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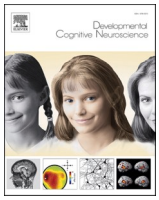

The promise and pitfalls of a strength-based approach to child poverty and neurocognitive development: Implications for policy

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ABSTRACT

There has been significant progress in understanding the effects of childhood poverty on neurocognitive development. This progress has captured the attention of policymakers and promoted progressive policy reform. However, the prevailing emphasis on the harms associated with childhood poverty may have inadvertently perpetuated a deficit-based narrative, focused on the presumed shortcomings of children and families in poverty. This focus can have unintended consequences for policy (e.g., overlooking strengths) as well as public discourse (e.g., focusing on individual rather than systemic factors). Here, we join scientists across disciplines in arguing for a more well-rounded, "strength-based" approach, which incorporates the positive and/or adaptive developmental responses to experiences of social disadvantage. Specifically, we first show the value of this approach in understanding normative brain development across diverse human environments. We then highlight its application to educational and social policy, explore pitfalls and ethical considerations, and offer practical solutions to conducting strength-based research responsibly. Our paper re-ignites old and recent calls for a strength-based paradigm shift, with a focus on its application to developmental cognitive neuroscience. We also offer a unique perspective from a new generation of early-career researchers engaged in this work, several of whom themselves have grown up in conditions of poverty. Ultimately, we argue that a balanced strength-based scientific approach will be essential to building more effective policies.

1. Introduction

> "*What I am most upset about is how me and my 'people' are treated. Not all of us are treated equally. Mostly people with a better education get better jobs and careers. Over here the education is not that great but maybe if they focus on giving us a chance in life we can actually do something in this world.*"
>
> - Adolescent research participant (Roy et al., 2019, pg. 554)

Growing up in poverty presents myriad challenges that children are forced to endure, resist, and learn to navigate. Childhood poverty is a pervasive social and public health crisis, affecting nearly 11 million children in the United States and approximately one billion children worldwide (Dawson, 2023; UNICEF, 2023). Rooted in historical structural inequalities, child poverty in Western nations disproportionately affects racially-minoritized children, who grow up in poverty at more than double the rate of White children (Parolin et al., 2022). Over the past decade, pioneering research at the intersections of psychology and neuroscience has provided foundational insights into the neurodevelopmental consequences of economic disadvantage. For example, several landmark studies have demonstrated that compared to children from affluent families, children growing up in poverty tend to show

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altered growth trajectories across various brain regions, coupled with cognitive and behavioral differences that may or may not be adaptive in a given context (e.g., Farah, 2017; Hanson et al., 2013; Noble et al., 2012; Rakesh et al., 2021). Such findings have justifiably captured the attention of policymakers and helped to promote progressive policy reform (e.g., cash transfer programs, early childhood interventions). However, this has come at the cost of producing a deficit narrative, focused on shortcomings of children and families in poverty—minimizing both the structural nature of the issue as well as the skills, agency, and heterogenous experiences of those in poverty (Raver and Blair, 2020). Here, we add to a new wave of research offering a different perspective, demonstrating that neural differences associated with poverty can be framed from a more balanced, strength-based approach. By "strength-based" approach, we mean approaches that highlight the positive and/or adaptive developmental responses that arise from experiencing diverse human experiences, including those related to social disadvantage (for review and working definitions, see Ellis et al., 2023; Silverman et al., 2023). Critically, this perspective has urgent importance for both policy and basic science, particularly given the enduring and inequitable burden of socioeconomic inequities.

While neuroscientific findings can provide a powerful motivation for policymakers to act, popular interpretations of these findings are often over-extended, with negative consequences (for a discussion, see Bruer, 1999; Thompson, 2023). The non-linear, experience-dependent nature of brain development makes interpreting neural differences between groups extremely complex, as we review in this paper. Even so, popular press articles boast titles including, "Poverty disturbs children's brain development and academic performance;" "Poverty changes your brain to make you less intelligent, study suggests;" and "The Poor's Mental Power" (E. J. Johnson et al., 2016; Kwon, 2015; Vohs, 2013). These deficit narratives often point to lower test performance among children in poverty and situate the cause within the individual children themselves, without sufficiently pointing to the interconnected systems and structures in which these children develop, learn, and perform. In short, they understate the role of contextual and structural factors. These findings also reduce individuals from lower socioeconomic status (SES)[1] backgrounds to a single group, minimizing the heterogeneity of people's experiences (Amso and Lynn, 2017) and largely ignoring the agentic ways they challenge and resist unequal structures (e.g., Jones et al., 2023)

Importantly, the proliferation of public views about the harms of poverty also reaches children and teachers. Sociological work has documented that children from lower-SES backgrounds[2] are not only familiar with public views on poverty, but often internalize them (Heberle et al., 2018). "Man, I'm bad," one study reported a young child saying, "and I want to become rich but I can't because I'm raised up like that" (Weinger, 1998, p. 113). Teachers are similarly affected by these deficit narratives. Not only do teachers internalize scientific messages about the capacities of students from low-SES homes—underestimating their ability to learn from high quality instruction—these messages may also influence the teaching practices they engage in, resulting in children having unequal learning environments (Adair et al., 2017). These narratives have far-reaching effects on children's opportunities: even after students graduate from college, potential employers evaluate first-generation college graduates (a component of SES), more negatively, through a deficit lens (Belmi et al., 2023). Importantly, employers are able to change their evaluations when nudged to take a strength-based lens (Belmi et al., 2023). Thus, there are real consequences to the deficit-focused research on neurodevelopmental correlates of SES, and the overextension of the research in the policy domain to date.

One potential driver of this deficit-focused discourse is that traditionally, most researchers conducting work on poverty and child development have come from high-SES backgrounds. Across STEM and the social sciences, the median childhood household income among academic faculty is 23.7% higher than the general public, and they are 25 times more likely to have a parent with a PhD (Morgan et al., 2022). Indeed, scientific norms and larger societal structures were largely built by, and in favor of, people from higher-SES backgrounds. Such homogeneous perspectives may have created blind spots and implicit bias in how studies with children in poverty are conducted and interpreted, reifying shared stories about what it means to be successful, how to live, and more (e.g., McLean, 2024; McLean and Syed, 2016). For example, if higher-SES individuals think the education system has worked well for them, they may believe it is more equitable (e.g., Rodriguez-Bailon et al., 2017; Zimmerman and Reyna, 2013). Therefore, they may be more likely to believe—implicitly or explicitly—that educational metrics such as test scores or cognitive[3] performance, which may not function uniformly across sociodemographic groups, are objective measures of ability or aptitude, and that children who perform poorly do so because of their own characteristics or effort. On the other hand, deficit narratives permeate the broader culture and may be held by people from lower-SES backgrounds as well, as the quote from the child above makes clear (Dudley-Marling, 2007; Sandel, 2020; Valencia, 2010); thus, diversifying the field alone may not be sufficient to change these dominant narratives. Indeed, these views have arguably formed the foundation of the scientific narrative around poverty and neurodevelopment to date.

Here, we offer the perspective of a new generation of early-career researchers actively engaging in a *strength-based* paradigm shift—several of whom themselves have grown up in conditions of poverty. Specifically, we re-ignite old and recent calls for such a shift (e.g., Riessman, 1964; Torrance, 1968; Ellis et al., 2023; Frankenhuis & Nettle, 2013) by bridging the emerging strength-based science of poverty to developmental cognitive neuroscience, and ultimately towards sensitive and respectful policies that foster children's thriving. We suggest that this explicit shift in research is necessary to shift public perceptions of children growing up in low-SES contexts.

We begin by demonstrating the value of a strength-based approach in understanding child poverty and neurocognitive development, offering three guiding principles to ground this work. Next, we delineate how these principles can inform social and educational policy. We focus on studies of child poverty and policies within a U.S. context as a case study to organize our examples, but we note here and elsewhere that the promise of this approach extends to the study of brain development more broadly, with policy implications for children across the socioeconomic gradient and across the globe. Finally, we explore potential pitfalls, ethical considerations, and practical solutions to prevent the misuse of a strength-based research agenda. Critically, as we argue in Section 4, this approach does not justify the status quo and is not intended to do so. The ramifications of structural-level socioeconomic inequalities are serious and must be addressed. Here we focus on the ways our science can be improved to accurately portray a wider range of

[1] Socioeconomic status (SES) encompasses both income and education, among other factors such as occupation. We note that while income and education tend to be correlated, they are not interchangeable, and the combinations of income and education among people vary. Although we use the term SES throughout this paper to integrate literature on child poverty that often considers multiple aspects of SES, we do not endorse conflating income and education.

[2] We intentionally use person-first language throughout this paper when referring to children (i.e., children from lower-SES backgrounds). We consider this terminology less stigmatizing than terms that essentialize children as belonging to a socially-constructed group (e.g., "poor children") (Denver et al., 2017).

[3] We use "cognitive" when discussing findings related to skills or behavioral performance, and "neurocognitive" when more specifically referencing the joint role of neural responses/development with cognitive skills/behavior.

human neurodevelopment, and to support this collectively shared goal.

2. Shifting the narrative: The value of a strength-based approach for understanding neurocognitive development in the context of childhood poverty

As early as the 1960 s, a handful of scholars have called for greater acknowledgement of the hidden strengths and talents among children from disadvantaged backgrounds (e.g., Torrance, 1968; Riessman, 1964, 1965). Such calls have re-emerged in the last decade, creating a family of strength-based approaches to studying childhood adversity and poverty. We begin by briefly reviewing a few of these approaches. These approaches share a broad, humanistic view on people living in poverty, but bring different focuses. Together, they emphasize context-specific norms and knowledge, social and cognitive skills, and adaptive strategies; each are supported by scientific evidence across levels of analysis. This emphasis on existing adaptive skills that develop in part *because of* adversity—which serves as adaptive in stressful contexts—distinguishes it from resilience, which identifies factors that enable youth to function in normative contexts *in spite* of adversity (for reviews, see Ellis et al., 2017, 2022, 2023; Frankenhuis and de Weerth, 2013). A strength-based approach to research on child poverty seeks to understand adaptive or optimal development in a given context, even if such adaptations come with potential trade-offs in other contexts.

