Chapter 18

Should we intervene to improve childhood circumstances?

W. Thomas Boyce and Daniel P. Keating

This chapter reviews epidemiological and developmental findings of relevance to the question, ‘Should we intervene to improve childhood circumstances?’ We begin with observations on the ‘circumstances’ of contemporary children in an international context, arguing that, despite major advances, there are reasons for continuing concern over the physical and social settings in which children are born and raised. The implications of such conditions, when considered within the framework of social disparities in mental and physical health, are disquieting. Social class gradients in morbidity are shown to be pervasive, in the sense that they involve multiple categories of disease within multiple developmental epochs, convergent, in that steeper national socioeconomic gradients in health are generally associated with lower average health outcomes, and enduring, in that socioeconomic-specific childhood experiences are carried forward into health effects in adult life. Further, the observed patterns of childhood socioeconomic status (SES) influences on later health suggest that such influences can be cumulative, in the sense that socioeconomic effects show gradual accretion over time, pathway related, in that SES may alter the trajectories in childhood from which adult health and well-being are derived, or latent, by virtue of experiences during critical developmental periods that have temporally distant consequences. Life course effects of socioeconomic and other adversities in childhood are rendered even more credible by evidence for plausible biological, social, and behavioural mediators of such effects. There is evidence from both human studies and animal experiments, for example, that experiences in early life are involved in the calibration of response characteristics within key neurobiological circuits activated under conditions of stress and adversity. Chronic or recurrent activation of such circuits may be one plausible pathway by which early hardships are transmuted into the disease processes of adult life. The chapter ends with a review of evidence supporting an affirmative answer to the target question and an argument, on both economic and moral grounds, for a societal imperative to protect and nurture the children of the world community.
18.1 Introduction

Children occupy a unique niche within the ecology of human populations. They are the demographic sector most likely both to benefit from a nation’s advances and to be jeopardized by its indifferences and perils. As such, children constitute a subpopulation of disproportionate sensitivity to the social and environmental indiscretions of a society, a generation, or an era. Indeed, children can be usefully viewed as fulfilling a kind of ‘signal detection’ role in the adaptation of human groups, their environmental susceptibilities offering an early warning of threat or risk. Ensuring the environmental safety of children, it has been argued, guarantees the safety of an entire population. Countries and societies thus have moral and public health imperatives to protect children from the environmental hazards—both psychosocial and physical—that can impair health and undermine well-being, within childhood and over the human lifespan.

In many ways, posing the chapter’s title question implies its own answer. Yes, we should intervene to improve the circumstances of children. Why would we not? In fact, rhetorical commitment to this affirmation is now represented among international conventions and government policies at many levels. In an ideal world, the simple affirmation might suffice. In the real world, efforts to advance childhood circumstances are challenged on many fronts. The costs associated with intervention are substantial and compete for priority not only with other items on the social agenda, but also with trends in the political economy to reduce social expenditures more generally. A rhetorical affirmative is thus nearly self-evident, but enacting a national or international policy far more challenging.

To argue for childhood interventions in this more complex policy arena requires substantive evidence and analyses, as well as precision with respect to the focal questions. In this chapter, we attempt both to parse the answer with respect to contemporary evidence and to offer detailed consideration of its critical components. Consider first the implied concluding phrase of the question, in the context of this volume: Should we intervene to improve childhood circumstances in order to improve life course health? An affirmative answer to this question implies a set of related questions, which we consider in detail. Is there evidence that experiences in early development have life course consequences for health? If so, are these consequences substantial enough (that is, account for enough variance in subsequent health outcomes) to warrant significant investment? If so, is there evidence that changes in childhood circumstances reap positive life course health benefits, suggesting that observed associations are more than merely correlational? If so, is there theory and evidence that affords an understanding of the underlying developmental mechanisms, such that interventions can be properly guided and unintended harm avoided? Finally, are the identified interventions feasible in current policy contexts and what arguments can be made to make them more viable?

Drawing on epidemiological, developmental, and biological evidence, we contend that provisionally affirmative answers can be given for each of these linked questions.

At a more fundamental level, there are classical as well as emerging ethical perspectives that give special attention to individuals in vulnerable periods of development, in part due to the inability of not yet mature individuals to argue on their own behalf. These developmental vulnerabilities interact with societal vulnerabilities, increasing risks during periods of high social stress. We suggest that these ethical considerations serve as a crucial underpinning for the scientific and policy debates that are implied by the question that animates this chapter.
18.2 What are the ‘circumstances’ of contemporary childhood?

Acknowledging these special vulnerabilities, many nations of the world have adopted legislation, policies, and practices aimed at protecting the rights and well-being of children, ratifying trans-national agreements, such as the Convention on the Rights of the Child and convening international meetings on children’s interests, such as the 1990 World Summit for Children.

Such rallying and focusing of international attention on issues of child health and welfare has resulted in public health practices that save millions of lives annually. These efforts have led in recent years, for example, to the eradication of smallpox (at least in peacetime) and to the near-elimination of polio, two of childhood’s most feared and destructive infectious diseases. Iodine deficiency, a leading preventable cause of mental retardation, may also soon disappear from the inventory of threats to healthy child development and over 70% of children worldwide have been successfully immunized against measles, polio, diphtheria, pertussis, and tetanus. As a consequence, disability and mortality under age 5 years has progressively declined since the 1960s, in all but a handful of nations.

Despite such advances, at least 600 million children continue to live in poverty, subsisting on less than US$ 1 per day. New infectious threats to the world’s children have also emerged, to replace recently or imminently defeated morbidities. Each day, for example, 8500 children are newly infected with the human immunodeficiency virus (HIV) and 1.4 million children worldwide are living with HIV infection and acquired immunodeficiency syndrome (AIDS). In 2000, 10.4 million children under 15 years of age were orphaned by the HIV epidemic, rendering them far more vulnerable to exploitation and more likely to become infected themselves. Further, as many as one million children are lured or forced into prostitution each year and more than half a billion children grow up in circumstances of national, local, or family violence, resulting, for example, in two million war-related child deaths in the last 10 years. Although an unprecedented 82% of children are now in school around the world, 130 million still have no access to education and among these girls are disproportionately deprived. One-third of children from developing countries do not complete 5 years of elementary schooling, rendering them illiterate, disempowered, and susceptible to a generational cycle of poverty, resignation, and early death.

18.3 Social disparities in health and well-being through the life course

Beyond these well-documented global challenges to children’s health and development, which create heavy burdens not only for individual children but also for the societies whose populations are most affected, there is substantial evidence for socioeconomic effects throughout the life course for both individuals and populations. Socioeconomic influences are dramatically apparent, for example, among indicators of child health status. Despite anti-poverty programmes in place for more than 30 years, the number of poor US children has increased and there is compelling evidence that mental and physical health in childhood are strongly tied to socioeconomic circumstances. Lower SES children are at greater risk for most forms of childhood morbidity, from
injuries and acute illnesses to chronic medical conditions and behavioural disorders. In the Great Smoky Mountains study, poverty was identified as the strongest demographic predictor of psychiatric diagnoses in urban and rural youth. As noted by Keating and Hertzman, these circumstances give rise to a central paradox: the existence of previously unimaginable material wealth and a concurrent deterioration of those human environments in which children grow and develop.

