

# Study Design 2: Cross-Sectional Studies

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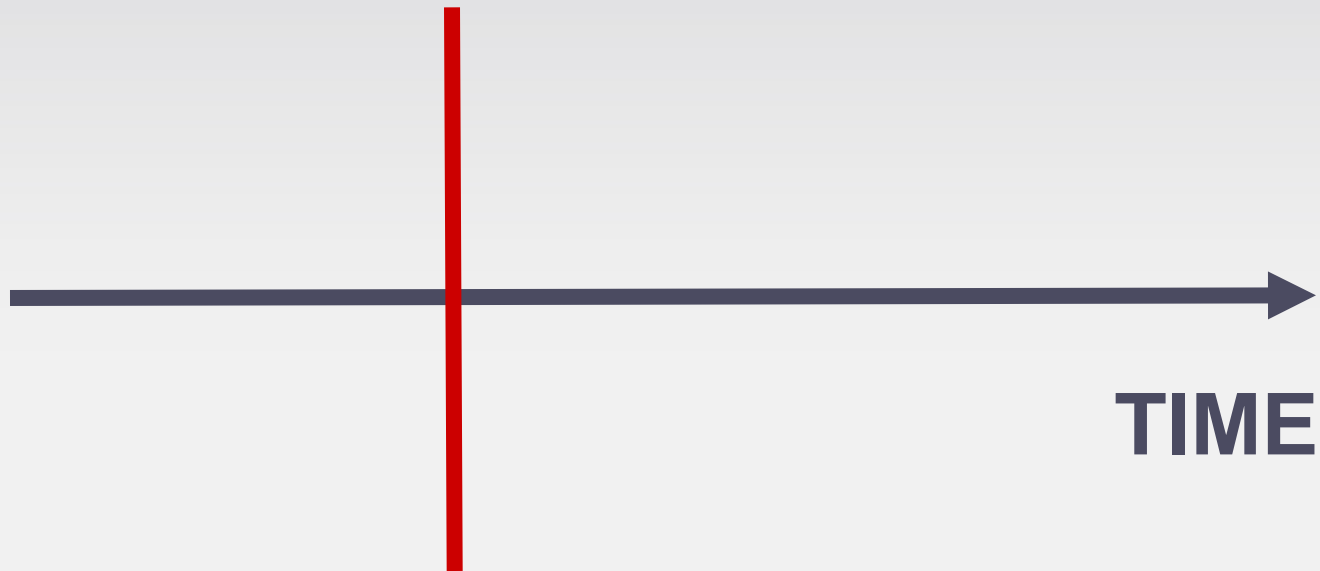
# Study Design



## **Life's a journey...**

The “study base” is a population of individuals, each carrying the burden of personal and group risk factors.

