

Estimating the Health and Economic Benefits of Federal Air Quality Regulations

Presentation for 2010 Summit: America's
Healthcare Policy through the Lens of
Environmental Health
September 28, 2010

Different Objectives

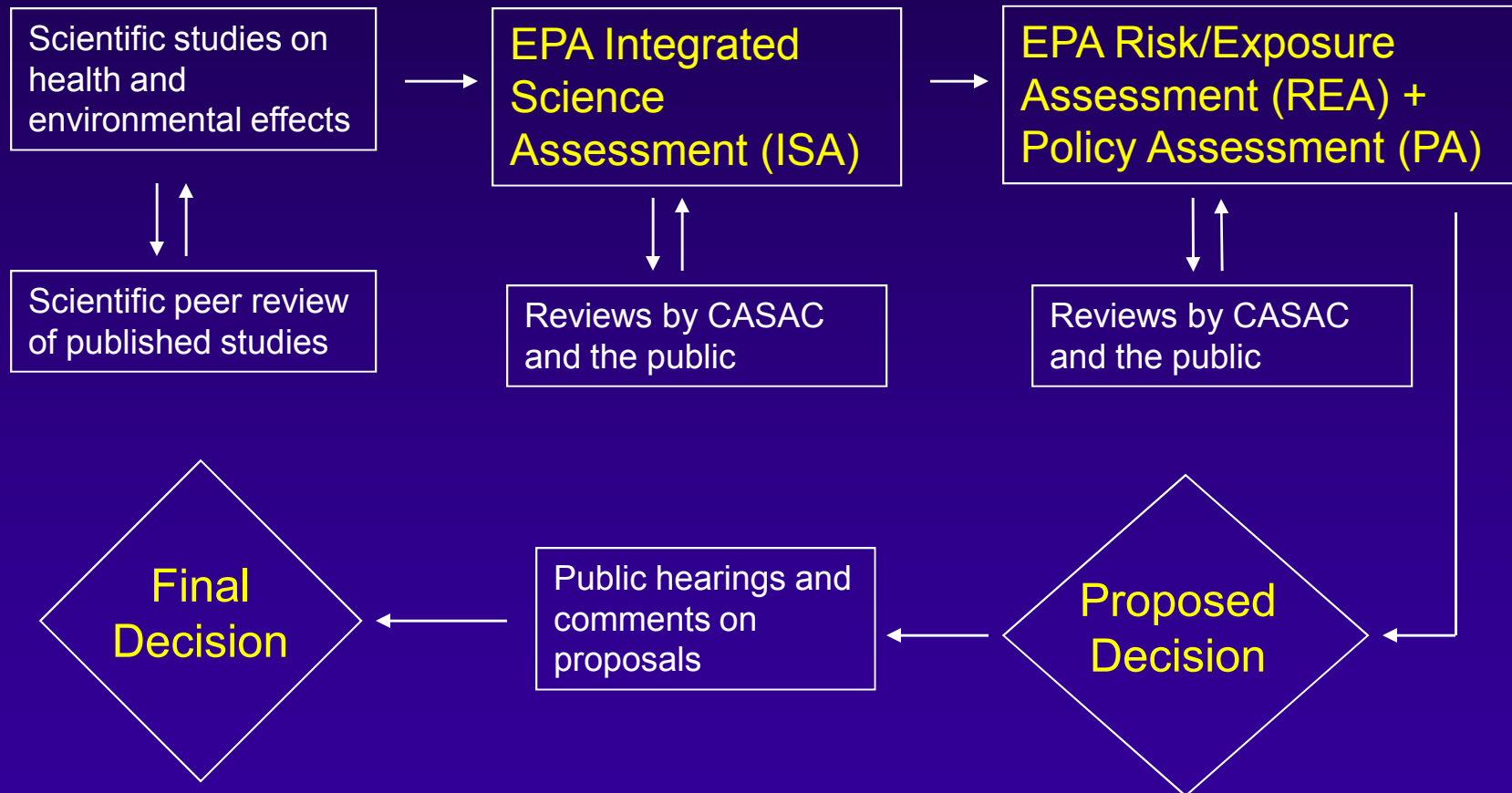
National Ambient Air Quality Standards (NAAQS)

- The EPA Administrator makes the ultimate decision on the level of the standard
- Standards must be requisite to protect the public health with an adequate margin of safety
 - Cannot consider costs of implementation in standard setting

