

Secondhand Smoke Exposure and Acute Coronary Events

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Cigarette Smoking and Cardiovascular Disease

Acute Vascular Events

- Acute myocardial infarction
- Sudden death
- Stroke
- Restenosis after coronary bypass, angioplasty, thrombolysis

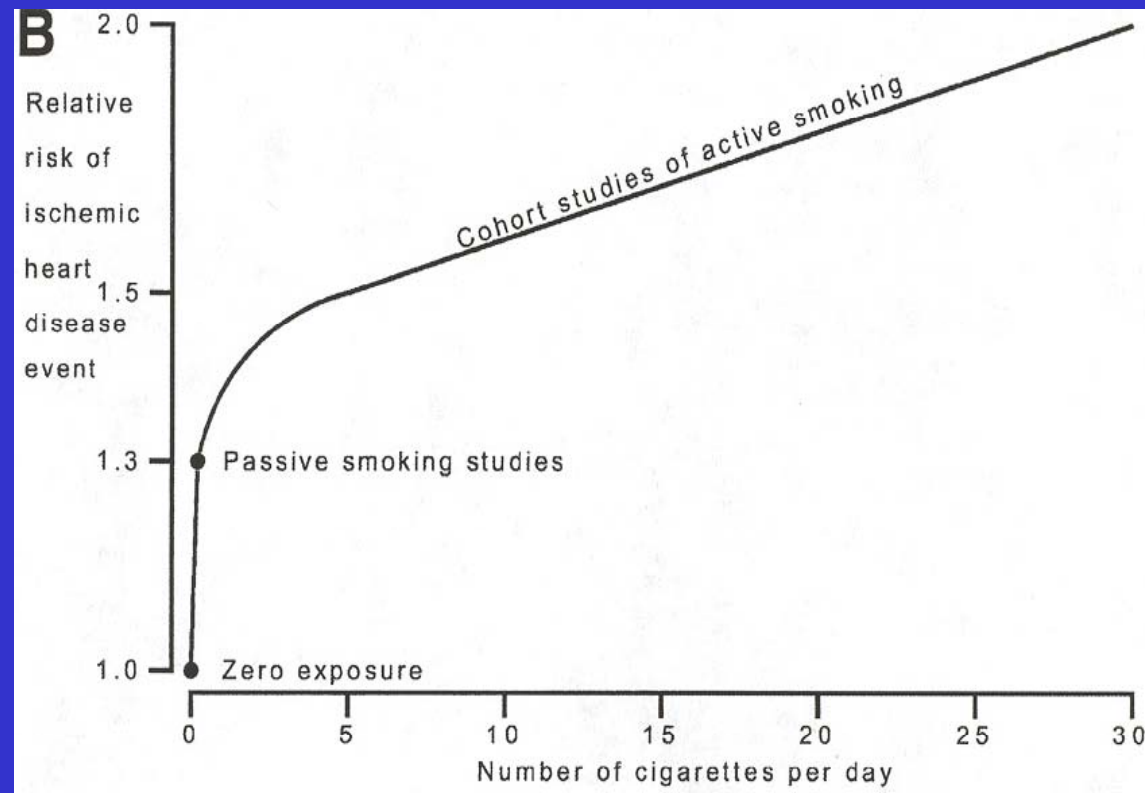
Accelerated Atherosclerosis

- Coronary arteries
- Peripheral arteries
- Carotid, cerebral arteries
- Aortic aneurysm

