The First 1,000 Days – The Connection between You and the Health Legacy of the Next Generation

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April 19, 2017
Acknowledgements

• Nelida Duran, PhD, RD, Assistant Professor, California State University, Northridge
• Marion Taylor Baer, PhD, RD, UCLA Fielding School of Public Health
Interest in Good Nutrition is Growing Among the Public and ...
“This document is directed at a range of stakeholders with the intention of highlighting the **central role that nutrition has on adolescent, maternal and infant well-being**. This is an area that has traditionally been of low priority, but which has major **implications for girls’ and women’s health as well as the health of their offspring.**”

Recommendations of the Federation of Gynecology and Obstetrics (FIGO) Hanson et al, 2015
Life Course Perspective:
a new MCH paradigm
This is *not* prevention
Determinants of Health
Determinants of Health
Life Course Perspective
Key Concepts – $T^2E^2$

Timeline
Timing
Environment
Equity

Kotelchuck & Fine, 2010
“T”imeline Concept

Conveys idea that today’s exposures determine tomorrow’s health - cumulative impacts over time.
Timeline and Nutrition

Figure 1: Public Health Nutrition Programs Influence Health Development.
“T”iming Concept

Health trajectories are especially affected during critical periods in life.

The earliest exposures and experiences are most important.
Figure 2. Examples of Key Foods/Nutrients Affecting Critical Periods

Herman, Baer, Adams, et al. MCHJ, 2013
“E”nvironment

The broader community environment including the physical, social, and economic environments, strongly affects a person’s capacity to be healthy.
Income Disparities

Higher Income, Longer Life

Adult life expectancy* increases with increasing income. Men and women in the highest-income group can expect to live at least six and a half years longer than poor men and women.

Prepared for the Robert Wood Johnson Foundation by the Center on Social Disparities in Health at the University of California, San Francisco; and Norman Johnson, U.S. Bureau of the Census.


*This chart describes the number of years that adults in different income groups can expect to live beyond age 25. For example, a 25-year-old woman whose family income is at or below 100 percent of the Federal Poverty Level can expect to live 51.5 more years and reach an age of 76.5 years.
Poverty is a Major Risk Factor for Sub-optimal Development

Adapted from Poulsen, MK, 2011
Figure 5.
**Poverty Rates by Age: 1959 to 2014**

Note: The 2013 data reflect the implementation of the redesigned income questions. See Appendix D for more information. The data points are placed at the midpoints of the respective years. Data for people aged 18 to 64 and 65 and older are not available from 1960 to 1965. For information on recessions, see Appendix A. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see <ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar15.pdf>.

“E”quity

The importance of addressing disparities in health and development across populations.

Inequality in access to resources has as much or more influence on health as genetics or personal choice.
Geographic Disparities

Population in poverty (Percent) - 2009

- 9% - 11%
- 12% - 13%
- 14% - 16%
- 17% - 22%
Figure 1.
Real Median Household Income by Race and Hispanic Origin: 1967 to 2013

Note: Median household income data are not available prior to 1967. For more information on recessions, see Appendix A. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see <ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf>.

Food Insecurity in the US

U.S. households with children by food security status of adults and children, 2015

- Food-insecure households -- 16.6%
  - Food insecurity among adults only in households with children -- 8.8%
  - Food-insecure, children -- 7.8%
- Low food security among children -- 7.1%
- Very low food security among children -- 0.7%

Food-secure households -- 83.4%

Note: In most instances, when children are food insecure, the adults in the household are also food insecure.

Prevalence of food insecurity, average 2013-15

Summary: Life Course Perspective

**Access** to health-promoting factors (**environment**) for **all**, (**equity**) protects during **critical periods** (**timing**) and assures optimal health early in life to promote **lifelong health** (**timeline**).
Healthy People 2020: Overarching Goals

• Attain high-quality, longer lives free of preventable disease, disability, injury, and premature death.

• Achieve health equity, eliminate disparities, and improve the health of all groups.

• Create social and physical environments that promote good health for all.

