Population Wide Consequences of Micronutrient Deficiencies
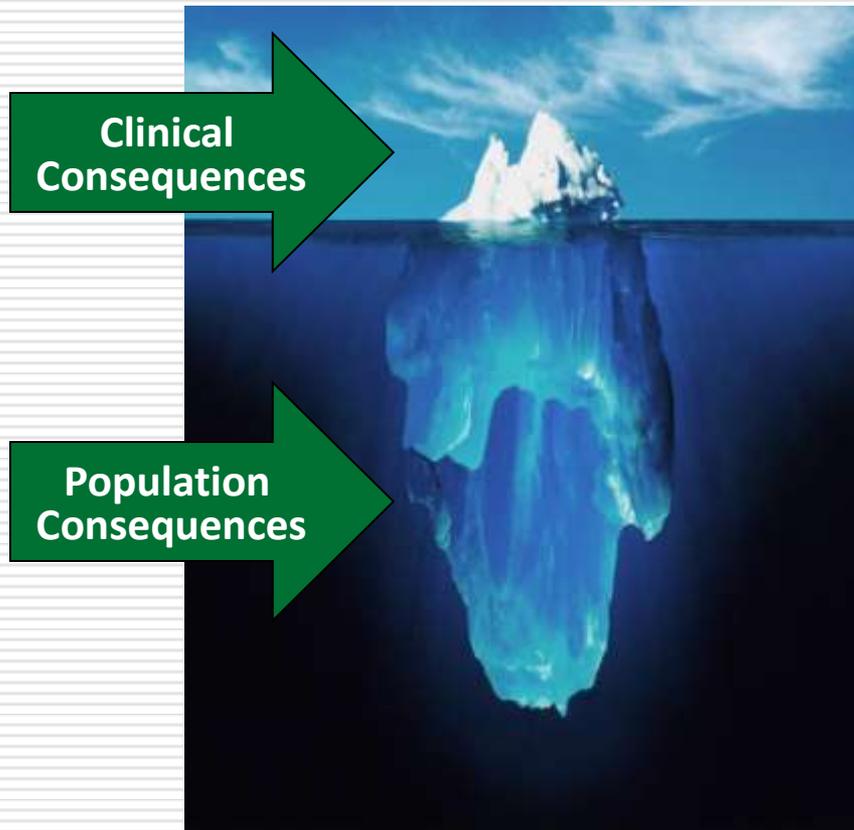

- ☐ Invisible Burden
  - ■ Biochemical Indicators
- ☐ Contributing Factor
  - ■ Mortality
  - ■ Morbidity
  - ■ Mental/Physical Development
  - ■ Adult Productivity
  - ■ Quality of Life
- ☐ Advocacy Challenge
  - ■ Make the Invisible Visible
    - ☐ Consequence Model
    - ☐ Cost of Doing Nothing

Economic Rationale for Investing in Nutrition

- ☐ Old News
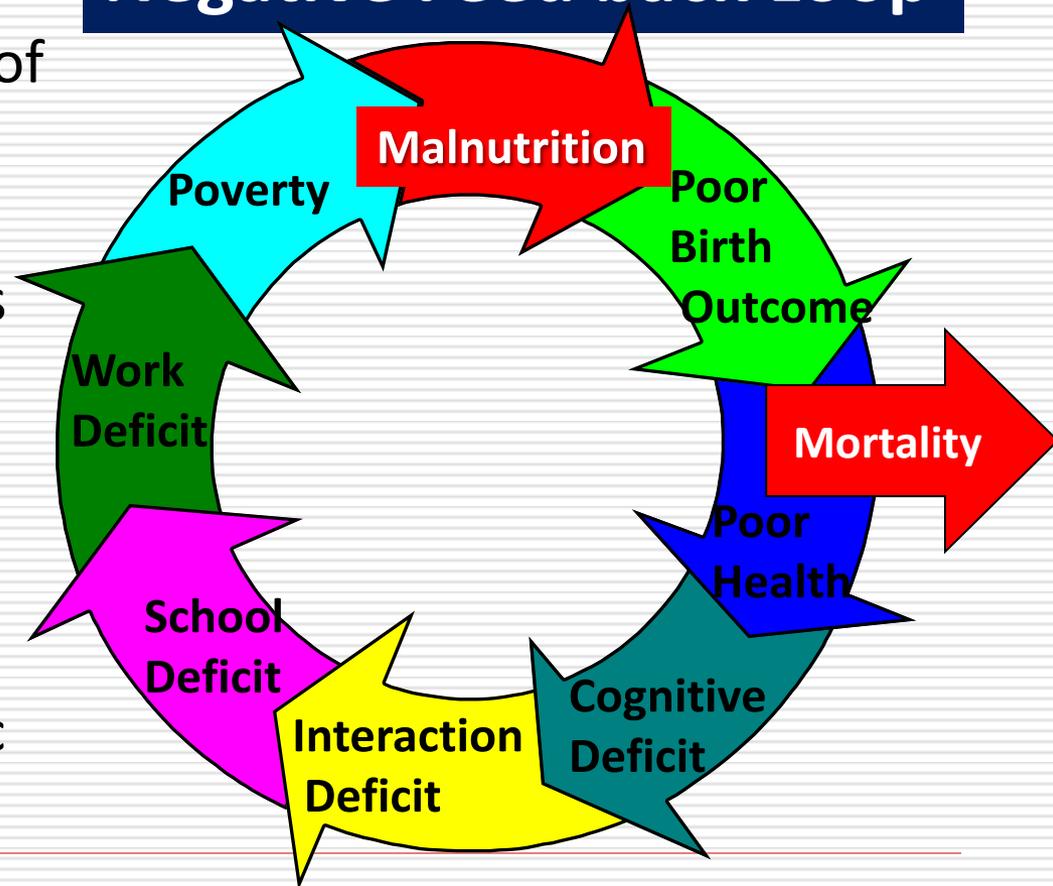 - ■ Poverty Root Cause of Malnutrition
- ☐ Recent Evidence
  - ■ Malnutrition causes poverty.
    - ☐ Human Capital
- ☐ Conclusion
  - ■ Lowering rates of malnutrition can accelerate economic growth.

