



# Mediators and Adverse Effects of Child Poverty in the United States

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The link between poverty and children's health is well recognized. Even temporary poverty may have an adverse effect on children's health, and data consistently support the observation that poverty in childhood continues to have a negative effect on health into adulthood. In addition to childhood morbidity being related to child poverty, epidemiologic studies have documented a mortality gradient for children aged 1 to 15 years (and adults), with poor children experiencing a higher mortality rate than children from higher-income families. The global great recession is only now very slowly abating for millions of America's children and their families. At this difficult time in the history of our nation's families and immediately after the 50th anniversary year of President Lyndon Johnson's War on Poverty, it is particularly germane for the American Academy of Pediatrics, which is "dedicated to the health of all children," to publish a research-supported technical report that examines the mediators associated with the long-recognized adverse effects of child poverty on children and their families. This technical report draws on research from a number of disciplines, including physiology, sociology, psychology, economics, and epidemiology, to describe the present state of knowledge regarding poverty's negative impact on children's health and development. Children inherit not only their parents' genes but also the family ecology and its social milieu. Thus, parenting skills, housing, neighborhood, schools, and other factors (eg, medical care) all have complex relations to each other and influence how each child's genetic canvas is expressed. Accompanying this technical report is a policy statement that describes specific actions that pediatricians and other child advocates can take to attenuate the negative effects of the mediators identified in this technical report and improve the well-being of our nation's children and their families.

## abstract

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There is no keener revelation of a society's soul than the way in which it treats its children.

—Nelson Mandela

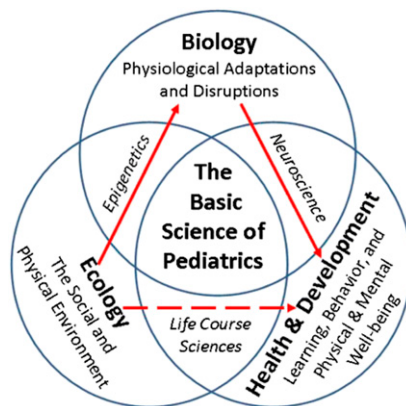
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The advent of the Great Recession in December 2007 heralded an increase in child poverty from a prerecession 13.3 million children to 16.3 million children by 2010.<sup>1,2</sup> The Great Recession is only now very slowly abating for millions of this nation's families, and "full employment" is forecasted finally to return sometime in 2017.<sup>3</sup> In 2014, an estimated 21.1% of children, or 15.5 million, lived in poverty.<sup>2</sup>

Although medical care and access to medical care are important factors in the health of children as well as adults, a broader perspective of the social determinants of health throughout the life cycle is critically important if significant gains are to be realized in our efforts to improve the health of this nation's children. Research that examines mediators of health as well as the effects of poverty and other circumstances in which people grow, live, work, and age in childhood and throughout the life course is accumulating rapidly, and findings are providing critical insights that can inform these efforts.<sup>4</sup>

The environment in which a child develops is influenced by parents' health, the immediate and extended family, housing, and community. All these factors are related to a family's social, economic, and health status.<sup>5</sup> These multiple factors in both the social and the physical domains have dynamic influences that link them to the long-term physical and mental health of children, youth, and adults.<sup>6,7</sup> The interaction of these factors that ultimately influence children's health has been published as a figure within an earlier technical report from the American Academy of Pediatrics (AAP) on toxic stress.<sup>8</sup> The ongoing investigation of these factors creates the basic science of pediatrics (Fig 1).

A 1958 birth cohort longitudinal study from the United Kingdom recently reported that 45-year-old adults who experienced psychological distress during childhood were at



**FIGURE 1**

The basic science of pediatrics. An emerging, multidisciplinary science of development supports an ecobiodevelopmental framework for understanding the evolution of human health and disease across the life span. In recent decades, epidemiology, developmental psychology, and longitudinal studies of early childhood interventions have shown significant associations (dashed arrow) between the ecology of childhood and a wide range of developmental outcomes and life-course trajectories. Concurrently, advances in the biological sciences, particularly in developmental neuroscience and epigenetics, have made parallel progress in beginning to elucidate the biological mechanisms (solid arrows) underlying these important associations. The convergence of these diverse disciplines defines a promising new basic science of pediatrics.

increased risk of adult cardiovascular and metabolic disease even if the distress resolved during adulthood.<sup>9</sup> Another recent study from Europe reviewed 201 studies from 32 countries from all European regions. The investigators found that multiple social factors from different levels (eg, neighborhood, household) are sources of child health or development disadvantage. These findings support the necessity for effective interventions to target multiple social factors operating at different levels.<sup>10</sup>

The notion that development is affected by both biology and experience coactively is sometimes referred to as "canalization." This idea is a major tenet of the psychobiological model of growth and development and provides a framework to understand why

individuals do, or do not, develop specific sets of skills that reflect their genes as well as their life experiences.<sup>11</sup> This concept is very similar to the ecobiodevelopmental framework proposed in the AAP policy statement and technical report on toxic stress.<sup>8,12</sup> Although occasional stories appear of extraordinary disadvantaged youth who have overcome the myriad negative experiences of their childhood, for most children early adversity casts a long shadow into their adulthood and even into the next generation.<sup>13</sup> This technical report provides an analysis of the current research on child poverty and mechanisms by which poverty and other factors associated with disadvantage influence the health and well-being of children. This report is especially appropriate immediately after the 50th anniversary year of President Johnson's War on Poverty.<sup>14,15</sup>

