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JOHNS HOPKINS  
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SCHOOL *of* PUBLIC HEALTH

## Measuring the Burden of Risk Factors

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## Section A

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# Comparative Quantification of Health Risks

Materials taken from and based on Ezzati, M., Lopez, A., Murray, C., et al. and World Health Organization materials

# Learning Objectives

- To become familiar with risk factors as considered in the Global Burden of Disease studies (1990 and 2000)
- To understand the methodology for Comparative Risk Factor Assessment (CRA)
- To review the results of CRA in GBD 2000 (as presented in World Health Report 2002)
- To appreciate the nuances of CRA and explore future applications

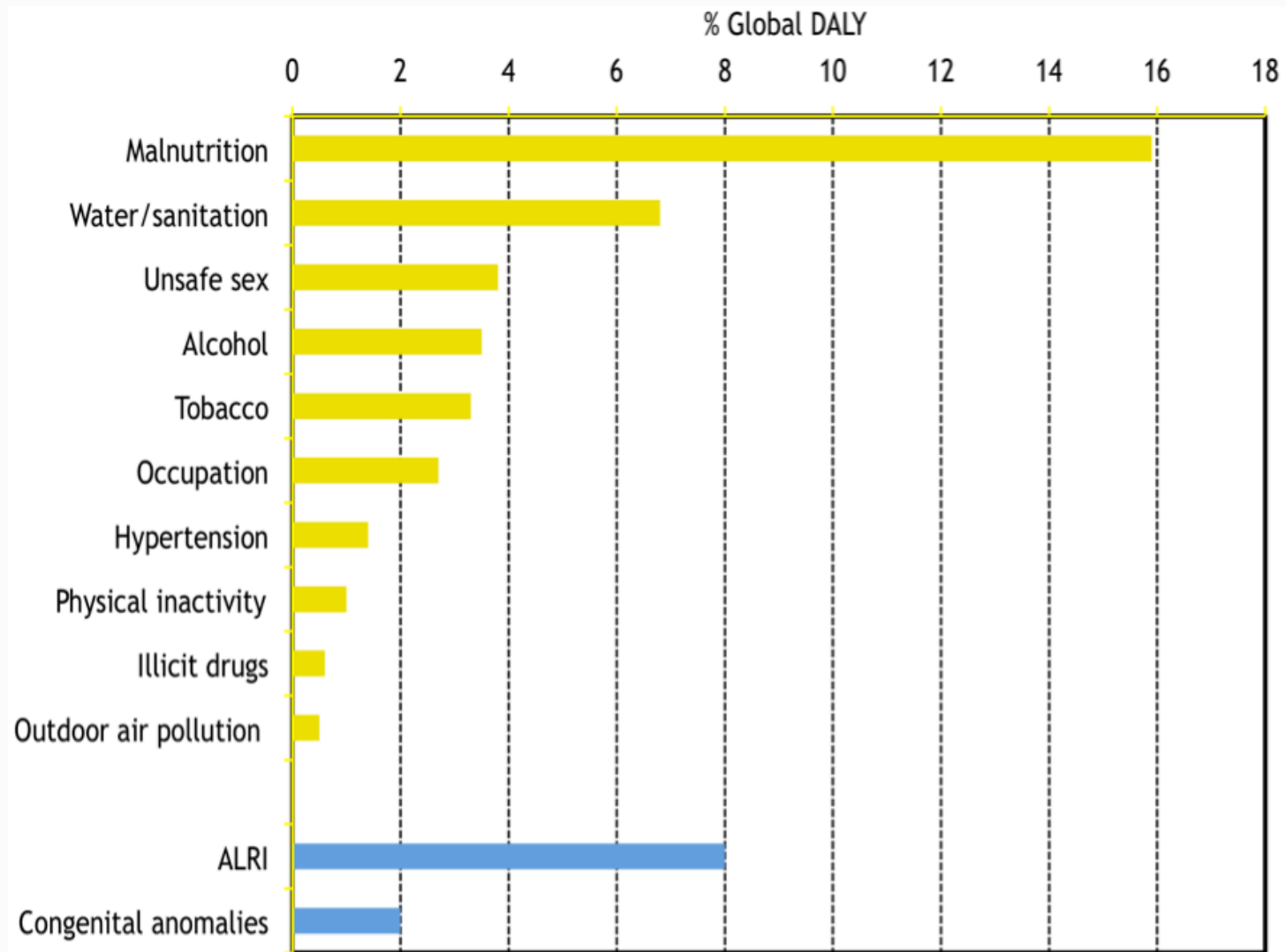
# Classification of Disease Burden

- Disease burden can be classified based on:
  - Diseases (outcomes)
  - Risk factors (causes)
- Global Burden of Disease (GBD) project made the first global estimates for both

