Stunting and Malnutrition in the Developing World

Shibani Ghosh
OVERVIEW

• Global trends
  • Stunting, Underweight, Wasting
  • Micronutrient Deficiencies
  • Co-existence

• Intergenerational cycle of malnutrition

• Factors associated with stunting

• Environmental exposures and stunting
Global Child Malnutrition Trends (1990-2014)

The graphs show trends (1990-2014) in child malnutrition indicators for stunting, underweight and overweight as well as the latest (2014) estimates of wasting and severe wasting. The green bar charts show estimates of numbers of children affected and the blue lines graph prevalence estimates with upper and lower 95% confidence limits in grey. Mouse-over, click or tap on bars or lines to view data details.

Legend
- Green: Number of affected (millions of Children aged <5)
- Blue: Prevalence (% of Children aged <5)
- Dark: 95% Confidence Limits

Stunting
- Number of children affected (millions)
- Prevalence (%)

Underweight
- Number of children affected (millions)
- Prevalence (%)

Wasting
- Number of children affected (millions)
- Prevalence (%)
- Years: 2014

Severe Wasting
- Number of children affected (millions)
- Prevalence (%)
- Years: 2014

Overweight
- Number of children affected (millions)
- Prevalence (%)

USAID
FROM THE AMERICAN PEOPLE

http://apps.who.int/gho/data/view.wrapper.nutrition-1-1&showonly=nutrition
Regional Trends (1990-2014) in Numbers of Children Affected and Share of Total Number

Step 1: Select an Agency Classification
UNICEF Regions

Step 2: Select a Measure:
Share (% of total number)

Step 3: Click on a Region (Subregion) below to highlight and view the data points
- CEE/CIS
- MIDDLE EAST & NORTH AFRICA
- LATIN AMERICA & CARIBBEAN
- EAST ASIA & PACIFIC
- SOUTH ASIA
- SUB-SAHARAN AFRICA (Eastern & Southern)
- SUB-SAHARAN AFRICA (West & Central)

Notes:
1. Vertical axis scales (millions) can vary across the five child malnutrition indicators graphs.
2. Shares are calculated with respect to the sum of regions for each agency's classification.
3. UN and MDG developed countries and the World Bank high-income countries: Due to consecutive lack of any data, results are not displayed.
4. MDG Caucasus & Central Asia and UNICEF CEE/CIS regions: Due to consecutive lack of any data, results are not displayed for year 1990.

Data are % (95% CI). UIC=urine iodine concentration.

<table>
<thead>
<tr>
<th></th>
<th>Vitamin A deficiency&lt;sup&gt;45&lt;/sup&gt;</th>
<th>Iodine deficiency&lt;sup&gt;46&lt;/sup&gt; (UIC &lt;100 μg/L)</th>
<th>Zinc deficiency&lt;sup&gt;47&lt;/sup&gt; (weighted average of country means)</th>
<th>Iron deficiency anaemia (haemoglobin &lt;110 g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Children &lt;5 years</td>
<td>Pregnant women</td>
<td>Children &lt;5 years</td>
<td>Pregnant women</td>
</tr>
<tr>
<td>Night blindness</td>
<td>Serum retinol &lt;0.70 μmol/L</td>
<td>Night blindness</td>
<td>Serum retinol &lt;0.70 μmol/L</td>
<td>夜盲症</td>
</tr>
<tr>
<td>Global</td>
<td>0.9% (0.1-1.8)</td>
<td>33.3% (29.4-37.1)</td>
<td>7.8% (6.5-9.1)</td>
<td>15.3% (6.0-24.6)</td>
</tr>
<tr>
<td>Africa</td>
<td>2.1% (1.0-3.1)</td>
<td>41.6% (34.4-44.9)</td>
<td>9.4% (8.1-10.7)</td>
<td>14.3% (9.7-19.0)</td>
</tr>
<tr>
<td>Americas and the Carribean</td>
<td>0.6% (0.0-1.3)</td>
<td>15.6% (6.6-24.5)</td>
<td>4.4% (2.7-6.2)</td>
<td>2.0% (0.4-3.6)</td>
</tr>
<tr>
<td>Asia</td>
<td>0.5% (0.0-1.3)</td>
<td>33.5% (30.7-36.3)</td>
<td>7.8% (6.6-9.0)</td>
<td>18.4% (5.4-31.4)</td>
</tr>
<tr>
<td>Europe</td>
<td>0.7% (0.0-1.5)</td>
<td>14.9% (0.1-29.7)</td>
<td>2.9% (1.1-4.6)</td>
<td>2.2% (0.0-4.3)</td>
</tr>
<tr>
<td>Oceania</td>
<td>0.5% (0.1-1.0)</td>
<td>12.6% (6.0-19.2)</td>
<td>9.2% (0.3-18.2)</td>
<td>1.4% (0.0-4.0)</td>
</tr>
</tbody>
</table>
Countries with Overlapping Under-five Stunting, Anemia in Women of Reproductive Age, and Adult Overweight

Select region
All

Select subregion
All

- No "significant" public health nutrition problem
- One of three significant public health nutrition problems
- Two of three significant public health nutrition problems
- All three significant public health nutrition problems
- Missing data for at least one indicator
GLOBAL NUTRITION TARGETS FOR 2025

- **Child Stunting**: Cut the number of stunted children by 40%.
- **Child Wasting**: Reduce and maintain child wasting to less than 5%.
- **Child Overweight**: No increase in childhood overweight.
- **Anemia**: Cut anemia in women of reproductive age by 50%.
- **Exclusive Breastfeeding**: Increase to at least 50%.
- **Low Birth Weight**: Cut low birth weight by 30%.

