Heading Upstream: Epigenetics, equity and the social determinants of maternal and child health

Maternal and Child Health
Title V Block Grantee Meeting
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A Core Public Health Principle

"The primary determinants of disease are mainly economic and social, and therefore its remedies must also be economic and social. Medicine and politics cannot and should not be kept apart."

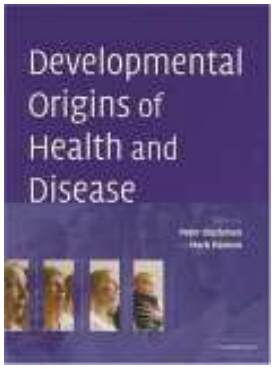
Geoffrey Rose, MD
The Strategy of Preventive Medicine,
Oxford University Press, 1992.

Three public health lessons

- Public health as social justice
- Social determinants of health
- Population focus

Developmental Origins of Health and Disease

DOHaD emphasizes preconception, prenatal, and early childhood periods as important for development of chronic disease throughout life.



Developmental Origins of Health & Disease

- Vulnerability for a range of physical diseases and mental health problems begins earlier than we thought;
- The genes that we inherit play a relatively small role in population levels of chronic diseases;
- How our genes are silenced or activated as a result of interaction with the environment is key (epigenetics);
- There are specific sensitive times when the impact of the environment is critical;
- Nature and nurture are inseparable;
- A concerted focus on changing our environment can ultimately change our biology and promote the public's health;
- This requires us to refocus prevention efforts further upstream.

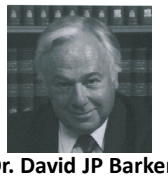
The Barker Hypothesis and the Developmental Origins of Health & Disease

"… coronary heart disease, type 2 diabetes, stroke and hypertension originate in developmental plasticity, in response to undernutrition during fetal life and infancy."

Why?

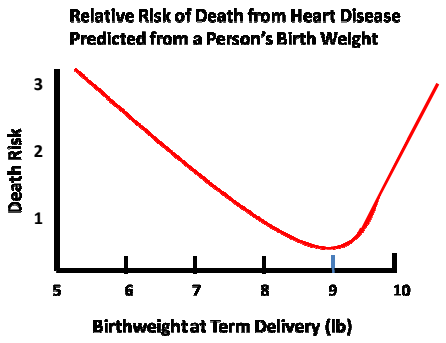
1. Reduced function in key organs
2. Altered settings in metabolism and hormonal feedback
3. Increased vulnerability to adverse environments later in life.

David Barker, MD, PhD, 2004



Dr. David JP Barker
1938-2013

The Barker Hypothesis: Early Life "Programming" of Chronic Disease



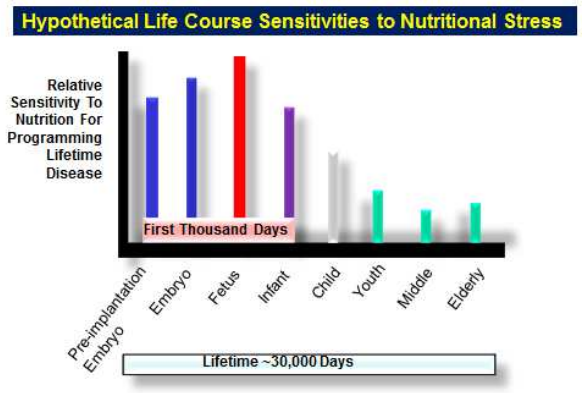
Poor growth before birth results in a weakened body for life

Birthweight Also Predicts:

- ✓ Type 2 Diabetes
- ✓ Obesity
- ✓ Hypertension
- ✓ COPD
- ✓ Asthma
- ✓ Cognitive Function

India: Stein. *Lancet* 348: 1269-1273, 1996.
Sweden: Leon. *BMJ* 317: 241-245, 1998
USA: Rich-Edwards. *BMJ* 315: 396-400, 1997.
Finland: Barker. *Int J Epidemiol* 31: 1235-1239, 2002.
China: *Ann of Medicine* 42: 596-602, 2010

