Life Course Health Development: A Framework for Transforming Health & Health Care

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Diabetes in Indian Country
Oklahoma City, Oklahoma

Optimizing Healthy Child Development

We work with local, state, and national partners to develop responsive systems of care and to bridge the gap between what we know and what we do.

We provide interdisciplinary training to health professionals preparing them to reshape health services and policies in order to improve children’s long-term development.

We study how both risk and protective factors influence children’s outcomes, and apply the latest knowledge to programs, community systems, and state and national policy.

We provide analysis that are crucial to creating policies that optimize early childhood outcomes and manage chronic disease. We collaborate with policymakers in California, Washington, D.C., the UK, Canada, and Australia.
All Children Thrive is a global network of people and places working together to identify the strategies and policies that can help all children thrive.

ACT California is transforming cities into microenterprise of social innovation, creating the conditions where families flourish and children thrive. $10 million allocated by California legislature to engage 40 cities in next 2 years

Transforming Early Childhood Community Systems is a national initiative to improve school readiness of children by measuring and mapping developmental progress. Working with over 70 places across the US.

The Gross Domestic Potential Project aims to create a new measurement framework for how we as a nation measure the opportunities, capabilities and potential of a child across the life course and determine what investments communities should make to maximize this potential.

Moving Health Care Upstream is a collaborations with Nemours to design new ways of engaging health systems in addressing social and developmental determinants of health.

Life Course Research Network is a collaborative network of researchers and MCH professionals committed to improving health and reducing disease by advancing life course health development research.
LCHD as a catalyst for transformation

- Life Course Health Development – LCHD – is analytic framework or model, used to make sense of the world,
- Diabetes is one of several health problems that is more prevalent in Native Americans
- LCHD provides a new way thinking about Diabetes connecting the dots between past, present and future,
- LCHD explains how health and disease develop across the life course and across generations
- LCHD focuses on the multiple ways risks and protective factors get under our skin during sensitive periods of development and get programmed into our behaviors and biology

The Three Horizons Required for Innovation’s Management

H3
H2
H1

Seeing beyond
LCHD- Incremental, Disruptive, & Transformative Change

- LCHD is helpful in rethinking and redefining
  - 1.0 medical care system can do to enhance prevention
  - 2.0 health care system can do to enhance health promotion
  - 3.0 health system does to optimize health development
- LCHD is useful in considering the culturally coherent developmental scaffolding needed to
  - Respond to and buffer the effects of historical trauma
  - Advance decolonizing methodologies and strategies
  - Redefine 1.0 clinical strategies into 3.0 health development ecosystems
  - Prioritize and position cultural revitalization as part of life course strategies that optimize health development
- LCHD can provide a way of transforming practice, systems, policy and reaching the 3rd Horizon

LCHD – Setting the Stage

- Big Complex Changes Underway (social, cultural, economic, environmental)
- Major Adaptive Challenges
- Responding Requires Transformative Approaches
- New Paradigms and Frameworks to Help Us Make Sense, Plan, Strategize & Act
- Complex Adaptive Systems Science
- Life Course Health Development & 3.0 Transformation Framework are new ways of making sense
- New Frameworks inform New Strategies,
Deep Drivers of New Forms of Adversity

- **Change of age** (economies/production ecosystems)
  - agriculture > industrial > digital
- **Major disruptions in our social ecosystems**
  - cultural forms, value streams, production models, relationship to environment/planet
- **Accelerators of change**
  - Globalization \times Technology \times Climate Change
- **Speed of change is increasing** (faster than we can adapt to; disease and disability due to adaptive failures)
- **Mismatches**—mismatch diseases like obesity, mental health problems, addictions on the rise

The Adaptive Challenge of our Age

Tom Friedman: Thank You For Being Late
New Frameworks & New Strategies

- Respect the dignity of people, culture, ecosystems in a sympathetic and useful way
- Focus on assets, ecosystem value, resilience
- Enhance capabilities to escape the pull of historical trauma, and structural inequalities
- Identify & leverage root causes,
- Build connections between individual, interpersonal, institutional, community, and policy levels and approaches
- Explain mismatches between who we are and the world we are creating (mismatch diseases)
Changing Pattern of Childhood Morbidity

- Increase in chronic health problems (40%)
  - Not Hemophilia, Cancer, Congenital Heart Disease
- Obesity, Metabolic Syndrome, Diabetes (19%)
- Growing prevalence of mental health disorders (22+%) 
- Greater appreciation of role and impact of neuro-developmental health problems – learning, language (10-17%)
- Growing number of children with multiple conditions (co-morbidities) e.g. asthma, obesity, ADHD

Trends in Childhood Disability - U.S.