# Risk Factors

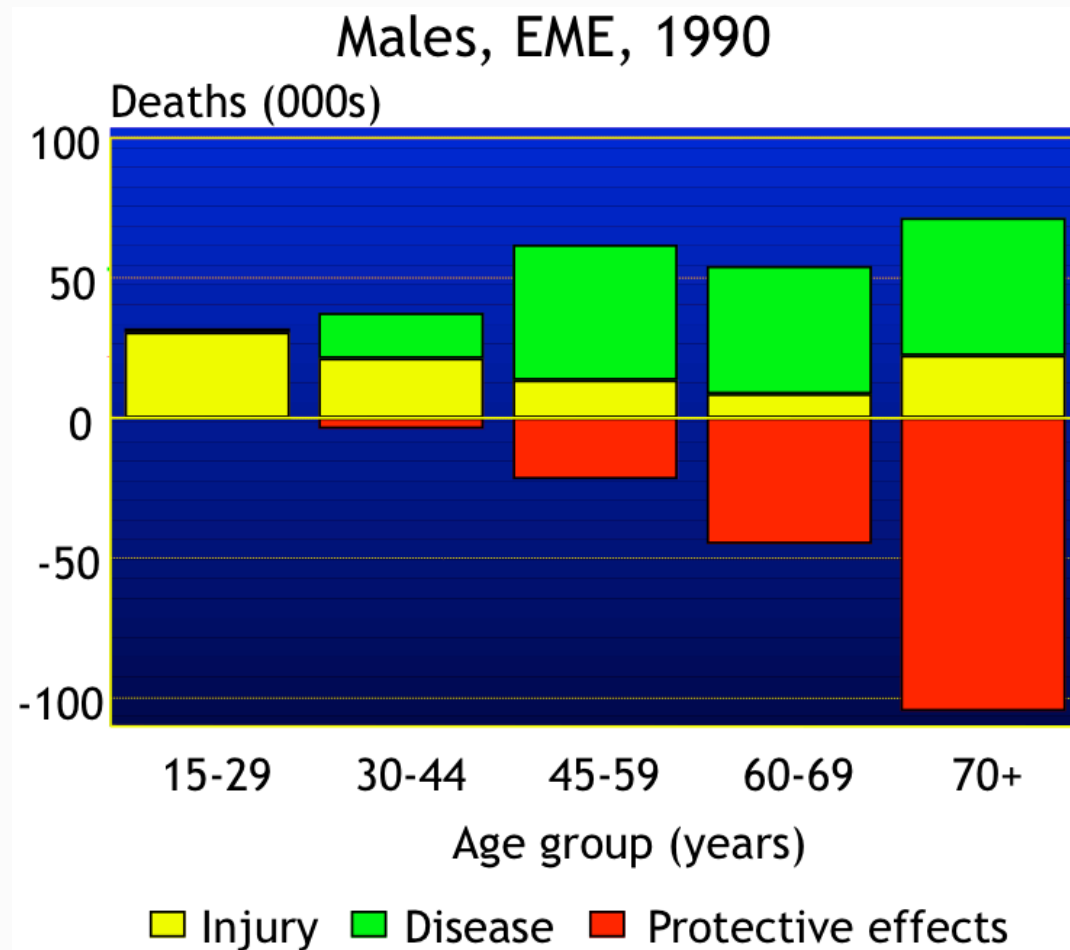
- Risk factors in GBD 1990

# GBD 1990: % DALYs Due to 10 Selected Risk Factors