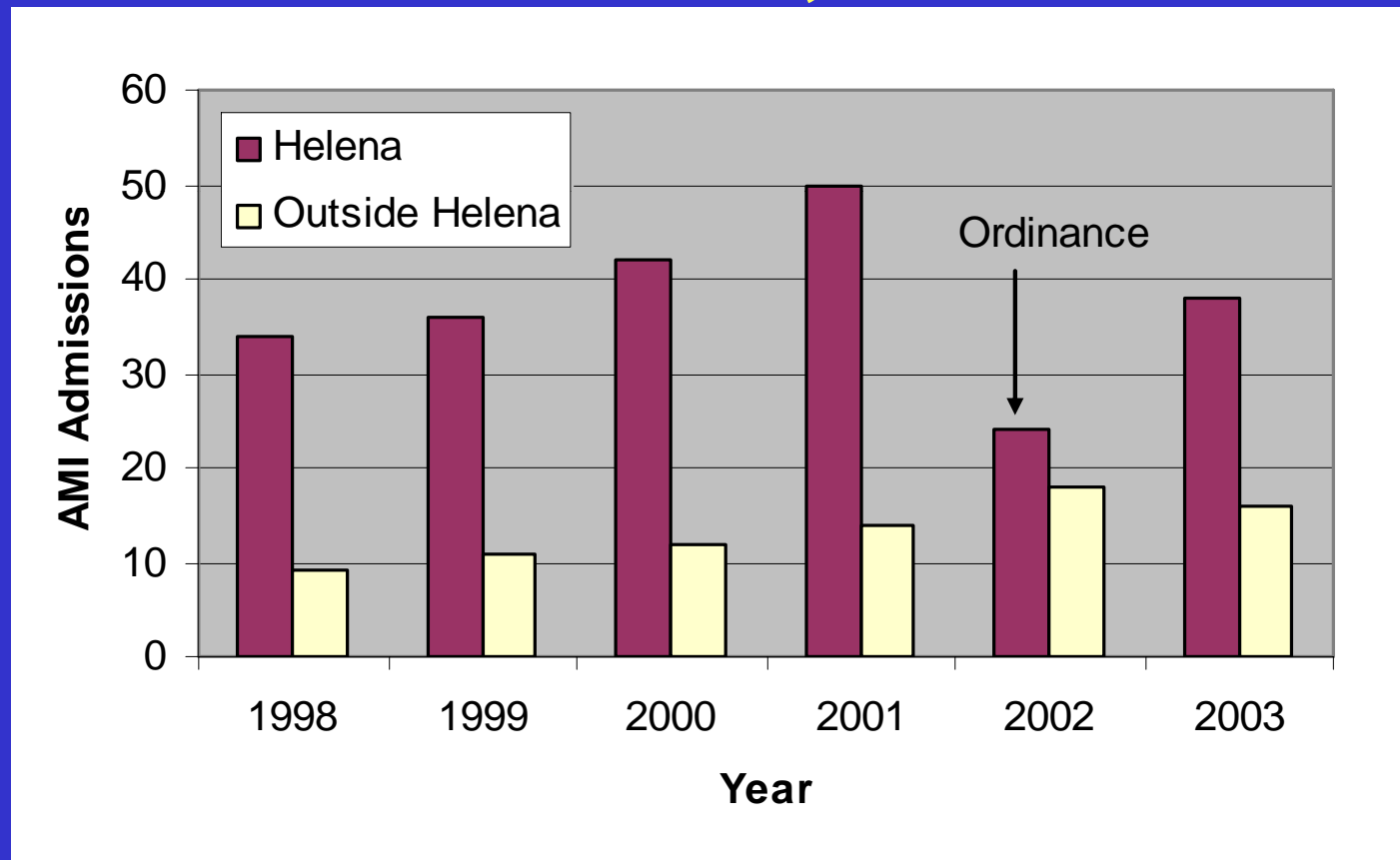
Overall Impact of Cigarette Smoking on CVD in U.S.

- 21% of all CV deaths
- 56% of ischemic heart disease deaths in people less than 65 years old

