

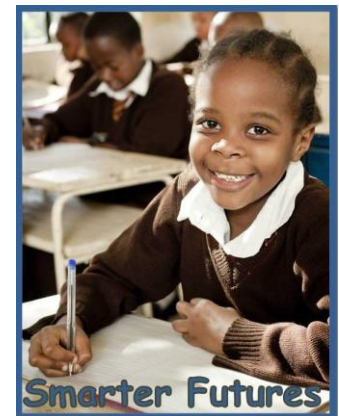
REGIONAL TRAINING WORKSHOP ON QUALITY ASSURANCE AND  
QUALITY CONTROL (QA/QC) FOR FLOUR FORTIFICATION  
Lusaka, Zambia, 15-18 May 2017

# Economic Consequences of Micronutrient Deficiencies and Potential Economic Benefit of Fortification

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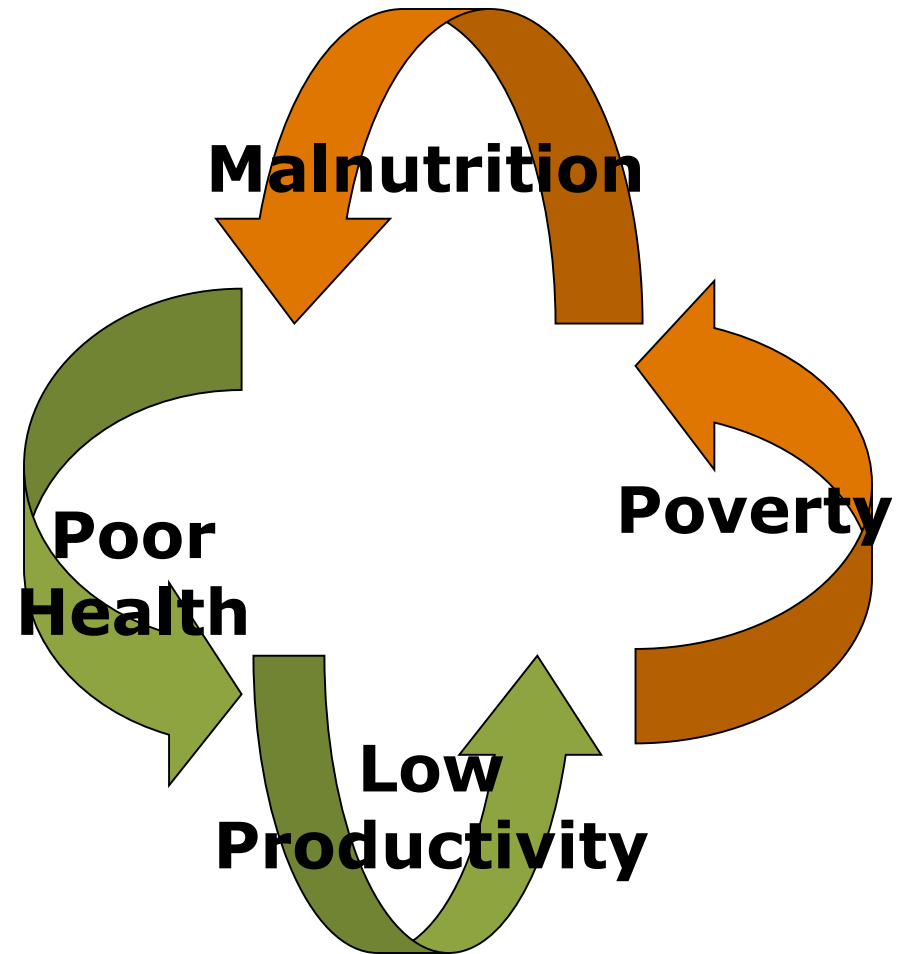