# Cross-Sectional Study

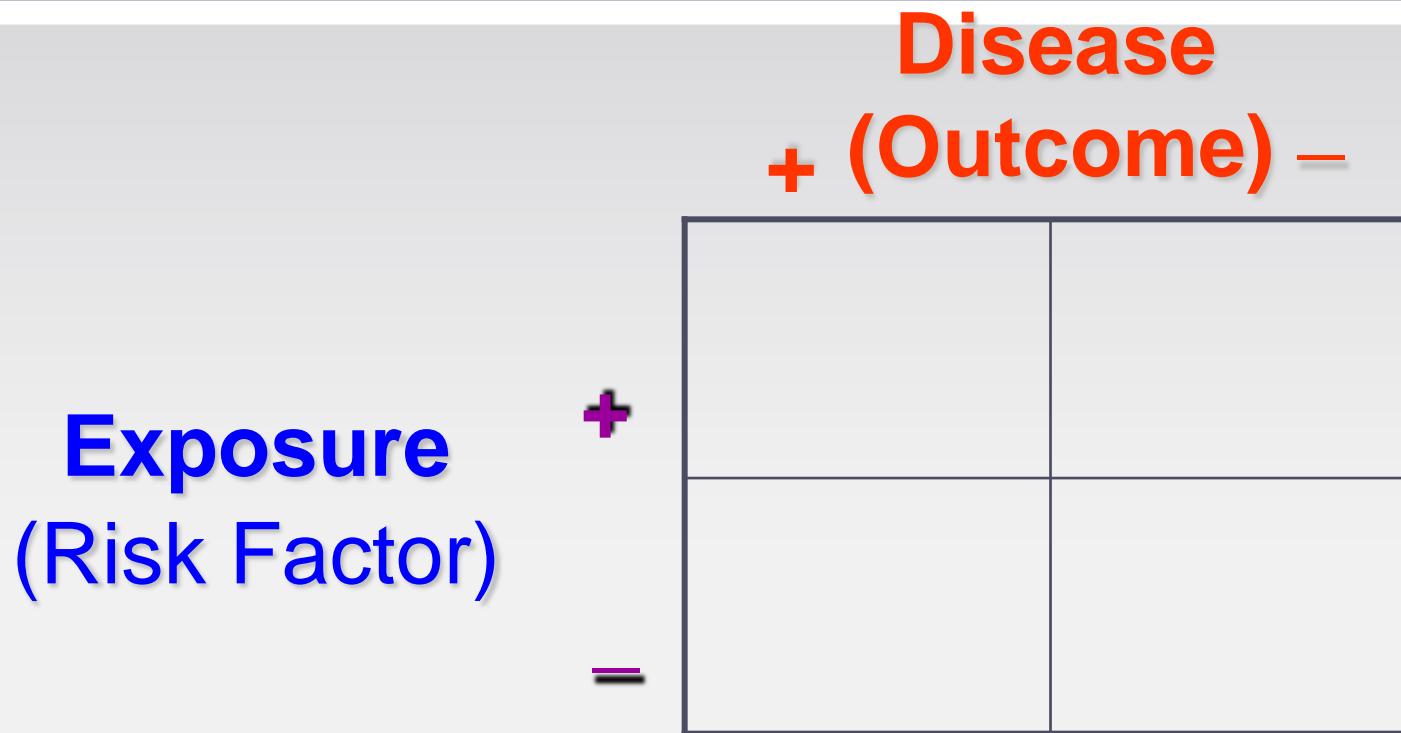


***“Snapshot”***

# Cross-Sectional Studies

- **OTHER TERMS:**
- Prevalence Study
- Survey

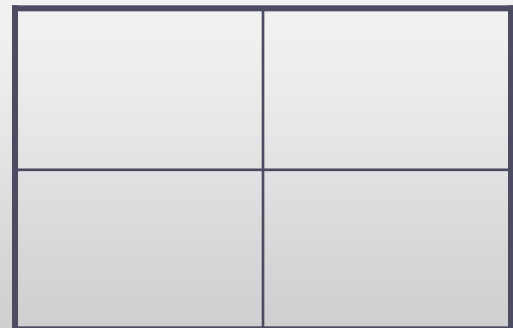
# Study Design: Cross-sectional studies



**EXPOSURE & DISEASE (Outcome)  
STATUS AT SAME TIME**

# Cross-Sectional Studies

- Begin with “**cross-sectional**” sample (study population)
- Determine **exposure** and **disease (outcome)** at same time
- Think of cross-sectional studies as a ***snapshot*** in time



# Examples of When to do a Cross-Sectional Study

- To estimate prevalence, burden or cost of disease e.g. COPD, TB, HIV, pulmonary hypertension
- To look at associations e.g. risk factors for multi-drug resistant TB, biomass exposure for COPD
- To measure resources e.g. number of hospital beds, number of doctors, nurses , critical care beds etc available in region
- To measure attitudes & behaviors of providers e.g. towards tobacco

