COPD: Worldwide Social & Economic Burden and Epidemiology of COPD

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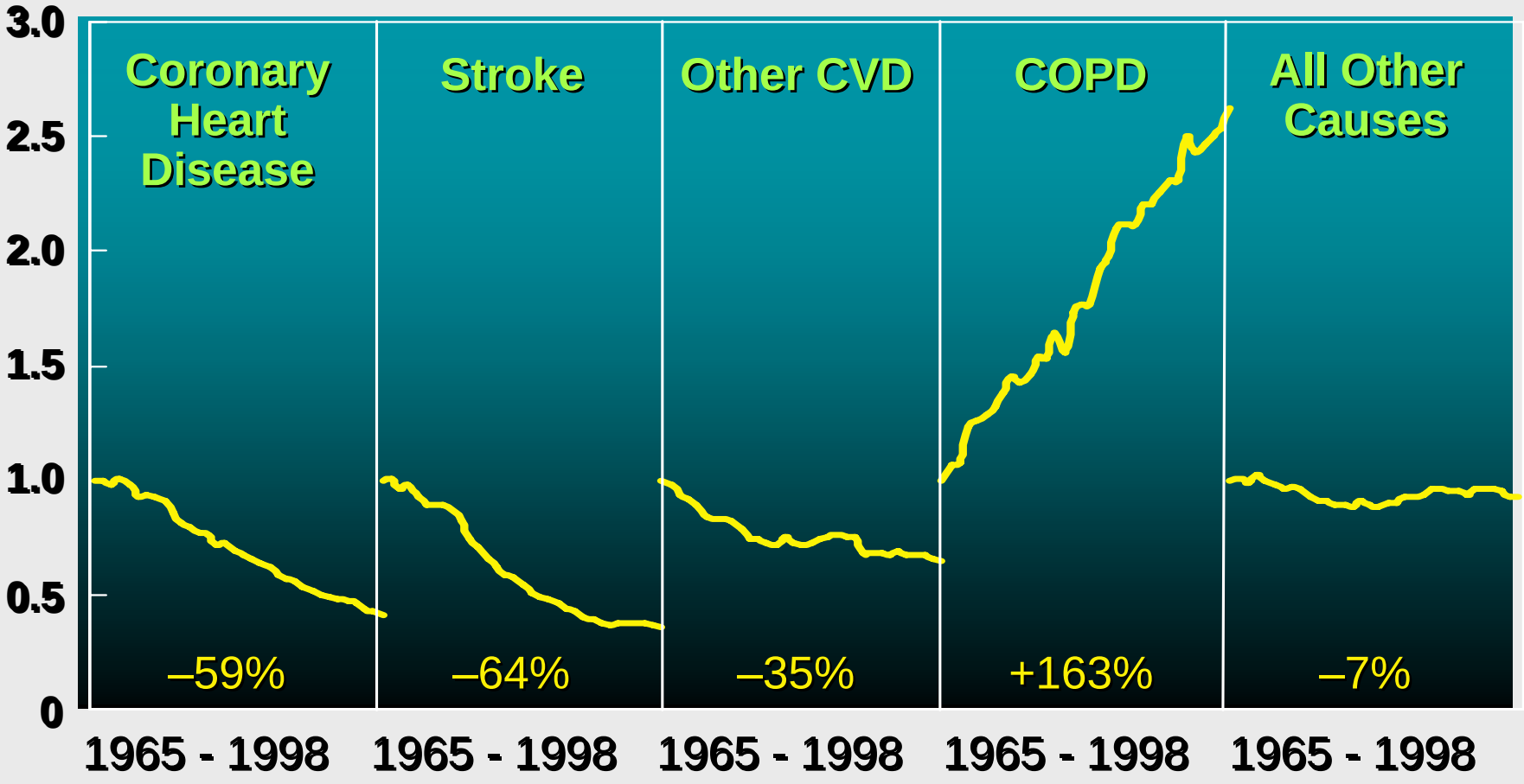
Why is COPD in the Spotlight?

- Mortality from COPD is increasing (especially in women) when other causes of death are decreasing
- Health care utilization is increasing
- Cost is very high
- COPD has a huge impact on quality of life
- Prevalence is much higher than appreciated

Social & Economic Burden & Epidemiology of COPD

- How is the burden of COPD estimated
- Risk factors for COPD
- Natural history of COPD
- Lessons for the clinician

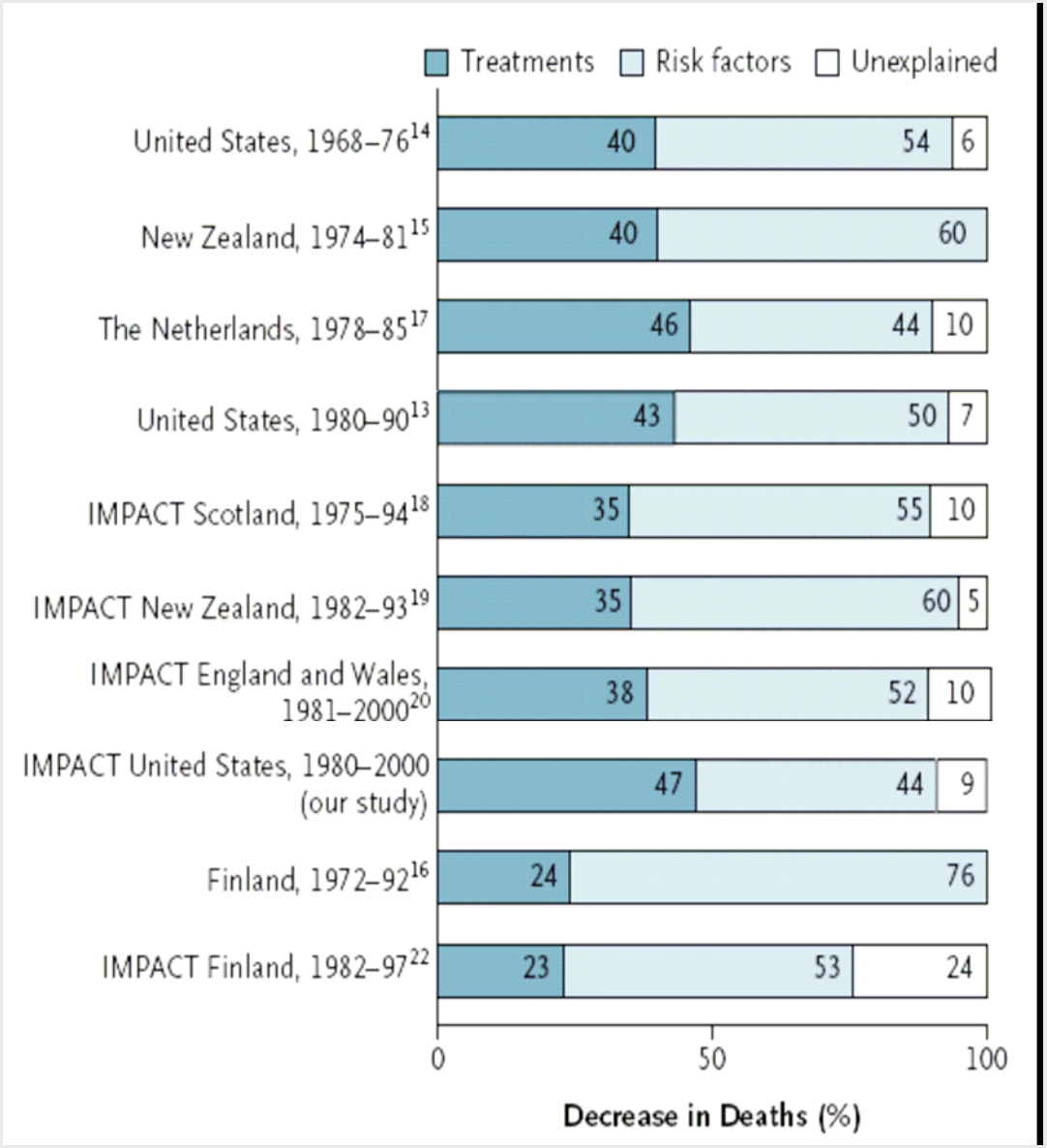
Percent Change in Age-Adjusted Death Rates, U.S., 1965-1998



Explaining the Decrease in US Deaths from Coronary Disease, 1980-2000.

Ford et al. NEJM 2007; 356: 2388

- US Adults 25-84 yrs
- Age-adjusted deaths for CAD fell from 543.0 to 266.7 deaths/100K (M) and from 263.3 to 134.4 (W)
- 47% of decrease attributed to treatments, 44% to changing risk factors
- Increases on deaths as result of increased BMI & diabetes



Ford ES et al, NEJM 2007;356(23):2388-97

Definition of COPD

- COPD is a *preventable and treatable* disease with some significant extrapulmonary effects that my contribute to the severity in individual patients
- Its pulmonary component is characterized by airflow limitation that is not fully reversible
- The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases

GOLD 2006

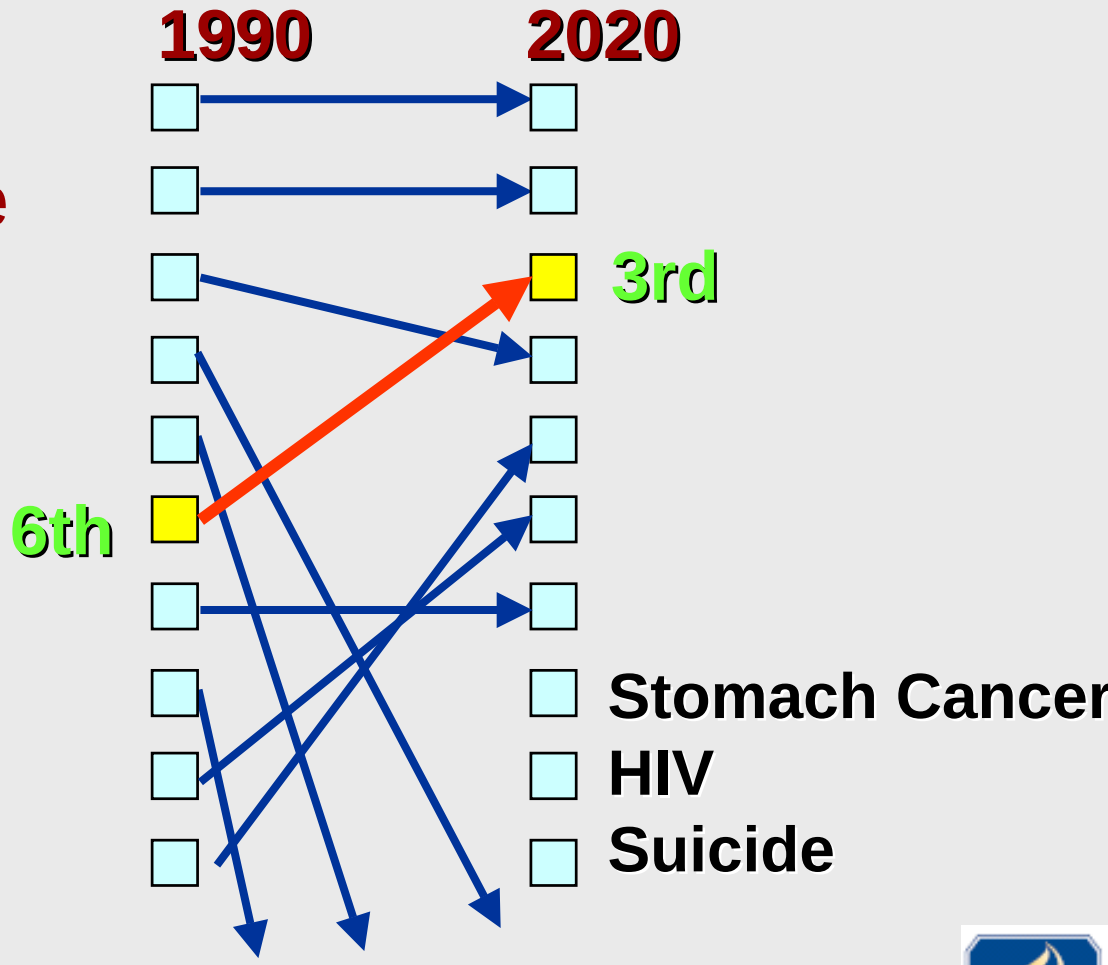
How is the Burden of COPD Estimated?

