



The Role of Economics in the Promotion of Food Safety

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Disclosures

(interests over prior 12 months)

- Employer: The Ohio State University
- Grants/Research Support
 - USDA NIFA
 - USDA HATCH
 - Bill and Melinda Gates Foundation
- Advisory Board
 - Global Food Safety Initiative
- Food Industry Stocks
 - Wendy's, El Pollo Loco (total value < \$3,000)

An Economist's View of Food Safety

Goal: **Maximize Social Welfare** from Food Safety Measures

- Social Welfare: The well-being of everyone in a society (\sum utility).
 - Based on residents' values for health, goods & services, and other outcomes.
- Loss of Social Welfare: What people are **willing to pay** to avoid risk from foodborne illness.
- Tradeoffs: There is a tradeoff between health and other things that improve well-being \Rightarrow We must make choices!

Key Tasks for Economists:

- 1. Estimate Economic Burden of Illness
 - Attribution to foods and pathogens
 - Prioritization of Hazards
 - Input into Intervention Evaluation
- 2. Understand Incentives
 - Guide the design and evaluation of interventions
- 3. Evaluate Interventions
 - Determine whether social welfare is improved by an intervention

1. Estimating Burden of Illness

Burden of Illness: The impact of a health problem for a given population over a specified period of time.

Basic Burden Measures:

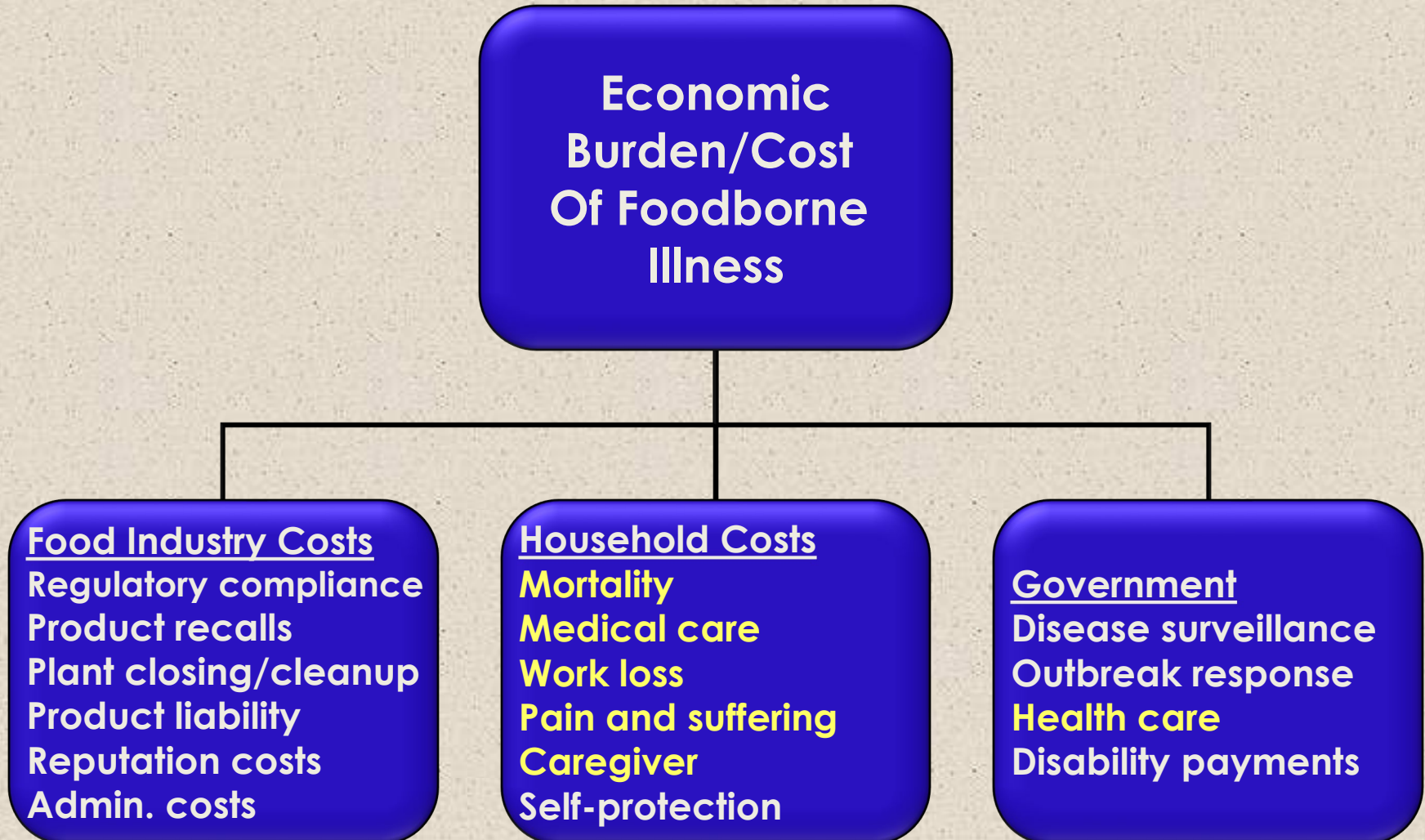
- The **incidence** or **prevalence** of illness in the population.
- Good as an input for economic burden measures when the goal is to evaluate interventions that reduce future illness or reduce the effects of chronic disease (prevalence).