(Limitation of Activity due to Chronic Conditions for U.S. Children, NHIS, 1960-2009)

From Halfon, Houtrow, Larson, Newacheck Future of Children 2012
What's Killing Our Children?
Child and Infant Mortality among American Indians and Alaska Natives
A National Academy of Medicine Discussion Paper

Unintentional injuries represent 41% of all deaths among American Indian and Alaska Native children.

Across all age groupings, deaths of American Indian and Alaska Native youth are 2-4 times higher than for white youth.

The overall American Indian and Alaska Native death rate for SIDS among infants is more than double that for the non-Hispanic white population.

Policy-level interventions with potential to make a dramatic impact:
- Alcohol control policies
- Motor vehicle policies
- Supportive breastfeeding policies
- Gun control policies
- Cultural preservation programs
Children & Adolescents at Risk

- 4-6% Severe Disabilities
- 14-18% Special Health Care Needs
- 30-40% Behavioral, Mental Health Learning Problems
- 50-60% Good Enough

Not Optimizing Healthy Development

Addressing the factors shaping health development trajectories over the lifespan
Evolving Notions: Life Course & Health
Effect of Health Protective Factors on Health Deficit Accumulation and Mortality Risk in Older Adults in the Beijing Longitudinal Study of Aging

Lifecourse Health Development: Past, Present and Future

Neal Halfon, Christopher B. Forrest, Richard M. Lerner, Elaine M. Faustman, Editors

Handbook of Life Course Health Development
Life Course Health Development

- Defines Health as a developmental process
- Builds Upon a rapidly Expanding Evidence Base
  - Life Course Chronic Disease Epidemiology
  - Neurobiology
  - Early Adversity and Early Intervention Research
  - Developmental Toxicology and Epigenetics
- Not just connecting the dots between early exposures and later or latent manifestations of those exposures
- Elucidating the mechanisms by which physical, social, emotional environment is embedded into developing bio-behavioral regulatory systems

Life Course Chronic Disease Epidemiology: Barker Hypothesis

- Barker ran the MRC Environmental epidemiology unit in South Hampton
- Conducted Historical Cohort Studies of CVD
- Key Finding: Fetal growth and development, and other factors, in first year(s) of life related to cardiovascular and other chronic disease in the fifth and sixth decade
- How did he discover this?
- Why it challenged prevailing orthodoxy?
Fig. 1.2  Standardised mortality ratios (SMR) for coronary heart disease in England and Wales among men aged 35–74 years during 1968–78.

Fig. 1.3  Infant mortality rates per 1000 births in England and Wales during 1901–10.
Mortality from coronary heart disease in 15726 men and women in Hertfordshire
Life Course Chronic Disease Epidemiology: Barker Hypothesis

- Barker challenged that CVD was just due to cumulative risks: diet, smoking, exercise, lifestyle,
- Suggested that something was being programmed very early on that might be latent
- He argued that nutrition or in some cases malnutrition was having an affect on evolutionary determined plasticity of development
- Fetus was being signaled that the environment might not be very nourishing, so it better reprogram its metabolism to be adaptive to this less than nurturing world

Birth weight and CVD Outcomes
Nurses’ Health Study

Curhan et al., Rich-Edwards et al.
### Down Stream Health Problems Related to Early Life

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Health Problems</th>
</tr>
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<tbody>
<tr>
<td>2nd Decade</td>
<td>• School Failure</td>
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<tr>
<td>3rd/4th Decade</td>
<td>• Obesity</td>
</tr>
<tr>
<td>5th/6th Decade</td>
<td>• Coronary Heart Disease</td>
</tr>
<tr>
<td>Old Age</td>
<td>• Premature Aging</td>
</tr>
<tr>
<td></td>
<td>• Elevated Blood Pressure</td>
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<tr>
<td></td>
<td>• Diabetes</td>
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<tr>
<td></td>
<td>• Memory Loss</td>
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<tr>
<td></td>
<td>• Depression</td>
</tr>
<tr>
<td></td>
<td>• Renal Disease</td>
</tr>
<tr>
<td></td>
<td>• Arthritis</td>
</tr>
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<td></td>
<td>• Anxiety Disorders</td>
</tr>
</tbody>
</table>