## OVERVIEW OF POVERTY, RELATIONAL HEALTH, AND TOXIC STRESS

Poor families experience a plethora of stressful challenges that influence health.<sup>16</sup> Housing and food insecurity are 2 examples of social determinants of health that contribute to health disparities in childhood.<sup>17,18</sup> Poverty is an independent determinant of health through its adverse effect on family relationships, also called relational health.<sup>19</sup> Relational health in early childhood is the ability to form secure attachments with engaged, responsive caregivers in a safe, stable, and nurturing emotional environment<sup>20</sup>; it is an essential protective factor for the development of emotional regulation and resilience and the ability to cope with adversity during an individual's lifetime.<sup>21</sup>

Family relational processes can be affected by both biological and psychosocial pathways. For example, parents' poverty-related stress can

activate children's stress mechanisms or children's immune systems, and economic hardship has been associated with depressed parental mood and marital conflict.<sup>22</sup>

Poverty has direct negative effects on early brain development through the mechanism of toxic stress. The pathophysiology of toxic stress consists of frequent, unremitting activation of the hypothalamic-pituitary-adrenocortical (HPA) axis stress system and chronic elevation of cortisol as well as inflammatory mediators. The most common physiologic adaptive response to stress involves activation of the HPA axis and the sympathetic-adrenomedullary system. This activation results in increased levels of stress hormones, such as corticotropin-releasing hormone, cortisol, norepinephrine, and adrenaline. These changes occur at the same time that other mediators are released, such as inflammatory cytokines.<sup>23,24</sup> Although transient increases in these hormones are protective and may be necessary for survival, very high levels or prolonged exposures can be harmful and even toxic for the human body.<sup>25</sup> The dysregulation of this combination of physiologic mediators (eg, too much or too little cortisol or inflammatory response) can create a "wear and tear" effect on a number of organs, including the brain.<sup>26</sup> The overall stress-induced burden on body functioning and the aggregated physiologic and psychological costs required for coping and returning to homeostatic balance have been termed "allostatic load."

The chronic stress of poverty during early childhood development is associated with an impaired ability of the prefrontal cortex to suppress the amygdala, the "on switch" for the stress response.<sup>27</sup> Prefrontal lobe dysfunction impairs executive control<sup>28</sup> of affect regulation and impulsive behavior, and the epigenetic, anatomic, and

neuroendocrine disruption related to chronic toxic stress may impair learning, behavior, and interpersonal relationships.<sup>29</sup> This dysregulation adversely affects physical and mental illness throughout the life course. The combination of impaired self-regulation and chronic stress may lead to maladaptive behaviors, such as smoking, excessive alcohol intake, overeating, promiscuity, and substance abuse, that transiently turn off the stress response but over the life course may cause morbidity and early mortality.<sup>30,31</sup>

In summary, poverty and other social determinants of health adversely affect relational health. Poor relational health, particularly the absence of emotional support by a nurturing adult, increases the risk of childhood toxic stress and difficulties in emotional regulation, early child development, and eventually, lifelong health. Prolonged activation of the body's stress response becomes intolerable in the absence of the buffering effect of a supportive adult relationship.<sup>32</sup> On the other hand, with good relational health and family stability, a child who experiences stress is more likely to turn off the physiologic stress response in a timely manner and avoid the adverse consequences.<sup>8,33</sup> Programs focused on building self-regulation in impoverished children have been shown to improve executive function and decrease chronic stress.<sup>34</sup> Thus, poverty-related stress may be tolerable if good relational health is present as a protective factor. Recommendations made in the accompanying policy statement,<sup>35</sup> "Poverty and Child Health in the United States," are based on emerging research and evaluation findings that support the notion that the brain development of a child experiencing poverty and his or her health during the life course may be protected from harm by programs that foster improved parent engagement and relational

health within the family and help to buffer the chronic stress of poverty.<sup>34,36</sup>

## **DEFINING AND DESCRIBING POVERTY IN THE UNITED STATES**

Poverty is defined as a state in which one lacks a usual or socially acceptable amount of money or material possessions to provide for his or her basic needs, which typically include food, water, sanitation, clothing, shelter, health care, and education.<sup>37</sup>

### **Federal Poverty Level**

In the United States, the current method of operationalizing and measuring poverty is called the federal poverty level (FPL). Each year, the US Department of Health and Human Services develops a set of poverty guidelines and thresholds on the basis of family size and family composition. These guidelines and thresholds are based on census data and are loosely referred to as the FPL. The income and demographic data for FPL estimates are collected within the Current Population Survey, an annual and nationally representative household survey jointly conducted by the US Census Bureau and the US Bureau of Labor Statistics within the US Department of Labor.

The FPL was developed in the early 1960s on the basis of data from the US Department of Agriculture's 1955 Food Consumption Survey. That research in the 1950s found that the average US family spent one-third of its pretax income on food. By using the US Department of Agriculture's Economy Food Plan, a bare-bones plan designed to provide a healthy diet for a temporary period when funds are low, the federal poverty measure was determined by multiplying the budget for the basic food plan by 3.