Negative Feed back Loop

Malnutrition

Poor Birth Outcome

Mortality

Poor Health

Cognitive Deficit

Interaction Deficit

School Deficit

Work Deficit

Poverty

Copenhagen Consensus: Economic Approach to Prioritize Public Investment

☐ "When financial resources are limited, it is necessary to prioritize the effort. Every day, policymakers and business leaders prioritize by investing in one project instead of another.

☐ Instead of being based on facts and science many vital decisions are based on political motives or even the possibility of media coverage.

☐ The Copenhagen Consensus approach gives an overview of research and facts, which means that the prioritization is based on evidence."
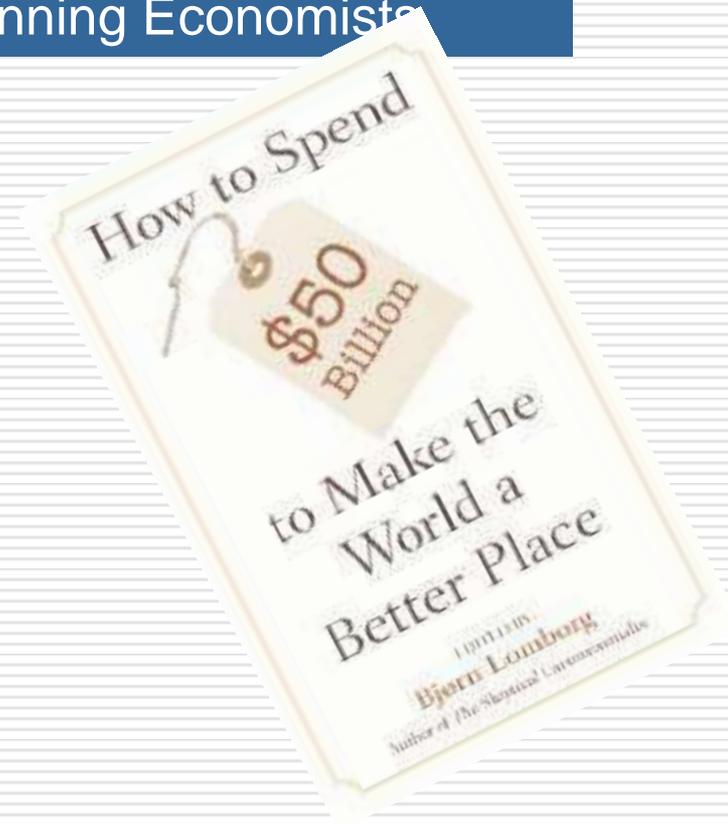

8 World Renown Economists

6 Nobel Prize Laureates

Jagdish Bhagwati, François Bourgignon, Finn Kydland*, Robert Mundell*, Douglass North*, Thomas Schelling*, Vernon L. Smith*, Nancy Stokey

Prioritizing Development Challenges by Economic Criteria

Copenhagen Consensus: 10 Global Development Challenges Considered by Panel of Nobel Prize Winning Economists