In circumstances where negative effects on child health are severe and widespread, as in the HIV/AIDS epidemic or war-related trauma, life course consequences—that is, childhood effects on the incidence or course of adult morbidities—are even more obvious and dramatic. Indeed, the evidence for life course health effects of early childhood circumstances, even in the absence of observed direct effects on child health, has been growing steadily. For example, numerous studies of the long-term effects associated with gradients in SES in the developed world have established a robust pattern linking childhood SES with adult health status. Such patterns have been extensively reviewed elsewhere (see, for example, References 17–21) and in Chapters 4 and 16 in this volume). It is, however, important to examine these gradient effects more precisely, not only to sharpen the argument that improvement in childhood circumstances will have a beneficial impact on life course health, but also to identify potential mechanisms that govern the effect. Without an understanding of potential mechanisms, recommendations on improving childhood circumstances may be too general as a guide for policy and action.

18.3.1 Key elements of the childhood socioeconomic status and health gradient

As a first step, we can consider key elements of the SES gradient effect as it has been observed across a number of studies. The first element is the pervasiveness of the SES gradient effect. It is observed not only for mortality data at all stages of life, but also for virtually all types of morbidity. Although disease-specific pathways exist, the SES gradient effect appears to function as a more general risk/resilience factor, extending even to measures of competence and behaviour, from literacy and mathematics to emotional and behavioural problems. Given the overall similarity of gradient effects for health and developmental outcomes, a full understanding of the impact of childhood circumstances must therefore accommodate their robust relationship with the broader construct of ‘developmental health’.

A second key element arises from cross-national or cross-regional comparisons of the shape of the SES gradient. A robust pattern is that societies with steeper SES gradients in health have generally lower average health outcomes, whereas societies with flatter gradients have generally higher average health outcomes. Willms has described this as a ‘fan-convergent’ pattern, such that cross-national or cross-regional differences are greatest at the lower end of SES and smallest at the higher end. Although the effects are starkest at the lower end of SES, there is little support for a specific poverty explanation; rather, the gradient effect operates similarly throughout the SES range.

The third key element of the SES gradient is observed in longitudinal datasets, where the prospective impact of childhood circumstances can be directly observed. Where such evidence is available, it appears that SES of the family of origin bears a graded
relationship to adult health similar in pattern and magnitude to that obtained when the individual’s SES is the independent variable (see, for example, Reference 21). Although the generalizability of this finding is constrained by the availability of appropriate longitudinal datasets, the evidence to date is generally supportive.\textsuperscript{18,30,33} The implications of these provisional but key findings are profound, in that they suggest that the SES gradient is both portable (as individuals, on average, carry that legacy into their adult lives) and \textit{enduring} (as life course health effects). Thus, failure to attend to childhood circumstances may create, at the population level, a range of societal burdens that are hard to subsequently shift. Conversely, investments in early development may generate enduring societal opportunities.\textsuperscript{34}

1.8.3.2 \textbf{Patterns of childhood socioeconomic status influence}

There are several hypothetical patterns of influence through which childhood circumstances may affect health outcomes over the life course and for both scientific and policy purposes, it is helpful to attempt a conceptual disaggregation of such patterns.\textsuperscript{18,20,21} This book (especially Chapter 1), as well as other published and forthcoming work (for example, References 35 and 36), represents a substantive attempt to define these patterns of influence and the features by which they can be usefully differentiated. Thus, one pattern progresses through stability of socioeconomic circumstances from childhood to later life, with an \textit{accumulation of risk}—via environmental exposures, social experience, or health-damaging behaviours—occurring over time.\textsuperscript{18,33,35,36} This can be conceived as the product of an individual’s ‘health capital’ over time, a construct with the two major components of environmental conditions and health-related habits.\textsuperscript{19} These can be further disaggregated, with environmental effects arising from both living and working conditions and behavioural effects comprising a range of lifestyles and practices. The implication of this account is that broad societal differences in the quality of the social and physical environment play a major role in health outcomes, through the overall degree of social partitioning and the SES-related patterns that emerge in early life.

A related set of childhood influences may be thought of as \textit{pathway effects}\textsuperscript{18} or \textit{chains of risk or protection}.\textsuperscript{35,36} If we construe the previous set as representing the cumulative effects of contexts over time, this set focuses, in contrast, on the ways in which early circumstances constrain or enable trajectories of health and development. For example, educational attainment plays a substantial role in both subsequent health and social status (as measured by occupation, income, wealth, and so on). Beyond simple continuity of context, the early acquisition of competencies, skills, and dispositions likely affects directly the pathways leading towards future health, well-being, and developmental attainments. Analyses of data from the Dunedin multidisciplinary health and development study, for example, have demonstrated longitudinal associations between low childhood SES and poorer cardiovascular and oral health status (as well as certain aspects of mental health status), independent of socioeconomic circumstances in adulthood.\textsuperscript{37} Such associations are likely attributable to sequences of linked exposures, in which early risk factors increase the likelihood of subsequent exposures, which in turn augment the probability of encountering others.

Another indicator of such pathway or linked effects is the phenomenon of resilience,\textsuperscript{38} in which significant early disadvantage is surmounted. The developmental trajectories
of many children growing up in adverse or suboptimal circumstances belie the expected declines in physical and mental health that are known to attend such conditions. Observations of anomalously good outcomes emerging from impoverished or unsupportive social settings are non-normative, but far from rare. In such accounts, resilience appears often derived from the establishment of chains of protection—individual characteristics and forms of individual support that predispose towards the pursuit of health-protective developmental trajectories.

The third type of influence can be thought of as critical period or latent effects (see Chapter 1). Even after removing the effects from other, later sources—adult SES, health habits, and so on—there is often a non-trivial impact of childhood circumstances on life course health outcomes. For example, the early instantiation of an over-reactive stress response system (described further below) may affect developmental trajectories through success in selected environments (pathway effects), but in addition, may create a health risk that will become manifest only at a later stage in the life course as stressors accumulate or grow more intense. Note, in this example, that the early experiential calibration of stress-responsive neural circuitry might alternately affect later health via risk accumulation (cumulative, long-term costs of repeated activation of biological circuits), pathway effects (exaggerated reactivity biasing developmental trajectories toward risk induction or away from risk protection), or critical period effects (early exposure in, for example, infancy alone results in biological response profiles that jeopardize adult health and adaptation).

Thus, consideration of the SES gradient effect (pervasive, convergent, and enduring) and patterns of transmission (cumulative, pathway, and critical period) leads toward a hypothesis of ‘biological embedding’, a process ‘whereby systematic differences in psychosocial/material circumstances, from conception onward, embed themselves in human biology such that the characteristics of gradients in developmental health can be accounted for’. The term ‘biological embedding’ bears conceptual commonality, if not identity, with the alternate terms ‘embodiment’ and ‘experience-based brain development’. All three refer to the processes by which differential social experiences establish functional and structural changes in the physiology, neurobiology, and gene expression of the individual, particularly in early life. Entertaining the biological embedding hypothesis therefore entails a detailed consideration of the biobehavioural mechanisms linking childhood circumstances and later developmental health gradients.