Economic Burden of Illness:

- Combines illness estimates with economic cost estimates.
- A means of demonstrating loss of social welfare
- Can be used to help prioritize public health efforts
- Can be used to evaluate the effectiveness of proposed interventions

Focus on Health-Related Economic Burden of Foodborne illness

Adapted from USDA-ERS



Financial Cost vs. Economic Burden

Financial Costs

- Medical costs
- Productivity losses
- Caregiver costs
- Other tangible costs to society (e.g. industry and government)

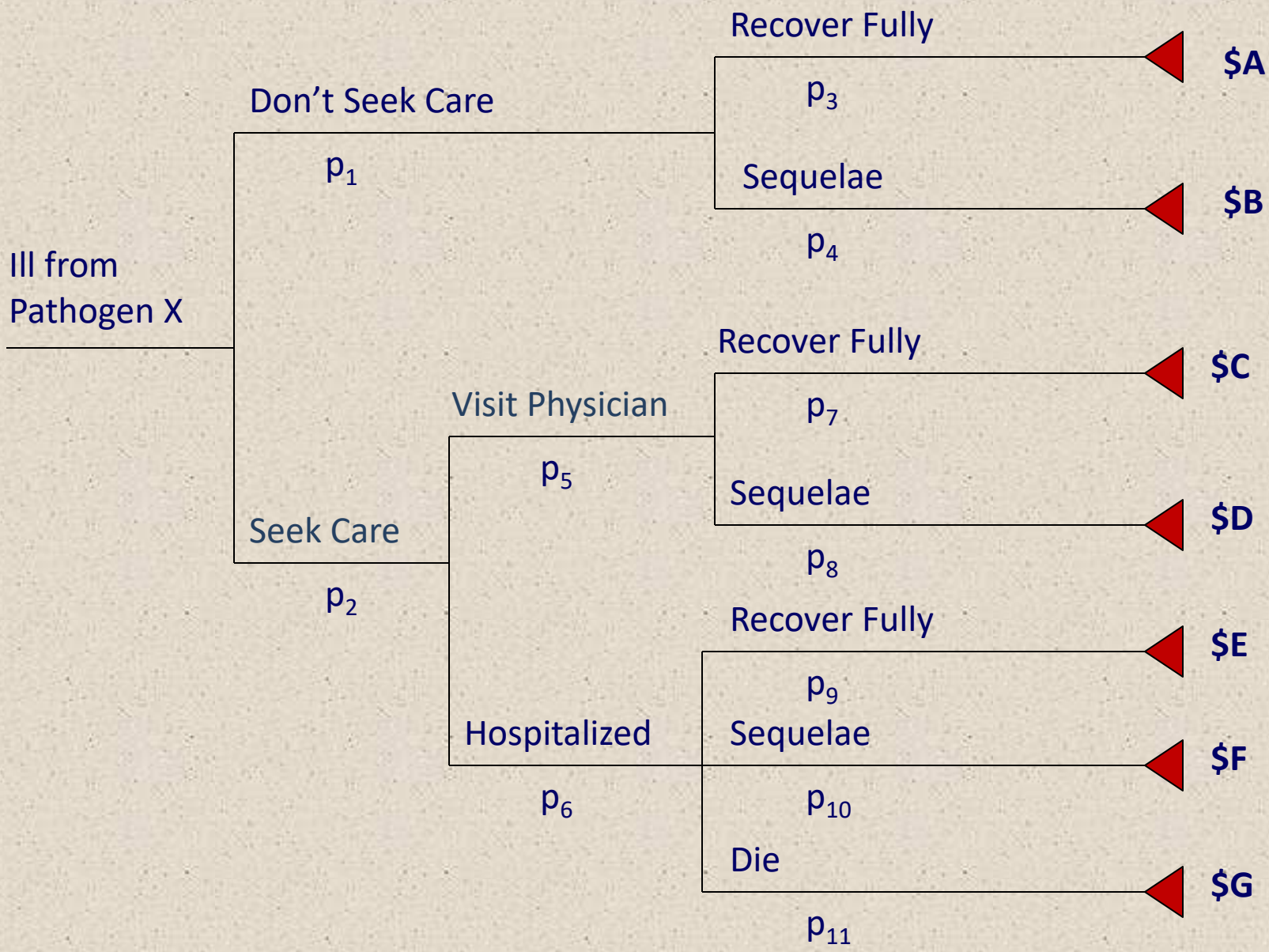
Economic Burden

- Financial costs +
- **Pain and suffering**
- **Lost life expectancy**

Ideal to use economic costs.

Why? A better measure of social welfare losses.

