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For additional presentations and related event materials, visit: http://spring-nutrition.org/nglee-africa
Addressing micronutrient deficiencies through stronger public/private partnerships
WHAT ARE “MICRONUTRIENTS”? 

• Two types of nutrients: macro and micro
  – Macro: fat, protein and carbohydrate (and water)
  – Micro: vitamins and minerals

• For public health purposes, “micronutrients” usually refers to vitamin A, iron, iodine and zinc because:
  – Deficiency is common
  – Deficiency consequences are severe
  – Feasible public health control measures exist
Micronutrient malnutrition has many adverse effects on human health, not all of which are clinically evident ("hidden hunger")

Even moderate levels of deficiency can have serious detrimental effects on human function

Profound implications for economic development & productivity
Severity of the Problem in Feed the Future Countries
Proportion Of Households Consuming Iodized Salt (%)

- **Kenya**: 0.2%
- **Uganda**: 1.5%
- **Rwanda**: 1.2%
- **Mali**: 8.5%
- **Zambia**: 3.5%
- **Tanzania**: 18.3%
- **Malawi**: 35.9%
- **Senegal**: 36%
- **Ghana**: 41.5%
- **Moz'que**: 45.7%
- **Ethiopia**: 45.7%

0 PPM (No iodine) | 1-14 ppm (Inadequate) | > 15 ppm (Adequate)

Source: Childinfo.org
Prevalence of Anemia in Children U5

Source: DHS Surveys

- Mali 2006 DHS
- Ghana 2008 DHS
- Senegal 2010-11 DHS
- Uganda 2006 DHS
- Tanzania 2010 DHS
- Rwanda 2010 DHS
- Ethiopia 2011 DHS
- Malawi 2010 DHS
- Liberia 2009 MIS

Mild
Moderate
Severe

Source: DHS Surveys
Prevalence of Anemia in Women (15 – 49 Yrs)

- **Ethiopia 2011 DHS**: Mild anemia (17), Moderate anemia (17) + Severe anemia (17)
- **Rwanda 2010 DHS**: Mild anemia (17), Moderate anemia (17) + Severe anemia (17)
- **Malawi 2010 DHS**: Mild anemia (29), Moderate anemia (40) + Severe anemia (29)
- **Tanzania 2010 DHS**: Mild anemia (40), Moderate anemia (42) + Severe anemia (42)
- **Uganda 2006 DHS**: Mild anemia (42), Moderate anemia (55) + Severe anemia (55)
- **Senegal 2010-11 DHS**: Mild anemia (55), Moderate anemia (59) + Severe anemia (59)
- **Ghana 2008 DHS**: Mild anemia (59), Moderate anemia (69) + Severe anemia (69)
- **Mali 2006 DHS**: Mild anemia (69), Moderate anemia (69) + Severe anemia (69)

Source: DHS Surveys
% Children Receiving Full Vit. A. Suppl (2 doses)

<table>
<thead>
<tr>
<th>Country</th>
<th>% Children Receiving Full Vit. A. Suppl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>62</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>84</td>
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<tr>
<td>Zambia</td>
<td>92</td>
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<tr>
<td>Rwanda</td>
<td>92</td>
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<tr>
<td>Ghana</td>
<td>93</td>
</tr>
<tr>
<td>Malawi</td>
<td>96</td>
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<tr>
<td>Liberia</td>
<td>97</td>
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<tr>
<td>Tanzania</td>
<td>99</td>
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<tr>
<td>Mali</td>
<td>99</td>
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<tr>
<td>Moz'que</td>
<td>100</td>
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</tbody>
</table>

% Children U3 Living with their Mother who Consumed Vit. Rich Fruits & Veg in Preceding 7 Days

<table>
<thead>
<tr>
<th>Country</th>
<th>% Children U3 Living with their Mother who Consumed Vit. Rich Fruits &amp; Veg</th>
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<tbody>
<tr>
<td>Ethiopia</td>
<td>9.6</td>
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<tr>
<td>Mali</td>
<td>20.7</td>
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<tr>
<td>Senegal</td>
<td>38.1</td>
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<td>Ghana</td>
<td>41.2</td>
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<tr>
<td>Uganda</td>
<td>48.9</td>
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<tr>
<td>Moz'que</td>
<td>49.9</td>
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<tr>
<td>Tanzania</td>
<td>53.7</td>
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<td>Rwanda</td>
<td>58.1</td>
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<tr>
<td>Zambia</td>
<td>58.6</td>
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<tr>
<td>Kenya</td>
<td>62.2</td>
</tr>
<tr>
<td>Malawi</td>
<td>64.8</td>
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</tbody>
</table>