Dose-Response for Cigarette Smoking and Ischemic Heart Disease Events

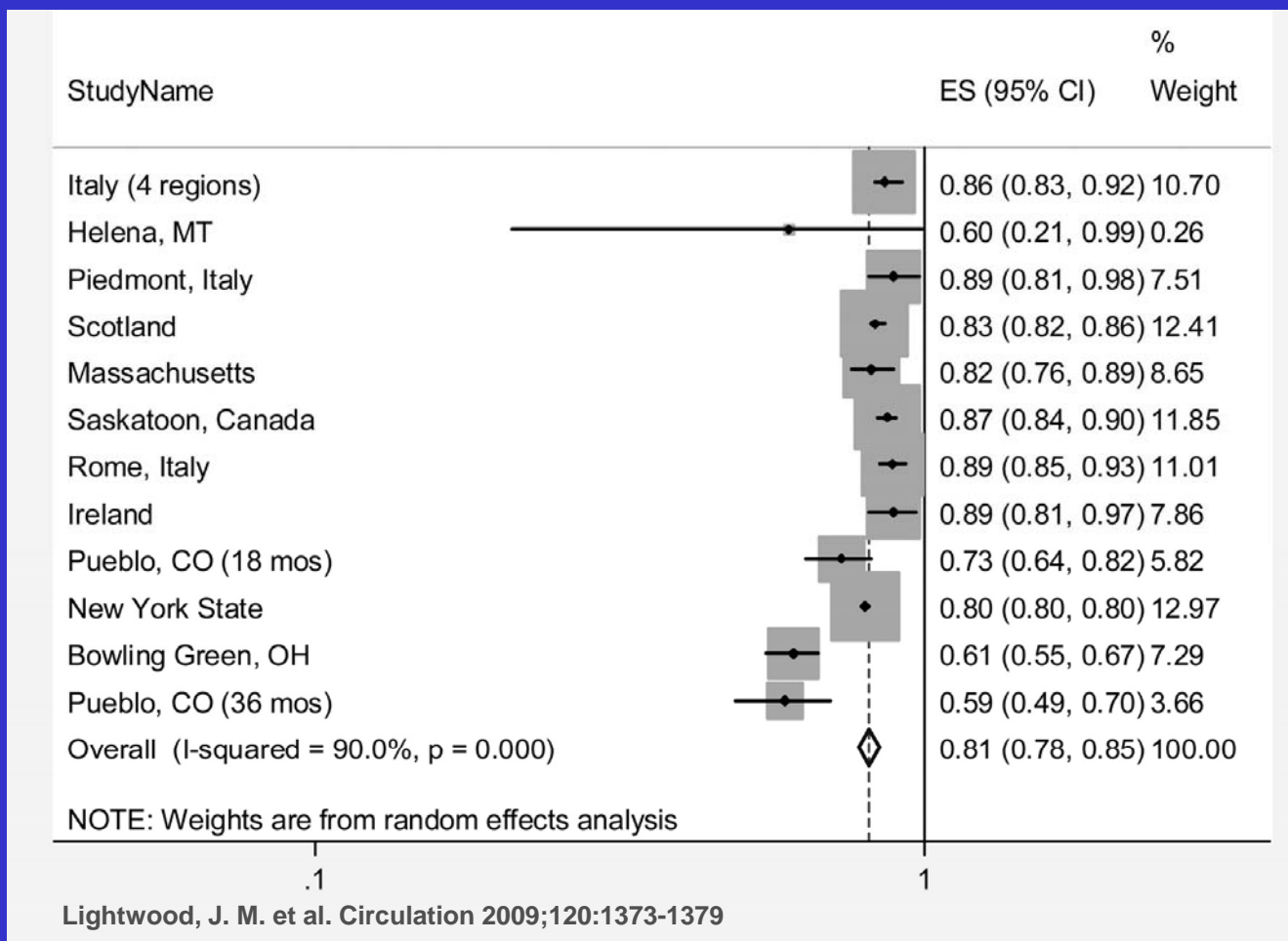


Drop in Acute Myocardial Infarction (AMI) Admissions in Helena, MT



Source: Sargent RP, Shepard RM, Glantz SA. Reduced Incidence of Admissions for Myocardial Infarction Associated with Public Smoking Ban: Before and After Study. *BMJ* 2004;328:977--80.