Diseases

Malnutrition and Hunger

Air Pollution

Sanitation and Water

Conflicts

Subsidies and Trade Barriers

Education

Terrorism

Global Warming

Women and Development

How to Spend $50 Billion to Make the World a Better Place

Edited by Bjørn Lomborg
Author of The Skeptical Environmentalist

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

The Copenhagen Consensus (2008): High Benefit Cost Ratio

	Solution	Challenge
1	**Micronutrient supplements for children**	Malnutrition
2	The Doha development agenda	Trade
3	**Micronutrient fortification**	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

Cost Benefit Analysis:
Tool to Rationally Prioritize

- ☐ Measures all benefits and costs of an intervention in monetary terms.
    - ■ Cost Effectiveness often used where it may be inappropriate to monetize health effect or benefit.
- ☐ Tool to Establish Priorities
    - ■ Valuation of program in monetary units allows decision-makers to directly compare interventions.
    - ■ Determine if it is a sound investment/decision.
        - ☐ Compared to other nutrition interventions
        - ☐ Compared to other national development investments

Using Global Science and Evidence to Develop National Policy and Programs

Think Global

Act Local

Using Global Science and Evidence to Develop National Policy and Programs

Think Global

Think Local

Act Local

Global Perspective Advantages of Flour Fortification

- ☐ Daily Dietary Dose Optimizes Impact
- ☐ Market-wide coverage (large population)
- ☐ Little build-out of Industry & Distribution Infrastructure
- ☐ No Behavior Change
  - ■ High Compliance
- ☐ Affordable & Sustainable Financing
  - ■ Small % of milling inputs
  - ■ Invisible % consumer purchase
- ☐ Frees Public Sector Resources to focus on highest risk
- ☐ Global Claim:
  - ■ "No other technology available today offers as large an opportunity to improve lives and accelerate development at such low cost and in such a short time." (World Bank)
  - ■ Principle is the same of flour, maize, oil, sugar

National Perspective Advantages Depend on Environment

- ☐ Public Health:
    - ■ Prevalence of Vitamin & Mineral Deficiency?
- ☐ Market & Distribution:
    - ■ How many people purchase and consume flour?
- ☐ Consumer Pattern:
    - ■ How much flour do they consume?
- ☐ Industry:
    - ■ What proportion can be fortified at reasonable cost?
- ☐ Government:
    - ■ What is public food control and quality assurance capacity?

Differs by Vehicle

Roadmap to National Benefit Cost Ratio

Baseline Losses (Status Quo)		Coverage		Effective		Benefits (Saved Losses)		Cost		Benefit Cost Ratio
$/yr	X	%	X	%	=	$/yr	/	$/yr	=	#
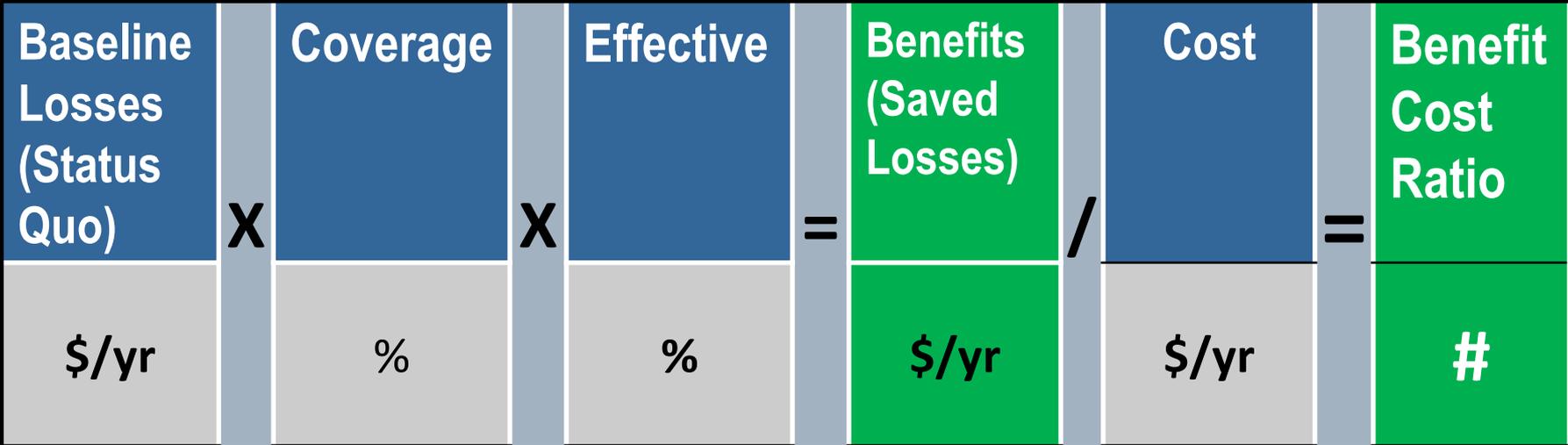
Roadmap to National Benefit Cost Ratio

