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Early Childhood Adversity, Toxic Stress, and the Impacts of Racism on the Foundations of Health

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Abstract

Inequalities in health outcomes impose substantial human and economic costs on all societies—and the relation between early adversity and lifelong well-being presents a rich scientific framework for fresh thinking about health promotion and disease prevention broadly, augmented by a deeper focus on how racism influences disparities more specifically. This review begins with an overview of advances in the biology of adversity and resilience through an early childhood lens, followed by an overview of the unique effects of racism on health and a selective review of findings from related intervention research. This article presents a framework for addressing multiple dimensions of the public health challenge—including institutional/structural racism, cultural racism, and interpersonal discrimination—and concludes with the compelling need to protect the developing brain and other biological systems from the physiological disruptions of toxic stress that can undermine the building blocks of optimal health and development in the early childhood period.

INTRODUCTION

The health and development of young children are shaped by a process of ongoing, interactive adaptation (at the molecular, cellular, organ system, and behavioral levels) that begins at conception and extends throughout the life course. The underlying plasticity that influences that adaptive capacity (which decreases with age) can lead to a wide range of positive or negative outcomes that are influenced by the inextricable interactions among individual genetic predispositions and the environments in which prenatal and postnatal development unfolds (13). Disparities in physical and mental health impose substantial human and economic costs on societies—and the relation between early adversity and lifelong well-being presents a rich scientific framework for fresh thinking about promoting health and preventing disease broadly, augmented by a deeper focus on how racism exacerbates inequalities more specifically.

The term toxic stress was initially formulated as one element within a conceptual taxonomy that named two other types of stress responses in young children—positive and tolerable—based on postulated differences in their potential to cause enduring biological disruptions (90, 112, 113). Positive stress was defined as a physiologic response (e.g., elevated heart rate and blood pressure) to normative stressors (e.g., dealing with frustration) that is brief and mild to moderate in magnitude. Tolerable stress is associated with nonnormative experiences that present a greater degree of hardship or threat (e.g., death of or serious illness in a family member) with the availability of at least one protective relationship that provides a sense of safety, which facilitates the restoration of physiologic stress responses to homeostatic baselines. Toxic stress, in contrast, is the result of strong, frequent, or prolonged activation of stress response systems in the absence of the buffering protection of a supportive relationship (89). When these biological disruptions persist during sensitive periods of development (in the brain as well as in other biological systems) they can result in enduring structural changes and/or physiologic dysregulations that lead to problems in learning, behavior, and both physical and mental health. Toxic stress is not defined by the source or type of stress. It is defined by the magnitude and duration of the biological response to the stressor. And the nature of that response, as well as its consequences, is influenced by the interactive effects of environmental exposures, personal experiences, individual genetic predispositions, and developmental timing (13).

The critical importance of efforts to address structural inequities shaped by systemic racism and other macrolevel influences on physical and mental health is clear (134, 137). The science of adversity and resilience suggests that greater progress in promoting health and preventing disease at scale will also require effective strategies for addressing differential sensitivity to adversity in the early years (13). While the scientific community continues to seek greater understanding of individual variation, effective public health practice will require attention to decreasing developmental plasticity over time.

The concept of critical or sensitive periods in the developing circuitry of the brain is well established (55). Recent research on the microbiome demonstrates that the same critical period concept applies to the establishment of the specific bacterial species that colonize the newborn intestines through both maternal transmission and environmental exposures, with subsequent influences on lifelong immune function documented for respiratory, gastrointestinal, and neural systems (75). Recent studies of plasticity and critical periods in brain development are also challenging longstanding principles that have influenced traditional approaches to health promotion and disease prevention. As one example, the discovery that significant adversity can accelerate the opening and closure of critical periods for the development of fear circuitry in animal models has compelling implications for early intervention to address the roots of health-related behaviors in humans (18).

EFFECTS OF EXCESSIVE ADVERSITY ON DEVELOPING BIOLOGICAL SYSTEMS

The association between toxic stress and enduring modifications in brain structure and function with lifelong consequences is well established (78, 79). Extensive evidence also demonstrates how all biological systems are interconnected and influence each other's development and function (13). Moreover, both animal and human studies show that adversity in the prenatal period and the first few years after birth creates a brain and a body that are more vulnerable to "second or third hits" by physiological or psychosocial stressors that arise later in life (6, 80, 96). Although time-limited activations of stress response systems are adaptive in a threatening early environment, the inability to recover after the source of the stress is eliminated or reduced can result in a brain that is stuck in a maladaptive state and may require behavioral and/or pharmacological intervention for later depression or an anxiety disorder (80).

