Economic Impact of flour fortification

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Outline

- Fortification originated in industrialized countries
- But recent progress has been primarily in developing world
- One of the highest development priorities!
- Industrialized countries have been left behind
- Strong economic case for additional investment

Progress of fortification worldwide - 1

- Fortification of flour in UK began 1942 (1949 became mandatory), US 1941 (voluntary), Canada 1949 (mandatory), Australia (1991)
- Addition of folic acid in 1996 (US and Canada)
- Salt iodization began in US 1920's, Switzerland 1922
- Fortification of dairy and/or oils with vitamin D in US, Canada, UK, Australia, Netherlands, New Zealand, Portugal

Progress of fortification worldwide - 2

- More recently, developing countries have overtaken industrialized countries in extent of fortification: 74 countries now have mandatory flour fortification, 5 voluntary
- Deficiencies have re-emerged in industrialized countries (e.g. iodine deficiency in Australia and New Zealand): 120 countries participating in Universal Salt Iodization
- Only 3 industrialized countries require folic acid in flour, but most developing countries now do so

Fortification – top priority for developing countries

Copenhagen Consensus 2008 – 8 top economists, including 5 Nobel laureates

Copenhagen Consensus results

- 2004: providing micronutrients was ranked #2 (second only to fighting HIV-AIDS)
- 2008: providing micronutrients was ranked #1 (supplements) and #3 (fortification)
- 2012: providing micronutrients (with other interventions for preschoolers) ranked #1

Costs of deficiency: iron

- Iron: in developing countries anemia is associated with
  - 5% lower productivity (light manual labour)
  - 17% lower productivity (heavy manual labour)
  - 4% lower productivity (other work) – related to one-half standard deviation LOWER score on cognitive tests (7-8 IQ points)

Costs of deficiency: folate

- Human costs are paramount;
- Economic costs also large: Yi et al (2011) review:
  - Annual direct cost/patient/year €43,000 in 2003 for NTDs and €12-54,000 for spina bifida in US
  - Spain annual medical costs/patient/year €3,500 spina bifida
  - Other costs for spina bifida are at least twice this (special education, lost productivity of individual)
  - Parents also less able to work, lose additional income

Costs of deficiency: iodine

- Mild iodine deficiency: IQ loss of 1-2 points
- Moderate deficiency: IQ loss of 2-3 points
- Severe: IQ loss of 13.5 points
- Lower IQ is associated with lower years of schooling completed, and lower earnings (Zimmermann et al)
- Definitions: Mild deficiency: median urinary iodine concentration (UIC) 50-99 µg/L; moderate deficiency: UIC 20-49 µg/L; severe: UIC <20 µg/L

Costs of fortifying

- Fortification costs are pennies per person
- Wheat flour fortification costs (depending on exact micronutrient composition, amount consumed) could cost €0.16/person/year
- US cost (folic acid) in 1990's was €0.02-€0.03/person/year
- Salt iodization costs of the order of €0.04/person/year

