Pertussis in Adolescents and Adults: Should We Vaccinate?

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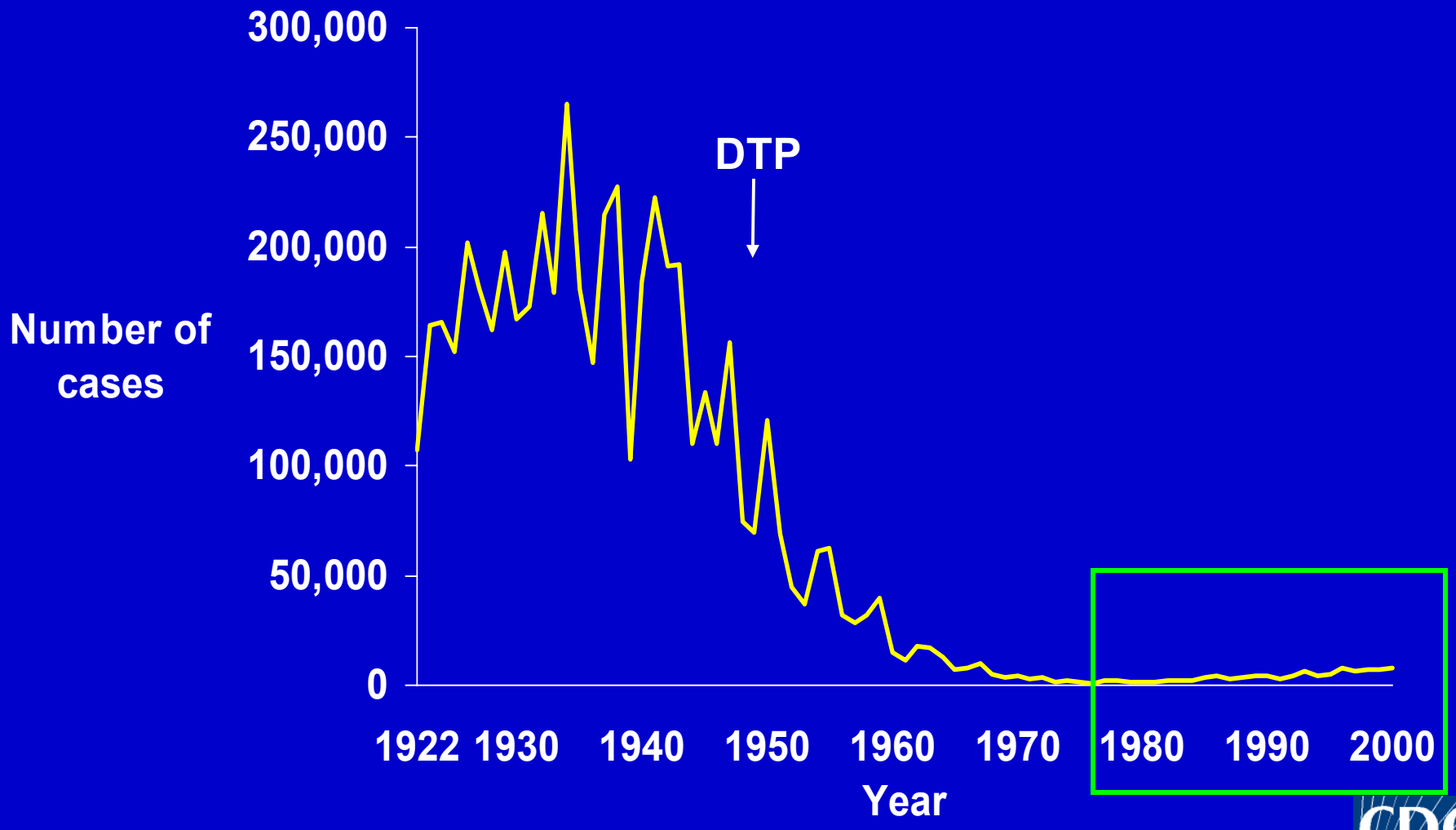
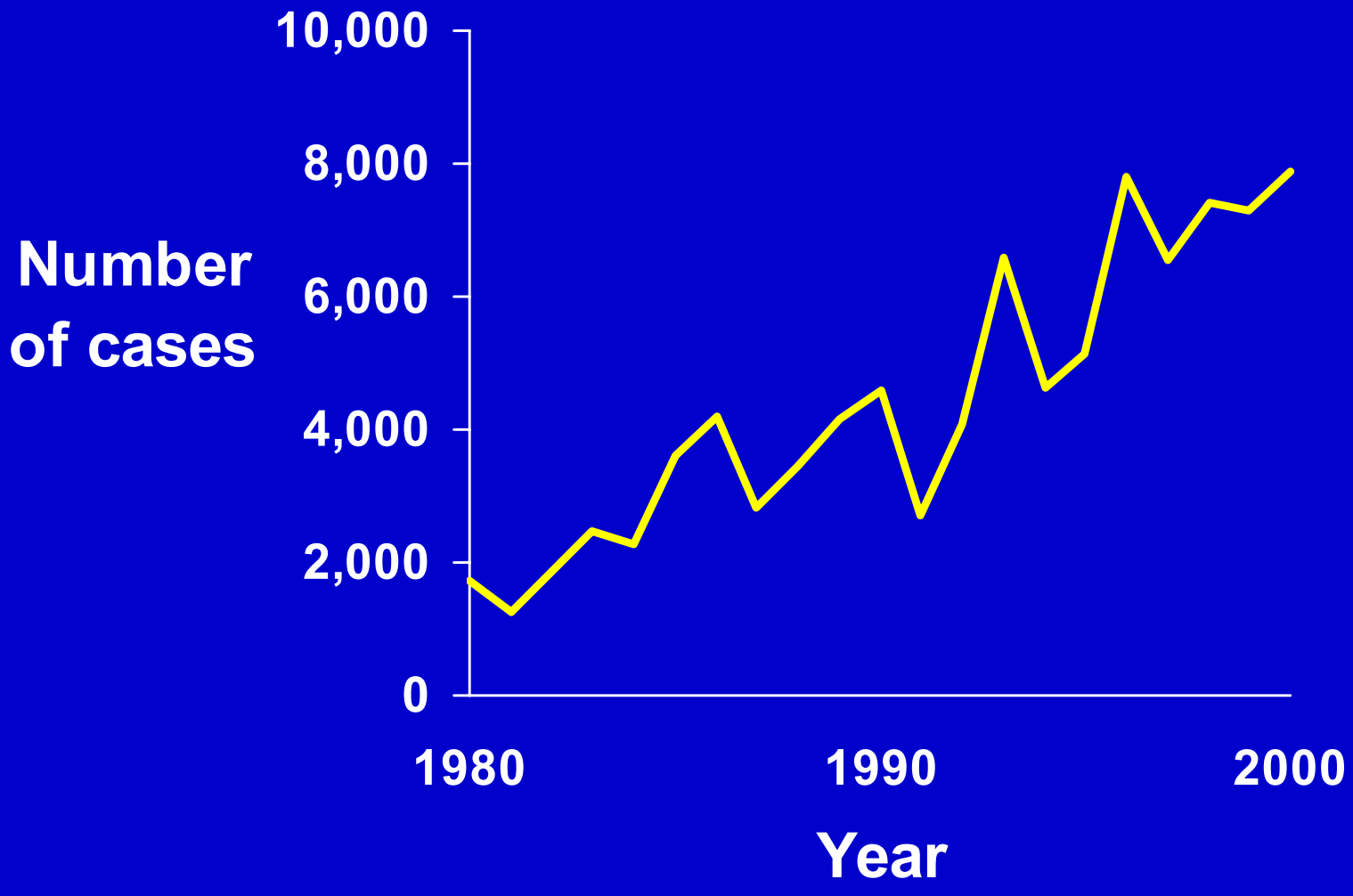
Messages

- Pertussis in adolescents and adults is increasing and costly
- Vaccination could be beneficial and cost-effective
- Need better data on incidence