One strength-based approach, the *identity- or background-specific strengths* approach, highlights the unique norms and knowledge acquired by people from historically minoritized and marginalized backgrounds, typically valued in the contexts they were raised in (Hernandez et al., 2021; Silverman et al., 2023). Consistent with this approach, people living in low-SES conditions develop more interdependent norms that focus on attending to others, and this helps them effectively engage in group problem-solving tasks (Piff et al., 2018). Another approach, the *hidden talents* approach, takes a more skill-based lens, focusing on social and cognitive abilities that are enhanced by adversity (Ellis et al., 2023; Frankenhuis and de Weerth, 2013; Torrance, 1968). Consistent with this approach are findings showing that children with a history of physical abuse might recognize angry facial expressions faster or more accurately than their peers (Pollak et al., 2000). Finally, the *reasonable response* approach emphasizes the strategies that people use to respond to the affordances and constraints in conditions of poverty or adversity (Frankenhuis and Nettle, 2020; Pepper and Nettle, 2017). Consistent with this approach, people tend to discount the future more steeply when future rewards are unlikely to materialize (Daly and Wilson, 2005; Pepper and Nettle, 2017). Jointly, these and other strength-based approaches provide a well-rounded and balanced view of people in poverty, which embraces the full spectrum of struggles and strengths in context. Such a well-rounded view can inform education, jobs, policy, and interventions that leverage the strengths, strategies, and assets of people in poverty.

In tenets that follow, we bridge this broad family of strength-based approaches to developmental cognitive neuroscience. Recent reviews on the neuroscience of poverty have argued in favor of adopting strength-based approaches (see Nketia et al., 2021; Noble et al., 2021; Taylor et al., 2023; Ellis et al., 2022; D'angiulli et al., 2012), but here we elaborate on its application to basic and applied science related to brain and cognitive development. We aim to build upon these reviews by offering a set of three core tenets of its application and subsequently describing its translation to policy. Specifically, we review evidence that illustrates (1) different dimensions of poverty-related experiences include not only unique challenges, but also forms of cultural wealth; (2) SES differences are not always indicative of a deficit but can point to strengths, skills, or adaptive processes; and (3) children's cognitive capacities can often be better understood when tested with materials and settings that elevate their strengths. Throughout, we situate these core tenets of our approach in a developmental systems framework (Bronfenbrenner and Ceci, 1994) to better contextualize the sociopolitical forces at play across levels of analysis.

2.1. Tenet 1: Poverty-related experiences encompass a wide range of both challenges and opportunities

Childhood poverty is often used as a descriptive term, as if to refer to a stable group of children with homogenous, difficult experiences. The reality, of course, is much more complex. Families transition in and out of poverty frequently; children living in poverty can have vastly different experiences from one another; and many of the characteristics that correlate with poverty—such as coming from a language community other than spoken English, or being a racial-ethnic minority—bring with them a richness of experience that the field has tended to overlook. Moreover, while poverty certainly brings substantial hardship to children and families, not all experiences associated with poverty are uniformly detrimental, nor do all children in poverty perceive, or respond to, their experiences the same way (Smith and Pollak, 2021). In this section, we attempt to move beyond distal proxies of children's experience, such as their parents' level of income or education, to review day-to-day experiences children may have that shape their neurodevelopment. A strength-based approach acknowledges and strives to account for the wide range of both poverty-related challenges and opportunities, which can be remediated and bolstered, respectively.

One way to empirically disentangle the complexity of children's daily experiences is by considering varying "types" or dimensions of experience, which are posited to shape the developing brain in specific ways. Contemporary models of adversity suggest that core dimensions of deprivation, threat, and unpredictability differentially shape neurodevelopmental systems to allow for developmental adaptation to a given set of environmental demands (McLaughlin et al., 2014; Young et al., 2022). Research has shown that experiences of deprivation (e.g., sociocognitive and/or material scarcity) are associated with alterations in brain areas supporting higher-order cognition, whereas experiences of threat or harm (e.g., interparental or parent-child conflict) are more associated with emotional regulatory systems (Johnson et al., 2021). Links between unpredictability and neurocognitive outcomes are less understood (for a recent review, see Munakata et al., 2023), although some intriguing recent findings show potential cognitive enhancements via keeping track of, and storing information about, rapidly changing conditions (Fields et al., 2021; Nweze et al., 2021; Young et al., 2018, 2022). Of course, it is important to note that many poverty-related experiences operate along a continuum (e.g., ranging from threat to safety; deprivation to support; predictable to unpredictable).

Despite the empirical utility of dimensional models of adversity, often overlooked is the fact that our measures of these experiences might not mean the same thing across time, socioeconomic level, or racial-ethnic groups. This results in measurement bias, which if not empirically tested and adjusted for, may result in socioculturally-inaccurate conclusions about the link between poverty-related experiences and neurocognitive development (DeJoseph et al., 2021, 2022). For example, consider the concept of "sociocognitive deprivation." While true forms of sociocognitive deprivation exist—such as a deaf child being deprived of language by hearing parents—much of what the literature conceptualizes as deprivation—such as parents not speaking a lot directly to their young infants—is in fact more typical of our species cross-culturally and historically. Similar points have been made about our concepts of adversity, citing that for generations people have faced resource scarcity and adapted in a multitude of ingenious ways (Frankenhuis and Amir, 2022; Humphreys and Salo, 2020). Many of the existing measures used to index sociocognitive deprivation lack consideration for the creative ways families in poverty may be providing similar levels of stimulation as more affluent families, despite lacking material items like fancy toys or books (DeJoseph et al., 2021). Experience is inherently rooted in sociocultural context, and thus any strength-based approach requires measures that can adequately capture such context.

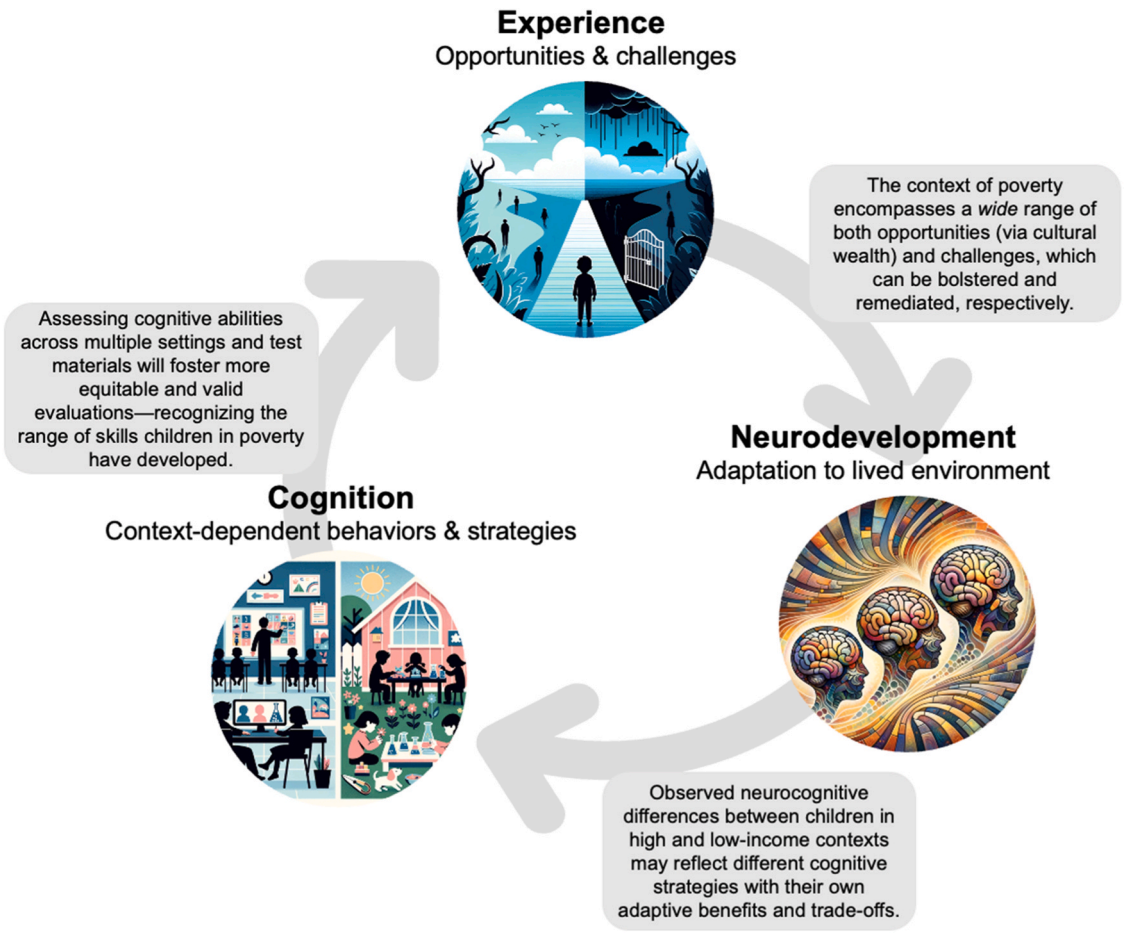

Fig. 1. Core tenets of a strength-based approach to understanding child poverty and neurocognitive development. This approach recognizes that (1) dimensions of poverty-related experiences include not only unique challenges, but also forms of cultural wealth; (2) socioeconomic differences are not always indicative of a deficit but can point to strengths, skills, or adaptive processes; and (3) children's cognitive abilities can often be better understood when tested with materials and settings that elevate their strengths. Note. Color images generated by DALL-E 3 (OpenAI).

A strength-based approach further acknowledges that some types of experiences may be two sides of the same coin: An experience labeled as "adverse" may also afford positive benefits to children growing up in poverty. For instance, overcrowding, and consequently, increased so-called "household chaos," is often described as an adversity and has been shown to have negative effects on child development (Evans et al., 2010). However, an additional perspective suggests that for families living below the poverty line, having additional adults in the household can also provide valuable emotional, cognitive, and financial resources. These resources may include access to childcare, greater exposure to rich cultural traditions, additional income to meet financial obligations, and tutoring support for children requiring academic assistance (García Coll et al., 1996; Miller-Cotto et al., 2022). In fact, a large, 42-country study recently found that living in a multigenerational home was linked to less parental burnout than living in a two-parent household (Roskam et al., 2021). Moreover, shared challenges can be a socially uniting force that may offer opportunities for social capital, community engagement, cultural ties, and a sense of belonging—all of which contribute to the developing form and function of children's brains (Qu et al., 2021).

