



# Inequality and child health: dynamic population health interventions

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## Purpose of review

Established social gradients across a wide range of child health issues including obesity, anxiety, infectious diseases, injuries, prematurity and low birth weight suggest that much illness is avoidable and there is an imperative to intervene in this whole of society issue. This review examines recent advances in understanding of the pathways to health and health inequalities and their application to interventions to improve health equity.

## Recent findings

Children's health develops over the life course in ways that are profoundly influenced by their entire developmental ecosystem including individual, family, community and system-level factors. Interventions to address child health inequalities must include action on the structural determinants of health, a greater focus on family and community health development, and attention to the acquisition of developmental capabilities. Nascent dynamic population health initiatives that address whole developmental ecosystems such as All Children Thrive, Better Start Bradford and Generation V, hold real promise for achieving child health equity.

## Summary

Pathways to health inequalities are driven by social and structural determinants of health. Interventions to address inequalities need to be driven less by older biomedical models, and more by prevailing ecological and complex systems models incorporating a life course health development approach.

## Keywords

capabilities, child health, health inequalities, intervention, life course

## INTRODUCTION

Children living in disadvantaged or marginalized circumstances have worse physical and mental health than their more advantaged peers [1<sup>–4</sup>]. This relationship holds true for conditions ranging from obesity to anxiety, infectious diseases to low birthweight [5]. There is an established social gradient in health from the bottom to the top of the socio-economic spectrum making this a societal issue [6]. Guided by a deeper understanding of the complex, multilayered, inter-connected pathways linking socioeconomic circumstances and child health [1<sup>–4</sup>], interventions need to disrupt suboptimal pathways to create more equitable health trajectories. In this paper, we review recent advances in models of health and health inequality and their implications for health equity interventions, considering the need for dynamic population health interventions based on a life course health development (LCHD) approach [7].

## MODELS OF HEALTH

For much of human history, children's healthcare focused more on surviving than thriving- if children

could survive the perils of birth and infectious diseases, it was thought, they would be 'healthy' through to the declines of old age. Broad public health measures including improved sanitation, coupled with safety-net programs for the poor dramatically improved infant mortality and the probability of surviving to adulthood [8] at the start of the last century.

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## KEY POINTS

- The existing child health system was designed based on older biomedical models of health and largely still operates on an individual clinical encounter model.
- Recent advances in understanding of how health and health inequalities develop over time suggest this model is poorly positioned to achieve child health equity.
- Interventions need to be driven by prevailing ecological and complex systems models that incorporate a life course health development approach, including action on the social and structural determinants of health.
- Interventions need to move beyond narrow ‘policy prescriptions’ and a focus on ‘individual risks for individual children’ to incorporate the child’s entire developmental ecosystem.
- Dynamic population health initiatives that take a whole of community approach with strong family and community engagement such as All Children Thrive, Better Start Bradford and Gen V hold promise for achieving health equity.

### Biomedical models

Biomedical models of health and disease initially took a reductionist, linear view of acute and chronic illness, searching primarily for single-cause, single-disease associations that emphasized physical health over mental health or social-emotional well-being. Interventions focused on surgical treatments and pharmaceuticals. Our children’s healthcare system was designed and largely still operates on, this *individual clinical encounter model* [9,10], focused on discrete treatments for discrete conditions. Providers can attempt to address specific social needs [11] relevant to a presenting problem, e.g., advocating for family housing relocation for a child with chronic respiratory problems who is living in a home with damp or mold, or referring to a food bank if there is household food insecurity, but there is little opportunity to consider and address other interrelated risk and protective factors in that child’s broader ecosystem.

### Biopsychosocial models and the social determinants of health

Gradually, more holistic, multilevel and dynamic biopsychosocial models of health [12] emerged demonstrating how social circumstances and health might influence each other in nonlinear, adaptive (and maladaptive) ways. Bronfenbrenner’s Ecological Model of Human Development

provided an organizing framework for influences on human development, the most proximal being child and family factors, followed by school and community factors, and finally the larger social, cultural and policy systems. Several models have proposed a similar ecological framework for the factors influencing child health [13,14]. The conditions in which children are born, grow up, work, and live – the social determinants of health – are now understood to be major drivers of children’s health trajectories, that interact with the child and with each other both within and across ecological layers in complex ways. Not just one or two, but all of these factors impact a child’s health.