Although the problems presented by a brain that is stuck are typically seen as part of the normal aging process, they can also be observed in accelerated aging that results from early adversity. Acceleration of the aging process in childhood can be especially problematic when combined with a stressful lifestyle in adulthood that produces circadian rhythm disruptions (e.g., from shift work) (103), social isolation and loneliness (71), or living in a noisy, polluted environment with limited green space (40, 66). These consequences are more likely to be long-lasting and more resistant to treatment (e.g., for depression) when they result from significant adversity early in life (122).

Foundational neural circuits are constructed during the mid to late fetal, infant, and toddler periods. These time frames reflect intervals of heightened plasticity that make the brain particularly sensitive to the influences of systemic hormones, neural and immune feedback, and endogenous neurochemicals on its circuitry and its responsiveness to stimuli. Growing evidence also indicates that persistently elevated inflammation can produce lasting changes in multiple biological systems, which increase the risk of later impairments in both physical and mental health (90).

Some of the earliest evidence for the influence of excessive, early adversity on systemic physiology is the documentation of increased obesity and elevated blood pressure in children who experience the stresses of poverty and/or unsupportive caregiving (19, 27, 29, 41). Increased systemic and neural inflammatory tone stimulated by high levels of adversity is a likely contributor to the development of these conditions. Growing evidence suggests that a common biological response to all forms of adversity early in life is a predisposition to a chronic proinflammatory phenotype, although the precise pathophysiology and causal mechanisms remain to be determined (84). The potential impact of preventive interventions cannot be underestimated as alterations in immune function (10) and measurable increases in inflammatory markers (83) are associated with insulin resistance and type 2 diabetes, as well as cardiovascular disease (3, 45), chronic obstructive pulmonary disease (139), autoimmune diseases (74), and depression (56), among other disorders. Oxidative stress generated by inefficient, energy-generating mitochondrial function also plays a central role in regulating inflammatory tone (98, 99).

An extensive meta-analysis investigated the association between childhood trauma and three key inflammatory markers in adults, including 18 studies of C-reactive protein (CRP), 15 studies of interleukin-6 (IL-6), and 10 studies of tumor necrosis factor-α (TNF-α) (7). These analyses found a significant association between childhood trauma and each of the biomarkers studied, with the largest effect sizes for TNF-α, followed by IL-6 and then CRP.

The potential implications of these findings for long-term health outcomes are illustrated by the documented association between harsh treatment during childhood and a significant and graded increase in the risk for clinically relevant serum elevations of CRP into adulthood 20 years later (28). Evidence that excessive early adversity may be associated with epigenetic signatures in

master regulatory genes that affect chronic inflammation suggests the future possibility that differential susceptibility to excessive, early adversity could be addressed by epigenome screening to identify children who are most at risk for later disease (60). An alternative approach favors the benefits of proportionate universality, whereby intervention strategies are attuned to the needs of the most sensitive children so that the needs of all are met.

Another area of promising investigation is the growing evidence of an association between chronic, systemic inflammation and changes in the composition of the host-associated microbiome, especially in the gut and airways. Recent studies have found evidence of critical periods in infancy when disruptions of microbial colonization of mucosal tissues can lead to persistent defects in the development of specific immune subsets that can have lifelong impacts on physical health (49). Isolation of specific bacterial species from the upper airway in the neonatal period and specific bacterial community structures in the intestines during the early postneonatal period have both been associated with an increased risk of asthma (12, 44). Specific gut microbiome communities have also been described in children who become overweight or obese (110). Further research on the dynamic relation between the immune system and mucosal microbes (the so-called microbial mucosal unit) (76) is exploring whether disruptions early in life might predispose some young children to greater risk for chronic inflammatory conditions (5). Although data in humans are currently limited, animal models have shown that early adversity may result in microbiome effects that persist into adulthood (94). The extent to which the microbiome might serve as an informative biological indicator of relative risk for disease or differential response to intervention awaits further investigation.

THE UNIQUE EFFECTS OF RACISM ON HEALTH

Extensive research on the association between adversity in childhood and disparities in lifelong health has consistently demonstrated a linear relation between the number of risk factors and the likelihood of poor outcomes. The resulting concept of cumulative burden of risk rather than differential weighting of specific sources of hardship or threat has led to limited attention to the unique challenges presented by significant sources of adversity that require distinctive strategies for preventive intervention. The impacts of maternal depression and parental substance abuse are two examples that require specialized attention rather than generic early childhood services. The time is long overdue to focus on the unique impacts of racism on the foundations of physical and mental health.