Reported Pertussis Cases
U.S, 1922-2000



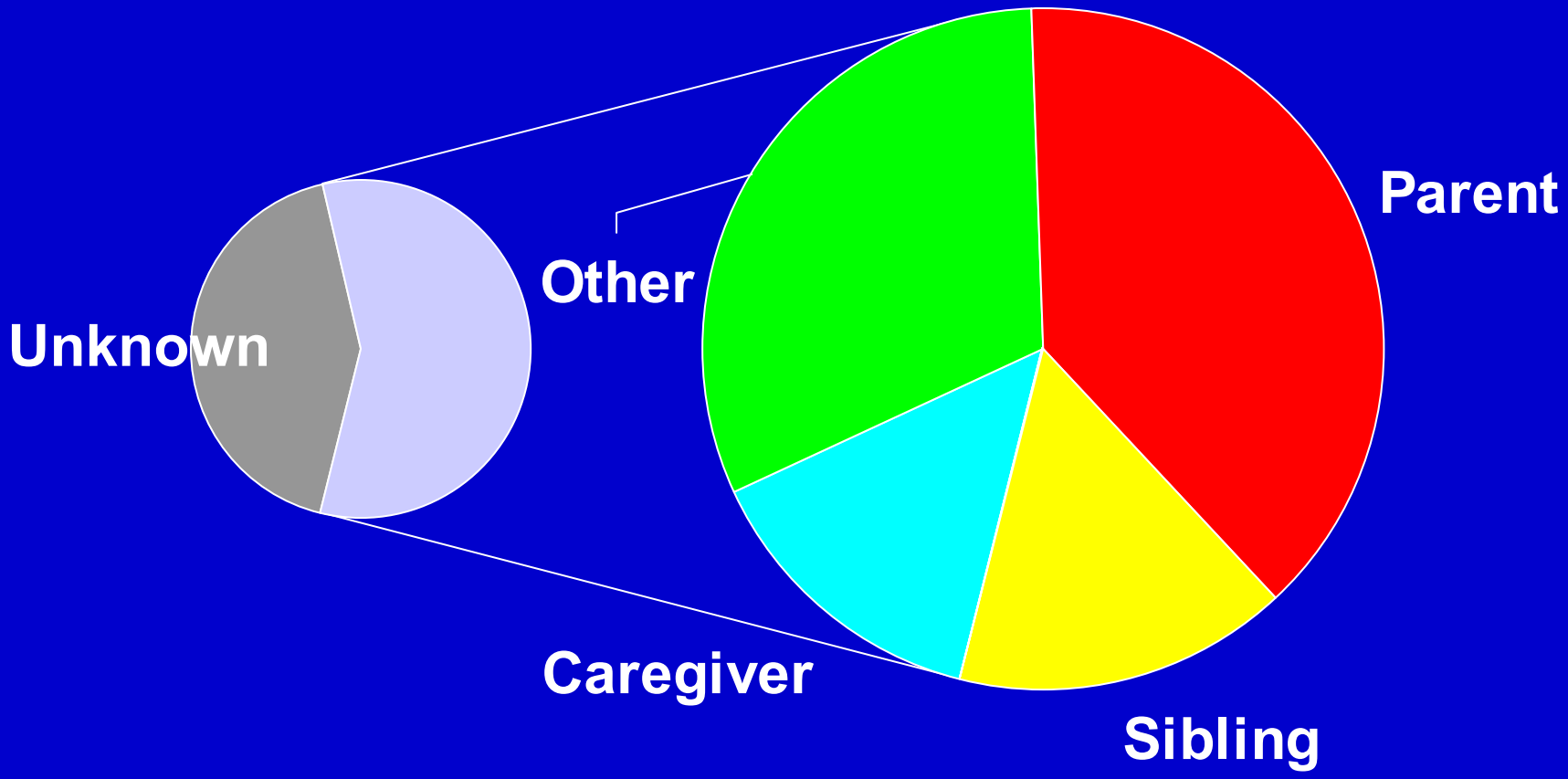
Reported Pertussis Cases
U.S., 1980-2000



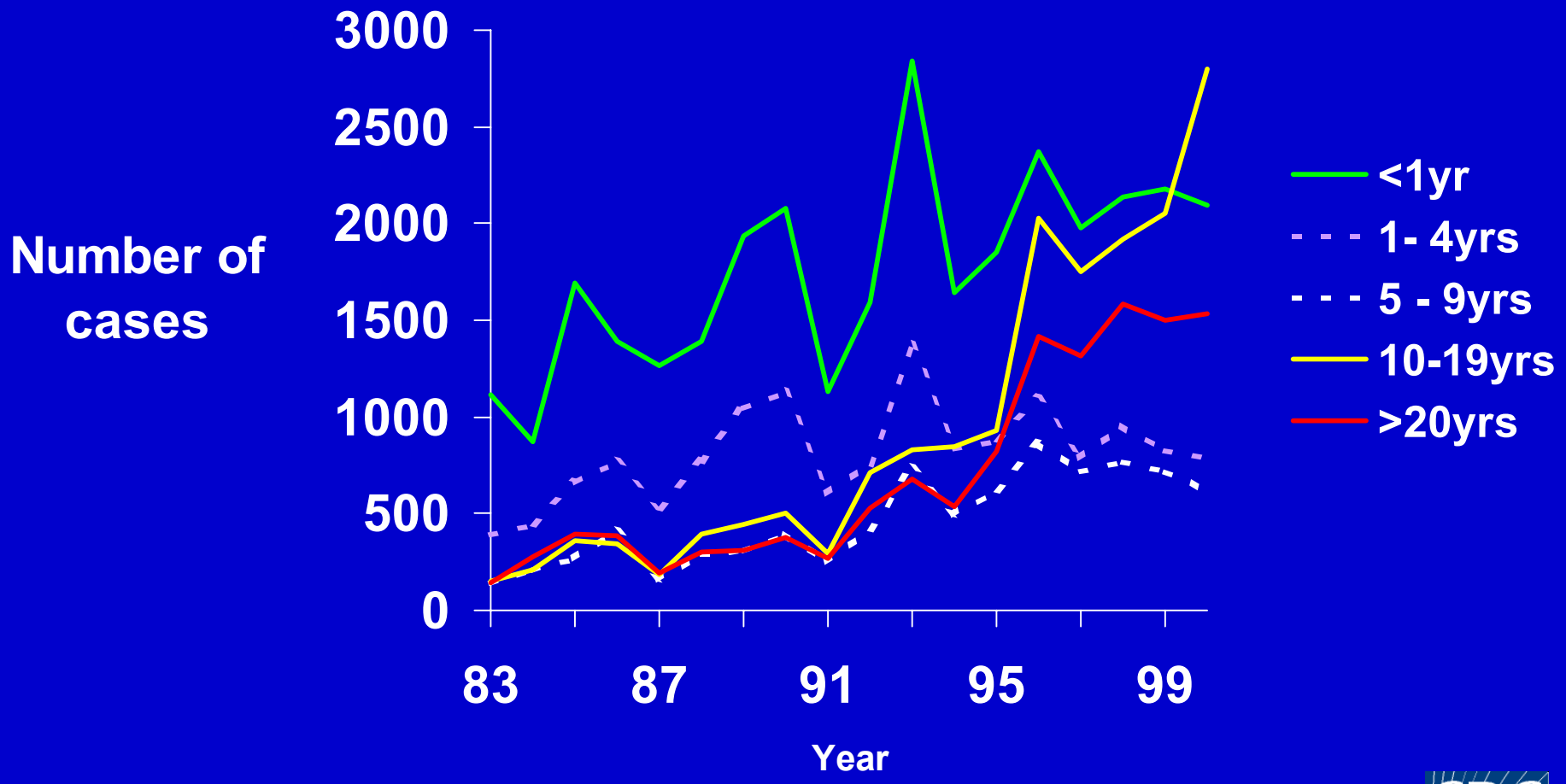
Pertussis in Infants

- Last year: 19 deaths, all infants
- Incidence in infants increasing
- Suggests pertussis circulation is increasing

Who Infects Infants?



