


Periodontal Disease and Cardiovascular Disease

**National Oral Health Conference
St Louis Missouri 27 April 2010**

Paul I Eke PhD MPH PhD
Division of Oral Health
CDC

Overview

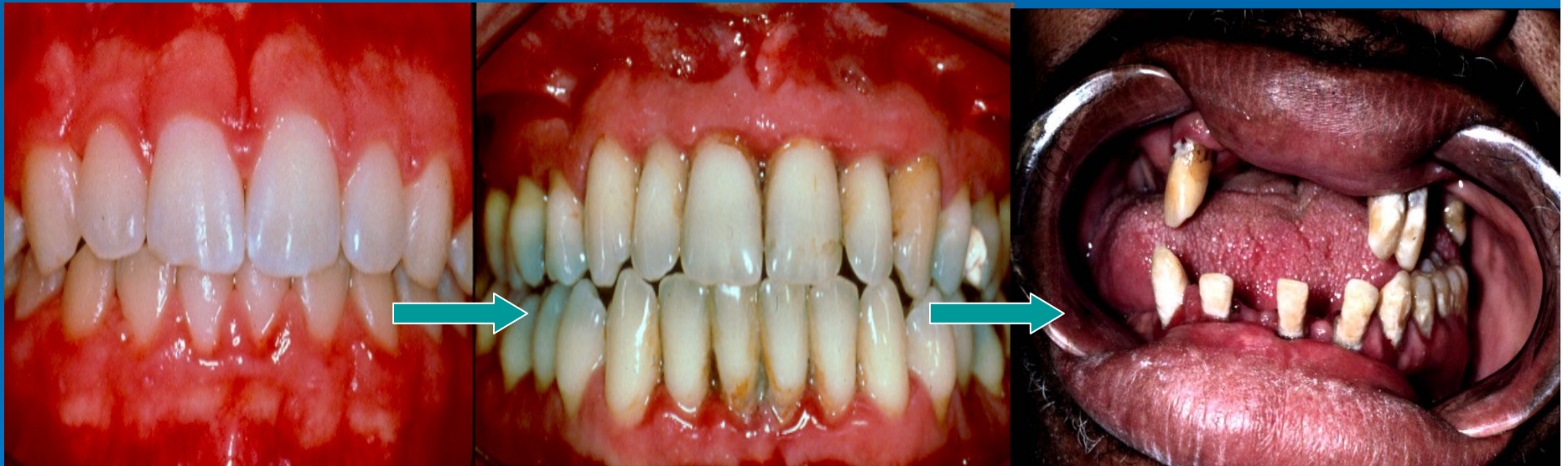
- **Introduction**
 - Periodontal Infections and CVD
 - Periodontal Infections and Systemic Inflammation
 - Periodontal Infections and Atherosclerosis
 - Intervention Studies
 - Institutional Responses
- 

