INTRODUCTION TO EPIDEMIOLOGY AND ENVIRONMENTAL HEALTH

E2040 – Lecture
E2041 – Practice

WHAT IS THIS COURSE ALL ABOUT?

1. Course rules and expectations
   - Syllabus, class content, and the course instructors
2. Introduction to the topic
   - Definition of epidemiology and public health
   - The tasks of epidemiology
   - The role of the environment in human health

SYLLABUS HIGHLIGHTS

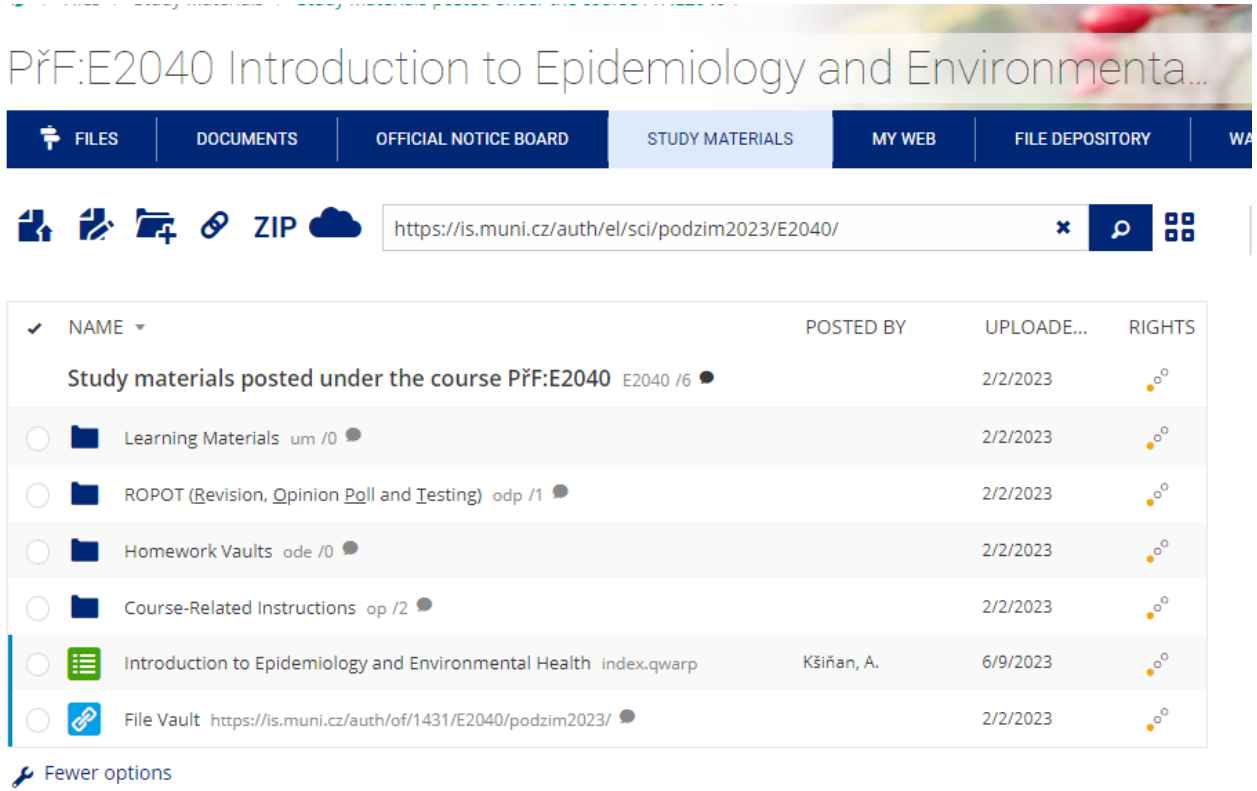
Study materials will be available in IS.MU before each lecture

2 exams (midterm and final during examination period)

Mandatory attendance at the practice sessions

2 assignments that require preparation at home

Read the syllabus!



CLASS CONTENT

1. Essential concepts in epidemiology and environmental health
2. Disease occurrence and determinants in populations
3. Measures of disease frequency, defining cases
4. The basics of quantitative methodology
5. Introduction to data analysis, sources of data
6. Measures of association and effect
7. Study designs in epidemiology
8. Confounding, effect modification, and bias in epidemiology studies
9. Critical evaluation of research studies
10. Ethical considerations in epidemiology research and practice
11. Translating science into practice

INSTRUCTORS

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WHAT IS EPIDEMIOLOGY? WHAT DOES AN EPIDEMIOLOGIST DO?

Write down first three things that come to your mind

1 idea = 1 sticky note

Put your sticky notes on the whiteboard

WHAT IS EPIDEMIOLOGY?

Study of **health** and **disease**

1. Their patterns
2. Their causes
3. In defined populations
4. To inform policy decisions, prevention, and evidence-based medicine = public health

BRANCHES OF EPIDEMIOLOGY

Infectious Disease Epidemiology

Environmental Epidemiology

Social Epidemiology

Nutritional Epidemiology

Occupational Epidemiology

Epidemiology of specific diseases (e.g., cardiovascular)