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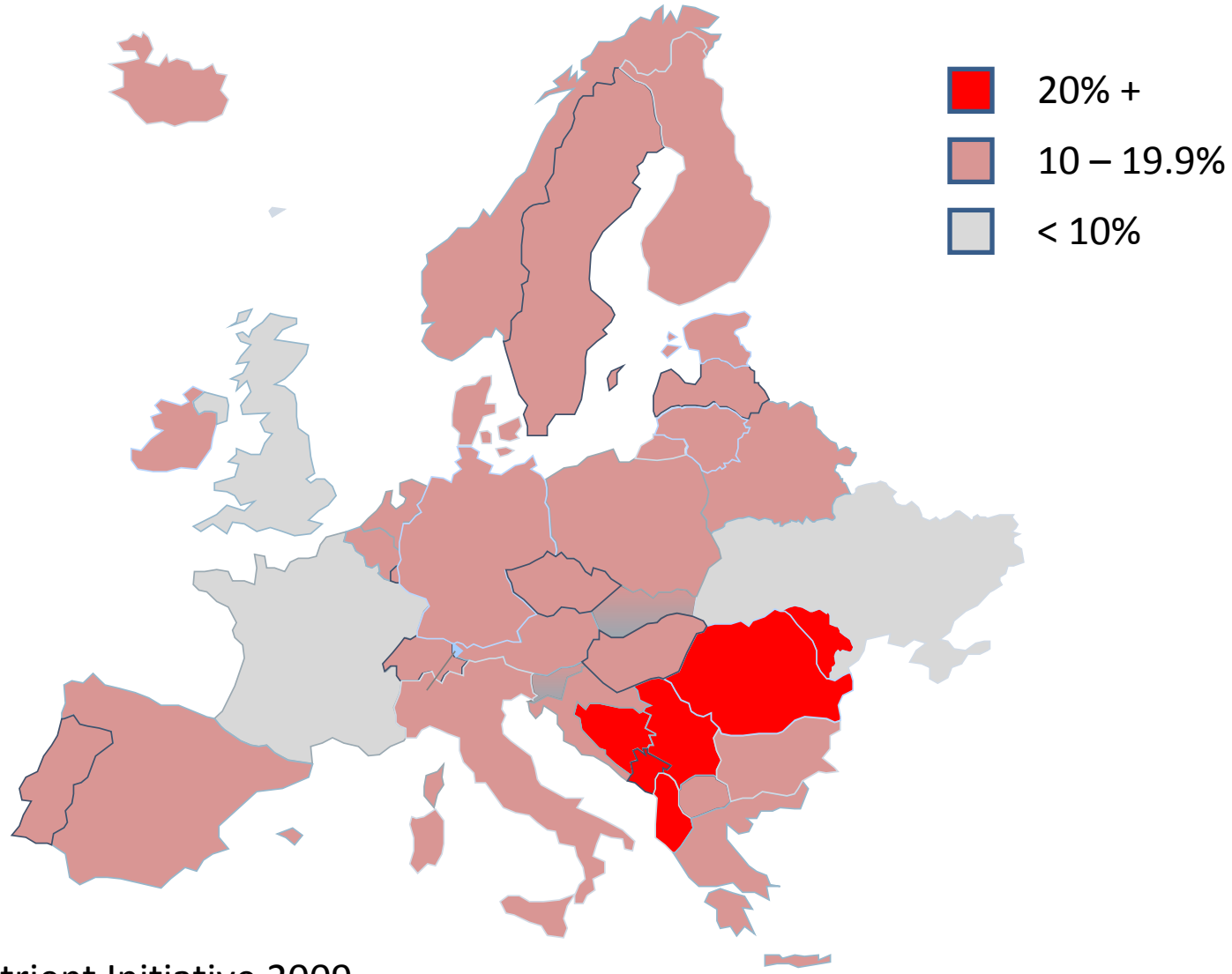
Benefit:cost of fortifying