The conventional designation of race or ethnicity as a risk factor for disparities in health outcomes diverts critical attention away from systemic racism, other structural inequities, and their deep historical roots as pernicious influences on the intergenerational transmission of stress-related disease (121). Although interventions that build resilience in children and caregivers who are facing adversity can lead to better individual outcomes at a program level and well-established public health policies (e.g., food assistance) can reduce population-level inequalities, evidence also shows that some policies (e.g., reducing air pollution through low emission zones) may actually increase inequalities by leading to differential benefits for more advantaged communities (117). On the basis of such observations, reducing disparities driven by social inequities will often require targeted strategies designed to improve the health of disadvantaged groups more rapidly than the rest of the population (138). In the final analysis, achieving greater impacts at scale for all children and families will require fresh thinking at a policy level to confront structural inequities that undermine the well-being of all marginalized groups—including unequal access to opportunities in education, employment, housing, health-promoting environments, and wealth creation. To that end, current strategies focused on access to high-quality medical care and early

Table 1 Forms of racism that can affect physical and mental health

Forms	Characteristics	Examples
Institutional/structural racism	Systemic, racial inequities embedded within interconnected social, political, and economic systems that have deep historical roots	Housing Criminal justice Labor markets Education Health care Immigration policy
Cultural racism	An ideology grounded in white supremacy that is deeply embedded in the language, symbols, media and taken-for-granted assumptions of the larger society	Education system inequities (e.g., differences in preschool expulsion rates) Health care inequities (e.g., delayed diagnosis and treatment) Stereotype threat and internalized racism
Interpersonal discrimination	Individual experiences in the context of everyday social interactions, including implicit biases, microaggressions, and vicarious discrimination	Experiences of unfair treatment (e.g., at work, at school, with law enforcement) Experiences of being threatened or harassed Intentional or unintentional racial insults, mistreatment, or slights

childhood programs focused on children and families are important, but they must be augmented by a more intentional, upstream focus on the multiple ways in which structural and cultural racism and deeply embedded patterns of discrimination create physical, social, and economic conditions that disproportionately threaten the healthy development of children of color and their families (111) (see **Table 1**).

Institutional/Structural Racism

Institutional or structural racism (used interchangeably) are terms that refer to racial discrimination embedded within interconnected social, political, and economic systems and institutions, such as housing and labor markets, criminal justice, immigration policies, education, health care, and the media, among others (4). In the following sections, we provide an overview of residential segregation, the criminal justice system, and immigration policies and their effects on the health and development of young children. Given space constraints, which do not allow a comprehensive review of additional domains of influence, we selected these three manifestations of structural racism, as each plays an important role in the intergenerational persistence of racial disparities in health across the life course.

Residential segregation. One of the most extensively studied examples of institutional racism, residential segregation is associated with significant differences in neighborhood quality, living conditions, and access to opportunities that undermine health through multiple pathways (4, 109, 130, 134). Segregation limits socioeconomic mobility by reducing access to quality early childhood services, elementary and high school education, preparation for higher education, and employment opportunities. Conditions created by concentrated poverty and residential segregation also make it more difficult for residents to adhere to good health practices. For example, the higher cost, poorer quality, and lower availability of healthy foods can lead to poor nutrition. Heavy targeting of communities of color with advertising for tobacco and alcohol can encourage their use. Limited recreation facilities and concerns about personal safety can discourage physical activity. High concentrations of poverty increase exposure to elevated levels of economic hardship

and other stressors at the individual, household, and neighborhood levels. Long-standing institutional neglect and disinvestment in poor, segregated communities contribute to increased exposure to poor-quality housing and limited investment return, criminal victimization, and weakened community and neighborhood infrastructures that adversely affect interpersonal relationships and trust among neighbors. And finally, segregation adversely affects both access to medical care and the quality of care received.

Residential and occupational segregation by race affects the patterning of risk exposures in the physical, chemical, and built environments in which families raise young children. Neighborhoods with large percentages of Hispanic and black or African American (used interchangeably in this article) residents have higher levels of economic insecurity, poor housing, and high rates of violence than do economically comparable neighborhoods with higher proportions of whites (85). Black women experience higher levels of exposure to environmental toxicants compared with white women, and a broad range of harmful exposures, including air pollution, heavy metals (e.g., cadmium, arsenic, and lead), contaminated water, and pesticides have been associated with an increased risk of poor pregnancy outcomes (85).

Stated simply, residential segregation by race in the United States has created neighborhood conditions for many families of color that impose higher levels of adversity and more health-damaging influences compared with those experienced by whites. Recent data from the Child Opportunity Index ranked US neighborhoods on multiple dimensions of opportunity, including number and quality of schools, early childhood centers, high school graduation rates, income, employment, home ownership, green space, healthy food outlets, walkability, and pollution of air, water, and soil (2). These data revealed that, in the 100 largest metropolitan areas in the United States, 67% of African American, 58% of Latino, and 53% of Native American children reside in low- or very-low-opportunity communities compared with one in five white and Asian children. In contrast, almost two-thirds of all white and Asian children live in high- or very-high-opportunity neighborhoods compared with 19% of African American, 23% of Latino, and 29% of Native American children.