Baseline Losses (Status Quo)	X	Coverage	X	Effective	=	Benefits (Saved Losses)	/	Cost	=	Benefit Cost Ratio
$/yr		%		%		$/yr		$/yr		#
National & Global		National		National				National & Global		

Xcel Benefit Cost Analysis Tool

	A	B	C	D	E
1		Cost	Benefit	Benefit Cost Ratio	
2		$000,000	$000,000		Assume Benefits take 12 months accrue
3	2014	$1.059	$0.000	-	Assume 6 Months fortification an no benefit in Year 1
4	2015	$0.874	$3.469	4.0	Benefits Begin after 6 months (50%
5	2016	$1.037	$7.155	6.9	
6	2017	$1.050	$7.838	7.5	
7	2018	$1.232	$8.083	6.6	
8	2019	$1.359	$8.825	6.5	
9	2020	$1.435	$9.100	6.3	
10	2021	$1.475	$9.696	6.6	
11	2022	$1.654	$9.998	6.0	
12	2023		$10.531		No Cost Applied as Benefits taken in 2024
13		$11.176	$74.694	6.7	
14					

D5 =C5/B5

Tabs: Econ | Demo & Heath | VAD | FE Neonatal | NTD | Maternal Mortality | SUM Mort | IDA kids | IDA Adults | Sum DAR | Cons Cov | Effect Est | SUM Mort Ben

Benefit Cost Analysis Tool
On Colored Coded Excel Work Sheets

- ☐ **Yellow Tab:** National Data

- ☐ **Red Tab:** Baseline Micronutrient Losses

- ☐ **Orange Tab:** Coverage and Effectiveness

- ☐ **Green Tab**: Costs

- ☐ **Blue Tab:** Summary Sheets

  - ■ Summary Micronutrient Losses

  - ■ Summary Potential Benefits

  - ■ Costs & Benefit Cost Ratio

14

Econ | Demo & Health | VAD | FE Neonatal | NTD | Maternal Mortality | SUM Mort | IDA kids | IDA Aduls | Sum DAR | Cons Cov | Effect. Est | SUM Mort. Ben

Ready   140%

Day 1: Assessing Human & Economic Impact of Micronutrient Deficiency

- ☐ Defining Baseline Losses
  - ■ The Status Quo or the Cost of Doing Nothing
- ☐ Pathways to Loss
  - ■ Lost Workforce: Mortality & Disability
    - ☐ IDA and FAD in Pregnancy
    - ☐ VAD in Childhood
  - ■ Lost Future Productivity: Cognitive Loss in Children
    - ☐ IDA in Childhood
  - ■ Lost Current Productivity: Adult Work Performance
    - ☐ IDA as Adults
  - ■ Excess Health Care Expenditures
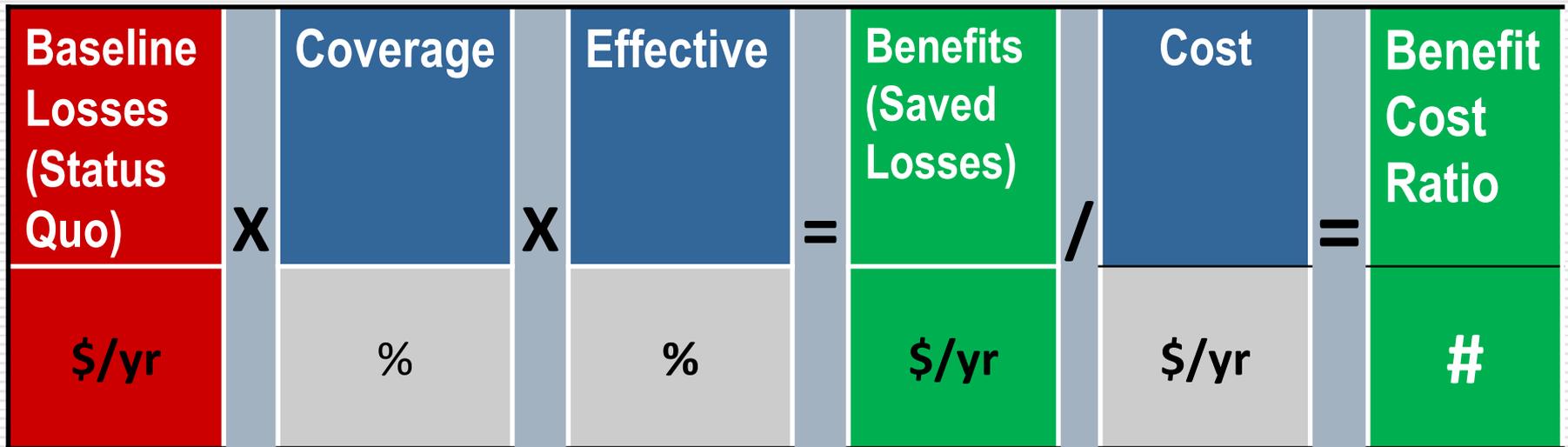
4 Pathways of "Damage" to Measure Baseline Economic Loss