Meta-Analysis of Studies on Smoke-free Laws and Heart Attack Hospitalizations



IOM Report: Process

- The Institute of Medicine (IOM) report is titled *Secondhand Smoke Exposure and Acute Cardiovascular Effects: Making Sense of the Evidence*
- IOM released the report on October 15, 2009
- The report was prepared by a committee of 11 scientists with a range of relevant expertise convened by IOM
- The committee was chaired by Dr. Lynn Goldman of Johns Hopkins University Bloomberg School of Public Health



IOM Report: Process

- Took almost a year to prepare
- Funded by CDC's Office on Smoking and Health and Division of Heart Disease and Stroke Prevention
- Prepared independently from CDC
- Most comprehensive review to date of the evidence on secondhand smoke (SHS) exposure, smoke-free policies, and acute coronary events

IOM Report: Major Conclusions

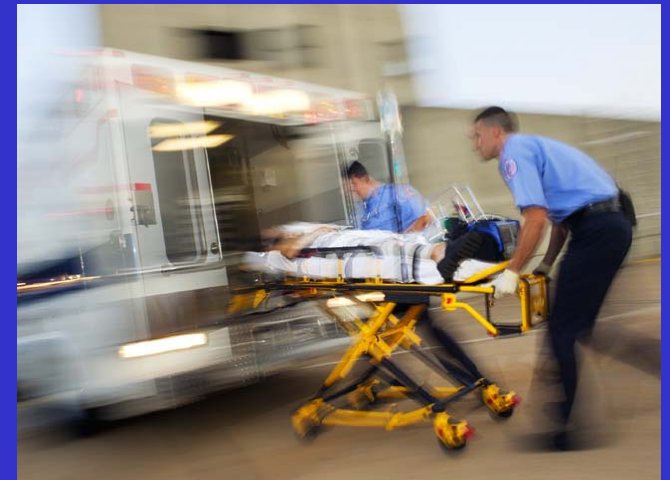
- The evidence is consistent with a *causal relationship* between *SHS exposure* and *acute coronary events*, including heart attacks.
- It is biologically plausible that a *relatively brief exposure* to SHS *could trigger an acute coronary event*.
- There is a *causal relationship* between *smoke-free laws* and *decreases in acute coronary events*.

IOM Report Findings: Epidemiology

- SHS exposure increases the risk of coronary heart disease (CHD) by 25 to 30 percent
- Studies with objective exposure assessment report higher risk estimates
- Increased risk is evident even at the lowest exposures
- Risk rises steeply at lower exposures and more gradually at higher exposures
- The U.S. population's high level of SHS exposure has important public health implications

IOM Report Findings: Mechanisms

- Experimental studies show that acute SHS exposure
 - induces endothelial dysfunction
 - increases thrombosis
 - causes inflammation
 - may adversely affect plaque stability.
- Outdoor air pollution studies have shown that a relatively brief exposure to PM can trigger an acute coronary event



Constituents of SHS that have been shown to have Significant Cardiovascular Toxicity