Ministerie van Buitenlandse Zaken



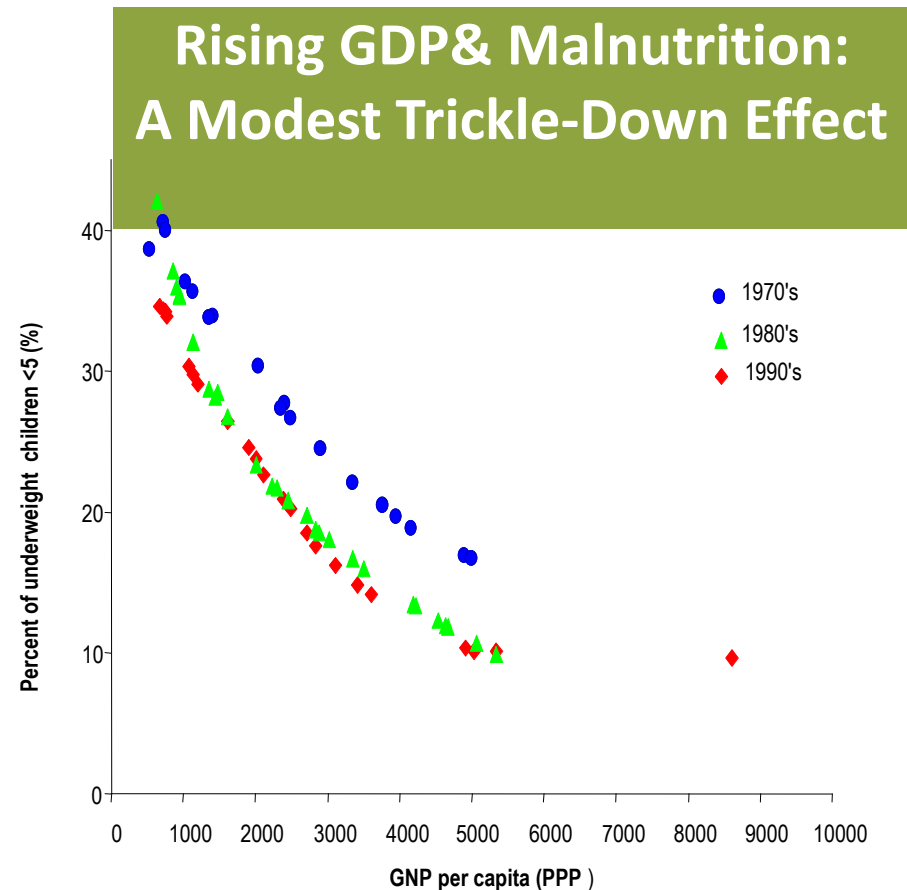
# Malnutrition: A Cause or Consequence of Poverty?

- People are Basic Unit of Economic Growth
- Association of poverty and malnutrition.
  - Inverse relation of GDP & Malnutrition
- Two-way Dynamic
  - Poverty is not simply root cause of hunger.
  - Malnutrition causes and reinforces poverty.



# Economic Growth Is Not Enough

- More purchasing power and more food reduces malnutrition but...
  - ... doubling GDP reduced malnutrition only 2% from 25% to 23%
- Public investment in nutrition interventions can close this gap of GDP growth and improved nutrition.



# Vitamin and Mineral Deficiency Contributes to:

- More than one-third of all **deaths in children** under the age of 5
- Stunting of an estimated **195 million children** under age 5 in developing countries
- Undeveloped **cognitive capacity**, productivity and earning potential



