The 10th APACT Conference

Smoking and Heart Diseases

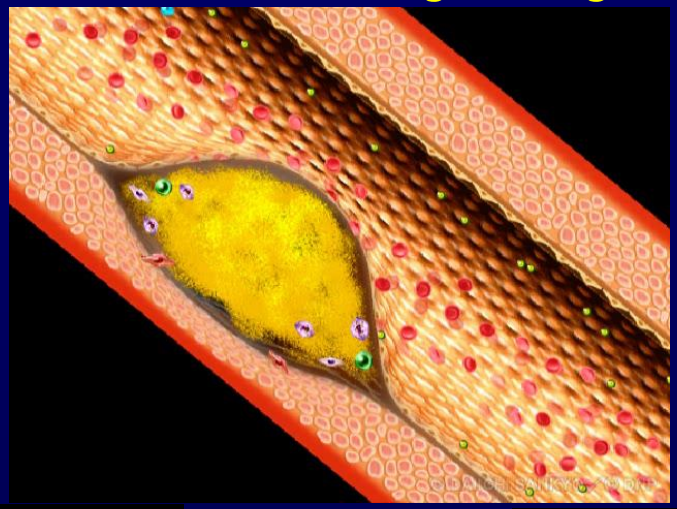
Ehime University Graduate School of Medicine
Department of Cardiology, Pulmonology, Hypertension & Nephrology

Akiyoshi OGIMOTO, Jitsuo HIGAKI

Smoking and Heart Disease Contents

- Acute Coronary Syndrome as an Tobacco Disease
- Epidemiology and Pathophysiology of Smoking
- Smoking as a Risk Factor for Heart Diseases
- Risk of Secondhand Smoke Exposure
- $PM_{2.5}$ and Smoking
- Smoking Ban

Acute Coronary Syndrome



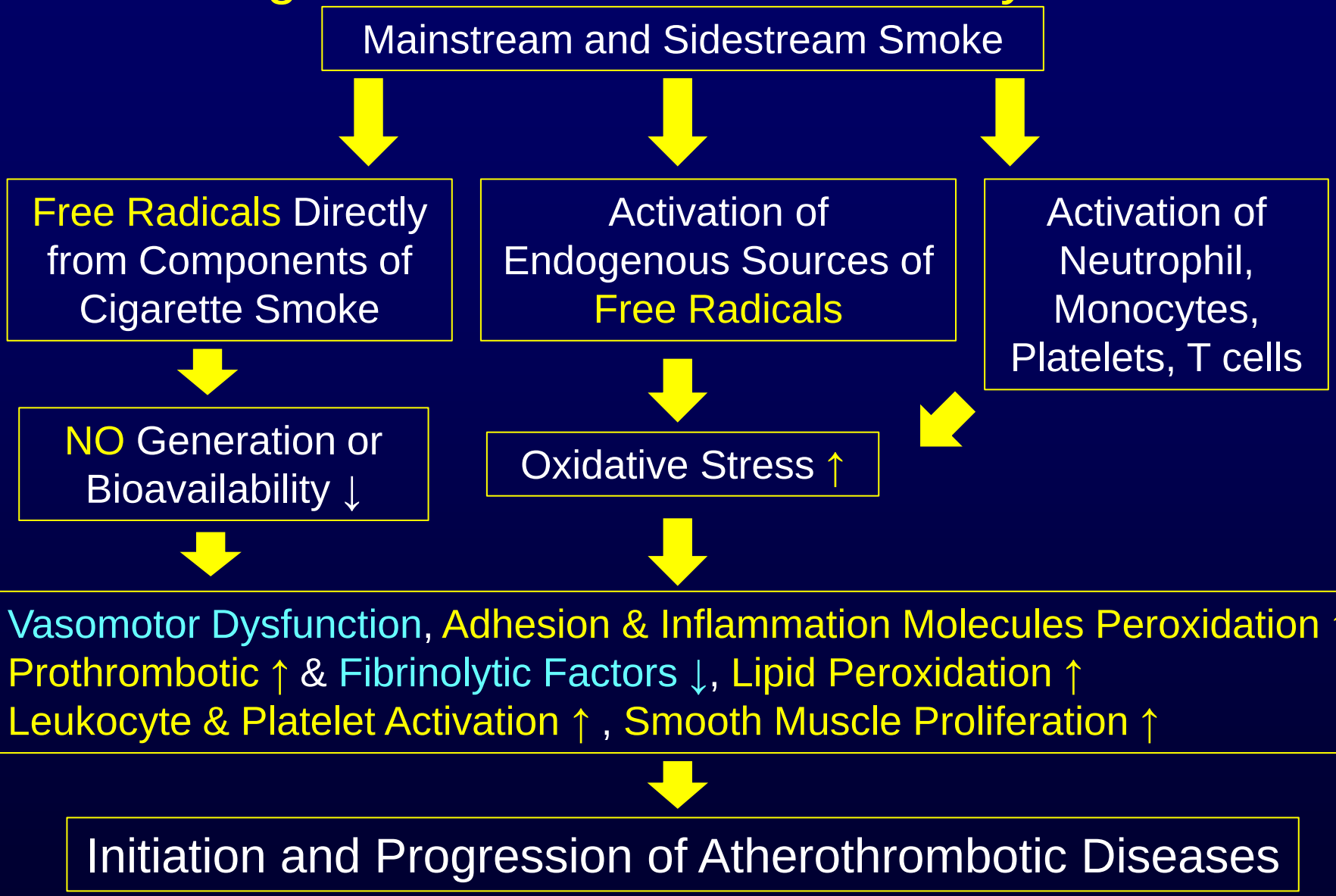
Percutaneous Coronary Intervention

Smoking Kills

- Tobacco continues to kill nearly 6 million people each year, including more than 600,000 non-smokers who die from exposure to tobacco smoke.
- If current trends continue, by 2030 tobacco will kill more than 8 million people worldwide each year.
- Up to half of the world's 1 billion smokers will eventually die of a tobacco-related disease.

WHO: Warning about the dangers of tobacco.
WHO report on the global tobacco epidemic, 2011.

Potential Pathways and Mechanisms for Cigarette Smoking-Mediated Cardiovascular Dysfunction



Ambrose JA, et al. ***J Am Coll Cardiol*** 2004; 43: 1731-7.

Smoking Rate in Patients With STEMI and General Population

Mean, %				
Age, y	Smoking Rate in Patients With STEMI	Estimated Smoking Rate in the General Population	STEMI Cases, No	Odds Ratio (95% CI)
18-34	78	24	91	11.4 (10.0-12.8)
35-39	72	22	173	8.9 (7.7-10.0)
40-44	69	21	396	8.2 (7.3-9.2)
45-49	67	24	735	6.3 (5.6-7.0)
50-54	65	27	1,010	5.1 (4.5-5.6)
55-59	54	23	1,124	4.0 (3.5-4.4)
60-64	44	20	1,012	3.2 (2.8-3.6)
>65	23	10	2,351	2.7 (2.4-3.0)
Overall	46	21	6,892	3.4 (3.3-3.4)

STEMI, ST elevation myocardial infarction

Larsen GK, et al. ***JAMA Intern Med*** 2013; 173: 1261-2.

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Smoking is a powerful risk factor contributing to new onset STEMI, especially in young population.

STEMI, ST elevation myocardial infarction

Larsen GK, et al. ***JAMA Intern Med*** 2013; 173: 1261-2.

Ten-year Risk of Fatal Cardiovascular Disease

in Populations at High Cardiovascular Disease Risk

65 years old Men

Conroy RM, et al. ***Eur Heart J*** 2003; 24: 987-1003.

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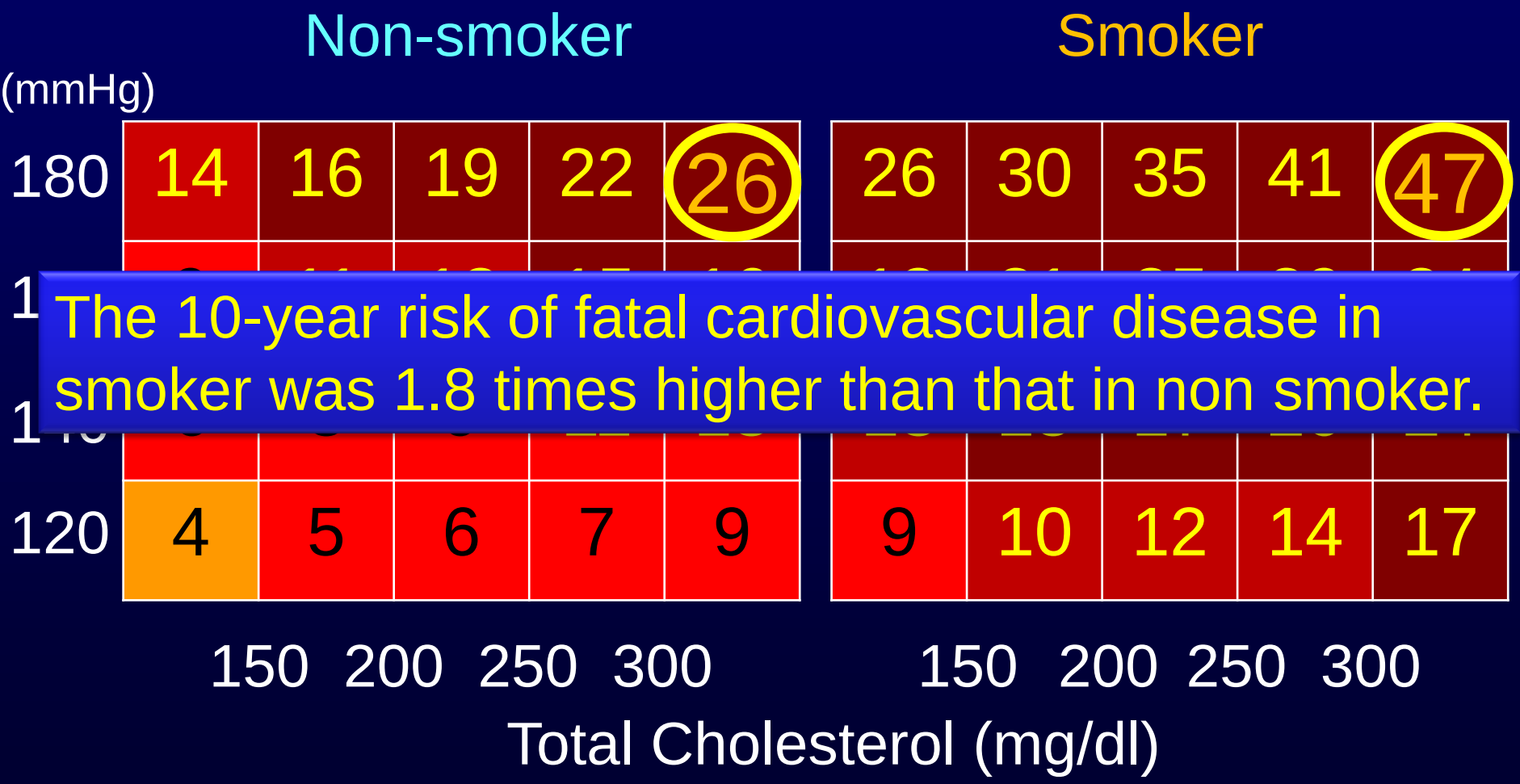
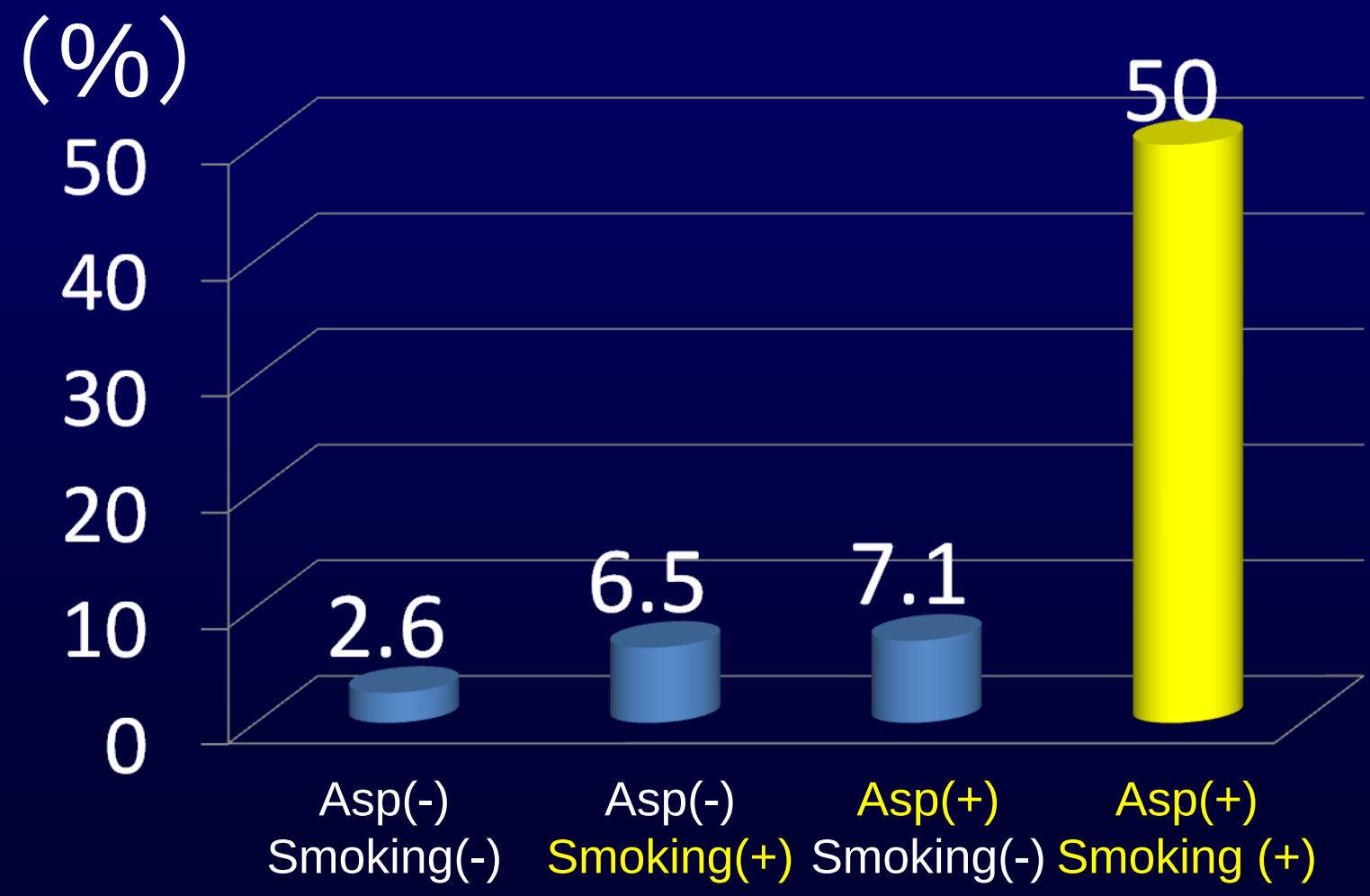