Slide courtesy of Kent Thornburg, PhD
Moore Institute for Nutrition & Wellness



Thornburg, unpublished

Low birth weight

- A marker for slow intrauterine growth and development due to necessary energy tradeoffs;
- Associated with higher risk of metabolic syndrome;
- Associated with higher risk of chronic diseases such as diabetes, heart disease, obesity, hypertension, various cancers;
- Associated with poorer school performance, lower test scores, higher rates of social problems, and higher risk of mental health problems;
- Low birth weight is not destiny, risk is not certainly; but it signifies vulnerability

Chronic Stress

- Chronic stress during pregnancy contributes to higher levels of cortisol that can cross into the placenta
- Consequences include the same risks as nutritional deficiencies including significant mental health problems, heightened response to stress, poor cognitive development, etc.
- "The elevated cortisol levels experienced by the fetus permanently adjust the setting of the stress axis of the fetus in a way that makes it more sensitive and hyper responsive to subsequent stress events."

Taxonomy of Stress in Childhood

(Shonkoff, Boyce, McEwen, 2009)

- Positive
  - Moderate, short-lived increases in heart rate, blood pressure, and stress hormone levels.
- Tolerable
  - Physiological state that could potentially disrupt brain architecture but is buffered by supportive relationships that facilitate adaptive coping.
- Toxic
  - Frequent and/or prolonged activation of the body's stress-response systems in the absence of buffering protection that disrupts brain architecture and affects other organs. Adverse impact across the life course.

The equity issue

"[DOHaD]identifies the most fundamental social equity issue in our society: that initial social and biological disadvantage, established even prior to birth, and linked to the social experience of prior generations, is made worse by adverse environments throughout the life course."

Wallack & Thornburg, 2016

"When it comes to your health, your zip code may be more important than your genetic code."

Robert Wood Johnson Foundation
Commission to Build a Healthier America, 2014

Epigenetics

- The process by which our genes respond to environmental cues and influence how our genes are programmed to regulate biological functions.
- 'Epi' refers to being above or on the genes. The genetic code does not change, but the biological switches that turn those genes on and off do.
- These altered regulatory commands can be passed from parent to child so that altered gene expression patterns that affect one's health all the way into adulthood can be passed on to the next generation, and the next.

Double Hit

- The first hit is the vulnerability created from the experience of previous generations through the first 1000 days.
- The second hit comes from hostile environments marked by racial and other discrimination, and social disadvantage that will increase the likelihood that the original vulnerability will transform into later disease.
- Because some of these changes can be transmitted across generations, the "second hit" of one generation can become the "first hit" of the next.

Heading Upstream

Upstream, midstream, downstream

- Broad social change
- Specific public health policy change
- Behavior change

"If they can get you asking the wrong questions, they don't have to worry about answers."

Thomas Pynchon
Gravity's Rainbow

Asking upstream questions (use nutrition and stress as starting points)

- What would Oregonlook like if it were the best place in the world to be pregnant and have a baby?
- What would need to change?
- What kind of policy is needed to make this happen?
- How can we mobilize the political will to create change?
- How can that change be initiated, supported, and/or accelerated?

Obstacles to progress

- The complexity of the concepts
- Uncertainty about best starting point and balancing short term impact with real long term population change
- The well known “silo” or “cylinders of excellence” effect
- Funders resistance to focus on interstitial approaches
- Long term, intergenerational perspective
- Tendency to focus on personal-individual-behavioral factors rather than deeply embedded social-economic-policy factors
- Need for significant social change; personal behavior change is necessary but not sufficient

The problem is whether we are determined to go in the direction of compassion or not . . . . If I lose my direction I have to look for the north star and I will go to the north. That does not mean I expect to arrive at the north star. I just want to go in that direction.

Thich Nhat Hanh

Final Thoughts:

What are the bridges necessary to move from the level of change on which we are working to the next level?