Similarly, while children growing up with ethnically or racially-minoritized identities are more likely to face day-to-day racism, discrimination, and systemic barriers to achievement and well-being, these identities can also be sources of buffering, support, and cultural wealth. Ethnic-racial socialization is the process through which families transmit information, values, and perspectives about ethnicity and race to their children (Wang et al., 2020). It can serve as a developmental and cultural asset, enhancing social cohesion among communities of color (Anderson et al., 2021; Berkel et al., 2010; Neblett et al., 2012) and acting as a buffer against racist encounters, while aiding in the effective processing of stereotypes and microaggressions (Berkel et al., 2010; Scott et al., 2020; Tyrell et al., 2023). It can also contribute to the development of executive functions, empathy, and prosociality (Bañales et al., 2021; Merculief et al., 2023). It remains an open question as to whether the different operationalizations of these varied cultural experiences enhance the development of brain regions associated with these skills and whether such changes buffer against the negative effects of more harmful poverty-related experiences like discrimination.

There are many other examples of experiences which can confer both risk and opportunity, a rich space for future research. For example, as discussed in the next section, U.S. children who speak languages other than English in the home may excel in certain sociocognitive skills, and also engage in special forms of helping and community service (e.g., such as language brokering, in which they play an important role translating and interpreting for community members; Bañales, 2021). There is also evidence that bilingual children retain plasticity of language for longer (D'Souza and D'Souza, 2021). In addition, youth exposed to greater neighborhood income inequality and violence are more likely to engage in sociopolitical action in their community (Roy et al., 2019; Yosso, 2005). Future work may consider mapping the neural correlates of such social and behavioral skills and identify convergence with other patterns of neurodevelopment that may similarly give rise to strengths in the context of poverty. While challenges like exposure to racism, language discrimination, and violence are serious and should be ameliorated, these findings and future directions highlight the various

ways sociocognitive strengths are formed *because of*, rather than *in spite of*, growing up in poverty. More research is needed to expand our definitions of normative development to include the full range of skills children develop in different sociocultural contexts.

2.2. Tenet 2: Observed neurocognitive differences for children growing up in low- compared to high-income contexts may indicate an adaptation rather than a deficit

Given the rich and varied experiences that children from low-SES households have, it is important to consider how different sociocultural contexts, and individual differences within those contexts, might shape brain development in adaptive ways. In daily life, we easily accept that people develop expertise in all different areas: You may not share your friend's knowledge and skill in baking while she may not share your skill in knitting. Importantly, we now know that these various forms of expertise can be reflected in the function and structure of the brain. A landmark neuroscience study found that London taxi drivers—who have developed expert navigational skills—showed differences in their hippocampal gray matter volume relative to bus drivers with fixed routes, otherwise matched in driving experiences and stress levels (Maguire et al., 2006). Results suggested that taxi drivers showed *increased* complex spatial representation and posterior hippocampal gray matter volume, but also that this appeared to develop with a trade-off: These taxi drivers also showed *decreased* visuo-spatial learning and gray matter volume in the anterior part of the hippocampus.

The study on London taxi drivers was ingenious in its combination of careful controls, behavioral testing, and neuroimaging, and was able to illustrate both the reflection of expertise in the brain and the benefits and drawbacks that come with this form of expertise in terms of learning. However, it can also serve as a cautionary tale for finding neural differences between groups without such careful testing, as these differences could just as easily reflect a strength as they could a deficit (D'anguilli et al., 2012; Ellwood-Lowe et al., 2016)—and often can represent both, highlighting the trade-offs inherent to brain plasticity. This is particularly true in the case of the developing brain, since the brain develops non-linearly over time, and no single pace or pattern of brain development is necessarily "optimal" across all contexts (Callaghan and Tottenham, 2016a; Rakesh et al., 2023; Kline et al., 2018). Similarly, brain regions typically expand and then renormalize or even shrink with expertise, pointing to the complexity of interpretation when comparing individuals to one another at a single timepoint (Wenger et al., 2017).

Could some neurocognitive differences between children from lower- and higher-SES backgrounds—typically interpreted as a deficit for children from lower-SES backgrounds—actually be signs of different forms of expertise? There is reason to think this may be the case. For example, behavioral evidence points to some skills that lower-SES individuals, on average, excel at relative to their higher-SES peers. These include more skills in working together collaboratively with groups (Dittmann et al., 2020), greater social attunement and empathy (Kraus et al., 2012; Piff et al., 2018), and more empathic accuracy (Kraus et al., 2010). More recent evidence has replicated and extended this latter finding, suggesting an interaction by sex and social class: SES differences in emotion recognition were driven by lower-SES men outperforming higher-SES men, while women perform highly across socioeconomic levels (Brener et al., 2023). These findings point to the need to consider the broader context in understanding skills individuals might have. Indeed, both cultural context and parental expectations shape the skills children develop (Rogoff et al., 2017).

Aggregating behavioral data with neuroscientific evidence points to opportunities for future research. For instance, SES differences in prefrontal regions could indicate differences between broad and narrow attention styles—the latter more commonly emphasized in educational settings, but each with their own benefits and trade-offs (Blanco and Sloutsky, 2020; Chavajay and Rogoff, 1999; Correa-Chávez and Rogoff, 2009; Decker et al., 2023). Similarly, SES differences in hippocampal regions could indicate differences in declarative versus procedural memory (Dang et al., 2016). SES differences in language regions could indicate differences in code switching (more common in lower-SES and minoritized children), narrative style, language brokering, metaphorical language use, or even differences in attention to speakers' mouths (Birulés et al., 2019; Figueroa, 2023; Gampe et al., 2019; Miller et al., 2005; Morales and Hanson, 2005; Rickford et al., 2015). Each of these points show how SES differences found in brain regions may reflect the complex development of skills, specialization, and trade-offs that can be seen in behavioral data, and represent areas ripe for future research.

Another, not mutually exclusive, possibility is that SES differences in brain development are evidence of children acquiring the *same* ultimate skills but in different, contextually-dependent ways. Interestingly, accumulating evidence supports the possibility that children might rely on different neurocognitive mechanisms to solve the same executive functioning tasks (Ellwood-Lowe et al., 2021; Ellwood-Lowe, Irving, et al., 2022; Finn et al., 2017; Leonard et al., 2022; Merz et al., 2019; Sheridan et al., 2012). For example, one study found that children whose families had lower incomes activated an area of the prefrontal cortex more than their peers from higher-income families when performing a working memory task, and that activation of this region was positively linked to performance for children from lower-SES-backgrounds, but negatively linked to performance for children from higher-SES backgrounds (Sheridan et al., 2012). Another study showed that cortical thickness of the rostrolateral prefrontal cortex—a region typically activated during reasoning—was positively related to reasoning performance for children from lower, but not higher-SES backgrounds (Leonard et al., 2019). Similar dissociations have been found in the realm of math (Demir-Lira et al., 2016) and reading (Gullick et al., 2016). One possibility is that, in some cases, these findings may be explained by the pace of maturation, given evidence that the brain matures at different rates depending on children's early experiences (Callaghan and Tottenham, 2016b; Ellwood-Lowe et al., 2018; McDermott et al., 2021; Rakesh et al., 2023; Rakesh and Whittle, 2021; Tooley et al., 2021). Slower maturation may allow the brain to retain its plasticity for an extended period, providing additional time for the refinement of neural circuits. However, research is yet to investigate how the pace of brain maturation is associated with children's outcomes, making it challenging to comment on whether, and in which contexts, alterations in developmental pace may be adaptive. While brain maturation is unlikely to be the full story, more work in this area is urgently needed.

Finally, there are a small number of studies that report null results—a lack of difference between children from low- and high-SES backgrounds (e.g., DeJoseph et al., 2022; Ellwood-Lowe et al., 2021; Leonard et al., 2015). Likely even more researchers have found null effects and not published them (Franco et al., 2014). These null results are often ignored or overlooked, while deficit interpretations are emphasized. Of course, a lack of differences between children can be informative, as this may reveal adaptive cross-context strengths that can be leveraged for children from both high- and low-SES backgrounds.

Taken together, these lines of evidence point to the importance of considering a strength-based lens when examining socioeconomic differences in neural development. This is not to suggest we ignore the potential harms that poverty can exert on children's development. Indeed, adaptation in one domain of neurocognitive functioning may incur trade-offs to others through similar or distinct mechanisms (e.g., allostatic load; McEwen, 1998; Blair et al., 2011). Thorough description of these negative effects is beyond the scope of the current review, but can be found elsewhere (e.g., Jensen et al., 2017; Luby et al., 2013). Here, we highlight the mounting evidence suggesting that different forms of brain development are adaptive in different contexts, and that patterns of brain development associated with high performance are not necessarily generalizable (e.g., Ellwood-Lowe et al., 2021; Li et al., 2022). In addition, some measures of cognitive performance (e.g., computerized trial-based tasks like Flanker) that the field has typically

relied on are subject to various forms of bias and worth reconsidering in future research, as we describe further in the next section (Miller-Cotto et al., 2022; Warne et al., 2014).

2.3. Tenet 3: Children's cognitive capacities tend to be best revealed when assessed with materials and settings that match their lived experiences

Researchers have classically evaluated entire populations using materials that were designed to be tailored to a small subset of people, with important negative consequences. For example, although "standardized" testing connotes materials that are developed to evaluate students abilities in an ostensibly fair manner, scholars dating back to W. E.B. DuBois have long recognized their role in justifying inequity and oppression (e.g., Guthrie, 2004; Reardon, 2013a; Zwick, 2023). While a strength-based approach does not necessarily entail a rejection of standardized evaluations—indeed, standardized assessments in their unrealized idealistic form should serve important equalizing functions (Every Student Succeeds Act, 2015; Thomas et al., 2023; Zelazo et al., 2013)—it does require a complete reconceptualization of what researchers, practitioners, and policymakers mean by "standard" (see also Au, 2015), per below.