istockphoto

# 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*

# The Copenhagen Consensus: Highest Benefit Cost Ratio

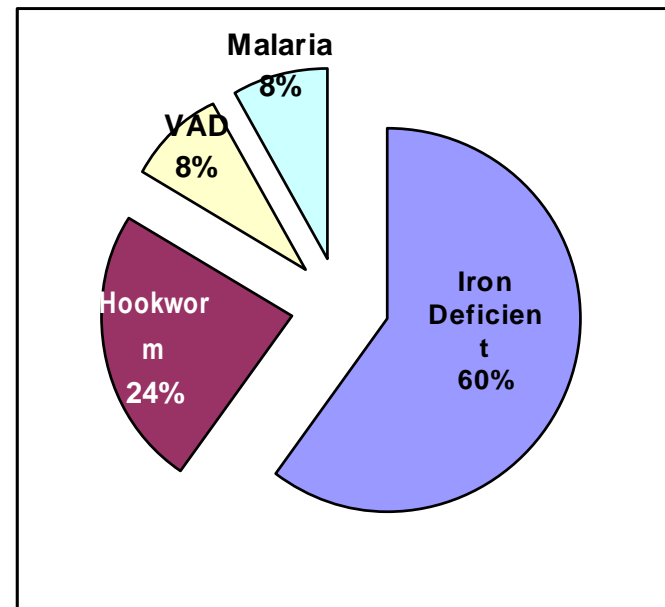
	<b>Solution</b>	<b>Challenge</b>
1	Micronutrient supplements for children (A & Zn)	Malnutrition
2	The Doha development agenda	Trade
3	<b>Micronutrient fortification</b>	Malnutrition
4	Expanded immunization coverage for children	Diseases
5	Biofortification	Malnutrition
6	Deworming, other nutrition programs in school	Malnutrition
7	Lowering the price of schooling	Education
8	Increase and improve girl's schooling	Women
9	Community-based nutrition programs	Malnutrition

Nobel Prizewinning Economists: Finn Kydland, Robert Mundell,  
Douglass North, Thomas Schelling, Vernon L. Smith

# Iron Deficiency as Cause of Anemia

- How much anemia is iron deficiency related?
  - “anemia prevalence can generally be taken as indicator of extent and trends of iron deficiency.” (WHO)
- Regional Situation
  - No Malaria
  - Limited VAD
  - Limited Hookworm and parasites
- Provisional Estimate of Iron deficiency as cause of anemia: 90%

## Global Causes of Anemia (WHO)



# Costs of Anemia

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**





# Example: Summary 10-Year Baseline of Economic Losses:

Year	Iron Deficiency Anemia				Folic Acid Deficiency			Total Projected Damage
	Perinatal Mortality	Adult Anemia	Childhood Anemia	Total IDA	Death & Disability	Medical & Welfare	Total Folic Acid	
	Future Productivity	Current Productivity	Future Productivity		Future Productivity	Current Expenses		
	\$000,000/yr	\$000,000/yr	\$000,000/yr	\$000,000/yr	\$000,000/yr	\$000,000/yr	\$000,000/yr	\$000,000/yr
2009	\$ 1.57	\$ 76.61	\$ 4.77	\$ 82.95	\$ 1.39	\$ 0.34	\$ 1.73	<b>84.7</b>
2010	\$ 1.58	\$ 77.37	\$ 4.82	\$ 83.78	\$ 1.40	\$ 0.34	\$ 1.75	<b>85.5</b>
2011	\$ 1.60	\$ 78.15	\$ 4.87	\$ 84.62	\$ 1.42	\$ 0.35	\$ 1.77	<b>86.4</b>
2012	\$ 1.62	\$ 78.93	\$ 4.92	\$ 85.46	\$ 1.43	\$ 0.35	\$ 1.78	<b>87.2</b>
2013	\$ 1.63	\$ 79.72	\$ 4.97	\$ 86.32	\$ 1.45	\$ 0.35	\$ 1.80	<b>88.1</b>
2014	\$ 1.65	\$ 80.52	\$ 5.02	\$ 87.18	\$ 1.46	\$ 0.36	\$ 1.82	<b>89.0</b>
2015	\$ 1.67	\$ 81.32	\$ 5.07	\$ 88.05	\$ 1.48	\$ 0.36	\$ 1.84	<b>89.9</b>
2016	\$ 1.68	\$ 82.13	\$ 5.12	\$ 88.93	\$ 1.49	\$ 0.37	\$ 1.86	<b>90.8</b>
2017	\$ 1.70	\$ 82.96	\$ 5.17	\$ 89.82	\$ 1.51	\$ 0.37	\$ 1.87	<b>91.7</b>
2018	\$ 1.72	\$ 83.79	\$ 5.22	\$ 90.72	\$ 1.52	\$ 0.37	\$ 1.89	<b>92.6</b>
	<b>\$ 16.4</b>	<b>\$ 801.5</b>	<b>\$ 49.9</b>	<b>\$ 867.8</b>	<b>\$ 14.5</b>	<b>\$ 3.6</b>	<b>\$ 18.1</b>	<b>885.9</b>
	1.9%	90.5%	5.6%	98.0%	1.6%	0.4%	2.0%	