Health impact and benefit-cost assessments

- Part of the NAAQS rulemaking process
 - BUT NOT used to set the level of the standard
 - Useful for evaluating implementation strategies, but there are many uncertainties
 - Useful for accountability assessments
- Useful for other types of standards (e.g., mobile source, technology-based)
- BenMAP (environmental Benefits Mapping Analysis Program)

Review Process for NAAQS



Health Impacts Pyramid of Effects

Magnitude of Impacts

Thousands

Death

Tens of Thousands

Hospital Admissions

Adversity of Effects

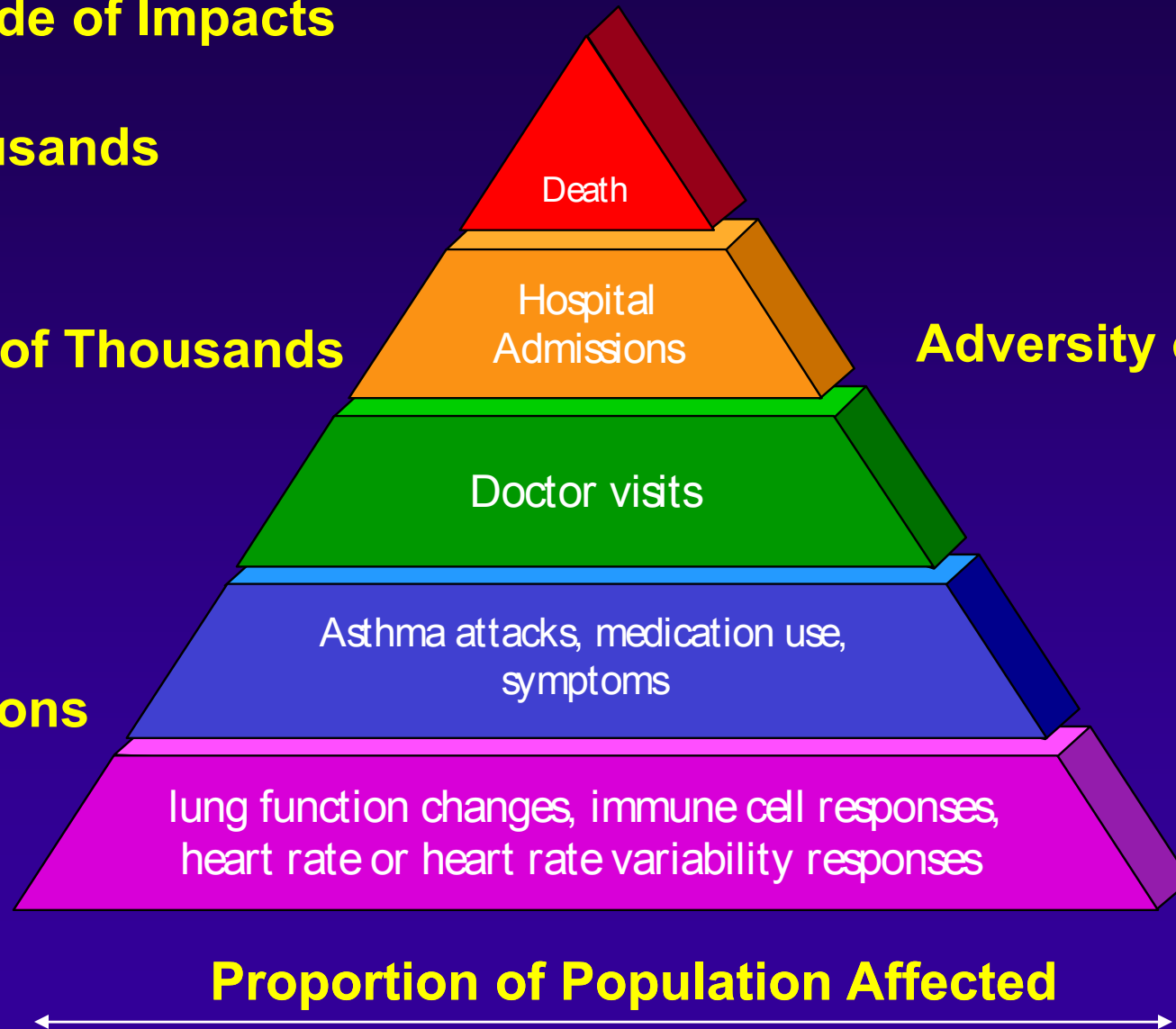
Doctor visits

Millions

Asthma attacks, medication use, symptoms

lung function changes, immune cell responses, heart rate or heart rate variability responses

