Economic Consequences of Deficiencies

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Smarter Futures

With thanks to Quentin Johnson (SF/FFI) and Jack Bagriansky
Population Wide Consequences of Micronutrient Deficiencies

- Invisible Burden
  - Biochemical Indicators

- Contributing Factor
  - Mortality
  - Morbidity
  - Mental/Physical Development
  - Adult Productivity
  - Quality of Life

- Advocacy Challenge
  - Make the Invisible Visible
    - Consequence Model
    - Cost of Doing Nothing
Economic Rationale for Investing in Nutrition

- **Old News**
  - Poverty Root Cause of Malnutrition

- **Recent Evidence**
  - Malnutrition causes poverty.
  - Human Capital

- **Conclusion**
  - Lowering rates of malnutrition can accelerate economic growth.
Cost-effective Investment

Leading economists, meeting every four years, ranked micronutrient interventions among their top three recommendations in 2004, 2008, and 2012.

“One of the most compelling investments is to get nutrients to the world’s undernourished. The benefits from doing so – in terms of increased health, schooling, and productivity – are tremendous.”

Nobel laureate economist Vernon Smith, part of 2012 Copenhagen Consensus Expert Panel

Prioritizing Development Challenges by Economic Criteria

Copenhagen Consensus: 10 Global Development Challenges Considered by Panel of Nobel Prize Winning Economists

Nobel Prizewinning Economists: Finn Kydland, Robert Mundell, Douglass North, Thomas Schelling, Vernon L. Smith
The Copenhagen Consensus 2008: Highest Benefit Cost Ratio

<table>
<thead>
<tr>
<th>Solution</th>
<th>Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Micronutrient supplements for children (A &amp; Zn)</td>
<td>Malnutrition</td>
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<tr>
<td>2 The Doha development agenda</td>
<td>Trade</td>
</tr>
<tr>
<td>3 <strong>Micronutrient fortification</strong></td>
<td>Malnutrition</td>
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<tr>
<td>4 Expanded immunization coverage for children</td>
<td>Diseases</td>
</tr>
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<td>5 Biofortification</td>
<td>Malnutrition</td>
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<td>6 Deworming, other nutrition programs in school</td>
<td>Malnutrition</td>
</tr>
<tr>
<td>7 Lowering the price of schooling</td>
<td>Education</td>
</tr>
<tr>
<td>8 Increase and improve girl’s schooling</td>
<td>Women</td>
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<tr>
<td>9 Community-based nutrition programs</td>
<td>Malnutrition</td>
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</tbody>
</table>
Examples of Economic losses
The National Burden of IDA, VAD & NTD

1. Child Mortality Cost of VAD
2. Neo-Natal Mortality Cost of IDA in Pregnant Women
3. Maternal Mortality Cost of IDA in Pregnant Women
4. Mortality & Disability Cost of NTDs
5. Future Productivity Loss Due to Cognitive Deficits in Children
6. Current Productivity Loss Due to Anemia in Adult Women and Men
7. Summary: Money, Mortality

Source: Jack Bagriansky
IDA = iron deficiency anemia
VAD = vitamin A deficiency
NTD = neural tube defect
Anemia leads to:

- 17% lower productivity in heavy manual labor
- 5% lower productivity in other manual labor
- Estimated 2.5% loss of earnings due to lower cognitive skills

Costs of Anemia

The Economics of Food Fortification (2006) by Sue Horton
Photo from The Lewis Family Blog [http://lewisesinchina.blogspot.com/2008/04/trek-on-yellow-mountain.html](http://lewisesinchina.blogspot.com/2008/04/trek-on-yellow-mountain.html)
Cost Benefit Analysis: Tool to Rationally Prioritize

- Measures all benefits and costs of an intervention in monetary terms.
  - Cost Effectiveness often used where it may be inappropriate to monetize health effect or benefit.