The 10-year risk of fatal cardiovascular disease in smoker was 1.8 times higher than that in non smoker.

Conroy RM, et al. ***Eur Heart J*** 2003; 24: 987-1003.

Frequencies of Coronary Spastic Angina in Patients With Hypertrophic Cardiomyopathy

Cumulative Effects of *eNOS* 298Asp Allele and Smoking Habit



Ogimoto A, et al. ***J Mol Med*** 2005; 83: 619-25.

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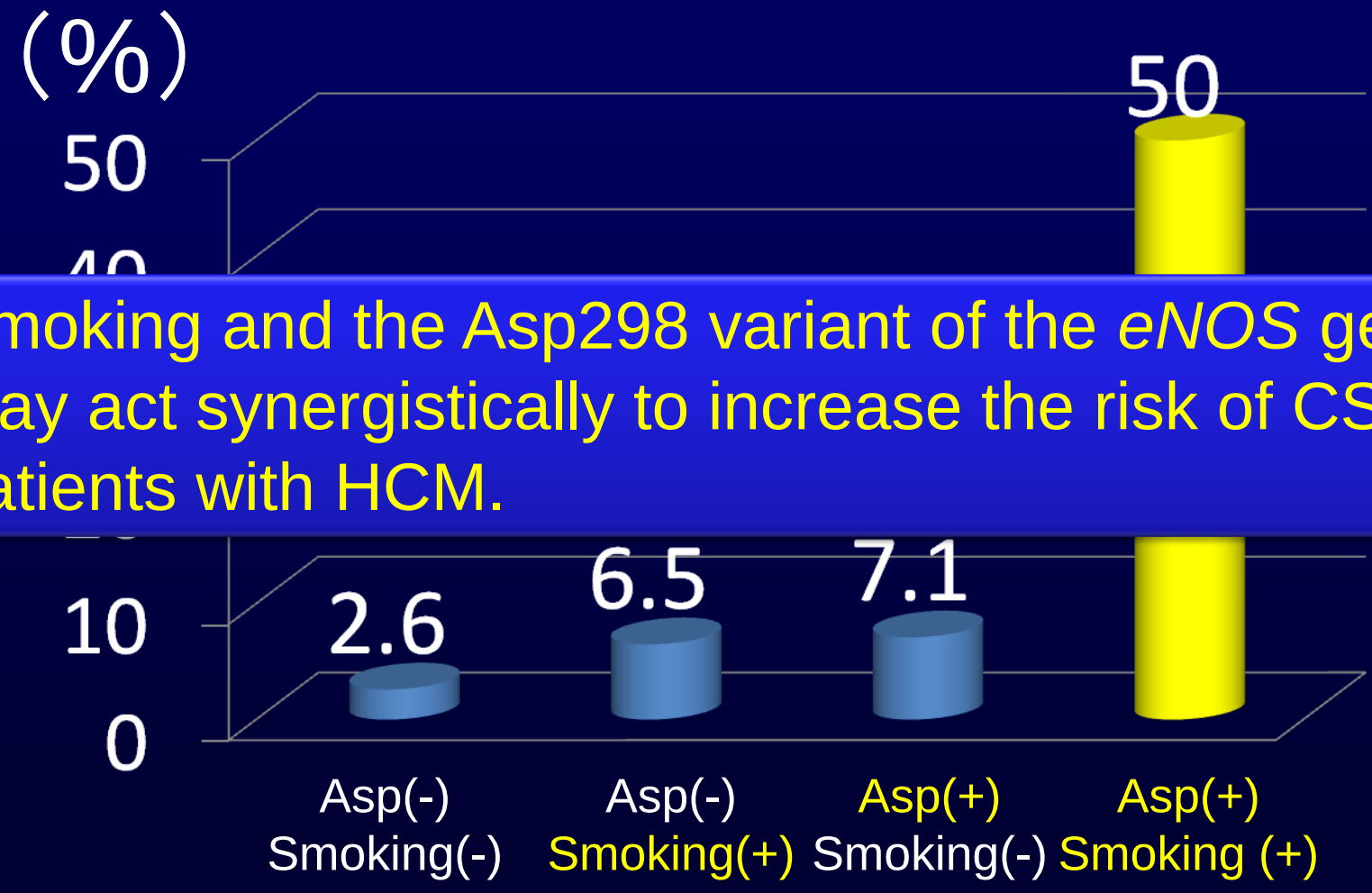
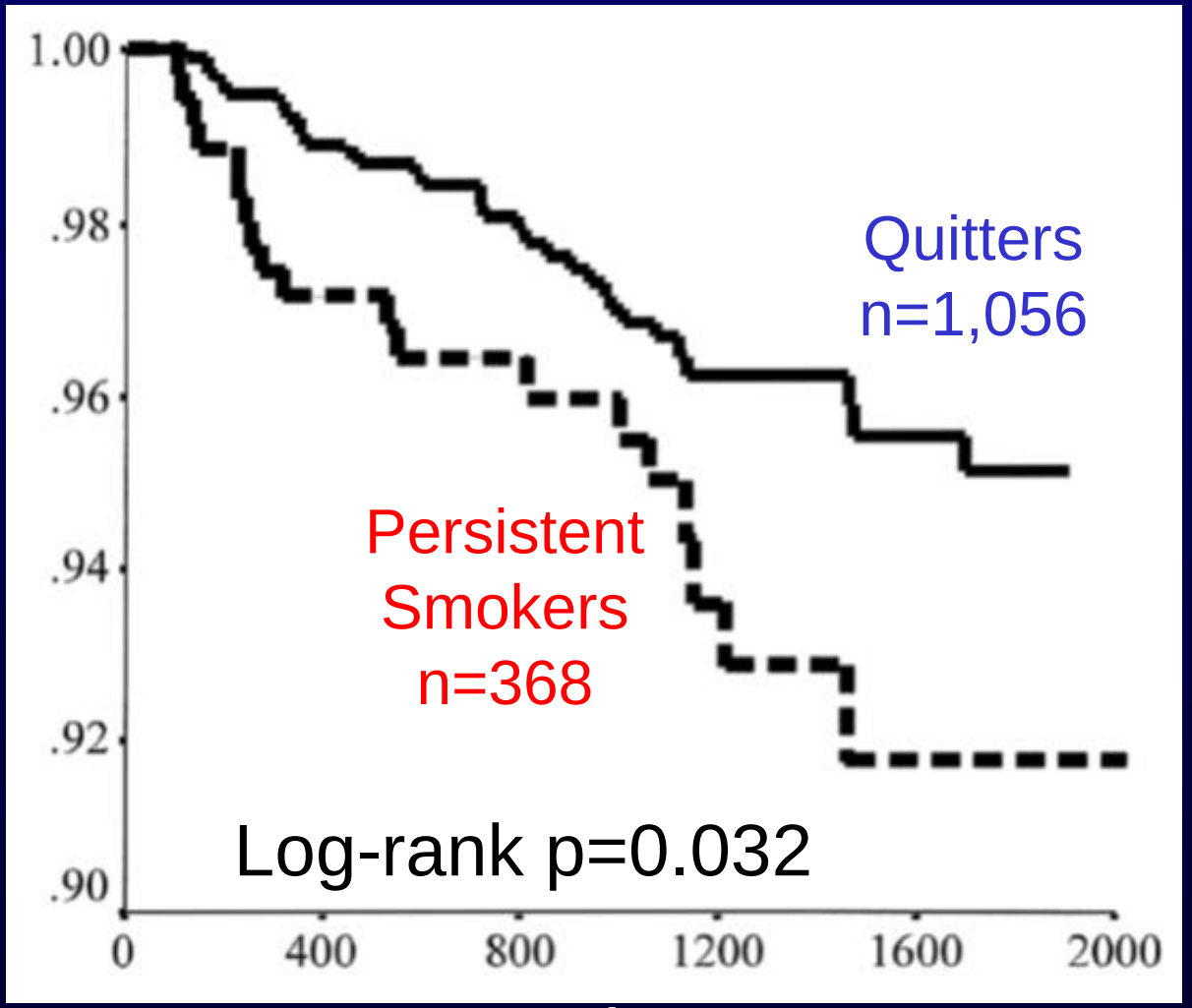


Smoking and the Asp298 variant of the *eNOS* gene may act synergistically to increase the risk of CSA in patients with HCM.

Ogimoto A, et al. ***J Mol Med*** 2005; 83: 619-25.

Kaplan-Meier Survival Curves for Long-Term Mortality According to Subsequent Smoking Status in Patients With AMI



Kinjo K, et al. ***Circ J*** 2005; 69: 7-12.