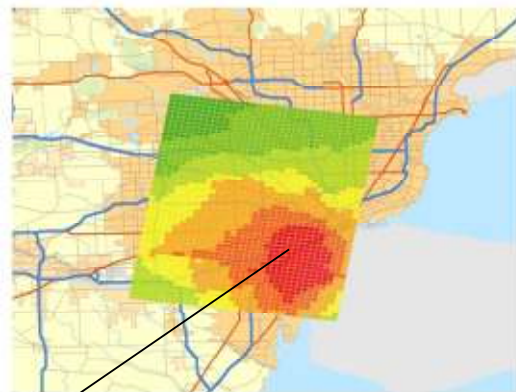
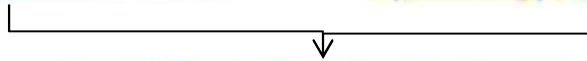
Proportion of Population Affected



Baseline Air Quality

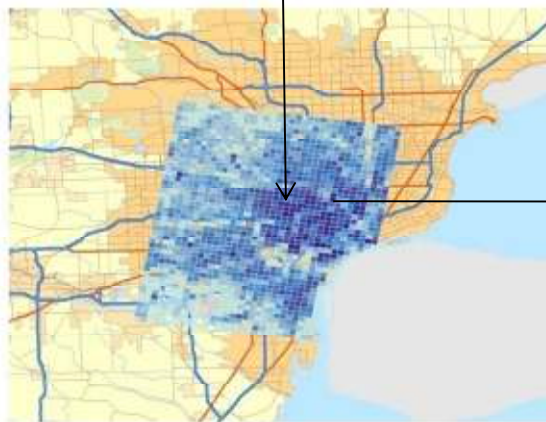


Post-Policy Scenario Air Quality

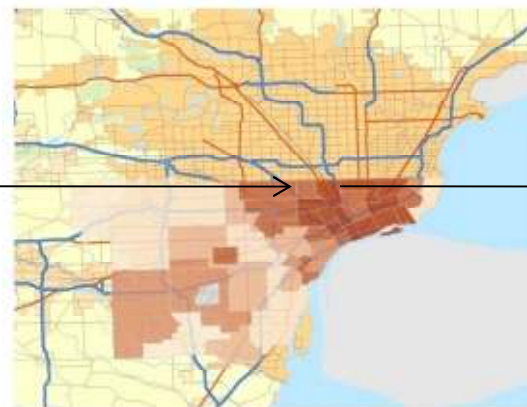


Incremental Air Quality Improvement

PM_{2.5} Reduction



Population Ages 18-65



Background Incidence Rate



Effect Estimate

Mortality Reduction

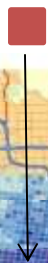


Figure 5.1. **Percent of All Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Decrement in FEV1 \geq 15 %) Associated with Exposure to O3 Concentrations That Just Meet the Current and Alternative Average 4th Daily Maximum 8-Hour Standards, for Location-Specific O3 Seasons: Based on Adjusting 2002 O3 Concentrations**

