ANH 101: Core Disciplines in Agriculture-Nutrition-Health Research

Nutrition

Jody Harris, Paula Dominguez, and Dominic Rowland
Addis Ababa, June 2016
Outline

• Essential epidemiology
• Nutrition definitions and determinants
• Measuring malnutrition
• Nutrition interventions
EPIDEMIOLOGY

“The study of the distribution and determinants of health-related states or events in specified populations”

(Dictionary of Epidemiology)
The Epidemiological Approach

- Case definition
- Specified population
- The core of epidemiology
- Compare:
  - Populations
  - Exposure to risk factors
  - Over time
Study designs

Descriptive
- who
- where
- when
- population
  - ecological
- individual
  - cross-sectional

Analytical
- why
- hypothesis
- observational
  - cohort
  - case-control
  - RCT
Association and causality

Three reasons an association might not be causal:

1. **Random Error**
   - Variation between samples
   - Cannot control

2. **Bias**
   - Systematic error in design or conduct
   - Can control with careful design

3. **Confounding**
   - A separate variable associated with the exposure or outcome
Bradford Hill’s criteria for causality

- Temporality
- Analogy
- Plausibility
- Consistency
- Reversibility
- Strength
- Specificity
- Dose-response relationship
SECTION 2: NUTRITION DEFINITIONS AND DETERMINANTS

NUTRITION
“The intake of food, considered in relation to the body’s dietary needs”. (WHO)

MALNUTRITION
“Broad term for a range of conditions that hinder good health, caused by inadequate or unbalanced food intake or from poor absorption of food consumed”. (FAO)
Malnutrition

Nutrient intake

Health status

Food security and quality

Care resources and practices

Health services and WASH

Institutions

Political and ideological framework

Economic structure

Resources

Environment, technology, people

Immediate causes

Underlying causes

Basic causes

Source: Adapted from UNICEF 1990
Determinants of malnutrition: Economic

Undernutrition and obesity by the level of GDP per capita

Variables:
- Stunting
- Obesity

Graph:
- GDP per capita (international dollars)
- Percentage

Legend:
- Child stunting
- Adult obesity
Determinants of malnutrition: Food insecurity

- Hunger (lack of calories)
- Usually measured by availability through food balance sheets
  \[(\text{Production} + \text{import} - \text{export}) / \text{population} = \text{per capita calories}\]
Determinants of malnutrition: Health and Care

- Breastfeeding
- Complementary feeding
- Health and hygiene
SECTION 3: MEASURING MALNUTRITION
Measuring Malnutrition: The ABCD

- **Anthropometry**—Study of size and measurements of the human body

- **Biochemical**—analyses of blood and urine for vitamins, minerals, amino acids

- **Clinical**—observation of disease in patients

- **Dietary**—assessing the quantity and quality of food eaten
Anthropometry

- Stunting
- Wasting
- Underweight
- BMI

Source: WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development (cover of main Technical Report)
Z-scores and growth charts

Green: Population curve for healthy, well-fed children
Red: Population in a context of high wasting

Growth charts: Tracking an individual child compared to the average.
Being below average is ok, but faltering is not.
Anthropometry: Stunting

- Chronic undernutrition
- **Low height-for-age** index
- Stunting in childhood is associated with poor cognitive, educational, productivity and income attainment through life
- Globally 25% children under 5y are stunted (165 million)

Two girls, both 12 years old, stand in front of a wall with a black tape line indicating the normal height for a 12-year-old girl (Source: Badham & Sweet, Sight & Life Magazine, issue 3/2010)
Anthropometry: Stunting
Anthropometry: Wasting

- Acute undernutrition

- Low weight for height index

- Wasting is associated with high risk of death, and requires treatment (in-patient or in the community)

- 52 million children under 5y are wasted, 19 million severely wasted

Top: Child at enrollment to feeding centre
Bottom: Same child at discharge
(Source: http://www.imtf.org/page/info/malnutrition-management/inpatient/)
Anthropometry: Wasting

Mid-Upper Arm Circumference (MUAC)

Weight/Height
Anthropometry: Underweight

- Low weight for age index
- 99 million children under 5y are underweight, 2/3 in Asia
- Underweight is the focus of many international goals
Anthropometry: Body Mass Index (BMI)

\[ BMI = \frac{\text{weight (kg)}}{\text{height}^2 \text{ (m}^2\text{)}} \]
Micronutrient malnutrition

Areas at high risk of micronutrient deficiency
- Iron deficiency
- Vitamin A and iron deficiency
- Iodine, vitamin A and iron deficiency

Source: L
Clinical Measurement

Two types:

- Type I: Functional Nutrients
- Type II: Growth Nutrients
## Biochemical Measurement

<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron deficiency anemia</td>
<td>Haemoglobin testing (blood colour)</td>
</tr>
<tr>
<td>Vitamin A deficiency</td>
<td>Hemoglobin testing (haermoglobinometer)</td>
</tr>
<tr>
<td>Vitamin A deficiency</td>
<td>Serum Vitamin A level</td>
</tr>
<tr>
<td>Iodine deficiency</td>
<td>Urinary Iodine level</td>
</tr>
</tbody>
</table>
Dietary intake
Measuring infant and young child feeding