Periodontal Diseases

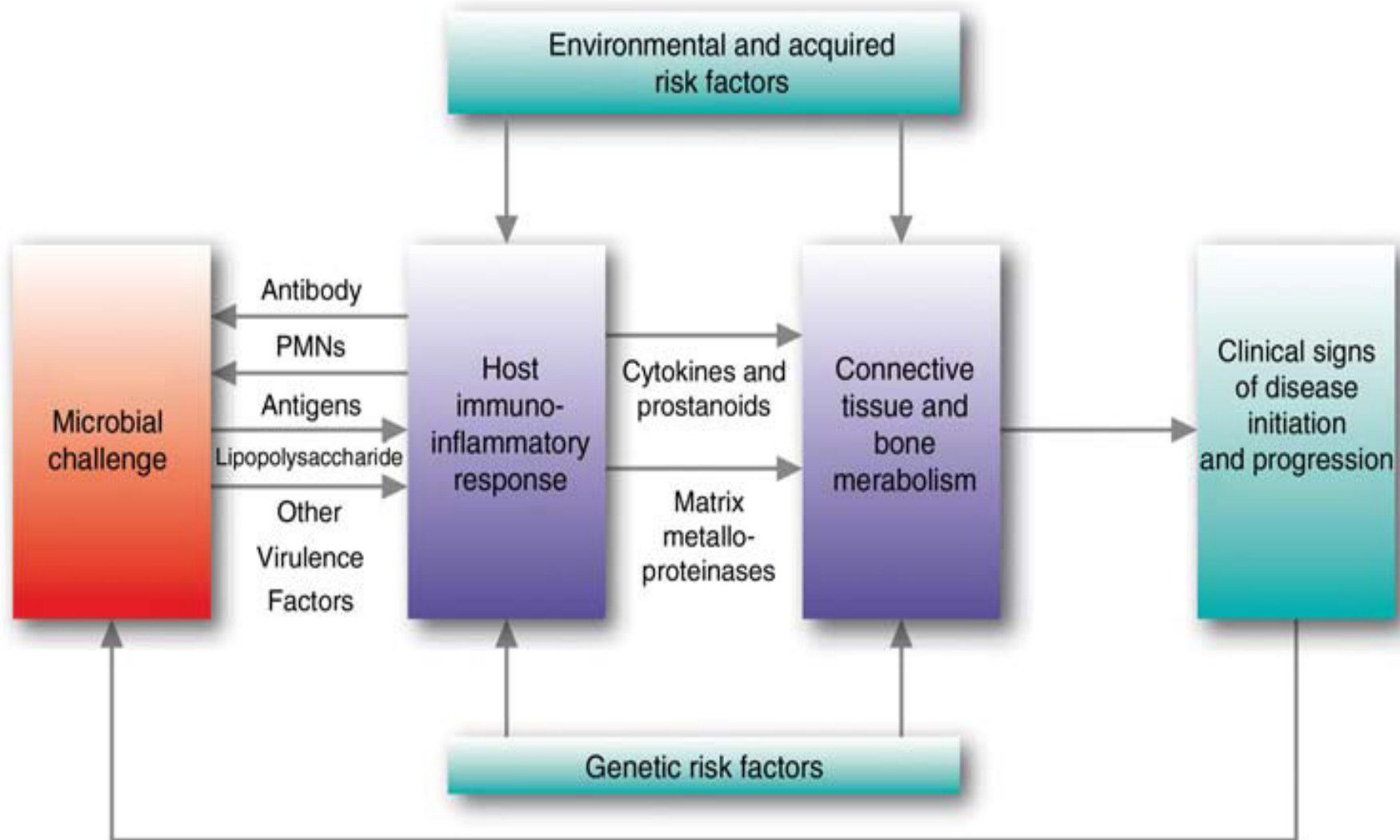
Gingivitis

Periodontitis

Periodontitis with
Tooth loss



Model of pathogenesis of periodontitis

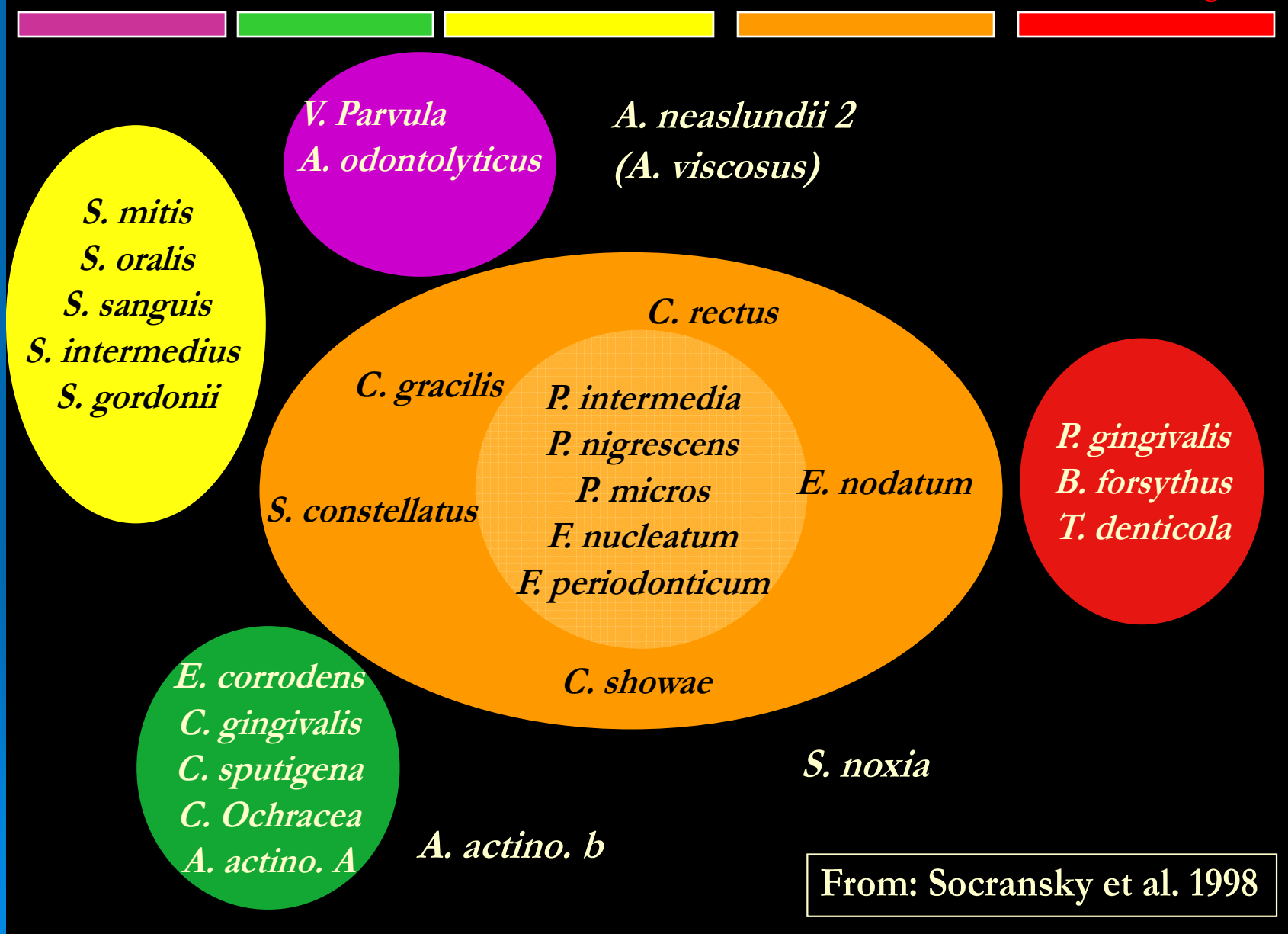


Source: Sanz M, D'Aiuto F et al. *European Heart J Suppl* 2010;12(suppl B):B3-B12;
Adapted from: Kornman K. *J Periodontol* 2008;79(8 Suppl):1560-8