Reported Pertussis Cases by Age U.S., 1983-2000



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September 10, 2001

Whooping Cough Makes Comeback, Striking Teens and Young Adults

ASSOCIATED PRESS

June 6, 2002

Whooping Cough Returns To U.S. as Immunity Wanes

By MARILYN CHASE

Acellular Pertussis Vaccines for Adolescents and Adults

- Licensed in Canada, Germany, Australia, France
- Combined with Td → TdaP
- U.S. trial suggests effective

Why Is This Not a Slam Dunk?

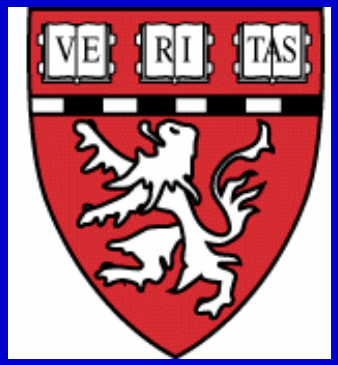
- Vaccination risks should be weighed
- Immunity wanes
- Vaccine price is as yet unknown
- Vaccine coverage is hard to attain

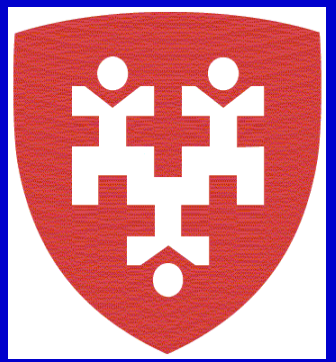
Programmatic Options

- Adolescents
- Adolescents + boosters every 10 years
- Adults at 20 years old
- Adults at 20 years old + boosters every 10 years

Figure 5. Drawing by S. Harris; © 1979 *The New Yorker Magazine.*

Joint Initiative in Vaccine Economics (JIVE)





Cost-effectiveness analyses of policy options for pertussis, influenza, polio, and hepatitis B

Cost-Effectiveness of Adolescent & Adult Pertussis Vaccination in the U.S.

Grace M. Lee, MD, MPH, Stephanie Schauer, PhD,
Susan Lett, MD MPH, Charles LeBaron, MD, MPH,
Trudy Murphy, MD, Tracy Lieu, MD, MPH,
and collaborators

Children's Hospital Boston, Massachusetts Department of Public Health,
Centers for Disease Control & Prevention, and Harvard Medical School

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Donna Rickert, Shannon Stokely

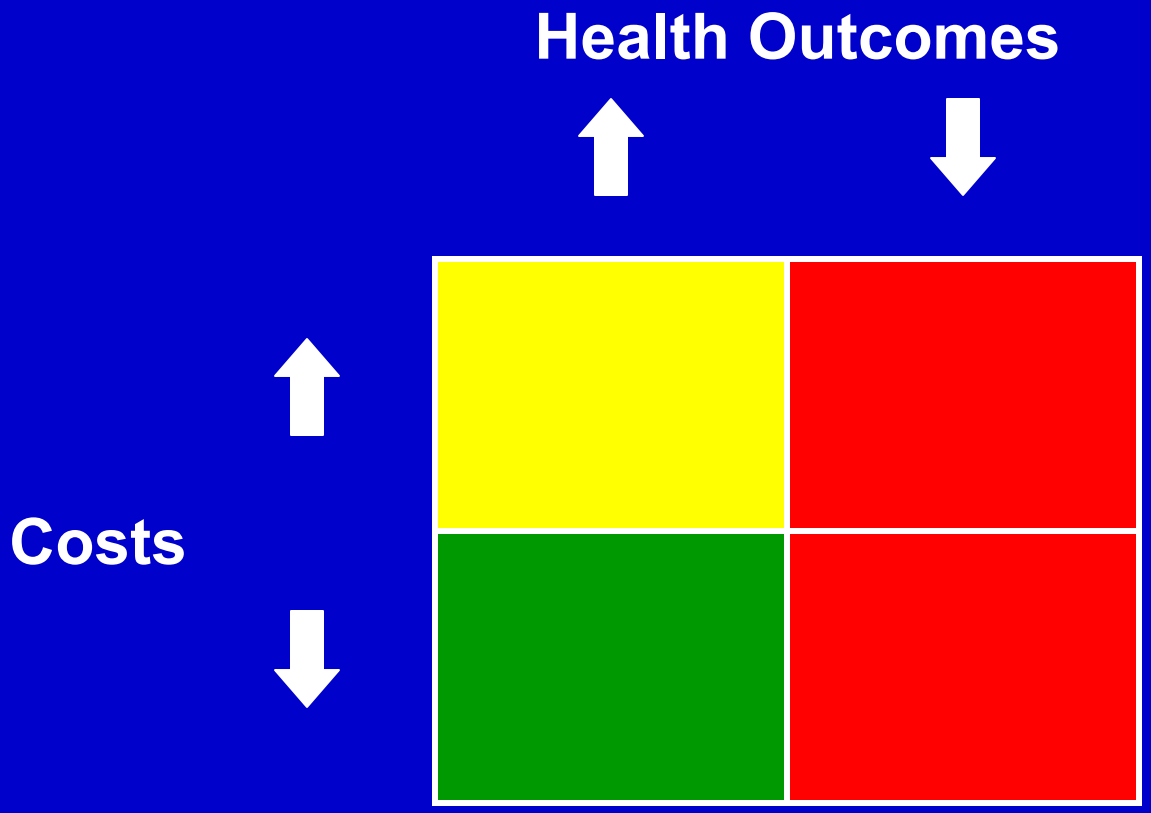
NIP/Epidemiology and Surveillance Division
Melinda Wharton, Trudy Murphy,
Kris Bisgard, Charles LeBaron, James Singleton,
John Glasser, Peng-Jun Lu

Expert panel
Kris Bisgard, Kathy Edwards,
Scott Halperin, Susan Lett, Colin Marchant,
Margaret Rennels, Joel Ward, Melinda Wharton