From Hertzman

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**Fig. 6.3** The fetal origins of non-insulin-dependent diabetes and insulin resistance syndrome: the ‘thrifty phenotype’ hypothesis.
Changing Contexts of Health Development: Multiple Factors, Dimensions, & Levels Dynamically Transacting

Dynamic Relational Environment

Time Specific
Biological, Behavioral Conditioning

Emergent Influences
Time Dependent, Cumulative Effects

Variable Adaptive Responses:
Plasticity & Optimization of Regulatory Processes

Behavioral Adaptation
- Responsiveness
- Temperament
- Aggression
- Attachment
- Self Regulation

Physiological Adaptation
- Hypothalamic-Pituitary Adrenal Axis
- Autonomic Nervous System
- Metabolic Processes
- Inflammatory & Immune Responses
- Allostatic Load
- More

Developmental Adaptation
- Adaptive Plasticity through Developmental Switches
- Selective Optimization Strategies
- More
Patterns of changes in health assets over time, affected by environmental and intrinsic factors.

**Dynamics of Health Development: Phases, Trajectories and Outcomes**

**Health Development Trajectories**

Patterns of changes in health assets over time, affected by environmental and intrinsic factors.

**Latent Effects**
- Resulting from experiences, particularly during sensitive periods, that influence health later in life.

**Cumulative Effects**
- Resulting from experiences that accumulate over time and manifest in health.

**Pathway Effects**
- Resulting from multiple, converging environmental and genetic influences, regulated by an array of specific developmental switches that set people on certain health development trajectories. (Combination of latent & cumulative effects)

**Phases of Health Development**
- Generativity
- Acquisition
- Maintenance
- Decline

**Life Course Health Development**

**Health Development Trajectories**

Patterns of changes in health over time, affected by environmental and intrinsic factors.

**Life Course Health Development Core Principles**

1. Health development integrates health and development over time in an individual.
2. Health development is influenced by both nature and nurture.
3. Health development involves the integration of adaptive and maladaptive strategies and events over time.
4. Health development is influenced by the interplay of biological, psychological, and social factors.
5. Health development is influenced by the interplay of individual, family, community, and societal factors.
6. Health development is influenced by the interplay of environmental, social, and cultural factors.
7. Health development is influenced by the interplay of individual, family, community, and societal factors.
8. Health development is influenced by the interplay of environmental, social, and cultural factors.
LCHD: Principles

• Health Development (HD) integrates the concepts of health and development into a unified whole
• Unfolding – HD unfolds continuously over the lifespan, shaped by experiences and environmental interactions
• Complexity – HD results from adaptive, multilevel, and reciprocal interactions between individual and their physical, natural, and social environments
• Timing – HD is sensitive to the timing and social structuring of environmental exposures and experiences

LCHD: Principles (cont)

• Plasticity – HD phenotypes are systematically malleable and enable and constrained by evolution to enhance adaptability to diverse environments
• Thriving – Optimal HD promotes survival, enhance thriving, and protects against disease
• Harmony – HD results from balanced interactions of molecular, physiological, behavioral, cultural, and evolutionary processes
How Risk and Protective Factors Influence Health Development

Reducing Risk & Optimizing Protective Factors
Building Healthy Brain Architecture – The Ingredients

- Takes more than having the right genes
- Takes the right, supportive experiences
- Experience literally writes on our genes, determining how well our genes work

How Early Experiences Alter Gene Expression and Shape Development
Genes Carry Instructions that Tell Our Bodies How to Work

Early Experiences Leave Lasting Chemical “Signatures” on Genes
Environment Influences Regulation of Gene Expression Beginning Before Birth

Stimulation is Needed In Order for the Brain To Develop

Human Infant is Unable to Provide Itself Adequate Stimulation for Normal Brain Development
The Brain Develops in the Context of Relationships

Socioeconomic Adversity and Child Health

- Born early, smaller, more fragile, and at risk
- Worse physical, cognitive, emotional health
- Hospitalized more, more obese, more asthma, more mental health problems, more disability
- Lower health trajectories, greater brain drain
- Carry the burden of their social status into adulthood
- Programmed into how their biology – an how their immune, endocrine, neurological systems develop, function and perform
Difference in Functional Brain Development:  Start Early & Compound Over Time

Cumulative Vocabulary (Words)