A national study of young adults calculated that the elimination of residential segregation would erase black–white differences in earnings, high school graduation rates, and unemployment and reduce racial differences in single motherhood by two-thirds (26). More recent research quantified the role of opportunity linked to place in the intergenerational transfer of economic status (20). Analyses linking parent earnings to those of their children revealed that, controlling for parent income, black males had lower earnings than white males in 99% of US Census tracts, which was attributed to differential access to opportunities for socioeconomic mobility. In contrast, racial differences were not found in neighborhoods with good resources and opportunities, but such contexts are relatively rare for African Americans. The documented influence of exposures linked to place on child health and development underscores the need for routine inclusion of data on geographic location in studies of children and youth (see the sidebar titled Residential Segregation).

Structural racism and the criminal justice system. With approximately 700 per 100,000 citizens incarcerated at any given time, the United States has the highest rate and largest number of incarcerated people in the world (132). Projections further indicate that almost one of every three black men will be incarcerated at least once in their lives, and nearly half of black women have a close or extended family member in jail or prison (132). Since the 1970s, rates of incarceration have increased dramatically, and significant inequalities in surveillance, prosecution, and sentencing have been associated with a tenfold increase in risk of incarceration for black men compared with whites, disparities that are often reinforced by policies that have differentially criminalized

RESIDENTIAL SEGREGATION

The multidimensional nature of neighborhood effects on human well-being provides a compelling framework for fresh thinking about the impacts of residential segregation on the early childhood roots of racial disparities in physical and mental health. Inequalities in access to well-paying jobs, nutritious food at affordable prices, high-quality child care and education, trusted medical services, and safe communities result in significant stresses on families of color in a segregated society. Marked discrepancies in proximity to air pollution, contaminated water, and other environmental toxicants are particularly critical in the prenatal and early childhood periods when the health consequences are the most serious, even at lower levels of exposure. Advances in the biology of adversity and resilience indicate that strategies designed to promote health and prevent disease could be strengthened by addressing neighborhood-level sources of toxic stress and physicochemical threats to developing brain function, immune responsiveness, metabolic regulation, and other biological systems in the early childhood period.

substance abuse and mental illness (132). For example, laws that linked markedly unequal criminal penalties to an arbitrary distinction between cocaine in powder form (viewed as a high-income white drug) versus crack cocaine (viewed as a low-income black drug) played a major role in the dramatic increase in incarceration rates for racial minorities and strikingly longer prison sentences (i.e., disparities of 100 to 1) for blacks compared with whites (77).

Considerable evidence indicates that adult incarceration affects the health and well-being of children and their families, including adverse influences on prenatal health, infant and child mortality, obesity, poor self-reported health in childhood and young adulthood, unhealthy behaviors and mental health problems, and poorer school outcomes (131). Mass incarceration of adults has increased racial disparities in children's behavioral and mental health problems by an estimated 15–25% for externalizing problems and 24–46% for internalizing problems (131). Analyses further suggest that the black–white gap in infant mortality would be 10% lower if mass incarceration did not exist (131).

Structural racism and immigration policy. Growing evidence indicates that immigration policies can have adverse impacts on child and adult health through multiple pathways (47). Recent research indicates that anti-immigrant initiatives trigger hostility that can lead to perceptions of vulnerability, threat, and psychological distress among immigrants who are directly targeted as well as those who are affected indirectly. For example, a study of Latinos in 38 US states found higher rates of mental health impairments in areas with more exclusionary policies (53).

Another study following a federal immigration raid at a meat-processing plant in Iowa found elevated rates of low birthweight only for infants born to Latina mothers in the year after the raid compared with the previous year (92). After an Arizona law was passed that empowered local police to stop anyone suspected of being undocumented and to detain those who lacked proof of citizenship, a statewide study of birth outcomes found that prenatal exposure to the law resulted in babies with lower birthweights among Latina immigrant women but no impact on birthweights among US born white, black, or Latina women (119). Following the passage of this legislation, use of social services and preventive health care for children decreased among mothers of Mexican ancestry, with the largest declines among Latinas who were born in the United States compared with those who were foreign born (118). Other emerging evidence suggests that anti-immigrant, anti-Hispanic, anti-Muslim, and racist rhetoric and policies may also adversely affect birth outcomes (48, 68) as well as child and adolescent health (39, 72).