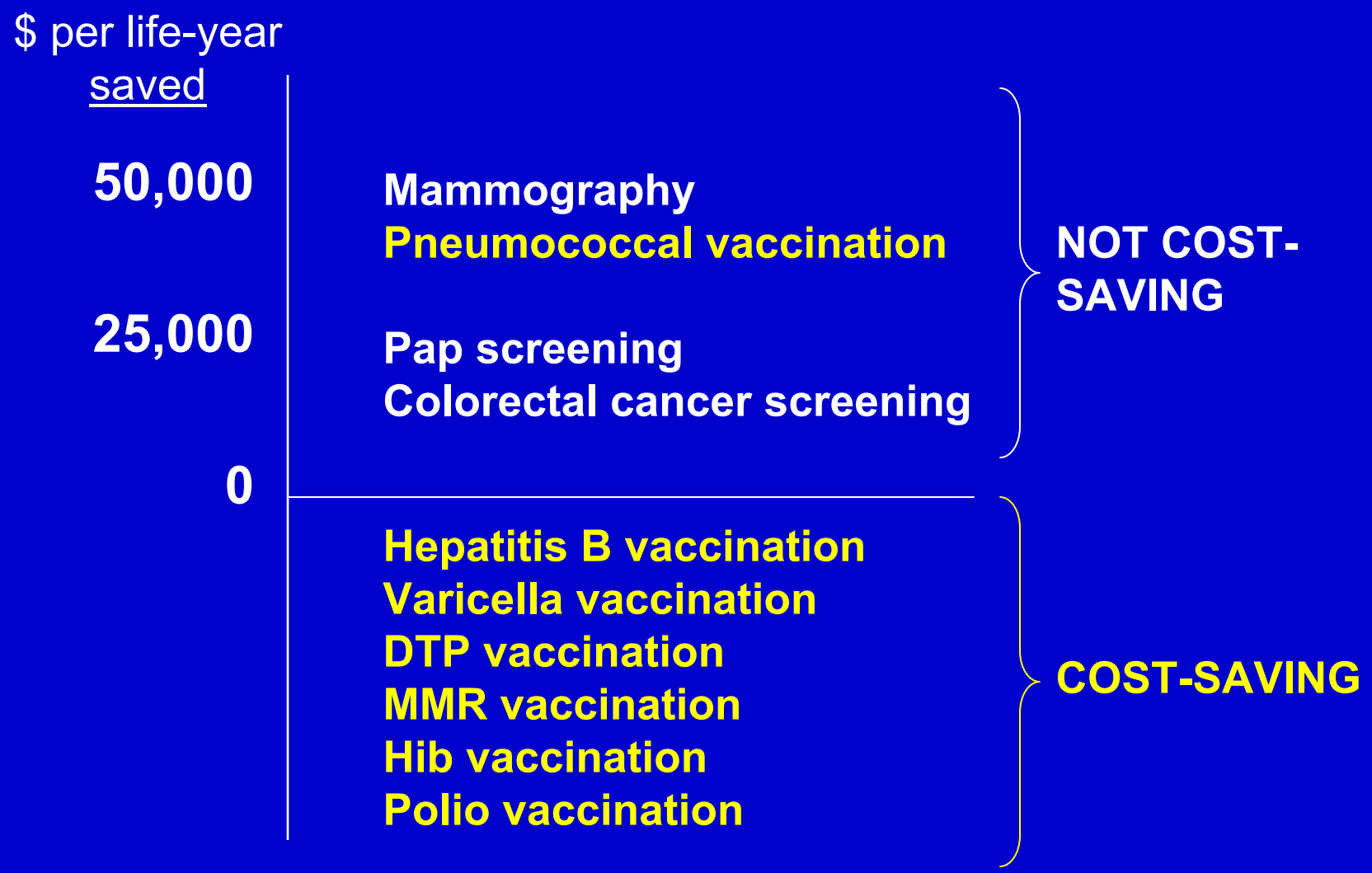
Questions

- Do the health benefits outweigh the vaccine risks?
- Will vaccination save money?
- Will it be cost-effective, relative to other health interventions?