18.4 Biobehavioural mediators of socioeconomic risk

What are the biological pathways by which socioeconomic liabilities and supports are transmuted into the physical processes of disease and disorder? Are individual differences in the character or functioning of such pathways responsible for the broad variability in consequences of challenge, stress, and hardship? Advances in understanding the mechanisms involved in biological responses to adversity have shed new light on such questions by revealing how early exposures ‘get into the body’ and create vulnerabilities to acute and chronic disease processes. Equally important and compelling are more recent studies suggesting that individual differences in biological sensitivity to aspects of social context may offer an explanation for both disproportionate vulnerability and unexpected resilience. Processes of biological embedding may thus illuminate...
either the *mediating* pathways by which social disadvantages predispose to maladaptive outcomes or the *moderating* processes by which individual children are differentially affected by such disadvantages. As elucidated by Kraemer and colleagues, mediators are variables, which, in this context, explain how or why SES inequalities affect developmental outcomes, while moderators specify in which subgroup or under what conditions such effects will hold. Although the moderation of SES effects is itself a topic of substantial importance for understanding life course development, our focus here is upon plausible mediators of socioeconomic adversity and the possibility that a richer understanding of SES mediation could lead to viable and effective interventions. We begin with a consideration of biological embedding as a possible mediating pathway for socioeconomic risk.

### 18.4.1 Biological embedding as a possible mediator of socioeconomic status risk

Accumulating advances in developmental neuroscience have produced an elegant and compelling picture of brain development and how early experience affects the character and complexity of central neural circuitry. Development of the fetal brain during pre-natal life is characterized by profuse overgrowth of neurones and the synaptic junctions through which networks of neurones communicate. At the height of its pre-natal growth, the brain adds 250,000 new neurones per minute, an exuberant neurogenesis resulting in a central nervous system of staggering complexity. At maturity, the brain comprises more than a 100 billion neurones, each with an average 10,000 synaptic connections to other neural units. All of the basic pathways involved in human emotion, volition, movement, and thought are already in place at birth, awaiting the experiential input that will propel latent pathways into the neural substrates of individual personalities, predispositions, talents, and failings. Over the course of the next several post-natal months, this rich neural network is progressively ‘pruned’, selectively eliminating neurones (through apoptosis, or programmed cell death) and synapses from the less utilized pathways and circuits. It appears that this process of neuronal elimination is as essential to the emergence of normal intelligence, behaviour, and mental functioning, as is the stage of neuronal proliferation that precedes it within fetal life.

Greenough and colleagues (for example, Reference 43) have proposed three distinct mechanisms for this ‘sculpting’ of brain circuitry through the sequential proliferation and elimination of synapses: experience-independent, experience-expectant, and experience-dependent processes. Experience-independent synaptogenesis refers to the formation of synapses without requirement for experiential input, such as the development of taste buds on the tongue. Experience-expectant and -dependent mechanisms, on the other hand, are the pathways through which aspects of social experience are transduced into the neural imprints of environmental experience. Experience-expectant processes reduce the amount of information the genome must carry by relying on information that is dependably present in the normal perinatal environments of the species. An example is the development of vision, in which normal visual input is both anticipated and necessary for the production of ocular neuronal columns in the visual cortex of the brain. These columnar structures fuse two retinal images, one from each eye, into a stereoscopic, three-dimensional representation and if one eye is occluded
during the early, 'sensitive' developmental period, vision in that eye may not ever develop normally due to aberrations in the formation of ocular cortical columns. Experience-dependent induction, by contrast, optimizes adaptation to specific, possibly unique features of the environment by facilitating individual learning of new cognitive structures and information. It is known, for example, that animals raised in complex (rather than impoverished) laboratory environments are cognitively superior on motivated learning tasks due to greater synaptic density and efficiency in several regions of the dorsal neocortex. Greenough and colleagues have thus argued that the neural substrate for the 'expectation' of post-natal environmental influences is the non-patterned, temporary over-production of synapses during an early sensitive period, with a subsequent purging of unessential or under-utilized synaptic linkages.

18.4.2 Experiential effects on stress response systems

Many features of emotional or social development likely depend on unique aspects of such interactions between environmental experience and the child’s developing neurobiology. Indeed, much of what we know as normative human behaviour and cognition is reliant upon this experiential shaping and calibrating of brain structures through the process of neural pruning. Among the neural structures and circuits modified by such early experience are the two principal brain systems involved in responses to adversity and challenge: the locus coeruleus–norepinephrine (LC–NE) system and the corticotropin-releasing hormone or hypothalamic–pituitary–adrenocortical (CRH–HPA) system. The LC-NE system triggers, through dopaminergic pathways from the dorsal pons to the hypothalamus, the activation of the sympathetic arm of the autonomic nervous system, which in turn mediates the so-called 'fight or flight' responses to threat. Such responses include the familiar behaviours and physiological changes that accompany stressors, that is, tremulousness, dry mouth, escalations in vigilance and arousal, and elevations in heart rate and blood pressure. Responses within the CRH–HPA axis—which begin with the activation of the arcuate and paraventricular nuclei of the hypothalamus—result in the production of CRH and cortisol, stress hormones responsible for the regulation of blood pressure, glucose and lipid metabolism, and immune competence.

In both experimental animals and humans, experiences in very early life appear to play an important role in defining and calibrating response characteristics of these two closely coordinated stress response systems, regulating parameters such as their trigger points, response intensities, and the rapidity of their recovery. The work of Meaney, for example, has demonstrated the capacity of early maternal–infant separations in rodent pups to up- or down-regulate the reactivity of the CRH–HPA axis, depending upon the duration and disruptiveness of such separations. Low frequency, short-duration separations (known as 'handling'), for example, appear to alter central glucocorticoid receptor expression in such a way that the early experience dampens adrenocortical responses to stress for the remainder of the infant’s life. More prolonged maternal–infant separations, on the other hand, have the opposite effect, producing adult animals that are systematically over-reactive to subsequent encounters with stressors. Meaney has further shown that the maternal behaviour that mediates these effects is the amount of licking and grooming of the rodent pup, a normative behaviour...
amplified by brief mother–infant separations and capable of altering the expression of genes for cortisol receptors in the hypothalamus.

The work of Suomi and colleagues has similarly shown, in non-human primate species, that early rearing conditions can have regulatory effects on the activation of stress responsive neural systems. As in rodent models, maternal separations produce predictable changes in peripheral and central neural circuitry, altering functional immune competence, up-regulating autonomic responses to physical stressors, increasing CRH expression in cerebrospinal fluid, and producing dysregulatory changes in CRH–HPA axis reactivity. In one study, for example, peer rearing (as opposed to mother rearing) of infant macaques was associated with blunted, down-regulatory changes in the circadian periodicity of cortisol secretion. The work of Sapolsky and Share, among wild olive baboons, has also revealed associations between dominance status and adrenocortical activation, suggesting either that experiences related to social adeptness and dominant hierarchical status tend to lower cortisol levels or that constitutionally less reactive individuals occupy higher status positions. Thus, comparable to observations within rodent models of stress reactivity, studies of non-human primates offer further evidence for social contextual influences on the regulation of stress response systems.

Finally, there is evidence that early social experience—including both trauma and experiences of supportiveness and care—can have important, lasting effects on stress reactivity in the human child as well. Several studies suggest, for example, that disruptions in early attachment relationships are associated with regulatory influences on and disturbances in stress-responsive biological systems. In a study of healthy women by Heim and colleagues, participants with a history of abusive experiences in childhood had dramatically increased levels of CRH–HPA and autonomic reactivity to a standardized laboratory stress protocol. De Bellis and colleagues similarly found increased 24 h urinary excretion of cortisol and norepinephrine among children with abuse-related post-traumatic stress disorder symptoms, in comparison to healthy control participants and Perry reported diminished adrenergic receptors on platelets and increased heart rates in a group of severely abused children. A series of studies by Yehuda and coworkers has further documented the psychobiological sequelae of early abusive experiences, including elevated 24 h urinary cortisol excretion, increased density of lymphocyte glucocorticoid receptors, and enhanced suppression of plasma cortisol responses to dexamethasone, each reflecting disturbances in the regulation of the CRH–HPA axis. In studies of broader societal influences on the development of stress responses, Lupien and colleagues found that lower SES was associated with higher salivary cortisol levels in children as young as 6 years of age and Fernald and Grantham-McGregor observed higher salivary cortisol levels and greater cardiovascular reactivity among growth-stunted children growing up in impoverished neighbourhoods in Jamaica. Steptoe and colleagues have also shown that autonomic responses to laboratory stressors are differentially graded by social class membership.