**Halt the rise in prevalence of:**

- **Adult Overweight**
- **Adult Diabetes** (high blood sugar)
- **Adult Obesity**

World Health Assembly Global Nutrition Targets- 2025 and Global Monitoring Framework for Prevention and Control of NCDs

### Table 2.2  Global progress against global nutrition targets

<table>
<thead>
<tr>
<th>Target and indicator</th>
<th>Baseline year</th>
<th>Baseline status</th>
<th>Target for 2025</th>
<th>On or off course?</th>
<th>Basis for assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stunting</strong></td>
<td>2012</td>
<td>162 million</td>
<td>~100 million (currently 159 million)</td>
<td>Off</td>
<td>Current rate of reduction not rapid enough to attain 100 million by 2025</td>
</tr>
<tr>
<td>Reduce and maintain childhood wasting at less than 5%</td>
<td>2012</td>
<td>8%</td>
<td>&lt; 5% (currently 7.5%)</td>
<td>Off</td>
<td>Current rate of reduction not rapid enough to reach below 5% by 2025</td>
</tr>
<tr>
<td><strong>Under-5 overweight</strong></td>
<td>2012</td>
<td>7%</td>
<td>No increase (currently 6.1%)</td>
<td>Off</td>
<td>The baseline proportion for 2012 was revised down from 7% to 5.9% in the JCMEs for 2015, and the current rate is marginally above this threshold and hence off course</td>
</tr>
<tr>
<td>No increase in childhood overweight</td>
<td>2012</td>
<td>7%</td>
<td>No increase (currently 6.1%)</td>
<td>Off</td>
<td>Very little progress since 1995, when it was estimated at 33%</td>
</tr>
<tr>
<td><strong>Anemia</strong></td>
<td>2011</td>
<td>29%</td>
<td>15% (no new data over baseline)</td>
<td>Off</td>
<td>Very little progress since 1995, when it was estimated at 33%</td>
</tr>
<tr>
<td><strong>Low birth weight</strong></td>
<td>2008–2012</td>
<td>15%</td>
<td>10%</td>
<td>NA</td>
<td>Estimating methods being revised (see Panel 2.1)</td>
</tr>
<tr>
<td>30% reduction in low birth weight</td>
<td>2008–2012</td>
<td>15%</td>
<td>10%</td>
<td>NA</td>
<td>Estimating methods being revised (see Panel 2.1)</td>
</tr>
<tr>
<td><strong>Exclusive breastfeeding</strong></td>
<td>2008–2012</td>
<td>38%</td>
<td>50% (currently 39%)</td>
<td>Off</td>
<td>Not increasing rapidly enough to meet 50% by 2025</td>
</tr>
<tr>
<td>Increase the rate of exclusive breastfeeding in the first six months to at least 50%</td>
<td>2008–2012</td>
<td>38%</td>
<td>50% (currently 39%)</td>
<td>Off</td>
<td>Not increasing rapidly enough to meet 50% by 2025</td>
</tr>
<tr>
<td><strong>Adult overweight</strong></td>
<td>2014</td>
<td>38%</td>
<td>Halt the rise in prevalence</td>
<td>Off</td>
<td>Rates are increasing in vast majority of countries, 2010–2014</td>
</tr>
<tr>
<td>Halt the rise in prevalence</td>
<td>2014</td>
<td>38%</td>
<td>Halt the rise in prevalence</td>
<td>Off</td>
<td>Rates are increasing in vast majority of countries, 2010–2014</td>
</tr>
<tr>
<td><strong>Adult obesity</strong></td>
<td>2014</td>
<td>12%</td>
<td>Halt the rise in prevalence</td>
<td>Off</td>
<td>Rates are increasing in vast majority of countries, 2010–2014</td>
</tr>
<tr>
<td>Halt the rise in prevalence</td>
<td>2014</td>
<td>12%</td>
<td>Halt the rise in prevalence</td>
<td>Off</td>
<td>Rates are increasing in vast majority of countries, 2010–2014</td>
</tr>
<tr>
<td><strong>Adult diabetes (raised blood glucose)</strong></td>
<td>2014</td>
<td>9%</td>
<td>Halt the rise in prevalence</td>
<td>Off</td>
<td>Rates are increasing in vast majority of countries, 2010–2014</td>
</tr>
</tbody>
</table>

Source: Based on IFPRI (2014, Table 3.1; 2015a, Table 2.1), UNICEF, WHO, and World Bank (2015), WHO (2014b, 2016a, 2016b); 1995 anemia estimate from Stevens et al. (2013).
IT’S HARD TO MEET NUTRITION GOALS IF YOU DON’T HAVE DATA ON NUTRITION

At a 2012 meeting of the World Health Assembly, all 193 UN member nations committed to achieving global nutrition targets by 2025. So far, the number of countries on course to meet the global targets is much too low. This is complicated by the fact that too many countries lack the data necessary to even evaluate their nutrition progress against the global targets.