As previously mentioned, a strength-based approach recognizes that scientific and educational systems have historically been built by and for people from systemically privileged backgrounds, including higher-SES people. As such, they tend to evaluate children based on skills and ways of being that are generally more common among children from higher-SES homes while devaluing strengths that are often associated with children's experiences coming from lower-SES homes (Dudley-Marling, 2007; Phillips et al., 2020; Stephens, Fryberg, et al., 2012; Stephens, Townsend, et al., 2012; Stephens and Townsend, 2015). Strength-based approaches resist these traditional practices in favor of those that support and celebrate a broader range of skills, cultures, knowledge, and perspectives as an important part of children's success and contributions to society broadly. Elucidating the potentially unique forms of creativity, problem-solving, and learning strategies—emphasizing the processes and contexts by which such cognition is activated—is a core goal of a strength-based approach.

In a research setting, highlighting children's unique skills requires creating more equitable conditions that allow children's unique cognitive expertise to manifest. Some tasks can be altered by providing a better ecological "match" between children's lived experience and experimental setting. For example, children from higher-SES backgrounds might be more familiar with abstract content (like a picture of a square or triangle), due to cultural values around labeling and test-like games in the home. A recent study found that low-to-middle-income preschoolers in Mombasa County, Kenya demonstrated greater vocabulary knowledge when assessed by labeling familiar objects in their physical form than in pictures, whereas children in high-income U.S. contexts performed similarly across both modalities (Zhu et al., 2023). Another study demonstrated that tasks involving real-world content (e.g., swapping out abstract shapes with pictures of money, an angry face, or a school bus) can, in some conditions, "level the playing field" for adversity-exposed youth (Young et al., 2022). Like previous research (e.g., Farah, 2017; Hanson et al., 2011; Ursache and Noble, 2016), this study shows that youth exposed to violence and poverty score lower on average than their peers on a working memory test involving abstract content (pictures of a triangle, square, or circle), but their performance improves when tested with real-world content, nearly closing the performance gap (Young et al., 2022). Similar examples have been found for accuracy on socioemotional versus non-socioemotional relational memory (Rifkin-Graboi et al., 2021) and reasoning tasks with three-dimensional versus two-dimensional stimuli (Zuilkowski et al., 2016). Indeed, some programs targeting gifted students from low-income backgrounds show promise from using concrete learning materials (VanTassel-Baska, 2018). Assessing children in more familiar settings like their home, school, or local community center may also promote enhanced cognitive performance by removing the confound of anticipatory stress or discomfort associated with an unfamiliar lab environment (Boykin and Bailey, 2000; Rouland et al., 2014). Collection of neural, physiological, and biological responses to cognitive tests across various ecological settings is another promising avenue to better understand how cognitive skills manifest across levels of analysis (Stangl et al., 2023; Pietto et al., 2023).

Mounting evidence supports the importance of considering the specific kinds of content, test settings, and modalities being used in cognitive tests, pointing to the need for careful evaluation for when changes to align with lived experiences are or are not helpful to improve assessment validity for children exposed to poverty. Importantly, it is not always the case that more ecologically valid content is better for lower-SES youth. For example, lower-SES youth have been found to score lower on math items in standardized tests about money, food, and social relationships—items thought to be particularly relevant to their lived experience—compared with other types of math items (Duquennois, 2022; Muskens et al., 2024). Moreover, this effect "spills over'' to subsequent items on a test, suggesting these contents evoke negative associations, causing distraction (Duquennois, 2022). Yet, other studies with children growing up in low-resource environments in Brazil and India showed improved performance on arithmetic when situated within market transactions (Banerjee et al., 2017; Nunes et al., 1993). Competing findings like these highlight the importance of carefully evaluating the specific testing conditions that afford or prevent opportunities for optimal performance among youth growing up in poverty. Providing youth with equitable opportunities to perform their best supports a more comprehensive understanding of neurocognitive development that affords greater progress for both science and policy (Lipina, 2022).

3. Maximizing insights for educational and social policy

How does a strength-based developmental cognitive neuroscience of child poverty inform policy? Here we consider several U.S.-based educational and social policies—both existing and not yet realized—that serve as one case study to reflect the core tenets we described above. Our policy discussion is intentionally limited to social and educational policy in U.S. contexts to narrow our scope, but many examples provided extend or can be adapted to health policy and non-U.S. contexts. We begin each subsection highlighting how deficit-focused narratives foster avoidable harms and missed opportunities. We subsequently describe how each core tenet of a strength-based approach cultivates an alternative narrative and framework for which to seize new opportunities that may maximize real-world benefits (Table 1). While most of these applications do not yet make direct contact with the literature on brain development, we highlight policies here that might compliment what we know about brain development from a strength-based lens. By providing descriptive examples, we hope that policymakers, prevention scientists, and program evaluators alike will be motivated to use strength-based principles to design, implement, and evaluate new and re-imagined policies and practices.

3.1. Educational policy

While many psychologists and policymakers have focused on ways to redress educational inequities, persistent disparities make it clear that current approaches are not sufficient. There is considerable evidence that SES-based disparities in key educational outcomes (e.g., grades, graduate rates) are not only important in and of themselves, but also contribute to disparities in mental and physical health, financial success, and other important societal outcomes (Baum et al., 2013; Ridley et al., 2020; Zajacova and Lawrence, 2018). These SES-disparities have persisted or even intensified in recent years (Jackson and Holzman, 2020; Reardon, 2013b), despite many intervention approaches focused on targeting children from lower-SES families through "light touch" interventions (Lewis Jr, 2019). We suggest that this may be in part because

Table 1
Overview of strength-based goals and potential approaches to maximize real-world benefits through educational and social policy. Notably, the approaches and examples outlined below are limited to policies in the United States and are presented as one case study that could be extended and adapted for application in other countries. We urge explicit consideration of the broader context before adapting these approaches outside of the United States.

Educational Policy		Social policy	
Strength-based goal	**Potential approach**	**Strength-based goal**	**Potential approach**
Target educational systems while leveraging learning variability	Provide schoola and teachers tools to cultivate "humanizing" classrooms that recognize and reward a broad range of strengths, including those that students from low-SES backgrounds offer	Provide space for variation in decision-making and aspirations, focusing on agency rather than micromanagement	Cash transfers that acknowledge diverse needs and trusts that caregivers know how to provide for their children
	Increase accessibility to high quality early education programs		Long term investments in children (e.g., Baby Bonds) that target systtemic wealth inequities and provide opportunities that capitalize on children's potential
Capitalize on positive cultural experiences in the classroom	Embrace broader ways of knowing by integrating more interdependent, culturally-affirming activities in the classroom	Leverage experience and skill that arose out of resistance to inequality and adversity	Fix challenges (e.g., housing instability) without presenting a new one (e.g., loss of childcare and cultural traditions from splitting up extended families)
			Co-create policy with youth via apprenticeships
Diversify educational materials to promote opportunities for equitable academic performance	Translate familiar and salient cues into the learning process	Ensure governmental systems are inclusive and accessible	Create online registration platforms that are more straightforward to generate automatic registration based on reported income

the majority of interventions have been focused at the level of individual deficits—targeted toward "fixing" of children from lower-SES backgrounds—with less attention to the broader contexts within which children operate or the skills they bring to the table. Below, we provide several promising alternative, holistic approaches that are more in line with a strength-based lens.

3.1.1. *Targeting educational systems while leveraging learning variability*

Drawing upon the guiding principle that children develop skills adapted to their context (tenet #2), we argue that intervening at the level of the context may be most beneficial for children. Importantly, these solutions start from the empirically supported assumption that students from lower-SES backgrounds are just as invested in their academic success as students from higher-SES backgrounds (e.g., Oyserman et al., 2011). As such, rather than focusing on how individual students should change, strength-based solutions encourage a focus on how the policies and practices surrounding students can be reimagined to ensure that students from lower-SES backgrounds are afforded the opportunities that they need to translate their academic investment into productive academic outcomes (Silverman et al., 2023; Zengilowski et al., 2023). These solutions are grounded in rich theoretical traditions focused on creating *humanizing* classrooms that recognize and reward the broad range of strengths that students from lower-SES backgrounds bring to their education (see del Carmen Salazar, 2013; Paris, 2012; Valencia, 2010).

Adopting a strength-based lens highlights the need for solutions that focus on larger, systemic factors that give rise to educational inequity, including important biases embedded across schools' policies and practices (e.g., Autin et al., 2019; Doyle et al., 2023; Goudeau et al., 2023, 2024; Stephens et al., 2014, see also Destin, 2020). Critically, such biases influence children's own biases of themselves, as one recent qualitative study noted (Heberle et al., 2018). In this study, children (ages 6–9 years old) from low-income homes overwhelmingly reported (67 %) the belief that children in poverty were less academically competent than their more affluent peers. At the same time, 50 % of these children also indicated that children in poverty may be more motivated than non-poor peers, as they worked toward a better future (Heberle et al., 2018). Such inherent motivations may serve as a powerful source of strength that can be bolstered by educational systems, while also working against negative stereotypes children may have about intellectual incompetence.

One important way the educational context can be changed is to equip teachers and schools with the tools to recognize and build from the unique strengths children from lower-SES backgrounds may bring to their education. For example, most kindergarten standards begin with a heavy emphasis on vocabulary—an area in which socioeconomic disparities upon school entry are perhaps most stark (Byrnes et al., 2019), and a number of studies have documented socioeconomic differences in language-related brain regions (e.g., Merz et al., 2019). These could lead to early consequences such as students from lower-SES backgrounds already feeling not "smart," or being perceived as behind by their teachers. Importantly, vocabulary is best learned in context. Therefore, if schools were to begin curricula with instruction more reliant on other sorts of skills in which children across contexts may be more matched, it might provide time and space for children to develop strong vocabularies. For example, it may be possible to promote diverse vocabulary use through collaborative learning opportunities where success is inclusive and achieved through participation rather than scores. As we discuss below, students from lower-SES households bring important cultural strengths, and skills for more collaborative learning that can be incorporated into the classroom.