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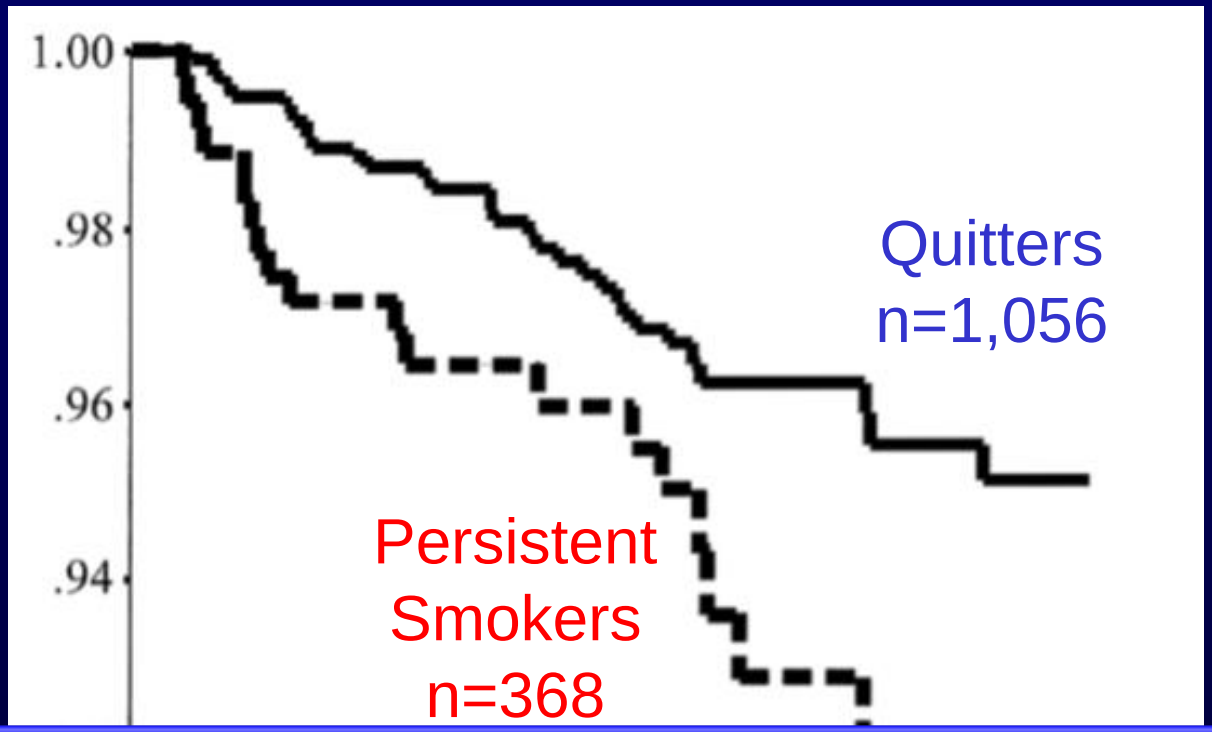
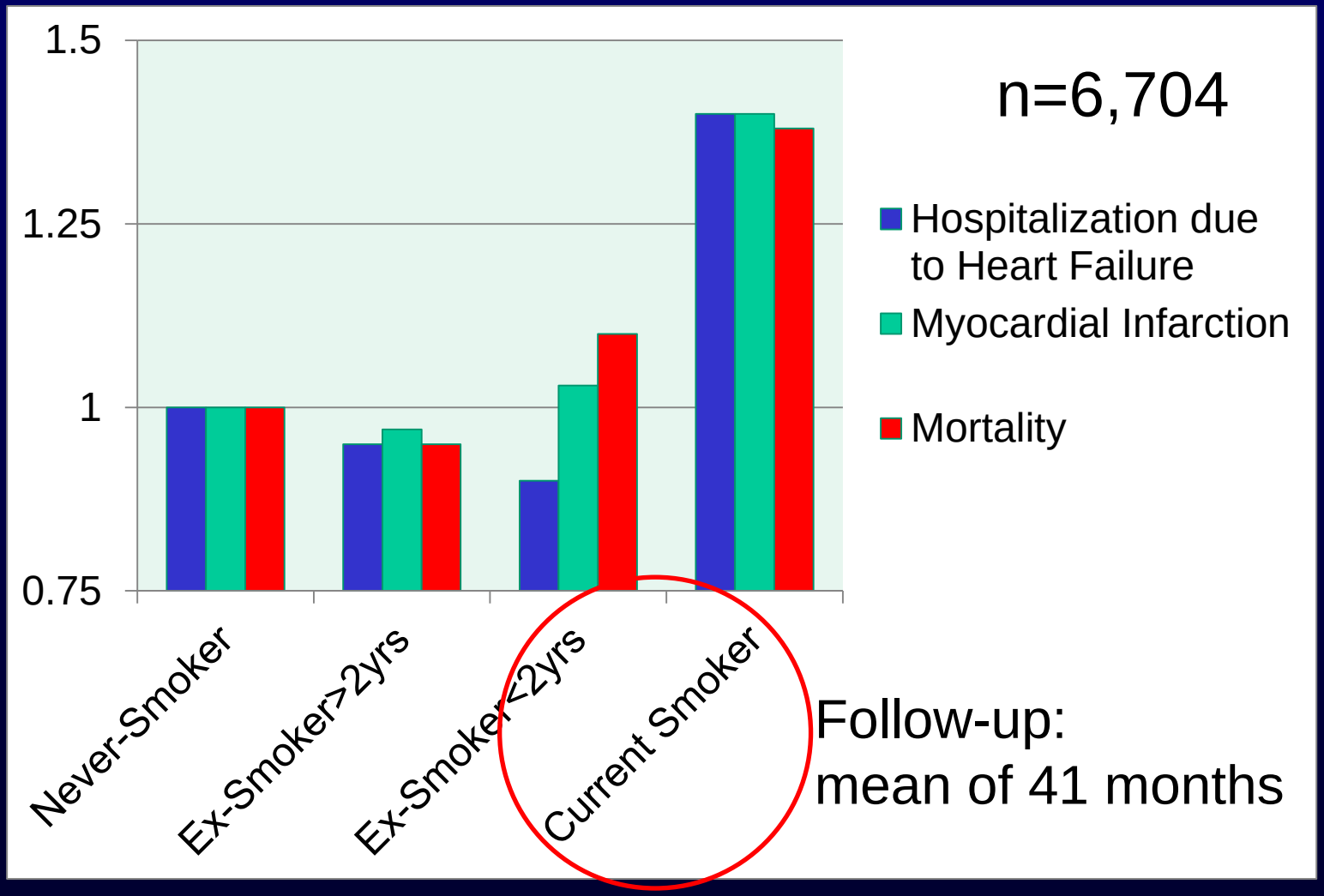


Patients who continue to smoke after AMI are at greater risk for death than patients who quit smoking. Cessation of smoking benefits the long-term prognosis in patients with AMI.

Kinjo K, et al. ***Circ J*** 2005; 69: 7-12.

Relative Risk of Events by Smoking Status Adjusted for Baseline Characteristics in Patients With Left Ventricular Dysfunction



Suskin N, et al. ***J Am Coll Cardiol*** 2001; 37: 1677-82.

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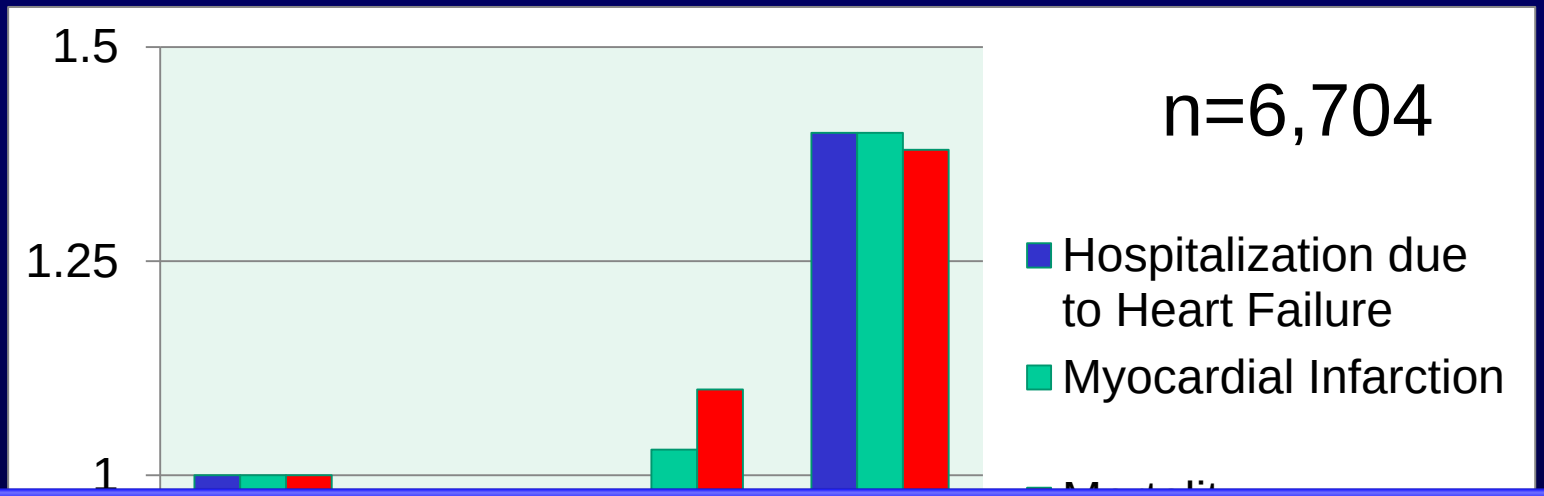
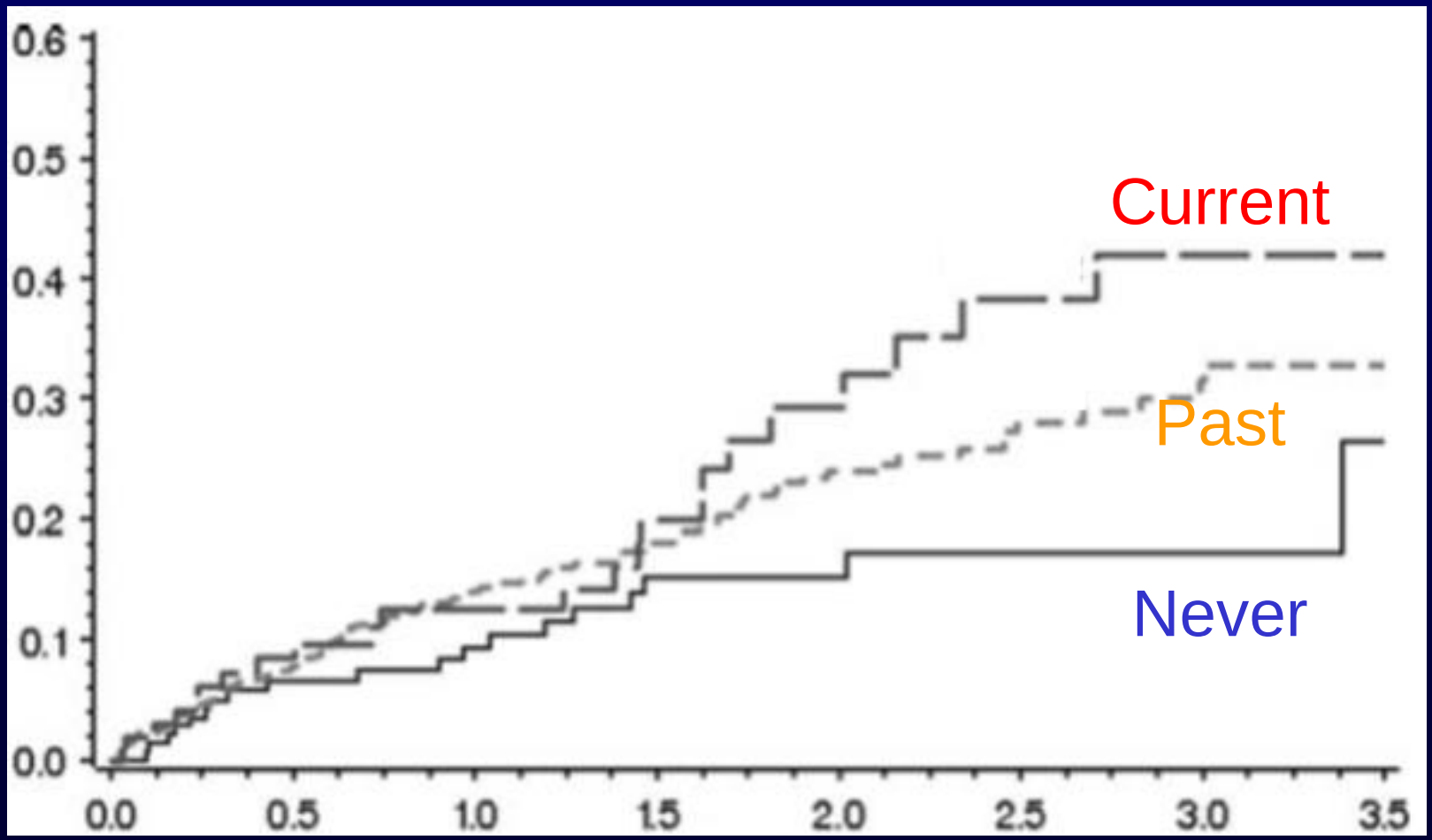


Quitting smoking appears to have a substantial and early effect (within two years) on decreasing morbidity and mortality in patients with left ventricular dysfunction, which is at least as large as proven drug treatments recommended in patients with left ventricular dysfunction.