<table>
<thead>
<tr>
<th>Child's Age (Months)</th>
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<tbody>
<tr>
<td>16 mos.</td>
</tr>
<tr>
<td>24 mos.</td>
</tr>
<tr>
<td>36 mos.</td>
</tr>
</tbody>
</table>


30 Million Word Gap

At Risk
Trajectory

High risk
Trajectory

Healthy
Trajectory

Reading to child

Pre-school

Mindfulness Training

Health Services

“Healthy”
Trajectory

“At Risk”
Trajectory

“High risk”
Trajectory

Parent Responsiveness Training

Family Foundations

Language Stimulation

High quality ECE

Specialized services

Home visiting

Strategies to Improve Developmental Trajectories

6 mo 12 mo 18 mo 24 mo 3 yrs 5 yrs
Early Infancy Early Toddler Early Preschool

Developmental Progress

Age

Any moment can be a Brain Building moment!

Whether you are at the grocery store counting fruits and finding colors…

…or riding a train or bus

BrainBuildingInProgress.org
Obesity prevention: a Life Course Approach (to optimize healthy weight)

**Fetal Life**
- SES
- Mother’s Nutrition
- Growth
- Birth weight
- Toxic Stress

**Infancy and Childhood**
- Breast Feeding
- SES
- Infection
- Micronutrients
- Growth rate
- Stature
- Physical Activity
- Food behaviour
- Toxic Stress

**Adolescence**
- Obesity
- Sedentarism
- Inactivity
- Smoking

**Adult Life**
- Established adult risky behaviours
- Diet/Physical activity, Tobacco, Alcohol
- Biological risks
- Socioeconomic status
- Environmental conditions

**Elderly**
- Biological risks
- Socioeconomic status
- Environmental conditions

**Accumulated risk**

**Genetic susceptibility to Obesity**

**Source:** WHO/NMH/NPH/ALC, 2001
Ecosystem Influences on HD Trajectories

- Conception
- Birth
- Pregnancy
- Delivery
- Age
- Puberty
- Childhood Events
- Exposure to Trains
- Healthy Relationships
- Exercise
- Education
- Health Care
- Family Planning
- Safe Neighborhood
- Nutrition
- Social Support
- Protective Factors
- Risk Factors
- Optimal Birth Outcome
- Poor Birth Outcome

Disparity at Birth

©Flojane Griffin, 2012
Adverse Childhood Experiences (ACEs)

### ABUSE
- Physical
- Emotional
- Sexual

### NEGLECT
- Physical
- Emotional

### HOUSEHOLD DYSFUNCTION
- Mental Illness
- Insanitary and Relative
- Mother/Parent Maltreatment
- Substance Abuse
- Divorce

#### BEHAVIOR

**PHYSICAL & MENTAL HEALTH**
- Lack of physical activity
- Severe obesity
- Diabetes

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$10$ BILLION SPENT ANNUALLY MARKETING FOOD TO CHILDREN
SUGAR SWEETENED BEVERAGES

38.6 Pounds of added sugars from sugar drinks are consumed by the average American each year

Sources of Added sugars

**Designed for Disease**

- Demonstrated Link Between Local Food Environments and Obesity and Diabetes
- Higher the ratio of fast-food restaurants and convenience stores to grocery stores and produce vendors the higher the prevalence of obesity and diabetes
A Multigenerational, Nested, Ecosystem, Life Course Approach >>>>>> Across three generations

Grandparent
parent
offspring

National level
Neighborhood level
Household level

Childhood cohort effect (B)
Joint neighborhood effects (A)

Period effect acting on all three generations (C)

A = Joint neighborhood effect of exposure on parent and offspring
B = Childhood cohort effect on grandparent
C = Period effect influencing all three generations


The Health Policy Challenge

- Most inefficient, low value, low ROI health system
- Many other challenges
  - Massive health inequalities,
  - Rapidly rising rates of chronic disease
  - Unavoidable demographic shifts
  - Relentless cost increases
- An Anemic and Tired Health Policy Strategy that does not reflect what we know about producing health
- Old Outdated Operating System
  - Mismatch between 3.0 apps and 2.0 goals and 1.0 payment methodology
Basic Storyline