Oxidants

Acrolein

Particulate Matter

Metals

Benzene

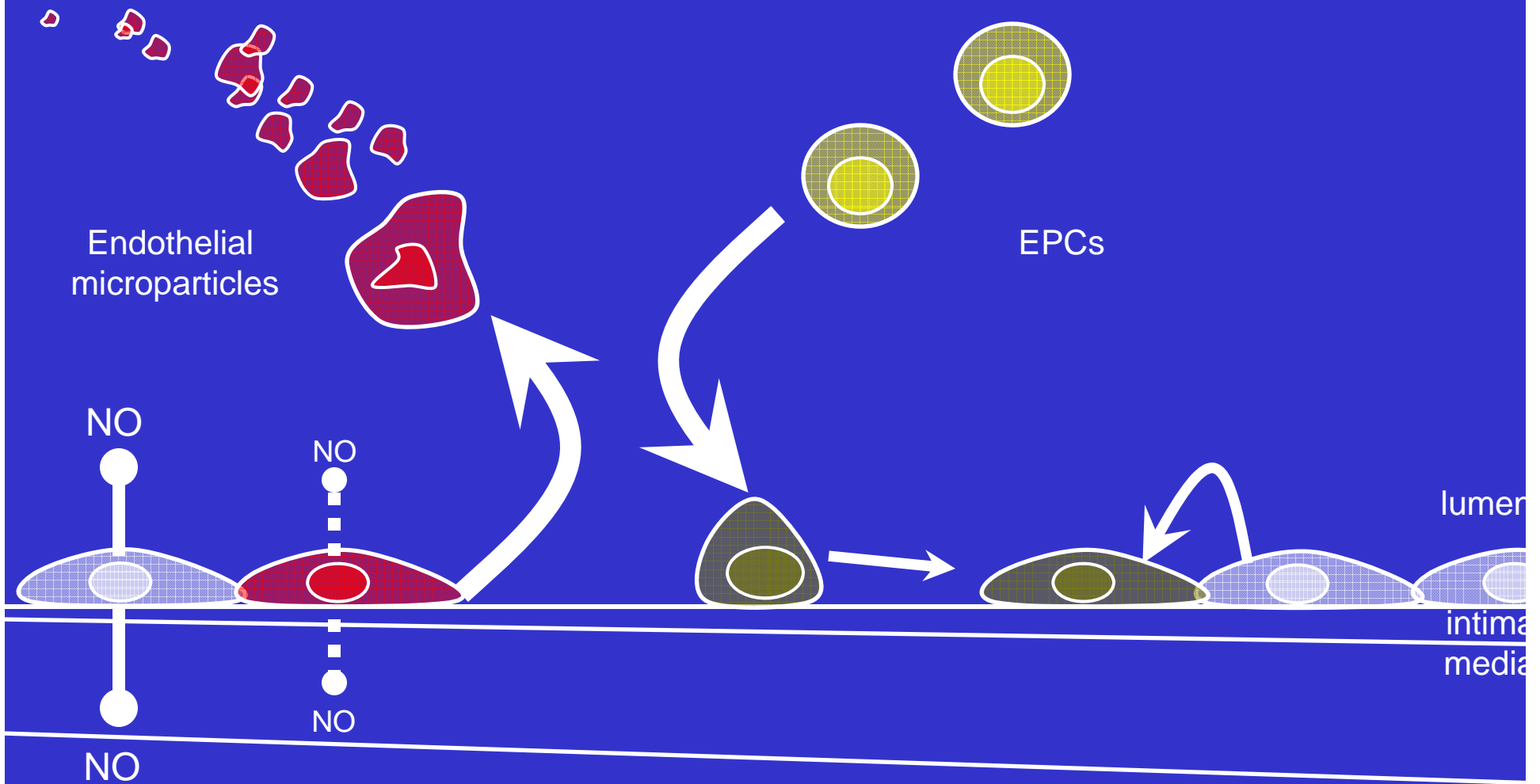
Brief Secondhand Smoke Exposure Decreases Endothelial Progenitor Cells Activity and Endothelial Function

(Heiss et al, JACC 51: 1760, 2008)

- Nonsmokers exposed to SHS or clean air in chamber for 30 minutes
- SHS resulted in plasma cotinine 0.3 ng/mL (active smokers – 200 ng/mL)

