

Micronutrient Malnutrition: Impact on Labour Productivity and Loss in GDP

Alexander J. Stein

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Introduction

World Bank (1994):

- “Deficiencies of just vitamin A, iodine, and iron could waste as much as 5% of GDP, but addressing them...would cost less than 0.3% of GDP.”
- “Policymakers must be motivated to take action against micronutrient malnutrition. They need persuasive information on the economic and social costs... and on the... cost-effectiveness of micronutrient programs.”

Introduction

1. Introduction
2. How does micronutrient malnutrition (MnM) affect productivity and GDP?
3. What are limits of looking at the GDP?
4. How can the impact of MnM on productivity be quantified?
5. Disability-adjusted live years (DALYs)
6. The magnitudes of the impact on GDP
7. Conclusion

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MnM, productivity and GDP

- MnM causes morbidity and mortality



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MnM, productivity and GDP

- Morbidity negatively affects productivity:
 - inability to work (workdays lost)
 - decreased capacity to work
 - lower educational attainments (future productivity)
 - inefficient use of resources in the education system
 - re-allocation of resources and labour to nurse the ill (health care costs)

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MnM, productivity and GDP

- Mortality negatively affects productivity:
 - child mortality affects productivity
 - “replacement” births tie resources
 - higher population growth
 - adult mortality affects productivity
 - loss of investment in “human capital”
 - short time horizons induce lower investment in physical and human capital

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Hohenheim logo MnM, productivity and GDP

- Poverty trap as consequence of MnM:

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graph TD
    SmallBudget[Small budget] --> WeakPHS[Weak public health system]
    WeakPHS --> PoorControl[Poor control of MnM]
    PoorControl --> MnM[MnM]
    MnM --> PoorDiet[Poor diet]
    PoorDiet --> Poverty[Poverty]
    Poverty --> LowEarnings[Low earnings]
    LowEarnings --> LowProductivity[Low productivity]
    LowProductivity --> SmallBudget
  
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Hohenheim logo MnM, productivity and GDP

- The *Gross Domestic Product* is the value of all final goods and services produced in the economy in a given time period (incl. taxes but without deduction for depreciation)
- GDP is the aggregated result of a society's economic productivity

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Mechanisms

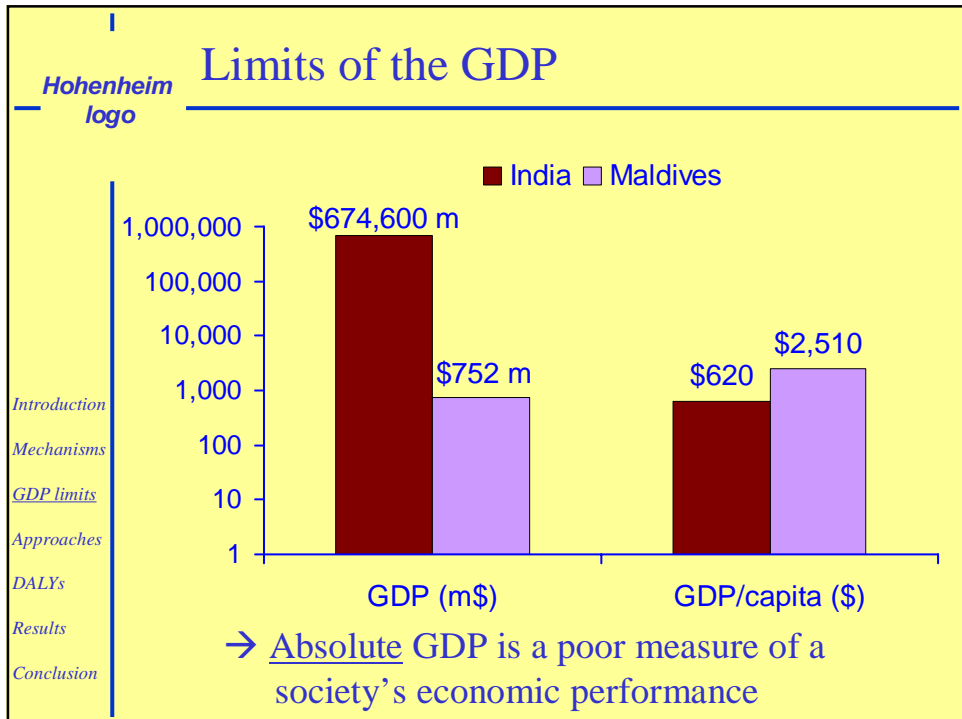
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- Hohenheim logo**
- ## Limits of the GDP
- Mortality could *positively* affect GDP
 - death of the economically unproductive
 - Environmental damages are not captured
 - growth at the cost of natural resource base
 - Cultural dimensions are not captured
 - loss of traditions & cultural heritage
 - Overall well-being is not captured
 - Bhutan's "Gross National Happiness"
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- GDP/economic statistics have their limits