Mortality → NPV Lost Workforce

Cognition & Growth → NPV Future Productivity

Higher Morbidity → Excess Health Care Costs

Adult Work Deficits → Lower Current Productivity

LOSS TO GDP
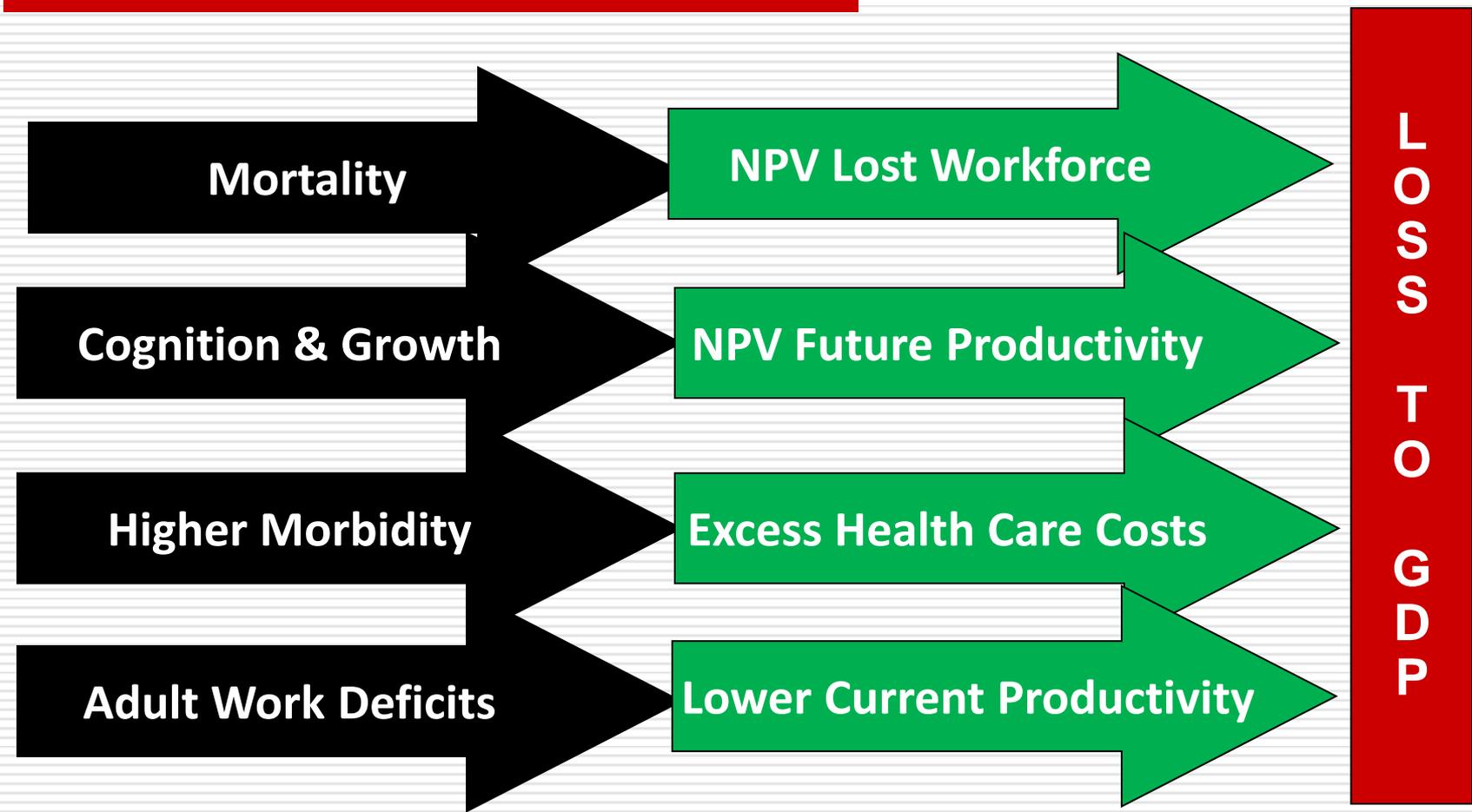
Status Quo Damage Assessment Report: Cost of Doing Nothing