Etc…

POPULATION VS CLINICAL APPROACH

Public Health Model

Focus on **population**

Prevention and health promotion of the **community**

Interventions aimed at the environment, lifestyle, and human behavior

Medical Model

Focus on **individual**

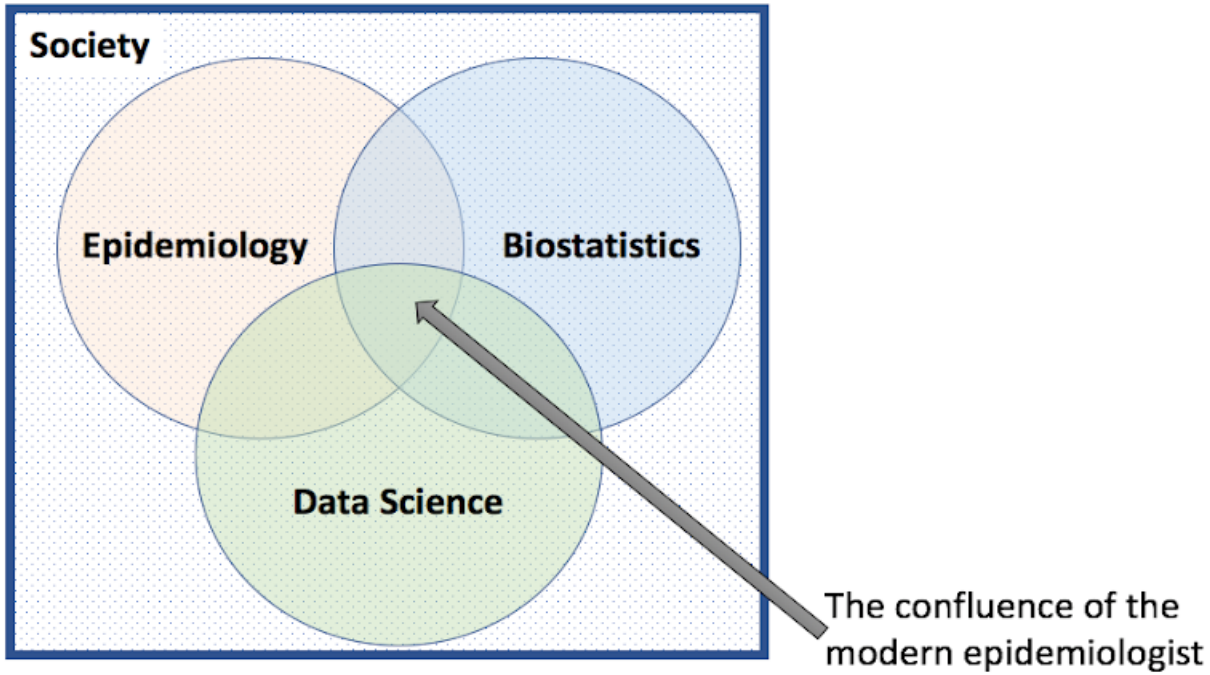
Diagnosis and treatment of the **patient**

Emphasis on medical care

TASKS OF EPIDEMIOLOGY

Research, surveillance, and evaluation

- Focus on data
- Quantitative analysis



Translating science into practice

- **Evidence-based medicine**

WHO recommendations: Intrapartum care for a positive childbirth experience https://apps.who.int/iris/bitstream/handle/10665/272447/WHO-RHR-18.12-eng.pdf

- **Policy development**

Chlorpyrifos ban in the US https://www.epa.gov/ingredients-used-pesticide-products/frequent-questions-about-chlorpyrifos-2021-final-rule

RESEARCH IN EPIDEMIOLOGY

Write down two questions that epidemiologists may be interested in answering

1 idea = 1 sticky note

Put your sticky notes on the whiteboard

A PUBLIC HEALTH APPROACH

Defining the problem/surveillance

Risk and protective factor identification

Developing and testing prevention strategies

Implementation and adoption of the strategies

EXAMPLE OF SAFE TO SLEEP CAMPAIGN

SIDS risk factors:

Sex of the baby

Ethnicity and SES of the family

Prematurity

Family history

But also:

Stomach sleeping

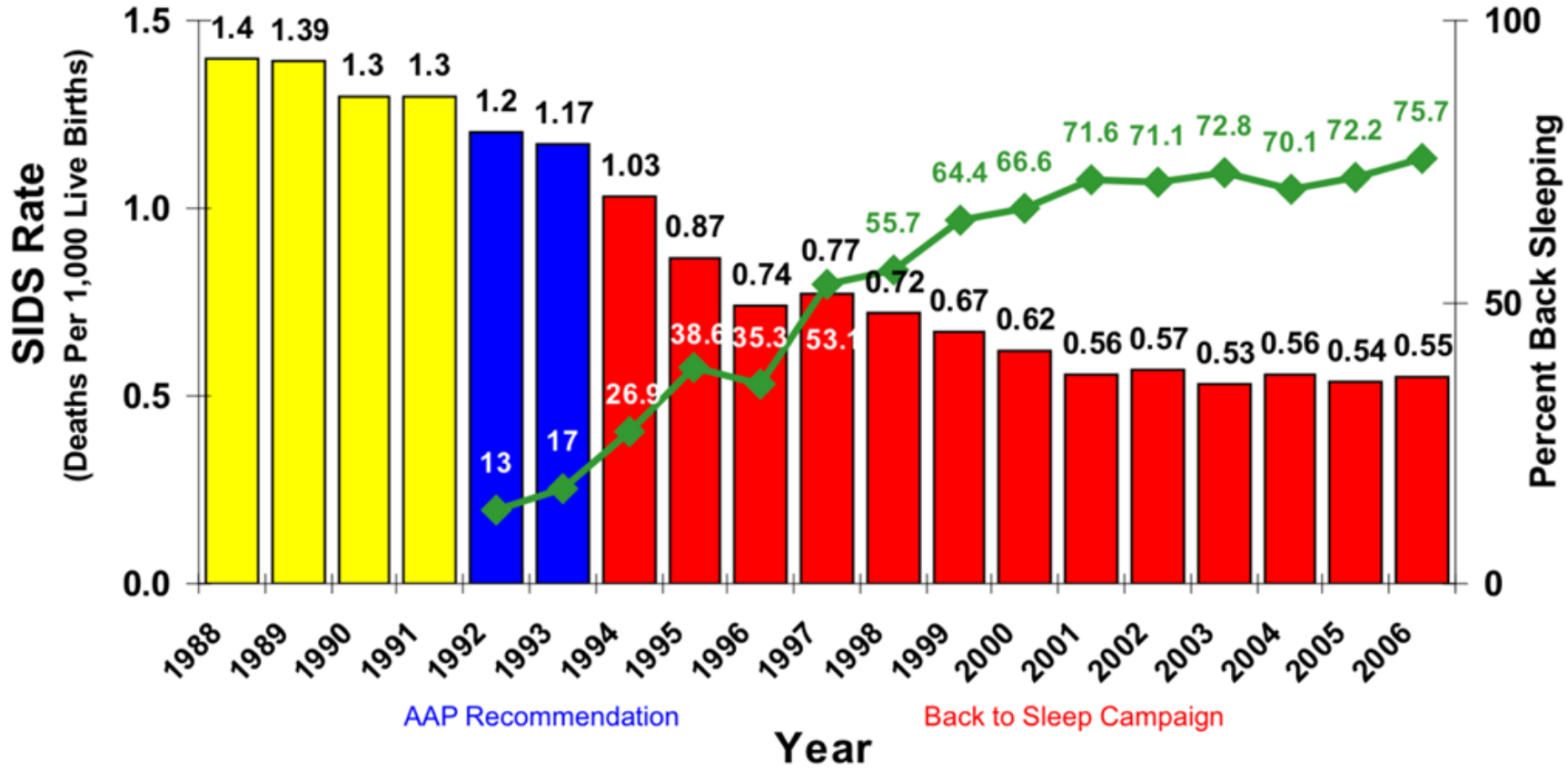
Bed-sharing

Exposure to secondhand smoke

Risk factors modifiable by an intervention

SIDS Rate and Back Sleeping

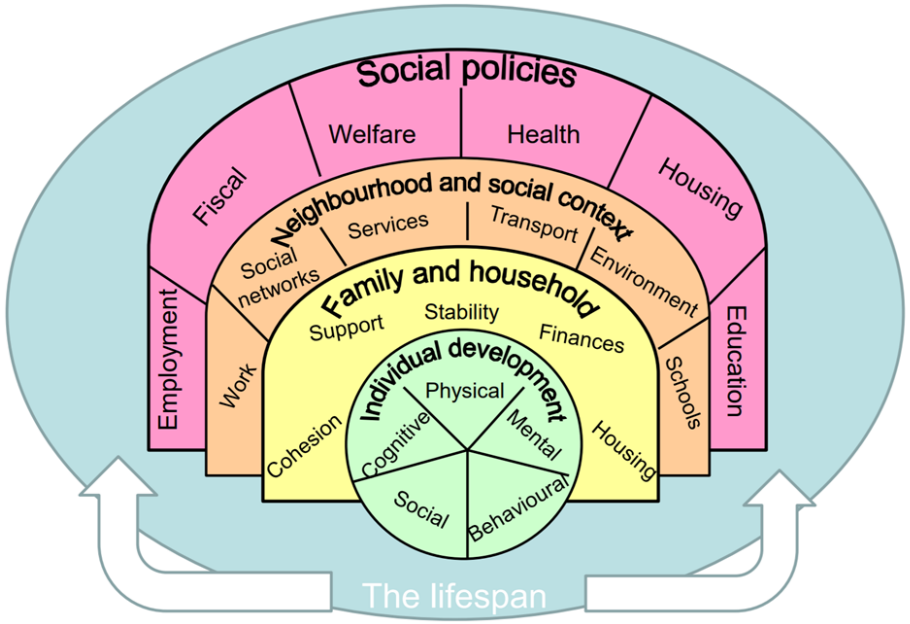
(1988 – 2006)