Source: Child Info
### Consequences of Micronutrient Deficiencies

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Iron</th>
<th>Vitamin A</th>
<th>Iodine</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal mortality, miscarriage and neonatal mortality</td>
<td>☑</td>
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<td>☑</td>
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<tr>
<td>Low birth weight</td>
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<td>☑</td>
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<tr>
<td>Impaired cognitive development and decreased intellectual capacity</td>
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<td>☑</td>
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<tr>
<td>Impaired immunity</td>
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<td>☑</td>
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<td>☑</td>
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<tr>
<td>Disability, especially blindness</td>
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<td>☑</td>
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<td>☑</td>
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<tr>
<td>Severe mental retardation</td>
<td></td>
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<td>☑</td>
<td>☑</td>
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<tr>
<td>Stunted growth</td>
<td>(☑)</td>
<td></td>
<td>☑</td>
<td>☑</td>
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<tr>
<td>Compromised life expectancy</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
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<tr>
<td>Reduced work output</td>
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Impact on Economic Development

• Lost potential
  – Adult work productivity
  – Cognitive functioning
  – Social costs of mortality and morbidity
  – Failure to achieve full potential as students, parents, workers & citizens

• Iron deficiency (Ross and Horton, 2003):
  – Productivity loss: USD 2.32 per capita
  – Productivity + cognitive loss: USD 16.32 per capita (4% of GDP)
4 strategies for preventing/correcting deficiencies in populations (implemented alone or in combination):

1. Supplementation
2. Food fortification
3. Biofortification
4. Dietary modification or diversification
The prophylactic or therapeutic provision of nutrients in pharmaceutical form.

With adequate coverage, supplementation can dramatically and rapidly reduce micronutrient deficiency.
1. Supplementation (cont.)

Advantages
• Rapid impact
• Therapeutic effectiveness
• Targeting of specific populations

Disadvantages
• Adherence requirements (behaviors)
• Delivery program costs
• Logistical complexity (forecasting, procurement, etc.)
2. Food Fortification

- *The practice of deliberately increasing content of an essential micronutrient in a food to improve its nutritional quality*

- The amount of nutrient added generally is very small, less than RDA.

- Though impact is not as rapid as supplementation, fortification can economically and sustainably reduce micronutrient deficiency.
2. Food Fortification

Advantages

• If fortify staple food, no changes required in dietary habits
• Very low cost per person
• Costs passed to the consumer (usually negligible)

Disadvantages

• Limited by scope of market for centrally processed foods
• To be most effective, requires food vehicle with relatively small variation in consumption
• Therapeutically less effective than supplementation
• Quality control difficult at small scale due to small amounts of nutrients added
Variants of Food Fortification Programs:

- **Targeted Food Fortification**: designed for specific populations e.g. as complementary foods
- **Mass Fortification**: addition of micronutrients to foods consumed by the general public
- **Community-based milling and fortification** (small-scale)
- **Market Driven Fortification** – Food manufacturers driven
- **Point-of-use fortification** e.g. MNPs
3. Dietary diversity promotion / behavior modification

*Promoting consumption of a diet that provides necessary micronutrients in adequate amounts.*

- Many different behaviors involved:
  - Feeding of infants and young children
  - Household food choices
  - Crop production choices
- Influenced on availability and cost
3. Dietary diversity / modification

**Advantages**
- Sustainable elimination of micronutrient deficiency
- Benefit from foods greater than sum of individual nutrients

**Disadvantages**
- Difficulty of achieving without improving incomes.
- Difficulty of changing food production patterns and markets.
- Difficulty of changing food habits.
- Adherence issues—who eats what they should even when they know what’s good for them?
- Time
Use of plant breeding techniques to enhance the micronutrient content of staple foods

✓ A new, complementary, approach

✓ The target nutrients include:
  
  – Fe and zinc in beans, rice, and wheat
  
  – Orange-fleshed sweet potatoes with beta-carotene (precursor of vit. A)
4. Biofortification

Advantages

• Targets the poor (staples a large share of diet)

• Rural-based (complements fortification and supplementation)

• Cost-effective (multiply across countries)

• Sustainable (investments front-loaded)

Disadvantages

• Time (e.g., change in zinc recommendations)

• Hybrid seed in some cases

• Crop itself may limit bioavailability (phytates in beans)