Cultural Racism

Cultural racism refers to an ideology that views whites as superior to blacks and other racial groups and that is deeply embedded in the language, symbols, media, and taken-for-granted assumptions of the larger society (137). These negative stereotypes and images of stigmatized racial groups normalize and reinforce the ideology of racial inferiority and can initiate and sustain both institutional and individual-level discrimination. An analysis of a database of American culture (including books, newspapers, and other materials that the average college-educated American would read in a lifetime) found that the word "black" was paired most frequently with poor, violent, religious, lazy, cheerful, and dangerous, whereas "white" was paired most frequently with wealthy, progressive, conventional, stubborn, successful, and educated (128).

Some research indicates that cultural racism contributes to bias in how students of color are treated in school, beginning in the preschool years. For example, black preschoolers are 3.6 times more likely than their white counterparts to receive one or more suspensions (50). Accordingly, although black children make up 19% of the preschool population, they represent almost half (47%) of the preschoolers suspended one or more times, with boys affected three times more than girls. One study had 135 pre-K teachers watch 12 short videos and asked them to detect challenging behavior in the classroom, acknowledging that doing so might require detecting behaviors before they become problematic (50). Each video featured four children (two black, two white); teachers were asked to identify the child who would require the most attention, and eye-tracking technology quantified time spent gazing at each child. The study found that both black and white teachers focused more on black children, with 42% indicating that the black boys (68% more than expected by chance) would require the most attention.

Cultural racism can also affect health in several ways. It can lead to implicit biases that result in structures and policies that provide differential access to societal opportunities (137). Unconscious bias at an individual level can lead to discrimination against other groups. In clinical encounters, these processes can lead to children of color experiencing discrimination and inferior treatment compared with whites (61, 106). A 2003 report from the Institute of Medicine concluded that across virtually every type of diagnostic and treatment intervention, blacks and other minorities received fewer procedures and poorer-quality medical care than did whites (58). Extensive research documents the persistence of these patterns and reveals that higher implicit bias scores among physicians are associated with biased treatment recommendations in caring for black patients (127). Providers' implicit bias has also been linked to poorer-quality patient-provider communication and lower patient evaluation of the quality of the medical encounter (25).

Stereotype threat, another manifestation of cultural racism, refers to expectations and anxieties that can be activated when negative stereotypes are made salient and have an adverse effect on children's academic performance and psychological functioning (115). In some circumstances, members of stigmatized groups respond to pervasive, negative racial stereotypes by accepting them to be true. This endorsement of the dominant society's beliefs about one's innate or cultural inferiority is called internalized racism or self-stereotyping. Research indicates that internalized racism is associated with lower self-esteem and psychological well-being and higher levels of alcohol consumption, depressive symptoms, and obesity (137). Identifying the earliest age at which this internalization process can begin is essential for preventive intervention.

Interpersonal Discrimination

Growing evidence demonstrates that experiences of interpersonal discrimination adversely affect health outcomes for children and youth. A 2014 review of 121 studies found that self-reports of discrimination were associated with worse mental health (e.g., anxiety and depressive

symptoms) and inversely associated with positive mental health (e.g., resilience, self-worth, and self-esteem) and general well-being (e.g., life satisfaction and quality of life). Discrimination was also positively associated with risky behaviors (e.g., alcohol use, drug use, and smoking) as well as preterm delivery and very low birth weight (100). In one study, adjusting for racial discrimination reduced the black–white gap in preterm delivery and low birth weight to a nonsignificant level (86).

Vicarious discrimination and child health. A recent review of 30 studies focused on the effects of secondhand discrimination on children and youth (i.e., situations where the child was not the direct target) and reported significant impacts on a variety of socioemotional and mental health outcomes, although there was no standard definition of vicarious racism (54). A longitudinal study of 704 poor black and Latina urban, teen mothers found that everyday discrimination reported during pregnancy predicted greater inhibition/separation problems and negative emotionality in their children at six months and at one year of age (105). Another study of 138 immigrant parents from Mexico assessed their perceived discrimination via a daily survey for two weeks and linked the results to behavioral outcomes in their children between 3 and 5 years of age (46). When fathers experienced bias, both parents reported more externalizing child behaviors and mothers reported fewer positive behaviors. When mothers reported discrimination, they reported more externalizing child behaviors and fathers reported more internalizing behaviors. A study of 54 mother–child dyads assessed hair cortisol and salivary proinflammatory cytokines and found that maternal discrimination was associated with increased IL-6 in children aged 4–9 years. While this study was underpowered, it was the first to document an association between biomarkers in young children and maternal discrimination (24). Finally, a longitudinal study of infants born in the United Kingdom found reports of discrimination experienced by black and ethnic minority mothers to be positively associated with child social and emotional problems six years later (8). Baseline reports of discrimination were also positively associated with mothers' mental health symptoms and harsh parenting practices two years later, and both factors predicted problems in children's social and emotional behavior four years afterward.