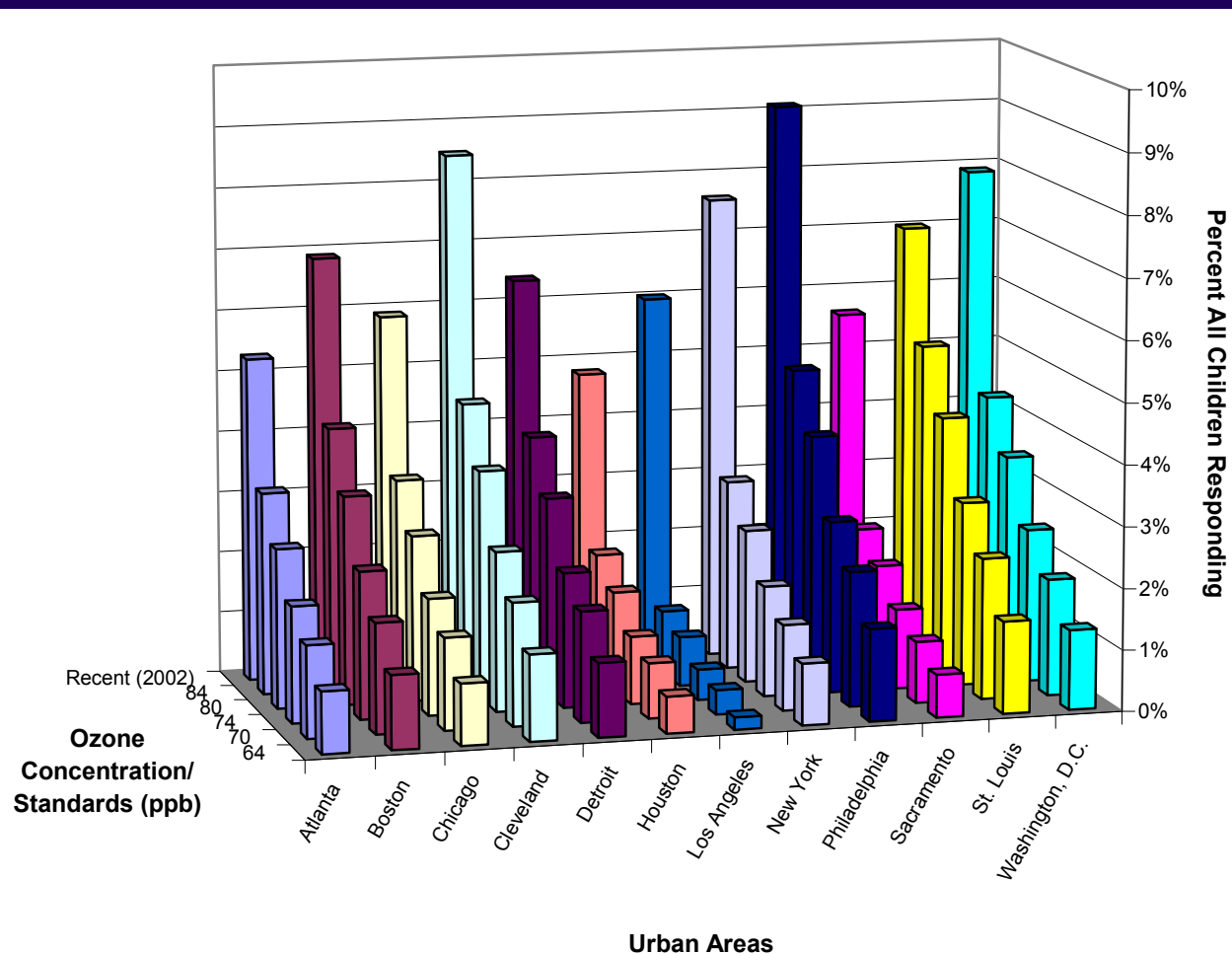


Table 6-10. Risks of Hospital Admissions for Respiratory Illness Associated with Just Meeting the Current and Alternative Ozone Standards Based on Adjusting 2002 and 2004 Air Quality in New York, NY

Current and Alternative Standards	Risk Metric	Hospital Admissions for Respiratory Illness Associated with Ozone Exposures ^{1,2} [percent reduction from current standard]	
		2002	2004
Current Standard (84/4)	Incidence	513	366
	Percent of Total Incidence	1.5%	1.0%
80/4	Incidence	483 [6% reduction]	341 [7% reduction]
	Percent of Total Incidence	1.4%	1.0%
74/4	Incidence	439 [14% reduction]	304 [17% reduction]
	Percent of Total Incidence	1.2%	0.9%
70/4	Incidence	410 [20% reduction]	278 [24% reduction]
	Percent of Total Incidence	1.2%	0.8%
64/4	Incidence	365 [29% reduction]	241 [34% reduction]
	Percent of Total Incidence	1.0%	0.7%

¹Incidence rounded to nearest whole number.