The federal poverty measure has not changed fundamentally since 1969, except that it is adjusted annually

for overall food price inflation, as measured by the Consumer Price Index. Thus, the FPL reflects 1950s living standards and has not been adjusted to reflect changes in needs associated with the dramatic increase in 2-parent working families and the improvement in the standards of living that have occurred over the past 45 years, which have significantly changed the composition of the family budget. Food now accounts for approximately 15% of the budget, and the proportion allocated to work-related costs, child care, housing, and transportation has increased substantially. If the same methodology of the basic food basket were applied today, the FPL would be more than 2 times higher than the current level.<sup>38</sup> However, it is also important to note that the FPL does not take into consideration government cash or near-cash subsidies, such as the Supplemental Nutrition Assistance Program (SNAP), the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), housing subsidies, low-income home energy assistance, or earned income and child tax credits. The FPL also does not account for variations in medical costs across population groups or geographic differences in the cost of living. To account for geographic variations in the cost of living and to include income-transfer programs listed above, in 2010 the National Academy of Sciences<sup>39</sup> conducted a study of current family budgets and developed the Supplemental Poverty Measure (SPM).<sup>40</sup>

Individuals and families living below the FPL are referred to as “poor” (in 2014, this was \$15 379 for a 2-person family and \$24 230 for a family of 4).<sup>2</sup> Research suggests that, on average, families need an income equal to at least 2 times the FPL to meet their basic needs.<sup>41</sup> Families with incomes up to 200% of the FPL are referred to as “low income” (\$48 460 for a family of 4). Families at 50% of the

**TABLE 1** Definitions of Poverty

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Low-income: income at 150% to 200% of the FPL
Poverty: income less than 100% of the FPL
Extreme or deep poverty: income less than 50% of the FPL
Sources:
Low-income: <a href="http://datacenter.kidscount.org/data/tables/118-children-living-in-low-income-families-below-200-percent-of-the-poverty-threshold-by-family-nativity?loc=1&amp;loct=2#detailed/2/2-52/false/36,868,867,133,38/78,79/451,452">http://datacenter.kidscount.org/data/tables/118-children-living-in-low-income-families-below-200-percent-of-the-poverty-threshold-by-family-nativity?loc=1&amp;loct=2#detailed/2/2-52/false/36,868,867,133,38/78,79/451,452</a>
Poverty: <a href="http://datacenter.kidscount.org/data/tables/52-population-in-poverty?loc=1&amp;loct=2#detailed/2/2-52/false/36,868,867,133,38/any/339,340">http://datacenter.kidscount.org/data/tables/52-population-in-poverty?loc=1&amp;loct=2#detailed/2/2-52/false/36,868,867,133,38/any/339,340</a>
Deep poverty: <a href="http://datacenter.kidscount.org/data/tables/45-children-in-extreme-poverty-50-percent-poverty#detailed/1/any/false/36,868,867,133,38/any/325,326">http://datacenter.kidscount.org/data/tables/45-children-in-extreme-poverty-50-percent-poverty#detailed/1/any/false/36,868,867,133,38/any/325,326</a> ; <a href="http://www.ers.usda.gov/amber-waves/2014-march/poverty-and-deep-poverty-increasing-in-rural-america.aspx#VSkziLrVQba">http://www.ers.usda.gov/amber-waves/2014-march/poverty-and-deep-poverty-increasing-in-rural-america.aspx#VSkziLrVQba</a>

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FPL are considered to be living in “deep poverty”; in 2014, 9.3% of children younger than 18 years in the United States lived in deep poverty, representing 32.7% of people living in deep poverty (Table 1).<sup>2</sup>

Family income is not the only, or perhaps best, indicator of poverty. Family wealth, defined as the total value of family assets such as housing, monetary savings, investments, etc, may be a more important measure of both family financial stability and the capacity to sufficiently provide for children. The wealth gap has widened significantly since the recent economic downturn. In 1995, the disparity of median household wealth (net assets) between white families and for both black and Hispanic families was 7:1. By 2009, at the end of the Great Recession, the median household wealth for white families was 18 times that for Hispanic families and 20 times that for black families.<sup>42</sup> Other measures of financial status or stability include measures of educational achievement, quality of housing, and stability of employment, all of which contribute to quality of life more directly than does a moderate increase in income or net wealth.<sup>43</sup>

### Challenges With the Poverty Measures

Current poverty measures all have inherent difficulties, and attempts have been made to compensate for them. For example, these measures are point-in-time or prevalence measures of poverty. However,

individual and family poverty and deprivation are not static; family income changes over time. Moreover, poverty and deprivation most strongly affect children and families over time. To measure the longitudinal dimension of poverty, researchers use recurring surveys, such as the Panel Study of Income Dynamics,<sup>44</sup> a nationally representative survey that interviewed respondents (including families with children) annually from 1968 to 1997 and biennially thereafter.<sup>45</sup>

Another problem with a federal measure of poverty is that the cost of living varies significantly by region. In 2012, the estimated cost of meeting a family’s basic needs for a family of 4 was approximately \$64 000 per year in Los Angeles, California; \$57 000 in Newark, New Jersey; \$46 000 in Indianapolis, Indiana; and \$42 000 in Jackson, Mississippi.<sup>46</sup> This variation is not taken into account by the FPL but is taken into account by the SPM. As a result, in high-cost areas (eg, New Jersey, California), the SPM indicates higher poverty rates than does the FPL, and in lower-cost areas (eg, Mississippi) the SPM indicates lower poverty rates than does the FPL.<sup>38</sup>

### PREVALENCE AND CHARACTERISTICS OF CHILD POVERTY IN THE UNITED STATES

By using the FPL, the percentage of children younger than 18 years living in poverty declined significantly

during the 1950s and 1960s,<sup>47</sup> but from the mid-1970s until 2010 the proportion of children living in poverty increased, rising strongly during economic recessions and declining modestly during periods of economic growth.<sup>38</sup> From 2007 to 2010, the percentage of children in poverty increased from 18% to 22%, an increase of 3 million children living in poverty. From 2010 to 2014, the child poverty rate was stable and did not appreciably increase or decline.<sup>2,48</sup> In 2014, 9.3% of children lived in extreme poverty, with their families earning less than 50% of the FPL.<sup>2,49,50</sup>

## Demographics

### Age.

Younger children are more likely to be poor or low income than are older children. In 2013, 25% of children from birth to 5 years of age were poor and 48% were low income, compared with adolescents, 19% of whom were poor and 41% of whom were low income.<sup>51,52</sup> In other words, poverty and low income have the highest prevalence among the most vulnerable members of our society during the most critical time in their development.