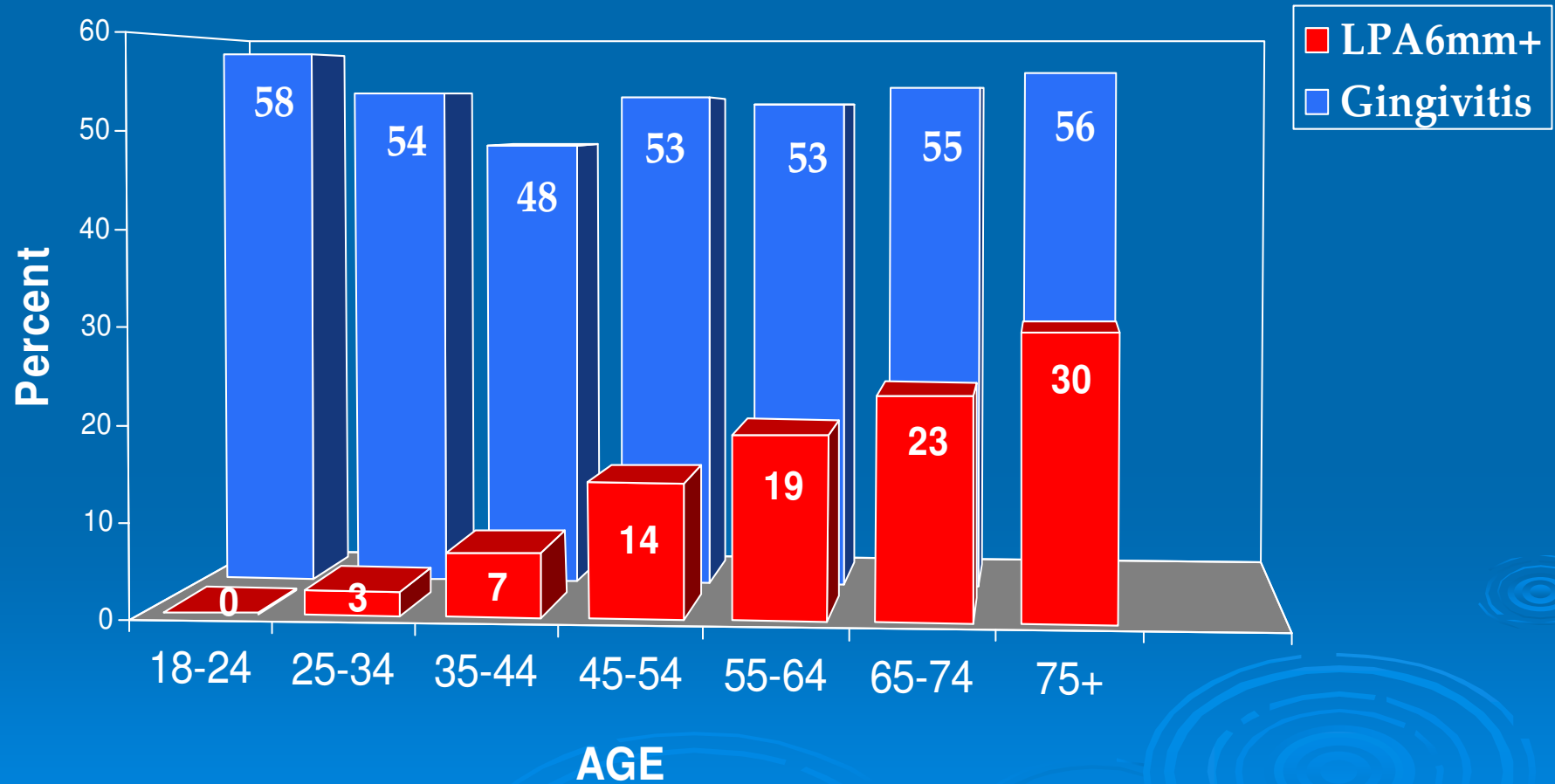
Clusters of Pathogenic Organisms Associated with Periodontal Infections

Weakest

Strongest



Prevalence of Gingivitis and Severe Periodontal Disease by Age Group in the US



Source: Taylor GW. NHANES III (1989-94)