Maintenance of Vascular Endothelium

Injury ← balance → Repair



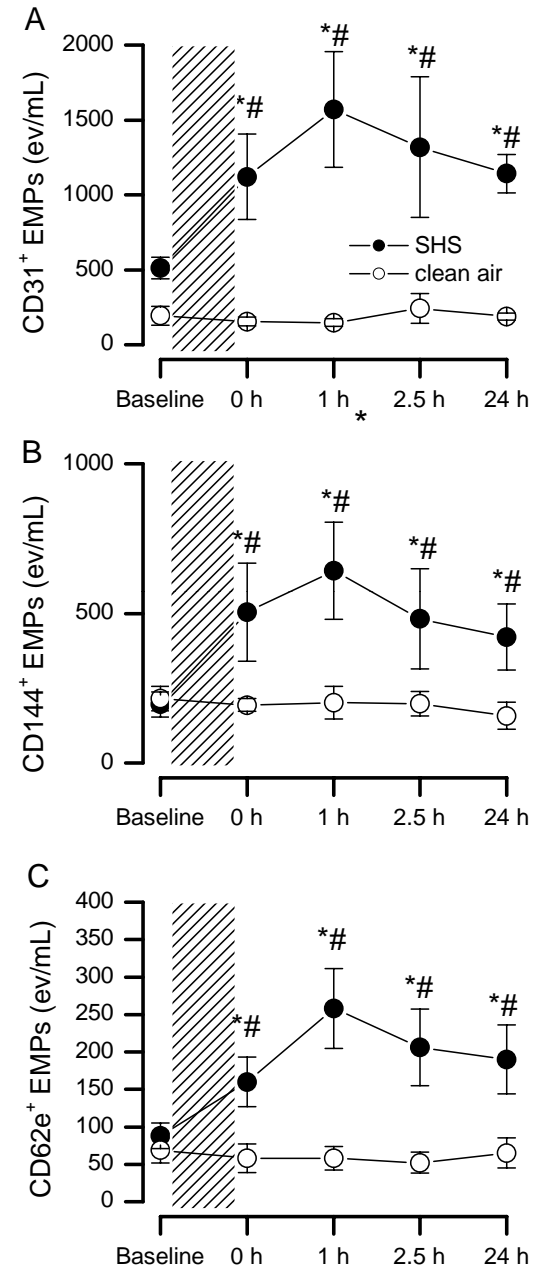
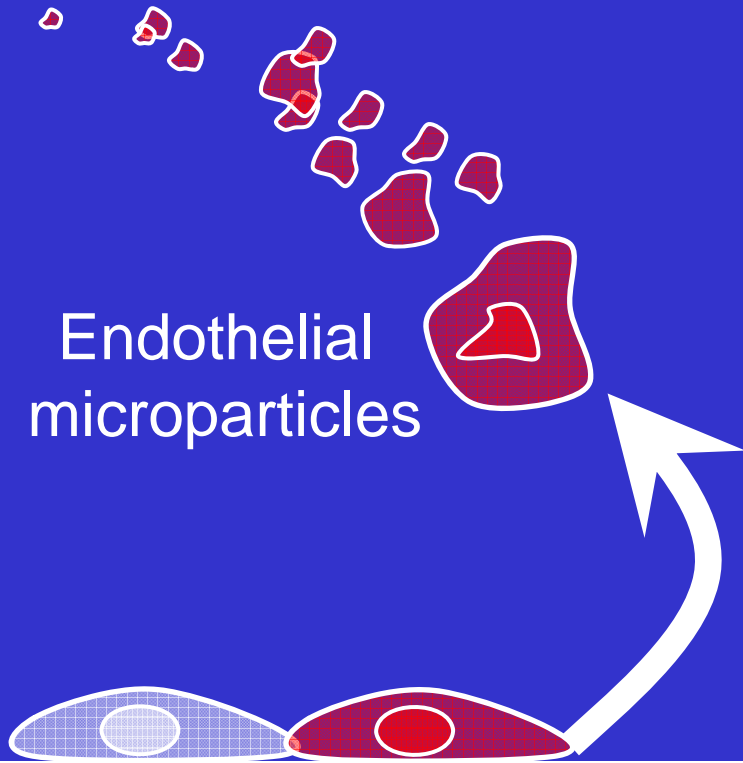
Physical evidence for endothelial damage

CD31⁺/CD41⁻
(PECAM/Gp IIb)

CD144⁺ (VE-Cadherin)
“Structural damage”