### Race, Ethnicity, and Immigrant Status.

Race and ethnicity are particularly strong determinants of both individual- and community-level poverty. In 2014, 12.3% of white children and 13.4% of Asian children lived below poverty level, compared with 37.1% of black children and 31.9% of Hispanic children.<sup>2</sup> In 2013, 25.8% of children in the United States had at least 1 immigrant parent. The poverty rate among children of immigrant parents in 2013 was 28.4%.<sup>53</sup>

### Parental Education.

Higher levels of parental education decrease the likelihood that a child will live in a low-income or poor family. Among children with at

least 1 parent with some college or additional education, 13% are poor and 31% are low income. By contrast, among children whose parents have less than a high school degree, 57% are poor and 86% are low income.<sup>46</sup>

### Parental Employment Status.

Children with a parent who is employed full-time, year-round are less likely to live in poor families than are children with parents who work part-time or part of the year or who are not employed. Of children with 1 parent who works full-time, year-round, 9% are poor and 31% are low income. In contrast, of children in families with no parent who works full-time, 48% are poor and 74% are low income. It is important to note that almost half (49%) of low-income children and 28% of poor children have at least 1 parent employed full-time, year-round.<sup>44,46</sup>

### Family Structure.

Single-parent families are more than 4 times more likely to be poor than are 2-parent families.<sup>48</sup> Among all single female-headed families, 42% are poor and 69% are low income compared with 12% and 32%, respectively, for 2-parent families.<sup>46</sup> A major contributor to poverty in the United States is the increase in the proportion of children who live in single-parent families. In 1960, 87.8% of children were living in 2-parent families, compared with 64.4% in 2014.<sup>54</sup> The absence of fathers in the home is associated with a fourfold risk of poverty. Children of single mothers are also at greater risk of infant mortality, child maltreatment, failure to graduate from high school, and incarceration.<sup>55,56</sup>

Children being raised by same-sex parents are twice as likely to live in poverty, compared with children living in households with heterosexual parents.<sup>47,57</sup> The average household income for families headed by same-sex parents

is 20% lower than that of families headed by heterosexual parent couples.<sup>57,58</sup> Moreover, only 51% of same-sex parent couples with children own their homes, compared with 71% of married heterosexual parent couples with children. A higher proportion of same-sex parent couples raising children live in states with high poverty rates: Mississippi, Wyoming, Alaska, Arkansas, Texas, Louisiana, Oklahoma, Kansas, Alabama, Montana, South Dakota, and South Carolina. In the past, because of limited federal and state recognition of spousal relationships between same-sex couples, families headed by same-sex couples were denied access to many family-income support programs.<sup>58</sup> However, recent Supreme Court decisions invalidating section 3 of the Defense of Marriage Act (which provided federal definitions of marriage that precluded federal recognition of same-sex marriages)<sup>59,60</sup> and the June 26, 2015, Supreme Court decision (*Obergefell et al v Hodges*) upholding the legality of marriage between same-sex couples should improve access to federal income-support programs for same-sex married couples.<sup>61</sup>

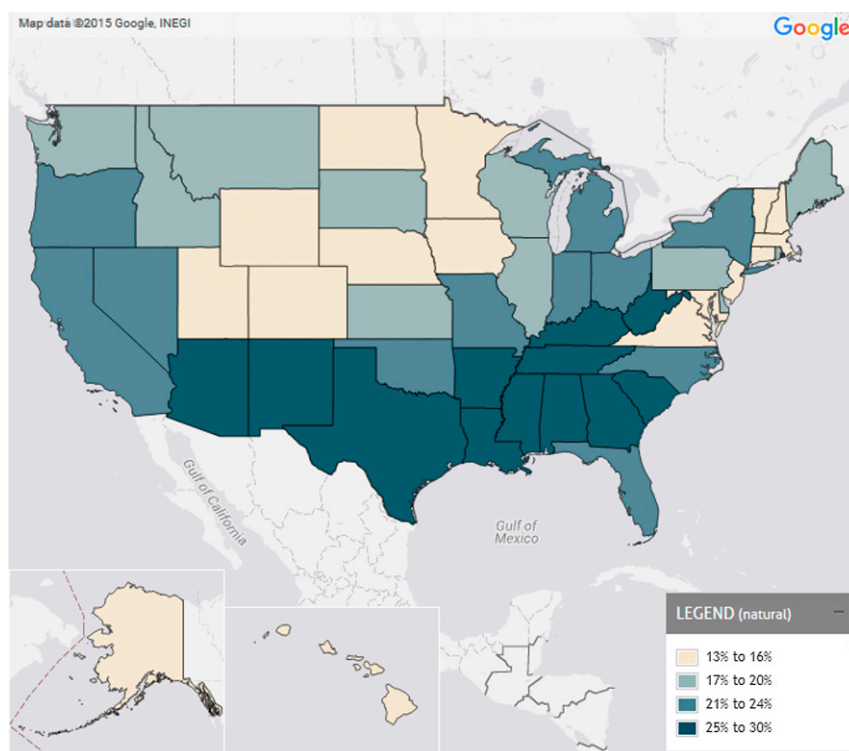
## Geography

The overall national child poverty estimates mask important geographic variation in poverty across states, cities, and neighborhoods. In 2014, the percentage of children living in poverty ranged from 13% in Maryland, New Hampshire, Utah, and Wyoming to 30% in New Mexico. As shown in Fig 2, the southern states have higher levels of child poverty than do the northern states.<sup>62</sup> More substantial variation in community poverty exists among large and small cities and neighborhoods. Among large metropolitan regions, the prevalence of poverty rates varies from a high of 36% (eg, McAllen-Edinburg-Mission, Texas, and Fresno, California) to a low of