Racism-related exacerbation of common stressors. Fully capturing the disproportionate impacts of racism on stress-related disease requires more focused attention on the higher prevalence of traditional risk factors in communities of color (133). The death of a loved one, for example, is a routine item on conventional inventories of stressful life events. However, because of poorer living and working conditions, along with earlier onset of disease and elevated rates of premature mortality, deaths are more common among populations of color compared with whites. For example, black children are three times more likely than their white peers to lose a mother by age 10, and black adults are more than twice as likely to lose a child by age 30 or a spouse by age 60 (124, 125). The fact that blacks experience more deaths of family and friends across the life course and beginning early in life constitutes an added burden of stress and a major loss of the supportive relationships that can buffer the effects of adversity on health.

Financial strain is another common stressor with a higher prevalence among black (32%), Hispanic (26%), and Native American (31%) children relative to non-Hispanic white children (11%) (64). Enormous racial disparities in wealth in the United States (126) further exacerbate both the stresses of low income and the consequences of economic insecurity. Poor children of color compared with poor white children are also more likely to be living in neighborhoods of concentrated economic and social disadvantage, which provide fewer formal and informal supports for upward mobility (2).

INTERVENTION RESEARCH AND PRIORITIES FOR FURTHER STUDY

Converging knowledge from the science of early childhood development and extensive research on racial disparities in educational achievement and lifelong health underscore the critical need for more effective policies and programs focused on confronting systemic, cultural, and interpersonal racism/discrimination in the earliest years of life. Substantial evidence further indicates that well-balanced strategies that capitalize on existing assets in families and communities of color while addressing the unique hardships and threats that racism imposes on families with young children will be most successful.

A comprehensive review of the full landscape of relevant early childhood programs and policies—including family economic stability and food security (37, 88), high-quality early education (89), and supportive interventions within the primary health care setting (9, 42)—is beyond the scope of this article. We refer readers to recent reviews and reports (9, 37, 42, 88, 89) outlining the current evidence base and research priorities for each of these areas. This review focuses on a selected set of key levers for interrupting intergenerational cycles of health disparities affecting young children and families of color that demand greater attention and investment. This section highlights interventions within a multilevel, ecological framework that have been tested using robust study designs and have the potential to be scaled. In instances where data on the developmental impacts of a promising intervention are limited for young children, we describe findings in older samples to inform priorities for future research in the early childhood period.

Housing and Residential Segregation

Housing and neighborhood conditions have considerable potential to influence healthy development in the prenatal and early childhood period. A number of housing-related factors can be modified in the context of an intervention, including (*a*) physical or chemical hazards present in the home (e.g., lead exposure, asthma triggers, or structural deficiencies that lead to injuries); (*b*) social risks and disadvantage related to location (e.g., concentrated poverty, violence, environmental toxicants); and (*c*) affordability (i.e., housing cost burden) (38, 107). Despite extensive data documenting the influence of these issues on health, causal evidence of the positive effects of housing-related interventions for infants and young children is extremely limited.

Notwithstanding this limited evidence base, new research focused on the early childhood period could be informed by findings from studies of school-aged children and youth. For example, using randomized controlled trial (RCT) designs, both the Boston site of the Moving to Opportunity (MTO) experiment (63) and the Seattle–King County Healthy Homes Project (67, 116) documented improvements in housing conditions, asthma symptoms, and urgent health care use for children in low-income families through different types of interventions (e.g., vouchers to relocate to low-poverty neighborhoods versus community outreach workers to help residents develop personalized intervention plans). Longer-term follow-up of MTO effects into young adulthood indicates that impacts varied on the basis of age at the time of the intervention. Compared with their counterparts in the control condition, children who were 13 years of age or younger when they moved to a low-poverty neighborhood were more likely than older youth to attend college and earn higher annual incomes and less likely to become single parents (21). This greater impact for children who received an earlier and longer dose of an advantaged neighborhood context highlights the need for a developmental approach to research on housing and neighborhoods that can investigate the influence of sensitive periods in development using refined age categories, younger samples of children, and detailed measures of child and parent outcomes to disentangle mechanisms of change. To inform future programs and more effective policies, new studies in this area should use causally informative designs, with measurement timing and constructs based on core

concepts of child development and science-informed understanding of how social and physical environments affect the early biological foundations of lifelong health.

Place-Based Interventions

In contrast with housing and relocation programs that focus on individual families, place-based strategies offer models of comprehensive community development that incorporate prevention-oriented interventions in the communities in which families live (4, 102). These approaches have gained support from policy makers and researchers who view interventions that target individual children, families, and family-level behaviors as reflecting a limited vision of sustainability and scalability, small effect sizes that fade over time, and inadequate appreciation for the social and environmental conditions that influence health and development (30, 31). By addressing structural causes of health disparities, place-based approaches involve cross-sectoral and sustainable collaborations that (*a*) are localized and sensitive to the specific geographic setting and (*b*) address community-specific objectives.