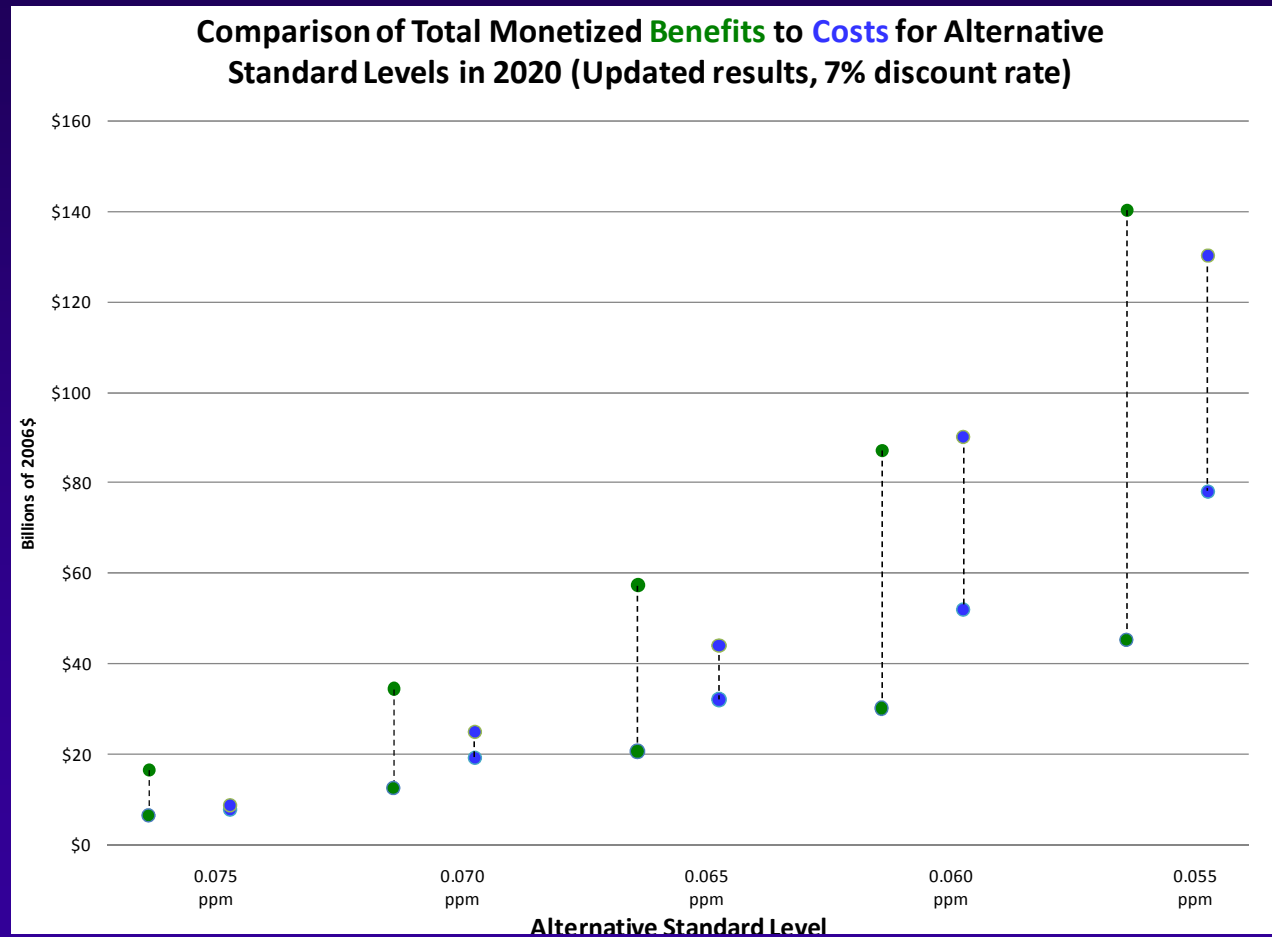
²95 % credible intervals based on statistical uncertainty surrounding the O₃ coefficient are presented in tables in Appendix 5C of this Staff Paper.

Estimated Number of Adverse Health Effects Avoided Under Alternate Ozone Standard Levels in 2020*

	0.070 parts per million	0.060 parts per million
Chronic bronchitis	880	2,200
Nonfatal heart attacks	2,200	5,300
Hospital and emergency room visits	6,700	21,000
Acute bronchitis	2,100	5,300
Upper and lower respiratory symptoms	44,000	111,000
Aggravated asthma	23,000	58,000
Days when people miss work or school	770,000	2.5 million
Days when people must restrict their activities	2.6 million	8.1 million
Avoided premature mortality	1,500 to 4,300	4,000 to 12,000

*Includes benefits of reduced fine particle concentrations associated with illustrative ozone controls applied to meet a primary ozone standard in the proposed range