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Limits of the GDP

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- UNDP: People should be the ultimate criteria for assessing the development of a country, not economic growth
- *Human Development Index (HDI)* captures basic aspects of human development: (i) longevity, (ii) knowledge, (iii) a decent standard of living
- India ranks higher for per capita GDP than for the HDI

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Limits of the GDP

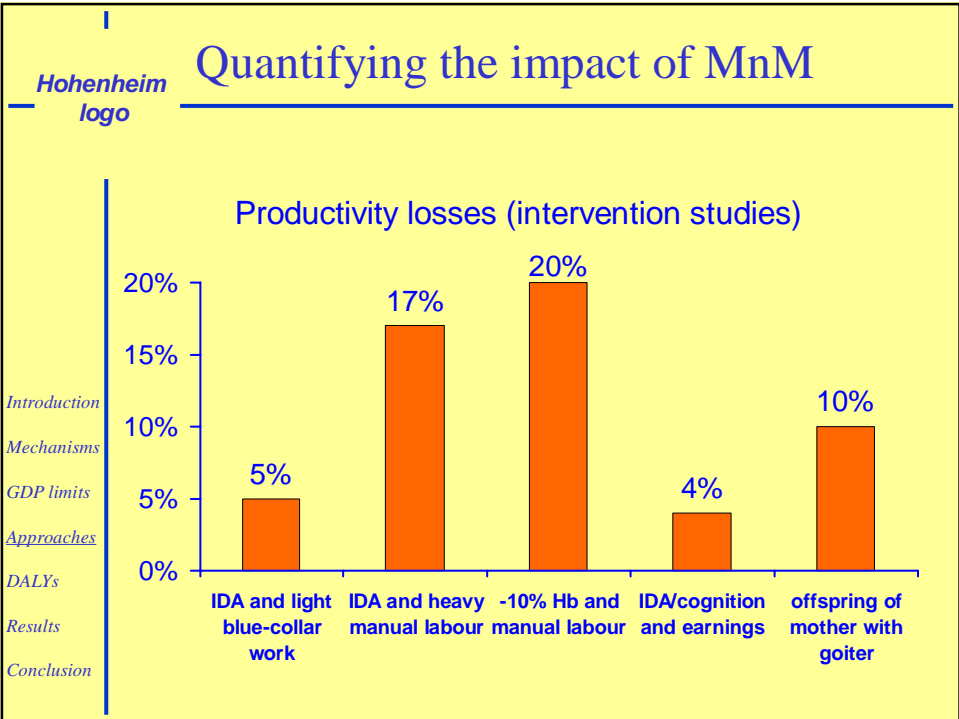
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- *Millennium Development Goals (MDGs)*
 - halving extreme poverty and hunger
 - achieving universal primary education
 - achieving gender equality
 - reducing child mortality by 2/3
 - reducing maternal mortality by 3/4
 - reversing the spread of... major diseases
 - ensuring environmental sustainability
 - global partnership for development

Hohenheim logo Quantifying the impact of MnM

- Intervention studies to establish the nutrition-productivity relationship (clinical or field trials)
- Estimation of nutrition-productivity relationship (regression analyses)
 - representative survey data
 - variables: wages, food consumption, health data (height, weight, serum levels) , socio-demographic data, etc.

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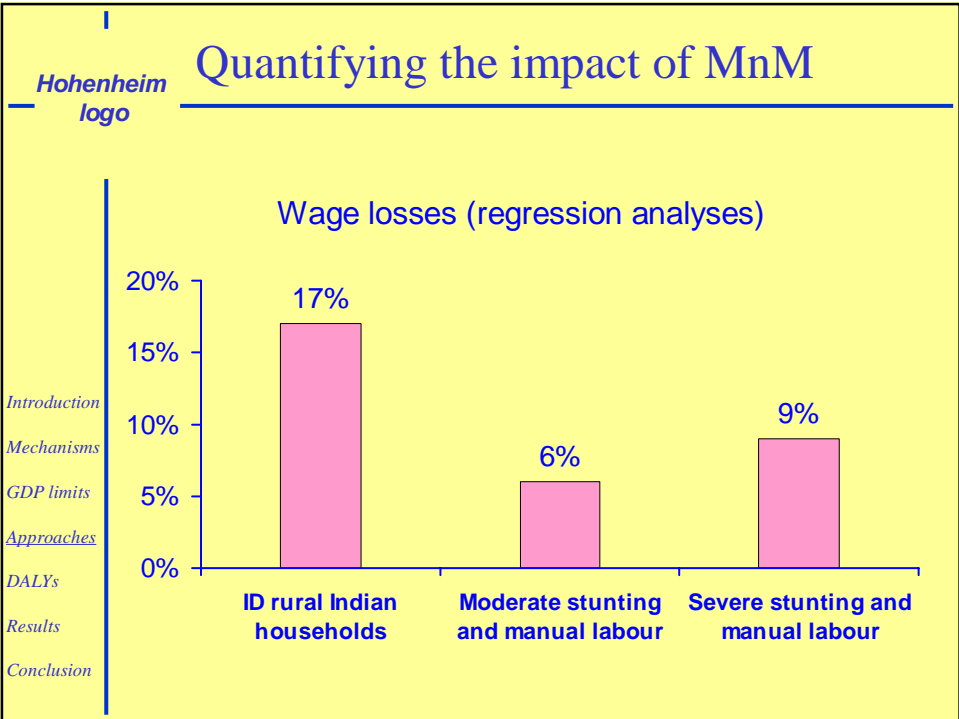