A number of large-scale comprehensive, place-based interventions in the United States have been designed to strengthen families, communities, and organizational collaborations in order to disrupt cycles of disadvantage. Examples include the Harlem Children's Zone (HCZ) (established in the 1990s) (120), the Fostering Hope Initiative (established in 2008) (31, 104), and the Magnolia Place community initiative (established in 2008) (57, 108). Of these programs, HCZ has conducted the most rigorous evaluation to date, showing that graduates of the preschool program are fully prepared for kindergarten (52) and that attending Promise Academy charter school helped close racial gaps in academic achievement (34, 35) as well as reduce teenage pregnancy and incarceration of males (35).

Generating a robust evidence base for the impact of place-based approaches to promote child development has been challenging for a variety of reasons (102). For example, this type of intervention strategy may require an extended timeline to yield significant effects, as well as outcomes that are more difficult to quantify beyond child health and academic achievement, such as community development and capacity building, improved efficiency for accessing resources and services, job creation, and expansion of housing options (102, 108). More extensive research on the effects of place-based interventions in the early childhood period is needed to determine whether (or which) specific services, programs, or collaborations have a meaningful impact on the lives of young children (73). This latter type of research can be particularly valuable to inform priorities for intervention where more comprehensive agendas are not immediately feasible owing to limited resources or other constraints.

Addressing Cultural Racism

To reduce the burdens of structural inequities on families or mitigate their effects on the health and development of young children of color in the United States, it will be essential to confront cultural racism (135, 136). The potential role that media could play requires greater attention. Experimental evidence from a small study shows that media can effectively counter negative stereotypes about African Americans and lead to increases in support for policies (such as affirmative action) that promote the well-being of out-group members (101). Further research is needed on whether and how the presentation of counterstereotypes in media can positively influence the beliefs and behaviors of adults and young children toward racially discordant peers (33).

Limited laboratory and field-based studies suggest promising strategies for reducing prejudices and building support for a more equitable society for raising young children (17, 91). However, a recent review of RCTs to reduce racial or ethnic prejudices through increased intergroup contact,

with outcomes measured at least one day after the intervention began, concluded that racial prejudice is more difficult to reduce than other types of prejudice, and there is very limited evidence that increased interracial contact is effective (95). A recent study, however, suggests that even imagined contact can be effective in promoting positive intergroup relationships in 4–6-year-old children (11), adding to existing evidence that age matters, as prejudice reduction following imagined contact is more pronounced for school-aged children compared with adults (81). In light of findings that preschool-aged children display racial bias and discriminatory behavior toward individuals of color (1, 97), high-quality longitudinal research in this area is essential for informing preventive interventions at the youngest possible ages and for identifying under which conditions racial prejudice can be reduced in the adults who work with children.

Research on interventions to reduce implicit racial biases among early child care providers and preschool teachers is clearly needed (50) and is largely absent from the peer-reviewed literature. The study describing implicit bias against black boys among preschool teachers, described above, makes this research gap particularly critical (50). Some RCTs, focused on college students, suggest that it is possible to change implicit racial biases, but few interventions have shown sustained effects or changes in real-world behaviors (43, 70). As a notable exception, an empathy-focused intervention to address implicit bias in middle school math teachers halved year-long student suspension rates (from 9.6% to 4.8%) and improved teacher perceptions of and respect for students considered to be the most at risk for problems in school (93).

Finally, given the view that early childhood is an ideal time to prevent or minimize racial biases before they become engrained (36, 65, 114), along with evidence suggesting that antibias instruction in a school setting can be effective (123), early childhood experts (32, 59, 69) and the National Association for the Education of Young Children (87) emphasize the importance of antibias education in child care settings. Although many early education programs incorporate a commitment to diversity and equity in their organizational structure and daily activities, impact evaluation data are limited. Understanding their long-term effects on behavior and determining the conditions under which these programs are most likely to be successful are priorities for further study.

Promoting Resilience in the Face of Interpersonal Discrimination

Several programs have been developed to enhance psychological resources and reduce the negative effects of exposure to internalized and interpersonal racism. Interventions with middle school and college students of color suggest that resilience-focused strategies are a fruitful line of research. For example, tested in an RCT design, a single one-hour social belonging intervention delivered in the first year of college for African American students improved student grades, self-reported health, and sense of belonging at the end of college (129), and the benefits continued 7–11 years after the intervention (average age of 27 years) (14). More recently, researchers have adapted this line of research for middle-school students (51). For example, an RCT of a social belonging intervention delivered in two 30-minute sessions to black and white sixth-grade students ($n = 137$) was effective in reducing concerns about being negatively stereotyped and increasing a sense of belonging. This intervention also produced a 65% reduction in disciplinary citations for black males, measured through the end of high school (i.e., 7 years after the intervention), thereby closing the black–white gap in citations by 75% (51). These results are consistent with earlier self-affirmation interventions designed to reduce stereotype threat. For example, two randomized field experiments tested the impact of a brief structured writing assignment to reaffirm sense of adequacy and self-worth among black and white middle school students and found improved grades among black students only, resulting in a 40% reduction in the racial achievement gap (22). Subsequent follow-up over two years found sustained impacts on academic achievement and self-perceptions