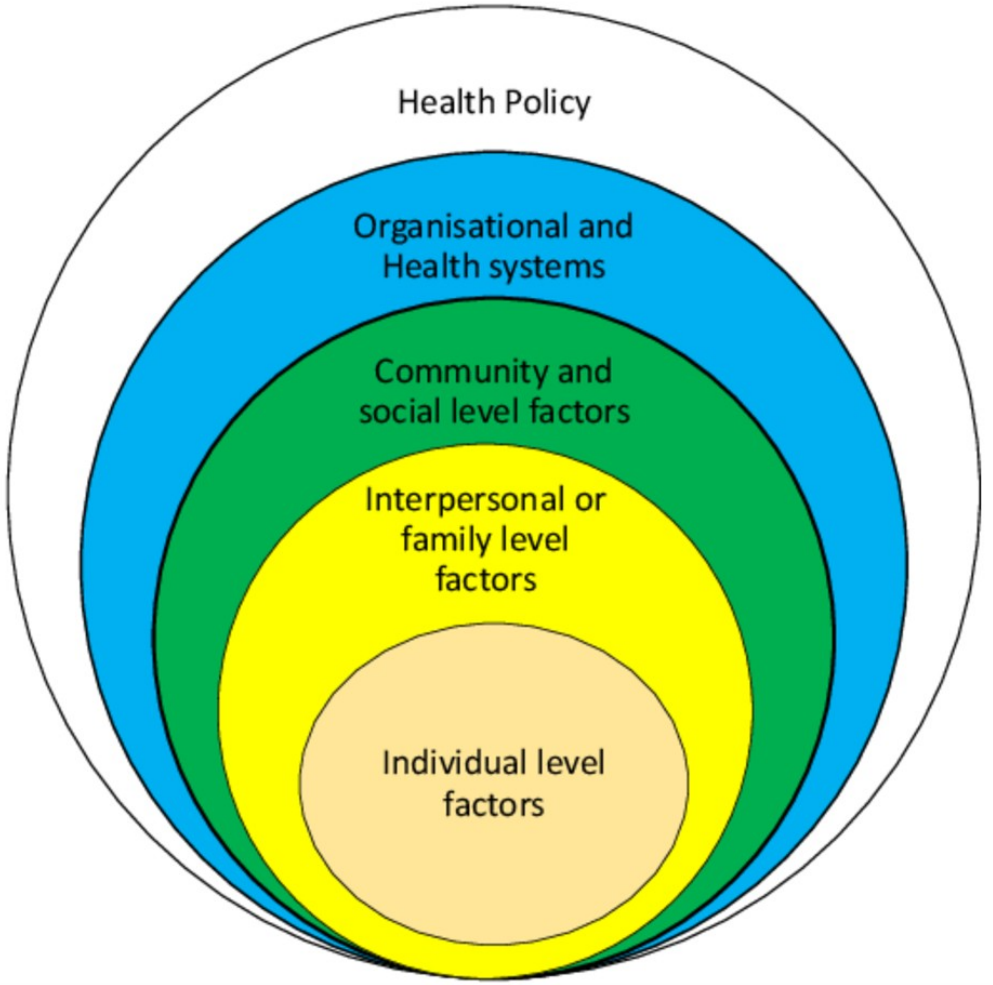


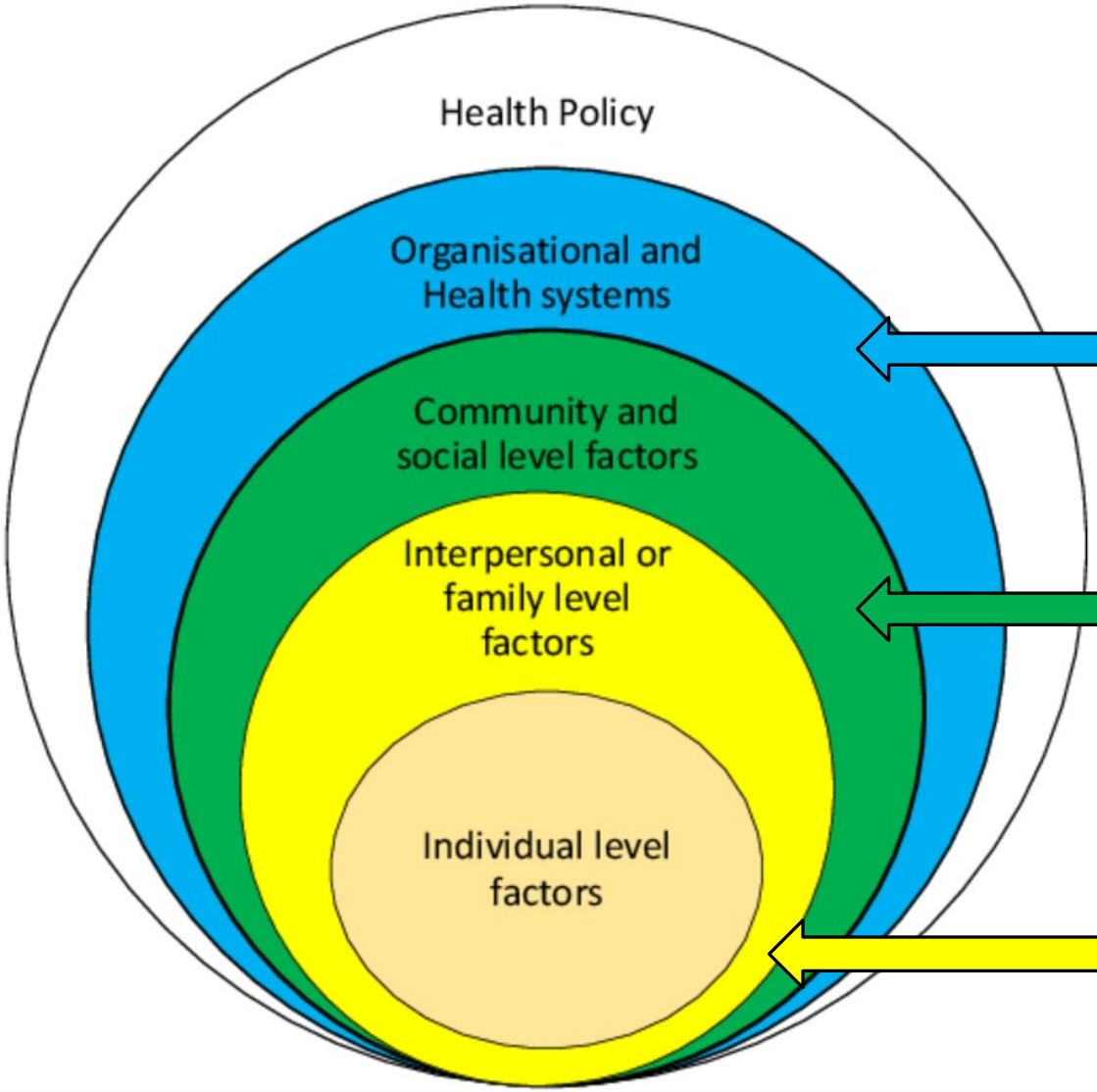
SIDS Rate Source: CDC, National Center for Health Statistics,
Sleep Position Data: NICHD, National Infant Sleep Position Study.

MULTILEVEL INTERVENTIONS

Ecological model of health across the lifecourse







Implementation of Safe to Sleep at different levels of influence

Including safe sleep guidelines to education of nursing students

Addressing cultural practices related to infant sleep (e.g. bed-sharing)

Educating parents on safe infant sleep

RESEARCH AND EVALUATION

Ústav zdravotnických informací a statistiky ČR
Institute of Health Information and Statistics of the Czech Republic

Data and understanding data is essential!

European Health Examination Survey

EHES Measuring the Health of Europeans

IHME
THE INSTITUTE FOR HEALTH METRICS AND EVALUATION

nhanes National Health and Nutrition Examination Survey

World Health Organization
European Region
European Health Information Gateway

…and many more

PREVENTION AND POLICY

The ultimate goal of the field is **improving population health**

European Environment Agency

World Health Organization

STÁTNÍ ZDRAVOTNÍ ÚSTAV
SZÚ
Staráme se o zdravé Česko

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

HISTORY OF EPIDEMIOLOGY

John Snow

Investigation into the causes of the 19th-century cholera epidemics in London

Identification of the Broad Street pump as the cause

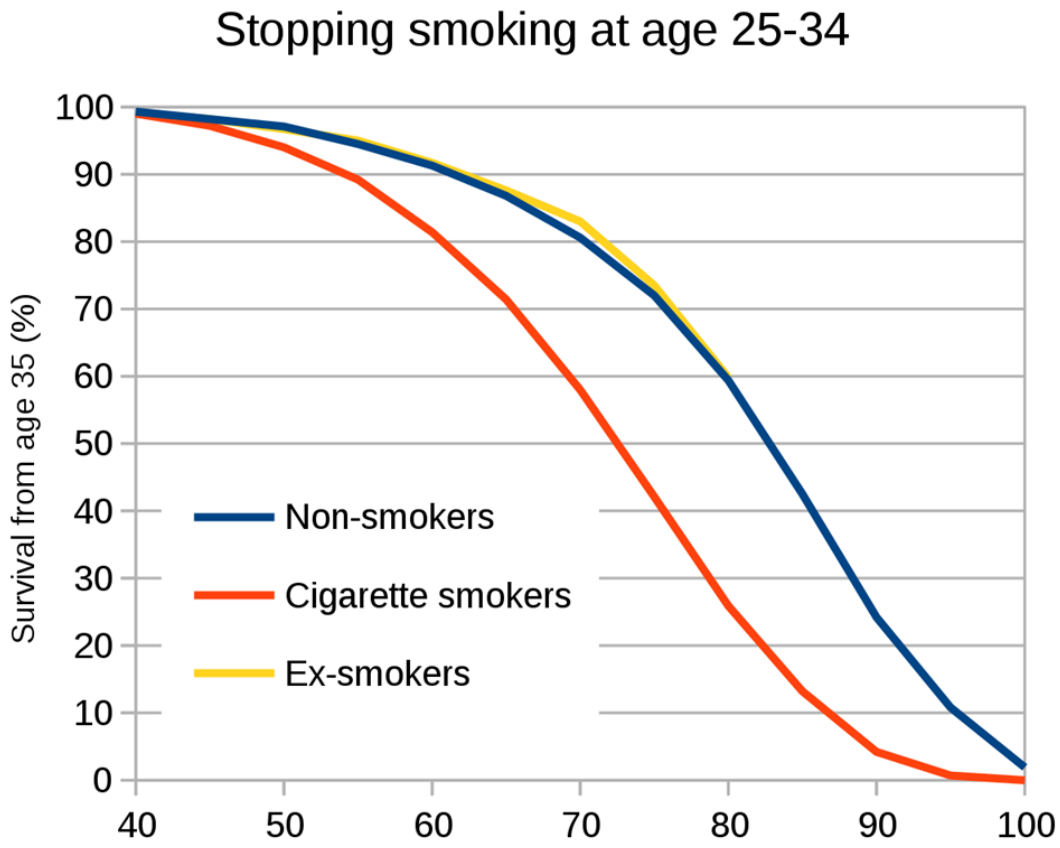
Snow removed the pump handle – this probably ended the outbreak