- Mortality
- Morbidity
- Prevalence
- Cost
- Quality of life

Future Mortality

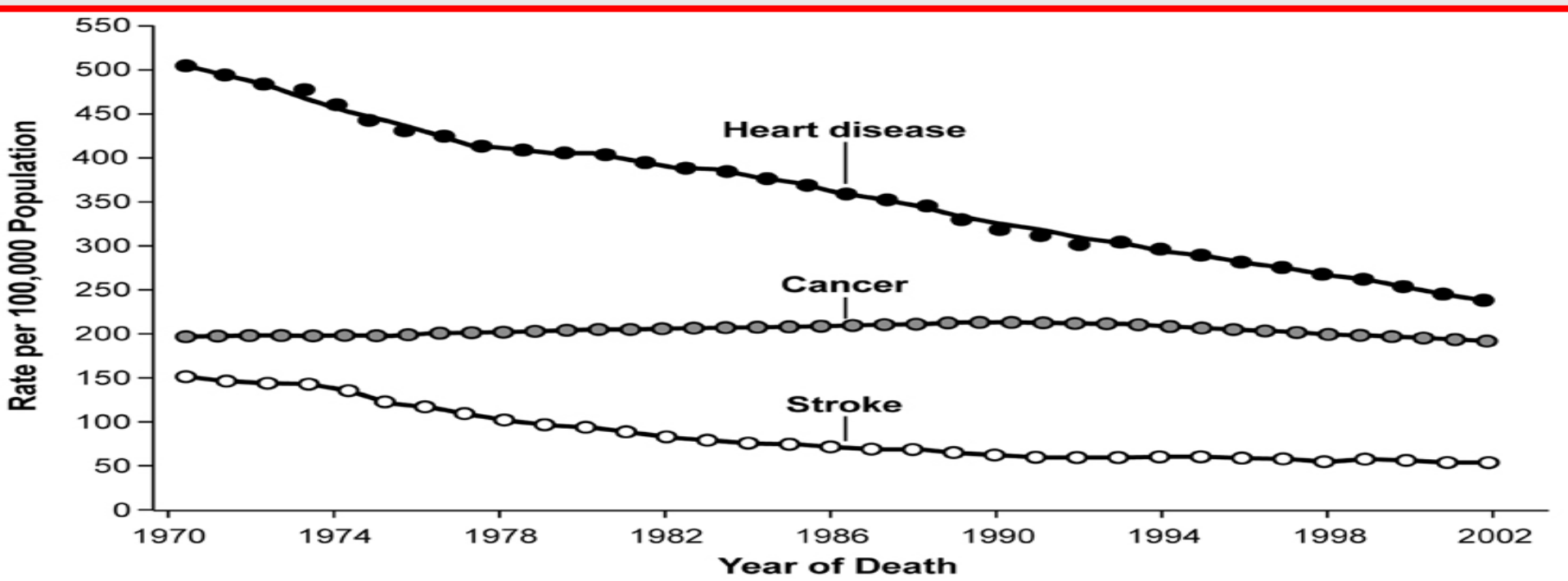
Murray & Lopez. Lancet 1997

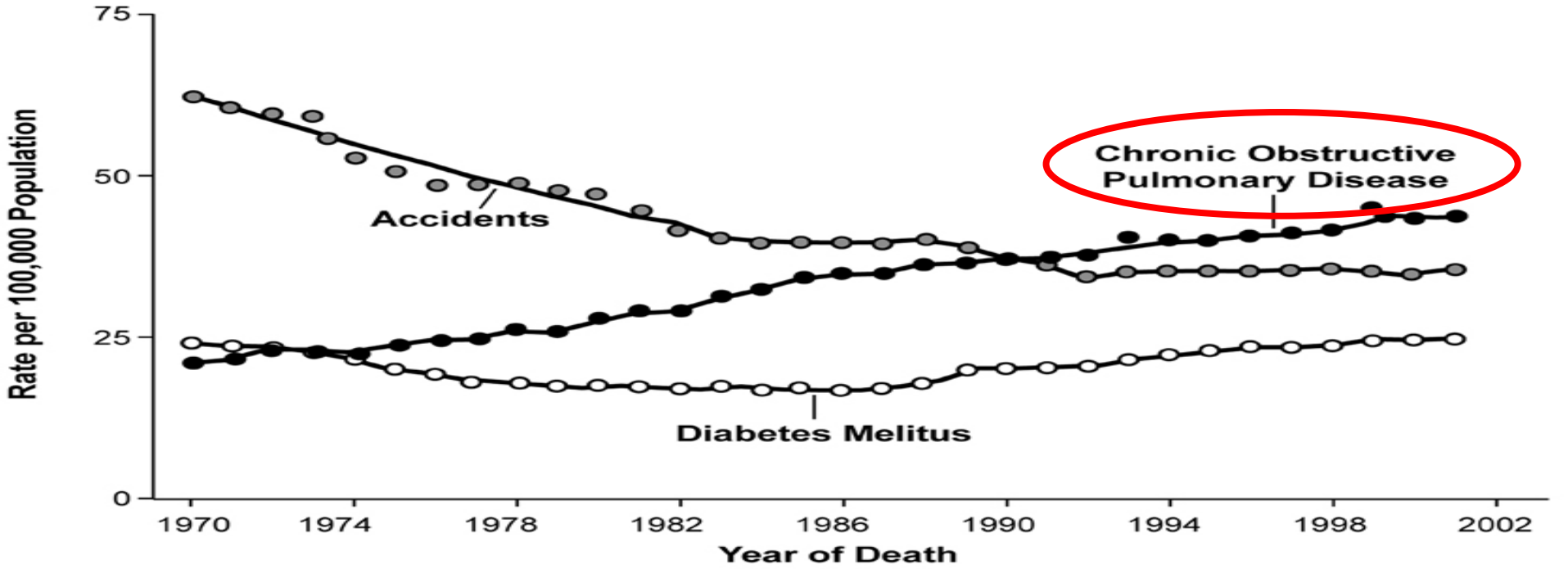
Ischaemic heart disease
Cerebrovascular disease
Lower resp infection
Diarrhoeal disease
Perinatal disorders
COPD
Tuberculosis
Measles
Road Traffic Accidents
Lung Cancer



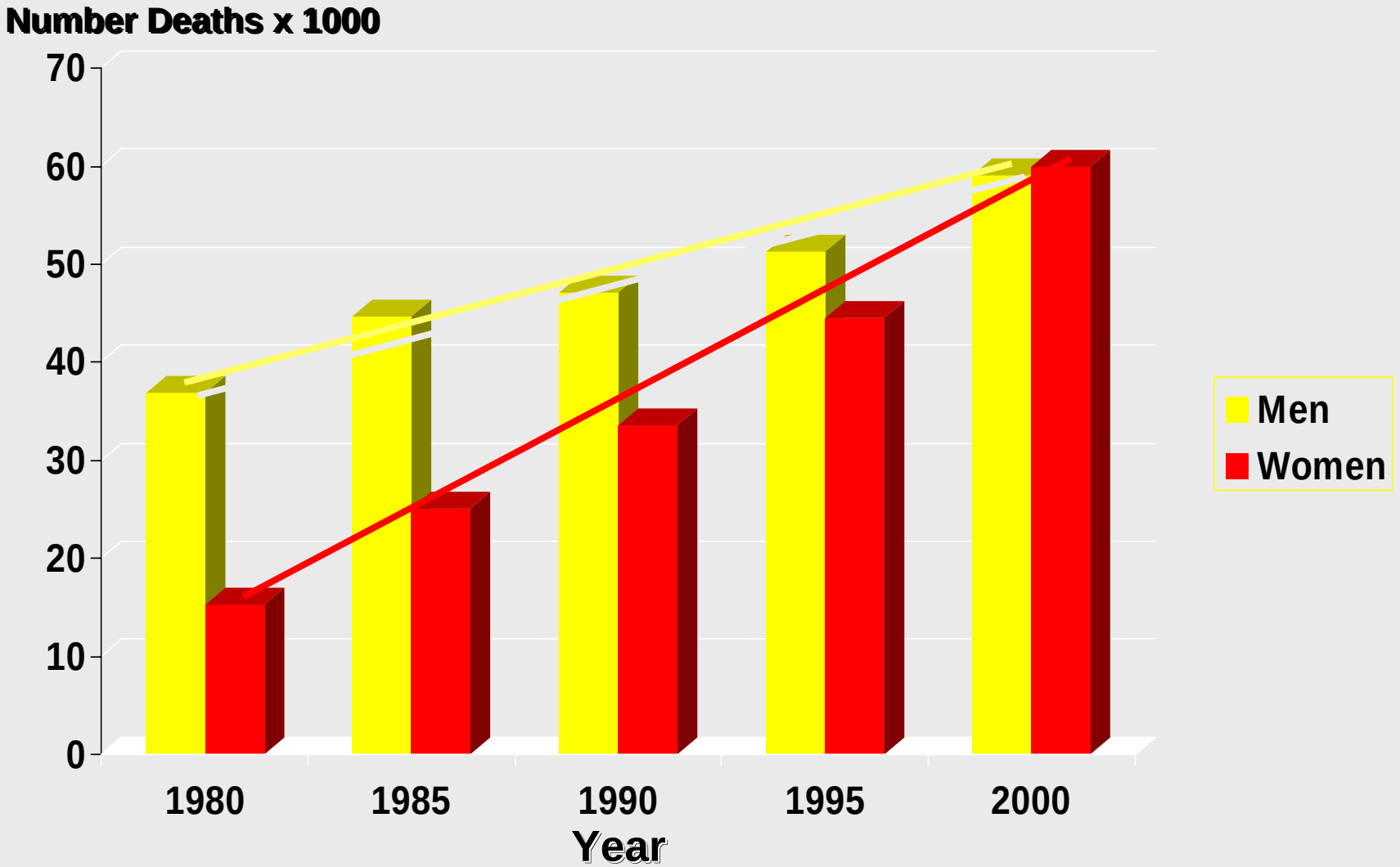
COPD Mortality in the US

COPD is the only one of the top 6 leading causes of death in the US that is increasing


Rate per 100,000 Population
550
500
450
400
350
300
250
200
150
100
50
0
Heart disease
Cancer
Stroke
1970
1974
1978
1982
1986
1990
1994
1998
2002
Year of Death


Rate per 100,000 Population
75
50
25
0
Accidents
Chronic Obstructive
Pulmonary Disease
Diabetes Melitus
1970
1974
1978
1982
1986
1990
1994
1998
2002
Year of Death

COPD Mortality by Gender, U.S., 1980-2000



Morbidity in COPD

Traditionally measured by:

- Physician visits
- Hospitalization
- Emergency visits

Morbidity in COPD

- May be affected by co-morbid chronic conditions that are not directly related to COPD but may have an impact on health status or may negatively interfere with COPD management
- Morbidity data are greatly affected by availability of hospital beds so should be interpreted with caution

Disability-Adjusted Life Years (DALYs)

- A metric used by WHO
- Combines premature death & disability

Leading Causes Of Disability-adjusted Life-Years (DALYs) Lost Worldwide: 1990 and 2020 (projected)

Disease or injury	RANK 1990	RANK 2020	% total DALYs
Lower respiratory infections	1	6	3.1
Diarrheal diseases	2	9	2.7
Ischemic heart disease	5	1	5.9
Cerebrovascular disease	6	4	4.4
Tuberculosis	7	7	3.1
Road traffic accidents	9	3	5.0
COPD	12	5	4.1

Murray & Lopez, Lancet 1997

Co-Morbidities of COPD

- Depression & anxiety
- Loss of bone mineral density & osteoporosis
- Myocardial infarction, angina & congestive heart failure
- Metabolic syndrome

% of Patients with Chronic Diseases in Netherlands van Weel Lancet 367: 550-1, 2006

# of Chronic Diseases	Self-Reported Dutch Survey	Primary Care >65 years	Primary Care >75 Years
0	43	34	31
1	26	27	29
2	14	22	25
≥3	16	17	15

Patterns of Co-Morbidities in Newly Diagnosed COPD in UK

- 2,699 patients with newly diagnosed COPD identified in UK General Practice Research Database
- Compared to non-COPD cohort, COPD patients were at increased risk of:
  - Pneumonia (RR 16)
  - Osteoporosis (RR 3.1)
  - Respiratory infections (RR 2.2)
  - Myocardial infarction and angina (RR for both1.7)
  - Fractures (RR 1.6)
  - Glaucoma (RR 1.3)

Soriano et al CHEST 2005; 128: 2099-2107

OHSU

Importance of Taking Co-Morbidities into Consideration

- Need for diagnostic testing
- Multiple drugs may be prescribed
- Adherence may be affected by multiple drugs and regimens
- Side effects of each drug and drug-drug interactions need to be monitored
- Quality of life affected
- Cost increases with each co-morbidity

COPD Prevalence

- COPD develops slowly over decades; usually becomes clinically apparent over age 40years
- Prevalence data are most helpful when expressed as rate over age 30 or 40 years
- Measuring COPD prevalence requires spirometry (simple breathing test)
- COPD occurs in smokers, nonsmokers and ex-smokers

Diagnosis of COPD

- Diagnosis of COPD is based on a history of exposure to risk factors and the presence of airflow limitation that is not fully reversible, with or without the presence of symptoms.

