differences in sociocultural processes, physical appearance, immigration status, etc. (Garcia Coll et al., 1996). The fact that the "skin-deep" resilience pattern is observed among both African American and Hispanic groups is an important clue that, among the many factors embedded in racial and ethnic identification, having minority status may play an key role. We will need more intervention studies that aim to improve mental and physical health simultaneously for racial and ethnic minority youth, because only with such designs can we test hypotheses about the interplay between these domains and probe the mechanisms underlying any trade-offs. Longitudinal studies that assess all three domains of functioning (educational, mental health, physical health) at each wave will also be needed to examine when and why biomarkers start showing a decline in health, as well as possible moderating influences.

Synergistic interactions.—Another challenge arises from evidence of synergistic interactions among social-environmental and individual factors that need to be considered

jointly in order to understand the emergence of socioeconomic health disparities. To illustrate these interactions, living in a low-income neighborhood where processed, high-carbohydrate foods are affordable and abundant can interact with an individual's stress-mediated shift towards "comfort foods" to promote dietary patterns that lead to poor glycemic control and diabetes. Environmental stressors can also bring about depression in vulnerable individuals, reducing motivation to exercise, and interacting with neighborhood threats to foster a sedentary lifestyle, worsening symptoms of diabetes and depression. In turn, depressive symptoms can impair individuals' ability to work, worsening economic hardship and reinforcing a vicious cycle.

Most research on these types of synergistic interactions has been conducted with adults, and more studies with children and adolescents are clearly needed. Some evidence from pediatric samples documents synergies between environmental, psychological, and biological conditions for disadvantaged children. For instance, childhood asthma onset and symptomatology is affected by interactions of air pollution with parental stress, neighborhood violence exposure, and general life stress (see Schreier and Chen, 2013 for a review). Additionally, there is new evidence of interactions between psychological and chemical stressors (e.g., lead or nitrate exposure) such that the former appears to lower the threshold at which the latter begins to harm health and cognition (Gump et al., 2009; McEwen & Tucker, 2011).

Future avenues.: Due to these interactions, we need to invest in multipronged interventions that can tackle socioeconomic, psychological, and health problems simultaneously because these domains are causally inter-related. Targeting a single psychological outcome such as parenting or self-regulation skills may not substantially reduce socioeconomic inequality if the ecology that surrounds disadvantaged youth continues to foster other health, social, and educational problems that might, over time, re-instantiate the original problem that the intervention was trying to address. Undoubtedly, interventions which focus on a single process have greater internal validity as they can confidently isolate the causal factor driving the outcomes. Furthermore, when ameliorating a process that is influential for many developmental domains (e.g., supportive parenting), interventions might also initiate positive developmental cascades in other domains (Masten & Cicchetti, 2010), as suggested by the correlational studies reviewed above. Nevertheless, the presence of synergistic interactions suggests that these programs might be even more beneficial if they were part of multifactorial interventions that tackled psychological, biological and socioeconomic conditions simultaneously (e.g., ameliorate psychological processes related to economic hardship, provide medical prevention/care, reduce exposure to toxins, and give cash assistance). However, more research is needed to evaluate the hypothesis that these multipronged interventions are more efficacious and cost-effective than the sum of single-outcome interventions.

Conclusions and Policy Implications

In sum, recent research reveals increasingly complex patterns of interaction between socioeconomic, psychological, and biological levels of organization. Some data reveal trade-offs or inverse associations between mental and physical health ("skin-deep" resilience

findings). Other studies are suggestive of mutually-reinforcing cycles of worsening mental and physical health problems (synergistic interactions results). These findings suggests two broad take-home messages for research and policy: focus on promoting both physical and psychological health, and intervene early on multiple fronts.

Focus on Promoting both Physical and Psychological Health

From a research standpoint, we need to embrace a more holistic, interactive, and dynamic view of the adaptation processes that enable at-risk children to become resilient in various domains. To develop this view, a common language around protective factors and how they operate will be needed and we proposed the beginnings of such an effort here. Additionally, to make progress in this area, the very nature of the interactions between different levels of analysis needs to become the explicit focus of research, where clear hypotheses are specified and tested about how various levels interact with or trade off with each other over time. Prior studies on children in economic hardship have either assessed “deficits” in functioning or documented resilience, but few studies have studied these jointly to understand the process of adaptation itself, whereby children deliberately or unintentionally sacrifice one domain of functioning to optimize another. Without understanding these “developmental trade-offs” (Blair & Raver, 2012, p. 312), interventions may replace behaviors that serve an adaptive function without providing any alternatives for coping with a specific problem in the environment. Understanding not just the causes but the functions of behaviors will be necessary to ensure a beneficial net result when children return to the social contexts they live in. To design these types of interventions and move this research agenda forward, interdisciplinary teams will be needed and psychologists have an important role to play in accurately representing the role of psychological processes in the integrative models that will need to be developed.