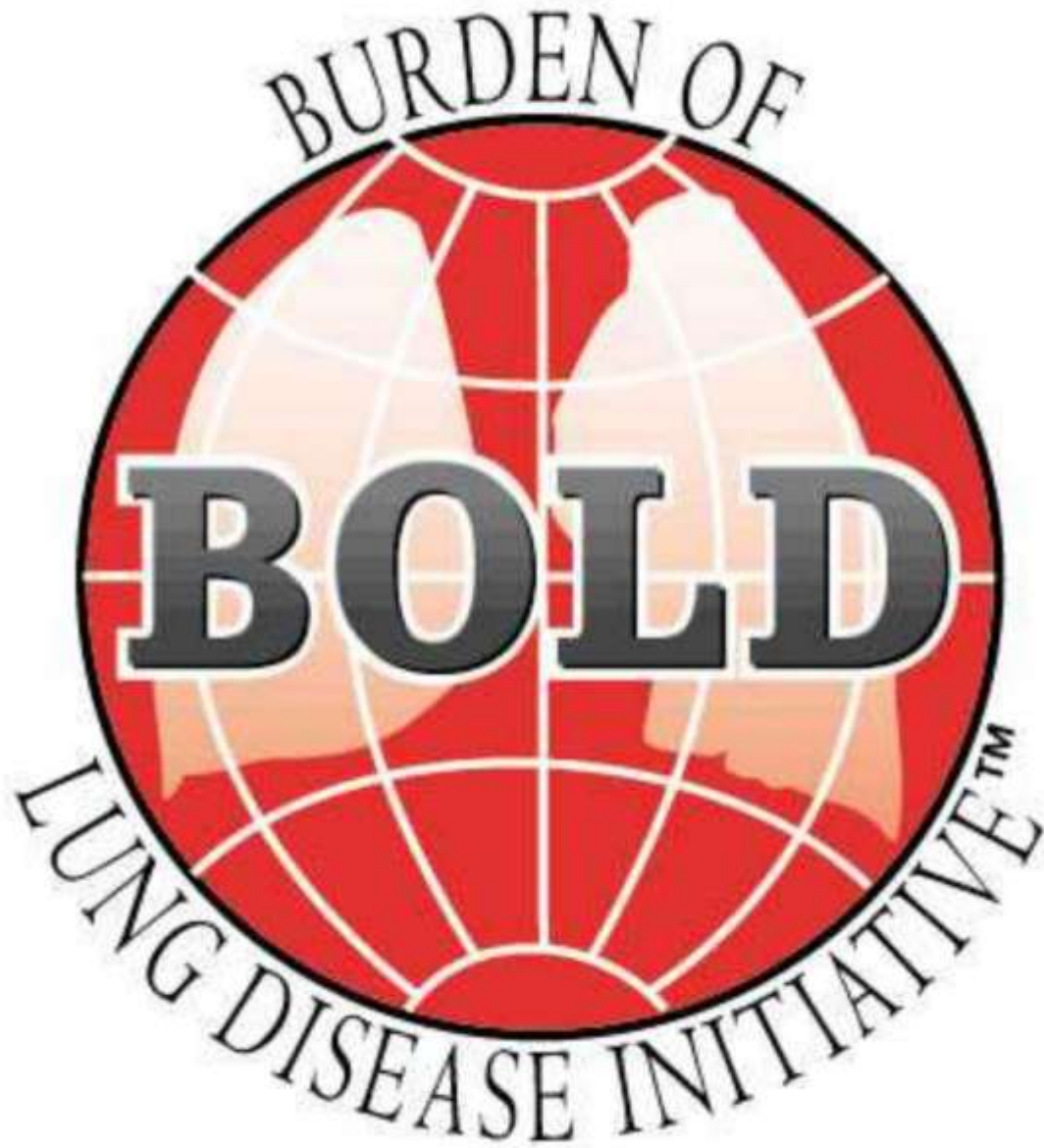
# Cross-Sectional Studies

- **Advantages**

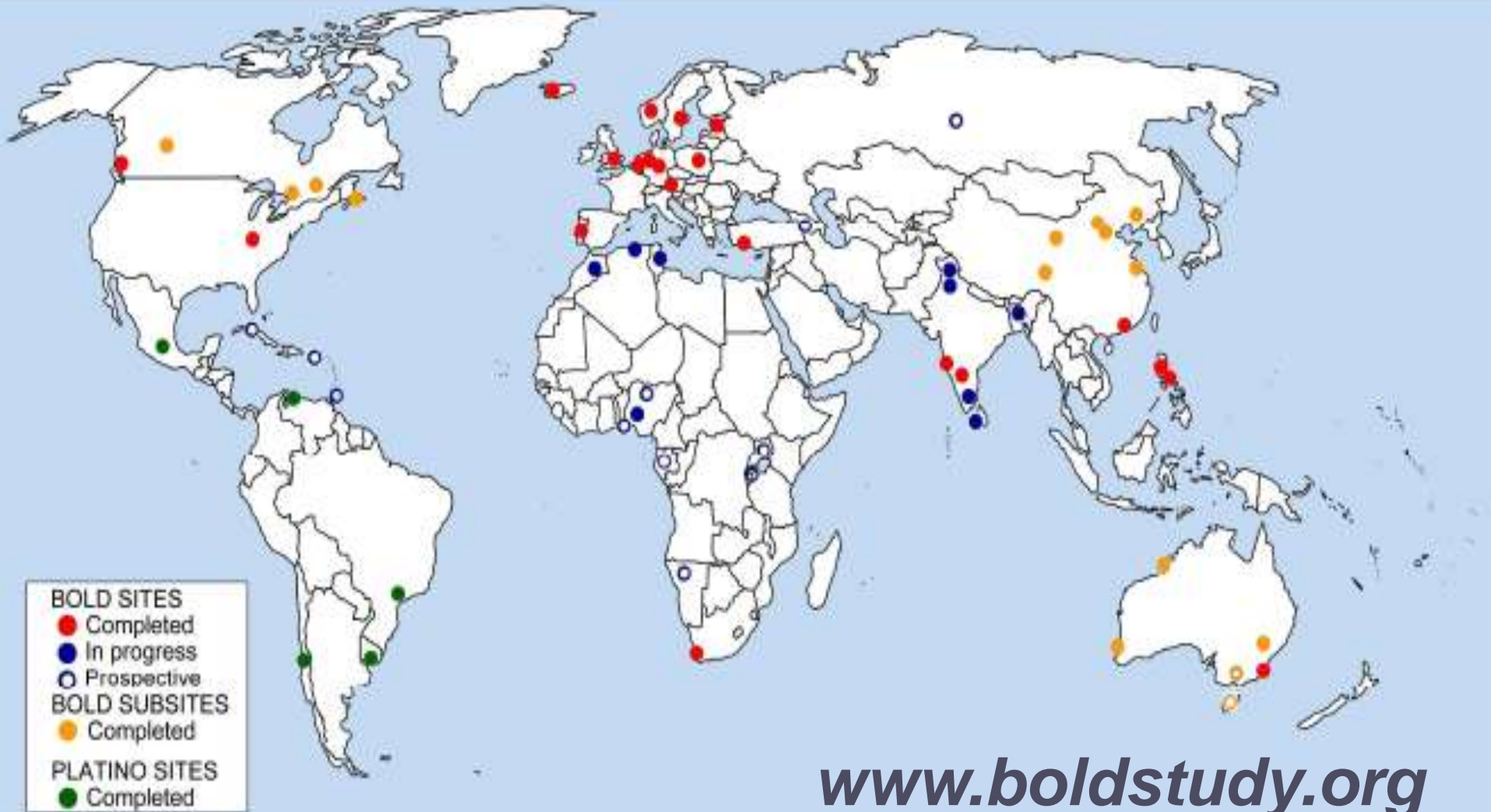
- Quick and cheap
- Descriptive role
- Examine associations
- Can be used to develop hypotheses

- **Disadvantages**

- Temporal associations not clear
- Selection bias
- Shows association, not causality