HISTORY OF EPIDEMIOLOGY

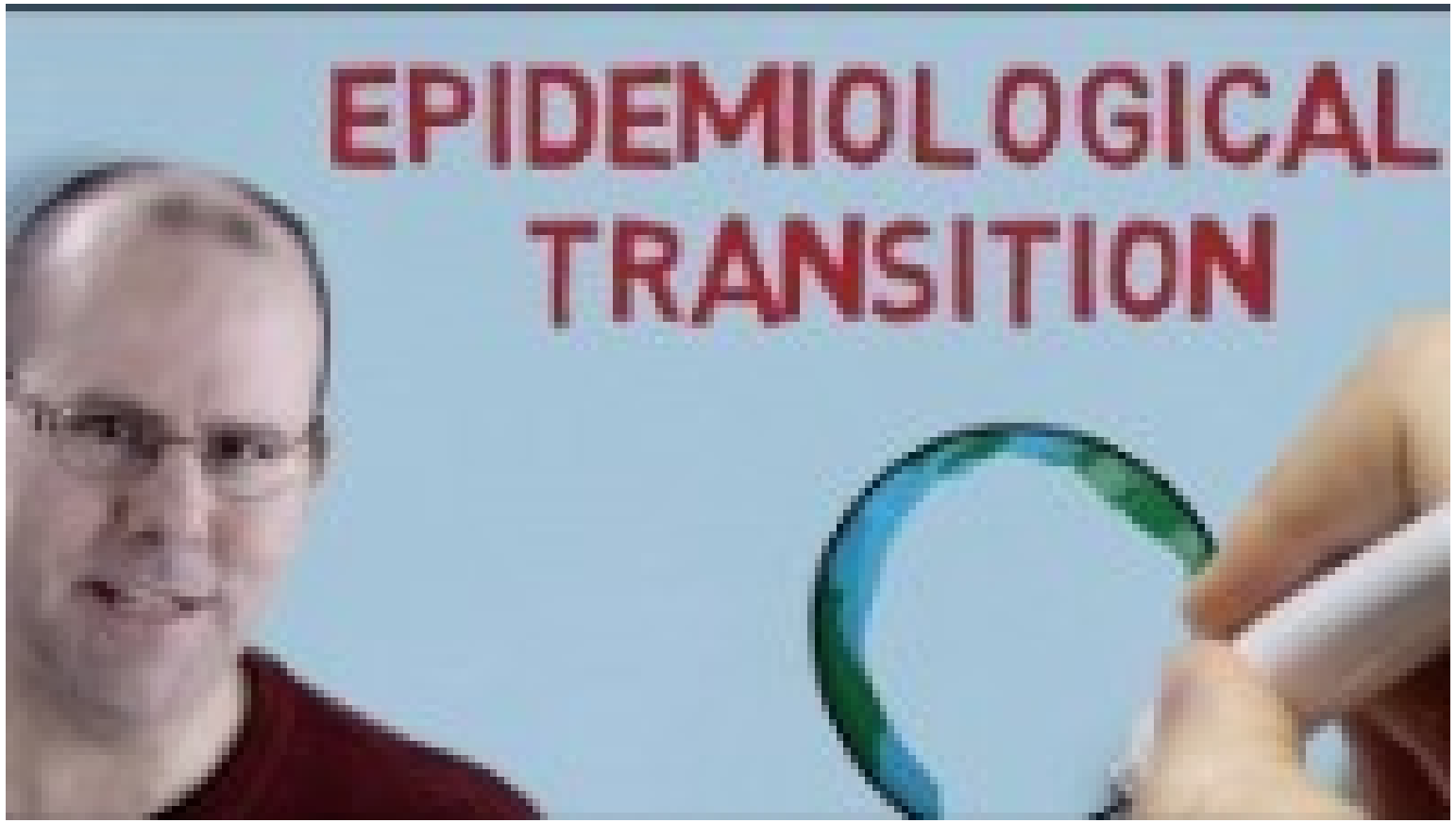
British Doctors' Study

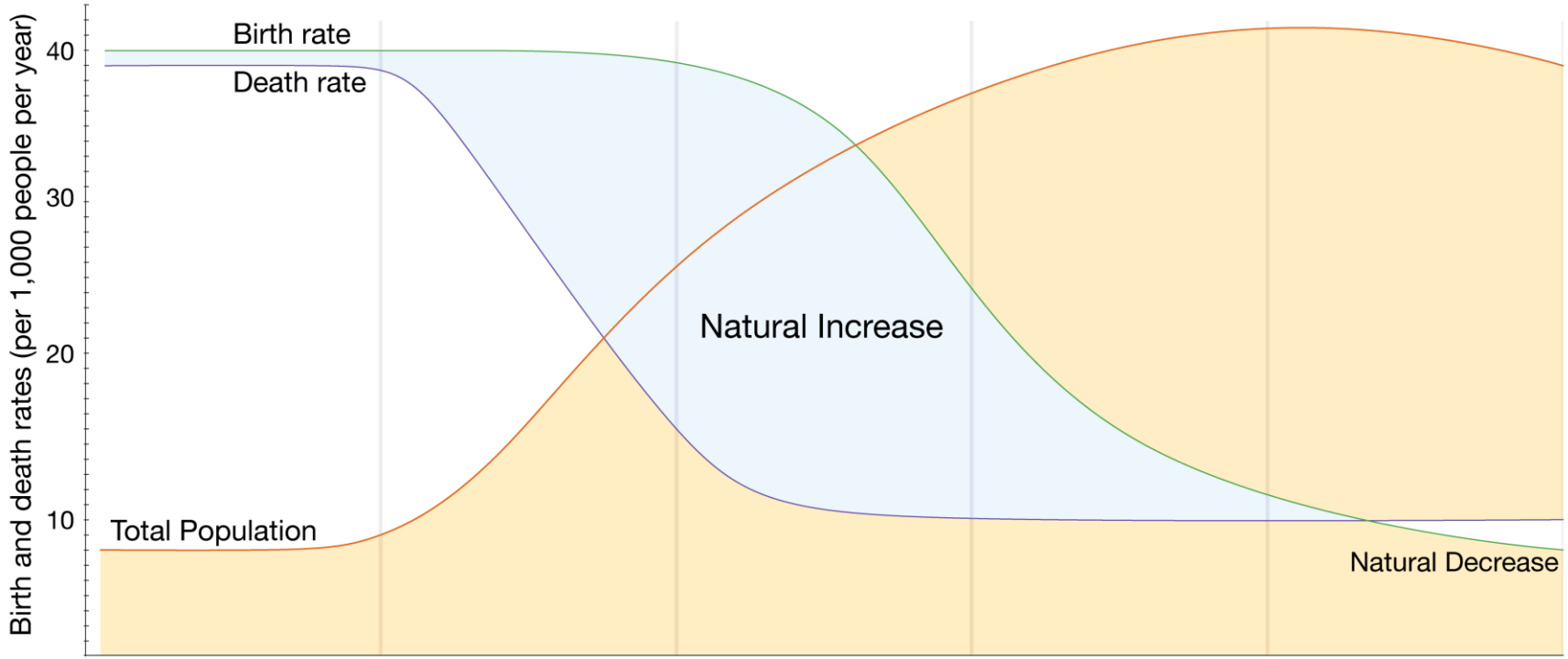
A prospective cohort study starting in 1950s