Equally if not more important than adjusting curricula is to make early educational programs accessible to all children. These programs have shown clear positive effects for children and their families. For example, one study made use of the fact that different counties in North Carolina had different levels of funding dedicated to preschool. Using a natural experiment design, they showed that children who were exposed to a better funded preschool had better outcomes at the end of elementary school. Importantly, these effects were true for all children, but particularly pronounced for those from the most disadvantaged backgrounds (Watts et al., 2023). This and many other studies on programs such as Head Start, an American federal program that promotes the school readiness of children from lower-income background illustrate the clear imperative of making early education accessible (Nores and Barnett, 2014).

3.1.2. *Capitalizing on positive cultural experiences in the classroom*

Drawing upon the strength-based principle that children in poverty have a wide range of potentially rich experiences (tenet #1), accumulating evidence suggests that culturally-relevant experiences can be

leveraged to promote thriving in the classroom. Teachers' views of students are an important part of children's academic contexts, and even predict children's learning above and beyond their skill level (Sorhagen, 2013). Given this, intervening at the level of teachers' beliefs may be useful. For example, some studies have focused on guiding teachers to effectively engage with the identities, experiences, and strengths of students from lower-SES backgrounds (Gray, 2018; Matthews et al., 2021). Doing so not only supports positive teacher-student relationships (Walton et al., 2021), but has also been shown to directly support the well-being, self-efficacy, and persistence of students from lower-SES backgrounds (Silverman et al., 2023).

Additional research points to the value of including a broader range of norms in the classroom context. Classroom-based research with Black children has shown that embracing Afrocultural styles (e.g., a sense of social connectedness that goes beyond the individual, an emphasis on emotional expression, an understanding of the interconnectedness of movement), can sometimes lead to improved academic engagement (Boykin and Bailey, 2000; Okagaki, 2001; Rouland et al., 2014). Similarly, classrooms with dual-language learners who incorporate concepts, cultural and indigenous knowledge, and skills from students' heritage language have been shown to enhance reading comprehension (Cummins et al., 2005; Aguilar et al., 2020; Hare, 2012). Across ethnic-racial groups, children from lower-SES backgrounds may be particularly skilled at collaborative learning (e.g., taking more turns), which may support better outcomes for their peers during group work (Dittmann et al., 2020). This shift toward interdependent, culturally-affirming activities in educational institutions can improve the fit and performance of students from lower-SES contexts without impeding those from higher-SES backgrounds, who perform similarly individually or together (Dittmann et al., 2020). Whether these educational practices show changes to brain or neurocognitive development remains a pressing empirical question.

3.1.3. *Diversifying educational materials to promote opportunities for learning and equitable academic performance*

Beyond the social landscape of the classroom, educational materials can also be created in alignment with the strength-based principle that children tend to perform best when materials are relevant to their experiences (tenet #3). There is great potential for enhanced cognitive performance in settings that translate familiar and salient cues into the learning process (Mittal et al., 2015; Young et al., 2018). Yet, this is not always reflected in the materials that children from lower-SES backgrounds regularly engage with. One study found that half of young children's books published in 2015 were of non-human characters and only half of those remaining had characters from racially diverse backgrounds (Wright and Counsell, 2018). A lack of racially and culturally diverse protagonists and narratives in books can contribute to under-represented students' struggle and disengagement in reading; conversely, engagement increases when culturally relevant texts are paired with prompts and discussion that encourage a sense of belonging and critical thinking grounded in students' lived experience (Meier, 2019; Wood and Jocius, 2013).

There are also potentially exciting opportunities to customize educational curricula from generative AI. For example, creators of the Khan Academy recently rolled out an experimental chatbot that simulates one-on-one human tutoring, providing children with access to greater scaffolding and personalized learning support than they might otherwise receive in large classroom settings (Pedro et al., 2019; Singer, 2023). Education initiatives to leverage intelligent tutoring systems (ITS) in low-resource communities have shown tentative promise: In one study, Brazilian students from low-SES communities improved their math and reading skills with an ITS, but incorporating adaptive learning technology promoted both effective (e.g., generate specific content matched to learners) and ineffective (e.g., use ITS as replacement for teacher support) pedagogical practices (Joaquim et al., 2022). However, AI technologies also often replicate and deepen inequities, because they have been trained on inequitable systems (Guillory, 2020). Thus, these technologies need to be carefully and continually vetted and used in combination with best practices within school support structures.

Taken together, creating more equalizing educational curriculum involves incorporating more cooperation, project-based activities following real-world scenarios, opportunities for spontaneous and open-ended responses, and materials and support structures reflecting diverse backgrounds (Albritton et al., 2023; Wright and Counsell, 2018).

3.2. *Social policy*

Emerging from the aftershocks of the Great Depression, the U.S. social safety net has become a cornerstone of modern governance. It has adapted over the decades to support children and families in poverty, and comprises services like childcare, healthcare, food and housing assistance, and unemployment benefits. Many of these programs have demonstrated strong poverty-reducing effects for children (Hoynes and Schanzenbach, 2018). However, these existing programs may carry implicit or explicit stigma that further fuels deficit narratives, often combined with demoralizing constraints that dismiss families' agency. For example, the Temporary Assistance for Needy Families, formerly known as welfare, provides financial support to low-income families with children. However, it has strict work requirements that are often challenging for caregivers to meet despite intensive efforts, limited benefit durations, inconsistent state-by-state policies, bureaucratic obstacles, and has been criticized for marginalizing the very families it aims to assist and often rendering the most vulnerable ineligible (Hoynes and Schanzenbach, 2018; Lens, 2002; Monnat, 2010; Ray, 2019). The program's emphasis on immediate employment over education, along with its punitive sanctions, can implicitly stigmatize recipients, painting them as perpetually dependent or unwilling to work. Furthermore, by not equipping families with long-term skills or sufficient safety nets, the program can inadvertently reduce their agency and aspirations for their futures (Lennon et al., 2001; Lens, 2002). Here, we point toward new initiatives and opportunities that take a strength-based approach, to move us away from deficit-focused policy.

3.2.1. *Providing space for variation in decision-making and aspirations: A focus on agency rather than micromanagement*

A strength-based social policy provides space for variation in the ways children and families move about their world (tenet #1). This requires proper acknowledgement of their diverse experiences and needs, and the trust that in most cases, caregivers know how to provide for their children if given the resources and dignity to do so. A prime example of this comes from cash transfer studies like the Baby's First Years (Noble, Magnuson, et al., 2021), which is the first U.S. randomized controlled trial providing unconditional monthly cash payments (ranging from $20 - $300) to mothers with low incomes. Emerging findings from this study suggest that the majority of mothers used the cash to cover basic necessities and child-directed enrichment activities, bringing greater financial and psychological security (Gennetian et al., 2022; Rojas et al., 2020). This has the potential to affect children's neural development (Troller-Renfree et al., 2022), though more conclusive evidence—coupled with a clear understanding of what this might mean for children at the behavioral level in various contexts—is needed.

Similar social policies have shown recent promise. For example, beginning in 2020, the COVID-19 stimulus checks and expanded child tax credit nearly cut child poverty rates in half—further illustrating the utility of providing families' agency in their caregiving decisions through increased financial freedom. In another recently proposed, though yet realized, social policy that affords agency among children themselves, called "Baby Bonds," children born into poverty would be given a bond up to $50,000 that they can access at age 18. Proposed by academic scholar Dr. Darrick Hamilton, this program aims to ameliorate generational wealth inequalities while offering a mechanism by which youth can invest in their future education or pursue a business venture

(Klein, 2023). This policy is ingenious in its balance of targeting systemic-level forces (e.g., wealth inequalities) with targeting individual opportunities that capitalize and foster the unique strengths and expertise of children growing up in poverty. Emerging evidence suggests that in states with more generous cash support for low-income families, SES disparities in neural development are reduced, pointing to the interplay between policy and brain development (Weissman et al., 2023).

Despite the promise and empirical support for the benefits of cash transfer policies, there is not uniform political support. As a result, most of these programs are temporary, stifling their full potential, in the absence of being written into formal legislation. Some critiques of cash transfers argue that caregivers receiving assistance would be less inclined to work; however, the evidence does not support this claim (Baird et al., 2018). In addition, while most studies of unconditional cash transfers show positive effects in international contexts, a randomized trial among adults in poverty in the United States receiving a one-time cash transfer of $0, $500, or $2000 found no positive effects of cash (Jaroszewicz et al., 2022). These effects of receiving a cash transfer were null or even negative across a range of outcomes, including related to health, cognitive performance, and psychological and financial well-being. Follow-up experiments suggested that this may have been due to the transfer not being sufficient to meet individuals' needs or alleviate significant barriers (e.g., second job), particularly given community expectations that money be shared across one's network; in other words, it highlighted for recipients what they still lacked (Goldrick-Rab, 2016; Jaroszewicz et al., 2022). Clearly, a one-time cash transfer in this context was insufficient to allay the many interconnected constraints imposed by structural inequality. Thus, a strength-based approach requires not only a recognition of individuals' agency, but an understanding of the larger contexts within which they operate. It is possible that extending benefits to an entire network of people—not just one individual embedded within a larger community—might have more sustained positive effects.

Taken together, these cash transfer programs hold the potential to be so successful because they couple a grounding in developmental science with a humanistic approach that gives families the agency to build from their own strengths. For example, the Baby's First Years provides support during a sensitive period of early brain development, the Baby Bonds provides support during a developmental period of increasing independence, and the COVID-19 initiated programs provide some financial stability during a period of increasing economic volatility. The timing of these treatments in combination with an appreciation for heterogeneity in families' needs creates more opportunities for children to thrive.

3.2.2. *Leveraging experiences and skills that arose out of resistance to inequality and adversity*

In addition to flexible cash transfer programs, more targeted social programs and policies that address specific needs can also operate within a strength-based framework. Drawing upon the guiding principle that some types of experiences may confer skills in addition to risk (tenet #2), social policies can both minimize a challenge while maximizing the unique cultural capital that arises from such a challenge.