GOLD 2006

Spirometry is Needed for Diagnosis

- For the diagnosis and assessment of COPD, spirometry is the gold standard.
- The presence of a post-bronchodilator FEV1/FVC<.7 and FEV<80% predicted confirms the presence of airflow limitation that is not fully reversible

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Classification by Severity

Stage	Characteristics*
I: Mild	$FEV_1/FVC < 70\%$; $FEV_1 > 80\%$ predicted
II: Moderate	$FEV_1/FVC < 70\%$; $50\% < FEV_1 < 80\%$ predicted
III: Severe	$FEV_1/FVC < 70\%$; $30\% > FEV_1 < 50\%$ predicted
IV: Very Severe	$FEV_1/FVC < 70\%$; $FEV_1 < 30\%$ predicted or $FEV_1 < 50\%$ predicted plus chronic respiratory failure

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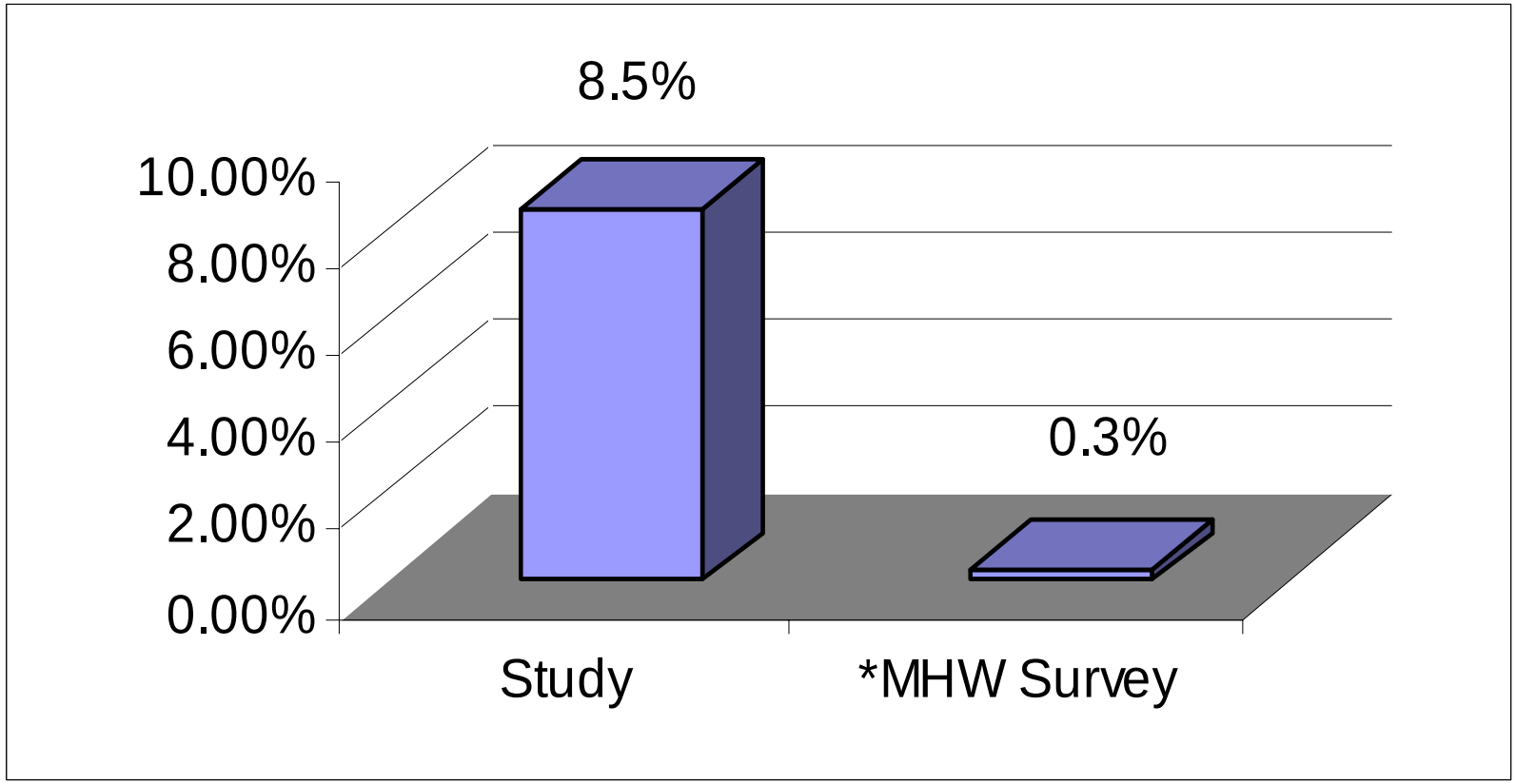
***Post-Bronchodilator**

COPD is Under-appreciated and Under-diagnosed

Example of Japan:

- NICE Survey of COPD prevalence
- Carried out in several regions of Japan using standardized methods

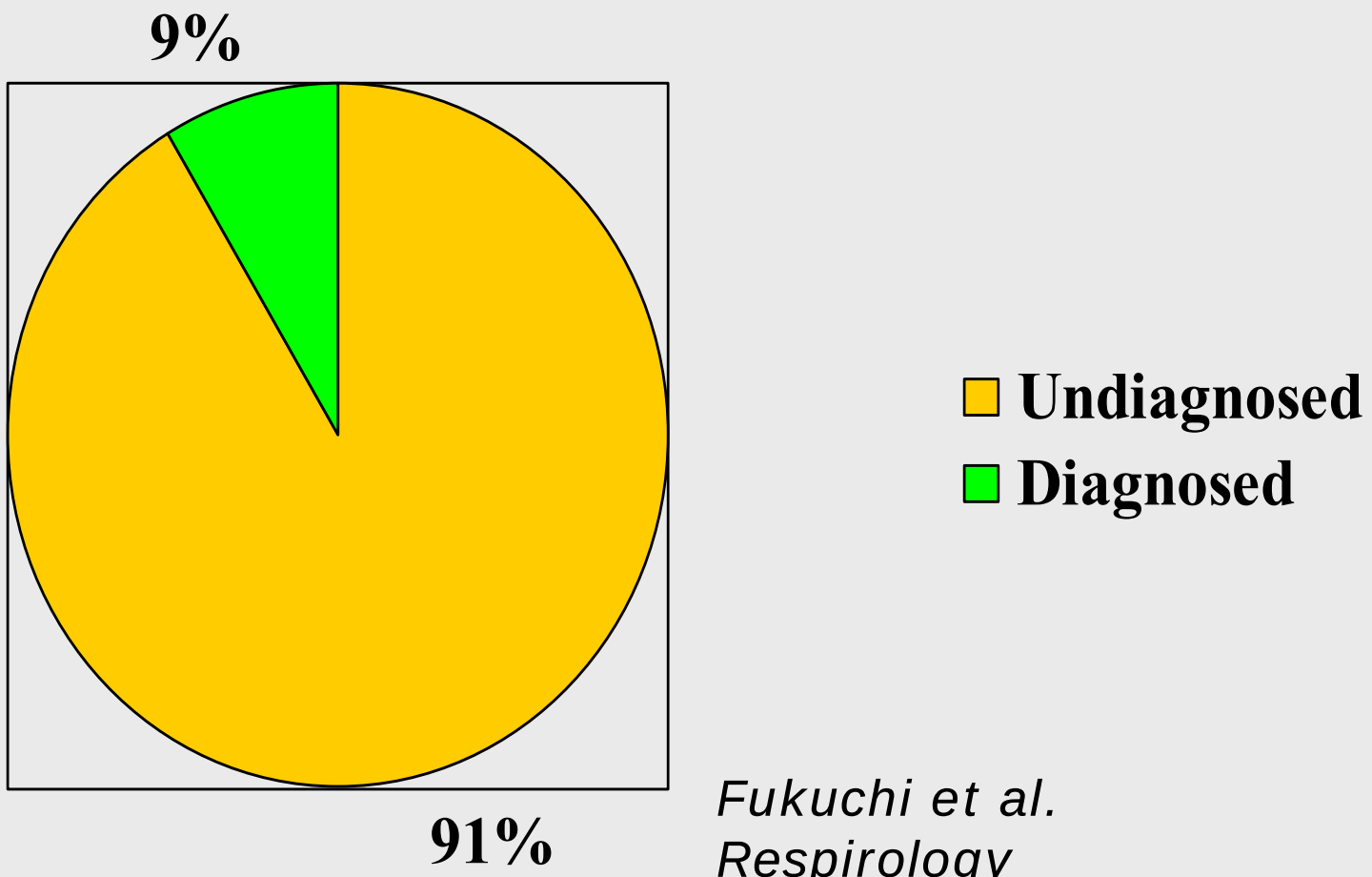
COPD Prevalence Rate (adjusted)** in Population > 40 years: NICE Study



* Ministry of Health and Welfare
**Adjusted for age, sex, cluster

Fukuchi et al. Respirology 2004;9:458-65

Diagnosed and Undiagnosed COPD in NICE Study in Japan:

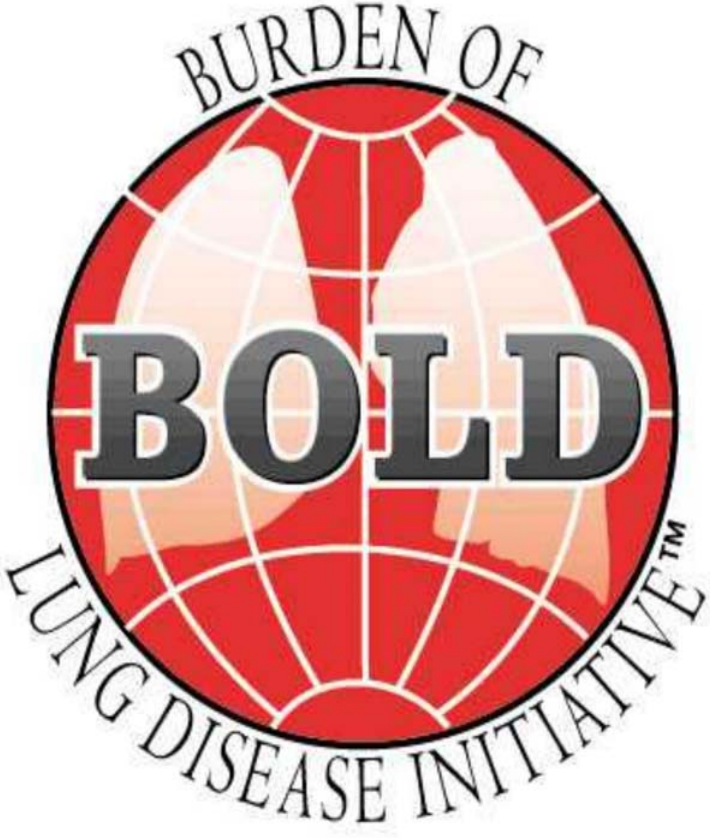


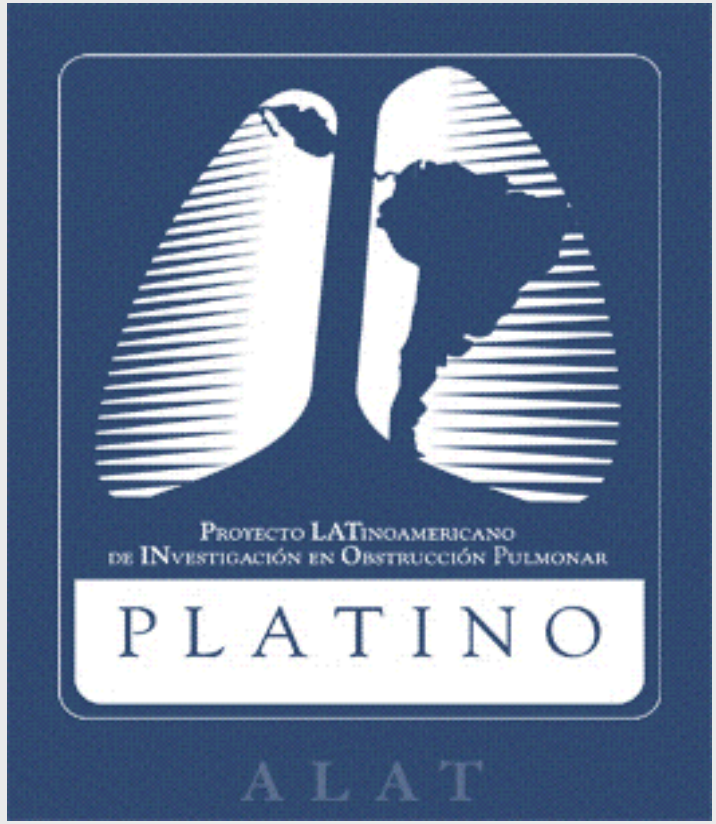
Fukuchi et al. Respirology 2004;9:458-65

Why is COPD Under-diagnosed?