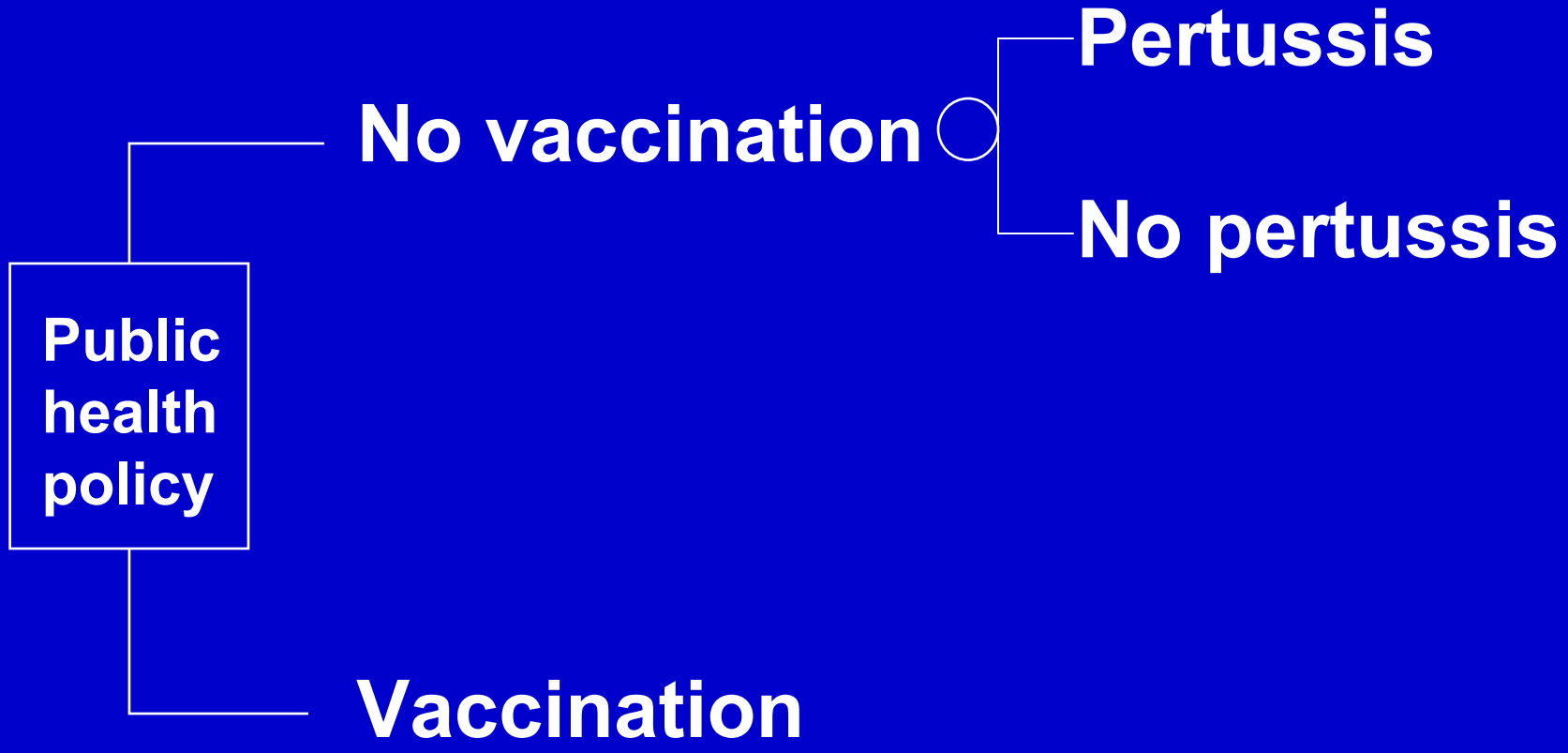
Cost-Effective ≠ Cost-Saving



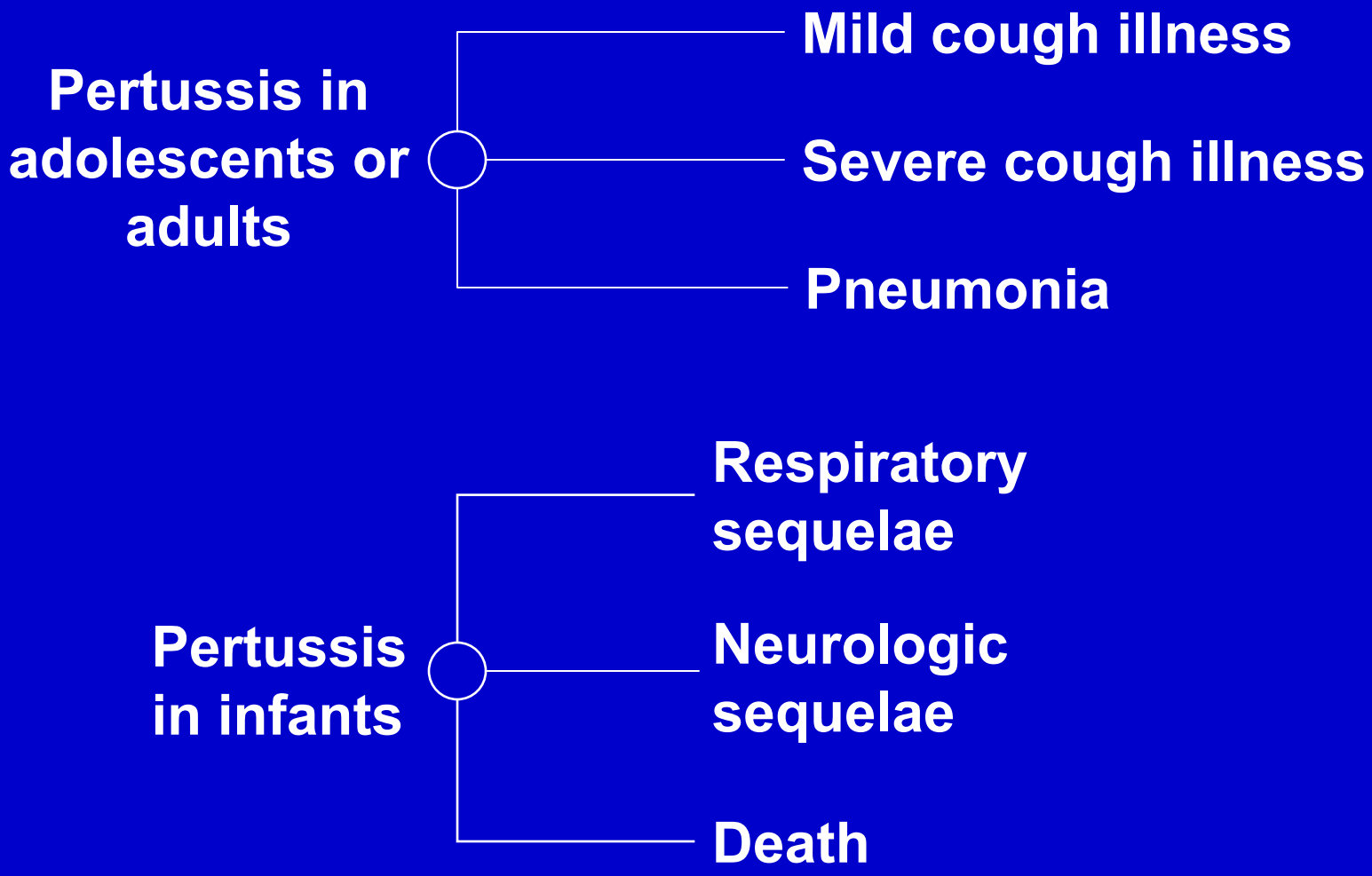
Vaccines Are Cost-Effective



Decision Tree



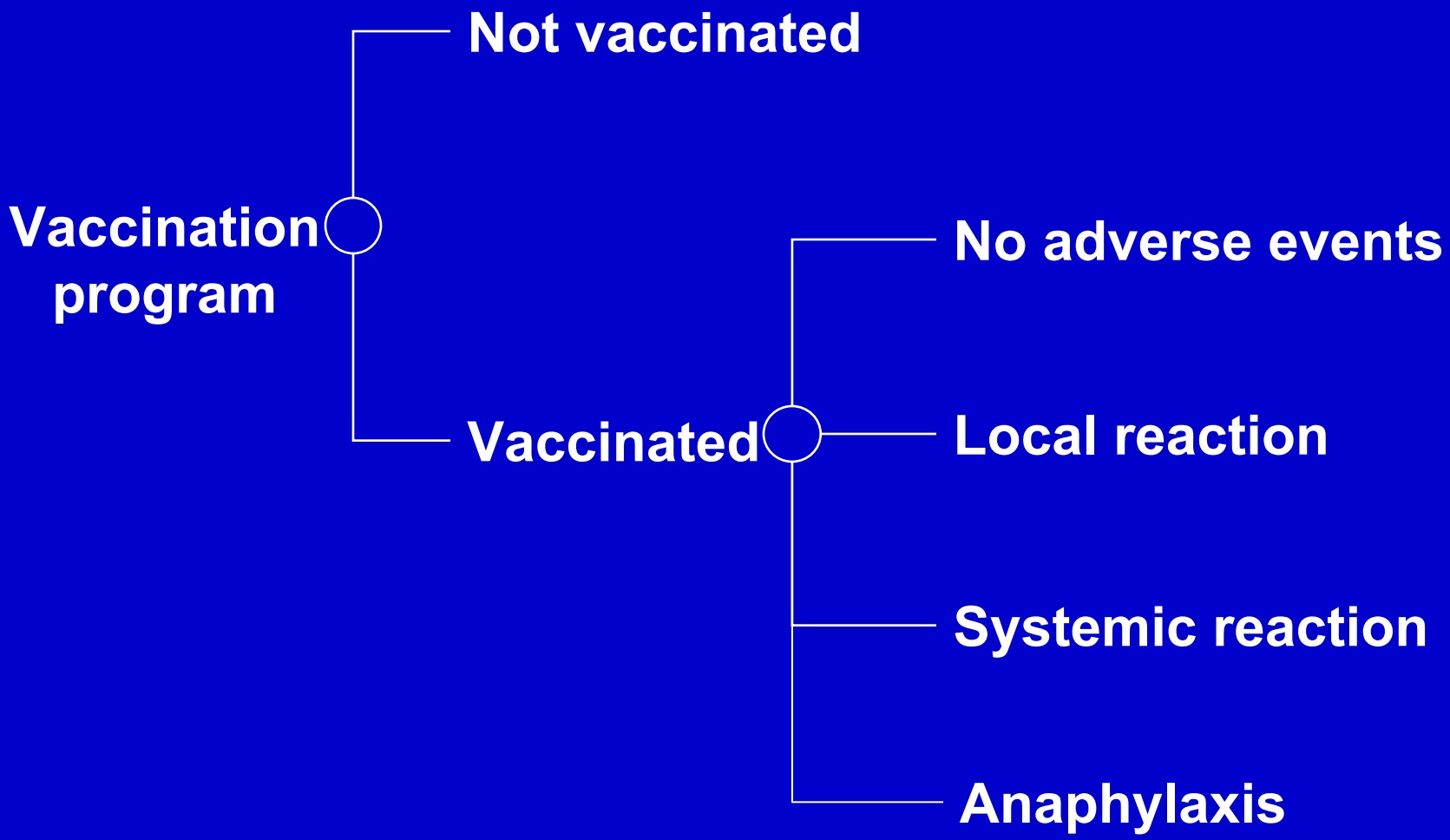
Outcomes of Pertussis



Pertussis Probabilities

Variable	Base Case Estimate
Incidence of pertussis	
Adolescents	114 per 100,000
Adults	8 per 100,000
Pneumonia after pertussis	
Adolescents	1%
Adults	3%

Outcomes of Vaccination



Vaccine Probabilities

Variable	Base Case Estimate
Vaccine coverage:	
Adolescents	78%
Adults	40%
Vaccine adverse events:	
Local	22%
Systemic	5%
Vaccine effectiveness	92% [30-95%]

Preliminary Results: Health Outcomes*

Preliminary Results: Health Outcomes*

Policy	Cases Prevented	Vaccine Adverse Events (mostly local)
Adolescents	23,000	840,000
Adols + boosters	27,000	2.6 million
Adults at 20 yrs	920	440,000
Adults + boosters	3600	1.8 million

*For 2002 birth cohort assuming 100% surveillance & no change in infant transmission

Dilemmas

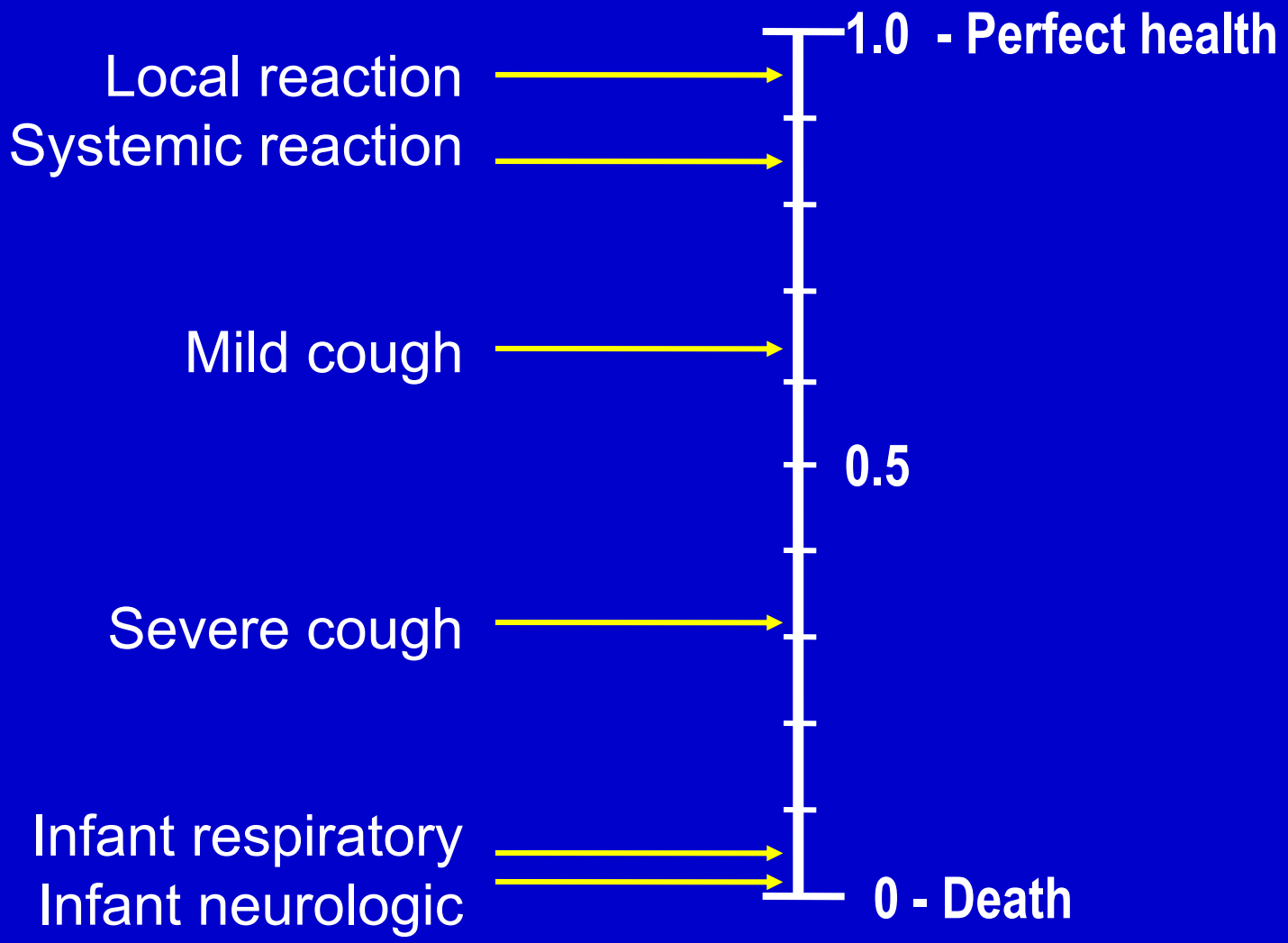
- How should we weigh preventing pertussis, vs. avoiding vaccine adverse events?
- Pertussis vaccination prevents few deaths
- Use time trade-off questions to get econometric measure -- quality-adjusted life-years