First statistical evidence that tobacco smoking increased the risk of lung cancer



EPIDEMIOLOGICAL TRANSITION

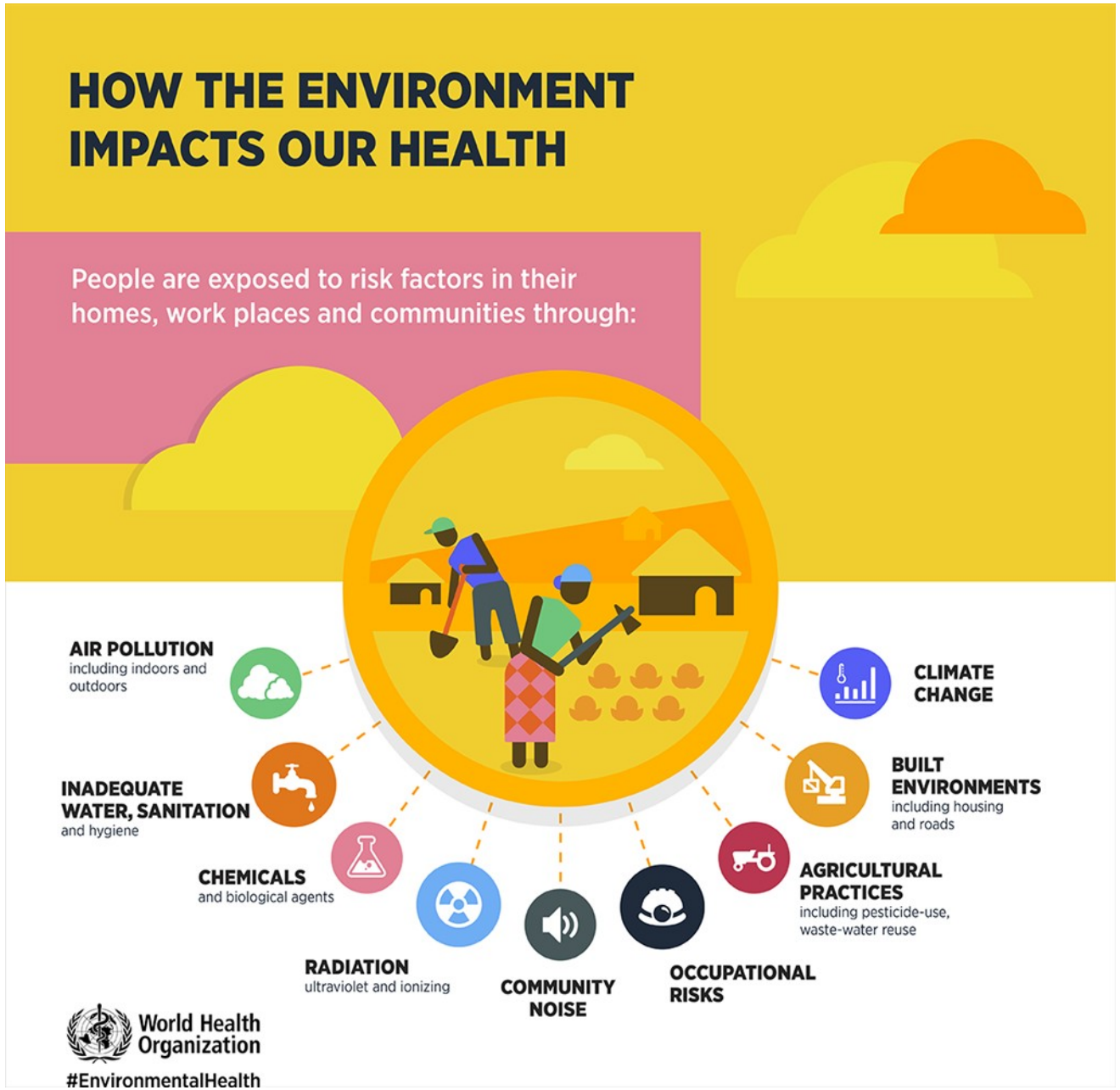




	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Birth rate	*High*	*High*	*Falling*	*Low*	*Very low*
Death rate	*High*	*Falls rapidly*	*Falls more slowly*	*Low*	*Low*
Natural increase	*Stable or slow increase*	*Very rapid increase*	*Increase slows down*	*Stable or slow increase*	*Stable or slow decrease*