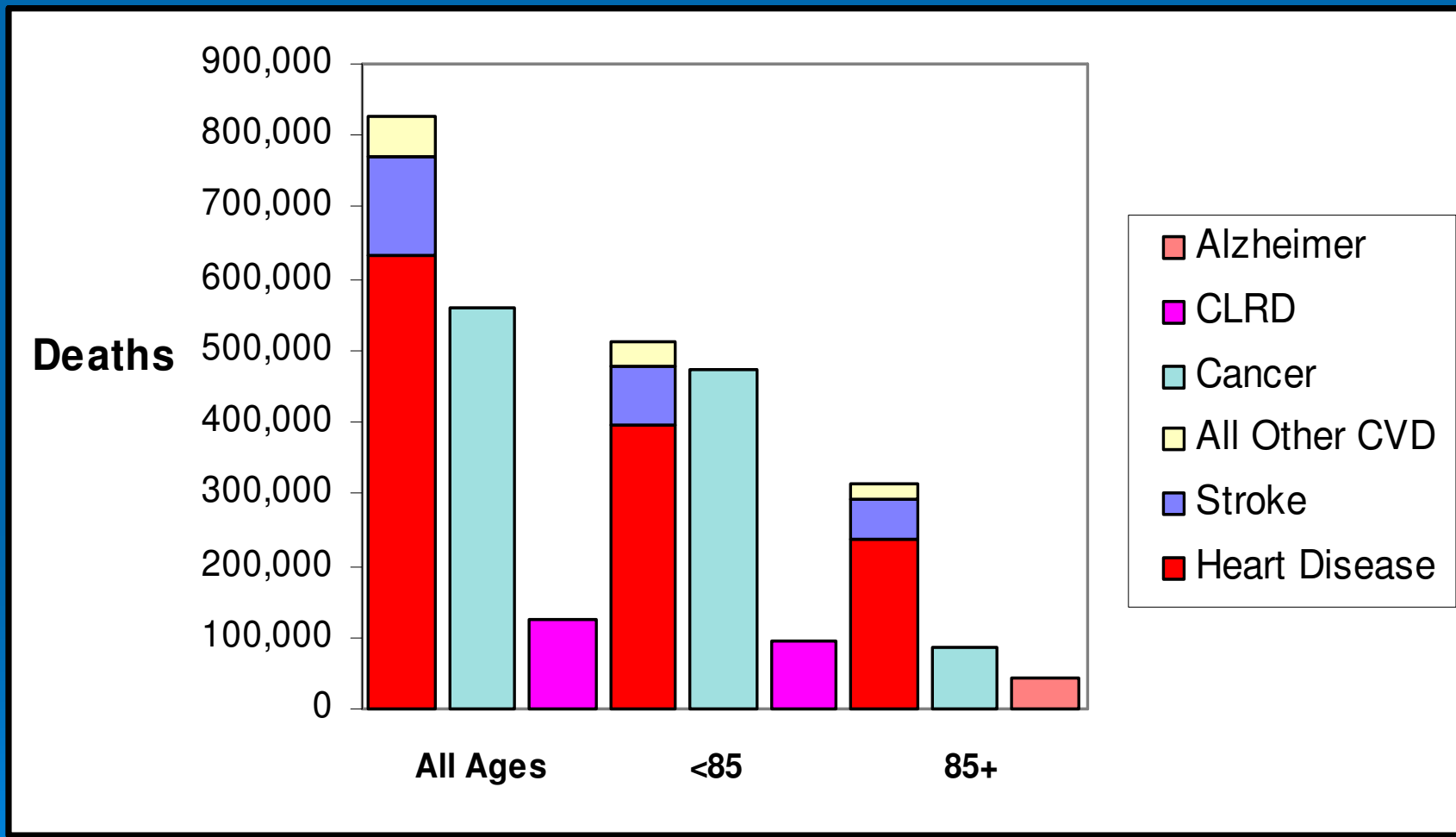
Cardiovascular Disease (CVD)



Cardiovascular Disease (CVD)

- Myocardial infarction (MI)
- Coronary heart disease (CHC)
- Coronary artery disease (CAD)
- Carotid atherosclerosis
- Stroke

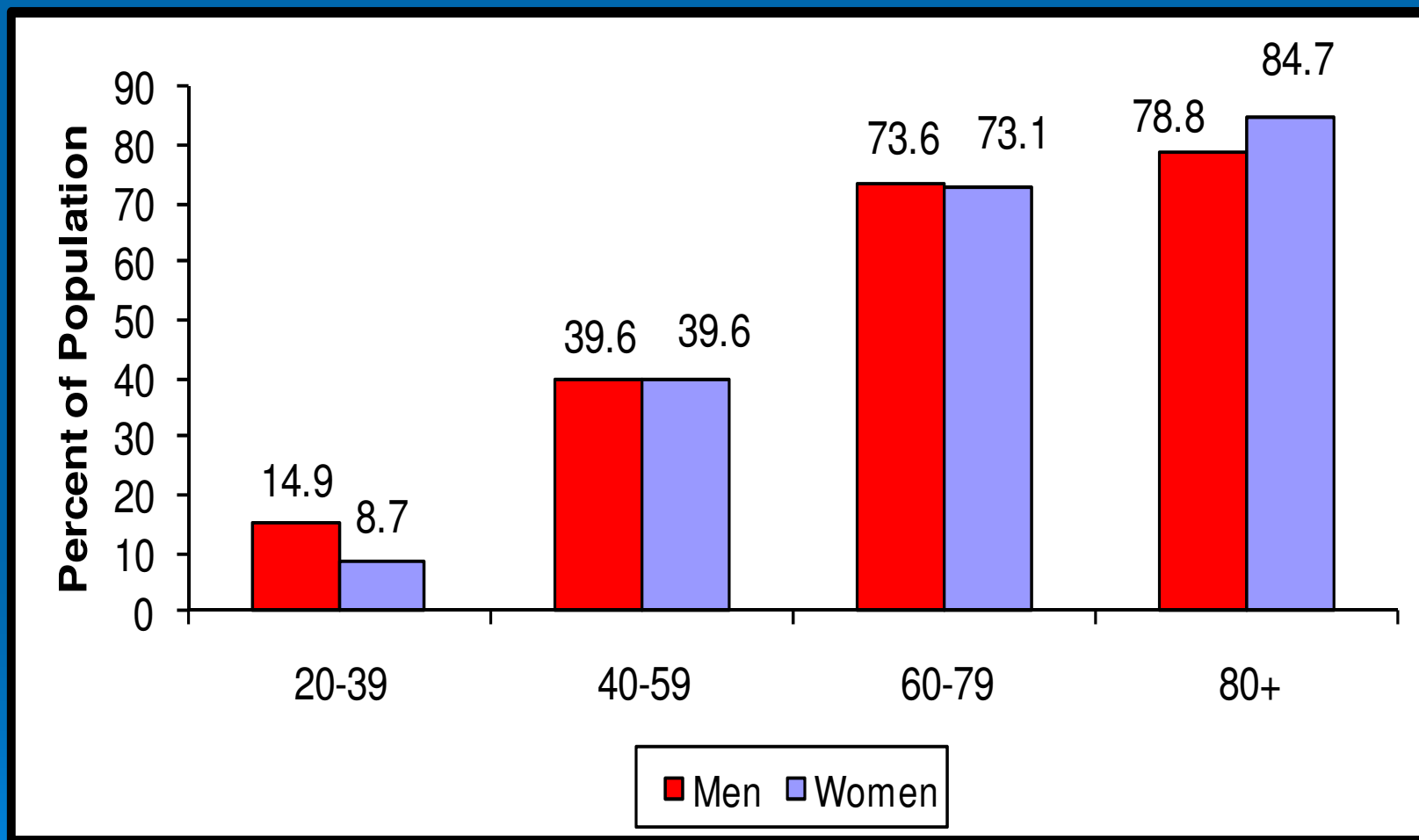
Why CVD is Important: Major Causes of Death: US 2006