- Cough & sputum are often thought of as normal in smokers
- The symptoms of COPD are often confused with aging (less fit, increased weight)
- COPD has poor name recognition

Two Models of International Collaboration





to Measure COPD Prevalence

PLATINO and BOLD

PLATINO: five countries in Latin America (Brazil, Chile, Uruguay, Mexico, Venezuela)

BOLD: 18 countries worldwide (China, Turkey, South Africa, Austria, Poland, Norway, Iceland, Canada, USA, Philippines, India, Estonia, Australia, UK, Portugal, India, Sweden, Netherlands)

Scientific Objectives of PLATINO & BOLD: Primary

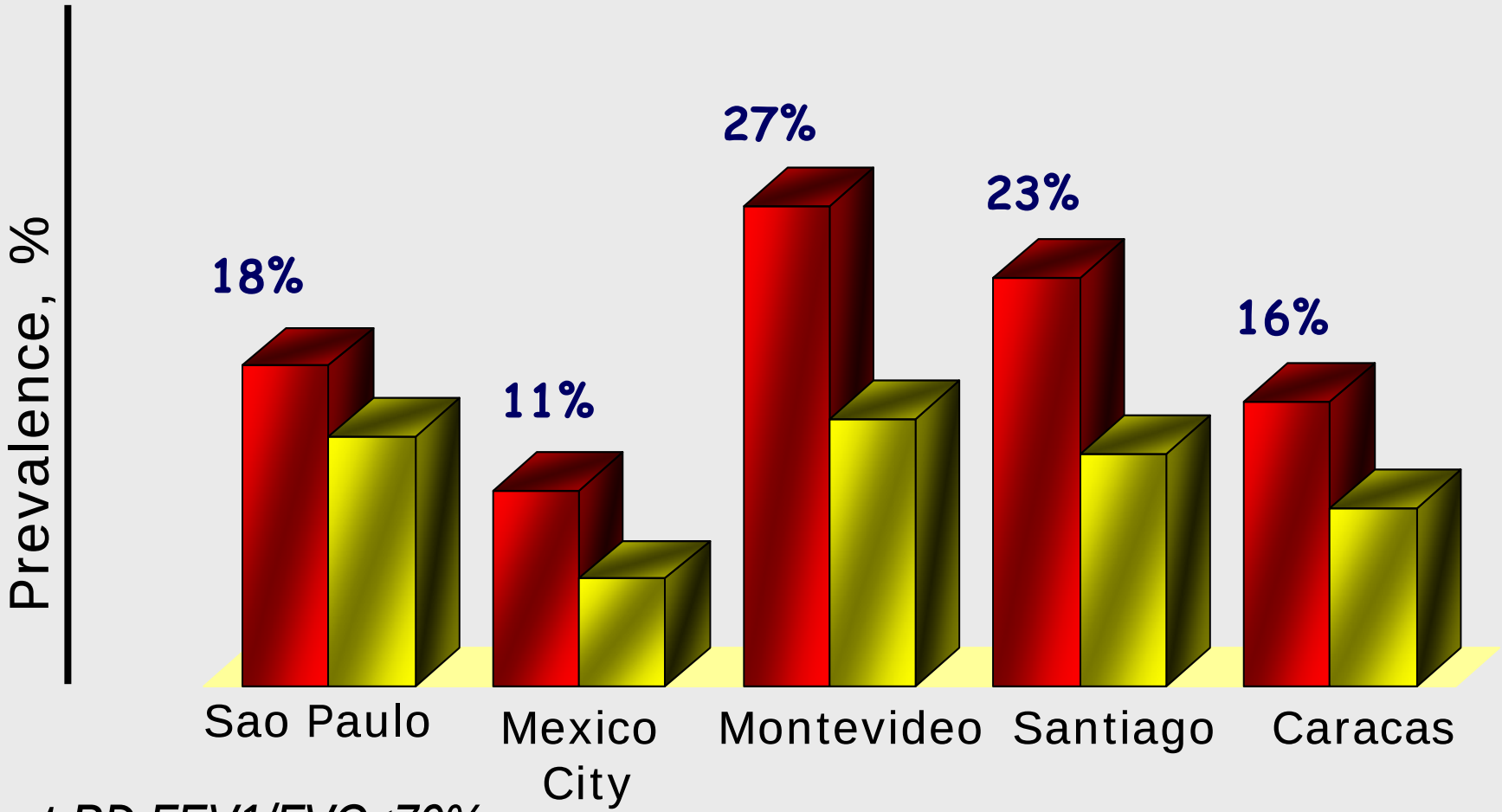
- Measure the prevalence of COPD & its risk factors by age & sex
- Estimate the burden of COPD
  - quality of life & activity limitation
  - respiratory symptoms
  - use of health care services

BOLD & PLATINO Entry Criteria

- ≥ 40 years
- Men & women
- Population-based e.g. random sample of population

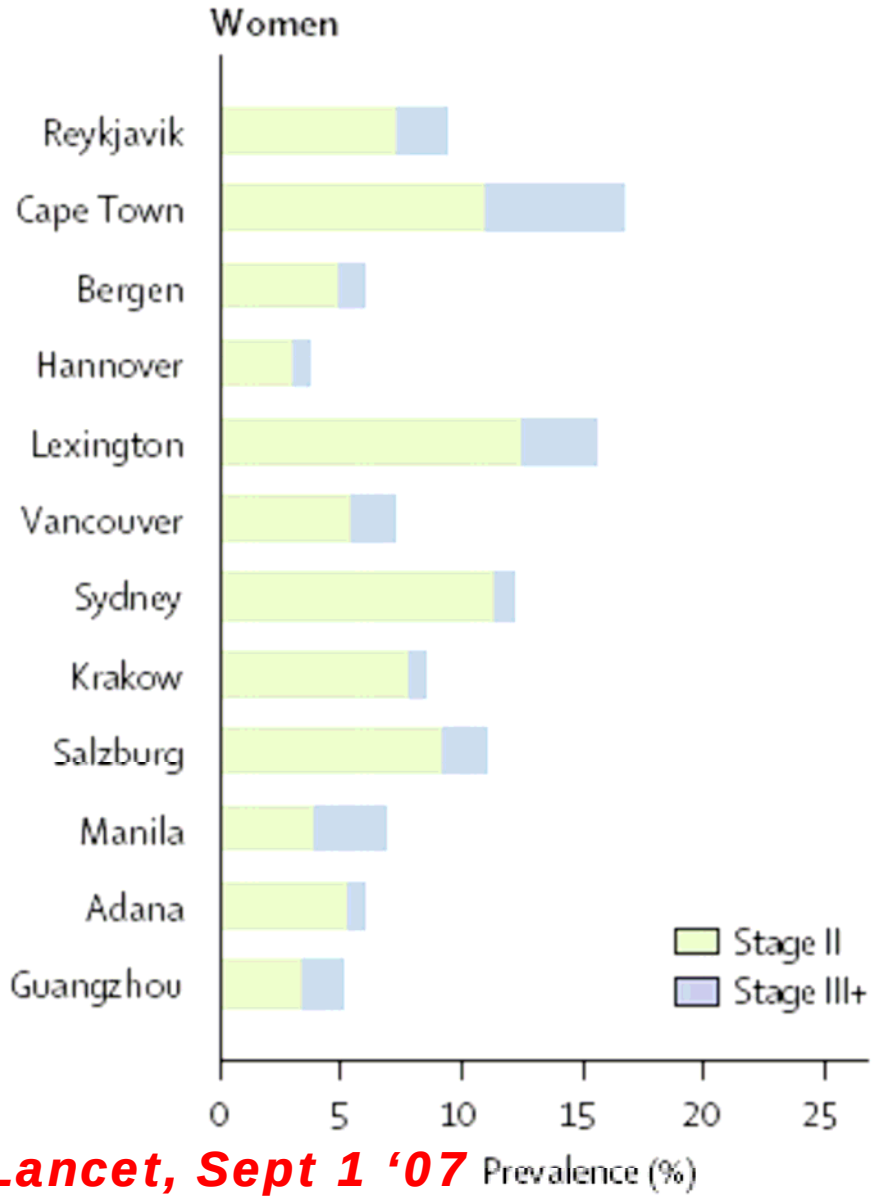
GOLD Stage 1+≥40 years in 5 Latin American Cities, PLATINO

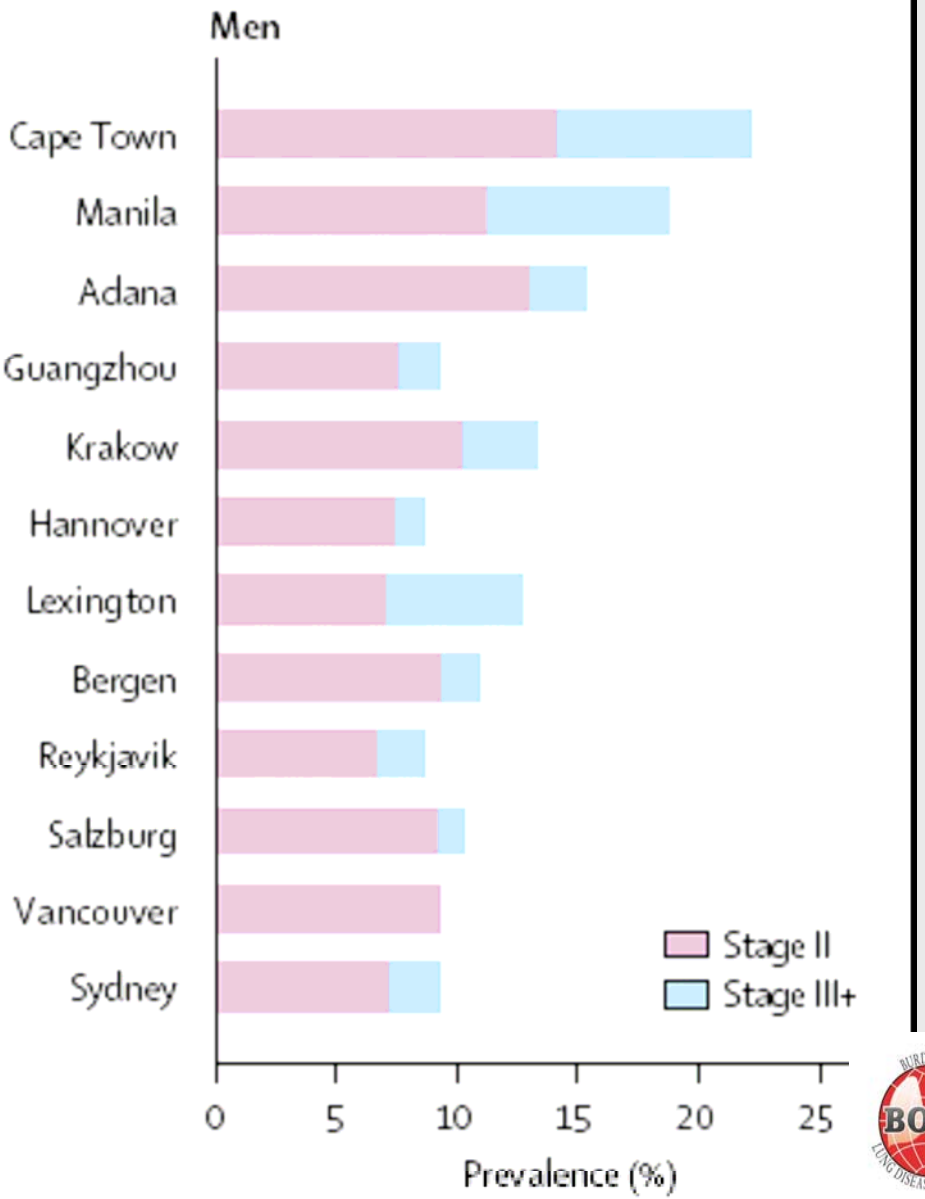
Menezes et al Lancet 2005



Post-BD FEV1/FVC<70%

Prevalence of GOLD Stage 2 & 3 COPD in 12 Countries by Descending Order of Smoking, BOLD

