Child Poverty and the Promise of Human Capacity: Childhood as a Foundation for Healthy Aging

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ABSTRACT

The effect of child poverty and related early life experiences on adult health outcomes and patterns of aging has become a central focus of child health research and advocacy. In this article a critical review of this proliferating literature and its relevance to child health programs and policy are presented. This literature review focused on evidence of the influence of child poverty on the major contributors to adult morbidity and mortality in the United States, the mechanisms by which these associations operate, and the implications for reforming child health programs and policies. Strong and varied evidence base documents the effect of child poverty and related early life experiences and exposures on the major threats to adult health and healthy aging. Studies using a variety of methodologies, including longitudinal and cross-sectional strategies, have reported significant findings regarding cardiovascular disorders, obesity and diabetes, certain cancers, mental health conditions, osteoporosis and fractures, and possibly dementia. These relationships can operate through alterations in fetal and infant development, stress reactivity and inflammation, the development of adverse health behaviors, the conveyance of child chronic illness into adulthood, and inadequate access to effective interventions in childhood. Although the reviewed studies document meaningful relationships between child poverty and adult outcomes, they also reveal that poverty, experiences, and behaviors in adulthood make important contributions to adult health and aging. There is strong evidence that poverty in childhood contributes significantly to adult health. Changes in the content, financing, and advocacy of current child health programs will be required to address the childhood influences on adult health and disease. Policy reforms that reduce child poverty and mitigate its developmental effects must be integrated into broader initiatives and advocacy that also attend to the health and well-being of adults.

KEYWORDS: adult health; child health; child poverty; developmental origins of health and disease

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OVERWHELMING EVIDENCE SHOWS that one's experiences in childhood can influence patterns of illness, aging, and mortality later in life. This evidence base is so deep and has emerged from so wide an array of disciplines and investigative strategies that there seems little rational basis to question this linkage between early life and adult health. The challenge in the consideration of poverty in childhood, therefore, is less to restate the veracity of the effect of child exposure on adult health than it is to make sense of this linkage in a manner that guides and ultimately motivates a coherent vision for an effective, collective response. This seems particularly important at a historical moment when child poverty and inequality are of urgent concern. This review cannot include all the pertinent studies being generated by a rapidly proliferating life-course literature. Rather, it attempts to provide a critical assessment of the most useful recent reports and reviews in the hope of generating the evidence and synoptic clarity required to guide how child health care practice and policy must change.

POVERTY, DEPRIVATION, AND CAPABILITIES

Poverty implies deprivation. However, deprivation of what remains a complex and often controversial issue. Absolute notions of poverty recognize that at some level material deprivation can be so severe that it can undermine physical efficiency and ultimately result in death. Such absolute definitions of poverty often rely on nutrition as a core requirement, as does the official poverty line in the United States. Relative definitions stress the minimum levels of resources required for social participation and how one perceives their own social or economic standing compared with others in their community or society. Although helpful for some purposes, an alternative approach articulated by Sen stresses the centrality of "capabilities," or the freedoms a person has to be or do something of fundamental value.[1] Although this approach includes such essential capabilities as access to adequate nutrition or good health, it also recognizes freedoms to address inherently social challenges, such as the avoidance of shame or humiliation,[2] a basic achievement first tied to the definition of poverty by Adam Smith.[3] Although more comprehensive

than strategies using simple income measures, the capabilities approach has been operationalized widely and used as the basis for the United Nations Human Development Index.[4] The capabilities approach is particularly attractive in assessing the importance of childhood as it emphasizes poverty as a process, and for our purposes, a developmental process, less defined by a monetary level per se than of freedoms to transform resources into valuable states or activities, such as being safe, having self-respect, or attaining a good job. In this manner, the capabilities approach speaks to questions of justice and underscores the human capacity to strive, adapt, and craft technical and social mechanisms that facilitate capability attainment. A broad capabilities approach also permits this critical review to address a highly diverse literature that uses a variety of poverty measures and metrics of adverse exposures that provide context for material and social deprivation in childhood. It is also a useful reminder that the metrics used to assess poverty in much of the life-course literature should in no way be considered fully adequate to capture the complexity and varied mechanisms by which economic and social deprivation shape and reshape health and well-being over the life-course.