# BOLD Sites, Completed, in Progress & Prospective



# Background of BOLD

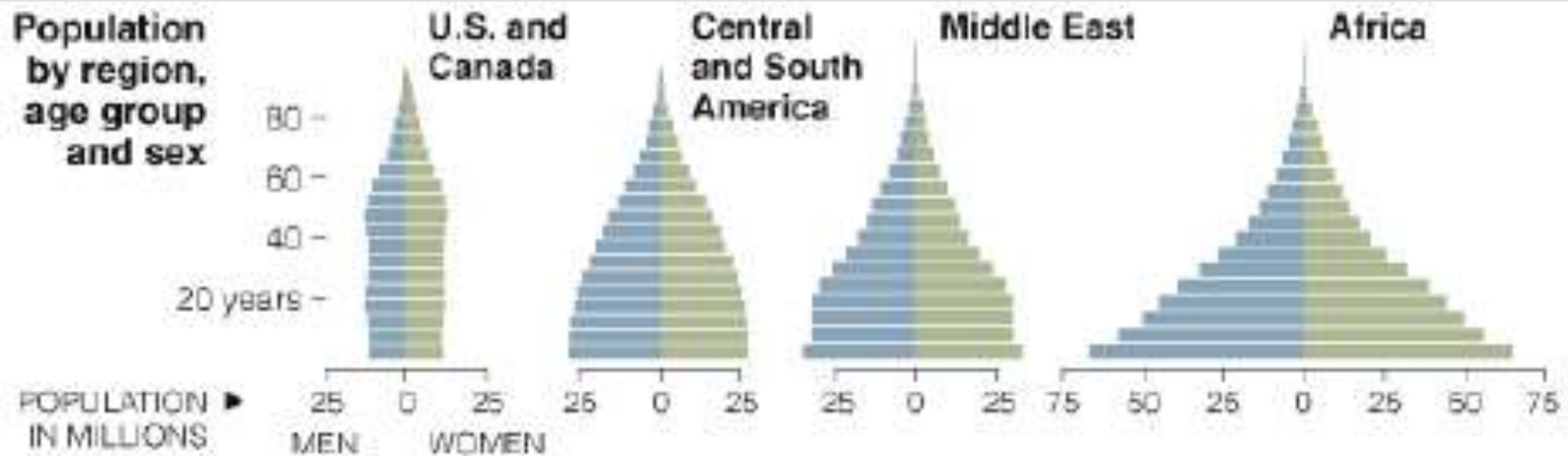
- COPD is a huge problem globally and an increasing problem, especially in developing countries and in women
- Data on COPD prevalence & mortality worldwide are inadequate
- COPD is appreciably under-diagnosed & under-treated