# Deaths and Alcohol Use

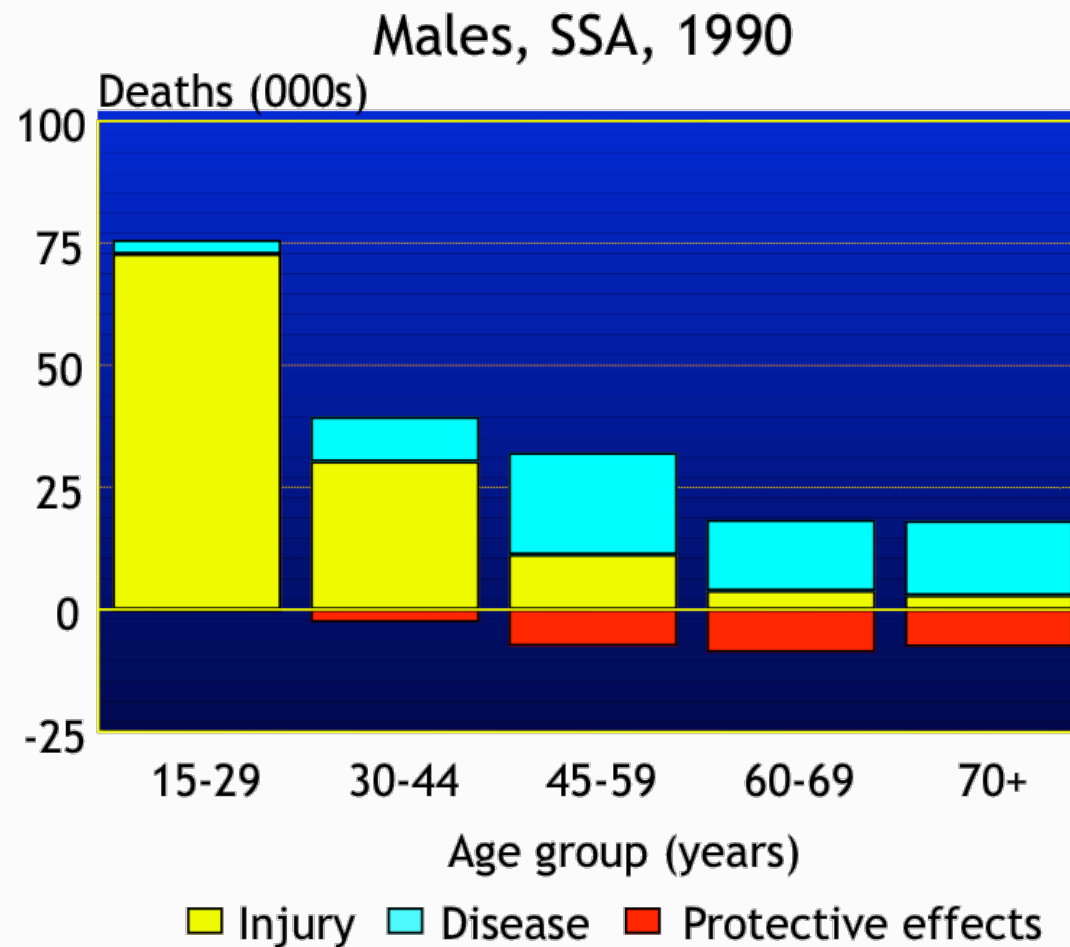
- Estimated deaths attributable to and averted by alcohol use