THE EFFECT OF CHILDHOOD EXPOSURES ON ADULT HEALTH

Although several recent reviews have underscored the wide variation in the time frames, social settings, and analytic strategies used to assess the relationship between childhood socioeconomic status and adult outcomes, a large majority of studies have revealed strong inverse associations between childhood status and adult patterns of morbidity and mortality.[5–8] In addition, recent arguments have suggested that the development of adult health and disease should be integrated into a larger framework of healthy aging.[9–11] Therefore, this review has been focused on the adult outcomes most likely to define healthy aging, chronic illness, and functional impairment.[12]

The most extensively studied relationship between childhood socioeconomic status and adult health outcomes has been in cardiovascular conditions. Although most cardiovascular conditions are expressed symptomatically later in life, there is a growing body of evidence documenting etiologic abnormalities in childhood.[13–15] Although the precise processes involved in this relationship are likely manifold, childhood status and experiences[16,17] have been related to a variety of risk factors and associated conditions operating in adulthood, including hypertension,[18–20] obesity,[17,21,22] diabetes,[23,24] smoking,[25] and biomarkers for cardiovascular disease.[26,27] However, systematic reviews of this literature have suggested that the nature and strength of these relationships can vary[28,29] and adult influences might be considerable.[7,14,23,30–32]

Evidence regarding the effect of childhood socioeconomic status on overall adult cancer has been more mixed.[33] Stomach cancer might be related to childhood infection with *Helicobacter pylori*[34,35] and several cohort analyses have suggested that some socially related parameters, including birth weight and young child growth patterns, are related to prostate, breast, and lung cancers.[36] Although the known relationship between women's use of diethylstilbestrol in pregnancy and adenocarcinoma of the vagina and cervix in their daughters illustrated the potential for gestational effects on adult cancer development, several recent studies have enhanced concerns that fetal and early life exposures to endocrine disruptive drugs or toxins can increase the risk for adult-onset cancers of the breast.[37] Fetal exposures might also alter stem cell communities in ways that could affect breast oncogenesis.[38]

Low childhood socioeconomic status and other adverse early exposures have been associated with long-term mental health conditions.[39–43] Social isolation[44] and bullying[17] during childhood can also affect the risk for adult depression and related disorders. However, studies also suggest a substantial influence of adult attributes or exposures.[39,43,45,46] Minimal childhood effects were noted for later stress sensitivity and its relation to depression.[40,47,48] The nature of these relationships is exceedingly complex and studies have suggested that parental maltreatment, parental divorce, and problems with early attachment, can affect the development of interpersonal capabilities and diminished support networks in adulthood.[49] In addition, the development of substance abuse, including of alcohol and tobacco, can have its roots in childhood and influence virtually all domains of mental health in adulthood.[46,50,51] There is also some evidence that early influences, including cognitive and language abilities, can influence the development of dementia in the elderly.[52,53]

Although studies of the relationship between childhood poverty and adult respiratory disease is somewhat mixed,[5] several recent studies have reported low childhood socioeconomic status and increased childhood adversities are associated with adult respiratory conditions.[33,54] These influences might operate through early lung development[55] or the development of asthma in children[56–58] and adults.[59,60] Adult osteoporosis and age-related fractures appear to be related to factors that occur in early life, childhood, and adolescence.[61] Peak bone mass is gained during puberty and factors such as physical activity, diet, and tobacco use can alter these developmental processes. In addition, there is growing evidence that maternal nutrition, fetal development, and slow height attainment during childhood can also affect bone growth and ultimately patterns of osteoporosis and fracture decades later in life.[62,63]