Downstream from the CRH–HPA and LC–NE axes, the neurotransmitters and hormones that are the effector products of these systems have important influences—both acute and chronic—on a variety of target end organs. Such targets include the structures and cells that coordinate immune surveillance and response, the cardiovascular
and neuroendocrine systems, organs involved in the regulation of metabolic activities, and the brain itself. The long-term consequences of repeated physiological reactivity, over years of stressful or traumatic experience, have been termed \textit{allostatic load}, that is, the cumulative biological costs of achieving homeostatic stability through recurrent psychobiological changes.\textsuperscript{73,74} As elucidated by McEwen and colleagues,\textsuperscript{75–77} the price of persistent, recurrent stress responses triggered by environmental events is a broad array of more enduring physiological changes, including but likely not limited to, alterations in lipid metabolism and the accumulation of abdominal fat, loss of bone minerals, the development of hypertension, the atrophy of nerve cells in the hippocampus, and the development of insulin resistance, leading to increases in glycosylated hemoglobin and type II diabetes mellitus. Allostatic load across the life course is clearly cumulative, but it may also operate at various points during the life course to deflect or further solidify particular developmental pathways; moreover, the ‘breaking point’ of the stress response system, when effects become evident as specific health problems, may be partially set in early life. The acuity of stress reactivity, integrated over years of developmental time, may produce the chronic burdens of allostatic load and the repeated challenges of an adverse and difficult life may become the degenerative changes of aging and decline.

Taken together, rodent, non-human primate, and human research all suggest that, in addition to genetically derived individual differences in stress reactivity, environmental factors contribute to the attunement and calibration of biological stress response systems over the course of early development. These studies further suggest that, while stable individual differences in stress reactivity emerge with maturation, there is pronounced early plasticity in the neurobiological systems that subserve such reactivity.\textsuperscript{78} There is also provisional evidence for a central developmental role of primary attachment relationships and maternal behaviour in shaping, constraining, and regulating psychobiological responses to experiences of future challenge and difficulty. The biological perturbations that reliably—but variably—accompany the social, economic, and psychological stresses of life may thus represent one credible mediating link between early adversity and health over the life course.

18.4.3 \textbf{Socioemotional and behavioural mediators of social class disparities}

Observations of social environmental influences on biological response characteristics are not surprising, however, given known disparities in the material and psychological resources of different SES groups and the deep influences of early childhood experience on social and biological development. As substantively reviewed in Chapters 4 and 16 of this book, children from lower SES backgrounds experience less adequate nutrition,\textsuperscript{79} more conflictive and fewer positive communications with their families,\textsuperscript{80} less warmth in parental relationships,\textsuperscript{81} and (variably) both over- and under-control of their behaviour.\textsuperscript{82} Lower SES may also undermine health through psychological mediators, such as hostility, hopelessness, or a diminished sense of control over life circumstances.\textsuperscript{83} Children from impoverished homes enter adulthood with more hostility and hopelessness,\textsuperscript{84} known risk factors for depression and heart disease\textsuperscript{85,86} and an impaired sense of control, which predicts poorer overall health status in adults\textsuperscript{87} and children.\textsuperscript{88} Those experiencing early hardships—such as parental divorce, domestic
violence, or a substance- or alcohol-abusing family member—are also at heightened risk for the acquisition of harmful health behaviors, such as smoking. Higley and colleagues have shown that early deprivation in infant macaques results in reduced serotonin turnover and a predisposition toward risk-taking behaviour and alcohol abuse. Though limited to experimental animals, these observations are important, because they identify the socioemotional and behavioural sequelae of the social, economic, and psychological challenges faced by low-SES families. Although lower childhood SES is demonstrably a risk factor for more frequent, accelerated, and severe morbidities in both childhood and adulthood, too little is currently known of the behavioural and interpersonal mediators and causal processes by which such risks are conveyed.

18.4.4 The role of social ordering per se: human and primate evidence

Another relatively unexplored, potentially mediating aspect of the SES–health association is the possibility that social ordering per se is a mechanism for socioeconomic influences on health. Resembling the dominance structures of primate troops, human children as young as 2–3 years of age form stable, linearly transitive social hierarchies within weeks of their assembly into social groups. Among possible reasons for the evolutionary preservation of such hierarchical organizations is the diminution in interpersonal aggression that follows development of stable, socially ordered relationships. Pre-school social hierarchies become increasingly fixed as children develop and in older children, such structures appear less dependent upon agonistic behaviours, but are rather more reflective of peer friendships and affiliative interactions. Dodge and colleagues have also shown that family SES may influence developmental outcomes through effects on parenting and child behaviour. Lower class children, who are more likely to experience harsh discipline and punitive parent behaviour, display more aggression than higher SES peers and are therefore more often rejected and marginalized within their social groups.

The social positions of young children may also affect psychobiological and neuroanatomical features that can lead to specific disease processes. In primate animal models, Sapolsky and Share have shown that a subordinate social position is associated with chronically upregulated adrenocortical secretion, lower gonadal steroids, and impaired immune competence and Kaplan and colleagues have demonstrated accelerated coronary atherogenesis among subordinate monkeys fed a high-cholesterol diet. Such social position-related differences in psychobiological arousal may have consequences for either the incidence or severity of disease. Summarizing three prospective studies of social status and host susceptibility to infection, Cohen demonstrated that low SES and low perceived social status in humans, as well as subordinate social positions in monkeys, have in common a pattern of decreased host resistance to experimental inoculations with respiratory viral pathogens. In one study, low-SES volunteers exposed to rhinovirus were three times more likely to develop clinical infections than were higher-SES volunteers. In a second paper, participants’ self-assessments of low status relative to others in the same community were associated with increased rates of infection following exposure, independent of smoking status, sleep, alcohol consumption, or exercise. In a third, chronically stressed, subordinate monkeys had a higher incidence of infection following nasal inoculation with virus.
The most direct evidence for the possible role of social ordering in child health outcomes, however, is derived from pilot studies recently completed at the Institute of Human Development, University of California, Berkeley. In a cross-sectional study examining social position, stress reactivity, and health problems in pre-school age children, Goldstein and colleagues found that children in higher social positions in their pre-school groups showed lower heart rate reactivity, lower baseline salivary cortisol concentrations, lower parasympathetic and sympathetic reactivity, and fewer parent-reported chronic medical conditions. Notably, these results parallel findings by Lupien and colleagues, showing that low-SES children have significantly higher salivary cortisol levels than high-SES children and by Steptoe and colleagues, demonstrating poorer cardiovascular recoveries from stressors among lower-grade UK civil servants. Together, these findings indicate that social position is itself associated with illness and health risk factors in ways that are comparable to the health correlates of dominance in subhuman primates and to the effects of SES on health in human adults. The influence of SES on child health may be both analogous and partially attributable to the biologically mediated effects of low position within the ‘pecking orders’ of childhood social groups.