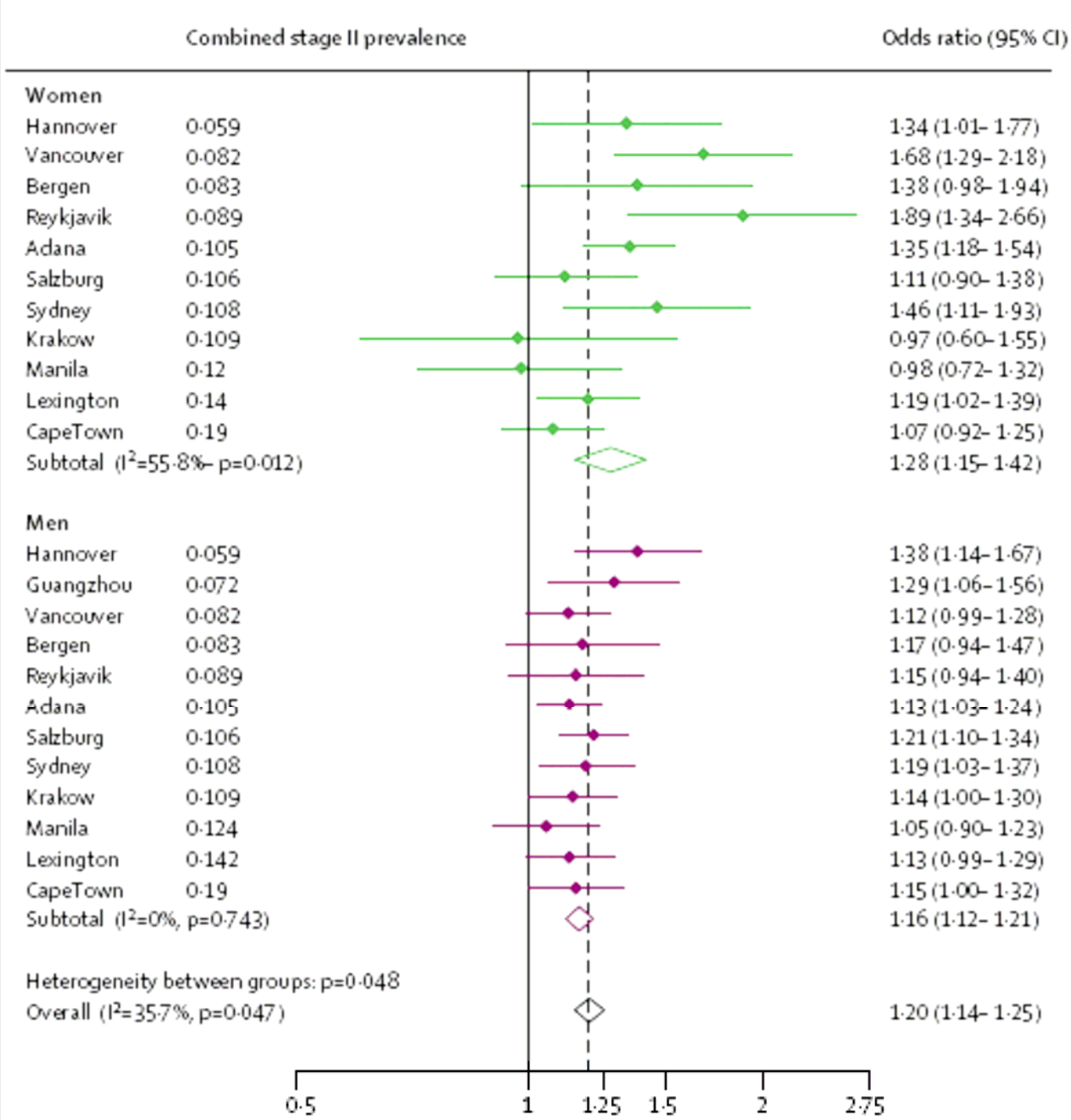




Lancet, Sept 1 '07

Odds Ratios of Stage 2+ COPD for each 10pack-year increments in smoking in ever smokers by sex & site, BOLD Study in 12 countries

Lancet, Sept 1 '07



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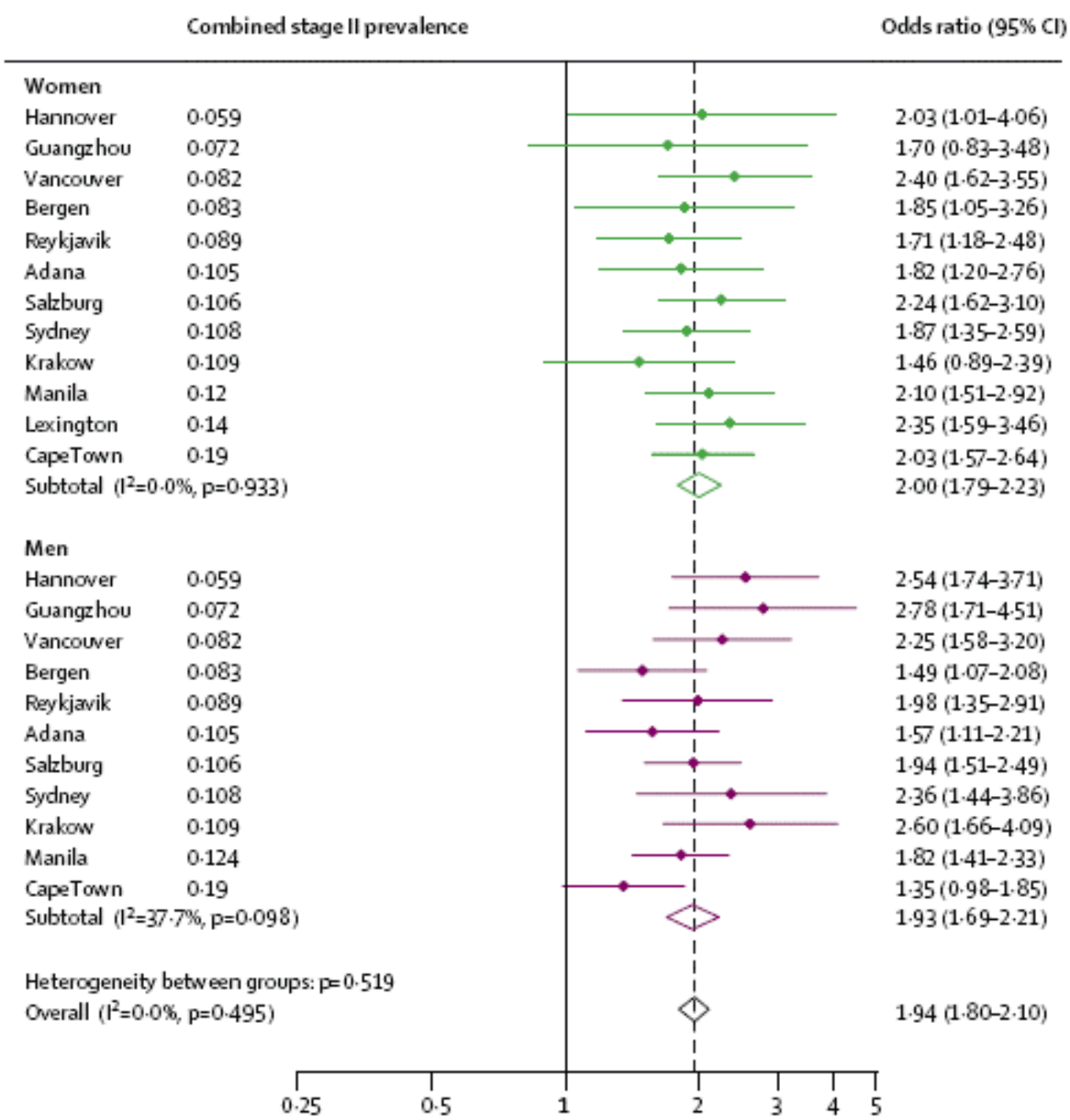
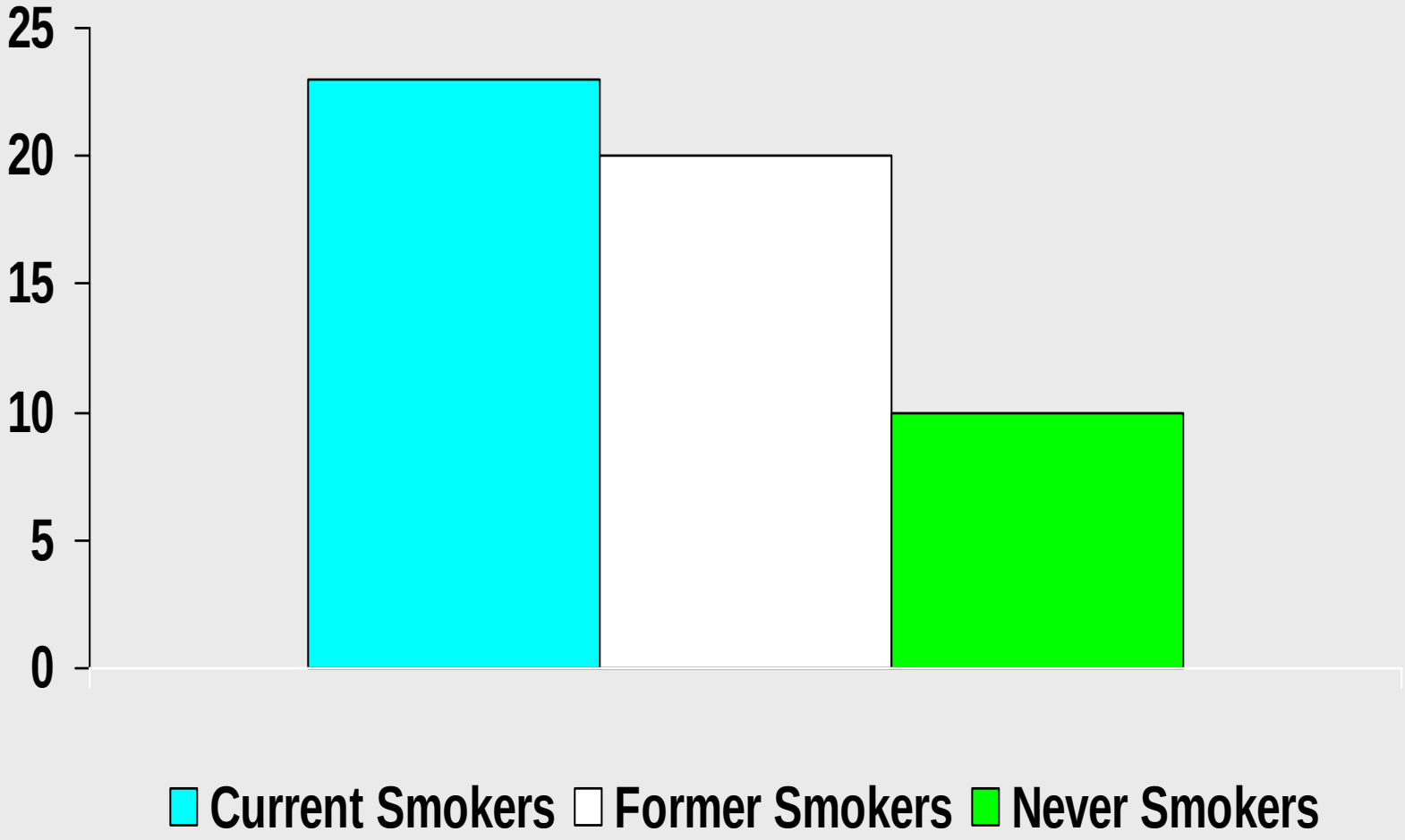