**REDUCE STUNTING** in children under age five by 40%

- 84 countries have no data
- 87 are off course
- 22 are on course

Stunting—when children are too short for their age—is associated with a host of negative health, educational, and economic consequences.

**PREVENT OVERWEIGHT** among children under age five from increasing

- 86 countries have no data
- 76 are off course
- 31 are on course

Overweight and obese children are more likely to develop noncommunicable diseases like diabetes and cardiovascular diseases at a younger age.

**CUT WASTING** in children under age five to less than 5%

- 70 countries have no data
- 64 are off course
- 59 are on course

Wasting—when children are too thin for their height—increases the risk of death from nutrition-related causes.

**HALVE ANEMIA** in women of reproductive age

- 8 countries have no data
- 180 are off course
- 5 are on course

Anemia—a form of iron deficiency and the most widespread nutritional disorder in the world—results in ill health, lost earnings, and premature death.

Note: Countries committed to six nutrition targets, but for two of these—reducing the share of infants who weigh too little at birth and increasing the share of children who are exclusively breastfed—it is not yet possible to assess country progress.
Mean anthropometric z scores according to age for all 54 studies, relative to the WHO standard (1 to 59 months).
Figure 1  The stunting syndrome. The green pathway denotes the period between conception and 2 years ("the first 1000 days").
FACTORS ASSOCIATED WITH STUNTING

Maternal factors: age, height, education, nutritional and health status, micronutrient status, diet during pregnancy

Fetal Growth (Length and Weight)

Infant and Young Child Feeding: Breast feeding, diet (appropriate and timely introduction of high quality complementary foods, micronutrients, fatty acids, amino acids, high quality protein)

Diarrhea and Other infections (e.g. parasitic infections, malaria)

Gut inflammation/Environmental Enteric Dysfunction (EED)
- Altered gut microbiota
- Animal–human interactions
- Recurrent and persistent diarrhea
- Oral–fecal contamination
- HIV infection
- Micronutrient deficiencies
- Severe acute malnutrition

Mycotoxin Exposure - Pregnancy and Early life

Arsenic exposure in pregnancy

Biomass fuel usage and indoor pollution

Household Level: Care giving, empowerment, income, social capital

Community Level: Access and utilization of services, markets

National Level: Economic growth and development, regulations, guidelines, enabling environment

- Mycotoxin Exposure - Pregnancy and Early life
- Arsenic exposure in pregnancy
- Biomass fuel usage and indoor pollution
Rate of weight gain (kg/week) during pregnancy by women’s HIV and Aflatoxin Exposure Status (±1S.E.).

246 Mother-Infant Dyads (Sub Sample of the Gulu Cohort Study)
Serum Sample in pregnancy enrollment(mean gestational age 19.4 weeks (+/- 3.8 weeks)

Barnabas Kahiira Natamba et al. FASEB J 2016;30:432.6

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1- to-12-month-old infant HAZ scores by their mothers HIV and aflatoxin exposure status in pregnancy (±1S.E.).

Adjusting for: prenatal food insecurity, dietary diversity, asset index, and infant age and gender,
AFLACOHORT FOLLOW UPS:
FEBRUARY 2018

- Birth follow ups, 3, 6, 9 and 12 months of age

- Linking aflatoxin levels to food consumption, household production and market practices (food purchases)
  - Corn production and consumption is associated with higher levels
  - Ground nut production and consumption is associated with higher levels

- Understanding how exposures through fetal growth, early life link to growth (Linear)
  - Maternal levels are associated with a higher risk of LBW - OR: 1.13 (1.011-1.28 CI, p=0.032) - adjusting for maternal education, height, MUAC, dietary diversity, infant gender
  - Breast milk sample analysis ongoing to assess contribution through 0-6 months of age
  - Assessment of introduction and type of complementary foods

- Aflatoxin analysis- Peanut and Mycotoxin Innovation Lab (U Georgia)
- Crop and soil assessment – Post Harvest Innovation Lab (Kansas State)
CONCLUSIONS

• Different forms of malnutrition co-exist simultaneously. While rates are improving, targets are not on course.

• Data is needed to understand to track progress.

• Stunting - cyclical and intergenerational, multi-faceted and complex.

• Emerging research on the role of environmental contaminants.