18.4.5 Childhood as critical period

As summarized above, early experiences of both trauma and protection may structurally alter the developing brain by their transcription into its evolving neural circuitry and by their other influences upon molecular systems of neurotransmission. These processes may also be time dependent, in two senses: (1) in that social experiences occurring within developmentally timed critical periods may have disproportionately large effects or (2) in that the character of experiential effects may vary with developmental stage. In an example of the former, Essex and colleagues found that exposures to maternal stress during infancy sensitized children's CRH–HPA axis, resulting in heightened cortisol responses to concurrent stressors, several years later, in the pre-school period. Similarly, studies of children born during the Dutch famine suggested that only exposures to maternal under-nutrition early in gestation affected lipid profiles and coronary disease risk, while significant increases in rates of major affective disorders in adulthood were related only to exposures in the third trimester. Parallel experimental work has shown that stress hormone administration in pregnant sheep produces increases in offspring blood pressure if given at a gestational age of 1 month, but not 2 months. The biological substrate for such period-restricted developmental effects may be the capacity of certain social, nutritional, and biophysical exposures to turn on and off the expression of genes regulating aspects of growth, behaviour, and neuroendocrine functions.

A literature review by Chen and colleagues, summarizing how SES differences in children's health vary with age, demonstrated the second category of time-dependent experimental effects—in which the character or direction of the effect varies within developmental time. The review cited three possible developmental models of the relationship between SES and child health: (1) a persistence model in which SES differences in health are established early in life and remain relatively constant (as, for example, in severe asthma), (2) a childhood-limited model in which SES effects are initially large but gradually diminish over time (for example, incidence of injuries), and (3) an adolescent-emergent
model in which SES differences are initially modest but increase with development, becoming most apparent in the teenage years (as in, for example, physical inactivity, a risk factor for heart disease). Among the prevalent sources of morbidity and mortality in childhood, different disorders and health conditions thus appeared to follow different models of SES–health associations over the course of development. The period of development in which children or adolescents are exposed to a particular risk factor is therefore capable of influencing the magnitude, and even the direction, of its health altering effects.

18.5 The case for intervention and experimentation: benefits to health

Despite the time-dependent effects of early experience on developmental outcomes, childhood is not destiny and there are thankfully few events so traumatic and prevalent as to alter irreversibly the health trajectories that originate, for most individuals, in the early years of life. There is also reason to believe that simple caretaking practices in the ordinary, day-to-day experiences of children can have disproportionately large effects on the direction and plasticity of such trajectories. In a seminal theoretical paper comparing the determinants of morbidity in 'sick individuals and sick populations', Rose pointed out that the disease risk factors most difficult to identify are always those with the highest prevalences in the population under study. Thus, in a population in which every individual smoked, lung cancer would be principally attributed to genetic variation, thereby overlooking the etiologic role of smoking itself. In work examining 'hidden regulators' in the maternal behaviour of rats, Hofer advanced a related argument, noting that some of the most prevalent behaviours and features involved in maternal–infant interactions play regulatory roles in the homeostasis and calibration of infant physiological systems. Just as highly prevalent risk factors are more difficult to detect, the preventive, health-promoting effects of the most ubiquitous and mundane aspects of parenting, even in human species, may prove difficult to discern. Aspects of the care and support of young children and families—routine in many societies, cultures, and human subgroups—may play essential, but often 'hidden', roles in the prevention of disorder and the preservation of health.

Indeed, evidence is now quite compelling that the experiences of childhood—those both extraordinary and mundane—have visible and enduring life course effects that are disproportionate in magnitude and, at times, anomalous in direction. Although substantial gaps remain in our knowledge of such effects, there is sufficient reason and justification to advance both research and policy agendas in parallel. As Keynes noted with respect to economic policy, it is better to be 'vaguely right than precisely wrong'. What is rather urgently needed is better articulation between the research and the policy agenda. There are also needs for a monitoring scheme to provide feedback on policy and programme successes and failures and a conceptual framework for evaluating which forms of intervention—universal, targeted, clinical—may be most effective. Before interventions can be put into place, however, a prior necessity is knowledge of the salient dimensions of childhood social contexts on which policies and programmes might operate.
18.5.1 Salient dimensions of childhood social contexts

Such dimensions of context can be thought of as the social and experiential targets of intervention for improving childhood circumstances. The focus here is on broader social contexts rather than on specific clinical interventions of an individual nature, because it is with respect to the former that social policies may conceivably alter circumstances. Three broad categories of context can be identified: national or regional income inequities, the availability of supportive developmental opportunities, and social capital—generally defined as those benefits derived from social relationships and affiliations—at the level of both society and community. Again, there is no a priori reason to assume that these categories of the broader social context operate independently or are mutually exclusive. Indeed, their natural covariation may complicate analytic efforts to disaggregate effects. Note also that the robustness of the evidence varies across categories. Because income data are relatively accessible and less prone to measurement error, the evidence for the first category is more robust. National and regional variations in policies that affect the provision of developmental opportunities can be readily identified, but quantifying their contribution to outcomes is more problematic. Finally, the social capital construct is perhaps the most susceptible to measurement error at this time and has accumulated less substantial evidence owing both to its recency and to challenges of measurement.

In considering any proposed intervention to improve childhood circumstances and developmental health outcomes, there are key questions to be asked, which together comprise a set of four criteria for intervention credibility. The first is whether there is evidence for a relationship between the target of intervention and health outcomes. More than the existence of a relationship, we should be interested in its magnitude or, more precisely, what percentage of the variance in health is attributable to the source in question. The second is whether the evidence is purely an association or whether there is reason to believe that a change in circumstances leads to a change in outcomes, whether through planned or naturally occurring experiments. For example, even if the magnitude of income inequality is associated with national or regional variations in health outcomes, it does not necessarily follow that change in the former will lead to change in the latter. Both may be governed by an unexamined third variable (social capital, for example). A third and more stringent test is whether there exists a hypothesized mechanism that can explain either association or correlated changes. While *post hoc* arguments for biological plausibility are often too simple to construct, the possibility of unexamined, confounding variables or chance findings are more difficult to exclude in the absence of an evidence-based account of the underlying mechanisms. This is not an argument for inaction, because sensible policies can be and often are generated in the absence of a clear understanding of mediating processes. But the impact of successful interventions is enhanced and the risks of harm are reduced when the underlying mechanisms are well understood. Finally, it is important to consider the potential for meaningful change within the broader policy environment. For example, flattening income inequities might be shown to have substantial impact with respect to all the identified criteria, but the prospects for enacting such a change also need to be considered from the perspective of political economy.
Interventions on income inequality

With respect to income inequalities, the evidence for impacts on health is substantial.\textsuperscript{118–121} Recall that there are two gradients that should be kept conceptually separate. The first is the bivariate relation between SES and some developmental health outcome. The second is the gradient of income distribution, that is, the relative equality or inequality across different levels of a society. The latter can be measured in several different ways, such as a Gini coefficient (where 0 means every individual has an identical income and 1 indicates that all income is held by a single individual) or median share (or the proportion of total household income held by those below the median of income).