*Both Sexes

Source: American Heart Association. Heart Disease and Stroke Statistics — 2010 Update (NCHS & NHLBI)


Prevalence of CVD* in US Adults by Age & Sex



*CVD: Coronary Heart Disease, Heart Failure, Stroke and Hypertension

Source: American Heart Association. Heart Disease and Stroke Statistics — 2010 Update (NCHS & NHLBI)

Overview

- Introduction
 - **Periodontal Infections and CVD**
 - Periodontal Infections and Systemic Inflammation
 - Periodontal Infections and Atherosclerosis
 - Intervention Studies
 - Institutional Responses
- 

Risk Factors Common to Periodontal Infection & CVD

- Age
- Education
- Gender
- Tobacco use
- Diabetes
- Genetics
- Systemic infection
- Finances
- Stress
- Social isolation

Observational Studies

- First report in 1989 in Finland
- Many countries, mostly Northern European & US
- In men, women and non-smokers
- Controlling for common risk factors
- For various CVD outcomes
- Using different clinical periodontal parameters
- Several cross-sectional, case-control, & cohort studies

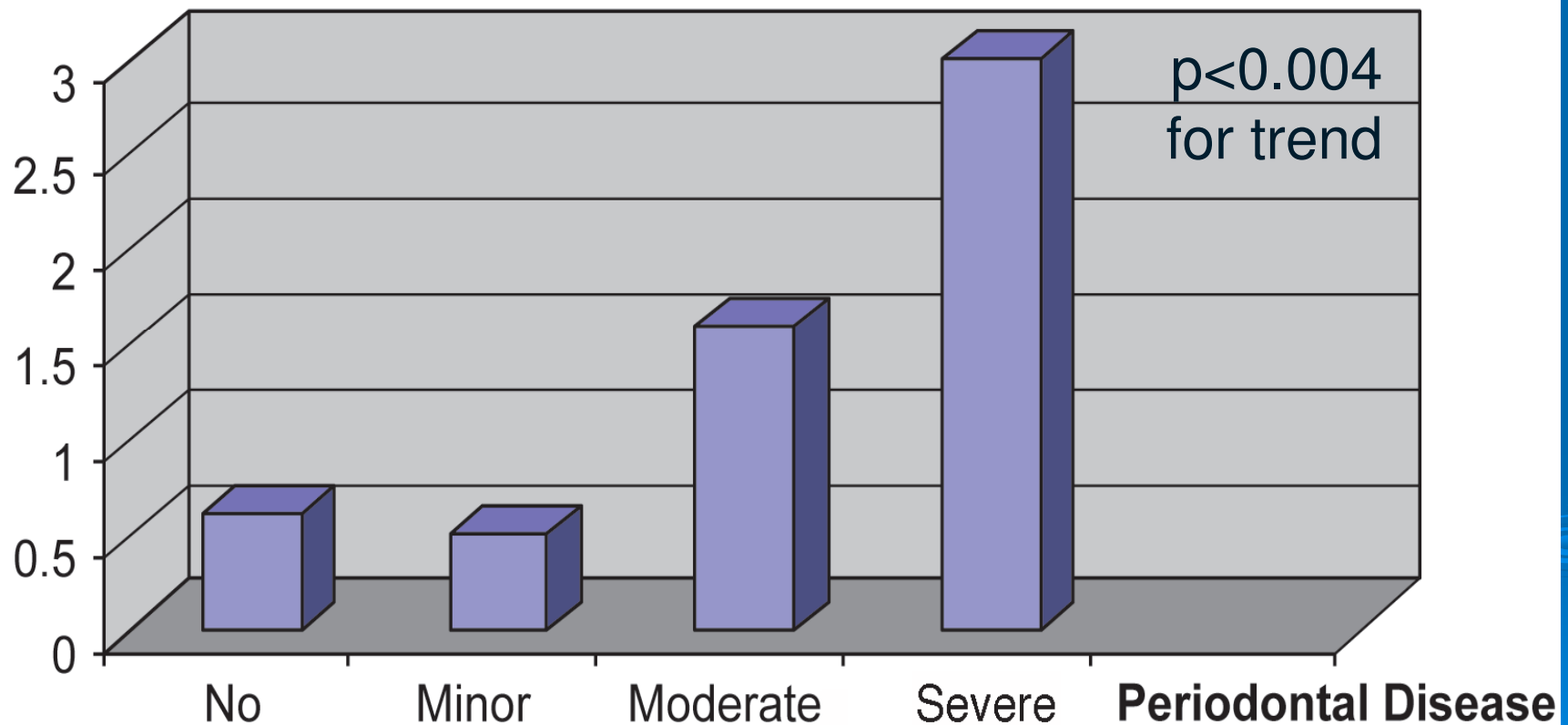
Meta-Analyses of Observational Studies

Author & Year	#	Design	Pooled N	OR/RR	CVD	95% CI	P
Blaizot 2009	7	Cohort	147,821	1.34	CVD	1.27-1.42	<0.0001
Humphrey 2008	7	Cohort	140,756	1.24	CVD	1.01-1.51	n/a
Janket 2003	9	Cohort	107,011	1.19	CVD	1.08-1.32	0.000
	6			1.44*	CVD	1.20-1.73	0.000
	2			2.85	Stroke	1.78-4.56	0.000
Bahekar 2007	5	Cohort	86,092	1.14	CHD	1.07-1.21	<0.001
Khader 2004	8	6 Cohort 2 CS	93,914	1.15	CHD	1.06-1.25	<0.001
Khader 2004	6	4 Cohort 1 CS+1CC	36,499	1.13	Stroke	1.01-1.27	0.032
Bahekar 2007	5	CC	1,432	2.22	CHD	1.59-3.12	<0.001
Blaizot 2009	22	12 CC 10 CS	19,650	2.35	CVD	1.87-2.96	<0.0001
Bahekar 2007	5	CS	17,724	1.59	CHD	1.33-1.91	<0.001

* ≤ 65 years

Myocardial Infarction & Severity of Periodontal Disease

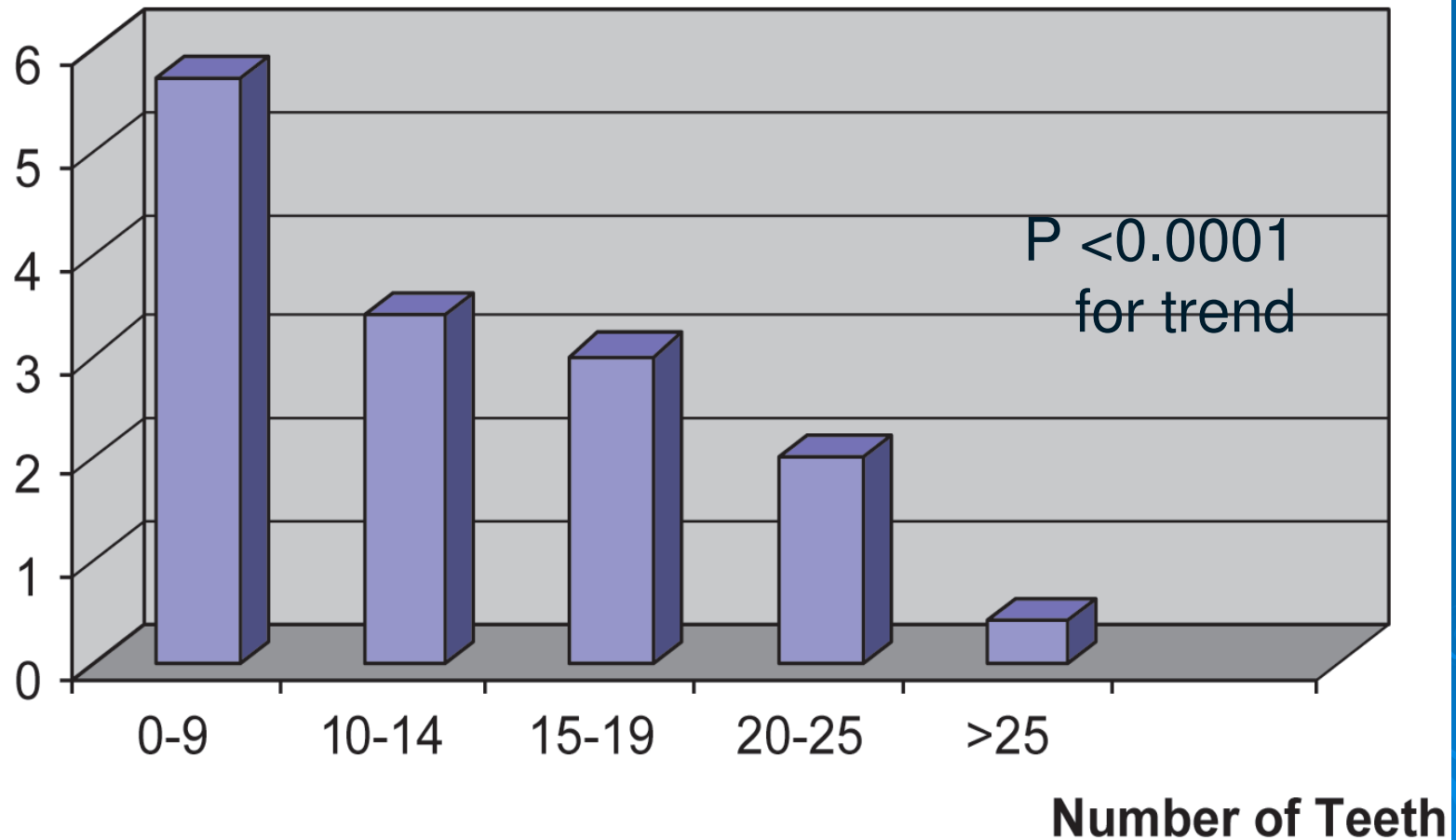
Prevalence of MI (%)



