The global pattern of malnutrition:
From undernutrition to obesity and diet-related disease

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In fifty years, from *more* food to *better* food

The global pattern of malnutrition
- stunting
- wasting
- obesity
- disease

Percent of energy from non-staple foods and total dietary energy by region, 1961-2011

(FAO Food Balance Sheet estimates)

Fifteen years into the 21st c., we have:

- Progress on stunting and wasting
  …but still far to go

- Sharp rise in obesity
  …and more to come

- Rapid shift in diet-related diseases
  …even in developing countries
How has the food system changed?

• **Are countries just richer, or different in other ways?**
  • Richer = more of everything, both public and private
  • Different = new things, both technologies and institutions

• **Strategy**
  • test for shifts in the global average *at each level of national income*
  • this generalizes the Preston curve (Preston 1975, Bloom & Canning 2007), first applied to life expectancy

• **Data**
  • national income:  purchasing power per capita
  • height and weight:  stunting, wasting and obesity
  • disease burden:  diabetes and diarrhea (% of DALYs lost)

• **Method**
  • all data are nationally representative; results are weighted by population
  • calculate local mean and confidence interval at each income level
  • this represents the average person in countries at that level of income, in each period of time
The main development goal: child stunting
**Clear progress against child stunting, at each level of income**

Pct. of children under 5, 1985-99 [n=250] and 2000-11 [n=337])

- **O = 1985-99**
- □ = 2000-11

Note: Symbols are sized by population, with decades shown by green circles for 1986-99 (250 surveys in 103 countries) and blue squares for 2000-2011 (337 surveys in 117 countries).

Lines show local means and confidence intervals for each period estimated by `-polyci-`, weighted by population and with a bandwidth of 0.75.

Source: World Bank, WHO and UNICEF joint data; GDP and population are from PWT 8.1.
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Focusing on the poorest in recent years, we can zoom in to see FTF countries’ gains

UNICEF/WHO/WB survey data on child stunting since 2000 in poor countries
Pct. of children under 5, 2000-05 [n=118] and 2006-11 [n=118]

O = 2000-05
□ = 2006-11

Note: 2007-09=green circles, 2000-11=blue squares, with darker colors for FTF focus countries of which a few are labeled. Lines show each period’s local means and confidence intervals estimated by -lpolicy-, weighted by population and with a bandwidth of 0.75.

Source: World Bank, WHO and UNICEF joint data; GDP and population are from PWT 8.1.
Less prevalent, but still serious: child wasting
Child wasting rates have also fallen

Pct. of children under 5, in 1985-99 [n=244] and 2000-11 [n=333]

Note: Symbols are sized by population, with decades shown by green circles for 1986-99 (244 surveys in 102 countries) and blue squares for 2000-2011 (333 surveys in 116 countries). Lines show local means and confidence intervals for each period estimated by -lpolyci-, weighted by population and with a bandwidth of 0.75.

Source: World Bank, WHO and UNICEF joint data; GDP and population are from PWT 8.1.
The most visible kind of change: adult obesity
Adult obesity had a clear income gradient in 1990

Global prevalence of obesity (share of adults aged 20+)
Modeled estimates for 1990 in 162 countries

Note: Symbols are sized by population, with year shown as 1990=green circles. Lines show each year’s local means and confidence intervals estimated by -lpolyci-, weighted by population and with a bandwidth of 0.75. Source: Global Burden of Disease Study; GDP and population are from PWT 8.1.
From 1990 to 2010, did the income gradient shift?

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Global prevalence of obesity (share of adults aged 20+)
Modeled estimates for 1990, 2005 & 2010 in 162 countries

Proportion of adults aged 20+ who are obese at each level of national income

O = 1990
Δ = 2005
□ = 2010

Real GDP per capita at PPP prices (2005 USD), log scale

Note: Symbols are sized by population, with year shown as 1990=green circles, 2005=red triangles, and 2010=blue squares. Lines show each year's local means and confidence intervals estimated by -ipolyci-, weighted by population and with a bandwidth of 0.75.
Source: Global Burden of Disease Study; GDP and population are from PWT 8.1.