The general finding is that in both cross-national and cross-regional comparisons, there is a relationship between level of income inequality (a population indicator) and levels of health (most often indexed as life expectancy or age-adjusted mortality). Wilkinson’s\textsuperscript{121} comparison of Organization for Economic Cooperation and Development (OECD) countries showed a substantial association between the Gini coefficient and life expectancy, with the Scandinavian countries having the highest equality of income and greatest longevity. In a comparison of US states, Kaplan and colleagues\textsuperscript{119} reported a strong correlation ($r = -0.62$) between age-adjusted mortality and median share of income. A comparison using major US metropolitan areas revealed a similar pattern, with ‘the most economically divided metropolitan areas’ showing excess mortality ‘equivalent to the combined loss of life from lung cancer, diabetes, motor vehicle accidents, HIV infection, suicide and homicide during 1995’ .\textsuperscript{122} When Canadian metropolitan areas were included to comprise a US dataset, the same pattern was obtained, although there was not a significant relationship among the Canadian metropolitan areas analysed separately.\textsuperscript{120}

Although evidence for an association between income inequality and health has been strongly supported and defended,\textsuperscript{17,121,123} the field has not yet achieved unanimity and a number of investigators have raised questions regarding the association’s authenticity. More specifically, dissenting voices have questioned the selection of countries from which data have been drawn and the quality of the national data from which the association has been inferred.\textsuperscript{124–127} It has also been suggested that an association at the aggregate level could result from statistical artifact due to the curvilinear relationship between income inequality and health at the individual level, a variation on the ecological fallacy.\textsuperscript{128} Clearly, testing the association within a broader set of national data would be valuable not only for generalizability but also to obtain more precise estimates of effect size. The substantial effect of income inequality for the US states (about 35% of variance) can be contrasted, for example, with the absence of an effect for comparisons of Canadian provinces and metropolitan areas. Beyond mere estimates of effect magnitude, multiple comparison points will generate more productive hypotheses about the possible sources of these effects. Evidence for correlated changes, mechanisms, or dynamics and opportunities for change in the broader policy environment, however, is sparse. There is a ‘natural experiment’ underway, at least in the USA, where income inequality has been sharply increasing for over a decade, affording the possibility of assessing correlated changes.

With respect to underlying dynamics, it is difficult to disaggregate income inequality \textit{per se} from other societal differences, on the basis of evidence in hand. In the available
datasets, the nations or regions with higher income equity and greater longevity tend also to be those with putatively higher social and human capital, such as the northern USA and Canada versus the southern USA or Scandinavia versus the USA, the UK, Canada, and Australia. Because these comparisons are at the ‘flat of the (international wealth–health) curve’, that is, among the wealthier societies, the distribution of material resources may be less important than the distribution of social status, educational and occupational pathways, or other less tangible factors. On the final criterion, the potential for policy change, it is noteworthy that current trends, at least in the USA and possibly globally, are tending in the opposite direction, towards greater rather than less income inequality.118

18.5.3 Interventions on developmental opportunities
A different picture emerges with respect to direct interventions through the provision of developmental opportunities. The efficacy of some specific interventions to improve various aspects of developmental health is well established, as in interventions involving the augmentation of social support.115,129,130 A 15-year follow-up of a randomized controlled trial (RCT) on pre-natal and early childhood home visits by nurses showed significant and clinically important declines in subsequent pregnancies, use of welfare, substance abuse, criminality, and child abuse and neglect.131 These are especially compelling results given that the women recruited for the study were consecutively recruited from a rural clinic offering free pre-natal care (that is, they were extreme in neither the direction of abject poverty nor middle-class comfort) and that the intervention involved the provision of only developmental screening, free transportation to the clinic, and brief, supportive visits to the home. The same RCT had earlier shown that the intervention resulted, over the short term, in a lower incidence of pregnancy-induced hypertension, fewer pediatric visits for injuries or ingestions, and fewer second pregnancies.132

Targeted programmes for children in disadvantaged or high-risk circumstances have also shown long-term benefits across a range of outcomes (see a review by Hertzman and Wiens138) and there are plausible if not fully identified developmental mechanisms through which these benefits may operate. The most successful interventions have been multisystemic, however, complicating the search for specific mechanisms. Nonetheless, pre-school, school, and community interventions have often yielded significant enhancements in behavioural and developmental outcomes among children receiving enriched early educational and care experiences. One of the largest and most successful national experiments to enhance child development is the Headstart program, based on the Perry preschool curriculum.139,140 In the Ypsilanti/Perry preschool study, 3–6-year-old children received an intensive pre-school curriculum 5 days per week for a period of 30 weeks per year, along with parental involvement facilitated through teacher home visits. Long-term effects at age 27 included lower high school dropout rates, fewer teen pregnancies, better and more consistent employment, and reduced drug abuse. The Carolina Abecedarian project, an RCT involving frequent home visits and year-round, high-quality, centre-based care beginning in infancy, found higher IQs in intervention group children at school entry, higher reading and maths scores at age 15 years, and better long-term educational achievements among the mothers of intervention children.141 The Child development project, a quasi-experimental study,
showed significant reductions in student drug use and delinquency following a school-based intervention designed to ‘help schools become caring communities of learners—environments that are characterized by supportive social relationships, a common sense of purpose, and a commitment to prosocial values’. The Infant health and development project, among the most extensive and carefully planned educational interventions, included an intensive programme of post-partum parent education and home visiting. Results showed significant though modest effects on maternal child behavioural competence and adaptive functioning and moderate effects on cognitive development.

Another elementary school-based intervention involved the introduction of a violence prevention curriculum and produced a sustained decrement in physical aggression and an increase in prosocial behaviour. The Ottawa project, one of very few community-based child development studies, is a recreational programme focused on non-academic skill development for 5–15-year-old children from a subsidized housing complex. The intervention group in this project have shown significant declines over control participants in the extent of ongoing anti-social behaviour, as well as positive effects on behavioural competence and cognitive development. Similarly, children participating in the Chicago child–parent center program—which provided education, social and health services, and pre-school to low-income families—had higher rates of high school completion and lower rates of arrest and school dropout. Taken together, these and other studies suggest that targeted, early intervention programmes can produce sizeable, sustained effects on developmental outcomes such as IQ, academic achievement, grade retention, high school graduation, and social competence.

This body of work addressing interventions to augment developmental opportunities appears to meet at least two of the evidential criteria noted above. There is evidence that targeted changes in circumstances lead to changes in outcomes and there are plausible mechanisms to begin accounting for these changes. More difficult to answer, however, are the questions of population impact and the potential for changes in social policy. The targeted interventions for which evidence is strongest tend also to be those most extensive and costly. Treating substantial portions of the childhood population as potential targets of specific interventions raises difficult questions on both implementation costs and on broad public support for such an approach. On the other hand, through monitoring mechanisms such as the UN human development index, it has become clear that improvements in basic nutrition, health services, and education have strong and positive effects on developmental health. At a global level, extending provision of these basic developmental supports can be defended as among the highest international priorities.

Although these general findings are useful as support for the broader notion that childhood circumstances matter, they provide little guidance for social policy in the developed world. Even though there is little variation in basic provisions—for example, elementary and secondary education is universal and generally available through public resources in these countries—there are identifiable differences in policies affecting the provision of developmental opportunities. Variation in the availability of early childhood education and learning opportunities, for example, is quite extensive. More generally, ‘public goods’ are unevenly distributed across regions and nations. These include not only programmes for children but also broader services (such as
parks and recreation) that may be related to child development. Are the distributional patterns of these public goods, as they affect childhood circumstances, responsible for the observed variations in developmental health? Here again is the difficulty that distributional patterns covary with patterns of income inequality. Societies that have less income inequality tend also to have a greater supply of public goods, including those provided directly for children.\footnote{150} It is possible to imagine empirical probes into the relative influences of income inequality and lack of developmental opportunities and such investigations may be fruitful. One possible outcome of such investigation would be that relative income equality and provision of developmental opportunities are correlated for substantive reasons. Such an association could be direct (income inequality is reduced through more progressive taxation regimes, whose proceeds are used for developmental investments) or indirect, through the social capital function. Societies with higher social capital in the sense of greater coordination and collaboration (see for example, Reference\footnote{151}) may make similar policy choices on income distribution and on developmental investments.