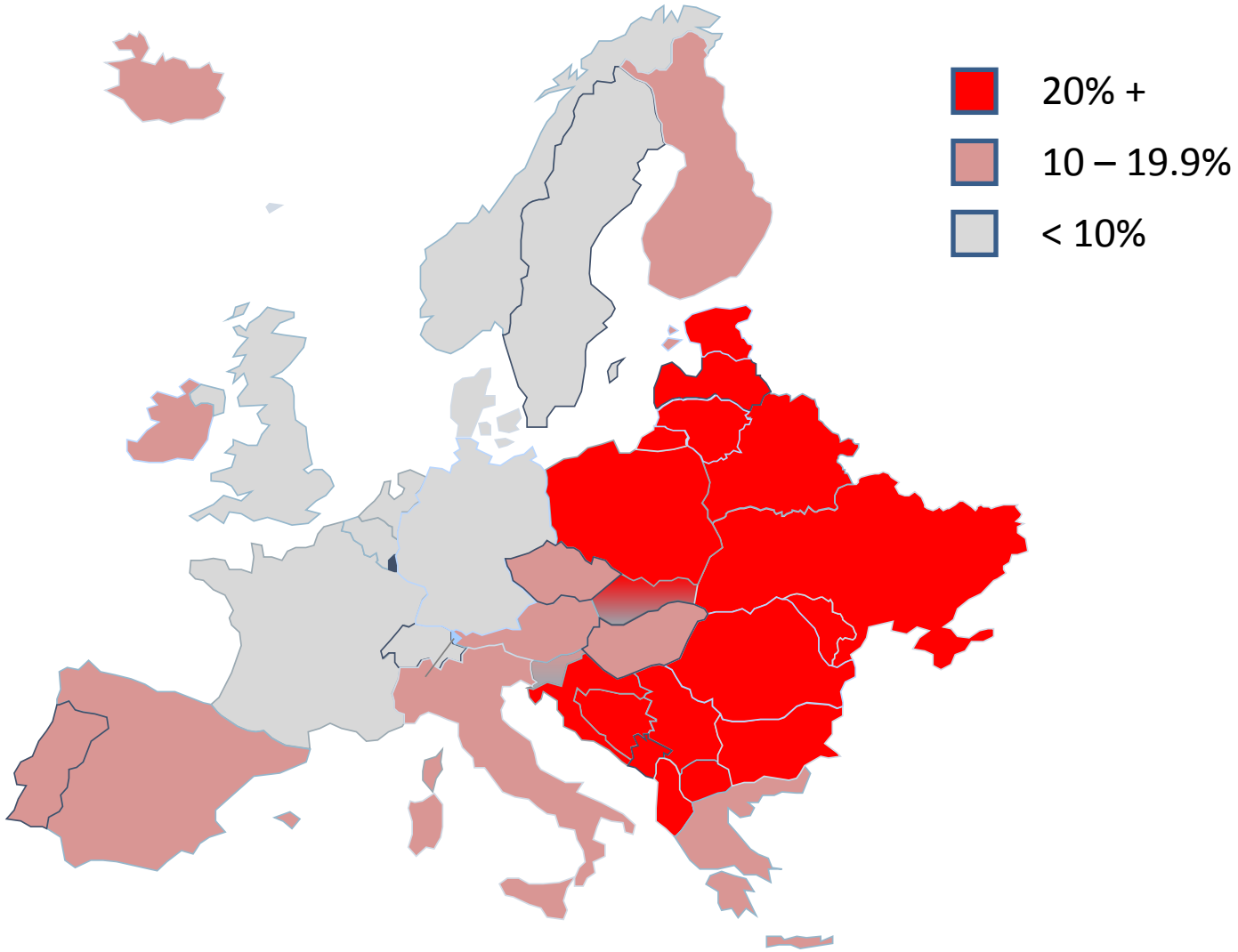
- Studies in 6 countries (US, Netherlands, Australia, New Zealand, Chile and South Africa) suggested in all but one case, fortification was cost-saving, even if only health costs are considered (Yi et al, 2011)
- B:C ratio for 10 developing countries, for iron fortification was 8.7:1 (Horton and Ross, 2003)
- B:C ratio for salt iodization (rough calculation for developing world) 30:1 (Horton et al, 2008)