• Promote quality of life, healthy development, and healthy behaviors across all life stages.
Share your thoughts...
In a few words, share how you can use the life course perspective to promote WIC services...
The First 1,000 Days: What is the Role of Nutrition and Epigenetics?
Nutrition and Epigenetics

your epigenetic life

pre-conception: Some epigenetic tags from parents are passed to offspring.

embryo: Cells develop specialized functions via epigenetic instruction.

infancy: Epigenome remains flexible through early growth stages as environmental and nutritional conditions change.

childhood: Nutrition and environmental exposures affect the epigenetic inheritance of future generations.

adolescence:

early adult:

adult:

maturity: Gene silencing through targeted nutrition allows epigenetic mechanisms of action to prevent or delay the onset of inherited health problems and improve quality of life.

Maternal nutrition provides epigenetic support.
Evolution of the Importance of Food to Health

Food as Medicine
1,500 BC - 1900
2020 - ??

Recognition of deficiency diseases

Discovery of Vitamins and Antibiotics
1900-1950

Emphasis on drugs and supplements
Explosion of processed and fortified foods

Discovery of Trace Minerals
1950-1980

“Nutritionism”
Discovery of Bioactive Dietary Components
1980-2000

DNA/Genetics
Understanding of role of other food components in absorption/metabolism of nutrients

Epigenetics
Nutrients as gene modulators
1990-present

Microbiome research

Epigenetics

- Phenotypic diversity is shaped by both genetic and epigenetic mechanisms

- Cells undergo massive epigenetic reprogramming during development

Nutrition and Epigenetics

• Epigenetics → **Combination of mechanisms** that gives long-term programming to genes

• Unlike genetic mechanisms (gene sequence), epigenetic mechanisms (gene function) are DYNAMIC!

• Therefore, **DIET** along with behavioral and nutritional strategies may serve as effective interventions to prevent and reverse harmful epigenetic changes.

Epigenomics: the analysis of epigenetic changes across many genes in a cell or entire organism.
What is the Epigenome?

• A multitude of chemical compounds that tell the genome what to do.

• DNA holds the instructions for building the proteins that carry out a variety of functions in a cell.

• Epigenomic compounds attach to DNA and modify its function.

Nutrition and the Epigenome

http://learn.genetics.utah.edu/content/epigenetics/nutrition/  Accessed April 12, 2016
How Can WIC Affect the Epigenome?

### A Snapshot of the First 1,000 Days in America

<table>
<thead>
<tr>
<th>THE 10 BUILDING BLOCKS FOR NUTRITION</th>
<th>HOW THE U.S. IS FARING</th>
</tr>
</thead>
<tbody>
<tr>
<td>A healthy and nutritious diet for mothers during pregnancy</td>
<td>Nearly half of women gain an excessive amount of weight during pregnancy.</td>
</tr>
<tr>
<td>Good care for all mothers during pregnancy</td>
<td>The U.S. has one of the highest maternal mortality rates of any wealthy country in the world.</td>
</tr>
<tr>
<td>Exclusive breastfeeding for the first 6 months</td>
<td>Only 22% of infants are exclusively breastfed at 6 months.</td>
</tr>
<tr>
<td>Nurturing, responsive care and feeding of babies and toddlers</td>
<td>Less than half of U.S. mothers receive any paid time off to care for their newborn.</td>
</tr>
<tr>
<td>The right foods introduced to babies at the right times</td>
<td>Almost 40% of parents introduced solid foods to their babies too early.</td>
</tr>
<tr>
<td>A healthy and nutritious diet for babies and toddlers</td>
<td>1 in 4 toddlers are not getting enough iron in their diets—a key nutrient for brain development.</td>
</tr>
<tr>
<td>Water and other healthy beverages with no added sugars for toddlers</td>
<td>More than half of toddlers and preschoolers consume one or more sugar-sweetened beverage every day.</td>
</tr>
<tr>
<td>The right knowledge and skills for parents and caregivers to properly nourish young children</td>
<td>54% of mothers say they receive mixed messages about what to feed their young children.</td>
</tr>
<tr>
<td>Consistent access to enough nutritious food for families of young children</td>
<td>1 in 5 children under the age of 6 live in families that struggle to put enough nutritious food on the table.</td>
</tr>
<tr>
<td>Societal investments in the well-being of every baby and toddler</td>
<td>More than 25% of infants and toddlers live in poverty.</td>
</tr>
</tbody>
</table>
A mother's diet during pregnancy & diet as an infant can affect the epigenome into adulthood.
## Which WIC Foods Affect the Epigenome?