18.5.4 Interventions on social capital

To date, social capital literature has primarily focused on economic outcomes.\footnote{151} Where developmental health outcomes have been explored, it has been primarily in circumstances of significant deprivation. In these instances, the operating hypothesis is that social capital may act as a buffer against economic disadvantage for a variety of outcomes.\footnote{152,153} That is, are individuals in distressed circumstances better off if their neighbourhood possesses higher levels of social capital (social cohesion, interpersonal trust, collective efficacy, and so on)? Application of the intervention criteria above is least clear in the case of social capital, largely owing to the fact that evidence is only beginning to emerge. It is, however, potentially a very productive research agenda and not only as a buffering hypothesis.\footnote{154}

Even at this early point in such research, an important thought experiment is to consider the social policy implications of a major social capital effect. Assume that positive evidence on association, correlated changes, and underlying dynamics were obtained. Are there social policy tools that can reliably increase the social capital of a community or society? Case studies of successful community development efforts\footnote{155} lead more strongly toward a contrasting inference, that positive changes tend to be largely self-organizing at a local level, often with the catalyst of personal charisma. At a larger level, the cultural supports for changes in social capital may be quite complex and not easily amenable to policy interventions.

18.5.5 Summary

To summarize, there is robust evidence that variation in childhood circumstances shows substantial concurrent and longitudinal relationships with variation in a wide range of developmental health outcomes. There are plausible hypotheses on the underlying developmental mechanisms that may give rise to these patterns. The evidence on these potential biodevelopmental mediators suggests a substantial role of child development in life course developmental health and points towards a potentially productive research agenda that follows from current evidence. Three sources at the broader societal level
have been considered in this section: income inequality, the provision of developmental opportunities, and social capital. There are credible arguments to be made within each category and a proposed evaluation scheme identifies four key criteria: the degree of association, the evidence for correlated changes, the plausibility of underlying developmental mechanisms, and the potential for change within the prevailing policy environment. In none of the categories have all the relevant questions been successfully addressed, but taken together the existing evidence supports an emerging research agenda on human development that may prove quite productive.

As opposed to the evident gaps in our knowledge of how best to proceed, the evidence for the potential benefits of thoughtful intervention is substantial. As we expand our consideration of the contributors to and consequences of developmental health, it becomes clear that the issues have implications beyond health outcomes alone. In the following two sections, we briefly consider the overlap of these issues with the economic and the ethical arguments for intervention to improve childhood circumstances. In each case, space permits only an outline of the major issues that should be considered.

18.6 **Economic arguments for intervention**

By far the most common economic argument in favour of intervention to improve childhood circumstances is that future savings to society outweigh the initial investment. These savings have been identified in a wide range of areas (see, for example, Reference 40): lower special education services, lower use of social services, lower rates of arrest and incarceration, lower unemployment, and higher income and thus higher taxes paid. In the often cited Perry preschool project, these savings over a two-decade period have been estimated to generate a 7:1 return on initial programme investment. Other studies that have focused on universal programmes, such as high-quality day care, estimate more modest but still substantial returns on investment. Not estimated in these models are the effects on physical and mental health across the life course. If there is indeed a link between developmental health gradients and early experience-based brain development, as argued above, it is likely that such savings to the health system could be substantial. Thus, there is a sound economic argument to be made on behalf of early intervention to improve childhood circumstances arising from the return on this investment from subsequent savings to social and health services across the life course.

Supporters of this argument in the public policy arena face three important challenges. The first is the generalizability and robustness of the econometric estimates that have been put forward. Clearly, these are contingent on a host of local circumstances and are not easily transferable across jurisdictions. On the other hand, the consistency, if not the magnitude, of cost–benefit analyses in a number of jurisdictions supports the argument that early intervention is properly viewed as a social investment rather than a social expenditure. The second challenge is that the benefits (that is, the savings to future health and social services) rest on a premise that the services in the future will continue to be available in approximately similar fashion to the present. This is obviously not guaranteed. Cutbacks to the availability of such services due to changes in policies governing their administration could alter the cost–benefit ratios substantially.
The third challenge is the time horizon of the benefits (life course) relative to the costs (in early life). It is perhaps this factor more than any other—except perhaps the relative political weakness of the immediate beneficiaries, young children and their families, compared to claimants on, for example, health services—that has undermined the investment argument on behalf of early intervention. In short, current governments must bear the investment burden, whereas the benefits accrue to future, unknown governments.

There is a second category of economic arguments on behalf of improving childhood circumstances and this focuses on production rather than consumption. One version of this argument takes note of the similar or overlapping pathways to health and competence that are denoted by the term ‘developmental health’. From this observation, it is possible to identify a construct of population competence that shares many of the features and underlying dynamics of population health. Thus, a society’s pool of human resources for economic growth and production is likely to be affected in similar ways. Assessing these competencies at a population level, especially for comparative purposes, is less advanced than our population health indicators. But the available data (see, for example, Reference 25) offers considerable support for the argument that similar gradient effects—the bivariate SES/competence gradient, the comparative epidemiology associating steeper gradients with lower overall population competence, and the longitudinal effects of early experience—are observed. It is plausible that the similarity in gradient effects arises from common developmental pathways.

The importance of population competence is emphasized in light of contemporary economic theories that technological innovation lies at the centre of economic growth and that such innovation is endogenous to society, arising from numerous social innovations. Across history, this feedback loop from technological to social innovation can be viewed as an ‘innovation dynamic’ that has the characteristics of a dynamic system with a positive feedback loop, leading to accelerative change. The implication for the current historical moment, often characterized as the information or knowledge revolution, is that the cultivation of human resources may represent a society’s most significant investment for future economic growth.

It could be argued that such investments create an economic drag in the present and that policies to support future competence among elites alone will suffice, rather than more costly investments in population developmental health. The future cannot, of course, be known, but the available evidence seems not to support a view that investments in childhood circumstances create an economic drag. In a recent analysis of the post-Second World War economic performance of OECD countries, Hall and Soskice identify two major varieties of capitalism, coordinated market economies (for example, northern Europe and Scandinavia) and liberal market economies (for example, the UK, the USA, Canada, and Australia). The former tend also to be those countries with flatter and higher gradients in developmental health (although the degree of this association remains, thus far, unquantified). The long-term economic growth of both varieties is approximately the same, however, suggesting that a higher level of human development investment does not create a significant economic drag. Whether there is a major future benefit remains to be seen and is obviously dependent on a range of factors beyond population developmental health. Transformations of economic activity arising from advances in the organization of
production (the ‘learning organization’) and technological breakthroughs (the worldwide web and its associated features) may capitalize more effectively on the breadth and depth of population competence.\textsuperscript{159,162}

To summarize, there are sound economic arguments to be made on behalf of investments to improve childhood circumstances. The first argument identifies the cost–benefit ratios from targeted interventions and such analyses typically yield positive returns on investment. The second argument is not yet quantified, but draws on contemporary economic growth theory to infer that future growth may be heavily dependent on population developmental health, which is in turn dependent on investments early in the life course. The combination of savings from services not consumed in later life and increased economic growth arising from higher competence and health, makes a strong case for the economic sense of such investments, given the proper time horizon.