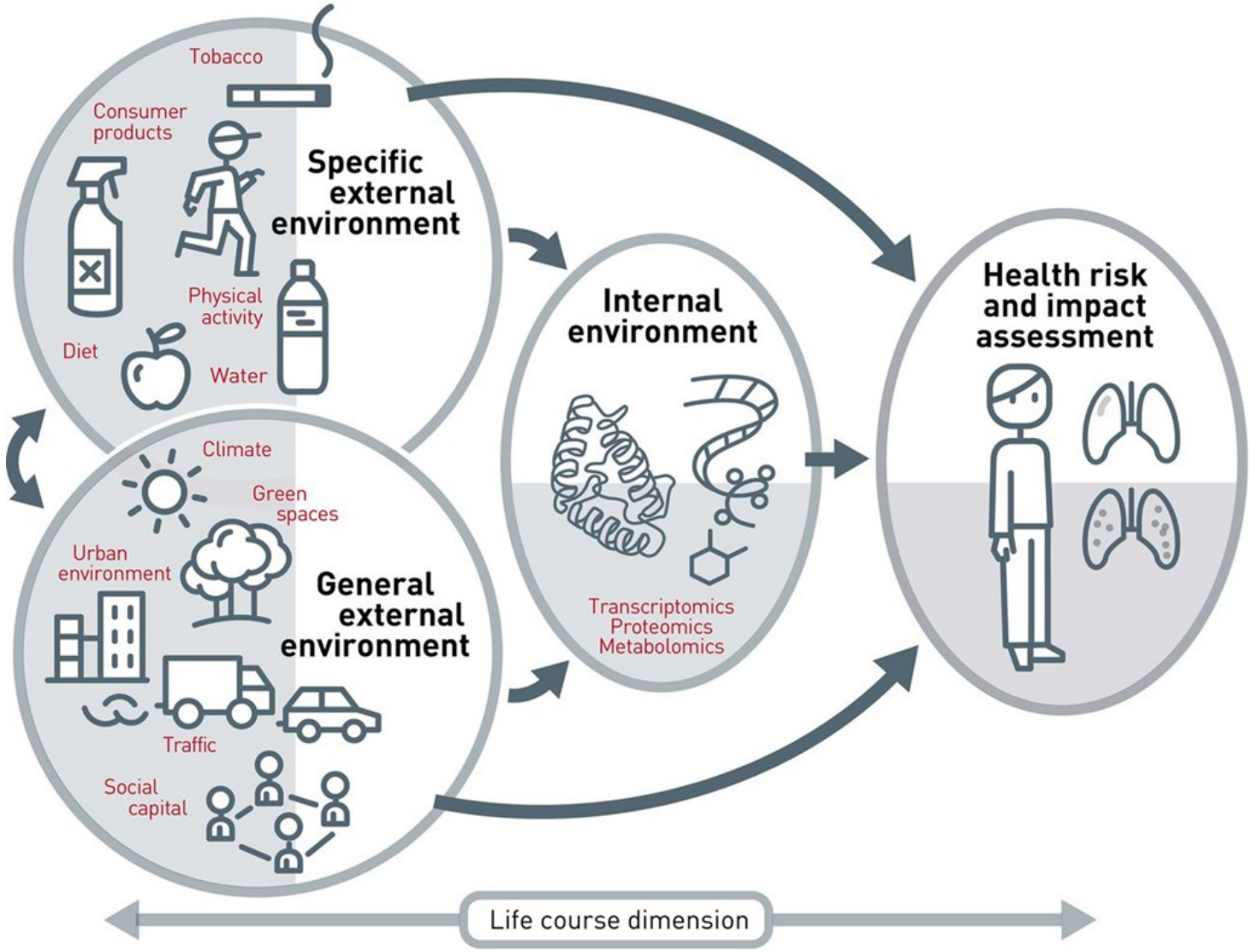
THE ROLE OF THE ENVIRONMENT

Environmental epidemiology is the study of the effect on human health of physical, biologic, and chemical factors in the external environment, broadly conceived.



EXPOSOME CONCEPT

The totality of human environmental (meaning all non-genetic) exposures from conception onwards



Source: Vrijheid, M. (2014). The exposome: A new paradigm to study the impact of environment on health. Thorax;69:876–878. doi:10.1136/thoraxjnl-2013-204949

Large number of environmental factors identified as having effects on child development

Ruiz Jdel et al. Contributions of a child's built, natural, and social environments to their general cognitive ability: a systematic scoping review. PLoS One 2016; 11: e0147741.

Slide courtesy of Dr. Katarzyna Kordas

EXAMPLE OF LEAD EXPOSURE

Lead exposure (even low-level) is associated with poor outcomes (particularly IQ loss)

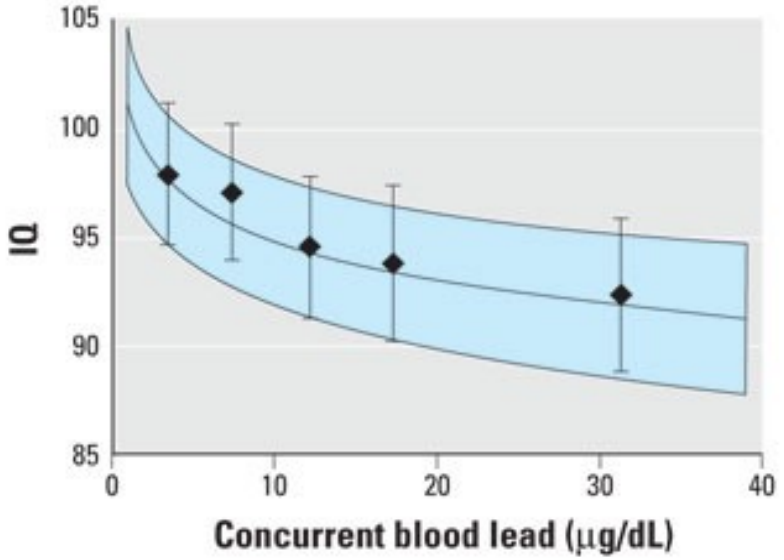


Figure 3. Log-linear model (95% CIs shaded) for concurrent blood lead concentration, adjusted for HOME score, maternal education, maternal IQ, and birth weight. The mean IQ (95% CI) for the intervals < 5 µg/dL, 5–10 µg/dL, 10–15 µg/dL, 15–20 µg/dL, and > 20 µg/dL are shown.