Intervene Early on Multiple Fronts

From a policy perspective, recent findings suggest that a compartmentalized, single-issue approach to the medical, psychological, academic and economic problems of disadvantaged children may be less effective than integrative solutions that address multiple needs simultaneously, in a holistic and context-informed manner. If recent evidence from psychology and public health is any indication, we need renewed commitment to multipronged social programs that can create enough positive synergies within economically marginalized communities to help ensure that children and families can adapt and withstand the shocks that do occur. Furthermore, economic analyses suggest that intervention in the first few years of life may yield the greatest return on investment for society due to developmental plasticity in these stages and the hierarchical nature of development, which ensures that “skills beget skills” (Heckman & Mosso, 2014; Knudsen, Heckman, Cameron, & Shonkoff, 2006, p. 10156). However, these analyses are based on human capital outcomes such as educational attainment and lifetime earnings, and it remains to be seen whether health outcomes follow a similar trajectory, particularly for the low-income youth of color who show the “skin-deep” resilience pattern. The biological “wear and tear” affecting their bodies may be difficult if not impossible to reverse, and later interventions may need to focus on repair factors and compensatory factors, whereas early-life interventions could focus on promoting inoculating factors and stress buffers.

Finally, the benefits of intervening on multiple fronts have been shown through experimental programs like the Perry Preschool and Abecedarian projects. These programs provided a strong foundation for healthy development of economically disadvantaged children in multiple domains (social, cognitive, as well as physical) and have been shown to not only have long-lasting benefits into adulthood, but provide returns on investment for society that would make up for their cost (Knudsen et al., 2006). Despite this evidence, national programs like Head Start have been stripped of many of the social services, medical care, and health education components they provided to parents when the program was launched, and today its beneficial impacts for children are weaker. Given the accumulating evidence on the interrelations between children's physical, cognitive, and social wellbeing, we believe policymakers should propose new programs or increase investment into existing multipronged programs for young children and families facing economic hardship. Children's resilience will then remain possible because a healthy foundation exists and protective factors have been bolstered at multiple levels.

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Public Significance Statement: Childhood poverty is prevalent in the United States and can have lasting negative effects on physical and mental health. Although some children in poverty exhibit resilient functioning, particularly when they have access to supportive relationships, research has also revealed limits to resilience. Prevention and intervention efforts should focus on promoting both physical and psychological well-being, and intervene early on multiple fronts to create a healthy foundation for children's development.

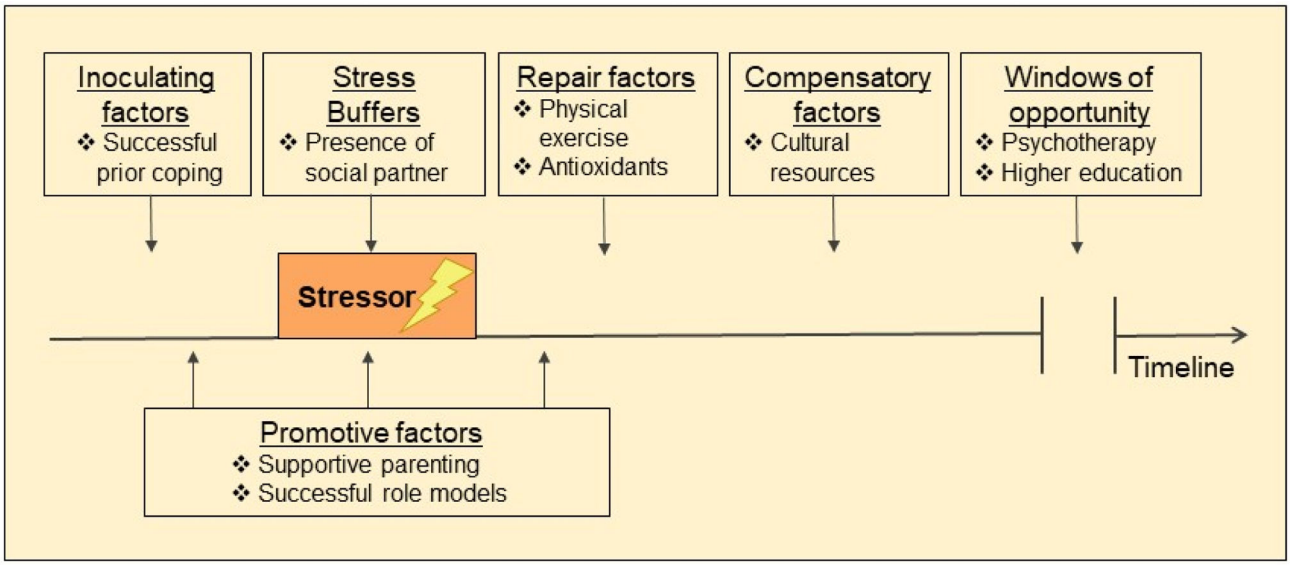

Figure 1.

Illustration of protective factors promoting adaptation to adversity as they relate to a hypothetical timeline surrounding the onset of an acute stressor. **Inoculating factors** occur before stressor onset and "steel" or "immunize" us by dampening stress responses to future adversity. **Stress buffers** are factors that dampen stress responses and the negative impact of adverse circumstances while they are occurring. **Repair factors** can be defined as factors that restore aspects of biological or psychological functioning and promote faster recovery after stressful events. **Compensatory factors** can begin to act after the repair stage is completed and can counterbalance effects of adversity that may be persistent. **Windows of opportunity** refer to major life changes that afford chances for improved outcomes, often long after the experience of adversity. **Promotive factors** provide continuous benefits for child development under both low-stress and high-stress conditions.