- Tool to Establish Priorities
  - Valuation of program in monetary units allows decision-makers to directly compare interventions.
  - Determine if it is a sound investment/decision.
    - Compared to other nutrition interventions
    - Compared to other national development investments
Using Global Science and Evidence to Develop National Policy and Programs

Think Global

Act Local
Using Global Science and Evidence to Develop National Policy and Programs

Think Global

Think Local

Act Local
Global Perspective: Advantages of Flour Fortification

- Daily Dietary Dose Optimizes Impact
- Market-wide coverage (large population)
- Little build-out of Industry & Distribution Infrastructure
- No Behavior Change
  - High Compliance
- Affordable & Sustainable Financing
  - Small % of milling inputs
  - Invisible % consumer purchase
- Frees Public Sector Resources to focus on highest risk
- Global Claim:
  - “No other technology available today offers as large an opportunity to improve lives and accelerate development at such low cost and in such a short time.” (World Bank)
  - Principle is the same of flour, maize, oil, sugar
National Perspective: Advantages Depend on Environment

- Public Health:
  - Prevalence of Vitamin & Mineral Deficiency?

- Market & Distribution:
  - How many people purchase and consume flour?

- Consumer Pattern:
  - How much flour do they consume?

- Industry:
  - What proportion can be fortified at reasonable cost?

- Government:
  - What is public food control and quality assurance capacity?
4 Pathways of “Damage” to Measure Baseline Economic Loss

- Mortality
- Cognition & Growth
- Higher Morbidity
- Adult Work Deficits

Lost Workforce
Future Productivity
Excess Health Care Costs
Lower Current Productivity

LOSS TO GDP
Over a 10 year period, the economic losses add up!

<table>
<thead>
<tr>
<th>Year</th>
<th>Perinatal Mortality Future Productivity</th>
<th>Adult Anemia Current Productivity</th>
<th>Childhood Anemia Future Productivity</th>
<th>Total IDA</th>
<th>Death &amp; Disability Future Productivity</th>
<th>Medical &amp; Welfare Current Expenses</th>
<th>Total Folic Acid</th>
<th>Total Projected Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>$1.57 $76.61 $4.77 $82.95 $1.39 $0.34 $1.73</td>
<td>84.7</td>
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<tr>
<td>2010</td>
<td>$1.58 $77.37 $4.82 $83.78 $1.40 $0.34 $1.75</td>
<td>85.5</td>
<td></td>
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<tr>
<td>2011</td>
<td>$1.60 $78.15 $4.87 $84.62 $1.42 $0.35 $1.77</td>
<td>86.4</td>
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<tr>
<td>2012</td>
<td>$1.62 $78.93 $4.92 $85.46 $1.43 $0.35 $1.78</td>
<td>87.2</td>
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<td>2013</td>
<td>$1.63 $79.72 $4.97 $86.32 $1.45 $0.35 $1.80</td>
<td>88.1</td>
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<td>2014</td>
<td>$1.65 $80.52 $5.02 $87.18 $1.46 $0.36 $1.82</td>
<td>89.0</td>
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<tr>
<td>2015</td>
<td>$1.67 $81.32 $5.07 $88.05 $1.48 $0.36 $1.84</td>
<td>89.9</td>
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<tr>
<td>2016</td>
<td>$1.68 $82.13 $5.12 $88.93 $1.49 $0.37 $1.86</td>
<td>90.8</td>
<td></td>
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<tr>
<td>2017</td>
<td>$1.70 $82.96 $5.17 $89.82 $1.51 $0.37 $1.87</td>
<td>91.7</td>
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<tr>
<td>2018</td>
<td>$1.72 $83.79 $5.22 $90.72 $1.52 $0.37 $1.89</td>
<td>92.6</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$16.4</strong> $801.5 $49.9 $867.8 $14.5 $3.6 $18.1</td>
<td><strong>885.9</strong></td>
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</table>

1.9% 90.5% 5.6% 98.0% 1.6% 0.4% 2.0%
A Strategy to Lower the Burden: Flour Fortification

Depending on:

1. Coverage of Flour Consumption

2. Effectiveness Among Consumers
   - Flour Addition Rates
   - % RNI for Risk Groups
   - Projected Reduction in Baseline Prevalence

We can calculate the benefits of Flour Fortification
   - Money and Lives

Then Estimate the Cost of Flour Fortification

And calculate the 10 Year Benefit Cost Ratio

Source: Jack Bagriansky
Multiple Rationales for Investment in Flour Fortification