Disease Outcome Tree – Cost Per Case



Illness Model

Reported illnesses



Adjustment Factors

Under-reporting

Under-diagnosis



Disposition of Cases

Doctor

Hospital

Death



Number of Illnesses by
Pathogen and Outcome

Economic Cost Model

Economic Costs

Medical
Care

Productivity
Losses

Death

Pain and
Suffering



Cost Per Case by Pathogen
and Outcome

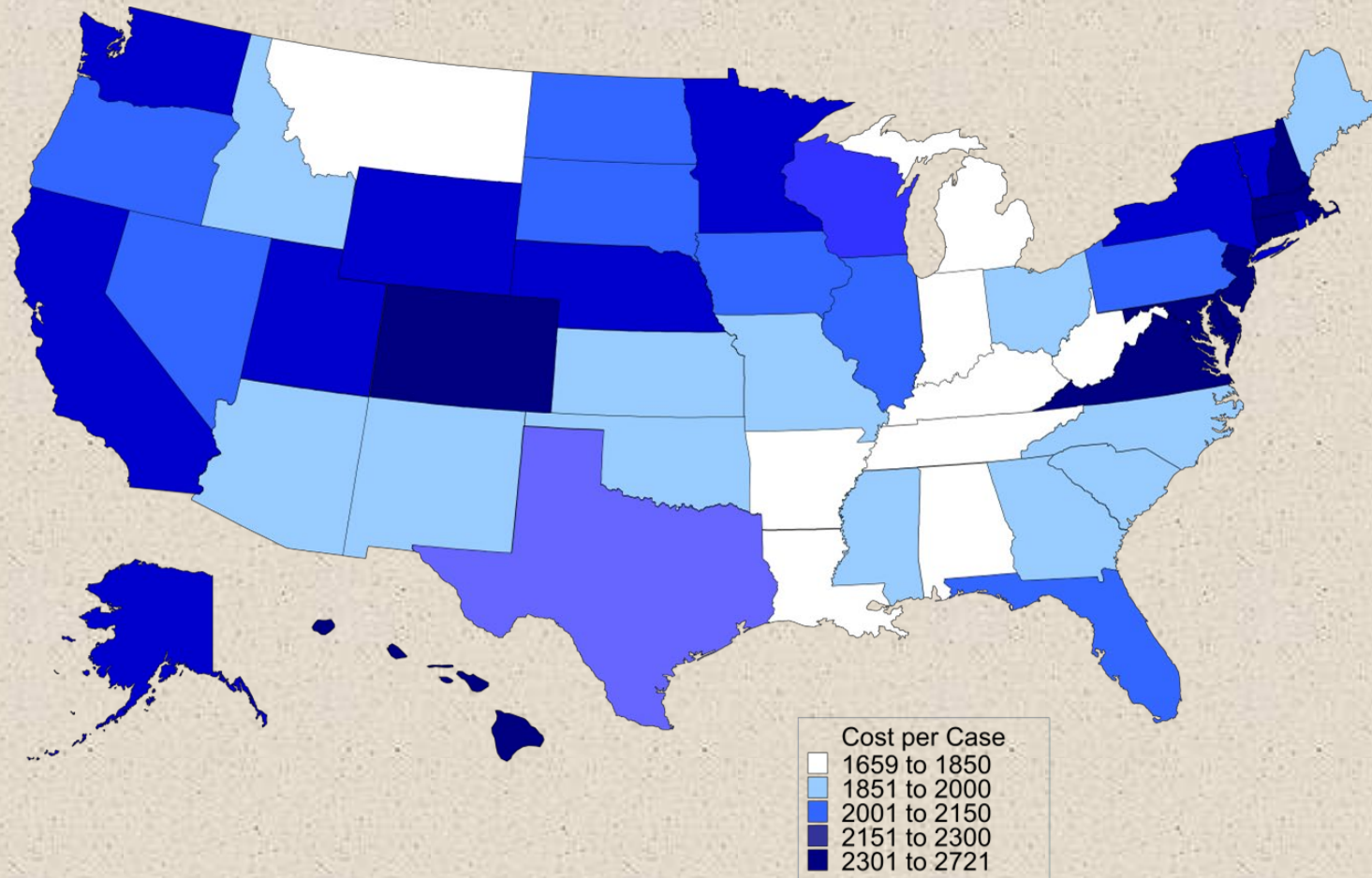


**Economic Cost of
Illnesses**

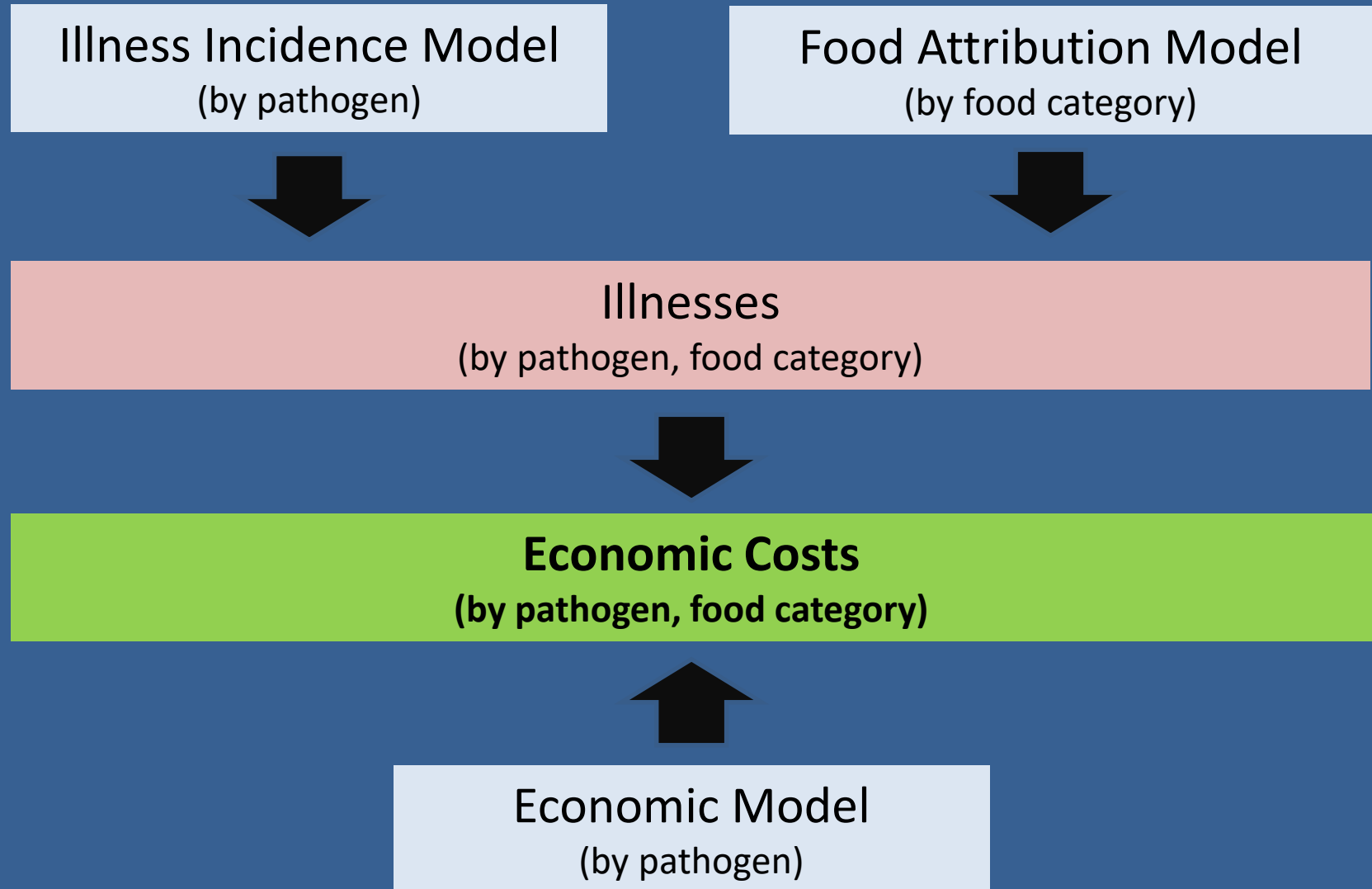


Cost Per Case Variation – State Differences

Important Factors: Health care costs, wages/employment, food consumption



