Early Diet = Lifelong Health for Generations

BOB AND CHARLEE MOORE INSTITUTE FOR NUTRITION AND WELLNESS
Oregon Health and Science University
Thank you to:

The Late David JP Barker & Helsinki Epidemiology Group

OHSU Pregnancy & Fetal Development Group
  Center for Developmental Health
  Knight Cardiovascular Institute (~60 Scientists)

Moore Institute for Nutrition and Wellness
  Staff and Program Experts

Support from:
  National Institute of Child Health & Human Development
  National Institute of Heart, Lung and Blood
  National Institute of Diabetes and Digestive and Kidney Diseases
  National Institute of Aging
  M. Lowell Edwards Endowment
TOPICS

Chronic Disease in the USA

Is It Genetic?

Developmental Roots of Disease

Transgenerational Effects of Diet

Diet before Pregnancy

Nutrients and Whole Grains

Epigenetic Influences

Let’s Eliminate Chronic Disease!
Average Life expectancy in years: 1900 - 2010

David S. Jones, M.D., Ph.D., Scott H. Podolsky, M.D., and Jeremy A. Greene, M.D., Ph.D.
US Death Rates from Different Causes Since 1900

Influenza Epidemic
>30K deaths worldwide

Heart Disease

Heart plus Stroke

Cancers

Stroke

3 Downward Trends


David S. Jones, M.D., Ph.D., Scott H. Podolsky, M.D., and Jeremy A. Greene, M.D., Ph.D.
The Worsening Health of the American Population

% Oregon Population Defined as Obese (BMI > 30)


% of Population

Year Measured

Uncontrolled Hypertension, USA

Millions of People


Uncontrolled Hypertension, USA

Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958-2010

Obesity, Type 2 Diabetes and Hypertension are risk factors for coronary heart disease and stroke.

--Heart disease costs $1.0 \times 10^9$ per day

--Costs will double by 2026 (Source: AHA 2014)
Obesity Prevalence

8-11 years

12-19 years

CDC NHANES 1971-2006

http://www.sbm.org/
Are Increases in Disease Prevalence Genetic?

Heart Deaths

Stroke Deaths

Adults with Diabetes

Obesity

Prevalence of Self-Reported Obesity Among U.S. Adults
BRFSS, 2011

Percentage of Adults Aged 20 Years and Older Who Have Been Told They Have High Blood Pressure, 2007

Depression Prevalence 2006
Birthweight Predicts:

- Type 2 Diabetes
- Obesity
- Hypertension
- Osteoporosis
- Asthma
- Cognitive Function

Early Life “Programming” of Chronic Disease

Relative Risk of Death from Heart Disease Predicted from a Person’s Birth Weight

Birthweight at Term Delivery (lb)

Original Data from Barker et al., 1989

Poor growth before birth results in a weakened body for life
Risk for impaired glucose tolerance or type 2 diabetes according to birth weight among 370 men aged 64 years born in Hertfordshire (adjusted for adult body mass index).

Diabetes is a vascular disease
In the USA 65% of people with type 2 diabetes die of heart disease or stroke.
American Heart Association
Maternal Role in Programmed Disease

Maternal Influence
- 100 year nutrition
- 1000 day nutrition
- Maternal body type
- Maternal Physiology
- Maternal diet
- Maternal social stress
- Placentation
- Placental function

Fetal Nutrition
- Oxygen
- Other Nutrients
- Hormones
- Stress molecules
- Cytokines

Fetal Outcome
- Birthweight
- Ponderal index
- Organ structure
- Epigenetic profile
- Blood Chemistry
- Fetal systems:
  - Immune
  - Redox
  - Stem Cells
  - Inflammation
  - Neuro endocrine

Offspring Vulnerability

The 2nd Hit
- Aging Rate
- Diet
- Infections
- Social cues
- Stress
- Hormones
- Toxins

Disease

Thornburg 2015
Prevalence of Hypertension

Helsinki Birth Cohort (Eriksson et al.,)
Beyond Birthweight

Maternal Body Type
Height, weight, muscle mass, fat mass, skeletal dimensions, hormone profile, blood lipids.

Preconception

Paternal Effects

How the Fetal Body is Constructed

Placental Size and Shape
Weight, width, length, thickness, number of cotyledons, cord insertion and length
Four Generations of Women, (1931 Photo)
Nutritional Flow Across Generations

Born ~1879

27 y/o Born ‘04

86 y/o in 2015
Her “egg age” ~110 years old

2 y/o

Born before 1854

Her mother was born in 1904, now would be 111 y/o
In rats, a low protein diet during embryo transit leads to cardiovascular disease in offspring and epigenetic changes in CV regulatory genes.

T. Flemming et al., 2006
Methylation is increased with low maternal carbohydrate intake.

FIG. 2. Child’s %fat mass and fat mass at age 9 years increase with higher umbilical cord RXRA chr9:136355885+ methylation in the PAH cohort. Values are means + SEM. *Fat mass and percentage fat mass are preadjusted for sex.
The New Frontier: Nutrient Regulation of Epigenetic Gene Regulation

My Pregnancy Plate

Choose large portions of a variety of non-starchy vegetables, such as leafy greens, broccoli, carrots, peppers or cabbage.

Choose small amounts of healthy oils (olive and canola) for cooking or to flavor foods. Nuts, seeds and avocados contain healthy fats.

Choose a variety of whole fruits. Limit juice and dried fruits. Fruit is great for snacks and dessert, too.

Aim for at least 30 minutes of walking or another physical activity each day.

Choose 2 to 3 servings of nonfat or 1% milk or yogurt (cow, soy or almond). A serving is 8 oz. Choose yogurt with less than 15 g of sugar per serving.

Drink mainly water, decaf tea or decaf coffee and avoid sugary beverages.

Choose protein sources such as poultry, beans, nuts, low-mercury seafood, eggs, tofu or low-fat cheese. Limit red meat and avoid cold cuts and other processed meats.

Choose whole grains, such as whole wheat bread or pasta, brown rice, quinoa or oats and other healthy starches like beans, lentils, sweet potatoes or acorn squash. Limit white bread, white rice and fried potatoes.

Oregon Health & Science University

Courtesy: Christie Naze, RD, Dept Ob/Gyn, OHSU
Grains are Eggs: They contain nutrients to start a new life.

Those nutrients are good for people too.
Whole Grain Consumption Is Associated with Lower Rates of Type 2 Diabetes

Rate of T2D in %

Whole grain ingredient intake in g/d

- Best fitting linear regression model
  \( y = -0.0293x + 5.6679 \)

- : lower and upper bands of the 95% CI of the predicted value
“The consumption of cereals, vegetables and fruits positively influenced the embryo quality at the cleavage stage. “

Reprod Biomed Online. 2015 Mar 27. pii: S1472-6483(15)00148-0. doi: 10.1016/j.rbmo.2015.03.007. [Epub ahead of print]
Multiple Environments and Programmed Inflammation: A model

- Chronic Social Stress
- Maternal Phenotype
- Poor maternal Diet
- Intergenerational malnutrition
- Disease
- "Second Hits"
- Paternal Contributions

Pro-inflammatory state & vulnerable for later disease
TAKE HOME MESSAGES

We will never overcome the increasing rates of chronic disease by treating ONLY adults or improving their diets.

We will never overcome increases in diabetes and obesity unless we halt the vulnerability of people at birth and in infancy.

The key to reversing rising disease rates is to change the food culture:
  - We must dramatically decrease consumption of processed foods
  - We must increase consumption of whole nutritious foods.
Whole grains are key ingredients of a wholesome diet.