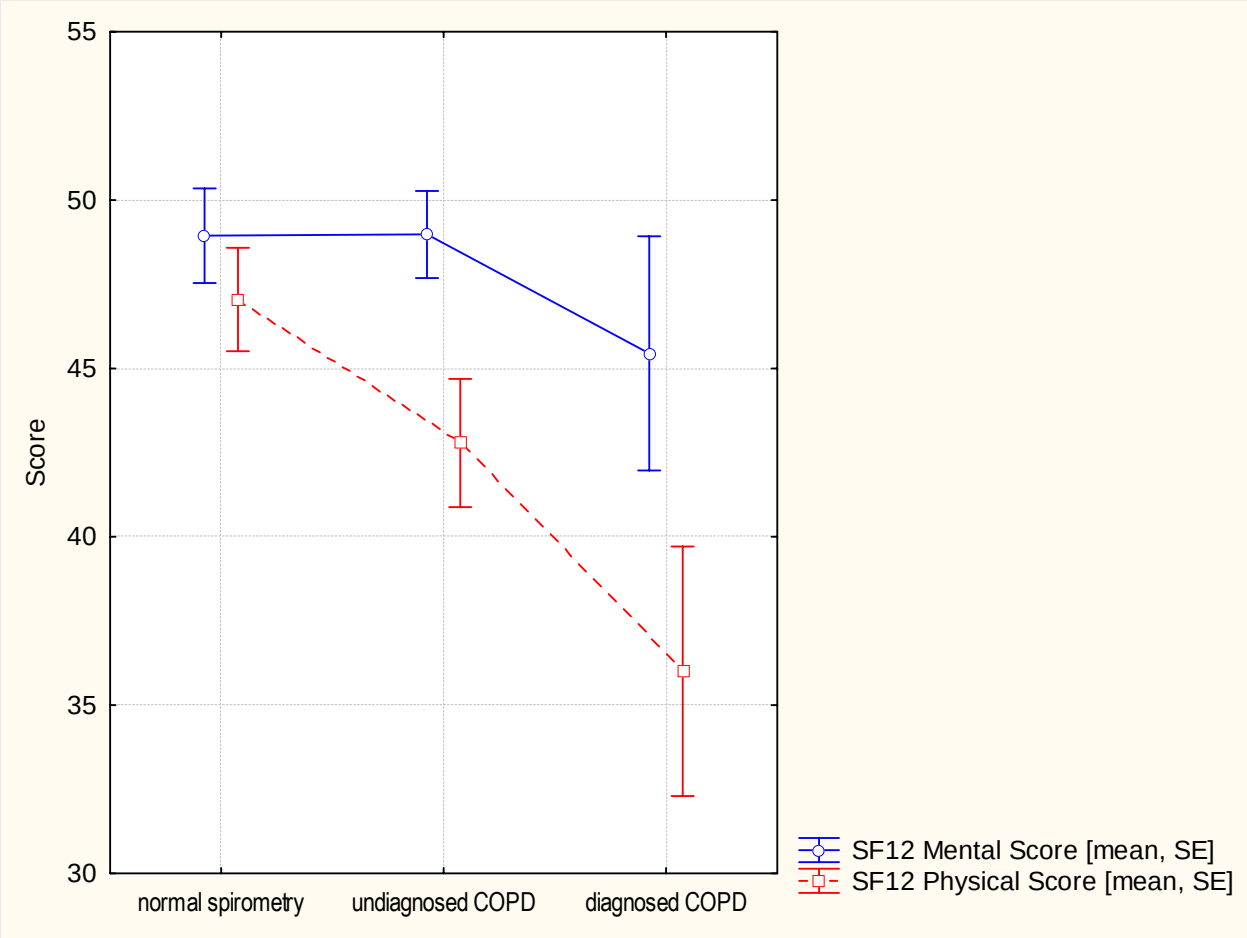
Proportion of Adults with $FEV_1/FVC < 70\%$, Age-adjusted to Total Population



NHANES III, U.S 1988-94

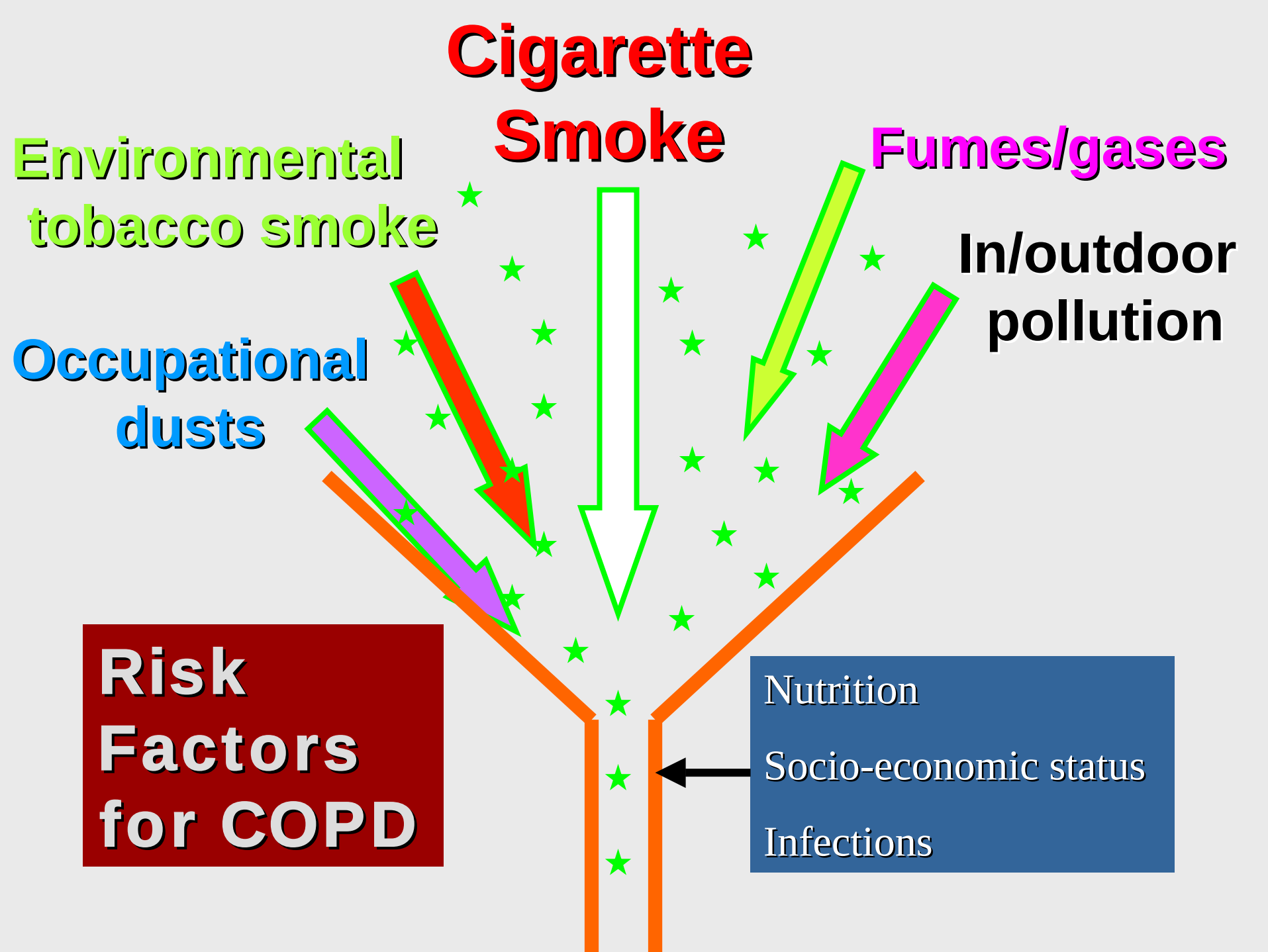
Quality of Life Scores in Poland BOLD Study

SF 12 scores in participants with normal lung function, undiagnosed COPD and diagnosed COPD

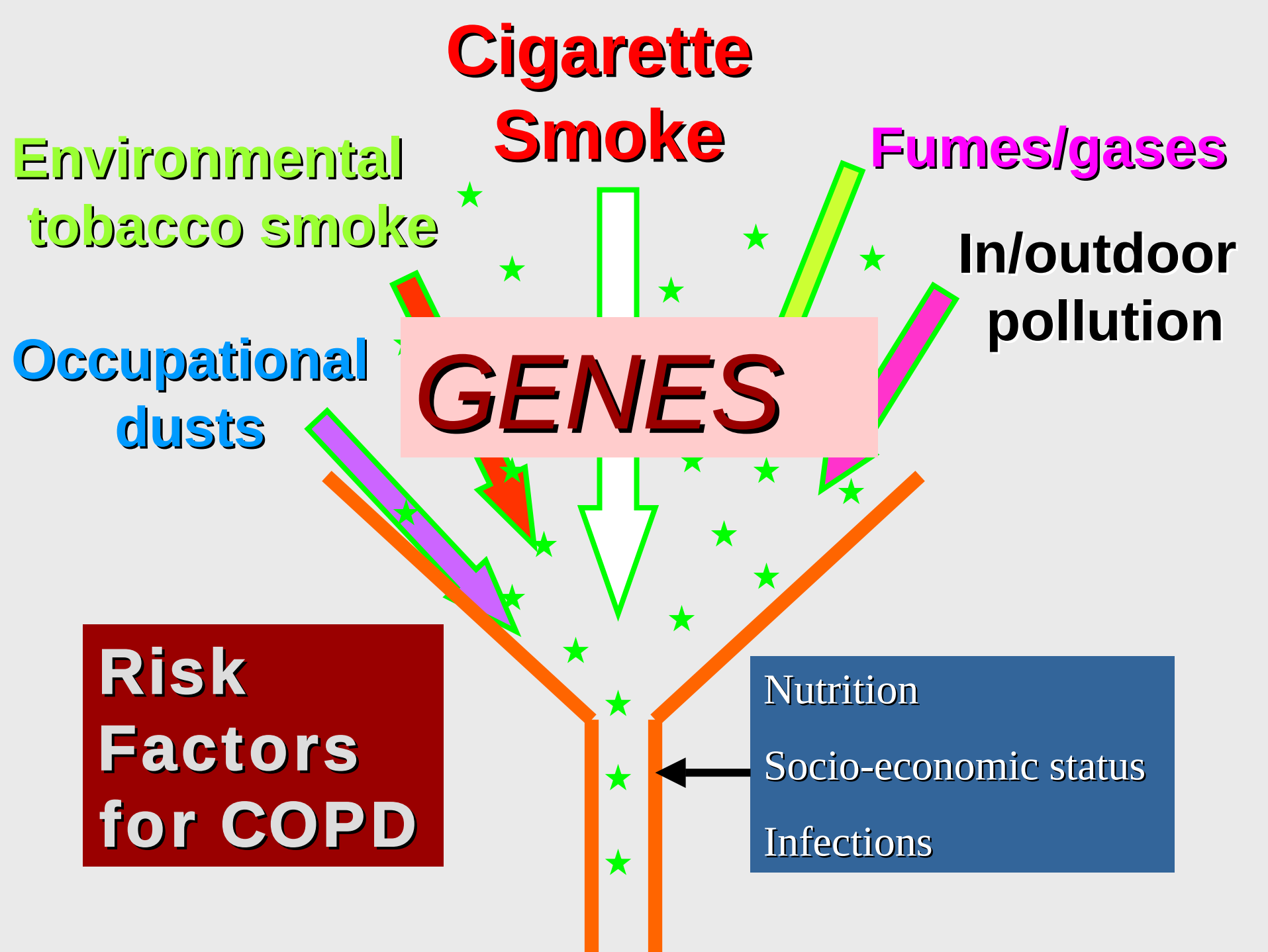


Why is the Burden of COPD Increasing Worldwide?