Suskin N, et al. ***J Am Coll Cardiol*** 2001; 37: 1677-82.

Kaplan-Meier Estimates of the Probability of Appropriate ICD Therapy for VF or VT by Smoking Status



Goldenberg I, et al. ***J Cardiovasc Electrophysiol*** 2006; 17: 931-6.

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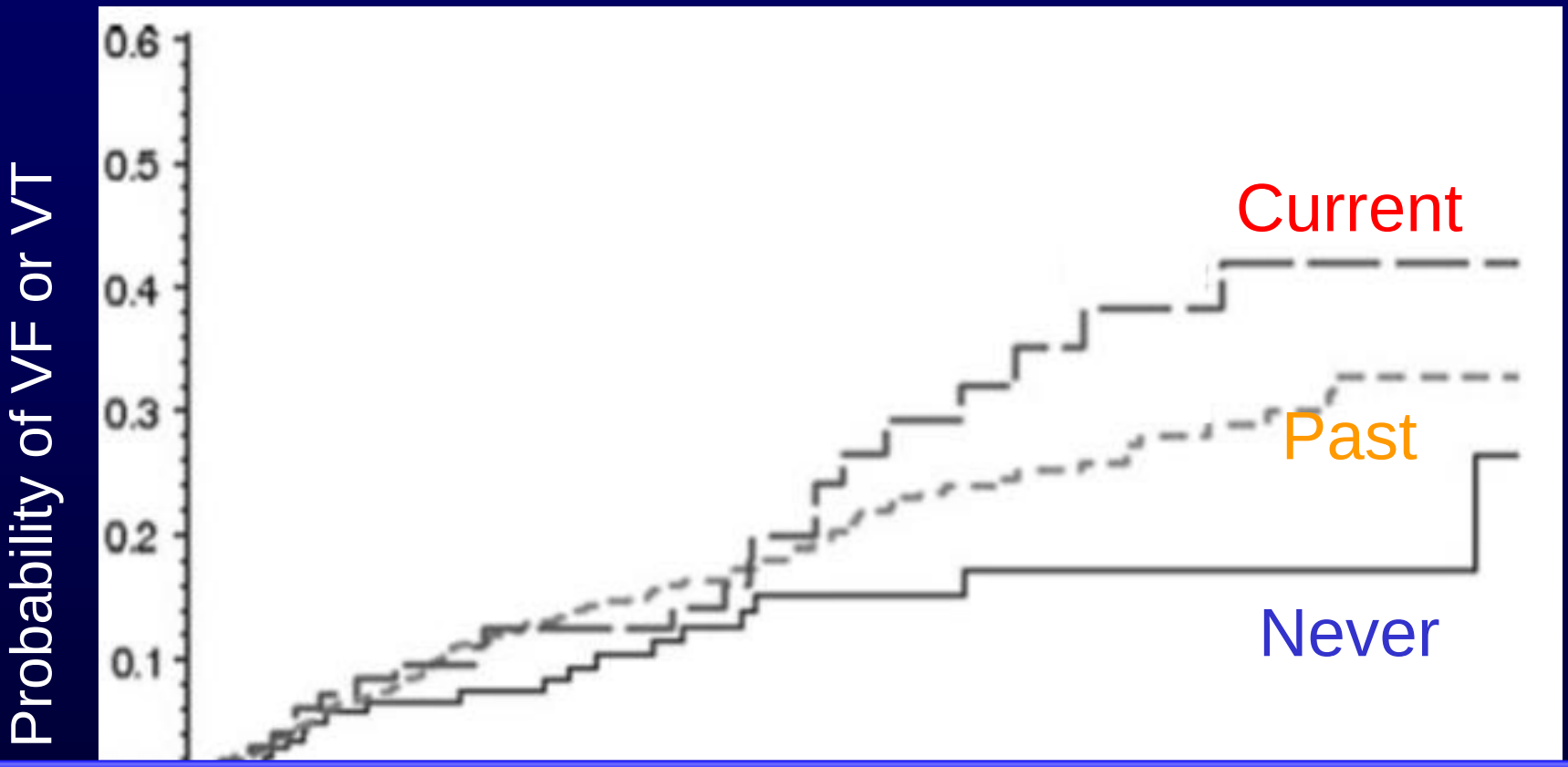


These findings stress the importance of complete smoking cessation in this high-risk population.

Goldenberg I, et al. ***J Cardiovasc Electrophysiol*** 2006; 17: 931-6.

Association of Smoking Cessation and Weight Change With Cardiovascular Disease Among Adults With and Without Diabetes

	Mean (SD)			
		Former Smokers		
	Smokers	Recent Quitters (≤4 y)	Long-term Quitters (>4 y)	Nonsmokers
No diabetes				
No. of participants	978	205	676	920
BMI at examination 3[a]	25.4 (4.2)	26.5 (4.6)	25.9 (3.9)	25.4 (4.3)
Weight at examination 3, kg	73.8 (15.7)	77.3 (15.7)	74.3 (14.3)	71.4 (14.6)
4-y weight change, kg				
Mean (SD) [95% CI][b]	1.2 (5.4) [0.9 to 1.4]	3.0 (7.3) [2.4 to 3.7]	0.9 (5.0) [0.7 to 1.0]	1.2 (5.2) [1.0 to 1.4]
Median (IQR)	0.9 (−1.8 to 4.6)	2.7 (−0.5 to 6.4)	0.9 (−1.4 to 3.2)	1.4 (−1.4 to 3.6)
Diabetes				
No. of participants	148	31	118	148
BMI at examination 3	28.7 (5.2)	29.8 (5.1)	29.1 (5.6)	30.3 (5.8)
Weight at examination 3, kg	84.2 (17.7)	88.3 (15.8)	85.8 (17.1)	84.2 (17.0)
4-y weight change, kg				
Mean (SD) [95% CI][b]	0.0 (7.4) [−0.1 to 1.1]	3.8 (7.6) [2.1 to 5.4]	0.1 (6.4) [−0.5 to 0.6]	0.5 (6.7) [−0.1to 1.1]
Median (IQR), kg	0.9 (−3.2 to 4.1)	3.6 (−1.4 to 8.2)	0.0 (−3.2 to 3.2)	0.5 (−2.7 to 3.6)

Clair C, et al. ***JAMA*** 2013; 309: 1014-21.

Association of Smoking Cessation and Weight Change With Cardiovascular Disease Among Adults With and Without Diabetes

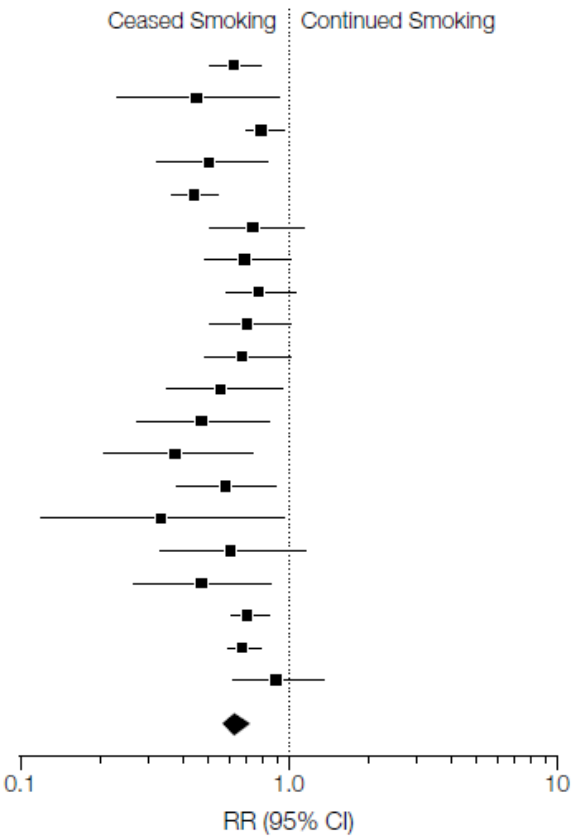
	Smokers	Former Smokers		Nonsmokers
		Recent Quitters (≤4 y)	Long-term Quitters (>4 y)	
No diabetes				
No. of person-examinations	1924	591	3761	3392
No. of CVD events	143	29	218	116
Age- and sex-adjusted IR of CVD per 100 person-examinations (95% CI)	5.89 (4.86-7.11)	3.22 (2.06-4.50)	3.06 (2.56-3.67)	2.43 (1.95-3.03)
HR (95% CI)				
Age- and sex-adjusted	1 [Reference]	0.50 (0.25-1.00)	0.50 (0.37-0.68)	0.32 (0.22-0.45)
Adjusted for CVD risk factors[b]	1 [Reference]	0.47 (0.23-0.94)	0.46 (0.34-0.63)	0.30 (0.21-0.44)
Adjusted for CVD risk factors and weight change	1 [Reference]	0.49 (0.24-0.99)	0.46 (0.34-0.63)	0.31 (0.21-0.44)

There is a net cardiovascular benefit of smoking cessation, despite subsequent weight gain.

Clair C, et al. ***JAMA*** 2013; 309: 1014-21.

Pooled Relative Risks of Mortality Reduction When Patients With CHD Stop Smoking: Random-Effects Meta-analysis of All 20

Study	Ceased Smoking		Continued Smoking		Weight, %	RR (95% CI)
	Patients, No.	Deaths, No.	Patients, No.	Deaths, No.		
Aberg et al,[41] 1983	542	110	443	142	8.3	0.63 (0.51-0.79)
Baughman et al,[51] 1982	45	9	32	14	1.8	0.46 (0.23-0.92)
Bednarzewski et al,[36] 1984	455	136	555	205	9.3	0.81 (0.68-0.97)
Burr et al,[38] 1992	665	27	521	41	3.5	0.52 (0.32-0.83)
Daly et al,[43] 1983	217	80	157	129	9.0	0.45 (0.37-0.54)
Greenwood et al,[19] 1995	396	64	136	29	4.5	0.76 (0.51-1.12)
Gupta et al,[37] 1993	173	56	52	24	4.9	0.70 (0.49-1.01)
Hallstrom et al,[46] 1986	91	34	219	104	6.1	0.79 (0.58-1.06)
Hasdai et al,[42] 1997	435	41	734	97	5.2	0.71 (0.50-1.01)
Hedback et al,[52] 1993	83	31	74	40	5.2	0.69 (0.49-0.98)
Herlitz et al,[50] 1995	115	20	102	31	3.2	0.57 (0.35-0.94)
Johansson et al,[7] 1985	81	14	75	27	2.6	0.48 (0.27-0.84)
Perkins and Dick,[47] 1985	52	9	67	30	2.1	0.39 (0.20-0.74)
Salonen,[45] 1980	221	26	302	60	4.0	0.59 (0.39-0.91)
Sato et al,[8] 1992	59	5	28	7	0.9	0.34 (0.12-0.97)
Sparrow and Dawber,[48] 1978	56	10	139	40	2.3	0.62 (0.33-1.15)
Tofler et al,[49] 1993	173	14	220	37	2.5	0.48 (0.27-0.86)
Van Domburg et al,[39] 2000	238	109	318	202	9.8	0.72 (0.61-0.85)
Vlietstra et al,[40] 1986	1490	223	2675	588	10.4	0.68 (0.59-0.78)
Voors et al,[44] 1996	72	26	95	37	4.4	0.93 (0.62-1.38)
Overall	5659	1044	6944	1884	100.0	0.64 (0.58-0.71)



36% reduction in crude relative risk (RR) of mortality for patients with CHD who quit compared with those who continued smoking.