Time Trade-Off

Example: Severe cough

How many days or weeks would you be willing to give up from the end of your life to avoid severe cough for 8 weeks? The cough can cause vomiting several times a week, difficulty eating or drinking, and difficulty sleeping.

Values


1.0 - Perfect health
Local reaction
Systemic reaction
Mild cough
0.5
Severe cough
Infant respiratory
Infant neurologic
0 - Death

Do Health Benefits Outweigh Vaccine Risks?

Do Health Benefits Outweigh Vaccine Risks?

Policy option	If NO infant disease prevented	If ALL infant disease prevented
Adolescents	Yes	Yes
Adols + boosters	Yes	Yes
Adults at 20 yrs	No	Yes
Adults + boosters	No	No

Questions

- Do the health benefits outweigh the vaccine risks?
- Will vaccination save money?
- Will it be cost-effective, relative to other health interventions?

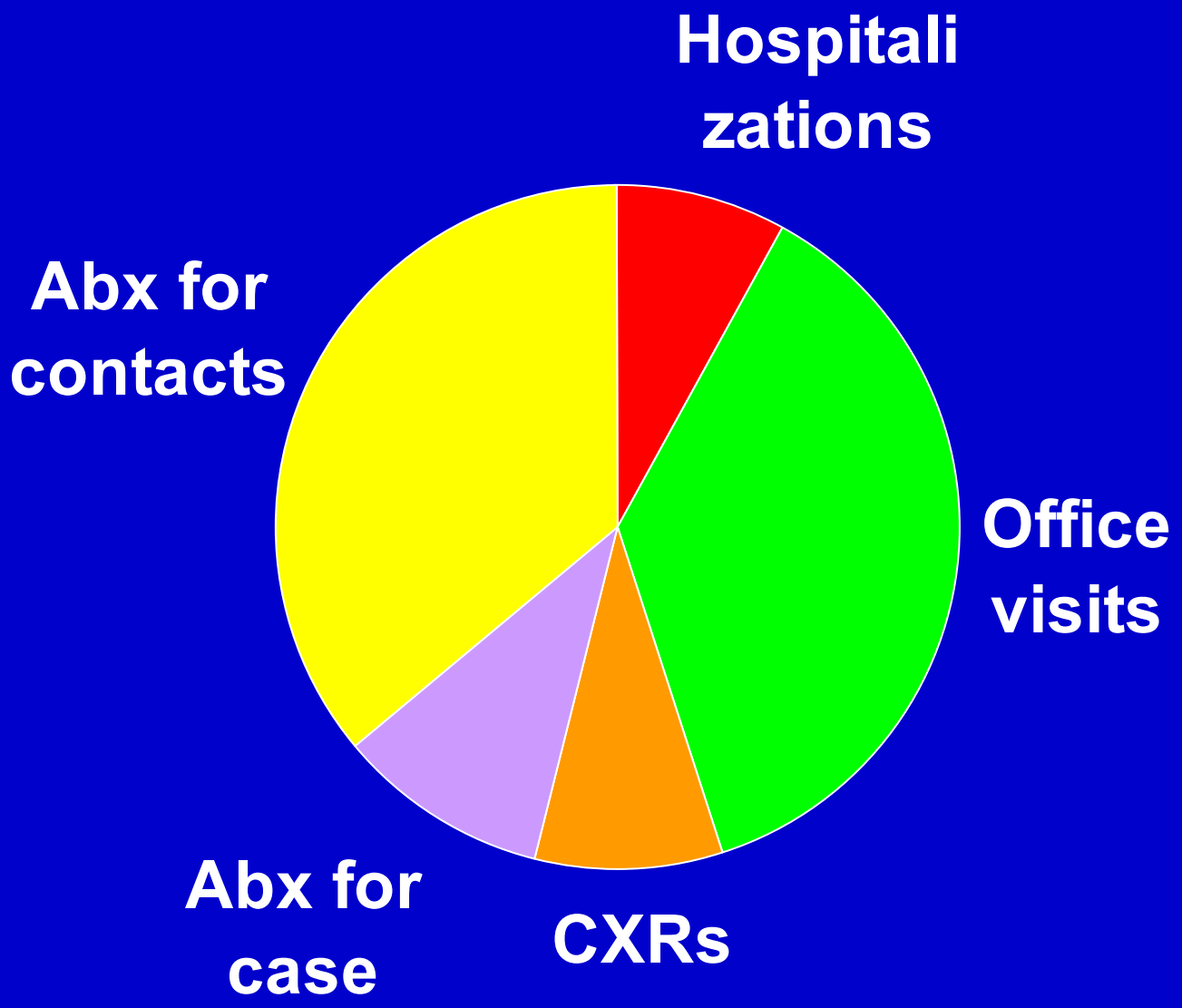
Costs of Pertussis in Adolescents & Adults

Massachusetts

Analysis of Medical Costs

- Retrospective analysis
- 2,800 cases of confirmed pertussis in Massachusetts, 1998-2000
- Utilization of health services
- Costs of services from national sources

Medical Costs
Adolescents = $300



Survey on Non-Medical Costs

- Include work-loss and other expenses
- Psychological costs
- Telephone interviews
- 400 adolescent and adult cases

Non-Medical Costs Are High

	Cost	
Age group	Medical	Non-medical
Adolescent	300	60% x medical
Adult	>300	150% x medical

Cost of Vaccination?

Vaccine price = ?

Vaccine administration = 0 if added to Td

Program costs = ?

