The economic burden from illnesses associated with coastal water pollution

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Objective:

- Quantify the economic burden from illnesses associated with coastal water pollution
- Provide example how results can be applied

Method:

Cost-of-Illness framework applied to health and economic data for:

- *Gastroenteritis (GI)*
- *Acute Respiratory Disease (ARD)*
- *Ear infections*
- *Eye infections*

Calculation of *Cost-per-Illness*

Cost-per-Illness = (Lost wages) + (Medical Costs)

- 1 day Lost Wages = (# ill * *A*) * (Income/day)
  - *A* adjusts number of patients by percent who lost normal activity
  - Income/day = ($39,895/yr / 240 workdays/yr) = $166.23 * *B* = $109.30 /day
  - *B* adjusts income/day by percent of lost days that occur on a weekend or holiday: *B* = chance sick on work day (240work days/365 days = 0.6575)
- Medical costs = (# ill * *C*) * ($108.98)
  - *C* adjusts number of patients by the percent that go to the doctor

Illness Severity Data

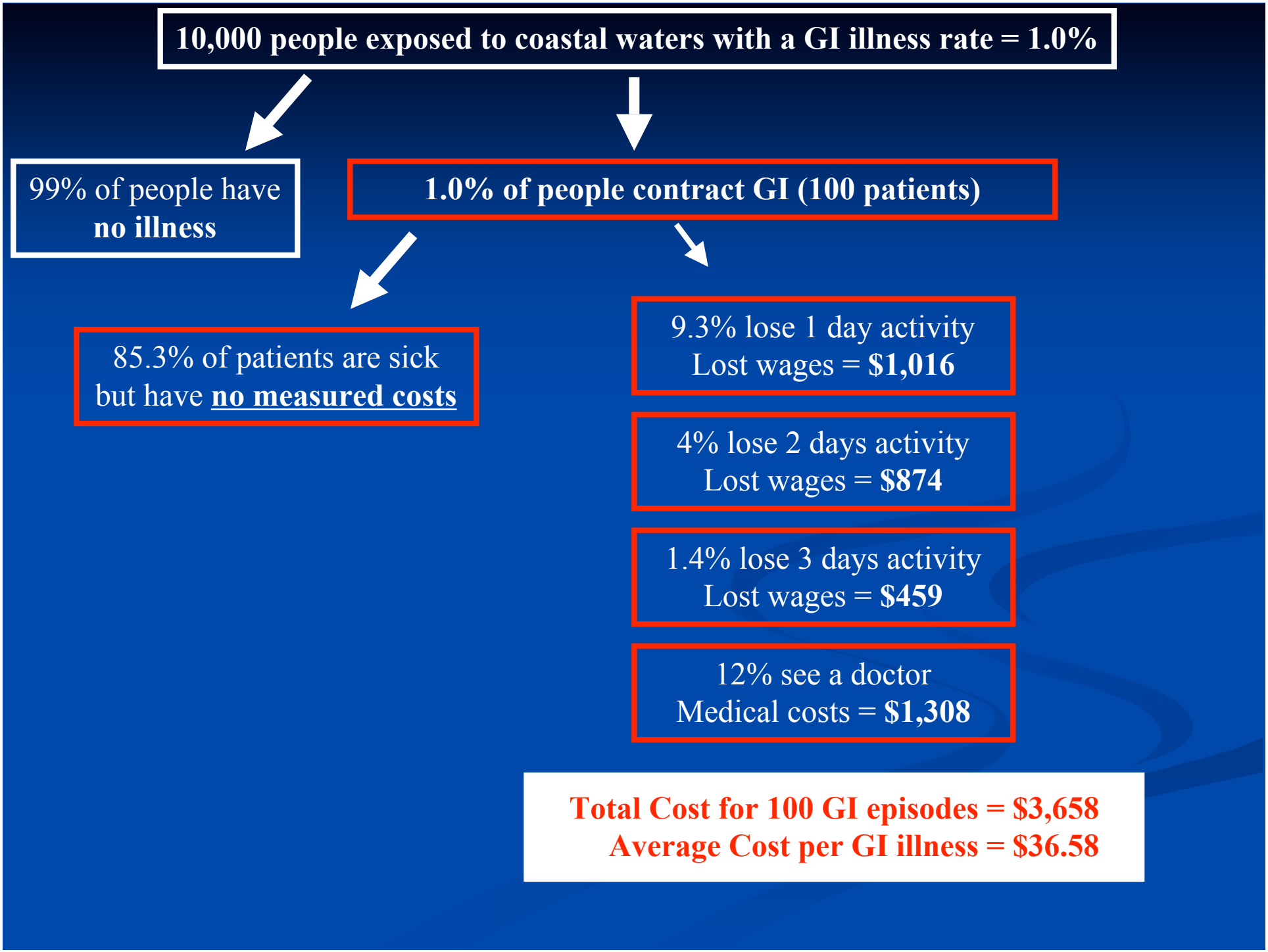
Fleisher et al., 1998, Estimates of the severity of illnesses associated with bathing in marine recreational waters contaminated with domestic sewage, *International Journal of Epidemiology*, 27:722-726.