18.7 Ethical arguments for intervention
Arguments based on the biological or economic consequences of intervening, or failing to intervene, to improve childhood circumstances are viewed by some as unnecessary or even inappropriate. From this perspective, justifications for the improvement of childhood circumstances based on future health or economic benefits undermine more fundamental ethical reasons to do so. In this chapter we have argued instead that a full understanding of the consequences arising from the circumstances of childhood is important for both science and policy. But societal utility (in terms of population health or economic prosperity) is clearly not the only basis for supporting the improvement of childhood circumstances. Identifying the fundamental ethical reasons for improving childhood circumstances is an essential complement, by elevating the issues beyond strictly utilitarian arguments.

We identify two major categories of ethical concern. The first is that the quality of life during childhood is itself a core issue, independent of life course consequences. In part, this is a reaction against excessive utilitarianism, in that children should be seen as valuable in their own right and not merely as cogs in some future political economy. This counterargument is somewhat tendentious, in that it down-plays the foreseeable interests of children in becoming healthy and productive adults. But there is a more positive version of the argument, drawing on Rawls’\textsuperscript{164} notions of ‘natural justice’. The core argument is that choices of fair social arrangements are inextricably influenced by one’s perceptions of how these arrangements affect one’s own personal circumstances. ‘Haves’ and ‘have-nots’, for example, view greater income equity differently. A thought experiment, the ‘veil of ignorance’, is proposed as a way to get beyond this. What social arrangements would individuals choose if they were unable to know what positions they would hold in the resulting society? This thought experiment has particular force with respect to children, because they are not in a position to influence such choices in reality. It is most likely that individuals would choose for children to have high-quality physical and social environments and equitable access to developmental opportunities.

The second category of ethical dilemma arises from the growing acceptance of the extension of fundamental human rights to children, as in the international conventions noted above. It is useful here to make a distinction that is often overlooked, though a distinction that adolescents and their parents are able to make.\textsuperscript{165,166}
Much attention has been paid to rights of self-determination, to give children standing as individual people in legal and quasi-legal contexts. Considerable efforts have been made in many jurisdictions to accommodate this emerging understanding. Equally important, and perhaps more germane to the improvement of childhood circumstances, is the notion of nurturance rights. Because of their relative powerlessness not only in society at large but also within families, children are in a vulnerable position with regard to the meeting of basic needs. Asserting that they have rights to nurturance, as the relevant international conventions do, is an attempt to raise the profile of such expectations. There has been less societal activity to date to explicate and embody nurturance rights compared with self-determination rights and thus much remains to be done. This remains, however, a promising avenue towards supporting arguments for the improvement of childhood circumstances.

From a pragmatic perspective, it seems productive to deploy both utilitarian arguments (that is, life course consequences for health and economic consequences for society) and ethical arguments (that is, natural justice and fundamental rights), because both point in the same direction. If policy change to improve circumstances in childhood is the goal, then attracting the widest range of support is a sensible approach.

18.8 The promise of non-genomic intergenerational transmission of benefits

To the variable extent with which valid human inferences can be made from experimental evidence in animal models, the work of Meaney and Champagne on non-genomic inheritance offers an illuminating and potentially encouraging additional perspective on the possibility of blunting or reversing developmental effects of early social inequities. As noted above, Meaney’s work has demonstrated that aspects of early maternal behaviour—behaviour that can be effectively altered by manipulations within the infant-rearing environment—are capable of calibrating set points and response characteristics within key biological systems that are activated under conditions of adversity. Such calibration—at least in rodent pups—becomes a stable response disposition, enduring over the life course of the individual and producing an adult with diminished fearfulness and more modest HPA responses to stress. What is less universally appreciated within this body of work is the finding that alterations in maternal caring behaviour have biological effects not only on the next, most immediate generation, but on the temporally and genetically more distal third generation, as well. Pups reared by mothers whose caring behaviour is attentive, tactile, and sustained grow up to become mothers who are themselves less anxious, more attentive, and in turn more likely to produce infants with similar adult, maternal predispositions. If such findings proved transferable, even in part, to human populations, the implications for societal interventions would be profound. What results from the Meaney laboratory suggest is the possibility that intensive and effective efforts to promote caring, nurturant maternal behaviour in one generation could have positive developmental effects not just on the offspring of the mothers whose behaviour was changed, but on those of future generations, as well. The findings seem speculatively to suggest that altering the parenting experience of a generation of children could have more enduring influences, promoting the health and well-being of their children and grandchildren to come.
18.9 Early intervention: ensuring the beneficence of childhood

How might the world be changed by a generation of children carefully and protectively nurtured through hazards of childhood into the promises of adult life? Given the evidence reviewed above for both cumulative and critically timed effects of early experience on health over the life course, it is plausible to argue that a hypothetical society’s commitment to a caring and protected childhood could have health effects as persistent and lasting as they would be pervasive and deep. Although developmental science has much yet to learn about the long-term consequences of early experience, there are a sufficient number and variety of observations now in place to argue that the biological, behavioural, and social implications of an intentional childhood might be vast indeed. Imagine a society in which children experienced, by virtue of a community’s specific intent, sustained, caring, and supportive parenting, the presence, love, and encouragement of at least two generations of family members, the advantages of universal preparation for school and learning, vigilant and reflexive community protection from situations of abuse or neglect, commitment to a minimum standard of housing and nutrition, and the availability of richly evocative environments for play, imagination, and creativity. It is arguably the case that such a society would visibly bear the mark of its children’s experiences and that a just and more egalitarian social order would emerge, dramatically distinguishing that society from its contemporary neighbours and peers.

Over the course of history, childhood has been variably regarded as a developmental phase of trivial activity and interest; the cauldron of immaturity from which emerge the passions, skills, and disorders of adult life, or an apprenticed preparation for the exigencies and serious business of adulthood. What has broadly emerged from the accumulating annals of developmental studies are two fundamental observations about the nature and significance of childhood and of children. First and perhaps most self-evident to twenty-first century sensibilities, children are fully intact and sentient human beings, invested of the full social, moral, and legal rights conferred upon adults within democratic societies. Neither the developmental anlage of an adult persona nor a primitive irrelevance on the road to legitimate maturity, a child is a human being, imbued with all of the same complexities, pains, sensitivities, and capacities for nuanced social interchange that characterize their parents and their future selves. As such, children are deserving of the same protection, opportunities, and advantages that we would more readily and easily grant their senior counterparts. Childhood is thus distinctive as a developmental period but indistinguishable in its moral and ethical substance.

Although this first observation alone would be sufficient basis for protecting and ensuring the beneficence of childhood, this chapter has argued, we hope persuasively, that the implications of children’s experience for health and well-being in adult life are likely profound. Even on economic grounds, it is to every society’s advantage to nurture and tend its youngest and most vulnerable members. We are finally learning, in the construction of social policy, what was long ago encoded in the evolutionary history of our species, that ‘the growing good of the world is partly dependent on unhistoric acts’ and the flourishing of a human society partly contingent upon acts of protection and care toward its children, who are—collectively—the legacy, promise, and future of every earthly nation.
References


