Prenatal Influences on Adult Health Disparities

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Fellow, Institute for Policy Research
Mortality from Coronary heart disease in UK women

Birth weight (lb)

rate per 100,000

Fetal Nutrition and Adult Health: The ‘Fetal Origins’ Hypothesis

Fetal
Undernutrition

Adaptation (survival)

Hypertension  Diabetes  Central Obesity  Cholesterol

Cardiovascular Disease

Prenatal influences on health disparities

Today: 2 examples

• International: CVD risk in the Philippines
• US: African American hypertension
Example #1
Cardiovascular risk in the Philippines
Study Setting: The Philippines
Study Site: Cebu City
The CLHNS

The Cebu Longitudinal Health & Nutrition Survey

U of N Carolina (Chapel Hill)
- Linda Adair

Office of Pop. Studies (USC - Cebu)
- Wilhelm Flieger
- Josephine Avila
- Judith Borja

Northwestern University
- Thom McDade
Sample: A cohort of 3,327 mothers and their children born between May 1, 1983 and April 30, 1984...

- Multiple follow-ups: diet, SES, activity, growth
- Data: from 3rd trimester of pregnancy to present

...in 17 urban and 16 rural barangays of Metro Cebu.
“Bad” cholesterol (LDLc)
Males: LDL cholesterol by birth weight quartiles

- BW-1: < 2.7 kg
  LDLc (mg/dl): 98.3
- BW-2: 2.7-3.0 kg
  LDLc (mg/dl): 90.2
- BW-3: 3.1-3.3 kg
  LDLc (mg/dl): 90.5
- BW-4: > 3.3 kg
  LDLc (mg/dl): 89.4
Male LDLc:
By weight at birth & adolescence

<table>
<thead>
<tr>
<th>Birth weight</th>
<th>LDLc (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW-1</td>
<td>105</td>
</tr>
<tr>
<td>BW-2</td>
<td>101</td>
</tr>
<tr>
<td>BW-3</td>
<td>96</td>
</tr>
<tr>
<td>BW-4</td>
<td>93</td>
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Adolescent weight
Males: Birth weight & cholesterol

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More relationships in males with higher triceps
### Females: Birth weight & cholesterol

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No relationships in females
Males: Mother’s energy status during pregnancy

A strong predictor of cholesterol in male offspring

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Male offspring of leaner mothers have **higher** cholesterol & CVD risk
More relationships in males with higher triceps

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All 6 outcomes as predicted in males with higher current adiposity

Male offspring of leaner mothers have higher cholesterol & CVD risk
Fetal Nutrition, Culture Change, and Adult Health

How important is fetal nutrition to CVD in the Philippines?
Interaction: fetal and postnatal nutrition

<table>
<thead>
<tr>
<th>Nutrition</th>
<th>Undernourished</th>
<th>Well-Nourished</th>
<th>Overnutrition</th>
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<td></td>
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<td>97.7</td>
<td>104.9</td>
<td>116.2</td>
</tr>
<tr>
<td>Nutrition-2</td>
<td>100</td>
<td>104.9</td>
<td>116.2</td>
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Adolescence

Undernutrition → Overnutrition
Is mother sending the wrong signal?

- **Ecology**
  - Low nutrition
  - Ecologic change
  - Excessive nutrition

- **Mother**
  - Hormones
  - Nutrients

- **Fetus**
  - Developmental Adaptations (Birth)

- **Adult**
  - CVD
Trends in dietary fat intake: Asian nations

% kcal from fat

Year


high income
mid income
upper low inc
lower low inc

The Prevalence of Low Birth Weight in Asia (1990’s)
Summary: Philippines

- Fetal undernutrition predicts elevated CVD risk later in life
- The health impact of lifestyle changes may be conditioned by one's nutritional experiences as a fetus
- Maternal health has lasting effects on the health of the next generation
Example #2

Hypertension among African-Americans
US health disparities
Hypertension

Source: NCHS 2004
Hypertension in populations of African & European descent

From: Cooper et al (2005), BMC Medicine 3:2
US health disparities
Low birth weight

Source: NCHS 2004
SES

- discrimination
- racism

“STRESS”

Prematurity & low birth weight
Birth weight & CVD risk in US
Bogalusa Heart Study

Mzayek et al 2004, Annals Epidemiology 14(4)258
“STRESS”

SES

discrimination

racism

Long-term effects:

Adulthood
Hypertension
Central obesity
Diabetes
Heart attack
Stroke

Prematurity & low birth weight
Maternal blood pressure during pregnancy and fetal growth

Generation #1
SES
- discrimination
- racism

Generation #2
Poor health

From SES, discrimination, and racism, poor health is passed down to the next generation.
Intergenerational, life course health model

Maternal health
- Hypertension
- Diabetes
- Stress
- Heart attack
- Stroke

Fetal health
- Prematurity
- Low birth weight
- Perinatal mortality
- High reactivity

Infant health

Adult health

Childhood health
Summary: Prenatal influences on health disparities

Philippines

- Example of rapidly changing society
- Prenatal undernutrition can condition disease response to later lifestyle changes

United States

- Chronic health disparities among sub-groups
- Intergenerational influences of stress and discrimination could help explain clusters of health disparities in certain demographic/ethnic groups.
Plans…

Philippines: 2005 new round of study
- participants now young adults

“CCHN” - health disparities in birth outcomes and early child development in five US cities