8% (eg, Washington, DC-Arlington/Alexandria, Virginia, and Bridgeport-Stamford-Norwalk, Connecticut). At the neighborhood level, poverty can be even more concentrated in particular areas. More than 4% of children live in neighborhoods of very concentrated poverty, defined as neighborhoods in which  $\geq 40\%$  of households are poor. Twenty percent of children live in “poverty areas,” defined as neighborhoods in which 20% to 39% of households are poor.<sup>63</sup>

Black, Hispanic, and American Indian/Alaska Native children are more likely to live in neighborhoods of concentrated poverty than are either Asian or white non-Hispanic children. Almost two-thirds of black, Hispanic, and American Indian/Alaska Native children live in areas of concentrated poverty, compared with one-third of white children.<sup>38</sup> As the severity of poverty in areas increases, the disproportionate representation of black, Hispanic, and American Indian/Alaska Native families and children increases to between 33% and 43%, compared with only 14% for white families.<sup>38</sup> Consistent with these data, recent studies show that residential segregation by income has increased over the past 30 years. The analysis found that 28% of lower-income households in 2010 were located in a majority lower-income census tract, up from 23% in 1980, and that 18% of upper-income households were located in a majority upper-income census tract, up from 9% in 1980.<sup>46,64</sup> That is, poverty and wealth are becoming more concentrated in very different neighborhoods.

An additional aspect of the geography of child poverty is that rural poverty rates have been historically higher than urban poverty rates, and rural poverty has increased more substantially in



**FIGURE 2**

Children in Poverty 2014: analysis of Census Bureau American Community Survey data. (Reprinted with permission from the Kids Count Data Center, a project of the Annie E. Casey Foundation; <http://datacenter.kidscount.org/data/Map/43-children-in-poverty-100-percent-poverty?loc=1&loc=1#2/any/false/869/any/322/Orange/>.)

recent years, to 26.7% compared with 20.9% for metropolitan areas.<sup>65</sup> Since 2008, city suburbs have experienced the fastest growth in poverty of any population area. Children living in neighborhoods and communities characterized by concentrated poverty are more frequently exposed to environmental toxins, poorly performing schools and child care settings, community violence, and fewer community and social supports. The accumulation of multiple environmental risks found in areas of concentrated poverty undermines the healthy development of children.<sup>66</sup> Therefore, poor and minority children are in double jeopardy because of the lack of resources within their own families and the exposure to detrimental influences or lack of social supports in areas of concentrated poverty in urban, suburban, and rural areas.

### Timing and Duration

Investigators from the Urban Institute studied the duration and severity of poverty among a sample of children over an interval of 18 years using data from the Panel Study of Income Dynamics. They found that 10% of children were persistently poor (more than 9 years) and another 10% were poor for 4 to 8 years. Persistent poverty differed significantly by race. Approximately 37% of black children were poor for more than 9 years of their childhood, whereas 5% of white children were persistently poor.<sup>67</sup> Children who experience poverty also tend to cycle into and out of poverty, and even the most persistently poor children spend intermittent years living above the FPL. The investigators also found that being poor at birth is a strong predictor of future poverty status: 31% of white children and 69% of black children who are poor at birth

go on to spend at least half their childhood living in poverty.

Another important observation is that the effects of poverty are cumulative, and poverty in 1 period of a child's life hinders development in another stage or even into adulthood.<sup>68</sup> Shonkoff and colleagues<sup>5</sup> asserted that a "scientific consensus" has evolved on the origins of adult disease as a direct result of childhood adverse experiences and that childhood adverse experiences affect adult health either through "cumulative damage" or "biological embedding of adversities" that are related to adult disease.

## THE PATHOPHYSIOLOGY OF POVERTY

### Toxic Stress

An important concept in understanding the well-documented childhood gradient of morbidity and mortality is "toxic stress," a concept related to the change in stress hormones in response to experience over time.<sup>69</sup> For challenges of limited duration, the body's response is twofold: turning on a response that initiates a complex hormonal pathway and then shutting it off as the challenge resolves. The most common response involves the sympathetic nervous system and the HPA axis. Catecholamines are released from nerves and the adrenal medulla that stimulate a cascade within the HPA axis that results in the secretion of adrenocorticotropin from the pituitary gland. Adrenocorticotropin hormone stimulates cortisol secretion by the adrenal cortex. Although the immune-enhancing effects of acute stress have been observed to last 3 to 5 days, during the state of toxic stress the delayed hypersensitivity response is substantially blunted. When stress is chronic and continuous, such as the stress associated with chronic poverty, response systems, including the HPA axis and the sympathetic

adrenal system, are on "high alert." As a result, stress hormones, such as cortisol, are relatively high.