- Increase in exposure to risk factors (especially tobacco) in developing countries & in women


Cigarette Smoke
Environmental tobacco smoke
Fumes/gases
In/outdoor pollution
Occupational dusts
Risk Factors for COPD
Nutrition
Socio-economic status
Infections

COPD is a classic gene-environment interaction disease


Cigarette Smoke
Environmental tobacco smoke
Fumes/gases
In/outdoor pollution
Occupational dusts
GENES
Risk Factors for COPD
Nutrition
Socio-economic status
Infections

Trends in Risk Factors
Smoking

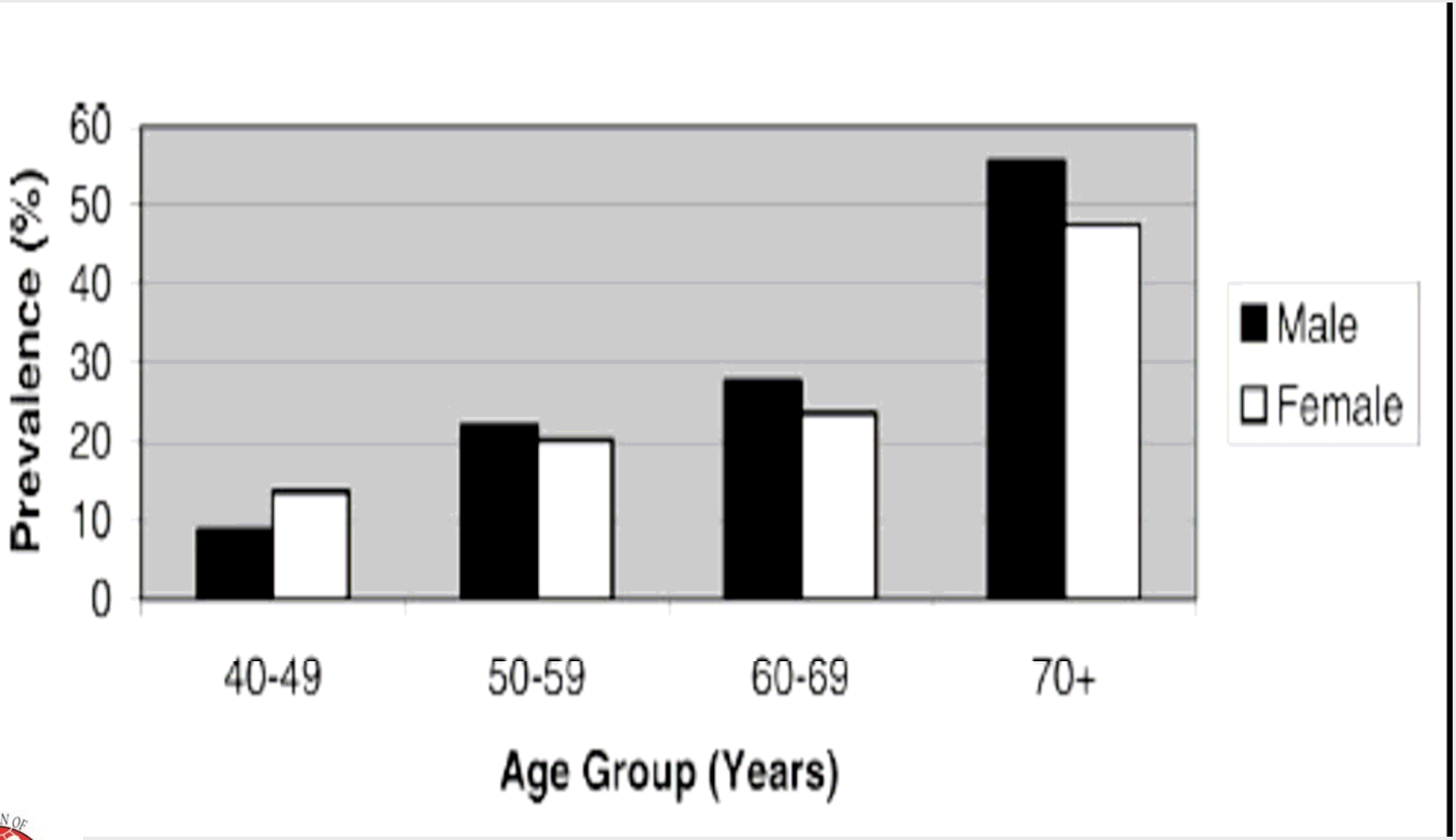
- Until 1940s, smoking prevalence in women much less than men worldwide
- Smoking increased in women in many countries in 1940s and gradually equaled rates in men

Trends in Risk Factors
Other Exposures

- Until WW2, men were much more likely than women to have heavy occupational exposures


DO YOU WANT
YOUR WIFE
TO WORK
AFTER THE WAR
?
EM 31
G I ROUNDTABLE
★
hirst
ROSIE

GOLD Stage 1+ ≥40 years in Salzburg, Austria, by Age & Sex (BOLD Study, 2006)



Schirnhofer et al, Chest 2007; 131:29036

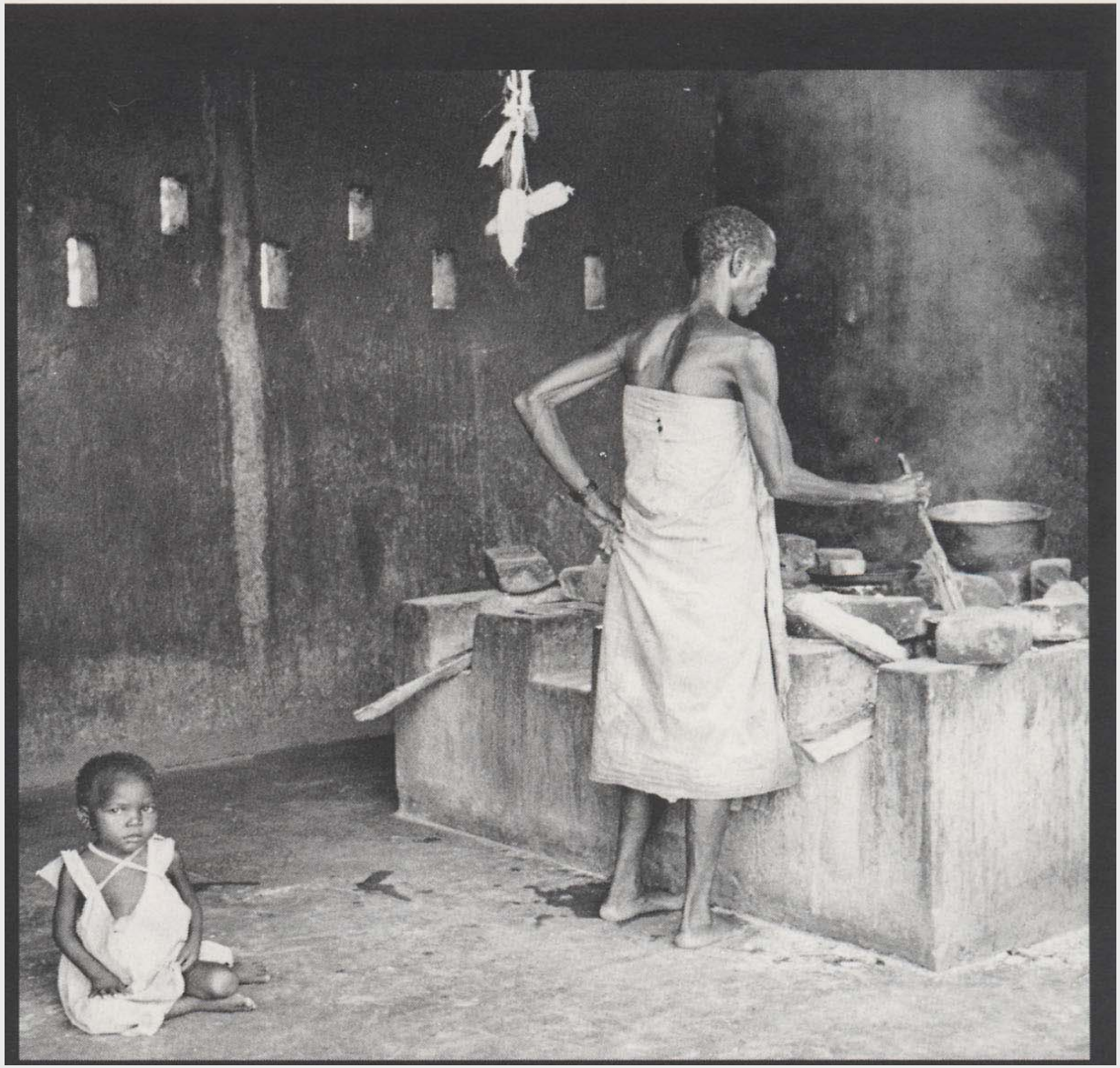
Occupation as a Risk Factor

- Data from the US NHANES III Survey (1988-'94) used to estimate % of COPD attributable to occupation
- Fraction of COPD attributable to work estimated as 19.2% overall and 31.2% among never-smokers

Trends in Risk Factors
Other Exposures

- Heavy exposures to indoor air pollution as a risk factor (especially in developing countries) were not recognized as important risk for COPD

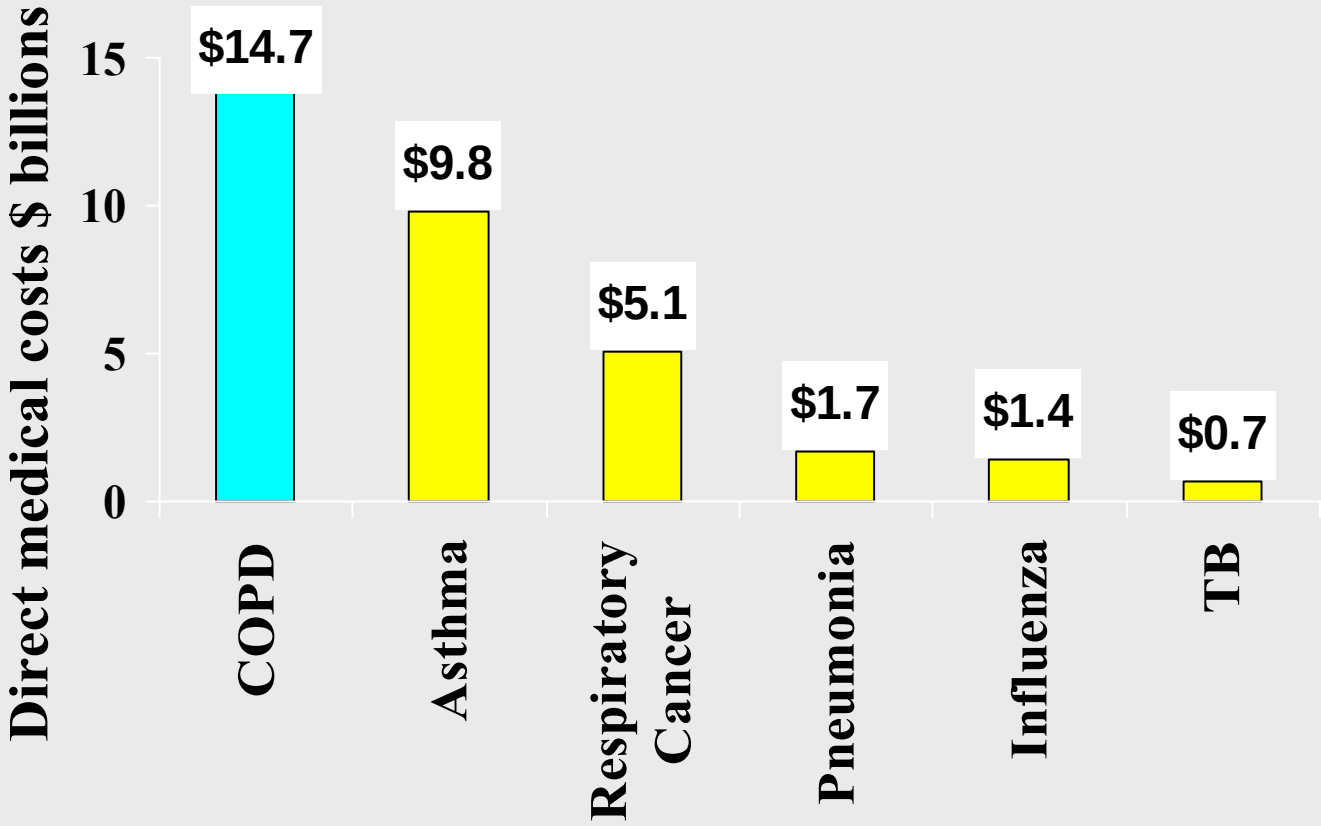
Indoor air pollution from biomass cooking



Cost of COPD in US

- COPD is a very costly disease
  - direct (diagnosis and management)
  - indirect (cost of disability, missed work, premature mortality and family costs)
- Annual per capita expenditures for people with COPD nearly 2½x those without COPD ($8,482 vs $3,511 in 1992 study)