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Food Sources</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folic Acid</td>
<td>Leafy vegetables, sunflower seeds, baker's yeast, liver</td>
<td>Methionine synthesis</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>Meat, liver, shellfish, milk</td>
<td>Methionine synthesis</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>Meats, whole grain products, vegetables, nuts</td>
<td>Methionine synthesis</td>
</tr>
<tr>
<td>Choline</td>
<td>Egg yolks, liver, soy, cooked beef, chicken, veal, turkey</td>
<td>Methyl donor to SAM</td>
</tr>
<tr>
<td>Sulforaphane</td>
<td>Broccoli</td>
<td>Increased histone acetylation turning on anti-cancer genes</td>
</tr>
<tr>
<td>Butyrate</td>
<td>Produced in intestine when dietary fiber is fermented</td>
<td>Increased histone acetylation turning on 'protective' genes, increased lifespan</td>
</tr>
</tbody>
</table>

http://learn.genetics.utah.edu/content/epigenetics/nutrition/  Accessed April 12, 2016
We are what our parents ate...

• Yellow mouse: unmethylated agouti gene

• Brown mouse: methylated agouti gene

→ Genetically IDENTICAL

• Methyl-rich diet offered to pregnant yellow mice

→ Offspring born brown and healthy

http://learn.genetics.utah.edu/content/epigenetics/nutrition/ Accessed April 12, 2016
Toxins and Supplements

These Two Mice are Genetically Identical and the Same Age

While pregnant, both of their mothers were fed Bisphenol A (BPA) but DIFFERENT DIETS:

The mother of this mouse received a normal mouse diet

The mother of this mouse received a diet supplemented with choline, folic acid, betaine and vitamin B12

http://learn.genetics.utah.edu/content/epigenetics/nutrition/  Accessed April 12, 2016
The Effect of Fathers’ Diets on Children’s Health

Where is the “F” in WIC?
Paternal Diet and Children’s Mental Health

• Cross-generational study, male rats allowed to eat abundant amounts of food compared to those with access to 25% fewer calories

• Offspring of food-limited rats were lighter, ate less, showed less evidence of anxiety

Govic et al, Psychoneuroendocrinology, 2016; 64: 1
Dads Also Eats for Two

• Sperm from obese men carry distinct epigenetic signature compared to lean men
• Sperm cells of lean and obese men possess different epigenetic marks in gene regions of appetite control

Donkin et al, *Cell Metabolism*, December 2015
Paternal Diet and Long-term Health

http://learn.genetics.utah.edu/content/epigenetics/nutrition/  Accessed April 12, 2016
KEEP CALM
ITS
QUIZ TIME
Q1.

Nutrition can affect how our genes are expressed.

a. True
b. False
Q2.

Which of the following foods in the WIC food package can affect the epigenome?

a. Whole grains
b. Fruits and vegetables
c. Milk
d. Eggs
e. All of the above
Q3.