The Economic Burden Model + Food Attribution



Health-Related Economic Costs Attributed to Leafy Greens

Economic Cost of Leafy Green Illnesses (\$million) per year^a

	Economic Cost	90% CI ^b	% in all leafy	Economic Cost	90% CI	% in all leafy
	M1 ^d			M2		
Lettuce family	2,925.07	(844.21-6,553.32)	70.0	3,207.24	(2,060.50-4,855.65)	60.8
Lettuce, other ^c	1931.71	(575.07-4300.72)	46.2	2664.07	(1717.83-4024.09)	50.5
Romaine ^c	728.52	(239.20-1529.26)	17.5	377.53	(220.81-602.87)	7.2
Iceberg ^c	264.84	(29.95-723.34)	6.3	165.64	(121.83-228.64)	3.1
Cabbage	310.63	(5.23-980.59)	7.4	401.44	(96.48-839.97)	7.6
Spinach	181.58	(27.88-442.54)	4.3	126.31	(79.12-194.17)	2.4
Kale	30.55	(1.49-89.85)	0.7	11.77	(10.13-14.14)	0.2
Parsley	144.36	(0.08-456.42)	3.5	327.09	(322.15-334.21)	6.2
Arugula	26.01	(1.23-78.49)	0.6	10.92	(6.32-17.55)	0.2
Other Leafy	558.86	(492.06-688.19)	13.4	648.56	(614.50-697.55)	12.3
Mixed Leafy	0	/	0.0	544.60	(41.34-1268.32)	10.3
All Leafy	4177.99	(2324.85-7688.04)	100	5277.95	(3230.48-8221.11)	100

^a The major cost components change in CPI was updated to the March 2023 level and cost estimates from Scharff (2012)

^b 90% CI is the 90% confidence interval.