	Lost Workforce 000,000/yr	Lost Future Productivity 000,000/yr	Lost Current 000,000/yr	Current Healthcare 000,000/yr	Total 000,000/yr	%
Summary Economic Consequences for All Indicators						
Maternal Mortality	$5.3				5.29	7%
Neo Natal Mortality	$8.2				8.18	11%
Birth Defect NTD	$5.2	$0.6		$0.11	5.97	8%
Childhood IDA		$22.0			22.02	29%
Vitamin A Def	$19.6				19.62	26%
IDA in Adults			$15.8		15.80	21%
Total	**$38.3**	**$22.7**	**$15.8**		**76.87**	**100%**
	50%	*29%*	*21%*		% of GDP	0.53%

Cell G11: =F10/(Econ!B16/1000000)

BCR FLOUR MODEL.xls [Compatibility Mode] - Microsoft Excel non-commercial use

Step 1: Roadmap to National Benefit Cost Ratio

Baseline Losses (Status Quo)		Coverage		Effective		Benefits (Saved Losses)		Cost		Benefit Cost Ratio
$/yr	X	%	X	%	=	$/yr	/	$/yr	=	#

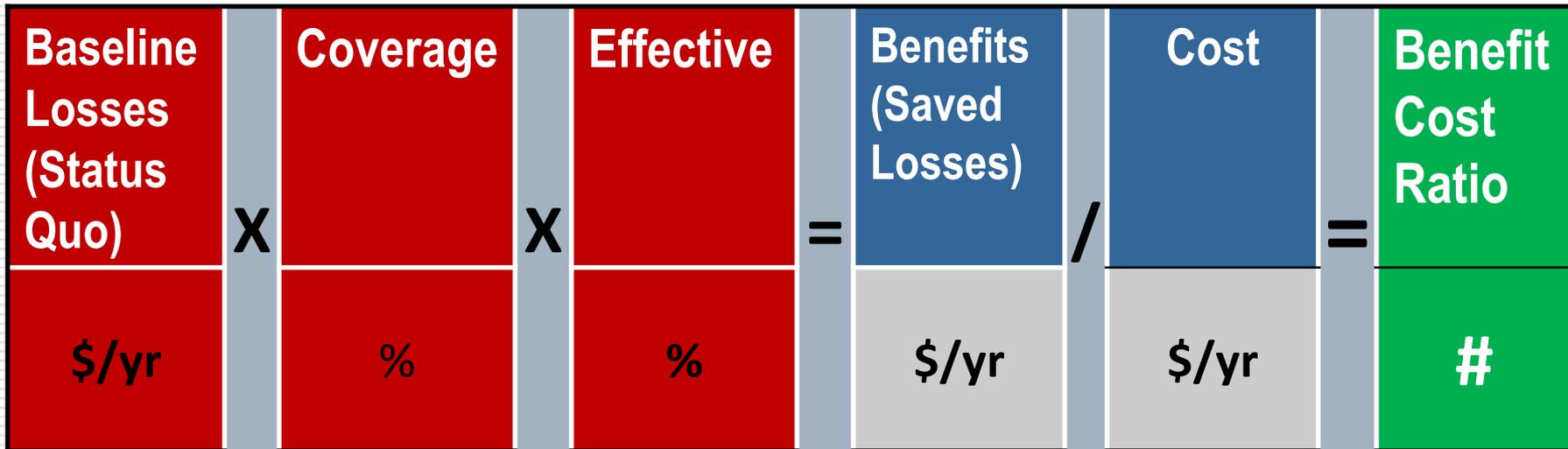# Day 2: Assessing Coverage and Consumption of Wheat Flour

- ☐ Coverage:
  - ■ How Flour Consumers.
  - ■ Market Reach: Number of Beneficiaries
  - ■ Industrial Reach: What % of Milling/Market is Fortified
- ☐ Consumption:
  - ■ National & Individual Flour Consumption
  - ■ Implications for:
    - ☐ Fortification Level & Standards
    - ☐ Cost of Fortification (90->95% Program)
    - ☐ Dose: Effectiveness

Day 3: Using Evidence & Courage to Establish Potential Benefits

☐ Set Objectives or Assumptions for Effectiveness

- ■ Consider Evidence of FF Effectiveness

- ■ Define Fortification Levels

- ■ Consider Nutrition Protection Delivered by Flour Fortification as % WHO RNI and EAR

☐ Prepare Presentation:

- ■ Potential Benefits of Flour Fortification

M29 | =M28/J28

	A	B	C	D	E	F	G	H	I	J	K	L	M
16		NTD				IDA Kids				IDA Adults			
17		Base Loss	Coverage	Effective	Total	Base Loss	Coverage	Effective	Total	Base Loss	Coverage	Effective	Total
18	2014	$5.97	40%	50%	$1.19	$22.02	40%	30%	$2.64	$15.80	40%	20%	$1.26
19	2015	$6.09	40%	50%	$1.23	$22.46	40%	30%	$2.72	$16.19	40%	20%	$1.31
20	2016	$6.21	43%	50%	$1.35	$22.91	43%	30%	$2.98	$16.60	43%	20%	$1.44
21	2017	$6.33	44%	50%	$1.39	$23.36	44%	30%	$3.07	$17.02	44%	20%	$1.49
22	2018	$6.46	47%	50%	$1.51	$23.83	47%	30%	$3.35	$17.44	47%	20%	$1.63
23	2019	$6.59	47%	50%	$1.56	$24.31	47%	30%	$3.45	$17.88	47%	20%	$1.69
24	2020	$6.72	49%	50%	$1.66	$24.79	49%	30%	$3.67	$18.33	49%	20%	$1.81
25	2021	$6.86	50%	50%	$1.71	$25.29	50%	30%	$3.78	$18.79	50%	20%	$1.87
26	2022	$6.99	51%	50%	$1.80	$25.80	51%	30%	$3.98	$19.26	51%	20%	$1.98
27	2023	$7.13	52%	50%	$1.85	$26.31	52%	30%	$4.10	$19.75	52%	20%	$2.05
28		$65.35			$15.24	$241.08			$33.74	$177.06			$16.54
29				Reduced	23%			Reduced	14%			Reduced	9%
30		Baseline Loss	Total Benefit	Improve									
31	2014	$76.9	$6.9	9.0%									
32	2015	$78.5	$7.2	9.1%									
33	2016	$80.1	$7.8	9.8%									
34	2017	$81.8	$8.1	9.9%									
35	2018	$83.6	$8.8	10.6%									
36	2019	$85.3	$9.1	10.7%									
37	2020	$87.1	$9.7	11.1%									
38	2021	$88.0	$10.0	11.2%									

Sheet tabs: VAD / FE Neonatal / NTD / Maternal Mortality / SUM Mort / IDA kids / IDA Adults / SUM DAR / Cons Cov / Effect Est / SUM Mort Ben / **SUM Fin Ben** / Pren

Ready   Average: 15329%   Count: 157   Sum: 2130743%   110%

National Roadmap to Defining Cost Benefit Ratio

Baseline Losses (Status Quo)		Coverage		Effective		Benefits (Saved Losses)		Cost		Benefit Cost Ratio
$/yr	X	%	X	%	=	$/yr	/	$/yr	=	#

Day 4: Estimating Costs

- ☐ Morning Presentation:
  - ■ Potential Benefits of Flour Fortification
- ☐ Project 10-Year Costs:
  - ■ Fortificant Premix Mix
  - ■ Mill Start-Up & Operation
  - ■ Government Start-Up, Food Control and Monitoring

	A	B	E	G	H	I
1		Fortification Level	Compound in MT Flour	Compound Cost/Kg	Cost per Component	Share N
2		mg/kg	mg/kg	$/kg	$	%
6	Folic Acid	2.6	2.9	$40.00	$0.26	3%
8	Iron	40	320.0	$4.00	$2.84	32%
11	Vitamin A	3	40.0	$50.00	$4.44	50%
12	Nutrients Subtotal		362.9			
13	Excipient		87.1	$1.00	$0.19	2%
14			450			
15				Nutrient Cost/KG	$7.74	87%
16				Up Charge/kg	$1.00	11%
17		Iron Compound	Cost/Kg	Transport/Distribution	$0.20	2%
18		Fumarate	$2.80	Cost/kg	$8.94	
19		Sulfate	$3.20	Cost/MT	$4.02	
20		NaFeEDTA	$4.00	Duty		
21				VAT		
22				Total Cost per Kg	$8.94	
23				Total Cost MT	$4.02	
24				Total Premix Cost Year 1	$755,464	

Maternal Mortality | SUM Mort | IDA kids | IDA Adults | SUM DAR | Cons Cov | Effect Est | SUM Mort Ben | SUM Fin Ben | Premix Cost | Mill Budget | Govt

	A	B	C	D	E
1		**Premix Cost**	**Industry**	**Govt**	**Total**
2					$000,000
3	2014	$288,291	$219,979	$457,200	$0.97
4	2015	$614,875	$51,873	$7,200	$0.67
5	2016	$696,691	$55,964	$57,200	$0.81
6	2017	$742,959	$58,277	$7,200	$0.81
7	2018	$838,906	$63,075	$57,200	$0.96
8	2019	$894,619	$65,860	$107,200	$1.07
9	2020	$985,834	$70,421	$57,200	$1.11
10	2021	$1,051,304	$73,695	$7,200	$1.13
11	2022	$1,145,233	$78,391	$57,200	$1.28
12	2023	$1,221,290	$82,194	$7,200	$1.31
13		$8,480,004	$819,729	$822,000	$10.1