Benefit-Cost Assessment Results



Air Quality Index

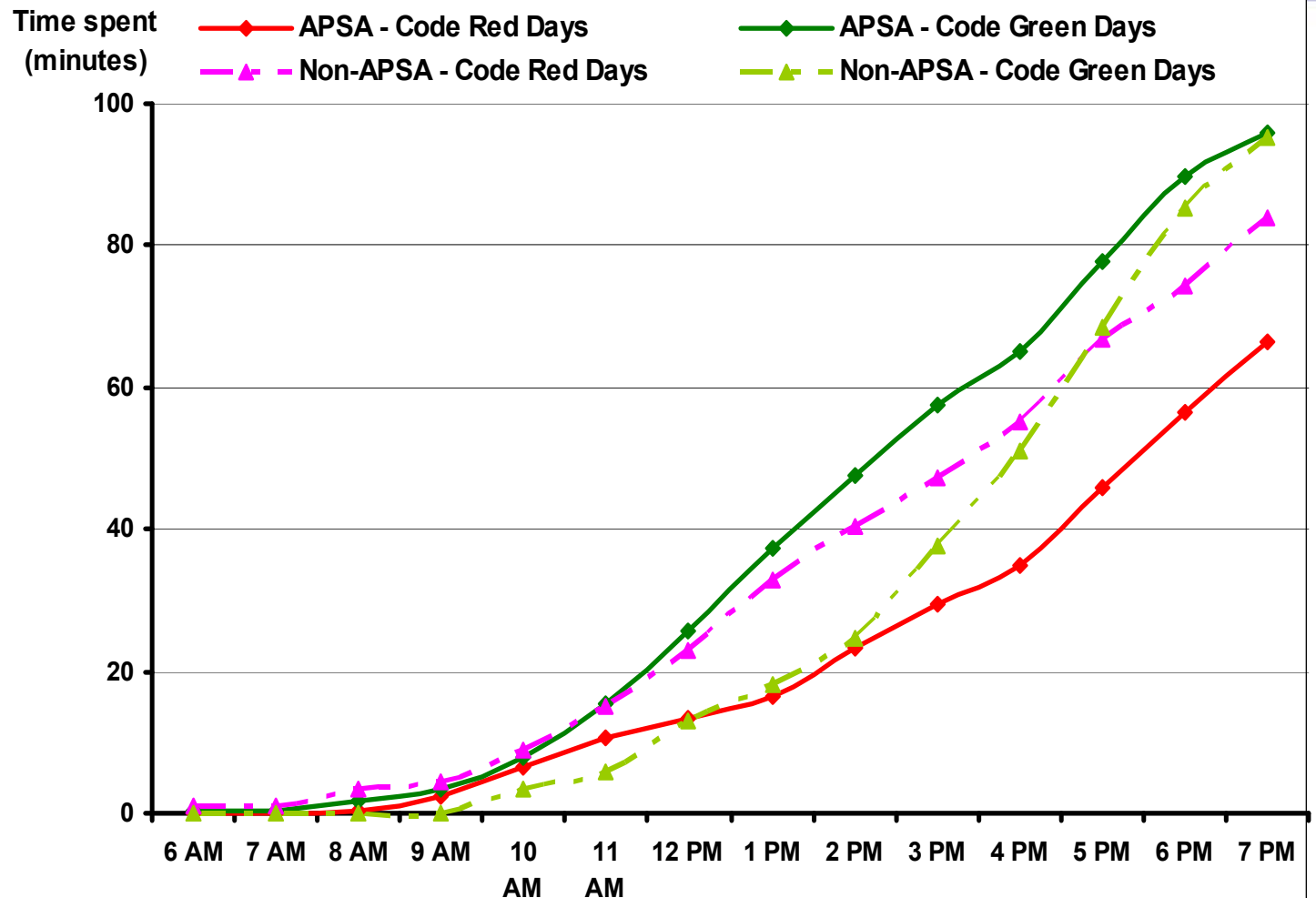
Descriptors	Cautionary Statement
Good 0 – 50	No message
Moderate 51 – 100	Unusually sensitive individuals
Unhealthy for Sensitive Groups 101 - 150	Identifiable groups at risk - different groups for different pollutants
Unhealthy 151 - 200	General public at risk; sensitive groups at greater risk
Very Unhealthy 201 - 300	General public at greater risk; sensitive groups at greatest risk

Effectiveness of the AQI

- Effectiveness has been measured many ways
 - Surveys: What people say
 - Behavior
 - Behavior and demographics (EPA, BRFSS)
 - Activity diaries: What people do (RTI)
 - Health studies: Changes in health outcomes
- Surveys
 - Large proportion report awareness (50 -75%)
 - Of those about 50% report taking action
 - People of older age, fair or poor health status, and females more likely to reduce exposure (EPA Health and Aging Survey)
 - Recommendation by healthcare provider much more likely to reduce exposure from BRFSS Survey (Wen et al., 2009)
 - Odds ratio of changing behavior based on media reports = 2.16 (95% CI: 1.61, 2.90)
 - Percent change in behavior based on alerts with professional advice = 50.7%; without professional advice = 14.2%

Air Pollution Sensitive vs. Not Air Pollution Sensitive Asthmatics

Source: Carol Mansfield, RTI



Health Studies

- Los Angeles study: Neidell and Kinney (2010)
 - Asthma hospital admissions 1989-1997
 - Control for air quality forecasts to account for avoidance behavior
 - Accounting for behavior leads to significantly larger effects estimates; however there is a cost to behavior