- 3 eras of health care; 3 major transitions
- 1st Era was focused on saving lives through acute care, emergency and rescue care, and public health safety
- 2nd Era was focused on prolonging life and decreasing levels of disability through chronic disease management and secondary prevention
- 3rd Era will focus on optimizing health and well being through ... primary prevention, health promotion, community integrated delivery systems
## The Evolving Health Care System

### The First Era (Yesterday)
- Focused on acute and infectious disease
- **Biomedical Model**
- Short time frames
- Medical Care
- Insurance-based financing
- **Industrial Model**
- **Reducing Deaths**

### The Second Era (Today)
- Increasing focus on chronic disease
- **BPS Model**
- Longer time frames
- Chronic Disease Mgmt & Prevention
- Pre-paid benefits
- Corporate Model
- **Prolonging Disability free Life**

### The Third Era (Tomorrow)
- Increasing focus on achieving optimal health
- **Life Course Health Development**
- Lifespan/ generational
- Investing in population-based prevention
- **Network Model**
- **Producing Optimal Health for All**

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### Transitioning to a 3.0 Operating Logic

<table>
<thead>
<tr>
<th></th>
<th>Old Operating Logic</th>
<th>New Operating Logic</th>
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</thead>
<tbody>
<tr>
<td>Definition of Health</td>
<td>Absence of Disease</td>
<td>Life Course Development of Capacities and Realizing Potential (IOM2004)</td>
</tr>
<tr>
<td>Goal of the Health System</td>
<td>Maintain Health, Prolong Life</td>
<td>Optimize Population Health Development</td>
</tr>
<tr>
<td>Client Model</td>
<td>Individual</td>
<td>Individual, Population, Community</td>
</tr>
<tr>
<td>Health Production Model</td>
<td>Down Stream &amp; Biomedical</td>
<td>Upstream Focus on Social and Developmental Origins</td>
</tr>
<tr>
<td>Intervention Approach</td>
<td>Diagnosis, Treatment and Rehabilitation</td>
<td>Disease prevention, Preemptive Interventions, Health Promotion, Optimization</td>
</tr>
<tr>
<td>Integration Strategy</td>
<td>Vertical</td>
<td>V, Horizontal, Longitudinal / Developmentan</td>
</tr>
</tbody>
</table>
All Children Thrive
All Children Thrive: What We Can Achieve

- Optimize Health, Development & Well Being
  - Healthy births, school readiness, high school graduation & college going rates
  - Health status, disability rates,
- Improve the conditions and context of childhood
  - Decrease poverty, inequality, adversity,
  - Improve family function, safety, opportunities, neighborhoods, communities
- Improve performance of systems
  Health, education, family support, housing, justice
- Create a sustainable culture of health development, resilience and sustainability for children, youth &
### 8 Strategies Prioritized & Roadmapped

<table>
<thead>
<tr>
<th>Strategy Roadmaps</th>
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<tbody>
<tr>
<td>Financing for a Healthy Future</td>
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<tr>
<td>Cross Sector Alignment</td>
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<tr>
<td>Enhancing Communication</td>
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<tr>
<td>Engaging Families &amp; Communities</td>
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<tr>
<td>Engineering Learning Systems</td>
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<tr>
<td>Data &amp; Health Development Metrics</td>
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<tr>
<td>Co-Designed Family Driven Systems</td>
</tr>
<tr>
<td>Community Capacity Building</td>
</tr>
</tbody>
</table>

### Outcome Measures

- Healthy births
- School readiness
- 3rd Grade reading
- School success
- Mental health
- Higher quality health care
- Fewer unnecessary hospitalizations
- Enhance Child and Family Well being
LCHD: Summary

- Life course health development models are emerging
  - New synthesis integrating life course chronic disease epidemiology, developmental neurobiology, psychology, toxicology, epigenetics
  - Not just arraying social determinants but understanding mechanisms, timing, dynamics

- Health development in US is comprised from the start
  - Poorer child health >> more chronic disease and lower Life expectancy
  - Steep social gradients when compared to other nations
  - Obesity epidemic and emerging mental health epidemic are prime examples
LCHD: Summary

- Improving the developmental health and well-being of young people is key strategy for reducing health disparities.
- Need to consider the fundamental causes (causes of causes) that are creating an enormous mismatch between human developmental plasticity determined by biocultural evolution and current environments.
- Transforming the US health system and reducing costs will depend on shifting the focus of health production from late in life to early intervention, prevention, and lifelong health promotion.
- More attention to the developmental and cultural scaffolding, especially the relational scaffolding, and not just the services.