**Breastfeeding**
- Early initiation of breastfeeding (within 1 hour of birth)
- Exclusive breastfeeding among children under 6 months
- Continued breastfeeding at 1 year (12-15 m)

**Complementary feeding**
- Introduction of solid, semi-solid or soft food (between 6-8 m)
- Minimum diet diversity (≥4 food groups)
- Minimum meal frequency 1
- Minimum acceptable diet 2
- Consumption of iron-rich food 3
- Minimum meal frequency, acceptable diet & consumption of iron-rich food
SECTION 4: INTERVENTIONS
Prevention of malnutrition: Food security

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

FAO (2009)
Prevention of malnutrition: Health

Supplementation

Immunization

Access to health services

Water and sanitation
Prevention of malnutrition: Care

- Breastfeeding (early, exclusive, continued)
- Introduction of acceptable foods at the right time
- Dietary diversity (individual child)
- Meal frequency

#ostentatiousbreastfeeding
Prevention of malnutrition: Lifecycle approach
Breaking the cycle: Treatment of acute malnutrition

<table>
<thead>
<tr>
<th>Step</th>
<th>Stabilisation</th>
<th>Phase</th>
<th>Rehabilitation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Days 1-2</td>
<td>Days 3-7</td>
<td>Weeks 2-6</td>
</tr>
<tr>
<td>1. Hypoglycaemia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Hypothermia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Dehydration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Electrolytes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Infection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Micronutrients</td>
<td>no iron</td>
<td>with iron</td>
<td></td>
</tr>
<tr>
<td>7. Cautious feeding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Catch-up growth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Sensory stimulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Prepare for follow-up</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In-patient:
- For children with medical complications or no appetite
- Long process; parent needs to be present

Community-based:
- For children without medical complications
- Allows parents to remain home with other children
Breaking the cycle

The first 1000 Days

-9 to 24 months

Height-for-Age by Region

Europe & Central Asia
LAC
North Africa
Near East
South Asia
SS Africa

Source: Victora et al. (2010)
Nutrition Specific Interventions

- Interventions or programs that address the **immediate determinants** of child nutrition — adequate food and nutrient intake, feeding, caregiving and parenting practices, and low burden of infectious diseases

---

**Examples**

- Adolescent, preconception, and maternal health and nutrition
- Maternal dietary or micronutrient supplementation
- Promotion of optimum breastfeeding
- Complementary feeding and responsive feeding practices and stimulation
- Dietary supplementation
- Diversification and micronutrient supplementation or fortification for children
- Treatment of severe acute malnutrition
- Disease prevention and management
- Nutrition in emergencies

Source: Lancet 2013
Nutrition Sensitive Interventions

Interventions or programs that address the **underlying determinants** of fetal and child nutrition and development—food security; adequate caregiving resources at the maternal, household and community levels; and access to health services and a safe and hygienic environment—and **incorporate specific nutrition goals and actions**

<table>
<thead>
<tr>
<th>Examples</th>
<th>Agriculture and food security</th>
<th>Social safety nets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early child development</td>
<td>Maternal mental health</td>
<td></td>
</tr>
<tr>
<td>Women’s empowerment</td>
<td>Child protection</td>
<td></td>
</tr>
<tr>
<td>Schooling</td>
<td>Water, sanitation and hygiene</td>
<td></td>
</tr>
<tr>
<td>Health and family planning services</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Lancet 2013
Mapping interventions back to an updated ‘UNICEF framework’

**Benefits during the life course**

- Morbidity and mortality in childhood
- Cognitive, motor, and socioemotional development
- School performance and learning capacity
- Adult stature
- Work capacity and productivity
- Obesity and NCDs

**Nutrition specific interventions and programmes**
- Adolescent health and preconception nutrition
- Maternal dietary supplementation
- Micronutrient supplementation or fortification
- Breastfeeding and complementary feeding
- Dietary supplementation
- Dietary diversification
- Feeding behaviours and stimulation
- Treatment of severe acute malnutrition
- Disease prevention and management
- Nutrition interventions in emergencies

**Nutrition sensitive programmes and approaches**
- Agriculture and food security
- Social safety nets
- Early child development
- Maternal mental health
- Women’s empowerment
- Child protection
- Classroom education
- Water and sanitation
- Health and family planning services

**Optimum fetal and child nutrition and development**

- Breastfeeding, nutrient-rich foods, and eating routine
- Feeding and caregiving practices, parenting stimulation
- Low burden of infectious diseases

- Food security, including availability, economic access, and use of food
- Feeding and caregiving resources (maternal, household, and community levels)
- Access to and use of health services, a safe and hygienic environment

**Knowledge and evidence**
- Politics and governance
- Leadership, capacity, and financial resources
- Social, economic, political, and environmental context (national and global)

**Building an enabling environment**
- Rigorous evaluations
- Advocacy strategies
- Horizontal and vertical coordination
- Accountability incentives regulation, legislation
- Leadership programmes
- Capacity investments
- Domestic resource mobilisation
Key Literature: Lancet undernutrition series (2013)

Nutrition-specific interventions, if scaled up to 90% coverage, could reduce stunting by 20% (33·5 million fewer stunted children)

Accelerating progress in nutrition requires increasing the nutritional impact of effective, large-scale, nutrition-sensitive development programs

Attention is also needed to the politics and enabling environment of undernutrition reduction if these actions are to be implemented and sustained
Thank you!