# Deaths and Alcohol Use

- Estimated deaths attributable to and averted by alcohol use



# Consideration of Risk Factors in GBD 1990

Risk factor	Type of risk factor		Relative risk controlled confound.	Measure of exposure	Reference distribution of exposure	Time lag from exposure to burden
	Exposure	Physio. state				
Malnutrition		<b>v</b>		Population less than 2 SDs weight-for-age based on extensive national surveys	Pop. weight-for-age > -2 SDs	Intermediate
Poor water, sanitation, hygiene	<b>v</b>			Based on the theoretical fecal-oral route of transmission	Zero	Short
Unsafe sex	<b>v</b>			Based on theoretical model of STD transmission and contraceptive demand surveys	Zero	Short to long
Alcohol (disease)	<b>v</b>		<b>v</b>	Indexed on alcohol consumption, non-hepatitis B cirrhosis, and alcohol dependence syndrome	Zero	Long
Alcohol (injury)	<b>v</b>			Indexed on consumption patterns from small studies	Zero	Short

# Consideration of Risk Factors in GBD 1990

Risk factor	Type of risk factor		Relative risk controlled confound.	Measure of exposure	Reference distribution of exposure	Time lag from exposure to burden
	Exposure	Physio. state				
Occup. (dis.)	✓			Registration data for EME, FSE and LAC and constant rates for all other regions	Zero	Long
Occup. (injury)	✓			Registration data for EME and constant rates for all other regions	Zero	Short
Tobacco	✓		✓	Indexed on lung cancer	Zero	Long
Hypertension		✓		Population surveys of blood pressure	Systolic bp 110 mm Hg	Long
Physical inact.	✓		✓	Population surveys of activity patterns	Regular physical activity	Long
Illicit drugs	✓			Small-scale studies	Zero	Short to intermed.
Air pollution	✓			Monitoring systems in urban areas for most regions	WHO guidelines	Short to long

# Ideal Features of Risk Assessment

- Risks assessed irrespective of place in a causal chain or discipline (physical, natural, health, and social sciences)
- Risks defined and studied comprehensively and with comparable methods
- “Common currency” outcome measures, with impact assessed in terms of lost healthy life years
- Protective as well as hazardous factors

# Risk Assessment Redefined

- For GBD 2000

# Comparative Risk Assessment

- Systematic evaluation of the changes in population health which result from modifying the population distribution of exposure to a risk factor or a group of risk factors
- Key goal: increased comparability
- Important for disease prevention

# What Is Comparative Risk Assessment?

- Procedures and methods to estimate disease and injury burden arising from population exposure to a given hazard using comparable definitions, frameworks, and outcome measures

# CRA Framework and Goals

- 224 age, sex, and region subgroups and by levels of poverty

## Risk factor levels

- Current distribution
- Counterfactual distribution(s)