Temporary assumption: $25

Cost of vaccination = $25
Will Vaccination Save Money?
Probably not:

Cost of vaccination = $25
Will Vaccination Save Money?
Probably not:

Policy option	If NO infant disease prevented	If ALL infant disease prevented
Adolescents	No	No
Adols + boosters	No	No
Adults at 20 yrs		No
Adults + boosters		

Cost of vaccination = $25

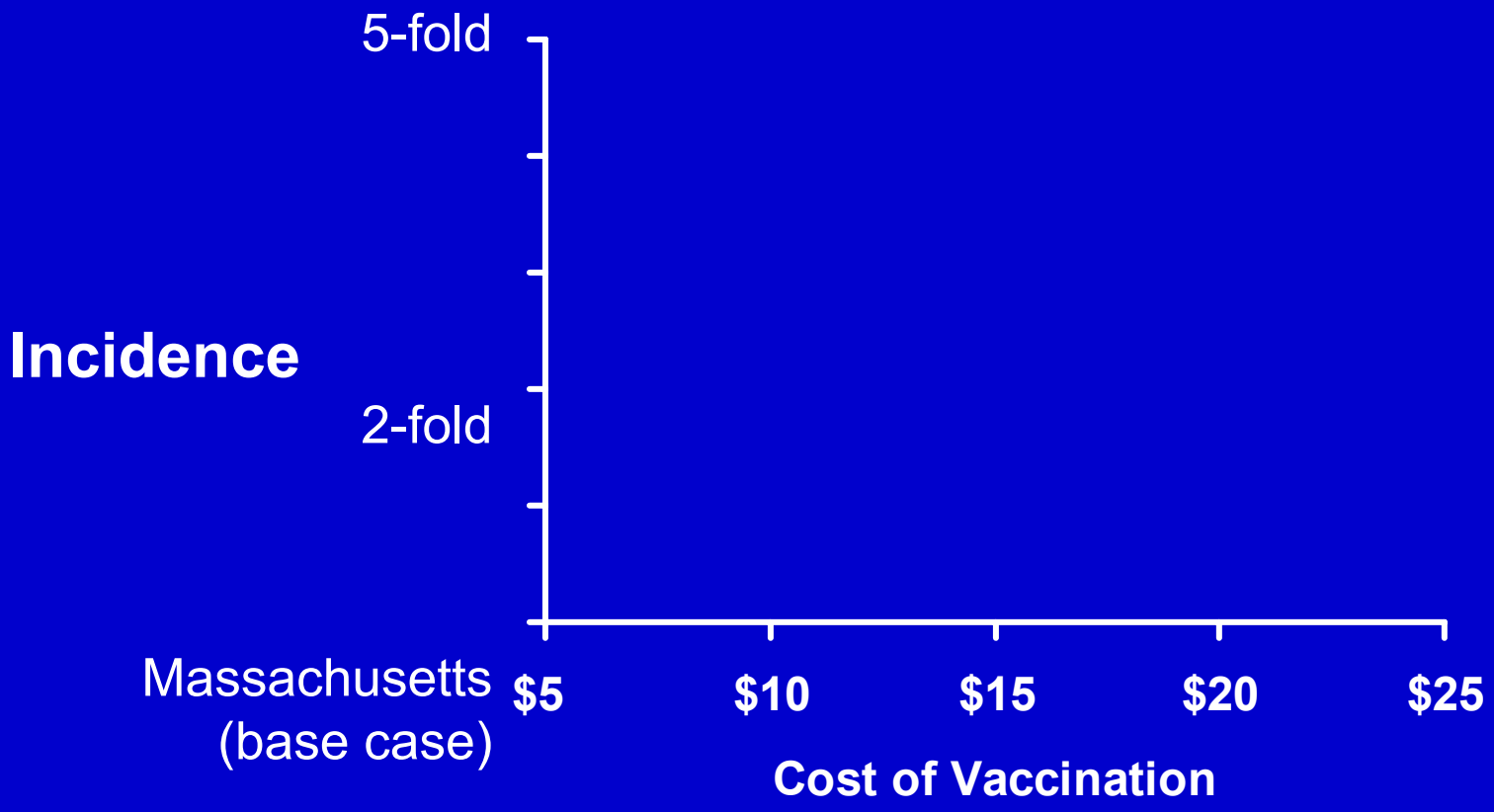
Will Vaccination Be Cost-Effective?

Cost < $50,000 per QALY saved

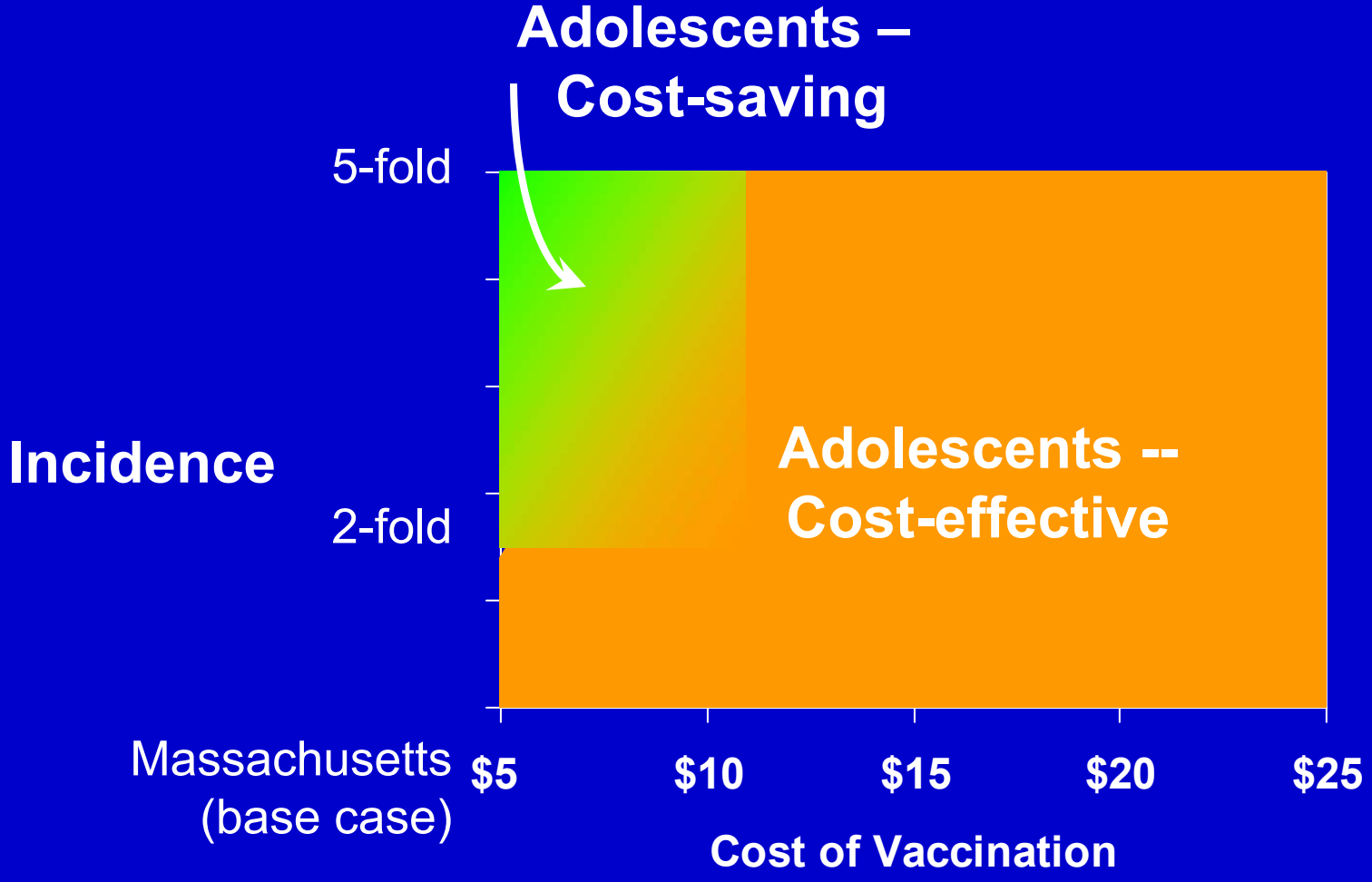
Cost of vaccination = $25
Will Vaccination Be Cost-Effective?
Cost < $50,000 per QALY saved

Policy option	If NO infant disease prevented	If ALL infant disease prevented
Adolescents	Yes	Yes
Adols + boosters	No	No
Adults at 20 yrs		Yes
Adults + boosters		