Sheet tabs: NTD | Mat Mort | SUM Mort | IDA kids | IDA Adults | SUM DAR | Cons Cov | Effect Est | SUM Mort Ben | SUM Fin Ben | Premix | Mill | Govt | SUM Cost | B

National Roadmap to Defining Cost Benefit Ratio

Baseline Losses (Status Quo)		Coverage		Effective		Benefits (Saved Losses)		Cost		Benefit Cost Ratio
$/yr	X	%	X	%	=	$/yr	/	$/yr	=	#

D5   =C5/B5

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14					
15					
16					
17					

Sheets: IDA kids / IDA Adults / SUM DAR / Cons Cov / Effect Est / SUM Mort Ben / SUM Fin Ben / Premix Cost / Mill Budget / Govt Budget / Sum Cost / **BCR** / Sheet

Ready   140%

The Roadmap to Defining Cost Benefit Ratio for Flour Fortification

Public Health Analysis		Market Analysis		Public Health Analysis		Financial Analysis		
Baseline Losses	X	**Coverage**	X	**Effective**	=	**Benefits (Saved Losses)**	/	**Cost**	=	**Benefit Cost Ratio**
Day 1		Day 2		Day 3		Day 4 Present		Day 4		Day 5 Present
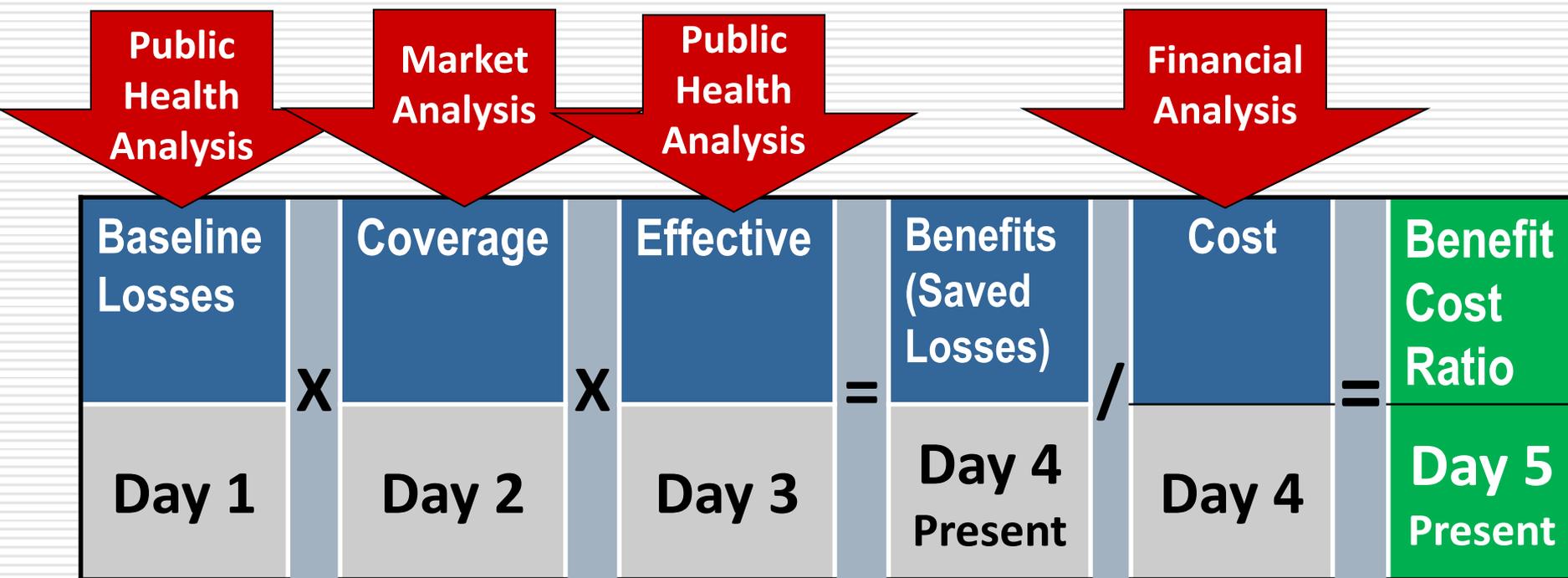
Multiple Rationales for Public Investment in Flour Fortification

- ☐ Moral
  - ■ Humanitarian Imperative
- ☐ Good Governance
  - ■ Obligation to Citizen Rights to Nutrition
- ☐ Economic Growth Development
  - ■ National Development Investment

Willie Sutton: Infamous Bank Robber in 1930's USA Depression Era.
Question: *Why do you rob banks?*
Answer: *"That's where the money is."*