Critchley JA, et al. ***JAMA*** 2003; 290: 86-97.

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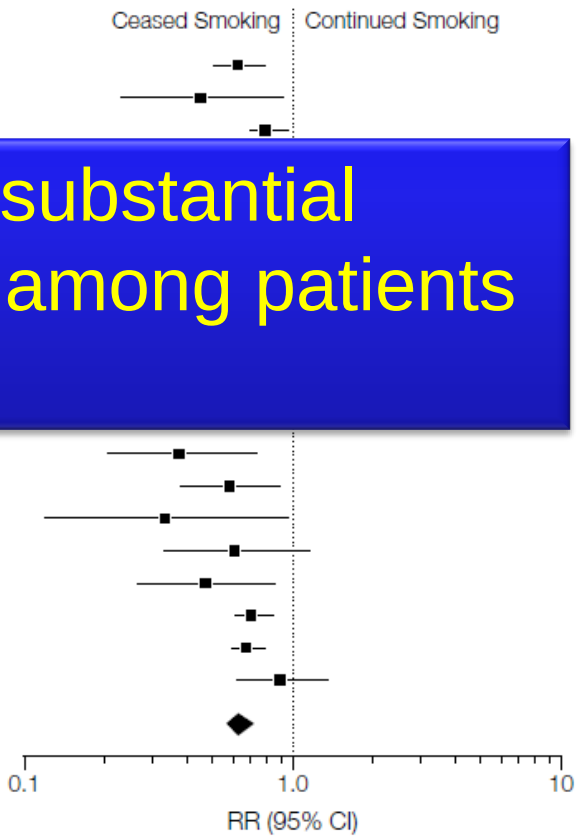

Quitting smoking is associated with a substantial reduction in risk of all-cause mortality among patients with coronary heart disease.

36% reduction in crude relative risk (RR) of mortality for patients with CHD who quit compared with those who continued smoking.

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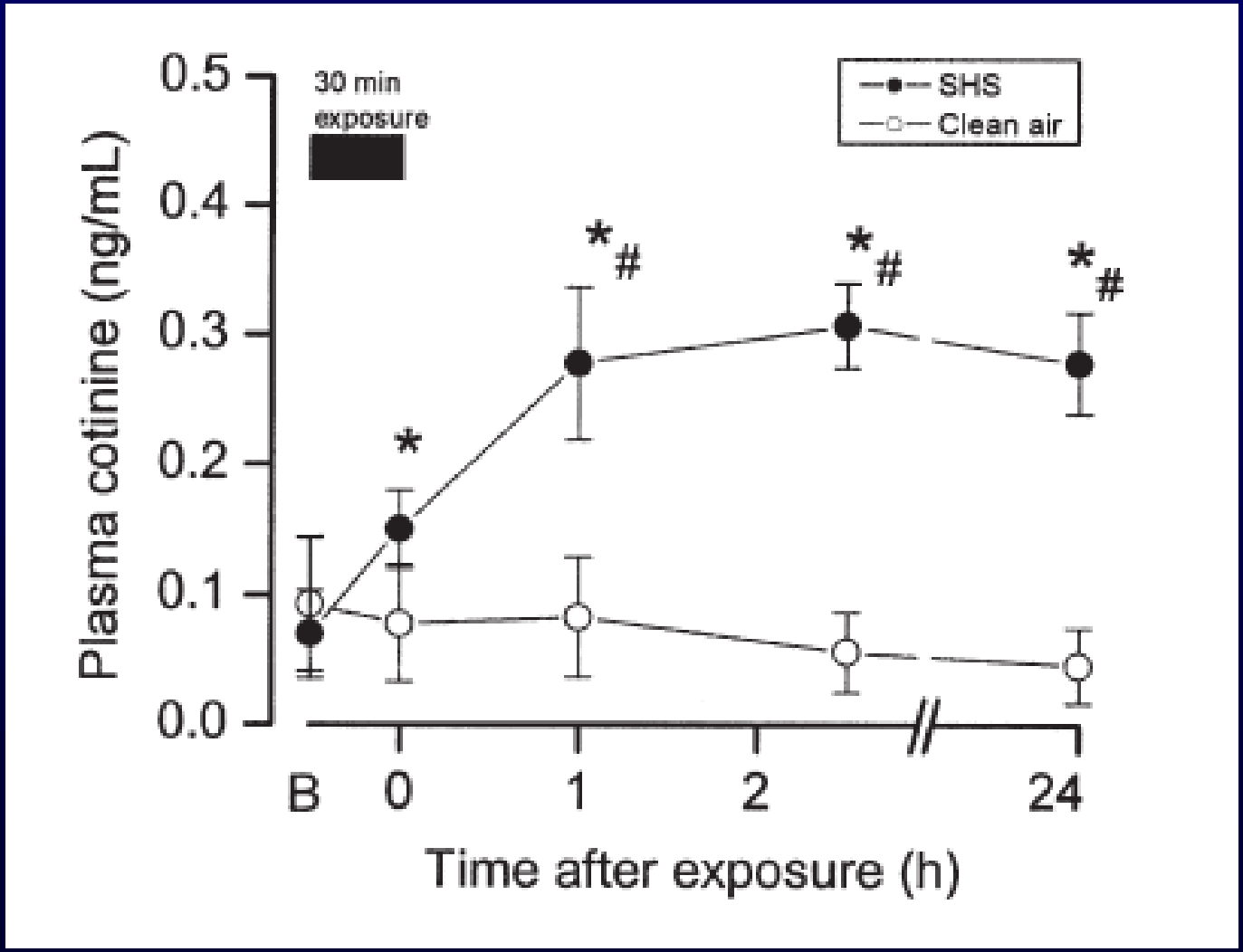
Risk of Secondhand Smoke

- Despite the fact that the dose of smoke delivered to active smokers is 100 times or more than that of secondhand smoke delivered passively, the relative risk of coronary heart disease for active smokers is 1.78, compared with 1.31 for nonsmokers exposed to second-hand smoke.

Barnoya J, et al. *Circulation* 2005; 111: 2684-98.

Time Course of Plasma Cotinine

After 30 minutes Secondhand Smoke Exposure (seen in smoking areas of restaurants and bars)

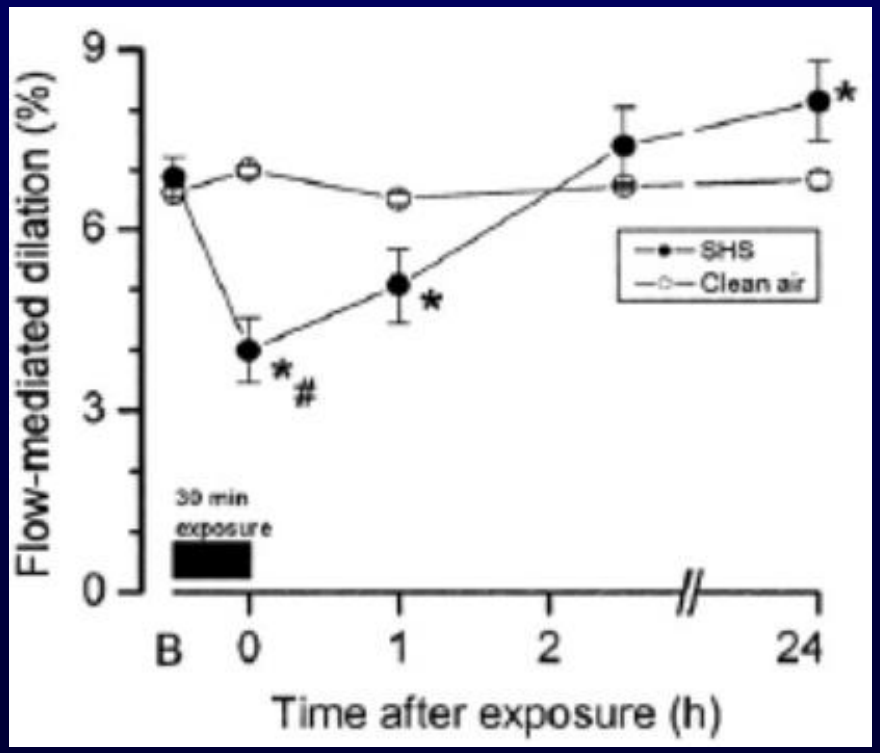


Heiss C, et al. ***J Am Coll Cardiol*** 2008; 51: 1760-71.

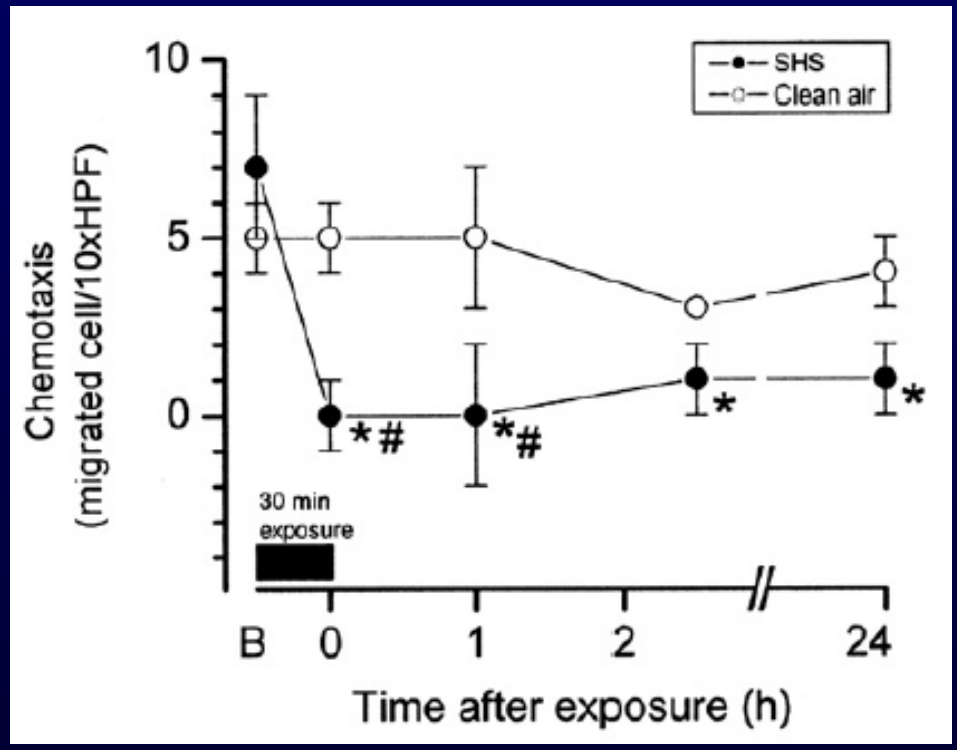
Flow-Mediated Dilation and Function of EPCs

After 30 minutes Secondhand Smoke Exposure

Acute Reversible Endothelial Dysfunction



Impairment of Chemotaxis of EPCs



EPC, Endothelial Progenitor Cell

Heiss C, et al. ***J Am Coll Cardiol*** 2008; 51: 1760-71.