Some existing social policies are weakened because they target a challenge without taking into account the context-specific strengths it affords. For example, consider again the challenges of crowding in the home. Living with extended family, or even rooming with non-related families, is often (though not always) driven by a lack of resources to afford rent. Thus, creating affordable housing is an obvious solution. Current housing programs like the Housing Choice Voucher (Section 8) program allow recipients to obtain housing from the private market in order to promote economically-mixed neighborhoods and provide residential mobility (United States House, 2003). While these have merit, they do not provide a means of capitalizing on the strong social resources that many families have established from living among extended family members. In other words, while a nuclear family may get into Section 8, it is not guaranteed that their extended family members—who perhaps they have come to rely on for childcare and other help—would get approved to live near or in the same complex, nor is it guaranteed they would remain in reasonable distance from the Section 8 housing (Teater, 2011). Thus, families are left with one challenge "fixed" (i.e., housing) while a new challenge presents itself (e.g., loss of childcare, loss of opportunities for cultural and familial rituals).

Identifying and reinforcing sources of strength among children from lower-SES backgrounds and families holds the potential to create more sustainable and beneficial programs and policies. Importantly, policymakers may not be best positioned to identify these strengths, often due to a lack of lived experience. As such, we recommend policymakers capitalize on family and youth's already existing sociopolitical motivations and strategic insights (Bang et al., 2016; Diemer, 2020) to create apprenticeships that include them in the lobbying and policymaking process itself.

3.2.3. *Creating governmental administrative systems that are inclusive and accessible*

To ensure the success of any existing or future strength-based social policy, sufficient infrastructure that enhances accessibility is critical. Just as children perform their best when given equitable access to opportunities (tenet #3), so too are their caregivers who must navigate governmental systems that are not often set up equitably. Securing governmental aid is burdensome, complicated, and requires technological or other resources that not all caregivers have access to. For example, only a quarter of families who qualify for the program Temporary Assistance for Needy Families apply for it (Desmond, 2023). In certain situations, families don't qualify for governmental assistance because one or more members lack legal immigration status. For many assistance programs, the legal standing of the caregivers is the determining factor for eligibility, rather than the needs of their children (Broder and Blazer, 2011; Martinez et al., 2015). We suggest policymakers rethink these outdated and bureaucratic systems and create online registration platforms that are more inclusive and straightforward; or better yet, generate automatic registration for a family whose reported income falls below a certain threshold. Informational outreach and registration for such programs can also be offered in local spaces that communities gather or frequently attend (e.g., church, school, parks, hospitals, grocery stores).

3.3. *Extensions to health policy and policies outside of the U.S. context*

While our scope is limited to educational and social policy, there are several possible extensions of a strength-based approach to enhance health policy. These involve incorporating possible strengths into public messaging, and shifting toward solutions that focus on systems rather than individuals. For example, last year, California launched a health campaign to raise awareness of Adverse Childhood Experiences (ACEs; Murphy et al., 2014) that contribute to "toxic stress" in young children. The campaign further emphasizes "actionable strategies for parents and caregivers to create safe, stable, nurturing relationships and environments" (First 5 California, 2023 pg. 1). Augmenting this initiative with a strength-based approach could involve not only a focus on ACEs but also positive experiences (and aspects of cultural wealth) and potential neurodevelopmental adaptations that emerge in response to such experiences. Similarly, instead of solely concentrating on what caregivers can do, it could pivot towards systemic solutions addressing the origins of stress that caregivers and their children are forced to endure. Concurrently, the national conversation about toxic stress has propelled the integration of ACEs screening in primary healthcare settings (Yaun et al., 2022). The utility of the types of interventions such screening prompts could be enhanced by incorporating other measures like the Benevolent Childhood Experiences questionnaire (BCEs; Narayan et al., 2023). The BCEs would offer practitioners a more nuanced overview of

existing strengths that can be leveraged when removing the presence of adversity is not possible.

There are numerous existing and evolving health policy initiatives that reflect the strength-based aims of capitalizing on families' cultural wealth and targeting systems rather than individuals. For instance, Stanford's Center on Early Childhood is forging partnerships with educators, health professionals, and pediatric clinics to develop integrated systems and programs that meet the cultural and contextual needs of children living in low-income communities (Lombardi, 2024). Community gardens in urban areas are another promising public health initiative, as these allow residents to access fresh produce and connect with neighbors on their own terms, and may improve psychosocial and health outcomes (Hume et al., 2022). Taken together, adopting a strength-based approach to health policy promotes a more balanced view that recognizes *both* the substantial stressors of poverty as well as families' agency and adaptive strengths that can bolster health and thriving.

Additionally, although we focus our policy applications to the U.S. context, we recognize that the U.S. is not representative of the global landscape. In addition to differences in sociodemographics and the meaning of sociocultural strengths, the education system and social safety net vary between countries and thus require bespoke solutions. Still, several extensions laid out above can be adapted or re-imagined for other countries from the Global North, as well as those from the Global South. For example, in countries like Japan, where children face academic pressure from family and teachers—which may disproportionately impact children from lower-SES homes—an educational curriculum that celebrates cultural capital and supports non-academic career prospects may be helpful (Tsuneyoshi, 2004). In nations with fewer economic resources, implementing strength-based policy requires innovative and adaptive strategies such as leveraging community-based resources, incorporating technology to reach remote areas, and collaborating with international organizations to access additional support. For example, Ekal Vidyalaya is an Indian non-profit organization that sets up one-teacher schools in remote rural areas. Through local volunteers and community involvement, the program provides basic education with an emphasis on indigenous languages and cultural knowledge while also leveraging new technologies (Ekal Vidyalaya, n.d.). Other countries in the Global South also have programs that have achieved success in this regard (e.g., IkamvaYouth in South Africa), which have collectively improved educational access and outcomes for marginalized communities (IkamvaYouth, n.d.). Across all global contexts, additional cash transfer studies are needed despite different regulations that may prevent the use of a control group. We hope to see greater discourse on the ways strength-based policies can be extended to various cultural contexts across the globe.

4. Potential pitfalls & ethical considerations for adopting a strength-based approach

While strength-based approaches to science and policy may appear straightforward in theory, in practice, they require careful thought to apply effectively. Researchers and policymakers must critically navigate several important pitfalls, abuses, and misconceptions as they look to incorporate these approaches to help create more equitable societies.

4.1. Pitfall: Acknowledging strengths excuses the harms of poverty and thus fuels the status quo

A recognition of the strengths that children may develop as a factor of their lower-SES upbringing does not entail an ignorance to the very real barriers and inequalities that children and families from lower-SES backgrounds often face. Strength-based policy needs to deliberately balance the need to reject common deficit-based notions about children from lower-SES backgrounds with the need to not ignore the very real material and psychological challenges that these children and their families may confront (e.g., diminished access to quality and affordable healthcare, inequitable financial opportunities, housing insecurity; Cutts et al., 2011; McMaughan et al., 2020). In this way, strength-based approaches should not be treated as a cure-all. Rather, they call on policy that not only recognizes these challenges but acknowledges that they are imposed on children and families, rather than being an immutable part of society or the people themselves (Chater and Loewenstein, 2023). While strength-based approaches may help mitigate imposed challenges, creating more just societies requires a reorientation to how children growing up in poverty are commonly viewed *and* a broader dismantling of the unjust structures that create inequitable opportunities.

A related risk of these approaches is that they can inadvertently glorify marginalization and oppression (see Silverman et al., 2023). When strength-based approaches solely focus on the skills and knowledge that children gain as a factor of the challenges imposed on them, they may inadvertently justify these challenges. Once again, strength-based policy should strike a balance to emphasize children's strengths while simultaneously acknowledging and addressing the oppressive structures that children and families in poverty are often forced to navigate. Further, policy should go beyond a focus on the typical strengths that people often associate with growing up in the context of poverty (e.g., resilience, resourcefulness), to attend to and support the skills and knowledge that children gain from their unique experiences outside of the challenges that they may face (e.g., cognitive strategies, social skills, cultural capital).

4.2. Misconception: Focusing, recognizing, or affirming strengths of children in poverty can negatively impact, or discount the strengths of affluent peers

Some opponents of strength-based perspectives posit that highlighting the strengths of children from low-income homes can discount the strengths of more affluent peers. However, a strength-based approach does not suggest that we no longer affirm mainstream strengths, such as good grades, but rather that we also affirm the talents of children from lower-SES families that are often unacknowledged. This is not an either-or situation, but rather an inclusive approach. Strengths, like all aspects of development, are context-specific. Affirming strengths adapted to contexts of adversity, such as the ability to leverage fleeting rewards in unpredictable situations, can provide understanding and support in a similar way as affirming delayed gratification in safe and stable contexts (Kidd et al., 2013; Mittal et al., 2015; Watts et al., 2018). As mentioned in tenet #3, children learn better when new content is scaffolded on their prior knowledge and skills, and empirical work tends to support this (Fyfe et al., 2014). If these contextual factors are not integrated into educational contexts, it may inadvertently widen the opportunity gap for children from low-SES homes to learn and perform at their best.

A related misconception is that by focusing attention and resources on fostering the strengths of children in poverty, more affluent children will be left behind (or on the extreme end, inadvertently harmed). However, there is little empirical evidence to support this idea. In fact, interventions that involve mixing children from high- and low-SES backgrounds, such as private school contexts or mixed housing, show only potential positive benefits for children from higher-SES households (Schechter and Bye, 2007; for a review see Slicker and Hustedt, 2020). Importantly, criticism of socioeconomic desegregation argues that efforts like mixed-income classrooms can unintentionally harm lower-SES students' academic performance and well-being when implemented *without* acknowledging their strengths and social value (Crosnoe, 2009; Odgers et al., 2015). By centering the needs of affluent children, as has historically been the case, we risk marginalizing children from lower-SES backgrounds in both the literature and our interpretations of their abilities (Ellwood-Lowe et al., 2016; Miller-Cotto et al., 2022). By acknowledging and affirming children's strengths within their specific

contexts, we can work towards providing equal opportunities for all children, regardless of socioeconomic status.