MECHANISMS OF EFFECT

FETAL/INFANT EXPOSURES AND EPIGENETICS

Although the evidence supporting the association of child poverty and later adult health is strong, the precise mechanisms by which this association is generated

continue to be the focus of intense investigation. In many ways, the recent dramatic growth in life-course research was set in motion by a series of epidemiological studies by Barker and colleagues relating altered fetal growth to the risk of cardiovascular disease in adults.[64,65] It has been postulated that these relationships are the product of a failed predictive adaptive response in utero[66–68] in which fetal metabolic systems adapt to a constrained nutritional environment only to be followed postnatally by the far less constrained nutritional environments of rapidly urbanizing societies. This mismatch between the predicted and actual nutritional environments can result in maladaptive metabolic processes and long-term increases in the risk of morbidity and mortality, particularly if fetal growth retardation is followed by accelerated weight gain in early childhood.[21,69,70] There is also a growing body of evidence that environmental contamination can generate changes in immunological and neurodevelopmental processes early in life.[71,72] Social inequalities in the exposure to these contaminants, including heavy metals, endocrine disruptors, and air pollutants are widespread and represent another potentially important mechanism by which poverty in early life can affect health across the lifespan.[73–75]

There is growing evidence from animal and human studies that epigenetic processes might serve as a primary mechanism for these biologic processes.[67,76] Epigenetic interactions operate by altering the functional expression of genes in response to environmental stimuli and can serve as a mechanism for nongenetic heritability in which an epigenetic predisposition can be transferred from one generation to the next.[77] Although the science of the epigenome is still in its infancy, there is already strong recognition that epigenetics likely plays a powerful role in shaping patterns of health and disease in a constantly changing external world.[78] There is also evidence that adverse fetal growth might result in altered development in a number of organ systems including a reduced number and function of nephrons[63,64,79,80–82] and pancreatic β-cells.[83]

Chronic Stress and Inflammation

All organisms alter their behavior and physiology to adapt to an environmental challenge or stress. When this process of constant adaptive response, often labeled allostasis, must confront a particularly intense or persistent stress over long periods of time, this response, or allostatic load, can result in perturbations in a variety of systems, including stress hormones, inflammation, endothelial function, and metabolic cascades.[14,84–86] Many of the well documented health effects of racial, ethnic, and gender-related discrimination over all life stages might be best understood in this context.[87–89] Although these effects operate in adult life, early life exposures can alter stress reactivity in childhood, generally related to the hypothalamic–pituitary–adrenal axis and enhanced inflammatory states.[90–93] Whereas epigenetic processes are likely involved in these interactions, they appear to be highly complex[94,95] and generate considerable individual heterogeneity in stress response.[96] There are also recent studies suggesting that highly stressful early exposures might alter the development of certain brain structures during gestation and early life.[95,97] However, although human actions are at some level always determined by underlying neurologic processes, the role of these observations in shaping complex human behaviors or life capabilities remain, although intriguing, largely speculative and potentially subject to misinterpretation.[96,98,99]

McEwen and colleagues in a series of useful reviews, suggest that the effect of early stress operates as a dynamic, adaptive system involving complex interactions between neurologic, autonomic, immune, and metabolic systems.[86,100,101] Models proposed by Belsky et al,[102] Boyce and Ellis and colleagues,[103–105] and Del Giudice and colleagues[106] emphasize the interaction of early life processes with ongoing plasticity to create adaptive capacities, or resilience, in responding to the contingencies of life in complex societies. There is remarkable heterogeneity in how different children respond to the same apparent stress or even in how the same child responds to the same stress at different points in time. For this reason, the oft-used categories of "toxic," "tolerable," and "positive" stress are best thought of as stress responses and not as stresses themselves.[107] Although children must be protected from all forms of child maltreatment, factors that help children succeed despite stressful challenges, what some have called "grit" or even plainly "character" have generated considerable interest in the research[108] and lay communities.[109,110] Indeed, one must ask whether resilience can be created without some meaningful exposure to stress in childhood. Some caution, therefore, should be used in labeling any painful but high prevalence experience, such as parental divorce or the death of a grandparent as being inherently toxic in itself. In addition, the use of composite indices of stressful exposures, such as Adverse Childhood Experiences (ACEs) should also be used cautiously because they tend to collapse high prevalence exposures together with relatively rare and far more severe exposures into a single metric.[111,112] More broadly, child poverty can be conflated with specified exposures, such as severe physical or emotional abuse or those delineated in the ACEs literature. Whereas there is some evidence that ACEs are increased in materially poor households,[108] exposure to ACEs occurs in all social and economic groups. Indeed, it is often forgotten that the original ACEs studies were conducted in largely middle-income families.[113]