Source: Holmlund A. *J Periodontol* 2006;77(7):1173-8

Myocardial Infarction and Number of Teeth

Prevalence of MI (%)



Source: Holmlund A. *J Periodontol* 2006;77(7):1173-8

Periodontal Infection & CVD

Serological Evidence


- IgA antibodies to periodontal organisms (e.g., *Aa* and *Pg*) predict incidence of MI, stroke & CHD
- Strong associations between antibodies to periodontal organism and prevalence of CHD events & carotid atherosclerosis

Periodontal Infection & CVD

Summary of Evidence

- Significant, weak to moderate associations between periodontal infection & CVD in observational studies
 - Most OR, RR, H R <2.0
- Significant , strong, more consistent and robust associations between periodontal infection and ischemic stroke :
 - RR > 2.0
- Dose-Response relationship: Prevalence of MI increases with severity of periodontal infection
- Stronger associations using serological measures of periodontal infections

Overview

- Introduction
 - Periodontal Infections and CVD
 - **Periodontal Infections and Systemic Inflammation**
 - Periodontal Infections and Atherosclerosis
 - Intervention Studies
 - Institutional Responses
- 

Simplified Biological Model

Genetic Risk Factors → Hyper-inflammatory response phenotype ← Environmental Factors
e.g., smoking, stress, DM

LOCAL
Y

Microbial challenge
Infection, Endotoxins



**Initiation and progression
of periodontal disease**

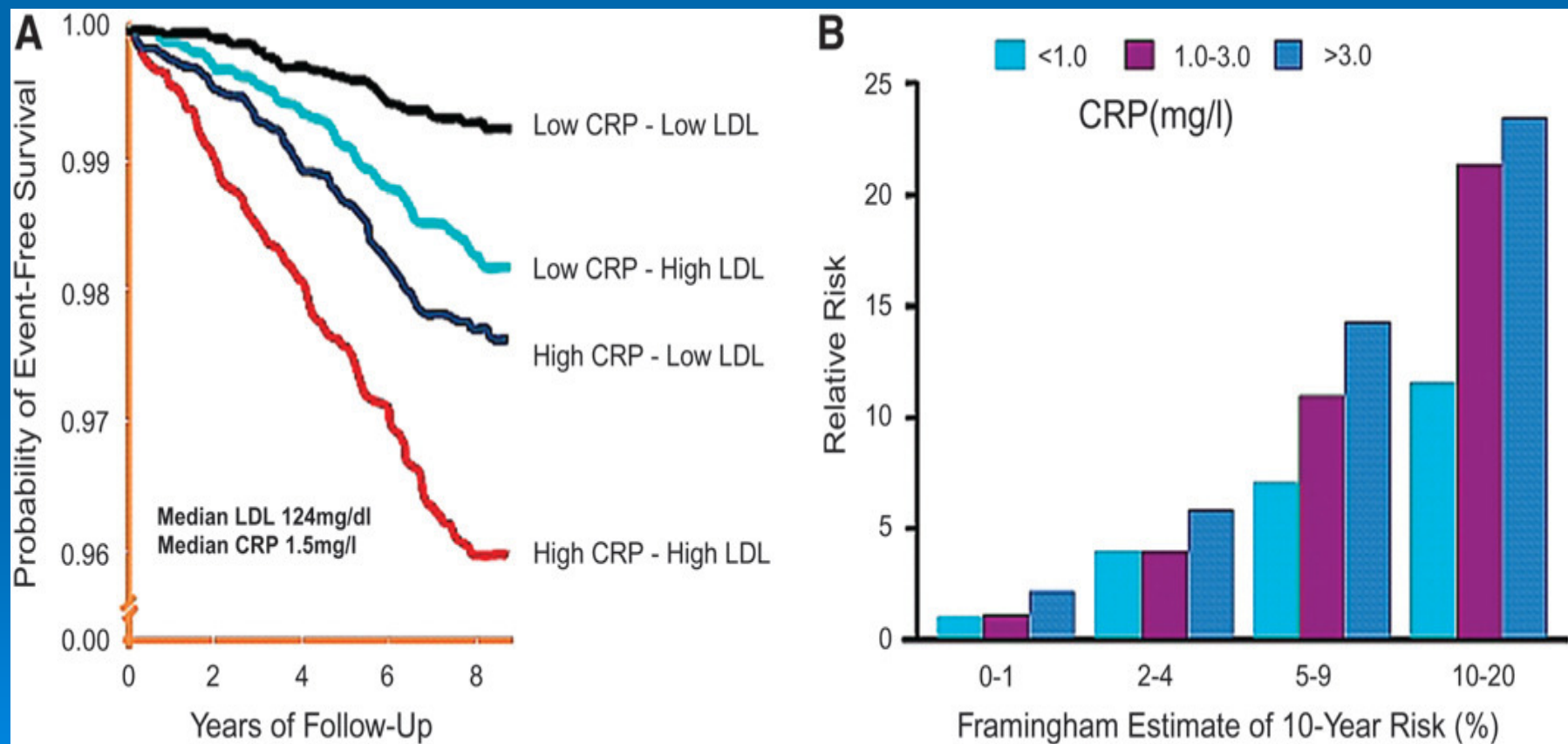
SYSTEMICALLY

Systemic exposure
to
Bacteria, LPS and
Host mediators



**Atherosclerosis/
thrombosis**
Coronary Heart Disease
Cardiovascular Disease

C-Reactive Protein Stronger Predictor of Cardio-Vascular Events than LDL Cholesterol