# What are the possible reasons for the variation in COPD prevalence?

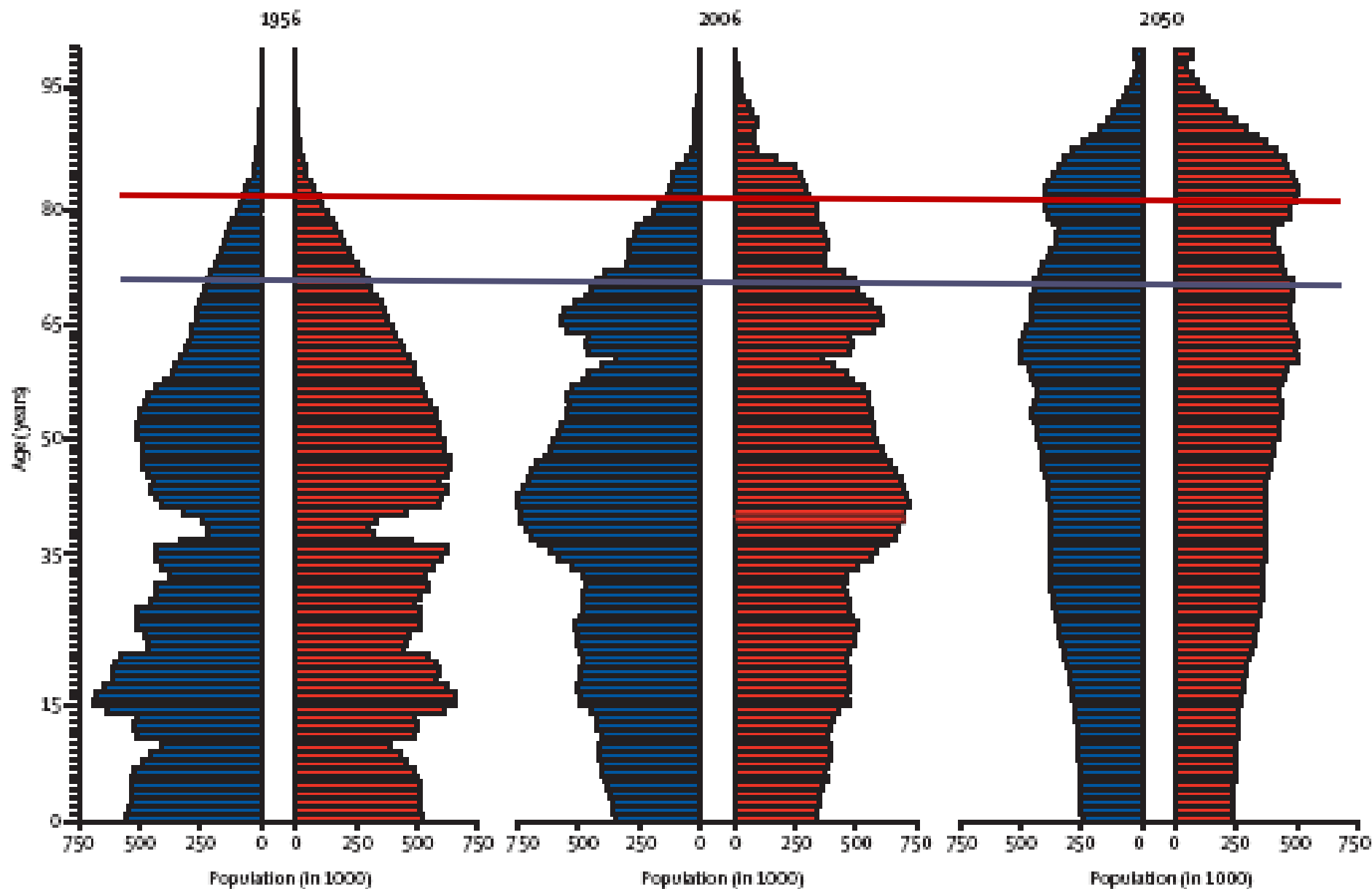
- The variation is correct
- Differences in populations sampled
- Different diagnostic criteria
- Different equipment
- Different methods for spirometry
- Different training of technicians