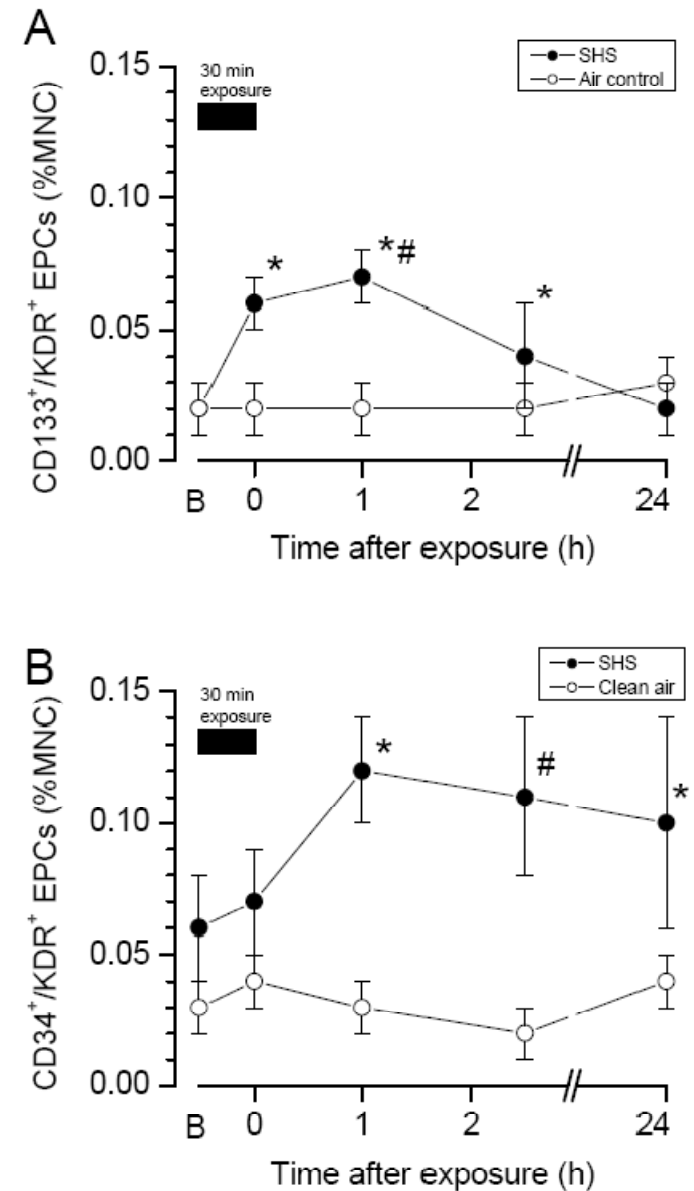
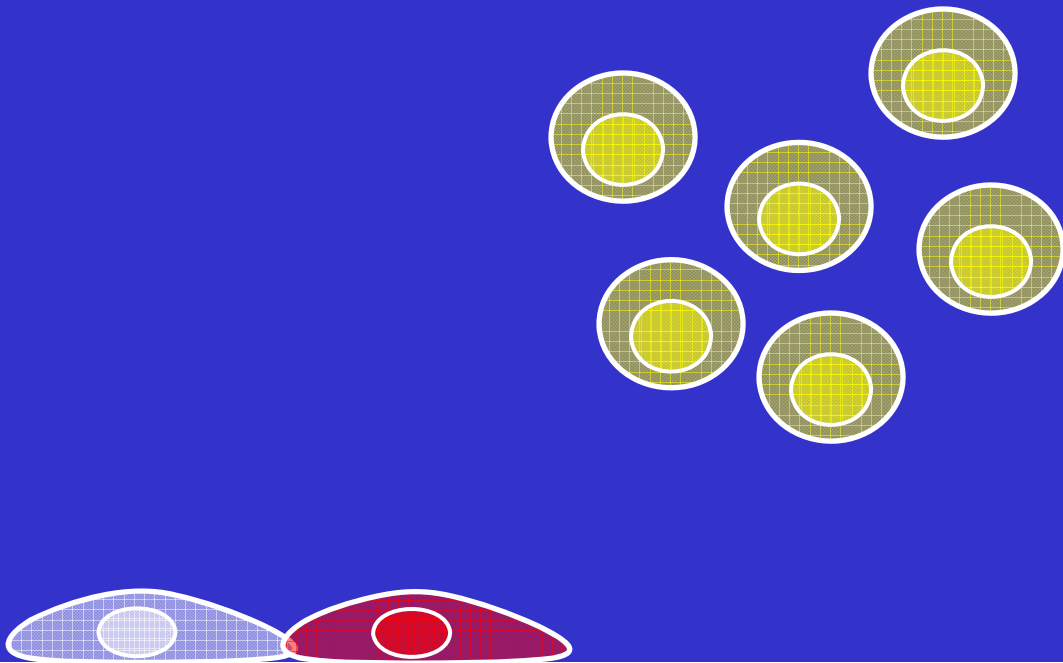
CD62e⁺ (E-Selectin)
“Activation”