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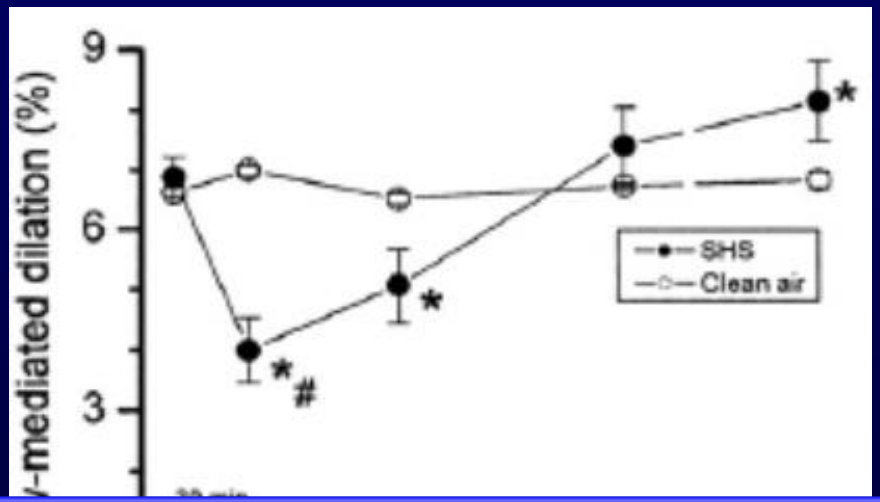

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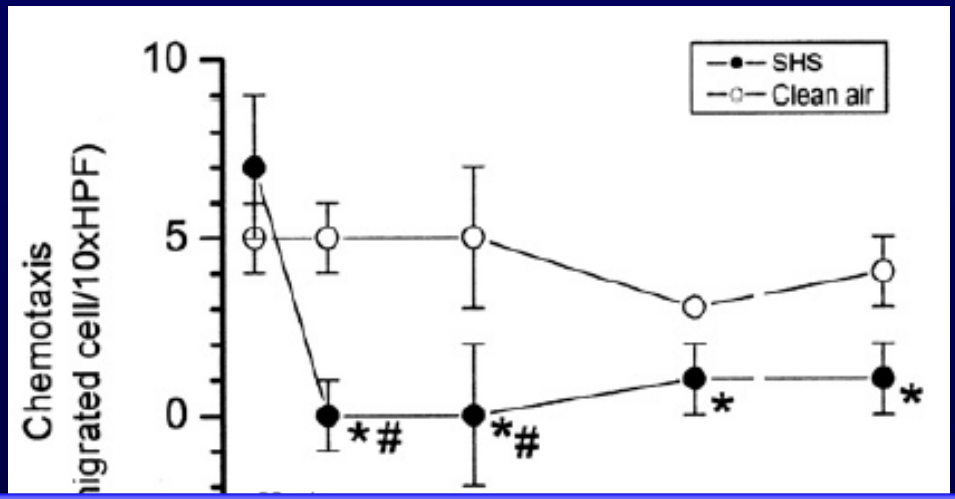

Smoking impairs not only endothelial function, but also endothelial regeneration or maintenance.

Brief exposure of secondhand smoke not only affects the vascular endothelium, but also the function of EPCs.

Heiss C, et al. ***J Am Coll Cardiol*** 2008; 51: 1760-71.

Secondhand Tobacco Smoke in Never Smokers is a Significant Risk Factor for Coronary Artery Calcification

	OR	95% CI	p Value
SHTS categories			
Low	1.5	1.2–2.0	0.002
Moderate	1.6	1.2–2.1	0.0008
Extensive	1.9	1.5–2.5	<0.0001
Other risk factors			
Age per decade	1.1	1.1–1.1	<0.0001
Male	2.5	2.0–3.0	<0.0001
Diabetes	1.9	1.3–2.7	0.0008
High cholesterol	1.6	1.3–1.9	<0.0001
Hypertension	1.4	1.2–1.8	0.001
Renal disease	1.3	0.7–2.6	0.45

Yankelevitz DF, et al. ***JACC Cardiovasc Imaging*** 2013; 6: 651-7.

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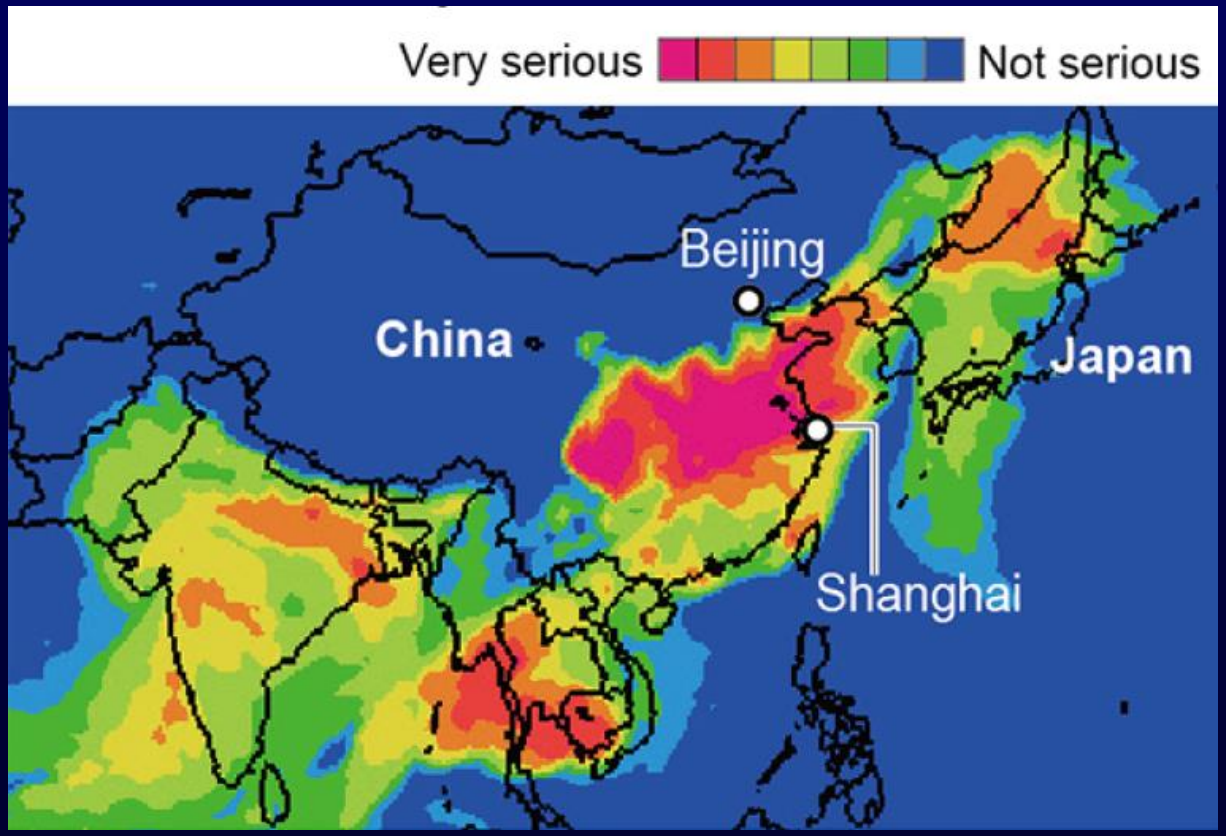
Renal disease	1.3	0.7–2.6	0.45

The presence and extent of CAC were associated with extent of SHTS exposure even when adjusted for other risk factors for CAC, suggesting that SHTS exposure causes CAC.

Yankelevitz DF, et al. ***JACC Cardiovasc Imaging*** 2013; 6: 651-7.

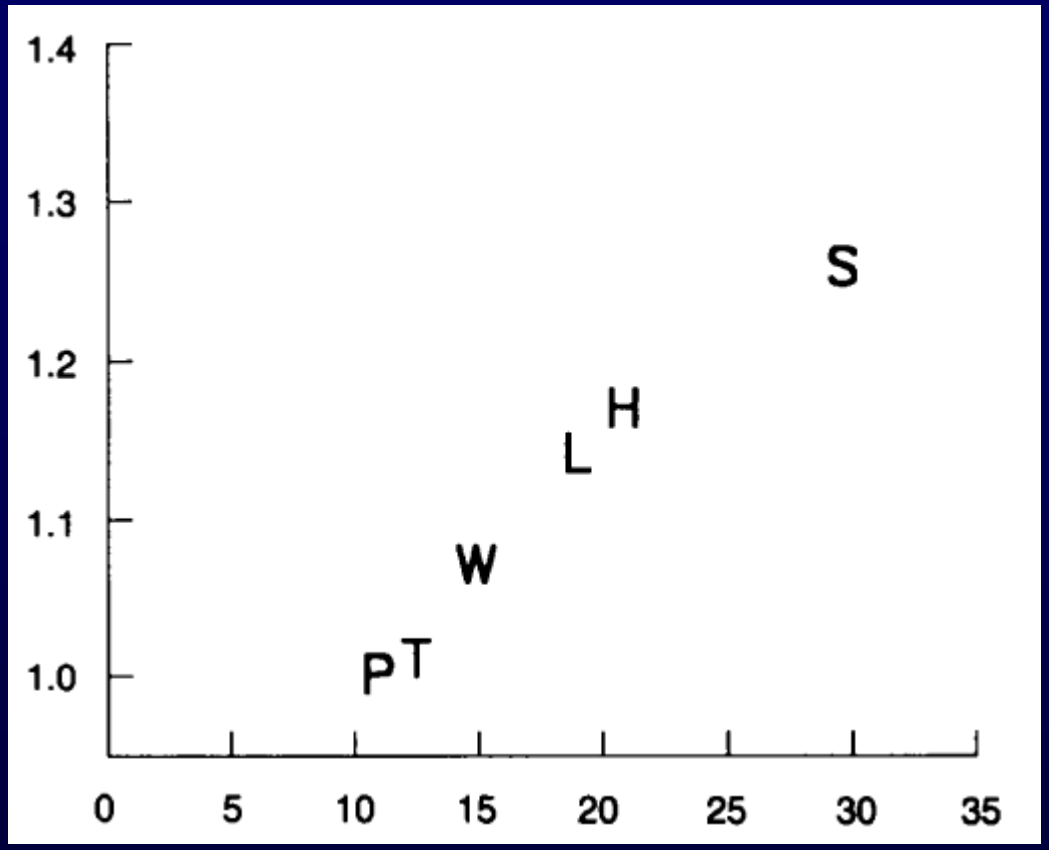
Air Pollution ($PM_{2.5}$) from China Reaches Japan

$PM_{2.5}$ stands for particulate matter with a diameter of 2.5 micrometers or less, which can reach deep into the lungs and blood vessels and cause asthma, heart disease and an increased risk of death.



The Asahi Shimbun

Estimated adjusted Mortality-Rate Ratios and Pollution Levels in the Six Cities



P Portage, T Topeka, W Watertown, L St Louis, H Harriman, S Steubenville

Dockery DW, et al. ***N Engl J Med*** 1993; 329: 1753-9.