A and *C* adjustments

	GI	ARD	Ear	Eye
Illnesses resulting in 1 day of lost activity	9.3%	7.4%	2.3%	4.2%
Illnesses resulting in 2 days of lost activity	4.0%	14.8%	2.3%	8.3%
Illnesses resulting in 3 days of lost activity	1.4%	3.7%	2.3%	0%
% of illnesses with a doctor visit	12.0%	22.2%	20.9%	4.2%

Comparison of GI Severity Data

Citation	Days ill	Stay at home illnesses	Doctor visits
Fleisher, 1998	4.1 (mean)	0.201	0.12
Garthright, 1988	nr	0.52	0.083
Gerba, 1996	5-8 typical	nr	nr
Hardy, 1994	5.4 (mean)	nr	0.10
Payment, 1991	1.9 (mean)	nr	nr
Wit, 2001	6 (median)	0.60	0.20


10,000 people exposed to coastal waters with a GI illness rate = 1.0%
99% of people have no illness
1.0% of people contract GI (100 patients)
85.3% of patients are sick but have no measured costs
9.3% lose 1 day activity
Lost wages = $1,016
4% lose 2 days activity
Lost wages = $874
1.4% lose 3 days activity
Lost wages = $459
12% see a doctor
Medical costs = $1,308
Total Cost for 100 GI episodes = $3,658
Average Cost per GI illness = $36.58