Anemia, non-pregnant women



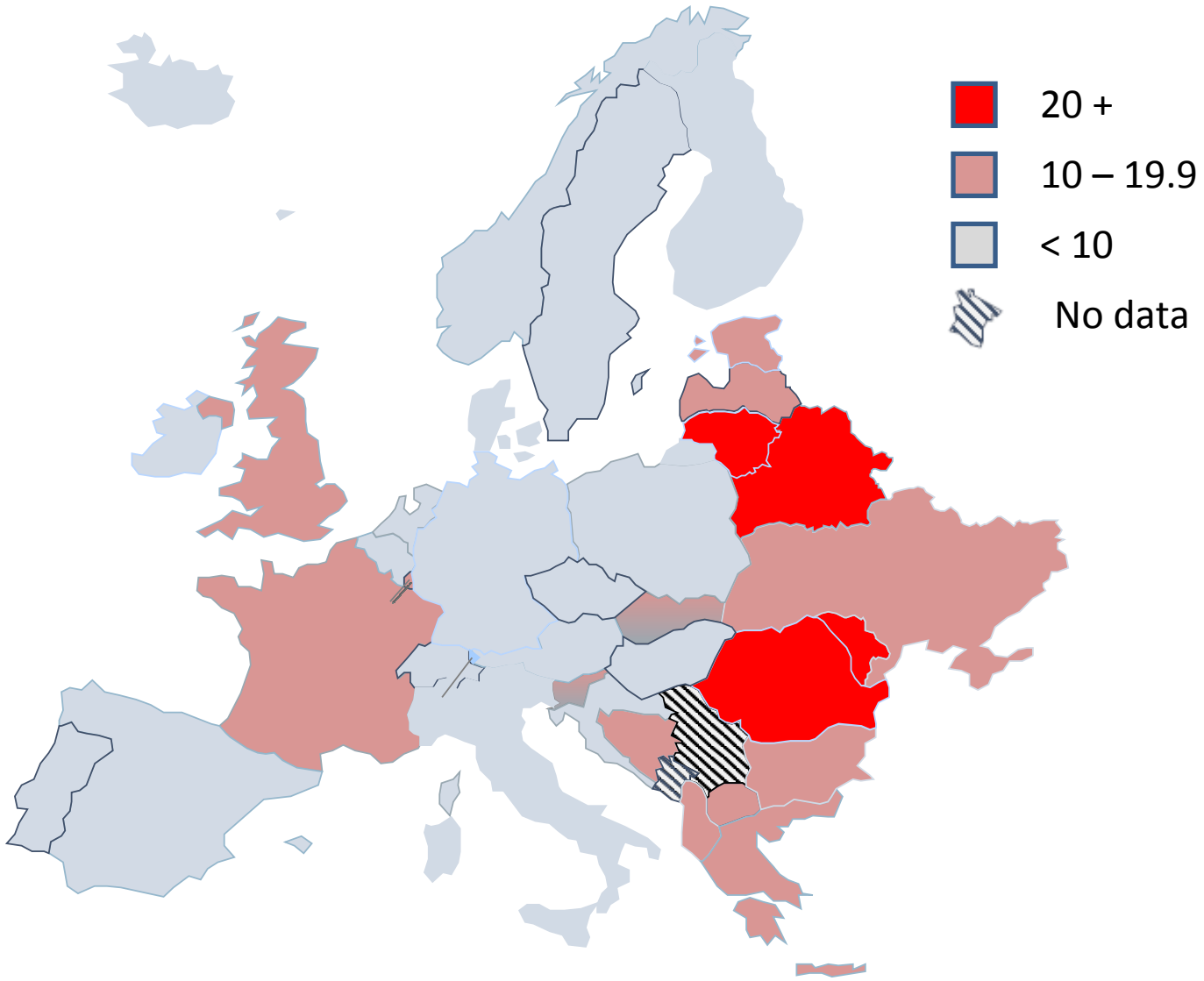
Data: Micronutrient Initiative 2009

Anemia, preschool children



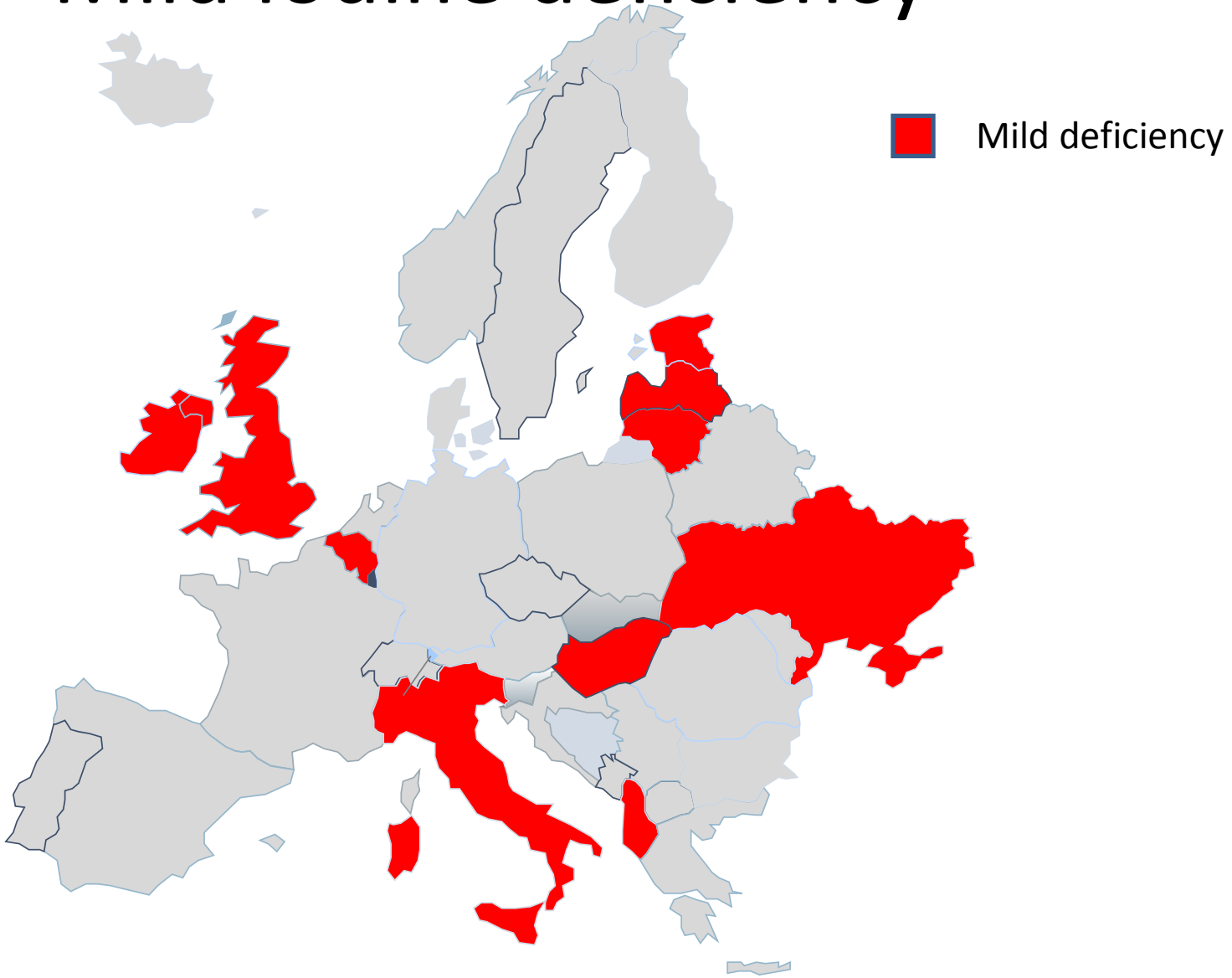
Data: Micronutrient Initiative 2009

NTDs per 10,000 births



Data: Eurocat, for 2009

Mild iodine deficiency



Data: Iodine Nutrition Scorecard

Benefits of reducing deficiencies: iron

- Example: UK has anemia rates at least 5 percentage points lower than neighbours (non-pregnant women)
- If productivity benefit is 4% for reduction in anemia, women are 46% of the labour force, the labour share of GDP is 30%, GDP/capita is around €28,000, then benefit is around €8/person/year
- Compares to cost of < €0.16/year
- Excludes benefit of gain of 0.5 IQ points per child

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Benefits of reducing deficiencies: folate

- Cost of fortification for Netherlands estimated as €312,000 to €686,000 in 2005 (Jentink et al 2008)
- Compared to lifetime cost per child born with NTD of €128,774 (discounted at 4%)
- 148 children per year born with NTD's
- Even with only 7 cases/year averted by fortification (conservative), is cost-saving; NTD rates in South Africa fell 30% with fortification

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Data

- Eurocat (European surveillance of congenital abnormalities), data for 2009 http://www.eurocat-network.eu/accessprevalencedata/prevalencetables
- Global Iodine Nutrition Scorecard 2011. Iodine Network, http://www.iodinenetwork.net
- Micronutrient Initiative (2009). Investing in the future: a united call to action on vitamin and mineral deficiencies. Ottawa: MI

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- Horton S, Ross J. (2003) The economics of iron deficiency. Food Policy 28:51-75.
- Jentink J, van de Vrie-Hoekstra NW, de Jong-van den Berg LRW, Postmaa MJ. (2008) Economic evaluation of folic acid food fortification in The Netherlands. Eur J Pub Health 18:270-274.

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References 2

- Yi Y, Lindemann M, Colligs A, Snowball C. (2011) Economic burden of neural tube defects and impact of prevention with folic acid. Eur J Pediatr 170(11):1391-1400.
- Zimmermann MB, Karumbunathan V, Andersson M. Development of the Child Health Epidemiology Reference Group estimates for the global burden of disease due to iodine deficiency (unpublished).

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