Appropriately labeled "a biology of misfortune" by Boyce,<sup>70</sup> the observation about toxic stress described above is supported by 2 recent studies. The Family Life Project was designed to follow young children and their families with high levels of poverty in eastern North Carolina and central Pennsylvania from the index child's birth through 4 years of age.<sup>71</sup> A representative sample of 1292 children were selected and home visited at approximately 7, 15, 24, 36, and 48 months of age. Salivary cortisol samples were collected at each home visit. During the first 4 years of the study, the statistically significant predictors of higher cortisol levels were black race, poor-quality housing, and 2 or more adults leaving the home before the index child's fourth birthday. Older children were studied by Evans and Kim,<sup>72</sup> who monitored overnight urinary cortisol concentrations to assess "chronic physiologic stress." Children were assessed in wave 1 at approximately 8 years of age and in wave 2 at 13 years of age with 12-hour overnight urinary free cortisol samples. After controlling for urinary cortisol concentrations in wave 1, urinary cortisol concentrations in wave 2 were significantly related to duration of family poverty. In addition, more time living in poverty for children aged 13 years old was related to a more attenuated cardiovascular response to an acute stressor. This pattern of chronic elevated HPA axis activity, muted cardiovascular response, and a gradient of cumulative risk for children living in poverty corroborates the findings of a large longitudinal British study that found the self-reported health of study participants aged 23 years old was related to a number of risk factors that began in childhood.<sup>73</sup>

## Chronic Inflammation

Another biological process that may have a direct effect on the negative health outcomes observed in adults who experienced child poverty is chronic inflammation. Ziol-Guest et al<sup>74</sup> reported on a nationally representative sample of adults from the Panel Study of Income Dynamics. Adult study subjects (30–41 years of age) who experienced child poverty were more likely to report arthritis or hypertension and limitations in daily activities compared with adults who did not experience child poverty. Although the investigators noted the lack of direct measures of immune function in their study, earlier work has described a link between low social class early in life and chronic inflammation.<sup>75</sup> Facilitated by other exposures and genetic liabilities, chronic inflammation drives the pathogenic mechanisms that ultimately result in chronic disease.<sup>76</sup> In addition, animal research in mice has identified upregulation of inflammatory gene expression in the presence of social stress.<sup>77</sup>

## THE ENVIRONMENT OF POVERTY

Children growing up in low-income families and low-income neighborhoods face a daunting array of psychosocial and environmental inequities that undermine their healthy development. The exposure to multiple stressors may be a unique, critically important feature of the environment of children growing up in poverty. Compared with their economically advantaged counterparts, children living in poor families and poor neighborhoods are exposed to more family turmoil, violence, and separation from their families.<sup>65</sup> Children from low-income families hear fewer words between age 1 and 3 years and the context of the language to which they are exposed is more negative and punitive compared with higher-income families.<sup>78</sup> More

than one-quarter of poor children (28%) live in families with divorced or separated parents compared with less than 5% of children in the highest income group.<sup>79</sup> Almost half (45%) of children with single mothers live in poverty, compared with 13% of children from 2-parent families.<sup>80</sup> Low-income children also are much more likely to experience housing instability and multiple moves.<sup>81,82</sup> The physical environment of low-income children is more hazardous than that of higher-income children, because they are exposed more frequently to pollution, lower-quality homes, and dangerous neighborhoods.<sup>83</sup>

### **Unintentional Injuries and Child Maltreatment**

Although mortality among US children has decreased over the past 15 years, injury and violence still account for nearly 50% of all childhood deaths after the first birthday.<sup>84</sup> Children from the lowest socioeconomic stratum have a death rate from unintentional injuries that is 5 times that of children from higher socioeconomic strata. Poor families are more likely to reside in homes without functional smoke detectors and with open fires, unprotected windows, and unsafe roofs or stairs. They may live close to dense, fast-moving traffic and lack safe areas in which to play.<sup>85</sup> Children in poor neighborhoods are at increased risk of cycling accidents, pedestrian injuries, falls, burns, poisonings, and chemical burns.<sup>86</sup> If children in the least healthy communities experienced mortality rates from unintentional injuries and homicide similar to those of the most resource-rich communities, overall US child mortality would decrease by one-third.<sup>87</sup>

Injuries from child maltreatment and developmental consequences of neglect also are risks for poor children. Recent survey data confirm that both poverty and income

inequality are positively associated with the rates of protective service referrals for child maltreatment.<sup>88</sup> Within families, poverty is associated with intimate partner violence, maternal depression, single-parent families, and parental substance abuse, all of which are risk factors for child maltreatment.<sup>89</sup> In 1998, Felitti et al<sup>90</sup> published the Adverse Childhood Experiences (ACE) Study, a landmark study that linked adverse childhood experiences, including childhood maltreatment, and mortality in adults. A recent study<sup>88</sup> corroborated the association between child poverty and child maltreatment at the county level for each of the 3142 counties in the United States. Child maltreatment is a global problem<sup>91</sup> that has a well-documented association with later negative physical and mental health outcomes in adults.<sup>92</sup> Although toxic stress has a role in the association between child maltreatment and later mental and physical health problems,<sup>93</sup> posttraumatic cognition (eg, an individual's appraisal or interpretation of the traumatic event or events) is another putative mediator.<sup>94</sup> Posttraumatic cognitions may act to either attenuate the adverse effects of child maltreatment or prevent healthy coping. Dysfunctional posttraumatic cognitions may lead to poorer health outcomes for the victims of child maltreatment.<sup>95</sup>

### **ADVERSE PSYCHOSOCIAL AND ENVIRONMENTAL EFFECTS OF POVERTY AND LOW INCOME ON CHILDREN**

#### **Inadequate Housing and Neighborhoods**

Place matters. Where a child lives contributes to health disparities and predicts health inequities.<sup>96</sup> In addition to experiencing food insecurity, poor families may have difficulty maintaining adequate housing, heat, and utilities. In 2011, more than 45% of all households

with children reported housing problems, including multiple moves, overcrowding, and physically inadequate housing as well as inability to pay the rent.<sup>97</sup> An estimated 1.6 million American children experienced homelessness in 2010.<sup>98</sup> Household energy security (ie, the costs of home heating, cooling, and utilities) can present a constant struggle for low-income families. Researchers at the pediatric research center Children's Health Watch have identified energy insecurity as a risk to child health that is often found among families who are also food insecure.<sup>99,100</sup>

Poverty affects where and how families live. Housing options are often limited to urban areas with crowding, violence, and lack of safety; to rural areas that are isolated and lack social support<sup>66, 101</sup>; or to suburban neighborhoods that are either ethnic enclaves or affected by foreclosures and deteriorating housing stock. A large body of research has documented the relationship between neighborhood conditions and health.<sup>102</sup> For example, poverty is a risk factor for lead exposure in the home, and poor black children are twice as likely as poor Hispanic and white children to have concentrations of lead in their blood of at least 2.5 µg/dL (33% vs 17% and 13%, respectively).<sup>103,104</sup> There is an interaction between race and poverty, and not all poor children have the same experience. It appears that poor black children are more likely to be exposed to lead than poor children from other races.