Development of Health-Related Behaviors

Perhaps the strongest associations between early life processes and adult health lie in the development of adverse, health-related behaviors in childhood. Adult patterns of smoking, physical activity, dietary preferences,

and the use of media have all been shown to have strong roots in childhood and that social status in childhood and adulthood are related to these patterns.[114,115] Economic hardship can reduce the quantity and quality of nutritious foods available to families.[116] Physical activity might be constrained for low-income children, from reduced school-based programs as well as diminished availability of safe play areas in poor neighborhoods.[117] There has been an increasing awareness of the important role of neighborhood, community support, and the built environment in shaping health-related behaviors and parenting norms.[118–120] However, it should also be noted that adverse health-related behaviors might actually be adaptive to local challenges or at least mitigate the immediate effect of stress and social contestation.[100,121]

The Legacy of Chronic Illness in Childhood

Poverty increases the likelihood and severity of chronic illness in children.[122] Improved survival of children with conditions traditionally characterized by high childhood mortality, such as cystic fibrosis, sickle cell disease, complex congenital heart disease, and the increase in developmental and mental health conditions in childhood have together contributed to an increasing prevalence of chronic illness in older children.[123] Approximately 30% of all children have some form of a chronic health problem; approximately 15% require an increased use of health care services; and approximately 7.5% have a condition that limits usual activities.[122] This conveyance of child health problems into adulthood has become a meaningful contributor to adult health patterns and underscores the importance of the transition of children's care to adult health systems, particularly for poor children who might lose insurance and other benefits confined to childhood.[124]

Amenability to Intervention and Failed Access

The etiology of any given health disorder per se does not affect its inherent amenability to intervention. The effects of completely genetic disorders such as phenylketonuria can be prevented through the environmental alteration of diet; epigenetic effects are not only potentially reversible but also are also highly dynamic throughout life[78,125]; head injuries from bicycle crashes can be prevented through helmet use. Therefore, one should not confuse the language and metaphors often used to describe early life influences, such as "embedding," "programming," or "trajectories," as implying that nothing can be done subsequently to modify or even eliminate their effect on functioning later in life.

Failed access to effective interventions, therefore, can potentially play a role in transforming poverty's influences in early life into adult health problems. Policies intended to enhance access to effective interventions must conform to accepted social strategies, which can vary substantially between countries with diverse political histories and values.

Translating the Evidence Base into Practice and Policy

The diversity and complexity of early influences on lifelong health suggests that there are likely a multitude of ways programmatic interventions and policies could improve child well-being and consequently enhance the potential for a healthy adulthood. However, there are 4 opportunities that deserve special attention, because they represent particularly promising uses of the child health community's strategic expertise as well as arenas that have been inadequately addressed or purposefully devalued by the child health community in practice and policy deliberation.