# Average Premix Cost for 1 Metric Ton



One metric ton of flour is about 2,200 pounds, as pictured here. FFI photo.

## **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

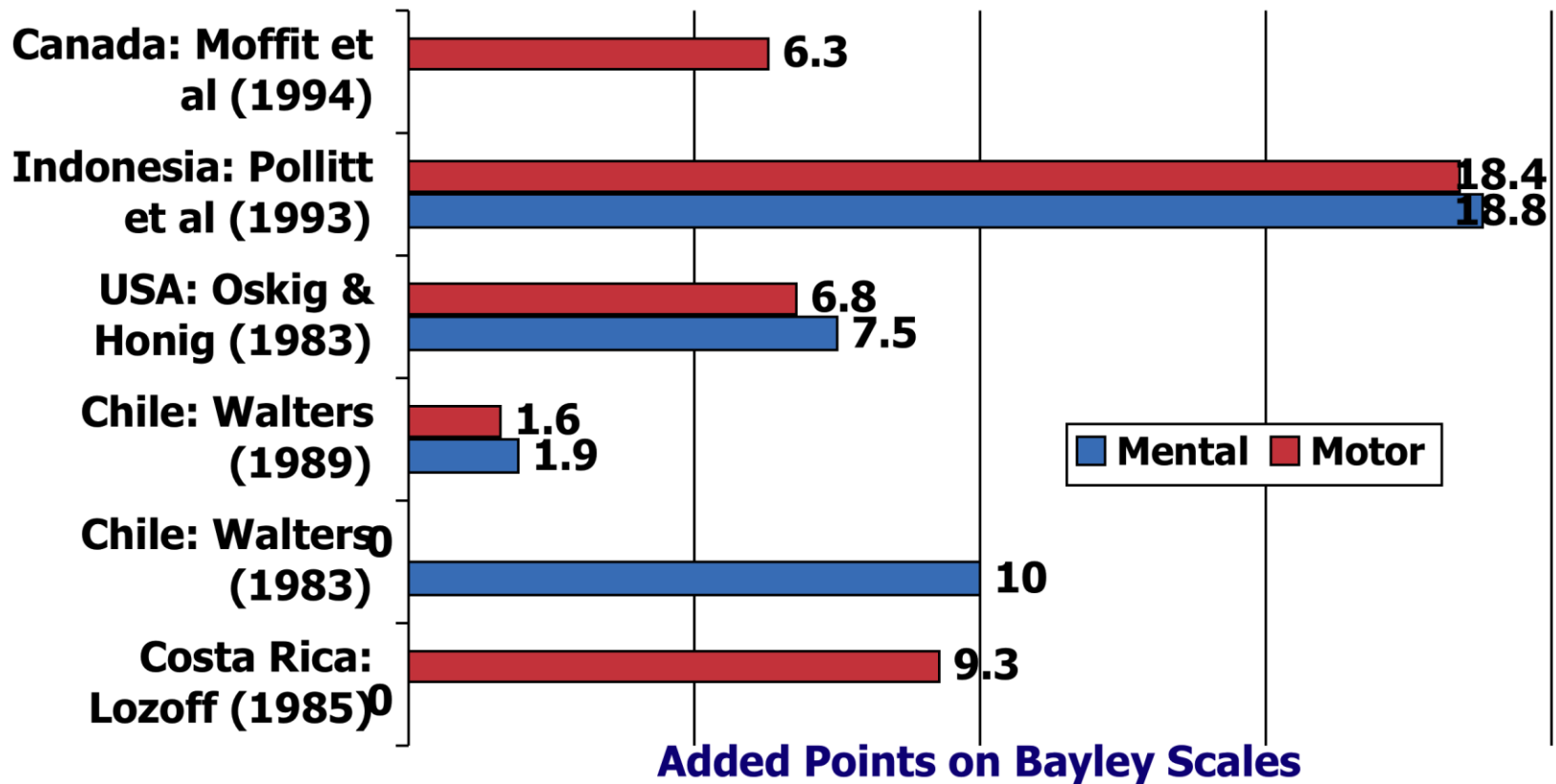
## **Rice:**

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