4.3. Misconception: The skills that children in poverty develop are not "as good" as the ones that develop in affluent contexts because contexts of poverty are inherently worse

A final misconception we consider is that the unique expertise or neurocognitive skills that children develop in the context of poverty are not as "good" or "useful" as the ones that develop in affluent contexts. The reasoning here may stem from the mistaken belief that most experiences in poverty are forms of adversity and thus the skills developed in response to such negative experiences must be bad or abnormal. Yet, at least evolutionarily speaking, it is not far beyond the norm to live in low-resource or high-stress environments (Frankenhuis and Amir, 2022). For centuries, our ancestors have navigated a wide range of circumstances, including harsh terrains and extreme weather, intragroup violence and warfare, and food shortages. Humans have evolved to respond to such conditions, leading to the development of contextually-adaptive responses. Furthermore, the development of strengths in the context of poverty not only arises in the face of hardship. There is vast heterogeneity in poverty-related experiences (Amso and Lynn, 2017), as discussed in tenet #1 above, some of which are shared across the socioeconomic gradient. Indeed, prior work has shown that children's

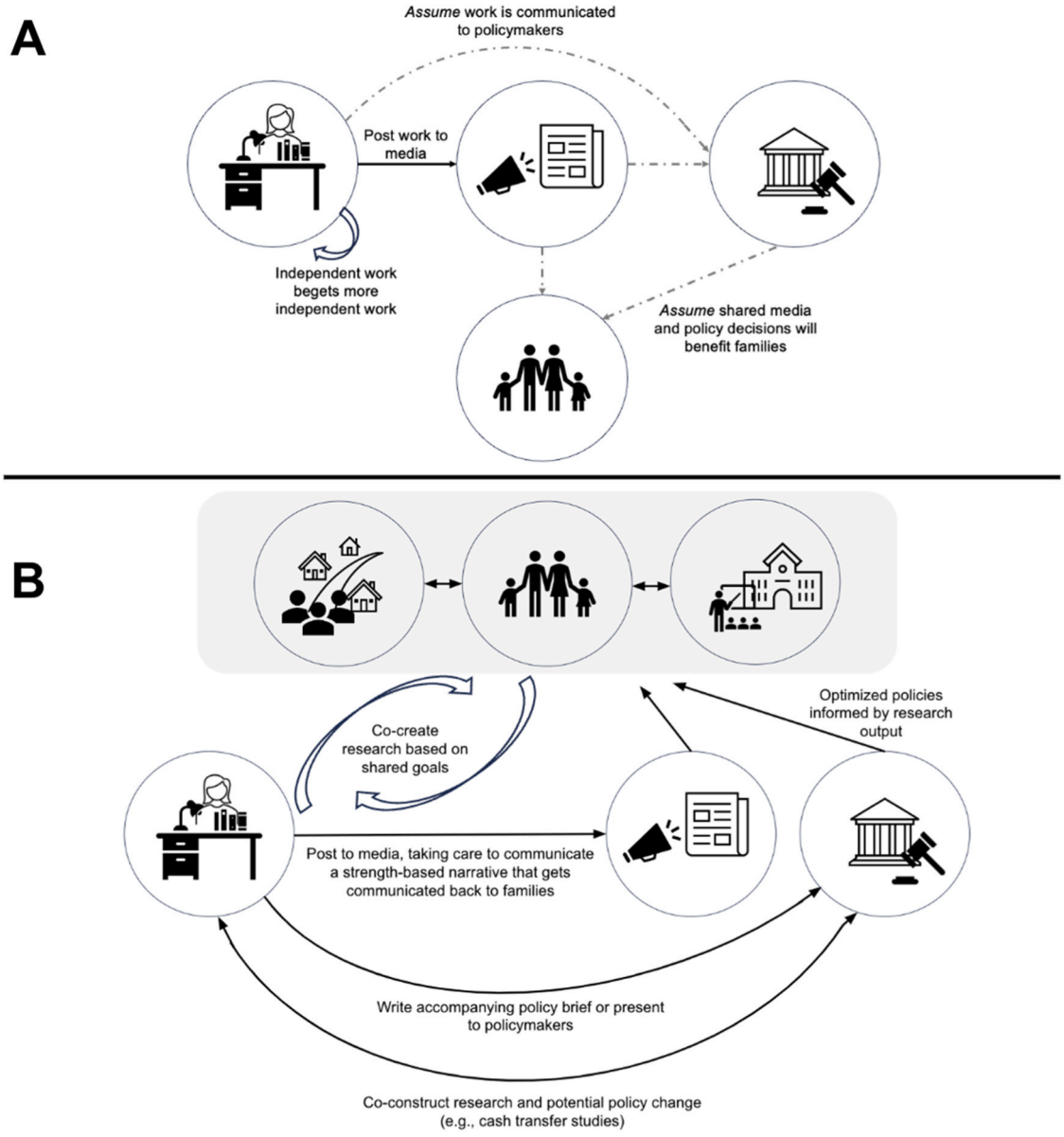

Fig. 2. Research to policy pipeline. **Panel A** depicts the typical way in which research on child poverty is conducted. Here, researchers work independently and with one another. Their work is then potentially shared on social media or picked up by media outlets. It is assumed that this research is subsequently communicated to policymakers through media or through academic papers. It is also often assumed that shared media and policy decisions will benefit children and families. **Panel B** depicts an alternative "ideal" research to policy pipeline that aligns with a strength-based approach. Here, researchers work in close collaboration with children and families, community stakeholders, and schools and teachers to inform and generate meaningful research together–based on shared goals. Similar to panel A, this work is shared on social media and potentially picked up by media outlets, at which point researchers play a pivotal role in controlling the narrative toward one that is strength-based, as such messages are likely communicated back to children and communities. Researchers may also write an accompanying policy brief to ensure that this research is directly communicated to policymakers, which then gives rise to optimized policies that remove systematic barriers and foster children's strengths. Researchers and policymakers may also co-construct and coordinate research agendas and potential policy changes, such as cash transfer studies that can translate to policy at scale.

perceived social support is nearly identical between children from low- and high-SES households, underscoring the ways families in poverty provide a loving and supportive environment despite grappling with stressors that come along with economic hardship (DeJoseph et al., 2021, 2022).

In a world characterized by environmental complexity and human variation, there can be no single "optimal" brain or "optimal" neurodevelopmental trajectory of cognition. There are only contextually sensitive developmental strategies that do or do not also come with costs and trade-offs. Using the neurodevelopment of children in affluent contexts as the norm and assuming any deviation from that is "worse" reinforces a deficit-based strategy to "fix" children in lower-SES contexts to be more like children in affluent ones. At worst, this risks resulting in harming children growing up in poverty by potentially minimizing an ability or neural adaptation that supports survival in their current environment. Careful consideration for their day-to-day challenges and constraints is key to understanding the form and function of their observed neurodevelopment and behavior. A better question is how such manifestations came to be in the first place. As Caldwell et al. (2006) note: "Adolescents might perceive longer, safer lives ahead if people in their neighborhood actually appeared to be living long and safe lives; if families provided an atmosphere of security and hope; and if adolescents felt empowered to realize their dreams and aspirations, rather than feeling as though they were at the mercy of hostile forces beyond their control" (p. 600).

5. Practical suggestions & future directions

We next turn our attention toward offering practical suggestions for building an authentic strength-based narrative and research agenda that can be harnessed in positive ways to promote children's ability to thrive. Specifically, we offer a research to policy pipeline (Fig. 2) that is built upon mutual trust and collaboration across scholars, policymakers, media, and most importantly the community of children and families we aim to serve. We appreciate that such a pipeline takes time and often a non-trivial amount of resources, and that more university support for these endeavors is needed (Gándara and Kim, 2022). A thorough discussion of the complexities surrounding community-engaged work is beyond the scope of the current article (for more see Bassok et al., 2021; Mikesell et al., 2013; Randolph et al., 2022; Wallerstein et al., 2020). In the section that follows, we highlight a few paths forward.

5.1. Cultivating cross-sector connections

Authentic efforts to bridge our science with policy involve cultivating connections between scholars, community members, schools, and legislatures. These connections should be nurtured through trust and recognition of shared humanity and the collective goal of improving the lives of children growing up in poverty. In part due to the immense academic pressures to produce publications, researchers will often work independently and with one another, with the assumption or hope that their work will reach larger audiences such as policymakers. Ideally, researchers work in close collaboration with children and families, community stakeholders, and teachers with the goal of *co-creating* knowledge that is accessible and trusted by the community (Fig. 2). In doing so, it is important that researchers strive to de-center the dominant voice of academia and recognize that diverse ways of knowing will lead to better outcomes for research, policy, and community/family/child well-being (Mikesell et al., 2013; Randolph et al., 2022).

Establishing a meaningful research-practice partnership (RPP) requires sustained collaboration, commitment, and mutual decision-making (for a more thorough discussion of RPPs, see Bassok et al., 2021; Emery et al., in press). It also takes substantial time and funding. To support the extensive efforts involved in RPPs, federal funding initiatives can play an important role in implementing grants to support community-based partnerships. While there has been increased calls from the academic community (e.g., La Scala et al., 2023) for such support among diverse neuroscientists at the forefront of such initiative, this work is costly and not highly rewarded by the academic system (Gándara and Kim, 2022; Weiland et al., 2021). This places an undue burden on early career academics and trainees from marginalized backgrounds, who may be interested and/or implicitly pushed to do this kind of work (Jimenez et al., 2019; DeJoseph and Carosella, 2023).

Emerging initiatives point to potential solutions to support these scholars. Two exemplary, albeit resource-intensive, RPPs in developmental cognitive neuroscience come from the Adolescent Brain and Cognitive Development (ABCD) consortium and University of Minnesota's Masonic Institute for the Developing Brain (MIDB). In the ABCD, there are several working groups of investigators, staff, and community stakeholders that work towards several justice, equity, diversity, and inclusion goals. This includes developing procedures that promote innovation and creativity produced by historically marginalized groups, ensuring the use of sociocultural-appropriate measurement practices, and overseeing ethical dissemination of research to prevent stigmatization (Auchter et al., 2018). At the MIDB, a Community Engagement and Education Core was developed to cultivate reciprocal community connections and infrastructure to foster bidirectional benefits (Randolph et al., 2022). This entailed extensive time listening to community members and centering their research priorities to better identify opportunities for community service and public policy. Critically, both the ABCD and MIDB have large grant funding that make their community-engaged efforts possible. Similar consortia exist or are currently being created in other countries as well (see Simmons et al., 2021), providing ample opportunity to intersect with diverse policy-making cultures. Such efforts fortunately have downstream benefits to scholars who might not have the time or resources to begin an RPP from scratch.