### Life course health development model

The LCHD approach attempts to improve on the biopsychosocial model, incorporating recent principles from a range of life course sciences including life course sociology, life span developmental psychology, chronic disease epidemiology and epigenetics. It integrates the developmental orientation of Bronfenbrenner’s Ecological Model of Human Development into a more robust explanatory model regarding human health development that has major implications for pediatric practice [15<sup>16</sup>]. Health is regarded as an emergent, dynamic and *developmental* characteristic resulting from complex adaptive relational interactions between biology, behaviors, and social ecological conditions [16–18]. Although the magnitude and later mutability of early effects are debated, some time frames, many in the prenatal, postnatal and early years, appear critical for healthy development and adaptation, and key to improving health. Humans are designed to adapt to circumstances purposefully and continuously and the ecosystems into which children are born are also continuously adapting and changing. Aligning all these systems in ways that support health development will foster good outcomes [19]. If they are misaligned, or ‘health diminishing’ then sub-optimal health trajectories may become established in childhood and worsen during adult life. For example, adverse childhood experiences (ACEs) have strong associations with alterations in structural mid-life brain integrity [20<sup>21</sup>], whereas increasing breastfeeding duration could flatten the social gradient in adult chronic inflammation by as much as 80% [21<sup>22</sup>].

### MODELS OF HEALTH INEQUALITY

Researchers draw a distinction between the *social determinants of health* and the *social determinants of health inequalities* [1<sup>22</sup>,22], rightly arguing that overall

improvements to population health do not necessarily lead to greater health equity. In considering pathways to health inequalities, Diderichson proposes differential power and resources, exposures, vulnerabilities and consequences of being sick as four main mechanisms [23]. Similarly, Pearce *et al.* distinguish between four major factors:

*Material:* social advantage confers greater access to healthy living conditions, such as a safe, uncrowded home with access to a garden or green space, warm clothing and footwear, and nutritious foods.

*Psychosocial:* social inequality produces feelings of subordination and lack of control influencing neuroendocrine pathways.

*Behavioral:* inequalities in parent and adolescent health behaviors, including smoking and physical activity, exhibit social gradients leading to later health inequalities.

*Structural:* these are outer layers of Bronfenbrenner's model such as access to healthcare and childcare, the system of taxes and benefits, 'classism' and structural racism that many theorists regard as the 'root cause' of health inequalities [24].

The LCHD Model adds considerations of *time* and *health development* to understanding pathways to health inequalities [25,26]. Inequalities in family living conditions, psychosocial health, stability and health behaviors prior to conception, during pregnancy and in the early years have implications for life-long health. These early inequalities may be potent drivers of an unequal ability to acquire key *developmental capacities or capabilities* that support children's healthy adaptation to their early environments and also buffer against future adversity. The unequal acquisition of these capacities may be driving much of the observed later-life health inequalities.

## IMPLICATIONS FOR INTERVENTIONS

Models of health and health inequality provide an analytic framework for understanding and potentially disrupting sub-optimal pathways between social circumstances and poorer health. They inform intervention design [27] and research priorities.

### The challenges of addressing the structural determinants of health

Acting on the structural determinants of health to produce a fairer, more equitable society and reduce childhood illness and mortality is a public health priority. The difficulty comes in designing policies to achieve this. Social determinants of health might be best represented as a three-dimensional system

of interlocking microsystems, i.e., a *complex adaptive system of systems* [28<sup>28</sup>,29,30]. These systems are not linear, with simple cause and effect paradigms, but complex and adaptive [31], multilayered and reciprocal, with bi- and multidirectional forces all affecting the whole. Simple policy changes that ignore the need for a systems approach, that fail to address the complexity and inter-relatedness of these systems or that fail to address the relevance of newer theories like critical race theory [32] may have unanticipated, even counter-intuitive effects, and fail to bring about improvements. Advocates are calling for a shift from health policy to health public policy, where the impact of policies on well-being is a key consideration across government sectors [33<sup>33</sup>,34].

### Multilevel interventions and the inverse evidence law

Interventions with components that impact the first order microsystem (direct effect on the child and family), second-order mesosystem (operate through schools, community or neighborhood services) and the third-order macrosystem (cultural, policy and social systems) are more likely to impact health inequalities than isolated policy changes or programs addressing only proximal risks e.g., maternal depression. More research on second and third-order interventions would address the existing evidence base imbalance, with its focus on proximal interventions [1<sup>1</sup>].

### Life Course interventions

The Life Course Intervention Research Network, <https://lcirn.ucla.edu> is a collaborative network of researchers, service providers, family and community representatives and thought leaders committed to improving life course trajectories and outcomes for children. The group is working to apply the seven principles of life course health development: health development, unfolding, complexity, timing, plasticity and harmony to interventions in ways that will also reduce health disparities [35,36]. This will include more integrated, networked strategies for developing and implementing multi-level interventions that transcend divisions between individual and population health. Multigenerational interventions [37], that acknowledge community history and structural constraints, and build on intergenerational strengths could provide new opportunities to address factors such as intergenerational trauma and improve the health status of children and grandchildren.