- **Moral**
  - Humanitarian Imperative

- **Good Governance**
  - Obligation to Citizen Rights to Nutrition

- **Economic Growth & Development**
  - National Development Investment

Willie Sutton: Infamous Bank Robber in 1930's USA Depression Era. 
**Question:** Why do you rob banks?  
**Answer:** “That’s where the money is.”
Average Premix Cost for 1 Metric Ton

**Wheat Flour:**
US$ 3 to fortify with iron, folic acid, and other B vitamins

**Ground Maize:**
US$ 4 to fortify with iron, zinc, vitamin A, folic acid, and other B vitamins

**Rice:**
US$ 6 to US$ 20 to fortify with iron, zinc, vitamin A, folic acid, and other B vitamins

One metric ton of flour is about 2,200 pounds, as pictured here. FFI photo.
# Effectiveness of National Flour Fortification Programmes

## National Programme Evaluations

### Prevalence of Iron Deficiency and Anemia

<table>
<thead>
<tr>
<th>Country</th>
<th>Risk Group</th>
<th>Condition</th>
<th>Pre</th>
<th>Post</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venezuela</td>
<td>Children &gt; 5yrs</td>
<td>Iron Deficiency</td>
<td>37.2%</td>
<td>15.5%</td>
<td>58.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18.1%</td>
<td>17.1%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>Adult Women</td>
<td>Anemia</td>
<td>18.4%</td>
<td>10.2%</td>
<td>45%</td>
</tr>
<tr>
<td>Kuwait</td>
<td>Pregnant Women</td>
<td></td>
<td>33%</td>
<td>24%</td>
<td>27%</td>
</tr>
<tr>
<td>Oman</td>
<td></td>
<td></td>
<td>49%</td>
<td>31%</td>
<td>37%</td>
</tr>
</tbody>
</table>
Canada Folic Acid Fortification: 37-78% Decrease in NTDs and Cost savings of about $1 million annually

The number of specialized operations on children born with NTDs in Canada at Toronto Sick Childrens Hospital has dropped from 52 per year before folic acid fortification to 12 per year.
Chile Folic Acid Fortification: 40% Decrease in NTDs

Legend:
- Blue: Pre Fortification
- Red: Post Fortification

Bar Chart:
- Anencephaly: 6.14 Pre, 3.65 Post
- Encephacelo: 2.41 Pre, 1.78 Post
- Spina Bifada: 8.63 Pre, 4.59 Post
- Total NTD: 17.1 Pre, 10.3 Post
The Cost: Benefit Ratio for Preventing Spina Bifida

1:12 Chile

1:30 South Africa

1:48 United States

A Modeling Tool was developed for Cost Benefit Analysis

- Excel software with multiple spreadsheets
- Fixed parameters used to determine **health** and **economic** related losses based on existing literature and economic studies.
  - Anemia, iron deficiency, NTDs
- Specific data for countries can be used based on country official data and statistics.
Rationale for the modeling tool

- Development of cost benefit case for flour fortification.
- Advocacy to private sector, milling industry etc.
- Allows economists to compare benefit:cost ratio of flour fortification to other government programmes and health interventions.
- Advocacy tool for policy makers in government ministries and Prime Minister Office.
Smarter Futures offers Training on Cost Benefit Analysis

- Objective: to develop a specific, concrete and national case for the cost-effectiveness of flour fortification
- Estimate and validate country health statistics
- Estimate Economic Losses
- Determine the costs of doing nothing
- Calculate costs of Flour Fortification
- Generate spreadsheet calculations on cost:benefit
Methodology

- Workshop Structure based on 4-5 days
- Country teams representing Industry, Ministry of Health, Ministry of Trade and/or Finance
- Country team 3 – 7 people ideal
- Data collection by country teams prior to the workshop – essential!
- Country teams need to reach consensus on their own country data and statistics.
Workshops held and planned:


- West Africa UEMOA and CEMAC countries, in French to be held in Dakar, late 2015

- North Africa, possibly 2016

- Further workshops as requested