5.2. Use of large-scale data

Increasing accessibility of large, open access neurodevelopmental datasets provide unprecedented opportunity—but also risks—for a strength-based developmental cognitive neuroscience. On the one hand, these studies afford scholars the ease and control of using a large-scale, more representative sample. This has numerous benefits. For example, it allows researchers to use innovative methods to test effects of policy, as described below. It also renders null findings more interpretable, as researchers more likely have adequate power to detect a true effect. Null findings are important for a strength-based approach, as they help to highlight not just potential strengths and challenges related to children's socioeconomic upbringings, but also a *lack* of difference. Finally, open access datasets are likely to contribute to more equitable opportunities indirectly. Due to funding inequities, students from disadvantaged institutions and countries have often had less access to these sorts of rich data, curtailing their academic opportunities and making it much more challenging for them to reach senior positions where they could influence change. Greater data access is one step toward mitigating this issue, thus increasing representation at higher levels, with the potential to shift the narrative as these scholars' voices are more readily heard. On the other hand, open access comes with risk: there is potential to misuse such large data, and the ABCD consortium works diligently to respond to and correct potential cases of misuse (Auchter et al., 2018; Cardenas-Iniguez et al., 2023).

Due to their more representative nature, large-scale datasets like ABCD may allow researchers to take quasi-experimental approaches to target the effects of specific policies, an important step for a well-rounded strength-based approach (Ellwood-Lowe, 2021). For example, the ABCD dataset follows approximately 10,000 children at different sites around the United States beginning in late childhood, capturing a range of family SES and race/ethnicity, in addition to natural variation in the state-wide social policies in each family's area. Using a natural experimental approach, one recent study recently found that children

from low-income households living in states with more generous anti-poverty programs showed protection from poverty-related effects in neural and socioemotional development (Weissman et al., 2023). This illustrates the potential utility for combining developmental cognitive neuroscience with policy-relevant insights.

There are several considerations for researchers embarking on a study examining socioeconomic status and neurocognitive development, irrespective of whether it comes from new or secondary data (Table 2). The generation of research questions should involve characterizing neurocognition *in context*. This may require the measurement of multiple outcomes and environmental indicators that go beyond family income and education—a fair endeavor in light of the accessibility of variables included in datasets like ABCD (for similar datasets around the globe, see Simmons et al., 2021). Equally important are methodological decisions one takes to examine their research questions. Simple income-based group comparisons likely obscure critical contextual factors, and thus an examination of individual or within-person differences will better align with a strength-based approach. Emerging methodological innovations such as computational (e.g., Astle et al., 2023; Eckstein et al., 2022; for an example using ABCD data, see Vermeent et al., 2024) and dynamic systems modeling (e.g., Favela, 2020; Safron et al., 2022; Wijnants, 2014) show particular promise for revealing complex impairment-enhancement patterns of neurocognition (i.e., emphasis on *mechanism* over aggregate performance). The incorporation of children and families' free responses to questions about their own experiences and skills is an additional method that affords the opportunity to identify strengths and contextual factors. This inclusion of qualitative data also amplifies and honors the voices of children and families living in poverty, which provides greater nuance and understanding to quantitative analyses. Often, the inclusion of free response options are absent in large-scale datasets, but novel methods such as structural topic modeling (STM; Roberts et al., 2019) are making the analysis of such data more feasible.

In addition to the careful generation of research aims and methods, scholars are encouraged to reflect on their positionality and identify potential areas where their own lived experience may enhance, bias, and/or limit their approach (for an example, see the positionality statement included in this paper). Indeed, many scholars have emphasized the importance of including a short positionality statement in the academic article itself as a way of enhancing transparency of unintentional subjective biases in the work (e.g., La Scala et al., 2023; Roberts and Rizzo, 2021; DeJoseph and Carosella, 2023). Adopting humility in one's approach is also critical when determining what and how key messages are communicated to general audiences, policymakers, and—most importantly—the children and families for which such research represents. It is at this stage in the research cycle that findings can be misconstrued and misused and highlights the critical responsibility of the researcher to thoughtfully control the narrative toward one that is strength- rather than deficit-based.

Other scholars have further outlined best practices for using publicly-available neuroimaging datasets (Nketia et al., 2021; Saragosa-Harris et al., 2022; Webb et al., 2022). We encourage readers to consult these resources, and hope the reflections in Table 1 will be used in conjunction with the best practices others have outlined.

Table 2
Before beginning any study that examines poverty and neurocognitive development, we encourage researchers to consider reflecting on research aims, positionality, communication, and potential misuses, using the reflection questions below.

Areas to consider	Reflection questions
Reflecting on research aims	Do my study objectives and hypotheses encompass *both* strengths and potential trade-offs? In which environmental or testing contexts would a neurocognitive outcome be considered an impairment and which as a strength? What methods can I apply to best distinguish between strengths and trade-offs?
Reflecting on positionality	How do my own lived experiences limit, bias, or enhance the formulation of my research question/ hypotheses and interpretation of the findings? Is this question informed by, or useful to, the community from which this data came?
Reflecting on resources for communication	What opportunities are available to communicate my findings to general audiences and/or policymakers? What are the key takeaways of my work and how might my study participants perceive these messages? Would these messages be helpful and empowering to them, or would they be disheartening and belittling?
Reflecting on potential misuses	What safeguards am I in control of to prevent misuse of the findings from my study? What are ways in which my work could be unintentionally misinterpreted or deliberately misconstrued?

6. Conclusion

Childhood poverty is pervasive and pernicious, within the United States and around the world. Yet the experience of poverty is not homogenous, and children and families develop creative, skillful ways of living within unequal structures. Critically, an exclusive scientific focus on the detriments of growing up in poverty in the absence of a consideration of the strengths of these individuals ultimately harms the very communities it aims to help, perpetuating inequity. Here we introduced a strength-based approach to understanding child poverty and neurocognitive development and offered practical suggestions for conducting meaningful research that informs educational and social policy. Such an approach considers both the broader structural context—including policies and institutions that reinforce inequities over time—and the multifaceted strengths of children in poverty.

We described three tenets for shifting the narrative in developmental cognitive neuroscience away from a perspective focused solely on children's presumed deficits and toward their strengths and skills. This involves acknowledging that: (1) the experience of poverty is heterogenous, and may include various forms of cultural wealth; (2) neurocognitive differences between children below and above poverty can be evidence of strengths and successful adaptation among children below poverty; and (3) an accurate understanding of children's skills across the socioeconomic spectrum requires a careful consideration of bias in our testing materials. All three tenets have practical utility for maximizing educational and social policy. Finally, we illustrated that a strength-based lens need not excuse the harms perpetuated by inequity, and that an understanding of children's unique strengths is beneficial for children across the socioeconomic spectrum, and thus for society as a whole.

An important step in shifting away from a deficit narrative is to amplify the voices of the children, families, and communities with experiences of poverty. Being detached or distancing oneself from low-income communities may lead to deficit-based thinking—centering the researcher as the "knower" and low-income communities as the "known," mere objects of study (Nzinga et al., 2018). This issue is underscored by the clear need for more researchers with lived experiences of poverty (Morgan et al., 2022). Thus, supporting the existing and future generations of scholars from historically underrepresented backgrounds is critical for a well-rounded science, as these individuals can bring a much-needed perspective, and serve as a bridge between communities (DeJoseph and Carosella, 2023).

Ultimately, rigorous research on effects of poverty requires community input, cross-disciplinary collaboration, and careful attention to methods that move beyond income-based group comparisons. The perspectives presented in the current paper reflect training across multiple disciplines and subfields, including developmental psychology, education, sociology, evolutionary biology, and developmental neuroscience, as well as lived experience across a wide range of socioeconomic, ethnic-racial, and international backgrounds. These experiences enriched our

discussions in the creation of our paper, highlighted areas of tension between us, and allowed for a more balanced, fruitful collaboration. Indeed, we encourage readers to look into the many references of our paper, which span disciplines including education, sociology, economics, neuroscience, linguistics, ethnic studies, and psychology, in addition to policy briefs and writing for a popular audience. We form part of a larger network of early-career cross-disciplinary scholars with the goal of improving science communication around people who experience adversity. We collaborate with journalists, policymakers, and other stakeholders to generate products that offer a more humanistic view of people who have traditionally been systematically disadvantaged by our societies. These kinds of cross-disciplinary collaborations are crucial not only for informing policy, but also for developing a well-rounded approach to normative brain development across the full spectrum of early life experiences.

Psychologists and neuroscientists studying the neurobiological consequences of poverty typically do so out of a concern for the well-being of children. However, our disciplines also have a long history of perpetuating the very inequities scholars seek to remedy (e.g., Center for the History of Psychology, 2021; Louçã, 2009; Nketia et al., 2021; Saini, 2019; Tulkin, 1972; for a case study of a deficit-focused scientific narrative reproducing inequitable policy, see Ellwood-Lowe, Foushee, et al., 2022, Appendix). We hope that the strength-based approach outlined here can begin to move researchers toward their shared goal of producing rigorous scientific work, and ultimately contributing to the greater good.

Author note

In recognition of the importance of acknowledging our positionalities and diverse perspectives in the scientific process, we present the following statement. At the time this article was drafted, all but the senior author were considered early-career researchers composed of graduate students, postdoctoral scholars, and assistant professors. Our academic training spans multiple disciplines including developmental psychology, education, sociology, evolutionary biology, and developmental neuroscience. A wide range of socioeconomic, ethnic-racial, and international backgrounds are represented among our team, and it is this diversity in lived experience that informs our motivation and approach to the work presented in this manuscript.

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CRediT authorship contribution statement

Meriah DeJoseph: Writing – review & editing, Writing – original draft, Visualization, Conceptualization. **Monica Ellwood-Lowe:** Writing – review & editing, Writing – original draft, Visualization. **Dana Miller-Cotto:** Writing – review & editing, Writing – original draft. **David Silverman:** Writing – review & editing, Writing – original draft. **Katherine Adams Shannon:** Writing – review & editing, Writing – original draft. **Gabriel Reyes:** Writing – review & editing, Writing – original draft. **Divyangana Rakesh:** Writing – review & editing, Writing – original draft. **Willem Frankenhuis:** Writing – review & editing, Writing – original draft, Supervision, Funding acquisition, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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