Poverty Reduction and Parental Well-Being

The most fundamental response to reducing the long-term effect of poverty in childhood is to reduce the prevalence of poverty in childhood. Although this challenge has been addressed creatively by a variety of disciplines,[126] it remains essential that the child health community recognize its strategic role in confronting child poverty in public discourse and policy deliberation. This strategic role is technical and political in nature and should be responsive to, but distinguished from, the strategic roles of other disciplines, such as economics, sociology, and psychology. Technical expertise in child development and pathophysiology conveys a special role to the pediatric and child health community to identify the mechanisms and power of poverty to shape child, and ultimately, adult well-being. This can draw upon basic and applied insights. The strategic political responsibilities of the child health community are rooted in the dual attributes of narrative and public trust. Child health professionals see poverty's effect in ways that few others in society can. Stories matter and, while protecting privacy, the child health community can help move public opinion through narratives that convey the suffering and resilience child health professionals witness every day. These strategic capabilities, however, are useful only if the public trusts that the pediatric and child health community is fundamentally committed to the well-being of children and not merely the parochial interests of a pediatric and child health guild during a period of unprecedented change in the financial basis of health care in the United States.

In this context, it is essential that the child health community link more directly, technically and politically, child health and the well-being of parents. Too often, the child health community has attempted to advocate for children by uncoupling and elevating children's claims above those of the parents.[127] Children are poor because their parents are poor. The child health community can strategically underscore the inherent link between child and parental well-being and join other disciplines in providing an evidence base and public advocacy for strategies that have been particularly effective in reducing severe poverty over the past several decades. These include full employment and minimum wage initiatives, the Earned Income Tax Credit and the Supplemental Nutrition Assistance Program (formerly known as Food Stamps).[128]

EARLY CHILD INTERVENTIONS AND PARENTAL SUPPORT

A series of highly influential analyses from Heckman and colleagues[129–131] have emphasized the importance of early life through a "skill begets skill" model in which early capacities help determine the acquisition of new, subsequent capacities.[132] This dynamic, developmental complementarity argues strongly for the importance of early life exposures and events.[129] However, it also recognizes the heterogeneity of effect and the potential for substantial interaction with later exposures, interventions, and adaptive processes. Indeed, there is good evidence that there are usually a combination of mechanisms by which early life exposures and processes contribute to health later in life.[133–135] Despite its wide use in advocacy, there is not much evidence that early exposures have a permanent and unalterable effect on outcomes through "critical period" or latent models of effect. Rather, evidence suggests that early development is better characterized as possessing sensitive periods, for which subsequent interaction, modification, and opportunities for effective intervention potentially exist.[136] Accumulation models suggest that early and later socioeconomic status influences have a cumulative effect on adult health and disease.[32,137] However, in addition to sensitive period and cumulative effects, there are also likely to be chains of risk mechanisms by which early factors determine the presence of influential factors occurring later in a causal pathway. Significantly, most life-course studies report risk associations and not the actual attributable contribution of early life factors to the prevalence of adult health problems. Although low birth weight might be significantly associated with adult cardiovascular disease, the vast majority of adults with cardiovascular problems were not born at low birth weight. Risk associations are helpful in elucidating mechanisms but they do not necessarily speak to clinical or public health importance.

Developmental complementarity and chains of risk models emphasize the importance of early life intervention strategies. A cogent analysis by Elango et al[138] documented the beneficial impact of early education and childcare programs, including long-term effects. These effects are dynamic, involving a complex interaction between cognitive and noncognitive influences. However, it should be recognized that early child education represents a downward extension of a long accepted social strategy in the United States: public education. New educational approaches that emphasize emotional well-being and noncognitive developmental and stress-regulation capacities are also worthy of more extensive implementation and evaluation.[108]

Other strategies that do not rely on public education infrastructure, such as providing social support to young families in poverty, paid parental leave for minimum wage earners, or strengthening child care availability and quality might not relate to accepted social strategies, particularly if they confront traditional notions of parental responsibility or autonomy. These critical but more challenging public strategies might prove more difficult to implement. New social strategies that relate to community development and the built environment might provide acceptable social strategies that have not traditionally addressed child or family well-being.[119] These kinds of highly integrated strategies that cross many traditional programmatic boundaries might require new governance structures capable of coordinating complex community and family support services.[139]