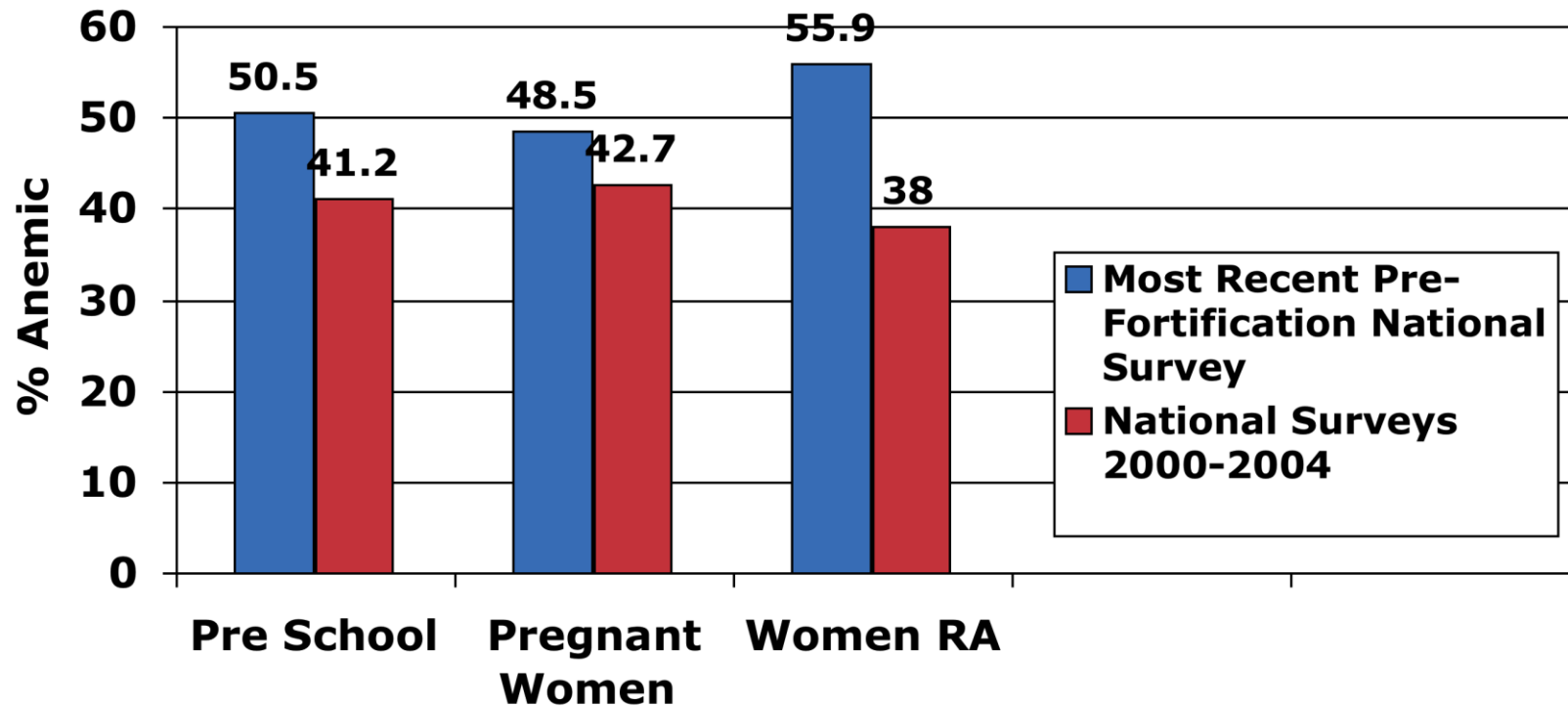
# Examples of Fortification Impact

- Cognitive Impact of iron on children
- Impact of Folic Acid fortification in Canada Two-way Dynamic
- - Poverty is not simply root cause of hunger.
  - Malnutrition causes and reinforces poverty.