# Population age distribution worldwide by gender



# Population Age pyramids for Germany, 1956, 2006, 2050.

Christensen *Lancet* 2009, 374, 1196



# Research questions for BOLD are:

- What is the prevalence of COPD & its risk factors?
- Does it vary across countries by age, gender and smoking?

# Scientific Objectives of 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

# Study Design: Cross-sectional

		Disease (COPD)	
		+	-
Exposure (smoking, age, biomass, gender etc)	+		
	-		

**EXPOSURE & DISEASE STATUS  
AT SAME TIME**

# Steps in a cross-sectional study to estimate the burden of COPD

- Choose population and take a cross-sectional sample
- Decide on exposures & outcomes
- Develop valid survey instrument(s)
  - Subjective: Questionnaire
  - Objective: Exam, Lab Tests
- 3. Administer Survey
  - High participation is key!!

# How did we select a Sample for the BOLD Study?

- Picked an administrative area with a population of at least 150,000—and with a sampling frame
- Selected a sample e.g. a simple random sample stratified by sex and age

# When selecting a population, you need to think about:

- What will be your population: how are you going to find it? Where can you find a sampling frame so that everyone in the eligible population has an equal chance of being invited to participate?
- Sample size: large enough to capture some people with COPD, small enough to be affordable
- Age range: need to make the study as *efficient* as possible
- Any other characteristics?

# Picking a Sample: Sampling Frames

- Population registries
- Censuses
- Telephone sampling
- Institutions: school, hospital, etc.
- Convenience
- Other haphazard approaches

# What are the Potential Pitfalls in Sampling?

- You pick a biased sample
- Sample you pick isn't accessible
- Non-response
- Sample isn't big enough
- Sample is too sick---too healthy



# Exposures

- Smoking
- Gender
- Age
- Biomass
- Occupational exposures
- etc

# Case Definition for COPD (Outcome)

- **Post-bronchodilator**  $FEV_1/FVC < 70\%$
- Severity staged using GOLD criteria
- For BOLD, GOLD Stage 2 & higher used to estimate burden of “clinically significant” COPD
- Chronic cough, sputum, shortness of breath determined but not part of the definition of COPD

# Methods for Estimating COPD Prevalence (BOLD)

- Population is a random sample of at least 300 men & 300 women  $\geq 40$  years of age. Must be population-based e.g. random sample of population
- Questionnaires (use standardized questionnaires)

Respiratory symptoms: risk factors/exposures: tobacco, occupation, biomass, history of other lung diseases e.g. TB; social & economic burden of COPD

- Lab tests/other measurements
  - Spirometry; height & weight

# Think about QUALITY CONTROL!!!!!!!

- Questionnaires
- Lab test e.g. spirometry, height, weight, sputum sample etc

# What can we learn from BOLD

- Prevalence of COPD & stage of disease
- Association with risk factors
  - Smoking
  - Age
  - Biomass
  - TB
  - Occupational exposure
  - .....