Average Cost-per-Illness

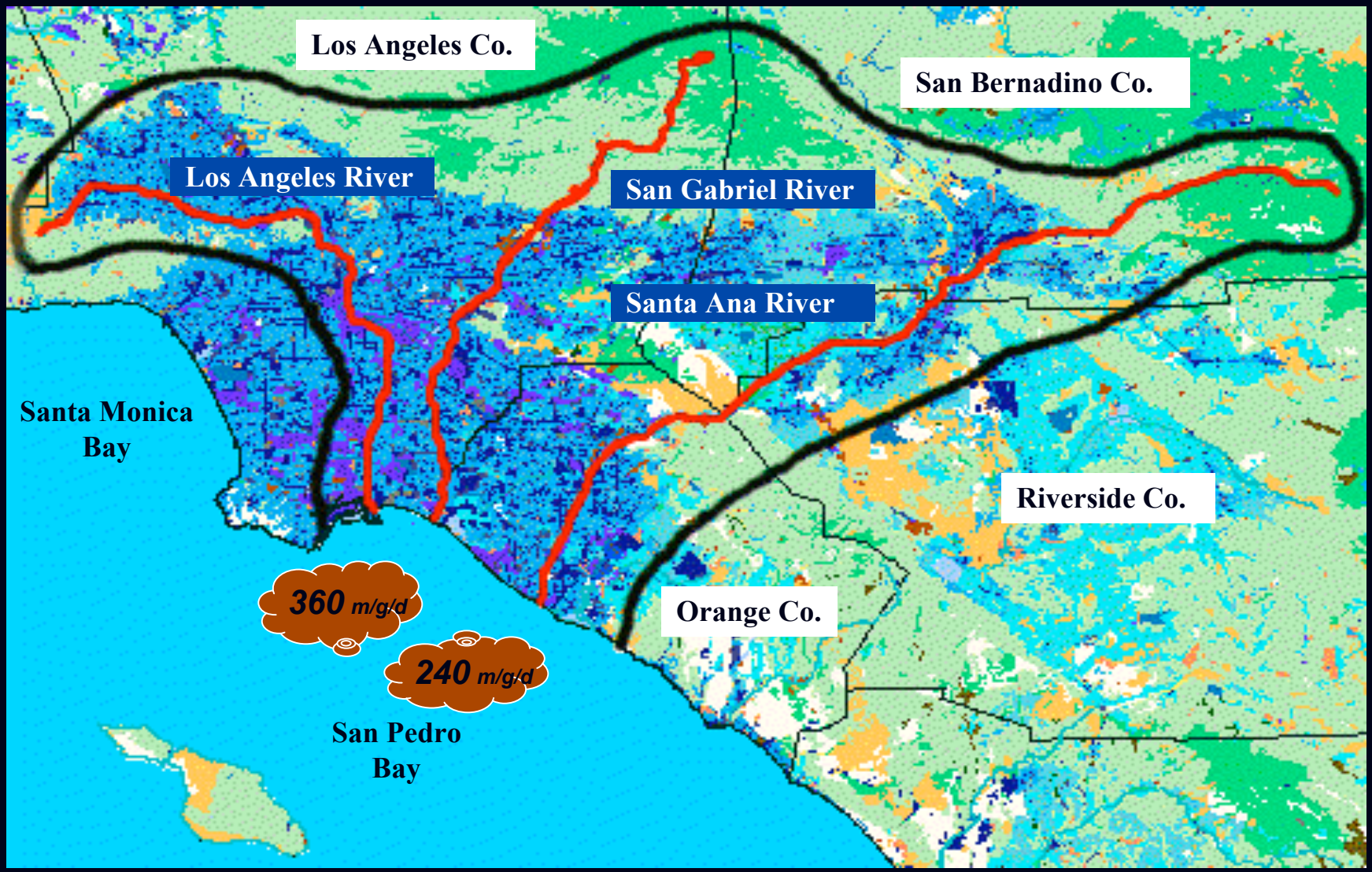
GI	= $ 36.58
ARD	= $ 76.76
Ear infection	= $ 37.86
Eye infection	= $ 27.31

Comparison of Health Costs

Citations	Cost-per-illness
GI: Dwight, 2005	$36
GI: Fruhwirth, 2001	$225 - $2,198
GI: Garthright, 1988	$322 - $521
GI: Hardy, 1994	$202
GI: Liddle, 1997	$354 - $1,403
GI: Scott, 2000	$218
Influenza: Nichol, 2001	$387
ARD: Dwight, 2005	$76
ARD: Carabin, 1999	$409
ARD: Ray, 1999	$34 - $1,978