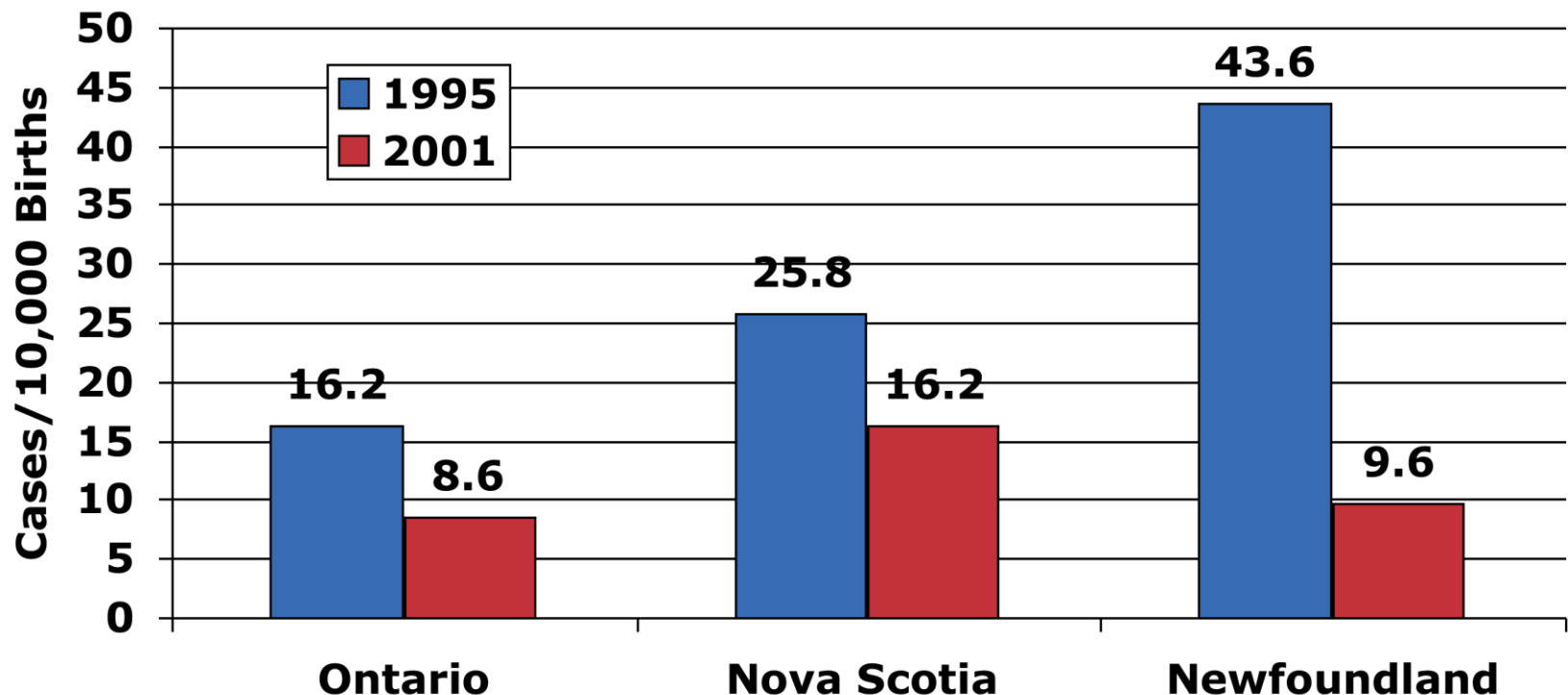
# Behavioral & Cognitive Impact on Children