Sensitivity to Incidence of Pertussis and Cost of Vaccination



Sensitivity to Incidence of Pertussis and Cost of Vaccination



Preliminary Findings

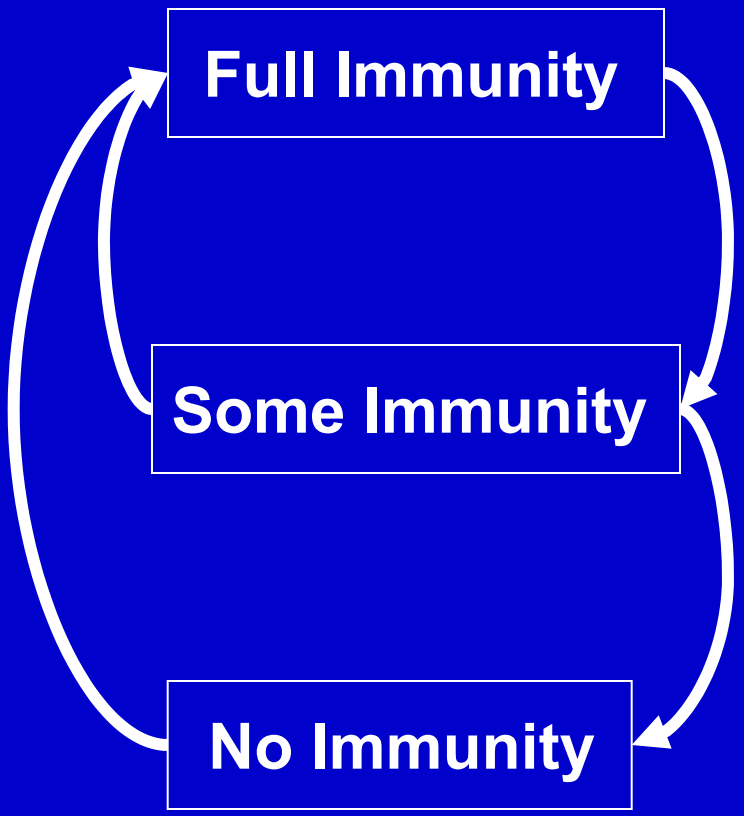
- Tradeoffs depend greatly on:
  - True incidence of disease
  - Cost of vaccination (including vaccine price and program costs)
  - Effects on infant disease

Messages

- Pertussis in adolescents and adults is increasing and costly
- Vaccination could be beneficial and cost-effective
- Need better data on incidence

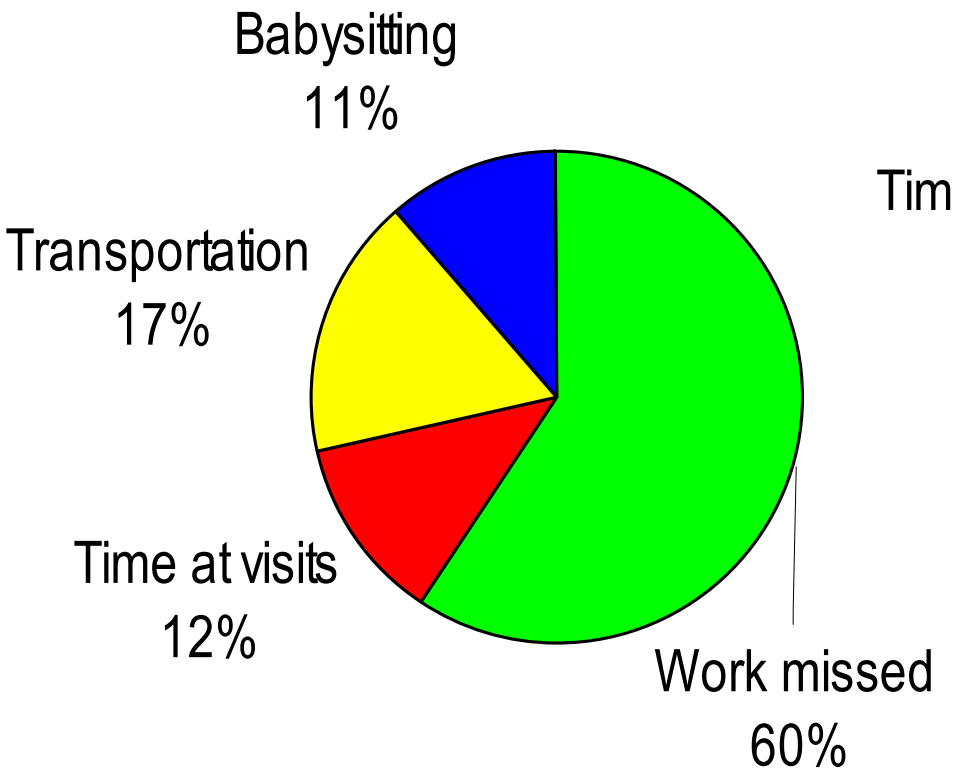
Slides following this slide are leftovers

Markov Model

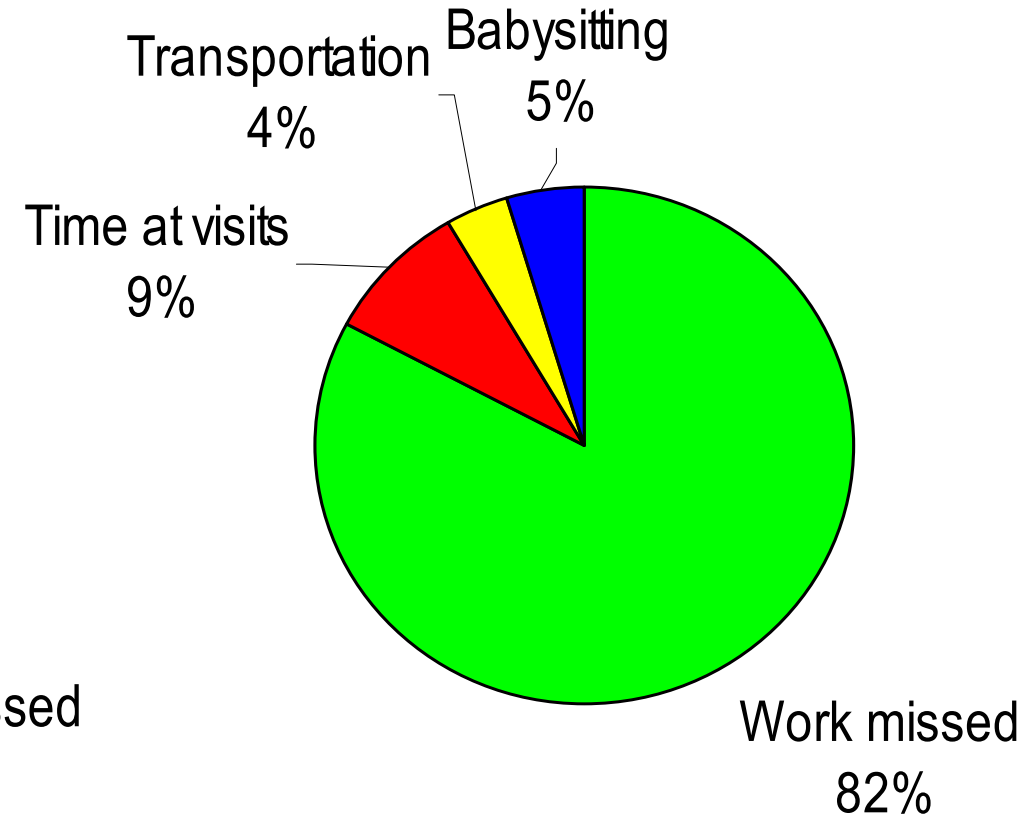


Non-medical Costs

Adolescents ($180)



Adults ($570)



Outcome Measures

- Cases of pertussis prevented
- Adverse effects
- Total cost
- Life-years saved

- Quality-adjusted life-years saved
- $ per QALY saved

Next Steps

- Add a “cocoon” strategy to the model
- Need estimates of impact on infant disease from dynamic models
- Include public health costs

Other Adolescent Time Costs

- 87% missed school due to illness
- Average days missed from school
  - 6.1 days (0.4-32 days)
- 27% of adolescents had jobs
- Average days missed from work
  - 4.8 days (0.5-15 days)

Public Health Costs

- Average costs of 3 states with high incidence of pertussis:
- Surveillance--$202,000 per year
- Health care outbreak--$33,000 per year
- School outbreak--$21,000 per year
- Average cost per state--$256,000
- Average cost for U.S.--$12.8 million