Calculating the Cost of A Poor Start to Life

For workshop on the “Theory, Science, and Statistics in the Use of Benefit-Cost Analysis”
October 20-21, 2011
Harold Alderman
World Bank
Introduction

The costs of a poor start to life can just as well be viewed as the benefits from investing in nutrition.

This can be illustrated with two graphs, the first of which was presented in the Lancet series on Early Child Development. The second is commonly presented in papers by the winner of the 2000 Nobel prize in Economics, James Heckman.
Figure 6.4  Cognitive Development by Wealth Decile in Ecuador, 2003–04

Source: Paxson and Schady 2007.

Note: TVIP = Test de Vocabulario en Imágenes Peabody. Each line corresponds to one decile from the national distribution of wealth, from the first (poorest) decile, to the fourth. The test is coded so that a score of 100 corresponds to the average performance in a reference population, and the standard deviation is 15.
Economist have used such evidence to stylize investment priorities in human capital.

Take advantage of malleability
- Build foundations for further learning
- Prevent early damage / avoid irreversible loss of potential

EARLY CHILDHOOD PROGRAMS APPEAR PROFITABLE, EVEN IF PAYOFF IS ONLY 20+ YEARS FROM TODAY
The economic returns shown the 2\textsuperscript{nd} graph come from adverting the declines shown in the previous one.

How does one calculate these economic benefits?

- Recognize benefits over life cycle and across generations, conditional on survival probabilities, but avoid double counting.
- Estimate benefits of improvements, not associations, given behavior.
- Estimate monetary value of each benefit.
- Obtain present discounted value of benefits.
Categories of Benefits

Reducing malnutrition can:

- Reduce infant and child mortality (but it is a major challenge to estimate the value of these benefits)
- Reduce costs of health care for neonates, infants and children
- Increase productivity by reducing stunting
- Increase productivity by increasing ability
- Reduce costs of obesity and chronic diseases
- Improve the health of next generation
Estimating these benefits is not straightforward

- What is economic value of a life saved?
- How does one integrate benefits and costs at different points in time?
- Are result robust? Need to avoid ‘cherry picking’
- Is evidence based on causality or merely associations?
- How does one distinguish between resource costs and market prices
- How does one distinguish between private and social benefits and costs?
There is no universally accepted means to place a monetary value on a life saved

- One approach is to use the expected earnings over the individual’s lifetime.
- Another approach – the statistical value of a life – is based on the differences in wages for risky occupations compared to wages elsewhere at similar levels of education and experience.
- A third approach uses the ‘revealed’ behavior of governments: How much do they spend to reduce mortality?

These approaches give answers that differ by one or even two orders of magnitude

Moreover, they generally place more value on a life in higher income settings
Example of sensitivity of benefits to different discount rates: Averting low birthweights

<table>
<thead>
<tr>
<th></th>
<th>1%</th>
<th>3%</th>
<th>5%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced infant mortality</td>
<td>96</td>
<td>95</td>
<td>93</td>
<td>88</td>
</tr>
<tr>
<td>Reduced illness costs</td>
<td>81</td>
<td>81</td>
<td>80</td>
<td>78</td>
</tr>
<tr>
<td>Gains from increased physical productivity</td>
<td>351</td>
<td>249</td>
<td>99</td>
<td>28</td>
</tr>
<tr>
<td>Gains from increased cognitive ability</td>
<td>846</td>
<td>600</td>
<td>239</td>
<td>69</td>
</tr>
<tr>
<td>Reductions in costs of chronic diseases</td>
<td>239</td>
<td>132</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>Intergenerational benefits</td>
<td>422</td>
<td>219</td>
<td>45</td>
<td>7</td>
</tr>
<tr>
<td>Sum of PDV in present $</td>
<td>2037</td>
<td>1378</td>
<td>580</td>
<td>273</td>
</tr>
<tr>
<td>% of 5% discount rate</td>
<td>351%</td>
<td>170%</td>
<td>100%</td>
<td>47%</td>
</tr>
</tbody>
</table>
Source of Benefits of Shifting one LBW Infant to non-LBW Status, with Different Discount Rates

- Intergenerational benefits
- Reduction in costs of chronic diseases
- Productivity gain from increased ability
- Productivity gain from reduced stunting
- Reduced costs of infant/child illness
- Reduced neonatal care
- Reduced infant mortality
Given the uncertainty in discount rates and value of early mortality averted it is often useful to present results with sensitivity analysis showing the degree to which conclusions may vary over plausible ranges.

Often it is possible to view the economic returns to investments in health in terms of saved resources for health care and productivity gains only. We know that the value of a life saved is positive, so these results are unambiguously an underestimation. The true economic returns will be larger than those reported.
Estimating this key impact of malnutrition on productivity: challenges

- Analyses of school-aged populations are unable to examine long-term [adult] outcomes.
- Conversely, adult attainments usually have limited data on childhood conditions.
- Difficult to separate causes of malnutrition from other causes of poor schooling.
- Econometric analyses often make strong assumptions to assume away other behavioral responses.
- Link to adult chronic disease still being explored.