# Oman: Pre-Post Fortification National Decrease in Anemia 18-32%

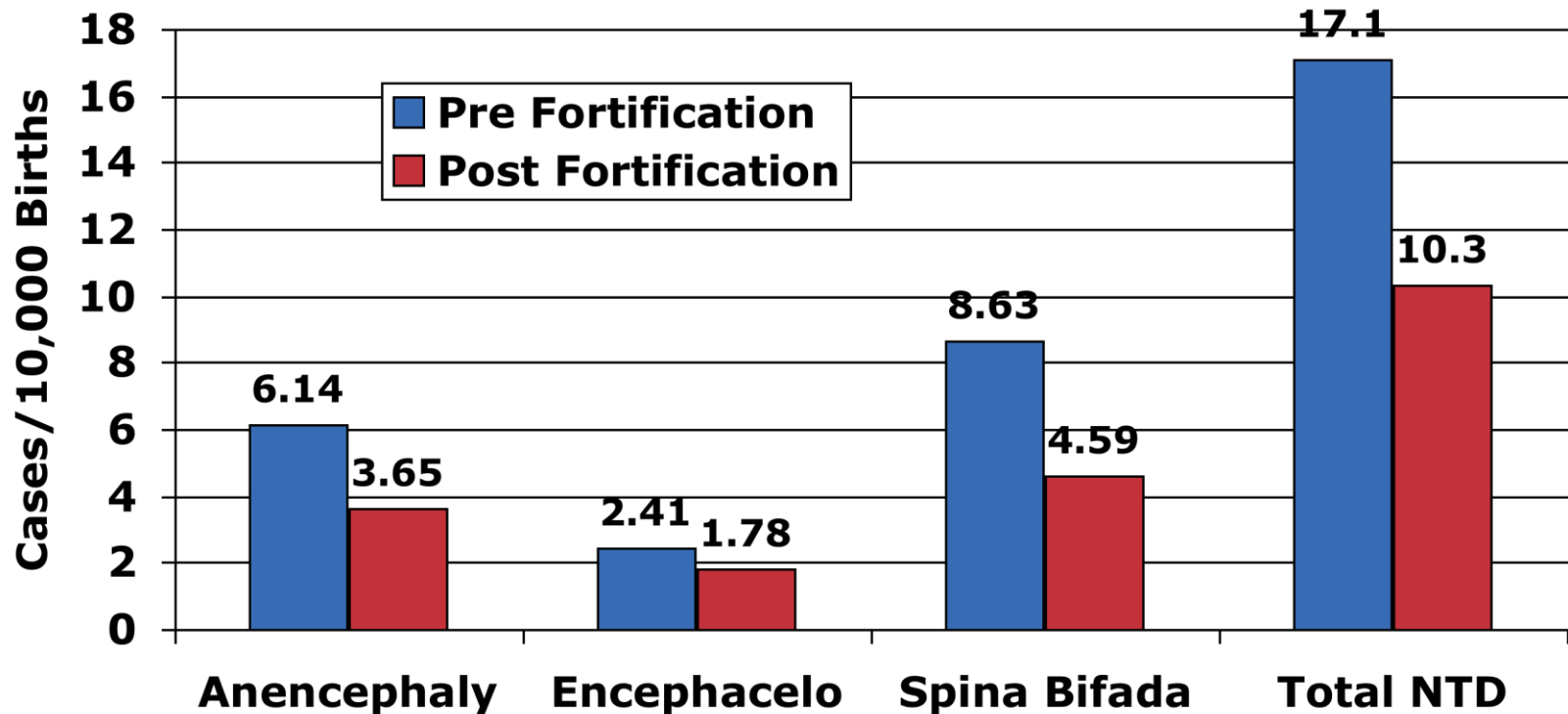


# Canada Folic Acid Fortification: 37-78% Decrease in NTDs and Cost savings of about \$1 million annually

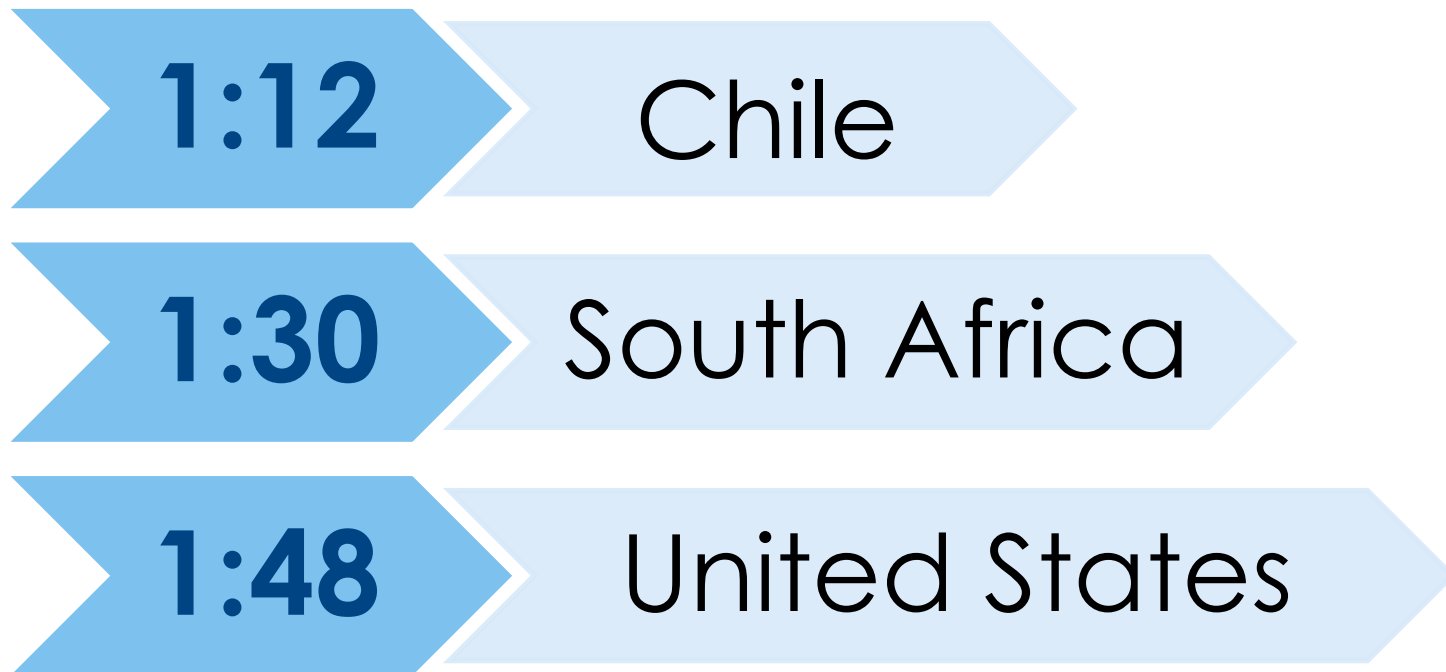


The number of specialized operations on children born with NTDs in Canada at Toronto Sick Children's Hospital has dropped from 52 per year before folic acid fortification to <5 per year

# Chile Folic Acid Fortification: 40% Decrease in NTDs



# Cost-Benefit Ratio for Preventing Spina Bifida



Llanos, A., et. al., Cost-effectiveness of a Folic Acid Fortification Program in Chile. *Health Policy* 83 2007:295-303.

Sayed, A., et.al., Decline in the Prevalence of Neural Tube Defects Following Folic Acid Fortification and Its Cost-Benefit in South Africa. *Birth Defects Research* 82 2008:211-216.

Grosse, Scott, et. al., Reevaluating the Benefits of Folic Acid Fortification in the United States: Economic Analysis, Regulation, and Public Health. *American Journal of Public Health* 95 2005:1917-1922.