But China and India may be influential
Adult obesity has shifted up in richer countries

Outside of China & India the gradient is now steeper

Note: Symbols are sized by population, with year shown as 1990=green circles, 2005=red triangles, and 2010=blue squares. Lines show each year’s local means and confidence intervals estimated by -lpolyci-, weighted by population and with a bandwidth of 0.75.

Source: Global Burden of Disease Study; GDP and population are from PWT 8.1.
The worst diet-related disease: diabetes
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Diabetes burdens in 1990

A clear income gradient
…but also more variance at higher incomes

Share of total DALYs lost at each level of national income

Note: Symbols are sized by population, with year shown as 1990=green circles.

Source: Global Burden of Disease Study, Results by Cause; GDP and population are from PWT 8.1.
Diabetes burdens in 1990, with local means

The global burden of diabetes (share of DALYs lost) Modeled estimates for 1990 in 162 countries

Note: Symbols are sized by population, with year shown as 1990=green circles.
Lines show each year’s local means and confidence intervals estimated by -lpolyci-, weighted by population and with a bandwidth of 0.75.
Source: Global Burden of Disease Study, Results by Cause; GDP and population are from PWT 8.1.

Note the wider confidence interval at higher incomes

Note India and China are near their local means
Changes in diabetes from 1990 to 2005

The global burden of diabetes (share of DALYs lost)
Modeled estimates for 1990 and 2005 in 162 countries

From 1990 to 2005, relative burden rose in lower and middle income countries

India and China shifted up and along the same curves as other countries

Note: Symbols are sized by population, with year shown as 1990=green circles and 2005=red triangles.
Lines show each year's local means and confidence intervals estimated by \(-\text{polyci}\), weighted by population and with a bandwidth of 0.75.
Source: Global Burden of Disease Study, Results by Cause; GDP and population are from PWT 8.1.
Diabetes burdens have risen in poor countries

The global burden of diabetes (share of DALYs lost)
Modeled estimates for 1990, 2005 and 2010 in 162 countries

China and India remain near their local means

The change was from 1990 to 2005; no significant further rise to 2010

Note: Symbols are sized by population, with year shown as 1990=green circles, 2005=red triangles, and 2010=blue squares. Lines show each year’s local means and confidence intervals estimated by -lpolyci-, weighted by population and with a bandwidth of 0.75.
Source: Global Burden of Disease Study, Results by Cause; GDP and population are from PWT 8.1.
Now contrast with the signature illness of undernourishment: diarrheal disease
Diarrhea burdens have fallen but are still large

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What happened at each income level other than India & China?

The global burden of diarrheal disease (share of DALYs lost)
Modeled estimates for 1990, 2005 and 2010 in 162 countries

China

India remains an outlier

Note: Symbols are sized by population, with year shown as 1990=green circles, 2005=red triangles, and 2010=blue squares. Lines show each year's local means and confidence intervals estimated by -lpolyci-, weighted by population and with a bandwidth of 0.75.

Source: Global Burden of Disease Study, Results by Cause; GDP and population are from PWT 8.1.
Diarrhea burdens have fallen but are still large

The global burden of diarrheal disease (excl. China & India)
Modeled estimates for 1990, 2005 and 2010 in 160 countries

Relative burdens fell most in the poorest countries

Note: Symbols are sized by population, with year shown as 1990=green circles, 2005=red triangles, and 2010=blue squares. Lines show each year’s local means and confidence intervals estimated by -lpoly- , weighted by population and with a bandwidth of 0.75.

Source: Global Burden of Disease Study, Results by Cause; GDP and population are from PWT 8.1.
In conclusion:
Fifteen years into the 21st c., we have…

• Progress on stunting and wasting
  …large gains from higher income,
  and also big improvement in poor countries

• Sharp rise in obesity
  …so far, almost entirely due to higher income
  and also worsening in the richest countries

• Rapid shift in diet-related diseases
  …worsening of diabetes at low and middle incomes
  while diarrhea is improving in poor countries
Looking forward:
In the coming decades, we can…

• Complete eradication of stunting and wasting
  …and reap large gains
  in later health & cognition

• Bend the curve of obesity
  …and reverse its rise
  at higher incomes

• Treat and prevent diet-related diseases
  …such as diabetes and diarrhea
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