## Risk factor-disease relationships

- Risk accumulation
- Risk reversal

Disease burden

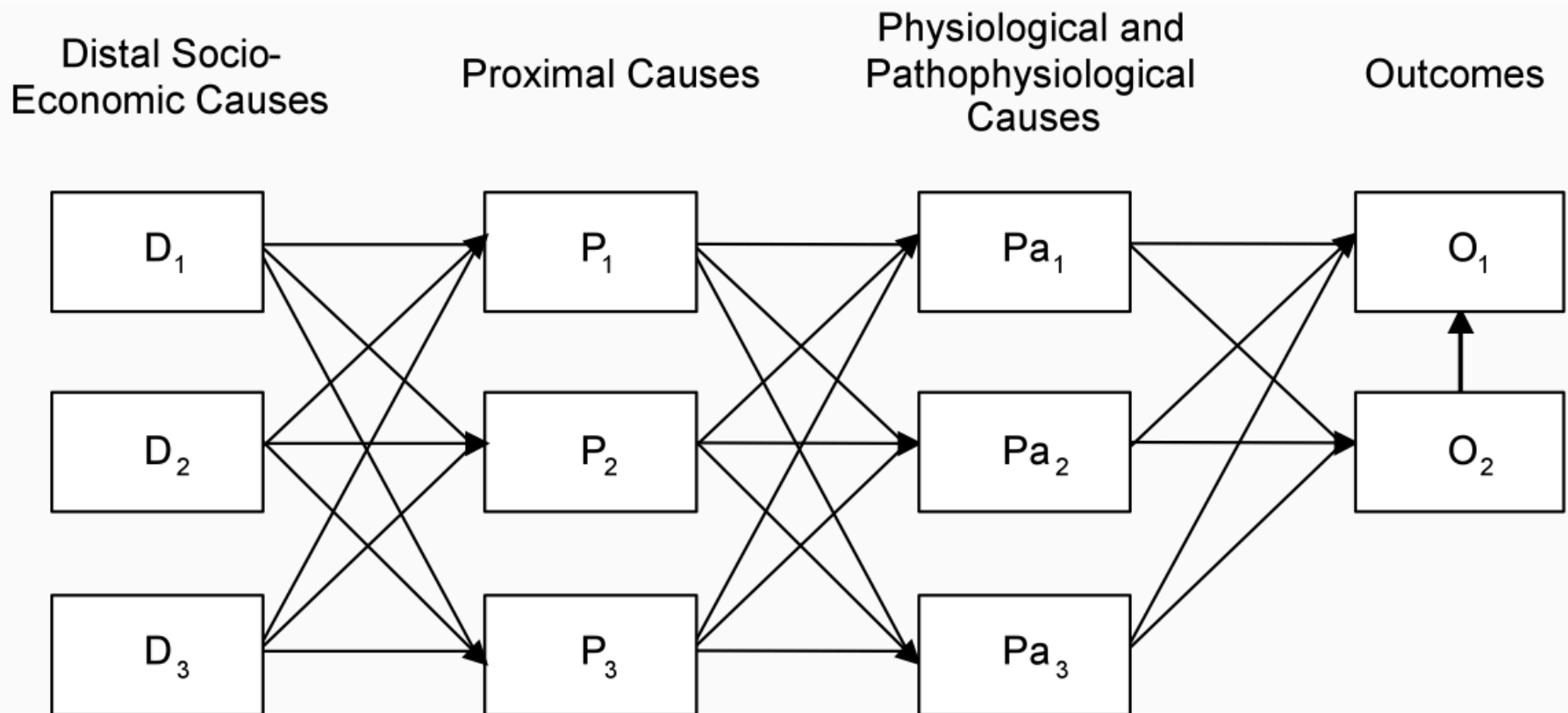
Attributable burden in 2000  
Avoidable burden in 2010 and 2020



# Why Do Comparative Risk Assessment?

- Quantify size of burden (current and future) due to exposure:
  - Value of estimates in policy process
  - Comparative magnitude vs. other diseases/injuries
  - Research prioritization
- Quantify benefits of interventions
  - Unrealistic to reduce exposure to zero hazard
  - Measure health gains achievable with interventions

# Simplified Causal Web Linking Exposures and Outcomes



# Approaches to Estimating Risk Factor Burden

- Categorical attribution
- Counterfactual analysis

# Estimation Methods: 1

- Attributable fractions (dichotomous exposure, with comparison being zero exposure, plus some measure of relative risk)