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Quantifying the impact of MnM

- Work performance also depends on incentives and motivation:
 - institutional factors (fixed hourly wages)
 - technological factors (inflexibility of assembly line work)
- Other factors may influence work output:
 - weather
 - alternative employment opportunities (seasonal production, job requirements, sluggish economies)

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Quantifying the impact of MnM

- Focus on wages and market activity only
- Nutritional improvements may have substantial welfare benefits in other areas:
 - child care
 - household maintenance
 - social & family responsibilities
- Economy-wide effects (e.g. public health budget, mortality-investment link) are difficult to capture

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Quantifying the impact of MnM

- Inter-temporal effects on people's "physiological capital" (Fogel 2004)
 - improved nutrition during prenatal period
 - fewer chronic conditions in adult life
 - later onset of chronic conditions
 - longer healthy & productive lives
- 30% of growth in British per capita income over the last two centuries due to better nutrition

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The impact of MnM on health

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- Putting *health* in the foreground
- Calculation of burden of deficiencies (disability-adjusted life years = DALYs)
 - association of actual health outcomes with micronutrient deficiencies
 - evaluation/weighting of health outcomes
 - consideration of duration of conditions
 - summing up of “healthy life years” lost

The impact of MnM on health

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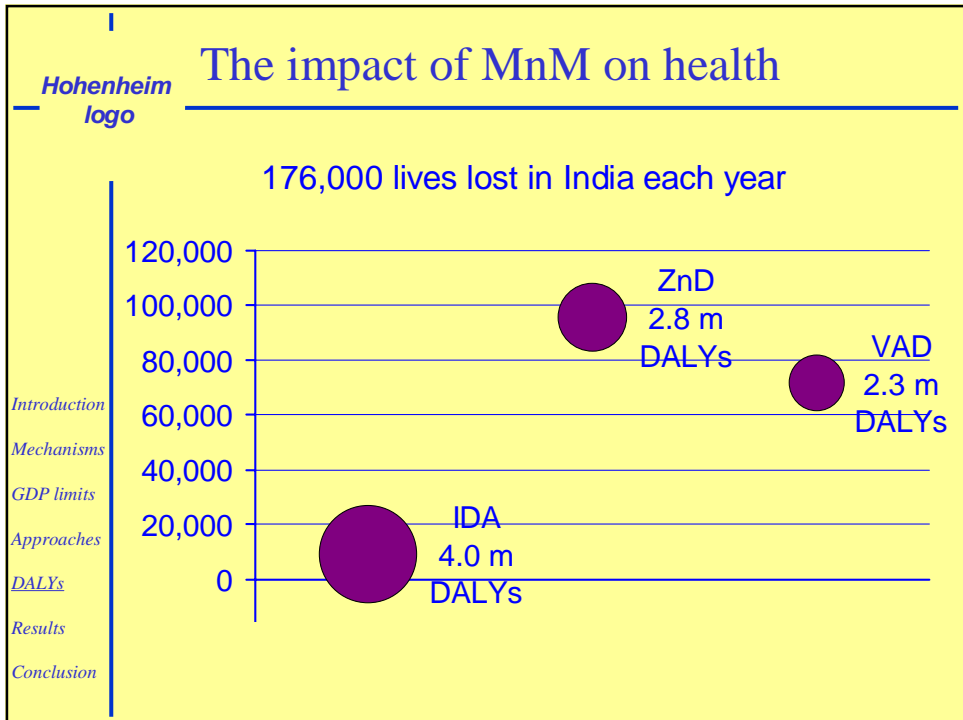
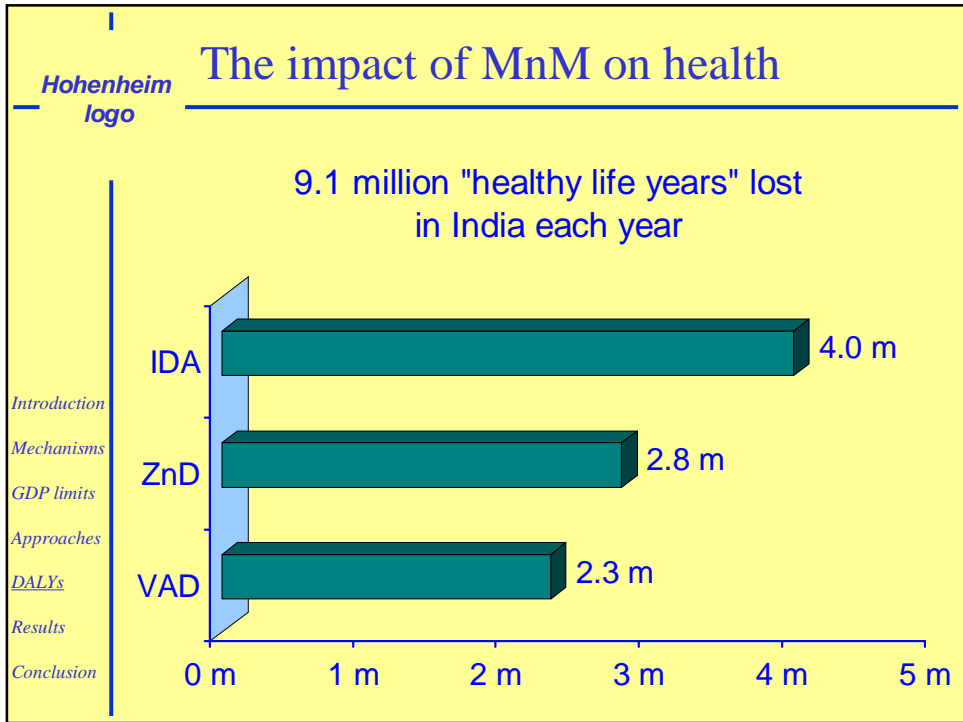
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- More formally:

$$DALYs_{lost} = \sum_j T_j M_{ij} \left(\frac{1 - e^{-rL_j}}{r} \right) + \sum_i \sum_j T_j I_{ij} D_{ij} \left(\frac{1 - e^{-rd_{ij}}}{r} \right)$$

- T = size of target group j
- M = mortality rate in target group j
- L = remaining life expectancy for target group j
- r = discount rate (3 percent)
- I = incidence rate of disease i in target group j
- D = disability weight of disease i in target group j
- d = duration of disease i in target group j



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The impact of MnM on GDP

- Impact of MnM on GDP
 - economy-wide extrapolations from results of intervention studies and/or regression analyses
 - example in the next presentation
- monetary valuation of DALYs:
 - 1 DALY = 3x GDP/capita (WHO 2001)
 - = \$1,860 ≈ Rs. 83,700

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The impact of MnM on GDP

Estimated GDP losses in India each year

Category	Estimated GDP Loss (%)
IDD, IDA, PEM, VAD	5.0%
IDD, IDA	4.4%
IDA	6.0%
IDA, VAD, folate	1.0%
IDA, ZnD, VAD	2.5%
GDP growth India	6.9%
GDP growth OECD	3.3%

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- Analyses at different points in time
- Analyses/bundling of different deficiencies (incl. PEM)
- Sometimes long chain of assumptions between intervention studies with individuals and economy-wide GDP
- When calculating the DALYs we were very conservative and cautious

The impact of MnM on GDP

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- GDP loss of 1-6% due to MnM in India
 - Indian GDP in 2004: \$675 billion
 - 2.5% = \$17 billion ≈ Rs. 760 billion
 - 5% = \$34 billion ≈ Rs. 1,500 billion
- Annual cost of IDA, ZnD & VAD
 - absolute loss of \$17 billion, i.e. \$16.5 per capita (≈ Rs. 750/capita)

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Conclusion

- MnM has a real, negative impact on productivity and GDP
- The absolute costs of MnM are tremendous, promising high returns for interventions that combat MnM
- MnM affects more dimensions of a country's development – and individual well-being – than simply GDP

→ There are more than enough good reasons to fight MnM...

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World Health Organisation (2001):

- “Improving the health and longevity of the poor is an end in itself, a fundamental goal of economic development. But it is also a means to achieving the other development goals relating to poverty reduction. The linkages of health to poverty reduction and to long-term economic growth are powerful, much stronger than is generally understood.”

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Thank you
for your attention!

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Alexander J. Stein, University of Hohenheim
Department of Agricultural Economics and Social Sciences
c/o Centre for Development Research (ZEF b)
Walter-Flex-Str. 3, 53113 Bonn (Germany)
Phone: +49-228-73-1842, fax: +49-228-73-1869
E-mail: [astein1\(at\)uni-hohenheim.de](mailto:astein1(at)uni-hohenheim.de)

Web: <http://www.AJStein.de>

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