RESEARCH PRIORITIES

- Neighborhood and housing research using causally informative designs, with measurement timing and constructs based on core concepts of early childhood development, is needed.
- Research on the effects of place-based interventions for early childhood outcomes would help to determine whether (or which) specific services, programs, or collaborations have a meaningful impact on the health and development of young children.
- We would encourage studies on whether and how the presentation of counterstereotypes in media can positively influence the beliefs and behaviors of young children toward racially discordant peers and the beliefs/behaviors of adults caring for young children.
- Longitudinal research is needed in the area of prejudice reduction and antibias preschool curricula to inform preventive interventions at the youngest possible ages and to identify under what conditions racial prejudice can be reduced among the adults who work with young children.

of abilities among the black participants, with the largest benefits for lower-achieving students at baseline (23).

Future research is needed to understand how resilience-oriented, school-based interventions may be effective and whether these types of intervention can have positive effects on younger children. Research is also needed to examine whether carefully developed, family-based interventions designed to promote resilience among minority youth [e.g., the Safe African American Families intervention encouraging racial pride (15, 16, 82; see Reference 62 for a review)], or novel interventions focused on promoting racial and cultural socialization, can have meaningful and sustained effects on health and development if tailored for preschool-aged children (see the sidebar titled Research Priorities).

CONCLUDING THOUGHTS

Significant adversity early in life can undermine the foundations of healthy development. Potential precipitants include the socioeconomic hardships of poverty and racism; the psychosocial threats of child maltreatment and community violence; the interpersonal challenges of maternal depression and parental addictions; the physiological disruptions of air pollution, contaminated water, and other environmental toxicants; and the metabolic consequences of poor nutrition. None of these conditions invariably leads to a toxic stress response, but each can be a potent predisposing factor for lifelong impairments in both physical and mental health.

Current early childhood policies focus largely on the implications of early adversity for later educational achievement. Grounded in developmental and behavioral research, most interventions are driven by an enrichment model that focuses on providing enhanced learning experiences for young children combined with information on child development and parenting education for their primary caregivers. Advances in the biology of adversity and resilience point to the need for a complementary protection model that focuses on shielding the developing brain and other biological systems (e.g., immune, cardiometabolic) from the physiological disruptions of toxic stress that can lead to disparities in both school achievement and lifelong health.

Decades of research on adversity and resilience suggest that the number of risk factors or sources of adversity is a stronger predictor of poor health and developmental outcomes than is a differential weighting of specific adversities. Notwithstanding this evidence, the unique and substantial burdens that the stresses of structural, cultural, and interpersonal racism impose on the

daily lives of families raising young children of color provide a compelling argument for rethinking the conventional belief in the generic pile-up of adversity versus the distinctive threat of deeply embedded social, economic, and political marginalization to physical and mental health.

The opportunity to leverage insights from the biological and social sciences, the findings of intervention research, the expertise of policy makers and service providers, and the lived experiences of families and communities presents a promising pathway forward to confront the deep historical roots and enduring structural inequities of racism in the United States and its pernicious influence on disparities in health outcomes and life expectancy. The striking evidence of racial and ethnic inequalities in prevalence, complications, and mortality rates from the coronavirus disease 2019 (COVID-19) pandemic has directed increased attention to many of the persistent social and structural inequities (e.g., overcrowded housing, front-line service jobs, unequal access to medical care) that compromise the health and development of people of color in the United States. That said, the relatively limited public discussion focused on the early childhood origins of many of the chronic health conditions associated with greater morbidity and mortality from COVID-19 infection (e.g., obesity, hypertension, heart disease, diabetes), which are more prevalent among African Americans, underscores the urgent need for increased attention to the scientific knowledge and policy implications presented in this review.

Families and communities play a critical role in protecting young children from the external stressors of racism, thereby preventing the internal, physiological disruptions of a toxic stress response. Primary health care has a vital role to play in addressing the fundamental importance of differential sensitivity to adversity and its implications for individualized, family-centered approaches to strengthening the foundations of healthy development. The challenge facing the public health community is to focus greater attention, at a societal level, on the essential need to confront the pathogenic influences of structural and cultural racism through an early childhood lens.

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