- DFW: Carls U of MI dissertation
 - Forecasts protective of health and alter relationships between asthma exacerbations and air quality
 - Previous day O₃ alerts were protective for high morbidity outcomes (hospital, ER); but not for the low morbidity outcomes (outpatient visits, medication use)

Increase asthma hospitalizations per 10 ppb O₃ - Neidell and Kinney (2010)

	All	5-19	≥ 65
No control	0.017	0.016	0.022
With control	0.027	0.037	0.037
Difference	1.59**	2.31**	1.36*

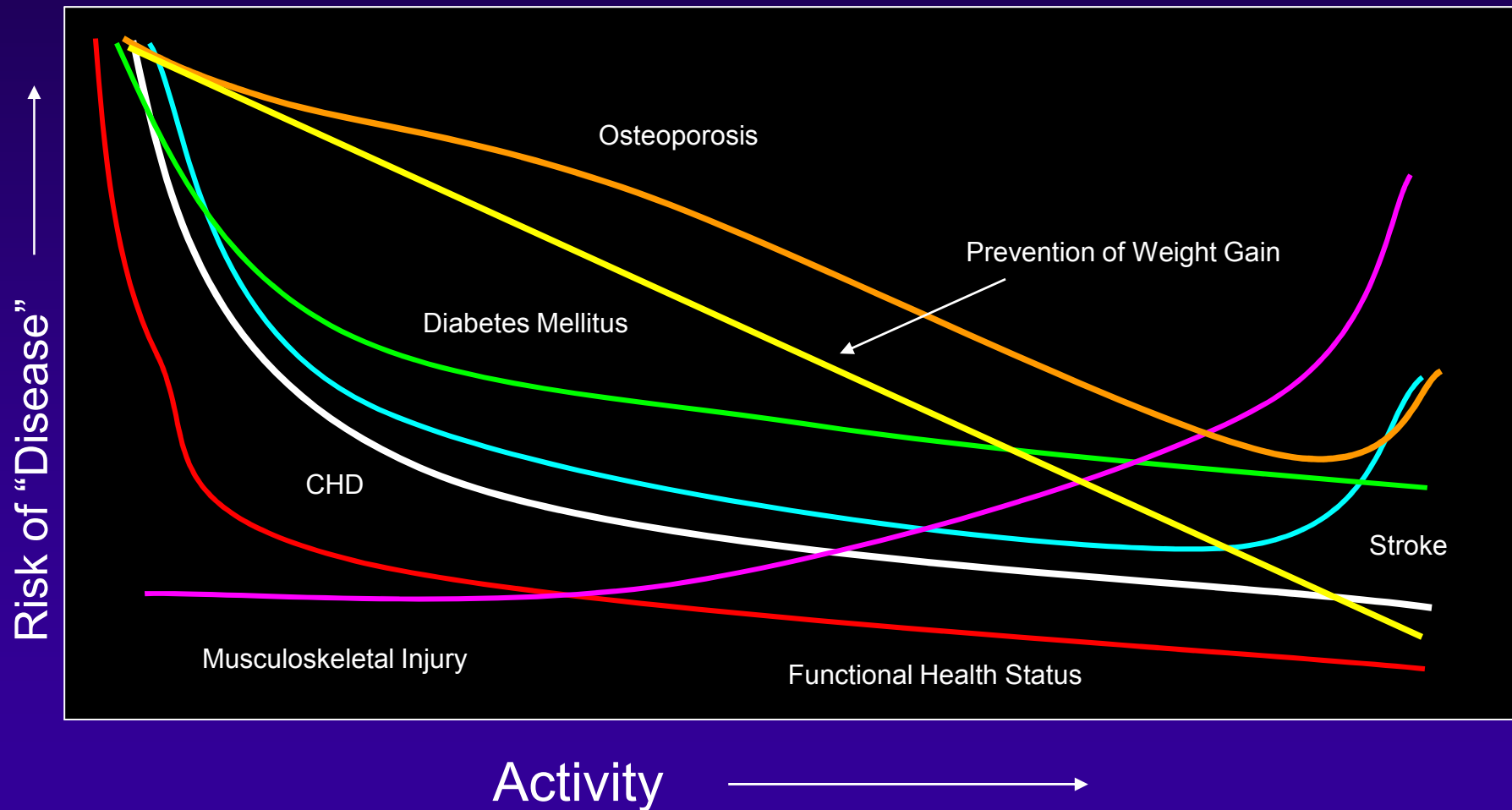
**P<0.01; *P<0.10

Change in asthma hospitalizations per 20 ppb O₃ - Carls (2010)