## Interventions that address emerging health development capabilities

The developing child is an active participant in a dynamic relational process during which capabilities [38,39], e.g., the capacity to regulate one's emotions, to make meaningful social connections, to become a lifelong learner, develop over time. Just as individual developmental stages and health development are important to the health of the individual, so too are family stages and *family health development* along with *community health development*, each with an attendant set of capabilities that need to be acquired. Interventions to address family and community capabilities, so that these components of a child's ecosystem will be maximally health giving, is an area ripe for research.

## Dynamic population health interventions

Although these types of interventions are not yet the norm, nascent programs are attempting to put these principles into practice.

*All Children Thrive (ACT)* is a dynamic population health initiative focused on building a movement within and between communities working to optimize children's health and well-being. ACT Cincinnati, launched in 2015 (<https://www.act-nowcincy.org/>) pioneered this approach, focusing on selected outcomes, e.g., thriving at kindergarten entry and reducing healthcare inequities. Consistent with LCIR principles, key elements of the approach include a focus on the whole population, building equity into measures, and co-designing with families and users. Given the need for emergent, adaptive, multilevel interventions, progress is driven by theory-based testing and learning rather than the implementation and spreading of predesigned programs. The Model for Improvement [40] is at the core of moving the 'ecosystem' of partners toward results [41]. Scale-up is driven in part by identifying systems issues at the root of individual poor outcomes. In one neighborhood in which the extreme prematurity rate was high for many years, the portfolio of interventions resulted in three years without a single extreme premature birth. Using similar strategies, the children's hospital achieved a 20% reduction in admissions [42]. ACT Cincinnati has developed practices for pursuing equity through its learning health system including: measuring for equity; leading from lived experience; co-producing interventions; redistributing power; practicing a growth mindset; and engaging beyond the healthcare system to catalyze change [43].

This success inspired the city of Long Beach to launch a similar program (ACT Long Beach) ([\[www.lbnplug.org/\]\(http://www.lbnplug.org/\)\) followed by the 2019 launch of the ACT California \(<https://act-ca.org/>\) pilot program which by December 2021 will reach 18 cities. This equity-focused, community-driven '\*whole ecosystem\*' initiative aims to develop, test and refine the tools that support diverse communities in preventing and healing ACEs and to promote child and family well-being. Strategies include:](https://</a></p>
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- (1) *Engaging and activating ACT cities* to implement evidence-based policies and practices to improve child well-being.
- (2) *Helping cities* employ user-centered design, networked improvements, and rapid cycle innovation and improvement strategies to achieve priority outcomes.
- (3) *Building capacity to implement systems improvements* including creating permanent city-level leadership on child well-being, and
- (4) *Monitoring* key measures of child development and well-being.

*Better Start Bradford* ([www.betterstartbradford.org.uk](http://www.betterstartbradford.org.uk)), launched in 2015, incorporates over 20 interventions within the context of the Born in Bradford longitudinal cohort study (<https://borninbradford.nhs.uk>) designed to improve children's healthy development [44]. These interventions target developmental capabilities including social emotional development, communication and language development and healthy nutrition, embracing a complex systems approach in a community-wide learning system. Considering the dynamic complexity of the social and environmental determinants of health the study links research and administrative data on parents and family, their genes, economic circumstances, the way families live, the environment, and services with a focus not just on observation but on change and community empowerment [44,45].

The even more ambitious *Generation Victoria* (Gen V) (<https://genv.org.au/>) will integrate intervention research within or alongside a whole-state Australian birth cohort study [46]. This prospective study targets all expected 150,000 newborns and their parents over two years starting late 2021 and provides an opportunity to study the effects of both simple and complex interventions in a life course framework that incorporates biological, physical, demographic, and generational measures. The information gleaned holds great potential to drive precision policies to improve health equity [47].

## CONCLUSION

Although studies of health inequalities frequently conclude that child health providers should be more

mindful of the social determinants of health and better advocates for policy change on the structural determinants [1<sup>■</sup>,48], many providers feel they have been doing just that for decades, with limited impact on either interventions or outcomes. Instead, these providers seek to play a more active role in working within communities to develop and deliver dynamic population interventions that harness all that we know about children's health development to improve children's long-term health trajectories. The LCHD Approach integrates knowledge from multiple disciplines in ways that inform intervention development, suggesting new avenues for multilevel interventions that are horizontally and longitudinally aligned across the entire ecosystem [49<sup>■</sup>] in a whole-community response to contemporary child health challenges. These interventions require new approaches to funding, planning, testing and evaluation and will require the development of robust measures and data systems that can inform continuous policy development in a process that mirrors one of continuous quality improvement with strong stakeholder engagement. Community-based, whole-ecosystem programs like ACT are the first step toward realizing this vision with a clear focus on achieving child health equity.

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## Conflicts of interest

There are no conflicts of interest.

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