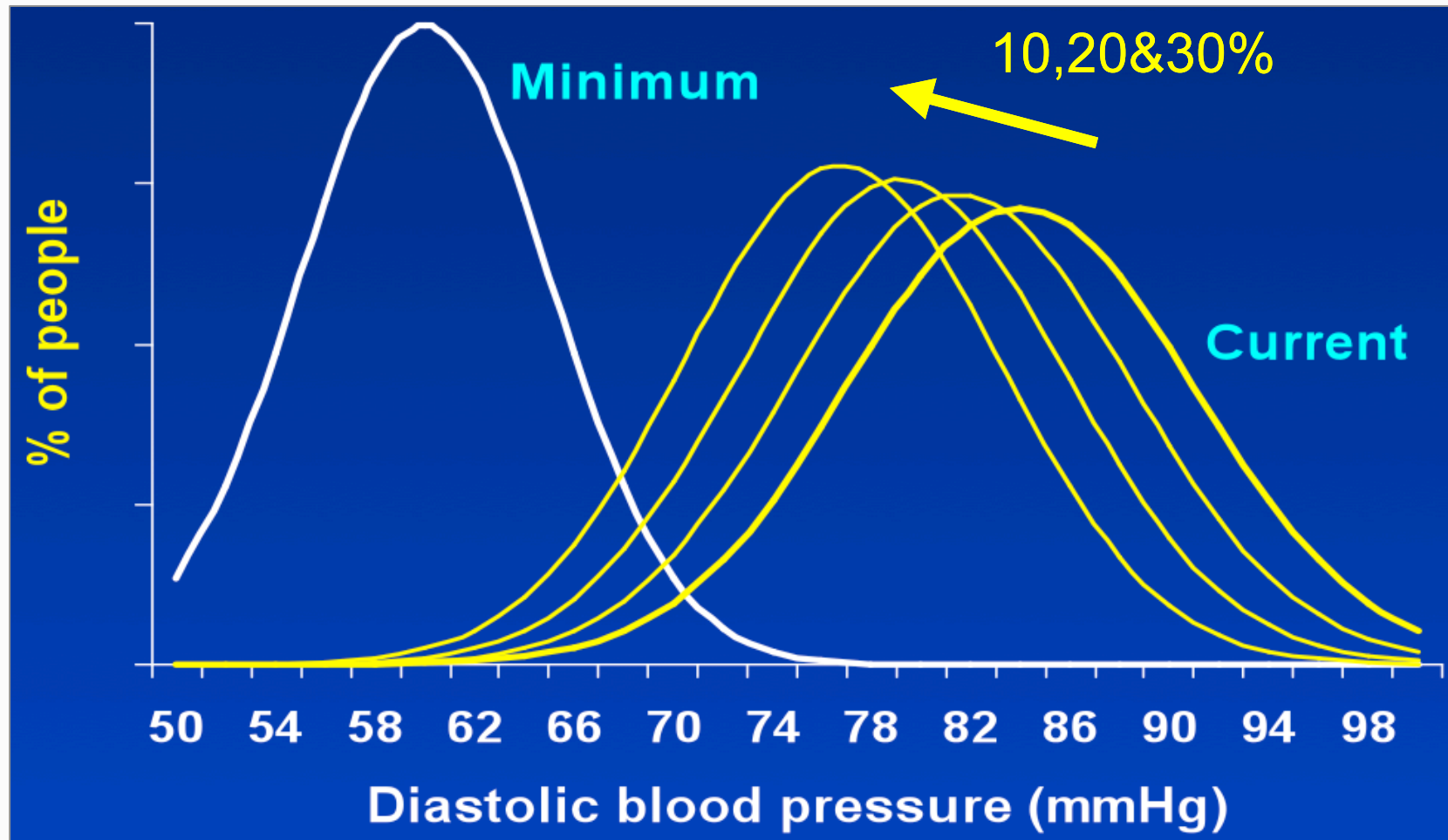
# Defining Attributable Fraction

Standard strategy	CRA strategy
“What if no exposure had occurred?”	“What if <i>some</i> exposure is reduced?”
Complete removal of exposure or distribution truncation	Shifts in exposure distributions to <i>counterfactuals</i>
One estimate only	Estimates for a range of exposure changes

## Estimation Methods: 2

- Attributable fractions (dichotomous exposure, with comparison being zero exposure, plus some measure of relative risk)
- Counterfactual analysis (difference between current burden and burden that would be observed under an alternative distribution of exposure, not necessarily zero)