^c The estimates of three lettuce subcategories sum up to the estimate of lettuce family.

^d These models are represented as follows: Interagency Food Safety Analytics Collaboration, 2021 (M1), and Triangular distribution-based attribution model adapted from Painter et al., 2013 (M2).

Prioritization of Food Safety Hazards

Illness-Based Burden of Illness:

- Illness-based measures have difficulty with severity
- Disability Adjusted Life Year (DALY) estimates are better, but
 - Are not consistent with social welfare
 - Do not include financial costs of foodborne disease.

Using Economic Burden of Illness:

- Weights illnesses by severity
- Reflects value of safety to consumers (social welfare)

Limits to the Use of Any Burden of Illness Measure:

- National priorities may not equal regional priorities
- Emerging pathogens may not be accurately reflected
- Feasibility of mitigation is not considered

Ranking Burden of Disease for Leafy Greens (selected pathogens)

Models	# of illnesses (Ranking)		Economic Cost (million \$) (Ranking)	
	M1	M2	M1	M2
<i>Pathogen</i> ^a				
<i>Bacillus cereus</i> ^c	249 (7)	1,993 (7)	0.11 (10)	0.86 (11)
<i>Campylobacter</i> spp.	37,425 (3)	56,259 (2)	550.64 (2)	827.75 (1)
STEC O157:H7	20,561 (5)	15,244 (6)	534.15 (3)	396.02 (4)
STEC Non-O157	52,931 (2)	24,449 (3)	175.13 (6)	80.89 (7)
<i>Listeria</i> <i>monocytogenes</i>	82 (9)	36 (10)	188.91 (5)	84.41 (6)
<i>Salmonella</i> , nontyphoidal	25,356 (4)	21,926 (4)	468.96 (4)	405.52 (3)
<i>Shigella</i> , spp. ^b	91 (8)	18,434 (5)	1.44 (8)	291.83 (5)
<i>Staphylococcus aureus</i>	0 (11)	1,577 (8)	0.00 (11)	1.75 (10)
<i>Vibrio</i> <i>parahaemolyticus</i>	0 (11)	0 (12)	0.00 (11)	0.00 (12)
<i>Cyclospora</i> <i>cayetanensis</i>	1,049 (6)	1,012 (9)	6.20 (7)	5.98 (8)
Hepatitis A ^b	14 (10)	26 (11)	0.92 (9)	1.78 (9)
Norovirus	710,121 (1)	585,688 (1)	799.42 (1)	659.34 (2)
<i>Giardia</i> spp. ^d	18,339	16,690	171.36	155.95

2. Understanding Incentives

Understanding **incentives** is critical for the design, implementation and evaluation of food safety measures