Endothelial microparticles



* p<0.05 vs baseline
p<0.05 vs respective time point on control day

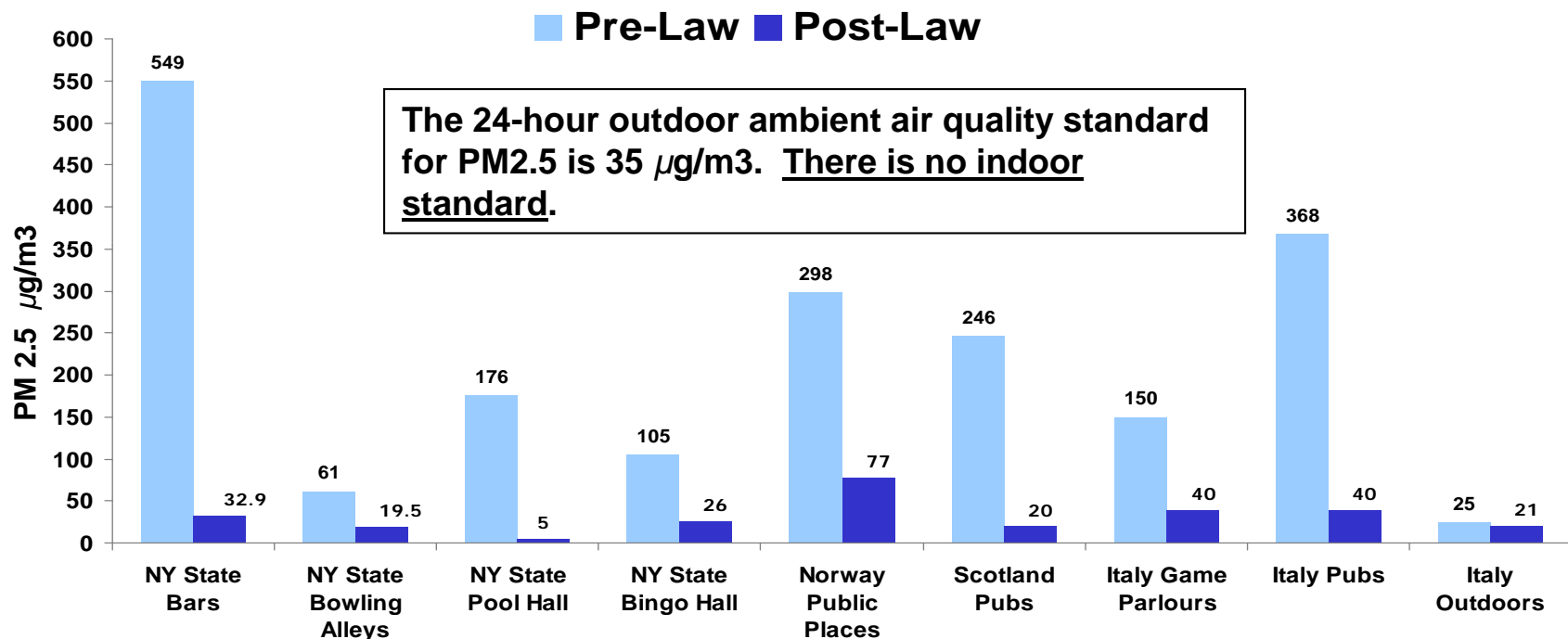
Increased EPC number in blood



* p < 0.05 vs baseline

p < 0.05 vs respective time point on control day

IOM Report Findings: PM Reductions After Smoke-free Laws



Source: Institute of Medicine. Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence. Washington, DC: The National Academies Press; 2009.

Potential Benefits

- Two recent reviews of published studies independently arrived at a pooled estimate of a 17 percent reduction in heart attack hospitalizations in the first year after a law took effect
- One of these reviews estimated that nationwide smoke-free protections could prevent 156,400 new heart attacks annually
- A study estimated that a state smoke-free law in New York generated \$56 million in health care cost savings in one year

The Bottom Line

- The evidence indicates that smoke-free policies result in significant reductions in heart attack hospitalizations
- Smoke-free policies are one of the most cost-effective and readily available approaches for preventing heart disease and heart attacks

Why This Matters

- Extending smoke-free protections to all U.S. nonsmokers could substantially reduce the burden of heart attacks, heart disease and death, and related medical and economic costs
- Provider advice to nonsmokers to avoid SHS exposure could yield additional benefits