# Study Design: Cross-sectional

		Disease	
		+ (COPD)	-
Exposure (smoking, age, biomass, gender etc)	+		
	-		

**EXPOSURE & DISEASE STATUS  
AT SAME TIME**

# Questions answered by BOLD

- *Descriptive:*

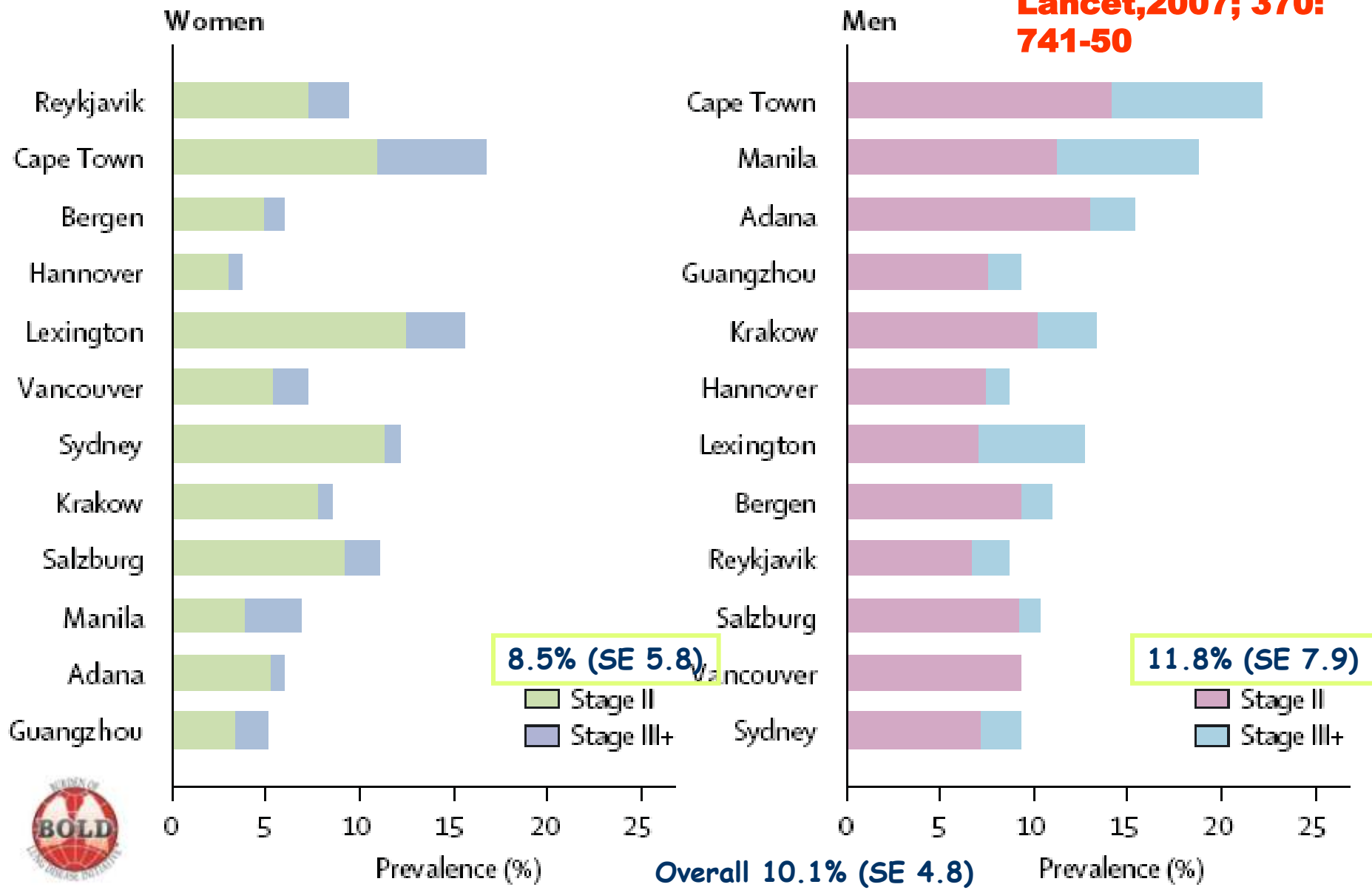
What is the prevalence of COPD by age & sex?

- *Analytic*

what is the association between smoking, age, biomass fuel etc and COPD?

# Prevalence of GOLD Stage II & III+ COPD in 12 Countries by Sex, BOLD Study

**Lancet, 2007; 370: 741-50**



# Questions answered by BOLD

- *Descriptive:*

What is the prevalence of COPD by age & sex?