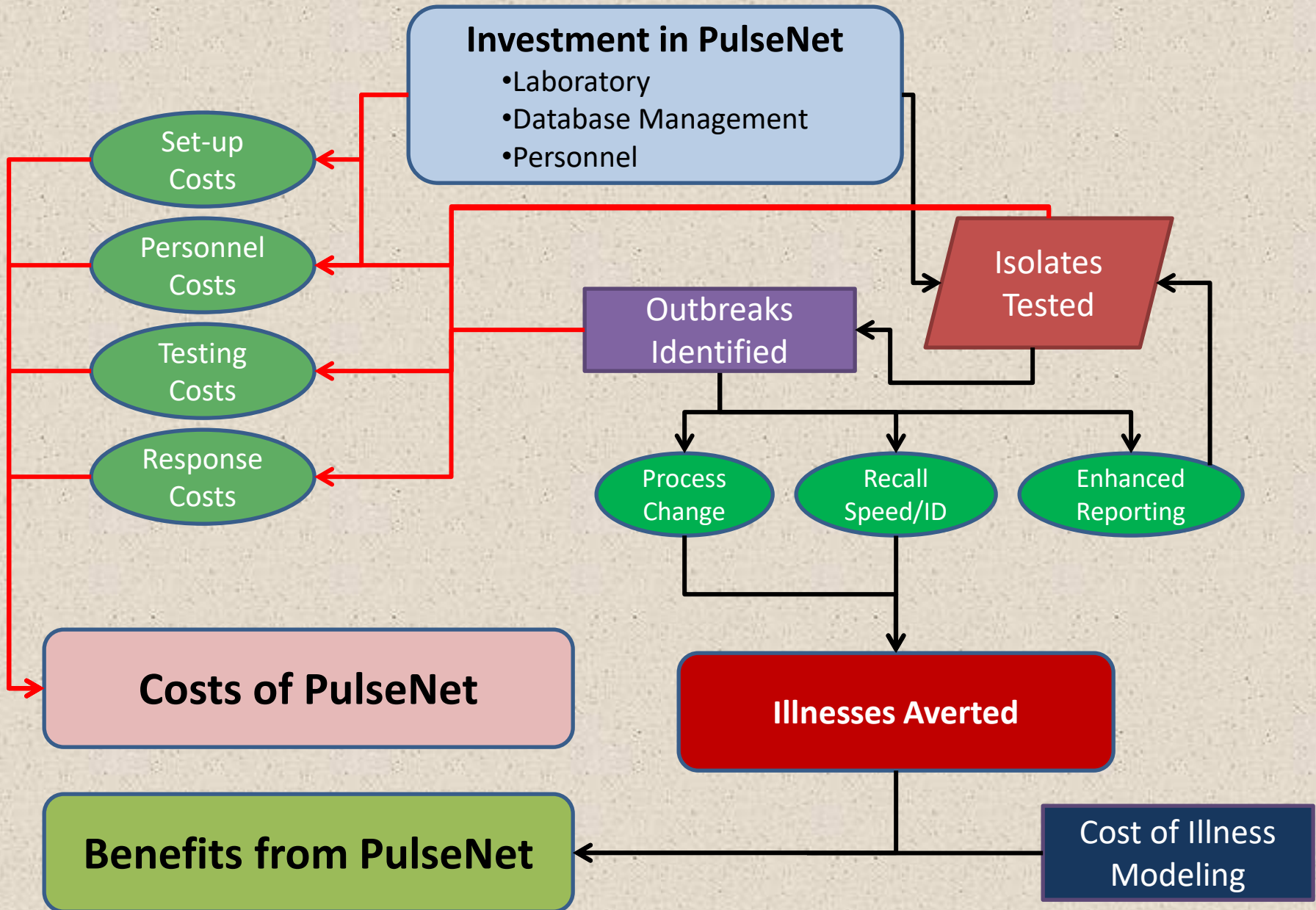
- **Design:** How will targeted stakeholders react to new regulations? Unintended consequences?
- **Implementation:** Has enough been allocated to enforcement to ensure compliance?
- **Evaluation:** What is driving behavior change?

3. Evaluate Interventions

Role of Economics in Policy Evaluation

- Evaluate Need for an Intervention
 - Does the market respond to consumer demands for health?
 - Key: Is there a **market failure**? (generally, “yes” for food safety)
- Develop and Test Potential Interventions (if needed)
 - Determine what works in theory
 - Test effectiveness in real-world conditions
 - Keep Incentives in mind
- Evaluate Costs and Benefits of Tested Interventions
 - Economic Evaluation of interventions (CBA or CEA)
 - Ideally: evaluate best combinations of multiple interventions

Benefit-Cost Analysis of the PulseNet System



Summary – Economics Can...

- Provide burden estimates that:
 - Reflect loss of social welfare
 - Aid in prioritization of hazards
- Reveal how incentives shape behavior
- Help in the design, implementation, and evaluation of interventions

Thank you!

Questions?

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