MANAGING THE PRECURSORS OF ADULT HEALTH AND DISEASE

Life-course science is placing an increasing burden on pediatric practice to more effectively manage the childhood precursors of adult-onset disease. New discoveries will also continue to redefine traditional adult and elderly disorders as life-long processes. Stronger and more creative approaches are urgently required to ensure that clinical pediatric practice has the tools and financial infrastructure to prevent, identify, and manage risks generally related to conditions that might only become symptomatic much later in life.[140] New predictive indicators, including genomic, epigenomic, and related biomarkers of precursor conditions will continue to be developed. These could ultimately help navigate known variations in the response to exposures and interventions.[141,142] Pediatric practice is currently poorly prepared for this expanded role. Improved training, decision support, and care systems as well as major reforms in the financial and organizational structure of pediatric practice and hospital-based care will be required.[143]

A COMMITMENT TO THE HEALTH OF WOMEN

The child health community must strengthen its commitment to the health of women. The importance of early life, including gestation, has made healthy childbearing a central concern of life-course epidemiology and policy. In general, the pediatric and child health community has operationalized this concern by focusing on the health of women only to the extent that it affects that of the newborn.[127] This has been expressed as a longstanding emphasis on the provision of prenatal care. More recently, this commitment has been expanded to include preconceptional and interconceptional care. Although helpful at some level, all of these positions remain referent to baby-making and in reality, are of little practical utility.[144] A careful examination of these framings will instead suggest that preconceptional, prenatal, and interconceptional care should be transformed into a comprehensive commitment to women's health regardless of pregnancy status. This should include practice-based referral mechanisms that ensure that every woman bringing her child in for care has access to high-quality care for herself. More broadly, it is time that the child health community expand its advocacy to include improving the general well-being and access to primary and reproductive health services for all women in need.

POLICY AND RESPECT FOR HUMAN CAPACITY

Poverty in early life is foundational in shaping adult health and healthy aging. It is foundational in the sense

that it generates the exposures and crucial substructure of physiological and behavioral processes that can shape adaptive capabilities over the entire life-course. Poverty in the United States has never been more heavily concentrated in childhood than it is today, a historical phenomenon that has defied business cycles and the party affiliations of presidents over the past 4 decades. This societal reality coupled with the foundational role of early life are sufficient to justify policies that reduce levels of childhood poverty and mitigate their implications for lifelong health. In this manner, the evidence reviewed in this article strongly supports calls for enhanced investment in early childhood,[145,146] particularly if followed by continued interventions over the full course of childhood and adolescence.[147] The evidence is clear and overwhelming.

However, the ravages of poverty are not confined to childhood. Capability approaches to poverty are as relevant to adults as children. Adult deprivation, adult maltreatment, and racism experienced in the workplace or in confrontations with police exact their own toll on adult health and patterns of aging. In addition, important social and physiological transitions occur during adulthood, such as pregnancy,[148] that can affect later health and well-being. Virtually all of the studies documenting the importance of early life experiences on adult health and aging also document the profound effect of experiences, behaviors, and processes occurring subsequent to reaching the age of majority.

A critical reading of life-course science emphasizes the utility of models that stress not the limits conveyed by any particular developmental period but by the opportunities they represent for effective adaptation, intervention, and investment. A model that emphasizes less the trauma of American childhood but the human capacity for individual, familial, community, and societal response to material and social deprivation seems not only far closer to the scientific evidence but also to the requirements of policy and collective action.[149] Despite the difficulties it might raise for effective advocacy, complexity in early life development is not only real but essential in creating robust, protective, adaptive capacities.[150] The findings of this review suggest that the evidence supports a highly integrative policy approach that does not confine the determinants of life opportunities, and therefore claims to societal resources and freedoms, to one developmental period. Rather, the science suggests that while childhood poverty is foundational to lifelong health it is also only part of the story, a story that unfolds in the mosaic of exposure and adaptation that human capacity, and therefore justice, demands at all stages of life.

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