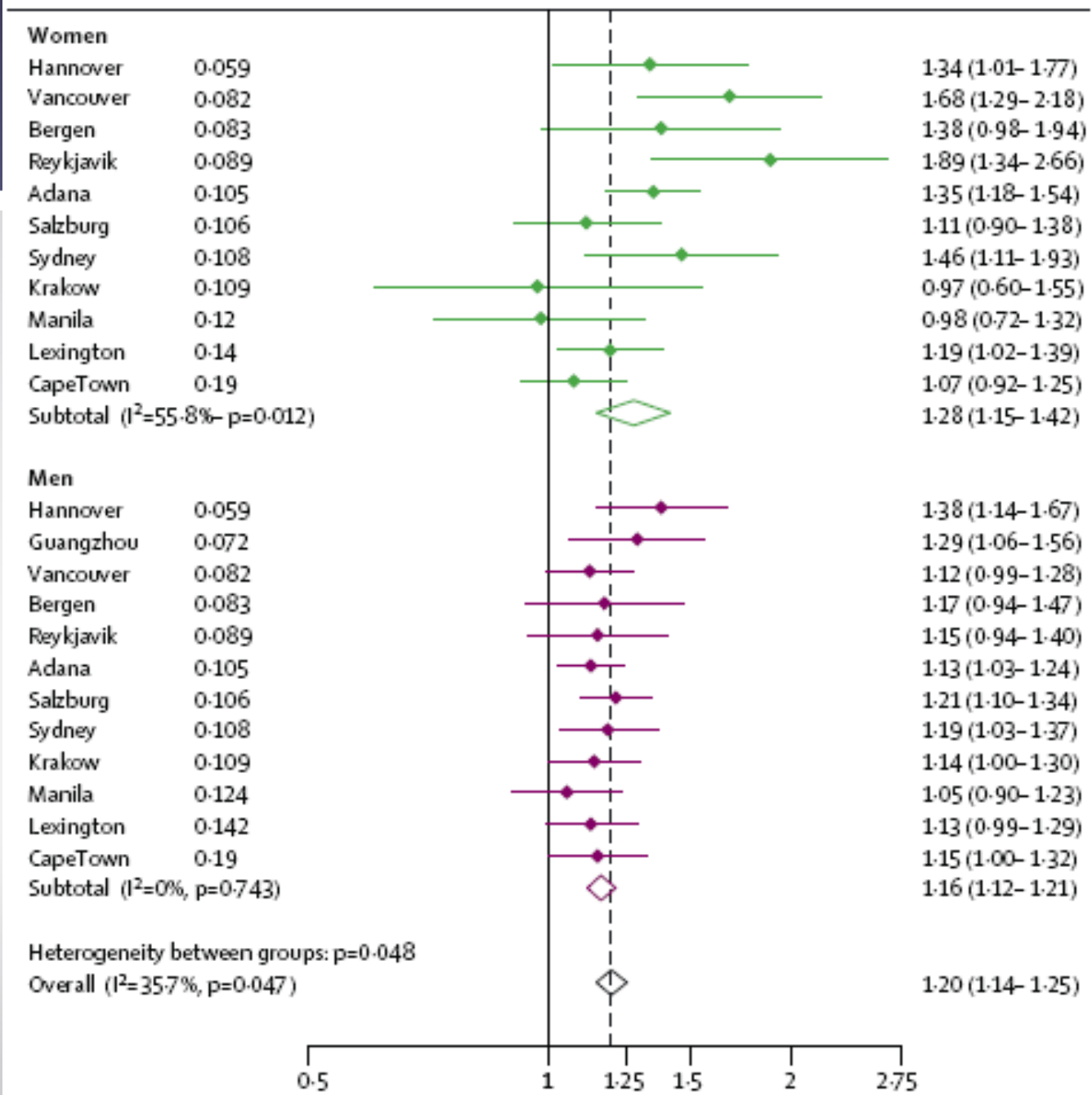
- *Analytic*

what is the association between smoking, age, biomass fuel etc and COPD?

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

Combined stage II prevalence

Odds ratio (95% CI)



**Lancet, 2007; 370: 741-50**



# Cross-sectional Studies

- Often the best study design to estimate burden of disease
- Straightforward design
- May be very inexpensive (depends on the methods!!)
- The validity of your results will depend on the quality of your data!