Direct Medical Costs of COPD in US

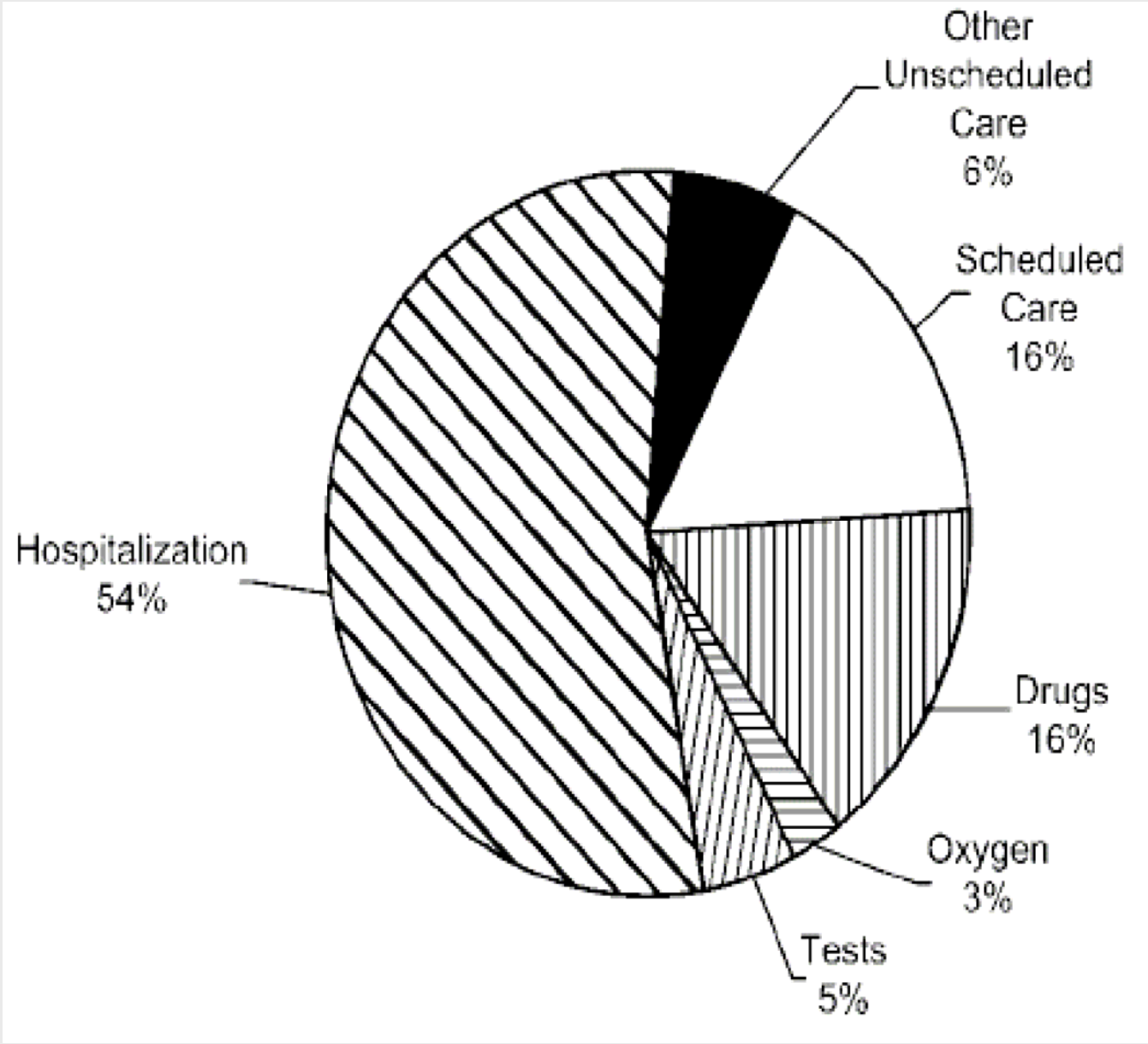


Average UK societal costs of COPD according to severity.

Severity	Direct Annual Costs (£)	Indirect Annual Costs (£)
Mild	232	399
Moderate	477	202
Severe	2,026	2,331

Halpin
Proc Am Thoracic Soc
2006;3(3): 227

Breakdown of Direct Costs of COPD care in the UK



Halpin
Proc Am Thoracic Soc 2006;3(3): 227

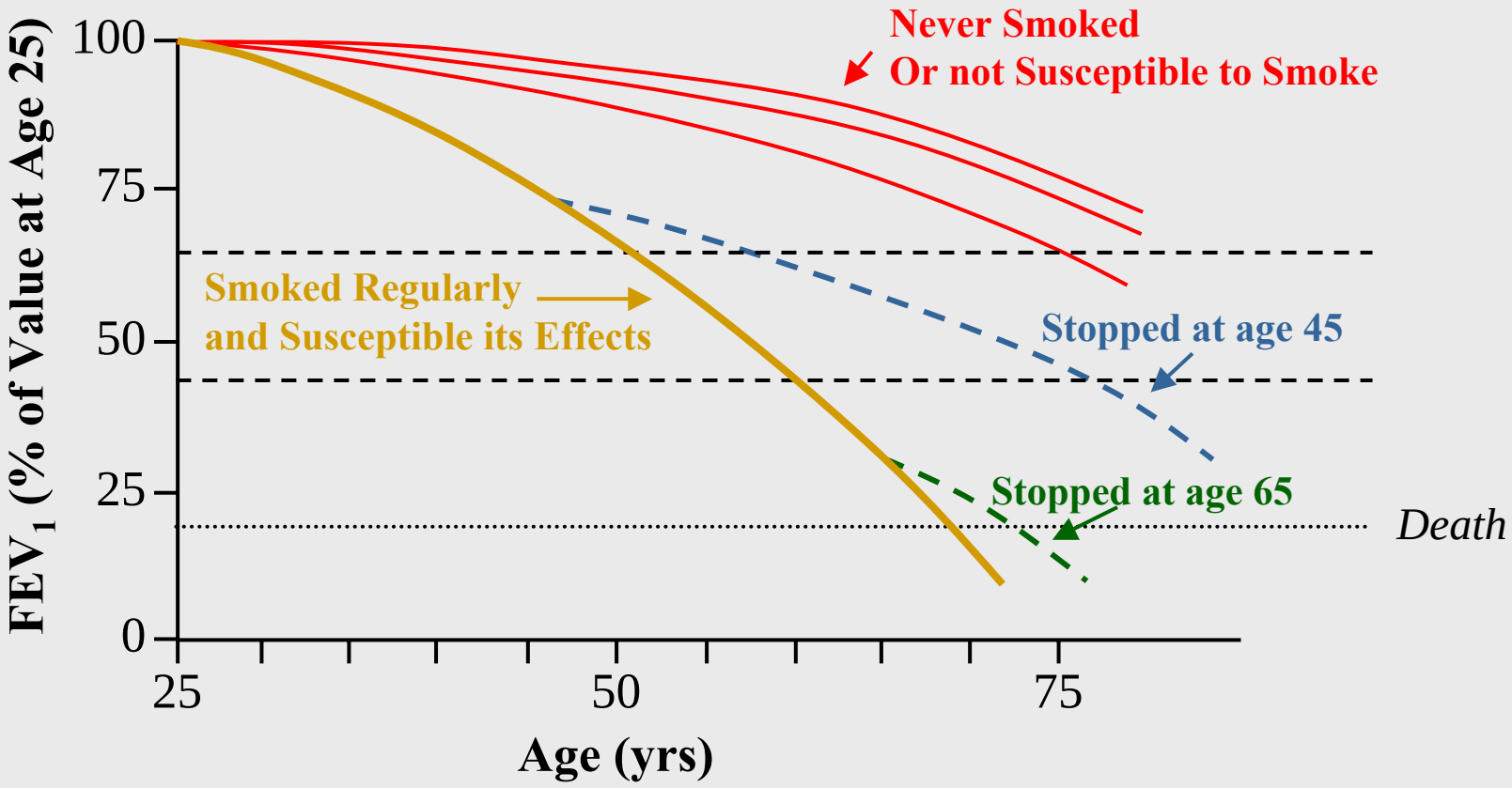
Why is the Burden of COPD Increasing Worldwide?

- Changing age structure of populations in developing countries (more are living into the COPD age range)

Changing Demographics in China

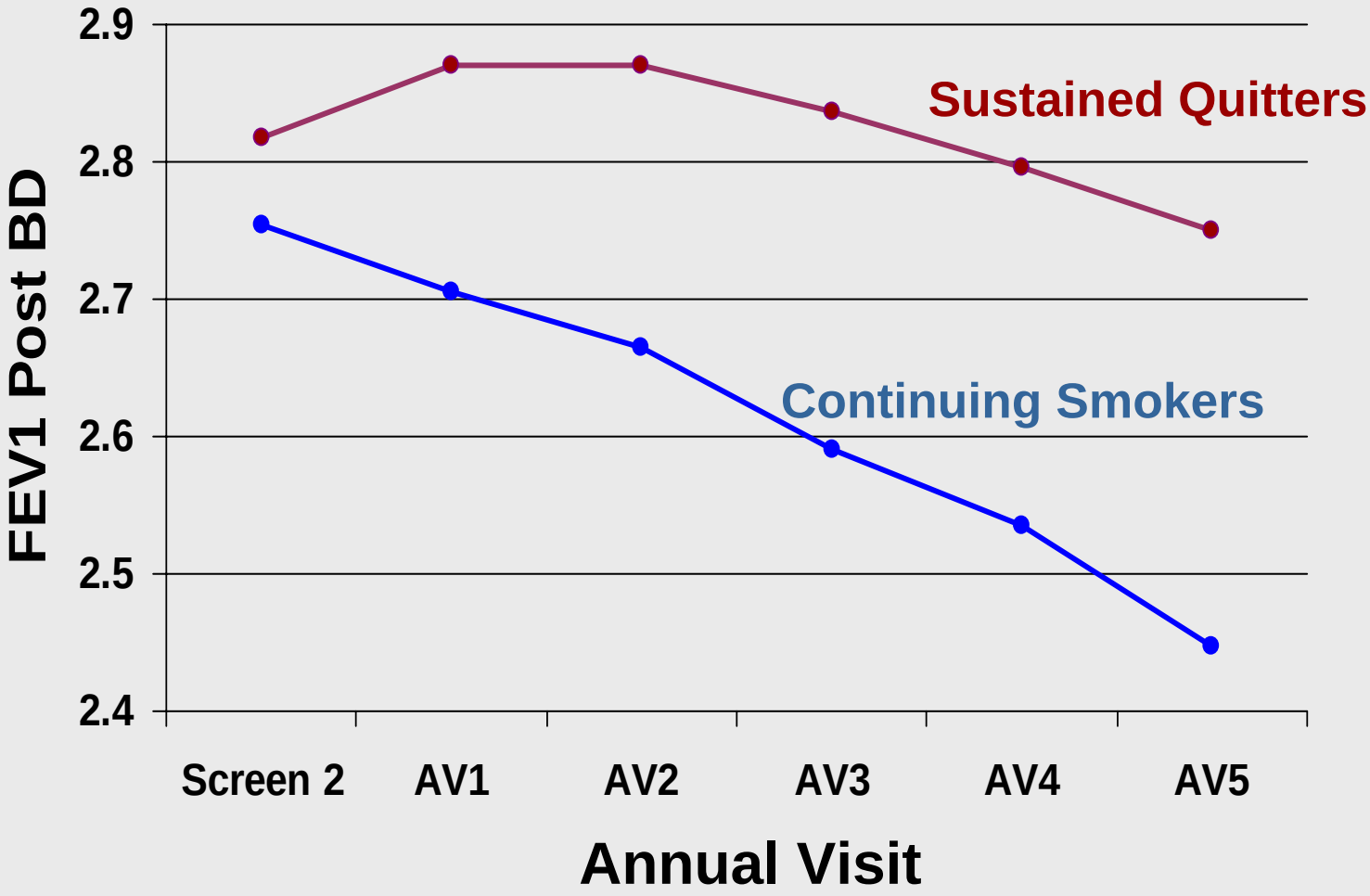
- Total population: ~1.3 B
- Population growth rate: 0.6%
- ≥ age 65 in 2006: 100M
- ≥ age 65 in 2015: 200M
- ≥ age 65 in 2050: 430M

Natural History of COPD:



Adapted from Fletcher C, Peto R. BMJ. 1977;1:1645-1648

Mean Post-BD FEV_1 in Placebo Group



Lung Health Studies I-III

Summary

- COPD is common, costly, and imposes a significant social and economic burden yet is mostly under-diagnosed and under-treated
- COPD has become as common in women as men as smoking habits have equalized
- COPD is common in smokers and ex-smokers but can also exist in nonsmokers
- The burden of COPD continues to rise steadily in all countries because of increasing life expectancy and decades of tobacco use

Key Messages to Physicians & Public

- Think COPD
- Do spirometry
- Reduce risk factors
- Manage actively

"COPD is preventable and treatable"