Source: Ridker PM, Silvertown JD. *J Perio* 2008;79(8 Suppl):1544-51

Periodontal Infection & CRP Meta-Analysis


- Elevated CRP levels in periodontal disease
 - CRP 1.56 mg/l higher (10 CS studies)
- Significant, modest decrease after non-surgical periodontal treatment (6 studies)

Source: Paraskevas S. J Clin Periodontol 2008 35(4):277-90

C-Reactive Protein (CRP) & Periodontal Disease Summary of the Evidence

- Strongly associated with periodontal disease
- Correlated with levels of periodontopathogens
- Levels decrease after periodontal treatment
- Associated with atherosclerosis
- Associated with increased risk for CVD

Overview

- Introduction
 - Periodontal Infections and CVD
 - Periodontal Infections and Systemic Inflammation
 - **Periodontal Infections and Atherosclerosis**
 - Intervention Studies
 - Institutional Responses
- 


Atherosclerosis

- Inflammatory disease
- Major underlying pathology in CVD
- Narrows or totally obstructs arteries => ischemia
- Shares several risk factors with CVD, e.g., smoking, hypertension, cholesterol, incidence of stroke
- Initiated or accelerated by infection, e.g., *Chlamydia pneumoniae*, *Cytomegalovirus*, *Helicobacter pylori*

Periodontal Infections & Atherosclerosis: Evidence

- Viable and invasive periodontal organisms from the red cluster detected in atherosclerotic plaque
- Organisms from dental plaque associated with carotid atherosclerosis
- Antibodies to periodontal organisms associated with carotid atherosclerosis, including non-smokers
- Oral organisms found in atheromas, in non-atheroma sites of coronary and renal arteries
- Periodontal disease associated with poorer endothelial function

Overview

- Introduction
 - Periodontal Infections and CVD
 - Periodontal Infections and Systemic inflammation
 - Periodontal Infections and Atherosclerosis
 - **Intervention Studies**
 - Institutional Responses
- 


Limitations with Intervention studies

- No RCT to date
- Ethical issues
- Cost and duration of study
- Large samples required
- Natural history of atherosclerosis
- Short term treatment might not effect long-term clinical CVD outcomes

Intervention Studies

- Periodontal therapy vs. CVD risk factors
 - Reduces CRP levels (Seinhost 2005, D'Aiuto 2005, Ebersole 1997)
 - Reduces IL-6 levels (D'Aiuto 2005, Iwamoto 2003)
 - Reduces TNF-alpha levels (Iwamoto 2003)
 - Improves endothelial function (Seinhost 2005, Elter 2006)
 - Reduces pro-atherogenic properties of LDL (Pussinen et al, 2004)

Overview

- Introduction
 - Periodontal Infections and CVD
 - Periodontal Infections and Systemic inflammation
 - Periodontal Infections and Atherosclerosis
 - Intervention Studies
 - **Institutional Responses**
- 

From Wall Street Journal

Ounce of Prevention

Some insurance plans that are covering more preventive dental services for some patients, amid evidence it improves overall health:

INSURERS

Aetna Inc.

**Blue Cross
Blue Shield
of Michigan**

Cigna Corp.

COVERED MEMBERS

13.4 million dental members in all states. Employers include Costco Wholesale.

1.1 million dental members in Michigan area. Employers include Ford Motor Co. and Kellogg Co.

5.5 million members with joint medical and dental coverage. Employers include Avnet Inc.

ENHANCED BENEFITS

Starting next year a free additional regular deep-cleaning and periodontal maintenance for diabetes and heart disease-management patients, as well as pregnant women. Implants available under some plans.

Pilot program covers an additional regular cleaning annually (over the usual limit of 2) for pregnant women, diabetics and heart patients, through year-end. Implants covered at 50% if employees pay for plan that includes them.

100% coverage for scaling and root planing and periodontal maintenance for pregnant members or those in a disease-management program for diabetes or heart disease. All pregnant women can receive an extra regular cleaning. Implants covered if employer pays for benefit.

Editors' Report

The American Journal of Cardiology and Journal of Periodontology Editors' Consensus: periodontitis and atherosclerotic cardiovascular disease.

Friedewald VE, Kornman KS, Beck JD, Genco R, Goldfine A, Libby P, Offenbacher S, Ridker PM, Van Dyke TE, Roberts WC.

1) J Periodontol 2009 Jul;80(7):1021-32

2) Am J Cardiol 2009 Jul 1;104(1):59-68

Periodontal Disease and CVD Summary

- No RCT trials to establish causal relationship =>
Consensus to be based on indirect evidence
- Consistently low to moderate association in CHD
- Stronger association in stroke
- Biologically plausible effect on CVD
- Association with intermediate risk factors for CVD
- Evidence accumulating for potential cardio-vascular protective benefits of periodontal therapy

Acknowledgement:
Wenche S Borgnakke DDS MPH PhD

Please, contact me:

peke@cdc.gov