The diet of fathers prenatally is important because it can affect children’s:

a. Lifespan
b. Chances to get diabetes
c. Chances to become obese
d. Chances to have mental health issues
e. All of the above
Improving WIC Participation: A Community Systems Approach
The WIC Participant Experience

WIC participant experience

- Knowledge about WIC
- Nutrition counseling, education, BF support, referral to health care
- Motivations/barriers
- Certified
- WIC foods issued (EBT/vouchers)
- WIC shopper in store
- WIC foods acquired
- WIC foods available in store
- WIC shopper doesn't use EBT/voucher
- WIC foods not purchased
- WIC foods not consumed by target person
- WIC foods consumed by target person

Retail food environment

State WIC regulations

USDA WIC regulations

IOM 2006 report recommendations

WIC-eligible individual
- Never certified
- Motivations/barriers
- Product on EBT/voucher
- State decides product requirements

Manufacturer makes WIC-compliant food

Vendor stocks WIC foods

Vendor authorization

Food preferences
- Storage available
- Food preparation available

Barriers to WIC Participation and Redemption

Barriers to Participation

- Long wait times; crowded physical environment
- Lack of transportation
- Belief that family is ineligible; changing eligibility restrictions
- Program requires too much effort, difficult paperwork
- Language barriers

Barriers to Redemption

- Embarrassment, negative interactions in stores
- Gaps in knowledge (e.g., determining amount of F/V with CVV)
- Limited selection of WIC foods at local vendors; products not available in allowable forms
- Vendor challenges anticipating demand and maintaining adequate supply of some WIC foods
- Maintaining food freshness at the vendor (particularly small vendors)

Community Systems Framework to Promote Healthy Families

Nadar et al, *Childhood Obesity*, June 2012

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The diagram illustrates a framework for promoting healthy families through community systems. It highlights the interplay between local, state, and national policies and individual, family, and social environment supports. The framework emphasizes the importance of cross-sectional interactions (labeled as 4) and how these can influence health outcomes. The diagram also outlines potential strategies and agents of change (labeled as 1, 2, 3, 5, 7, 6, 8) to address childhood obesity and other health issues.
Suggested Solutions Mentioned by caregivers, WIC staff, and vendors

AGENCY

- Tailored messaging
- Sell WIC campaign
- Participant incentives
- Automated text reminders
- “Get to Know WIC
- Staff” photo board
- Tailor education based on WIC experience
- Waiting room video

COMMUNITY

- Public education campaign
- Grocery delivery
- Mobile clinic
- Linkage with other services
- Partner with healthcare and childcare providers

VENDOR

- Vendor Training
- WIC grocery store tour
- Switch to EBT
- Improved WIC labeling

<table>
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<tbody>
<tr>
<td>• Engage in early prenatal, post-natal, and inter-conceptual care</td>
</tr>
<tr>
<td>• Achieve healthy gestational weight gain</td>
</tr>
<tr>
<td>• Post-partum return towards a healthy weight</td>
</tr>
<tr>
<td>• Prepare to breast feed</td>
</tr>
<tr>
<td><strong>Infancy</strong></td>
</tr>
<tr>
<td>• Initiate and maintain breast feeding</td>
</tr>
<tr>
<td>• Appropriate introduction of other beverages and foods</td>
</tr>
<tr>
<td>• Support for healthy sleep patterns</td>
</tr>
<tr>
<td>• Support for appropriate soothing, not always using food</td>
</tr>
<tr>
<td>• Support for motor development</td>
</tr>
<tr>
<td>• Avoid excessive weight gain in infancy</td>
</tr>
<tr>
<td>• Avoid screen time</td>
</tr>
<tr>
<td><strong>Toddler Years</strong></td>
</tr>
<tr>
<td>• Active play at least one hour per day, limitation of screen time</td>
</tr>
<tr>
<td>• Consumption of healthy foods, snacks, and un-sweetened beverages in appropriate portion sizes</td>
</tr>
<tr>
<td>• Healthy nutrition and activity standards in childcare settings</td>
</tr>
<tr>
<td>• Limit screen time</td>
</tr>
</tbody>
</table>

Nadar et al, *Childhood Obesity*, June 2012
What about the Millennials?

Finding Time:
Millennial Parents, Poverty, and Rising Costs

http://younginvincibles.org/
Preventive Care? Prenatal Care?

In response to a survey by Young Invincibles, responses were....

“What is that?”
“No instant gratification”

So, how can we better engage this demographic?
What did Emma eat that is part of the WIC Food Package?
Take home message...
You Are What your Grandparents Ate...
Thank you!