Poor neighborhoods expose families to a variety of barriers and harms. Poor families often face elevated levels of crime, violence, and toxic exposure inherited from the days of racial segregation, now referred to as spatial racism, when communities of color were targeted for diminished resources and toxic industry. Areas of concentrated poverty also may lack quality schools, sustainable jobs,



health care facilities, safe recreation spaces, and other resources that support healthy community activities.<sup>105,106</sup>

### **Limited Access to Developmentally Appropriate Experiences and High-Quality Educational Opportunities**

Poor families may have difficulty obtaining resources that support child development and provide a nurturing and stimulating home environment. Data from the National Longitudinal Survey of Youth indicate that children in poor households have less access to learning materials and experiences, including books, stimulating toys, skill-building lessons, and other enriching experiences.<sup>107</sup>

In addition to individual family characteristics, funding and resources for schools make a difference in achievement. Forty-three percent of public school principals reported that the condition of their school facility interfered with classroom instruction.<sup>108</sup> Smaller class size, which requires more money, has been shown to produce lasting gains, particularly for economically disadvantaged students.<sup>109</sup> School funding formulas vary by state but are often dependent on property taxes, which can exacerbate economic disparities between communities. Unless the state has a formula that equalizes resources, poor communities tend to have less to spend per pupil than do wealthier communities. In 1 study, communities with 22% of students in poverty spent one-third as much per pupil as communities with 6% of students in poverty (\$4000 vs \$13 000 annually).<sup>110</sup>

### **Suboptimal Nutrition**

Food insecurity is defined as limited or uncertain availability of nutritionally adequate and safe foods.<sup>111</sup> An estimated 20% of households with children in the United States experienced food

insecurity during 2013.<sup>112</sup> The rate of food insecurity for children living in poverty is nearly 40%.<sup>113</sup> Although children are often shielded from very low food security, in approximately 10% of households with children (more than 3.9 million households), children did not have access to adequate, nutritious food at some time during the year. Food insecurity has a significant effect on both physical and cognitive development, because the lack of adequate, nutritious food increases the likelihood of iron-deficiency anemia, lower academic achievement, and behavioral problems.<sup>114</sup>

Paradoxically, US children from the poorest communities have the highest rates of obesity.<sup>115,116</sup> In fact, children from poor families are 7 times as likely to be obese as they are to be underweight.<sup>117</sup> The origins of this obesity paradox are likely multifactorial but may stem from the fact that foods high in calories, fats, and added sugars tend to cost less than do nutrient-dense foods, and many low-income families face challenges in obtaining high-quality, nutritious foods.

## **EFFECTS OF POVERTY**

### **Infant Mortality, Adolescent Pregnancy, and Low Birth Weight**

Higher infant mortality rates among the impoverished have been recognized as a societal problem in the United States for 140 years.<sup>118</sup> Children in the poorest 20% of urban populations in the United States are twice as likely to die before their first birthday compared with children in the richest 20% of the population.<sup>119</sup> The risk of teen pregnancy increases 10-fold for the lowest income level compared with the highest,<sup>120</sup> and teen pregnancy increases the risk of remaining in poverty in the future.<sup>121</sup>

Low birth weight is often used as a marker for infant and child outcomes

and has been found to be a leading predictor of first-year mortality risk.<sup>122</sup> The increased risk of low birth weight in poor neighborhoods is associated with a high prevalence of teen pregnancy and inadequate prenatal care.<sup>123</sup> Low birth weight also may be related to the development of adult illness through epigenetic adaptation to intrauterine nutritional deficiencies (Barker hypothesis).<sup>124</sup>

### **Delayed Growth and Development**

The effects of poverty on both growth and development manifest in early infancy. For example, low-income children have measurable gaps in language development beginning at the time of their first words, resulting in substantial differences in school readiness.<sup>78</sup> These differences may be mediated by aspects of the early home environments, including less reading aloud by parents and more exposure to electronic media.<sup>125</sup> The influence of poverty on physical growth also can be measured in early childhood. According to the 2009 Pediatric Nutrition Surveillance Survey, 6% of children qualifying for federal nutritional assistance from birth to age 4 years were of short stature, compared with 3.7% of all US children of the same age.<sup>116</sup>

### **Chronic Conditions**

In addition to the high rate of obesity, poor children 6 to 18 years of age are more likely to be sedentary and exposed to tobacco when compared with their wealthiest counterparts, which may increase the risk of cardiovascular and pulmonary disease as adults.<sup>126</sup> Low family income during the first 2 years of life is associated with a twofold increase in the rate of hypertension in early adulthood.<sup>74</sup>

Chronic poverty also is associated with increased frequency of asthma attacks as well as worse overall health status reported by parents.<sup>127, 128</sup> The neighborhood in which

the family lives has a particularly strong effect on the prevalence of asthma, with asthma occurring much more frequently in neighborhoods with predominantly poor and nonwhite populations than in those with higher-income and white populations.<sup>129</sup> Characteristics of poor neighborhoods associated with the increase in asthma morbidity include crowding, air pollution, dampness, and the presence of pests.<sup>130</sup>