Nevertheless, the Evidence Base is Substantial.
How strong is this evidence?

1. Extensive evidence that nutrition affects cognitive capacity of children
2. Little doubt that cognitive (and non-cognitive) ability contributed to school performance
3. Wages respond to both years of school and learning
4. BUT seldom do we follow from #1 to #3 for the same individual
Example of applying such evidence: sensitivity analysis of Benefit:Cost Ratios

<table>
<thead>
<tr>
<th>Intervention</th>
<th>d=3% DALY= $1000</th>
<th>d=6% DALY= $1000</th>
<th>d=3% DALY= $5000</th>
<th>D=6% DALY= $5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Micronutrient supp.</td>
<td>17.3</td>
<td>10:1</td>
<td>86.5</td>
<td>52.1</td>
</tr>
<tr>
<td>2. Micronutrient fortif.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Iron</td>
<td>8.0</td>
<td>7.0</td>
<td>8.0</td>
<td>7.0</td>
</tr>
<tr>
<td>-Iodine</td>
<td>30.0</td>
<td>12.1</td>
<td>30.0</td>
<td>12.0</td>
</tr>
<tr>
<td>3. Biofortification</td>
<td>16.7</td>
<td>10.0</td>
<td>33.5</td>
<td>50.0</td>
</tr>
<tr>
<td>4. Deworming (preschool)</td>
<td>6.0</td>
<td>2.4</td>
<td>6.0</td>
<td>2.4</td>
</tr>
<tr>
<td>5. Nutrition education</td>
<td>12.5</td>
<td>7.5</td>
<td>62.5</td>
<td>37.5</td>
</tr>
</tbody>
</table>
Goal: To set priorities among proposals for confronting ten major global challenges (selected from a wider set of issues identified by the United Nations):

1) civil conflicts; 6) governance;
2) climate change; 7) hunger and malnutrition;
3) communicable diseases; 8) migration;
4) education; 9) trade reform;
5) financial stability; 10) water and sanitation.
In 2004 experts in various fields were invited to assess the returns to the most promising investments in their field using a common methodology. These were subsequently assessed and ranked by a team of economists including 3 Nobel laureates.

By this committee’s consensus, only addressing HIV/AIDS was considered as effective an intervention as addressing micronutrient deficiencies.
This exercise was repeated in 2008, with a new panel of economists including 5 Nobel laureates. The set of interventions was expanded to 30 possible development investments, again with a wide range of activities.

According to this committee, addressing micronutrient deficiency was the most profitable investment. Four of the top 6 were investments in nutrition.
The Top Ten Investments

1. Micronutrient supplements (vitamin A & zinc) - Malnutrition
2. The Doha development agenda - Trade
3. Micronutrient fortification (iron and salt) - Malnutrition
4. Expanded immunization coverage for children - Diseases
5. Agricultural R&D on micronutrients - Malnutrition
6. Deworming and nutrition programs at school - Malnutrition
7. Lowering the price of schooling - Education
8. Increase and improve girls’ schooling - Women
9. Community-based nutrition promotion - Malnutrition
10. Provide support for women’s reproductive role - Women
Is This Evidence Leading To New Investments?

- Evidence shows that interventions in health and nutrition can be justified for their economic returns.
- Yet investments often fail to follow from economic evidence.
- Why, for one example, is iodine deficiency still prevalent given high returns to a range of proven technologies?
- Is there an information gap that limits private investments where private returns seem apparent?
- Or is the investment gap more in the field of political economy?
Public policy also has to address the vexing question of private versus public returns

If investments in nutrition have such high benefit : cost ratios, why are individuals not making these investments?

Stating this somewhat differently, since the returns can be captured by the individual in terms of higher earnings, why does the state need to make these investments?

An easy answer is at the margin: if the state is already making investments then an improvement in nutrition that reduces the costs of such investments in health or schooling, is profitable for the state.

The larger issue, however, is complex and runs through a wider set of issues in public policy.
A partial answer lies in the value of equity which many calculations do not assess

The standard evaluation of benefits does not distinguish benefits according to who receives them. Benefits are valued the same, whether the recipients are the very rich or the very poor. The standard measures, thus, may address the productivity motive for policies, but not distributional motives. Distributional weights are core to transfer programs, but have a role in assessing productivity investments as well. Frequently, distributional weights are implicitly imposed by attempting to target particular populations through the nature of the policy. For example, priority may be given to a problem that is prevalent largely among the poor although this is seldom part of benefit estimates.
Conclusion

In summary, while the evidence on the average benefits from improved nutrition in terms of subsequent productivity can always be improved, it is fairly robust. There is, nevertheless, a need to understand the heterogeneity in both the returns to investments in nutrition and in the costs of service delivery. Finally, any means to lower the artificial barrier between investments in social welfare and investments in economic growth will assist in the application of such research to public policy.