Huntington and Newport Beaches

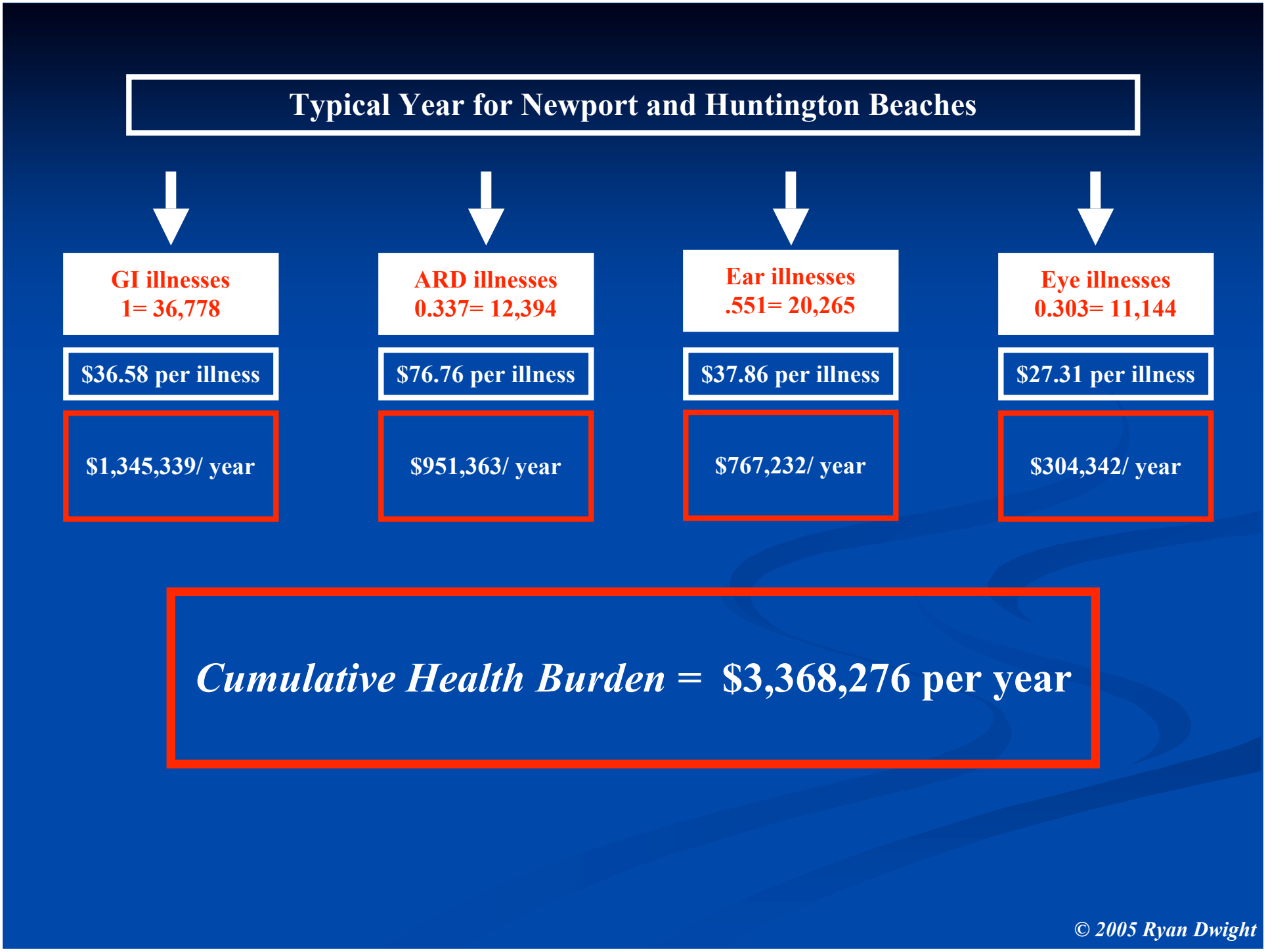
Combined Watershed Areas for the Los Angeles, San Gabriel and Santa Ana Rivers



Santa Ana River Pollution Plume

Cumulative Health Burden

- Turbow DJ, ND Osgood, SC Jiang, 2003, Evaluation of recreational health risk in coastal waters based on Enterococcus densities and bathing patterns, *Environmental Health Perspectives*, 111(4):598-603.
- Using Cabelli dose/response relationship they modeled water quality data with beach attendance data to produce an estimate of risk
- Reported 95,010 GI illnesses in 31 months: 1998-2000 (36,778 per year)



Discussion

1. **Water-related illnesses have health costs**
   - Future epidemiological studies should directly measure severity and costs of health outcomes
2. **Popular beaches can generate significant cumulative health costs**
   - >$3 million/year at one beach even if illness rate < 1%
3. **Need to re-evaluate 1.9% illness rate**
   - Rate is higher if include respiratory, eye, ear & skin inf.