Untreated early childhood caries are 2.5 times more common in children in poor families than in families with incomes above the FPL. The application of dental sealants and the rate of visits to a dentist are also lower for poor children.<sup>131</sup>

### **Compromised Mental Health, Behavioral Health, and Relational Development**

Children raised in poverty have been shown to have higher levels of depression and antisocial behavioral problems than those raised in families with adequate incomes. Depression in poor children younger than 18 years has been linked to substance abuse, poor academic performance, teen childbearing, and unemployment.<sup>132</sup> Poor children also are more likely to be diagnosed with conduct disorders<sup>133</sup> and attention-deficit/hyperactivity disorder.<sup>134</sup> Substance abuse, including alcohol and tobacco, is higher for poor adolescents, increasing the risk of emphysema and cirrhosis as well as cancer.<sup>135</sup> Parental depression and anxiety are common in low-income families and associated with well-documented adverse effects on children's relational and emotional development.<sup>136-138</sup>

### **Poor Academic Progress**

Many observational studies confirm the link between low socioeconomic status and poor achievement in school, both in primary and secondary education.<sup>139</sup> This

association is mediated by factors such as school violence,<sup>140</sup> family structure,<sup>141</sup> parental involvement at school,<sup>142</sup> and parental involvement in education at home.<sup>143</sup> Early intervention is critically important in this domain, because the disparities between poor and nonpoor children are already apparent at school entry.<sup>144</sup>

Data from 2013 revealed that 89% of fourth-grade students from low-income families read below the proficiency level, compared with 49% of students from higher-income families.<sup>145</sup> The national high school drop-out rate is 7.4% for low-income students and 1.4% for high-income students.<sup>146</sup> For students taking the SAT in 2012, students from families at or below the FPL averaged in the 30th percentile on reading and students from families with incomes greater than \$200 000/year scored in the 70th percentile.<sup>147</sup>

Studies that used functional MRI have shown that socioeconomic factors are associated with brain-behavior relationships in the acquisition of reading skills.<sup>148</sup> A longitudinal study that included multiple MRIs on 389 typically developing children found that childhood poverty was associated with structural differences in several areas of the brain important in the development of school readiness skills. The most significant changes were observed in children from the poorest families.<sup>149</sup> Adequate nutrition; a quiet, safe, toxin-free environment; and the effective, timely detection and treatment of chronic childhood health conditions are all factors that enable children to arrive at school each morning ready and able to learn.<sup>129</sup> Several putative mediators are well established in the relationship between poverty and school underachievement. Almost 17 million children are from families "at risk" of going hungry,<sup>150</sup> and even intermittent food insufficiency in

low-income children is associated with a number of adverse academic outcomes, including poor scores on achievement tests, grade repetition, and absenteeism, compared with children who are never hungry. In addition, chronic high-noise environments and exposure to indoor air pollution, especially passive smoking, have been associated with decreased academic performance. It is estimated that asthma accounts for approximately 10 million days of school missed each year, 3 times the amount of missed school for children without a chronic health condition.<sup>151</sup> In a recent analysis of data from the National Center for Health Statistics (2009-2011), asthma prevalence was associated with both urban and nonurban poverty.<sup>152</sup>

### **TRACKING IN HEALTH CARE SETTINGS**

Compared with the *International Classification of Diseases, Ninth Revision, Clinical Modification*, the *International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM)*<sup>153</sup> provides a more robust classification system that enables clinicians to track socioeconomic factors in patient care that may be related to families' annual income level. By using the ICD-10-CM, child health clinicians can submit supplemental codes for their patient care that include not only diagnosis, such as acute asthma exacerbation, but additional socioeconomic factors related to the asthma exacerbation and treatment, such as childhood poverty or the family's inability to afford the recommended medical regimen. It will be important to capture this additional socioeconomic information with the use of ICD-10-CM codes to enable investigators to examine the putative impact of expanded codes on children's health care.

## CONCLUSIONS

Knowledge about the effects of poverty on children and their development has increased dramatically since Brooks-Gunn and Duncan's often cited (over 65 000 citations) landmark study in 1997.<sup>154</sup> In the 21st century, Sir Michael Marmot has emerged as a global leader in studying the social determinants of health. Since 2005, Marmot has led the World Health Organization's Commission on Social Determinants of Health.<sup>155</sup> His 2009 article published in the *Journal of the American Medical Association*<sup>156</sup> noted that a global mortality gradient exists among poor and rich countries. Evidence supports the hypothesis that the slope of a health gradient is not fixed but responds to political, social, and economic changes.<sup>157</sup>

Research is rapidly accumulating that refines our understanding of the mediators of poverty's adverse effects on children and adults and informs the implementation of effective interventions to ameliorate poverty's adverse effects.<sup>158</sup> For example, recent research has strongly suggested that stress related to child poverty may be buffered by parent engagement and good relational health. The AAP policy statement that accompanies this technical report describes specific recommendations and population health strategies that could attenuate the adverse effects of child poverty and address many of the mediators of poverty that affect child health and development. Addressing the immediate needs of our youngest and poorest citizens is both the right thing to do for our children and an economically sound strategy for the future.<sup>159</sup>

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## ABBREVIATIONS

AAP: American Academy of Pediatrics  
FPL: federal poverty level  
HPA: hypothalamic-pituitary-adrenocortical  
ICD-10-CM: *International Classification of Diseases, 10th Revision, Clinical Modification*  
SPM: Supplemental Poverty Measure

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