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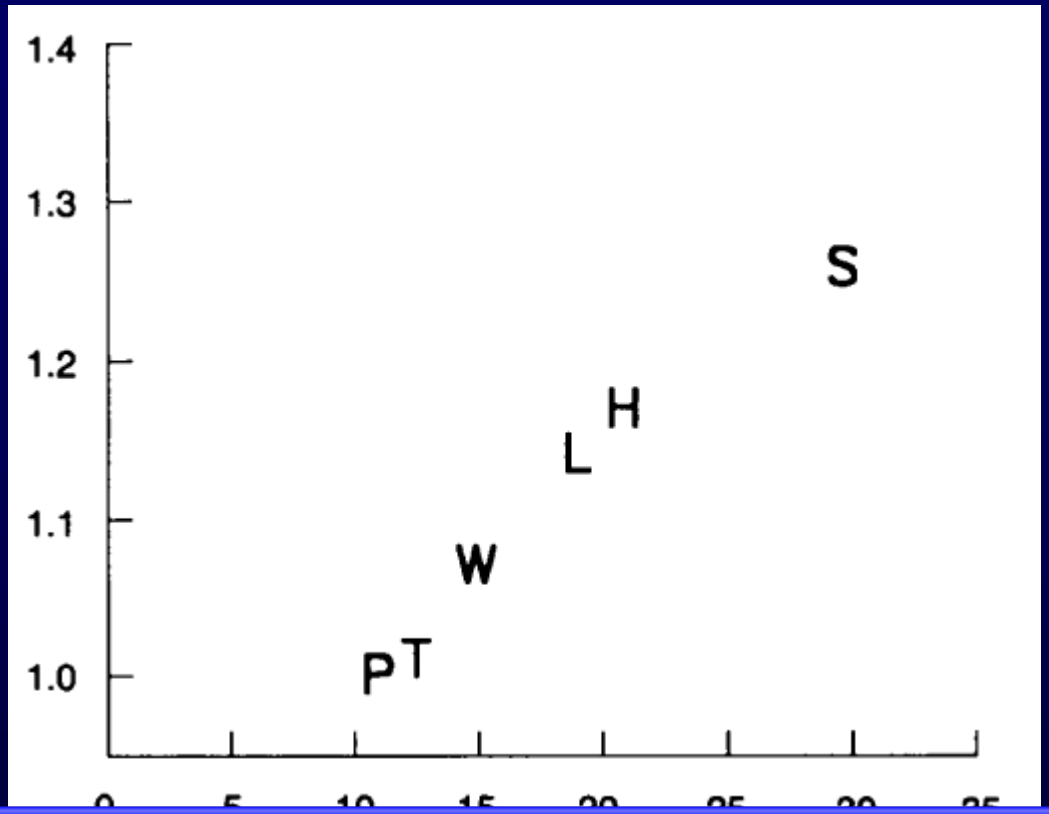


City-specific mortality rates, adjusted for variety of health risk factors, were associated with average levels of air pollutants in the cities.

Dockery DW, et al. ***N Engl J Med*** 1993; 329: 1753-9.

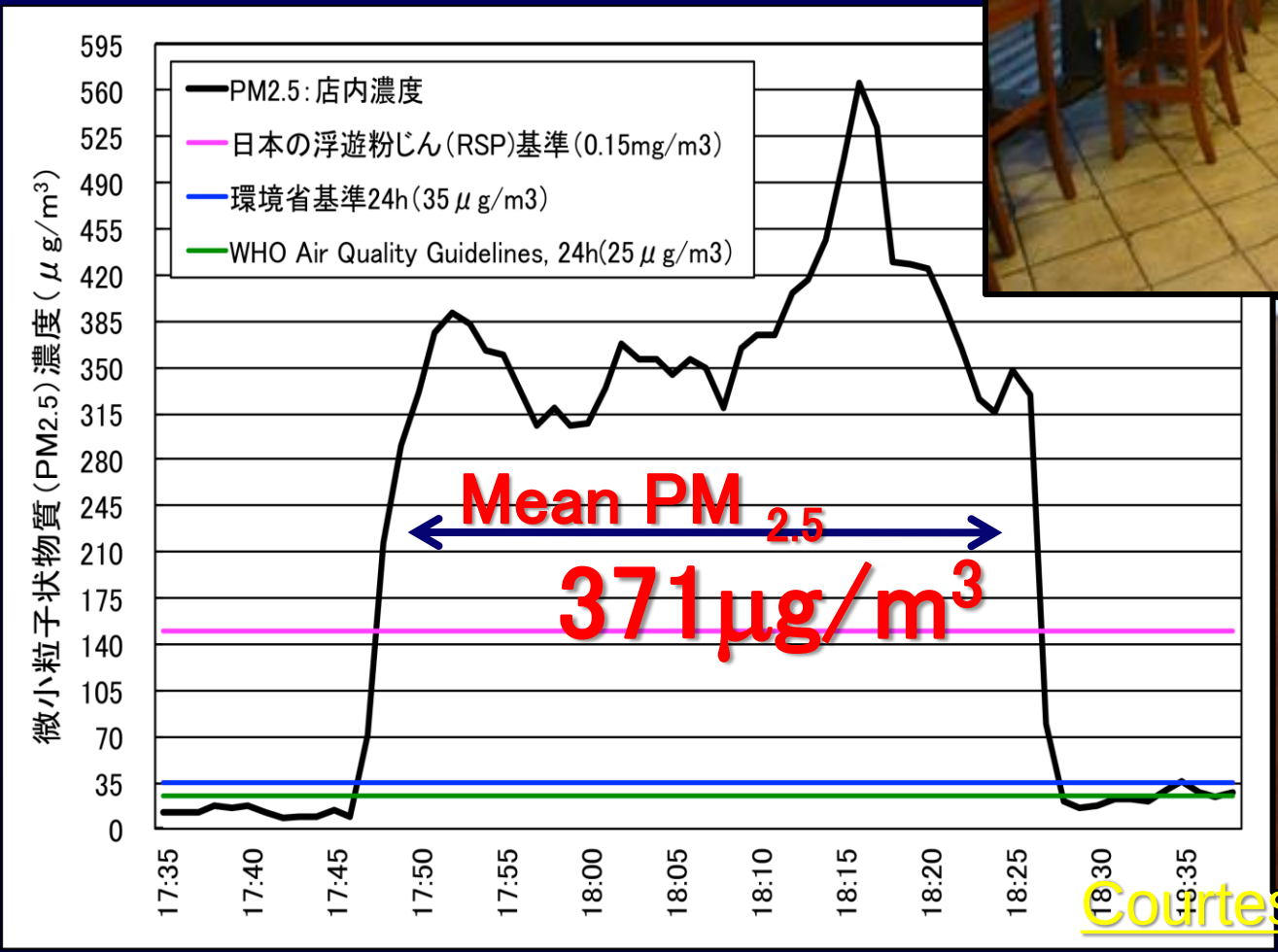
WHO Air Quality Guidelines (AQG) and Interim Targets for Particulate Matter 24-hour Concentrations

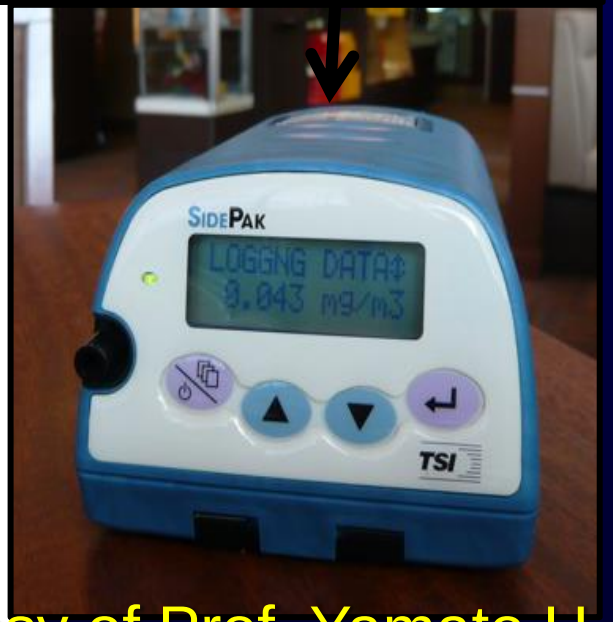
	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	Basis for the selected level
Interim target-1	150	75	About 5% increase of short-term mortality over the AQG value
Interim target-2	100	50	About 2.5% increase of short-term mortality over the AQG value
Interim target-3	75	37.5	About 1.2% increase in short-term mortality over the AQG value
Air Quality Guideline	50	25	Based on relationship between 24-hour and annual PM levels

WHO Air Quality Guidelines. Global update 2005

Air Pollution in Japan

Smoking Areas of restaurants and Bars





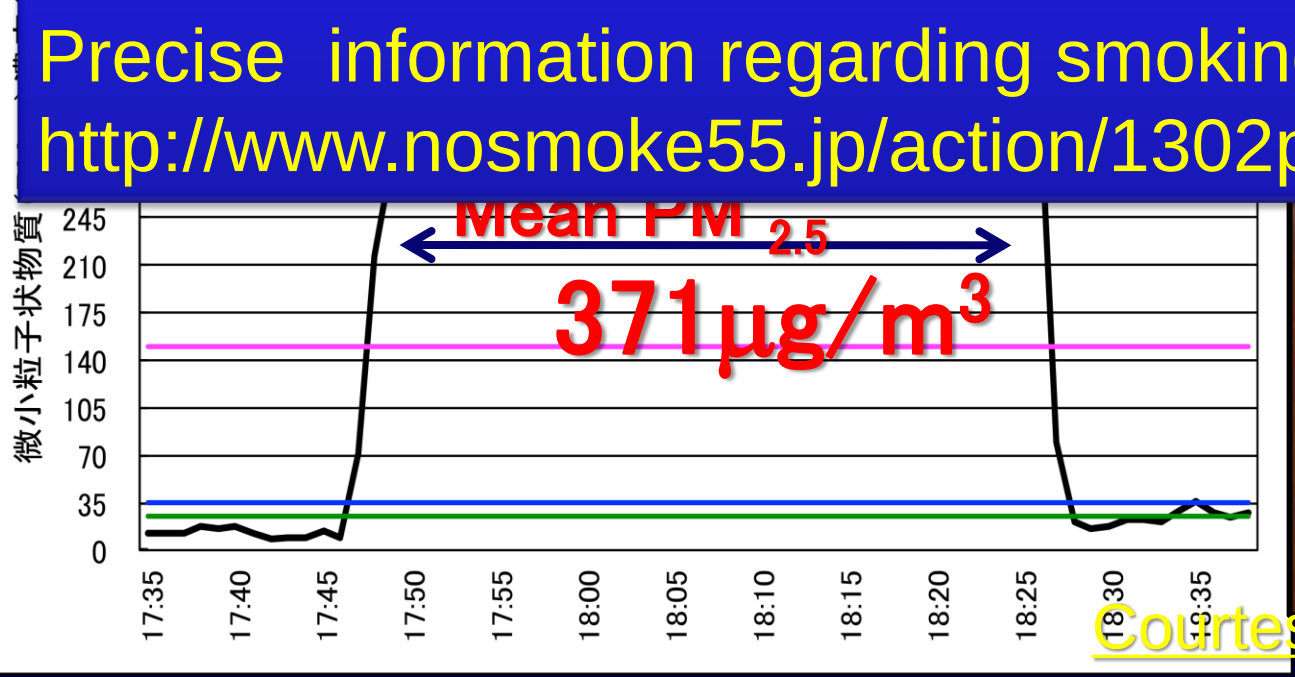
Courtesy of Prof. Yamato H

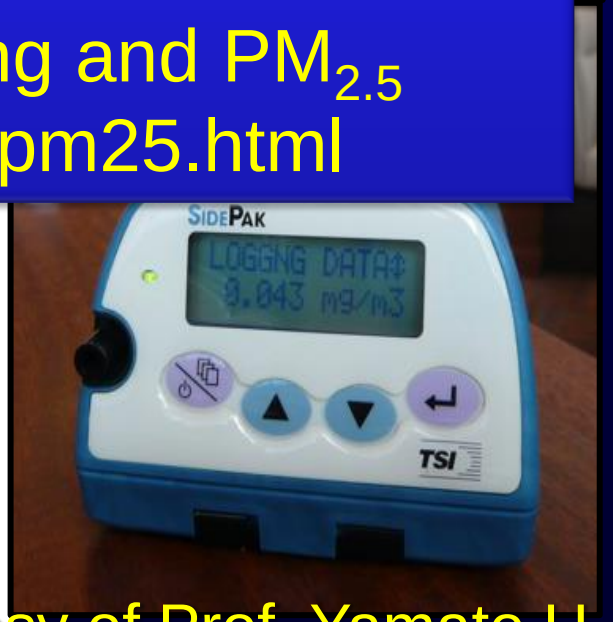
Air Pollution in Japan

Smoking Areas of restaurants and Bars

Active and passive smoking is the biggest $PM_{2.5}$ problem in Japan.