# Counterfactuals for Blood Pressure



# What Burden Are We Measuring?

- Time frame



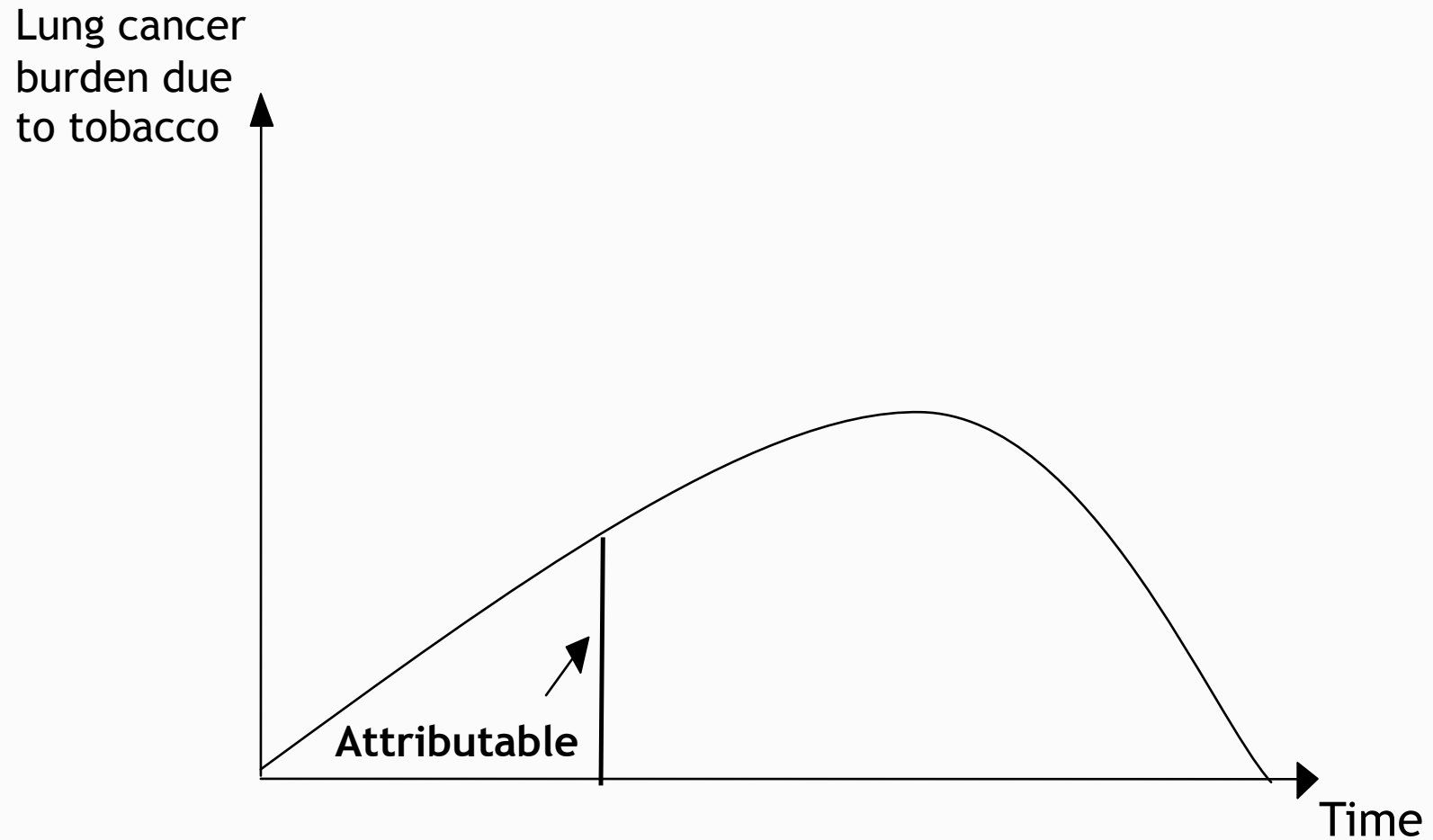
## Distinguishing between Current and Future Burdens

- Need to distinguish between *current* burden (due to past exposure) and *future* burden (due to current exposure)

# Attributable Burden

- Attributable burden: reduction in current burden that would have been observed if past exposure to a risk factor had been equal to some counterfactual distribution of exposure

# Attributable Burden



# Attributable Burden and Avoidable Burden

- Attributable burden: reduction in current burden that would have been observed if past exposure to a risk factor had been equal to some counterfactual distribution of exposure
- Avoidable burden: reduction in the future burden of disease that would be observed if current exposure to a risk factor was reduced to some counterfactual level

# Avoidable and Attributable Burden