No control	7.0%
Control	11.6%*
Orange Alert	- 14.1%*
Red Alert	-19.9%

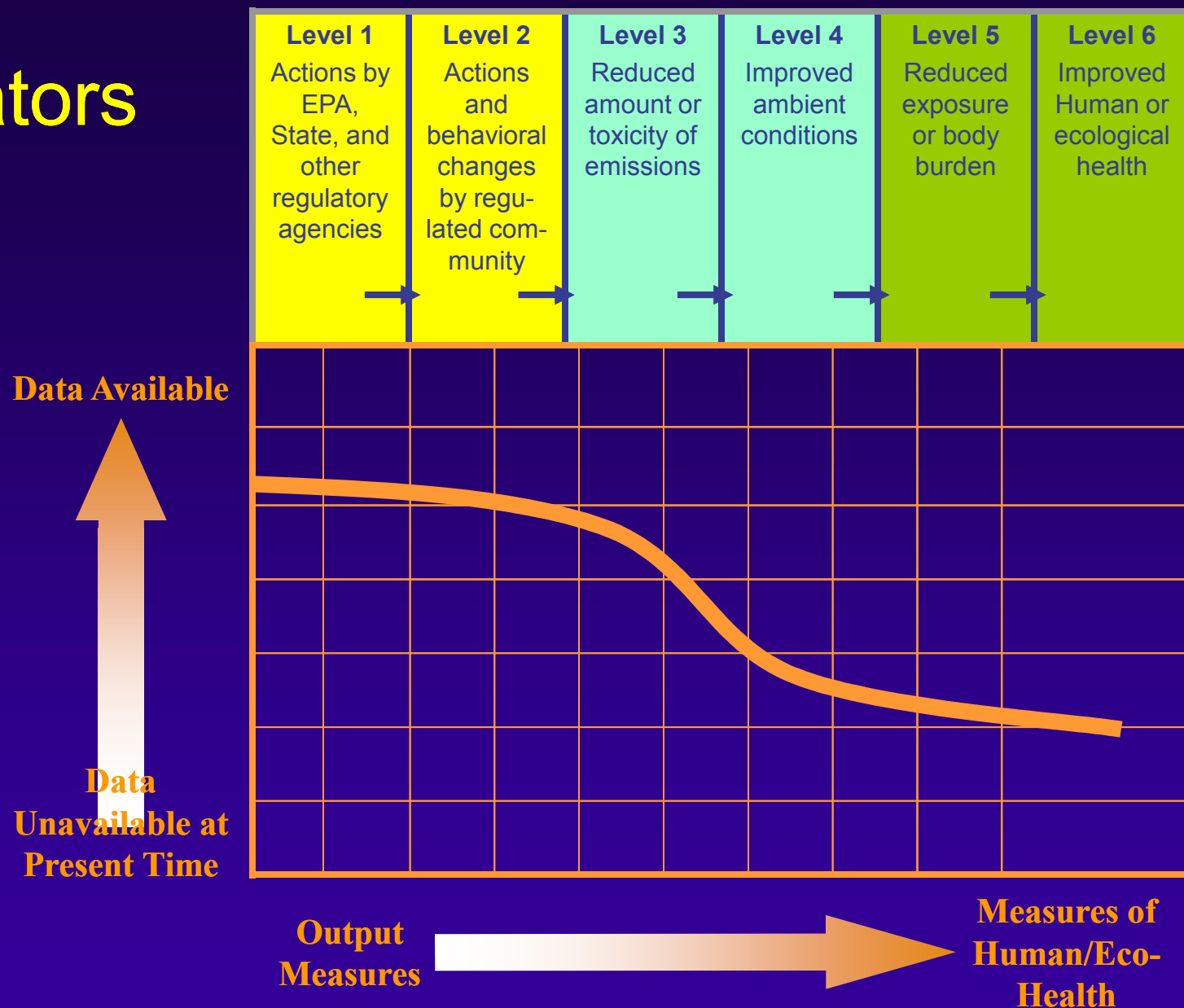
*P<0.05

Physical Activity and Health



Source: HW Kohl, University of Texas School of Public Health

Indicators



Issues to Consider

- Effects of different regulations
- Health indicators
 - Availability of health data
 - HIPAA constraints
- Effects of behavior changes
- Collaboration between Federal, State and local agencies, and health care organizations