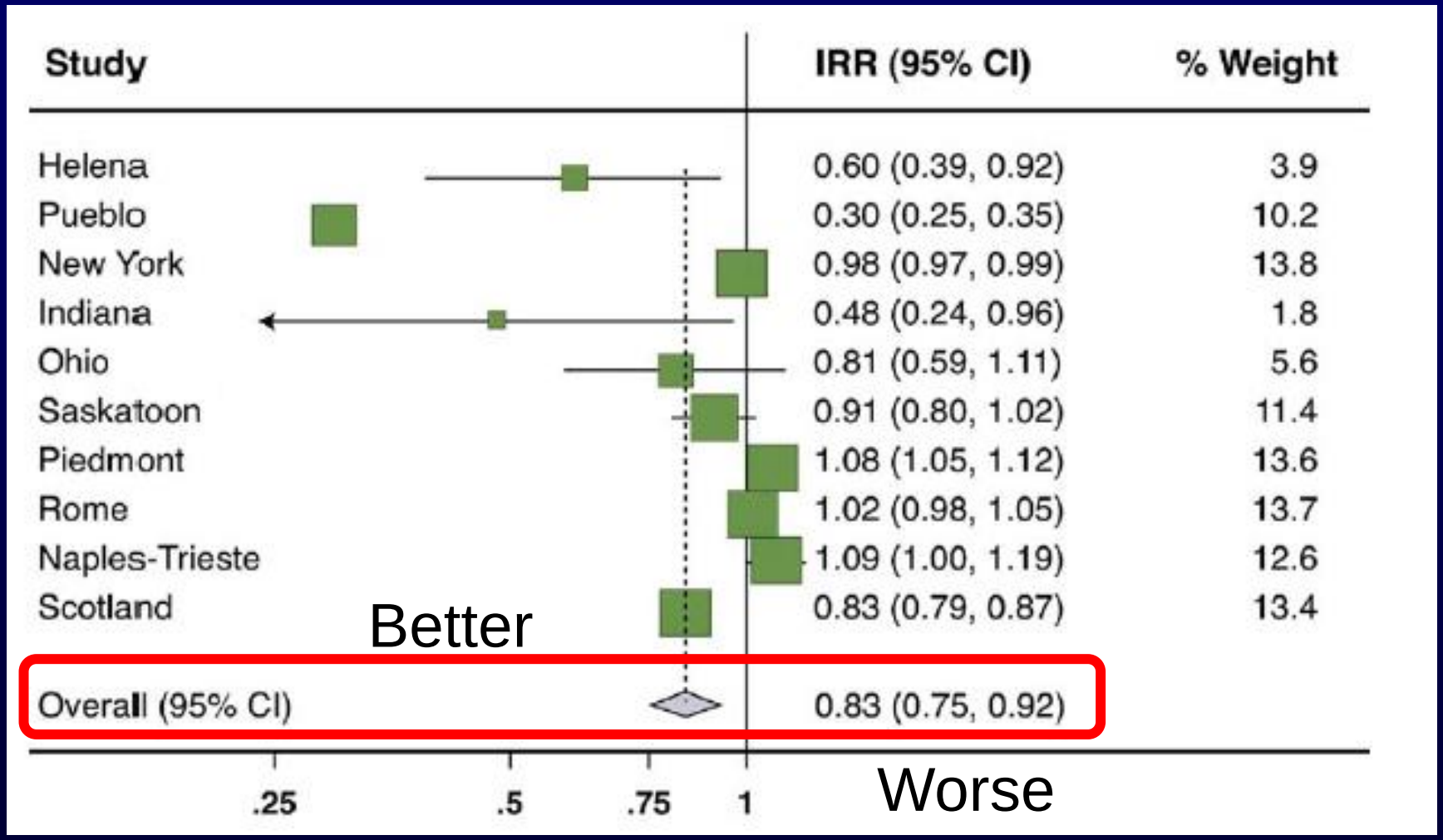
Precise information regarding smoking and $PM_{2.5}$
http://www.nosmoke55.jp/action/1302pm25.html





Courtesy of Prof. Yamato H

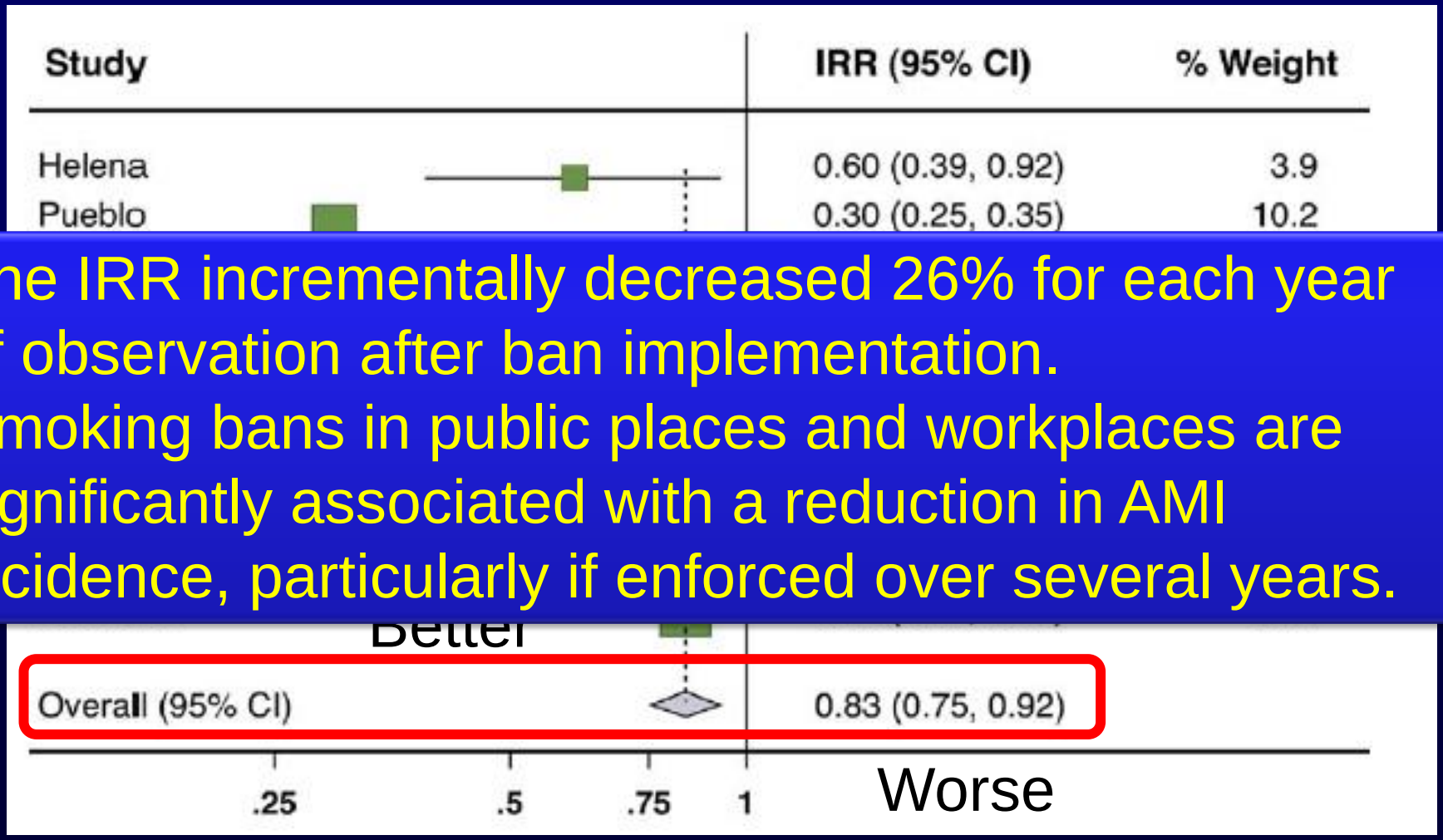
Effects of Community Smoking Bans on Incident Acute Myocardial Infarction



IRRs, incidence rate ratios

Meyers DG, et al. ***J Am Coll Cardiol*** 2009; 54: 1249-55.

Effects of Community Smoking Bans on Incident Acute Myocardial Infarction

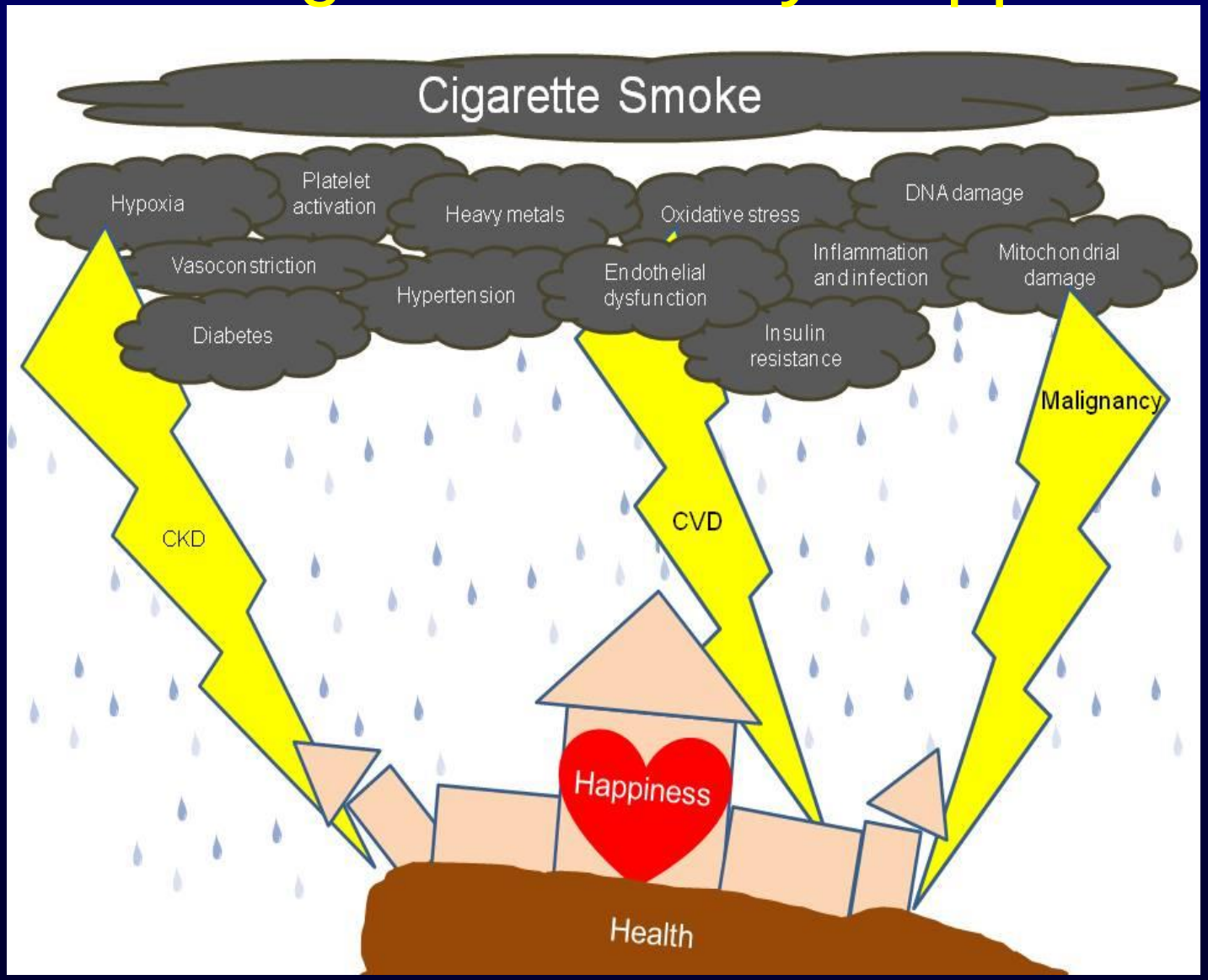


The IRR incrementally decreased 26% for each year of observation after ban implementation.
Smoking bans in public places and workplaces are significantly associated with a reduction in AMI incidence, particularly if enforced over several years.

IRRs, incidence rate ratios

Meyers DG, et al. ***J Am Coll Cardiol*** 2009; 54: 1249-55.

Smoking Thunders
Smoking Wears Away Happiness



Ogimoto A, Higaki J. ***Hypertens Res*** 2010; 33: 1104-5.

Thank you very much for your attention!

"An ounce of prevention is worth a pound of cure."

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