Slide courtesy of Dr. Katarzyna Kordas

EXAMPLE OF LEAD EXPOSURE

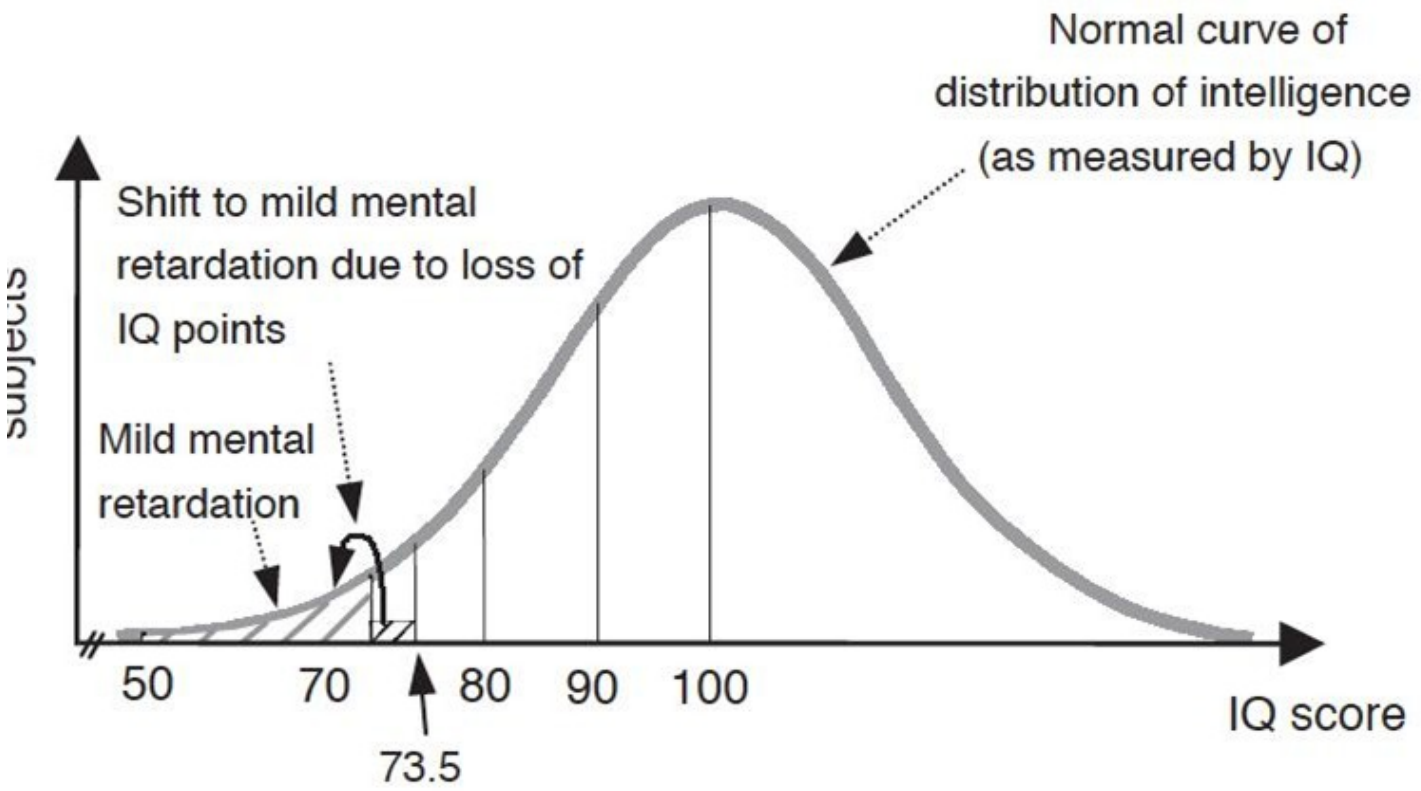
How do you understand the table?

What does it mean?

Risk factor	Total Full Scale IQ points lost
Preterm birth	34,031,025
Lead	22,947,450
Brain tumors	37,288
Acute lymphocytic leukemia	135,788
ASDs	7,109,899
Pediatric bipolar disorder	8,164,080
ADHD	16,799,400
Iron deficiency	9,404,500
Organophosphate pesticides	16,899,488
Methylmercury	284,580

Bellinger DC. A strategy for comparing the contributions of environmental chemicals and other risk factors to neurodevelopment of children. Environ Health Perspect 2012; 120: 501-507.

Slide courtesy of Dr. Katarzyna Kordas



EXAMPLE OF LEAD EXPOSURE

Even with low-level chemical exposures, we worry about shifting the IQ distribution

Pruss-Ustun et al. (2004) Lead exposure. In: Ezzati M et al., eds. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Geneva, WHO: 1495-1542.

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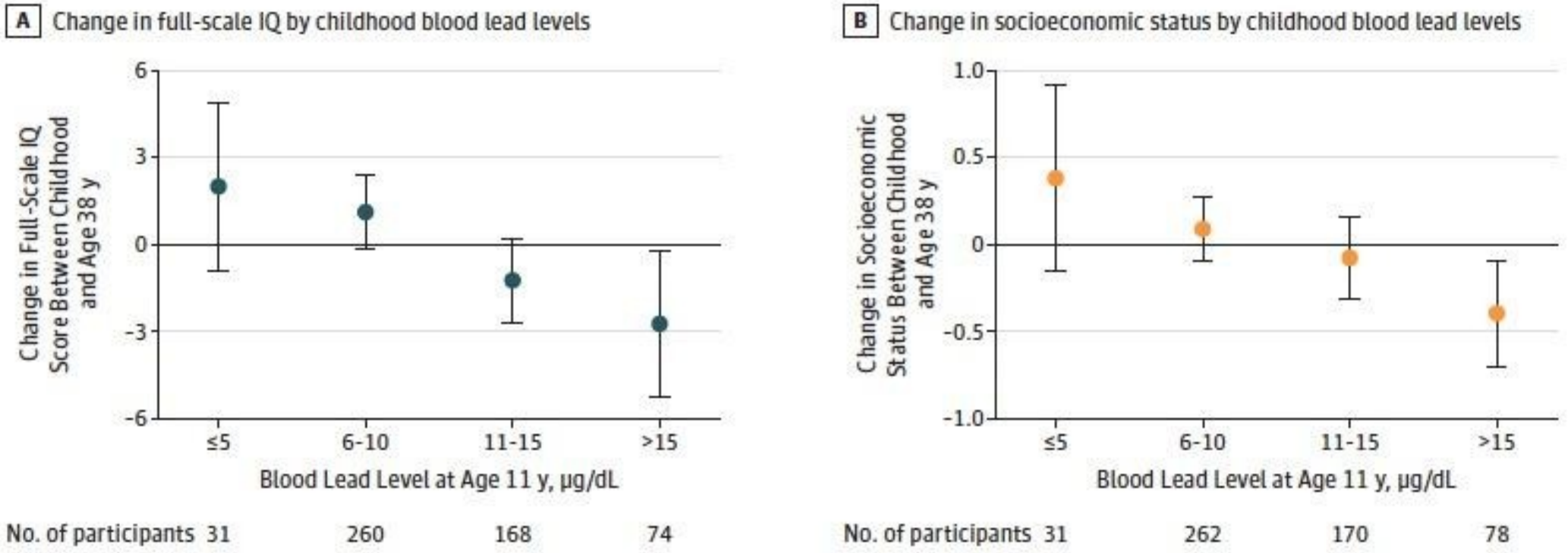
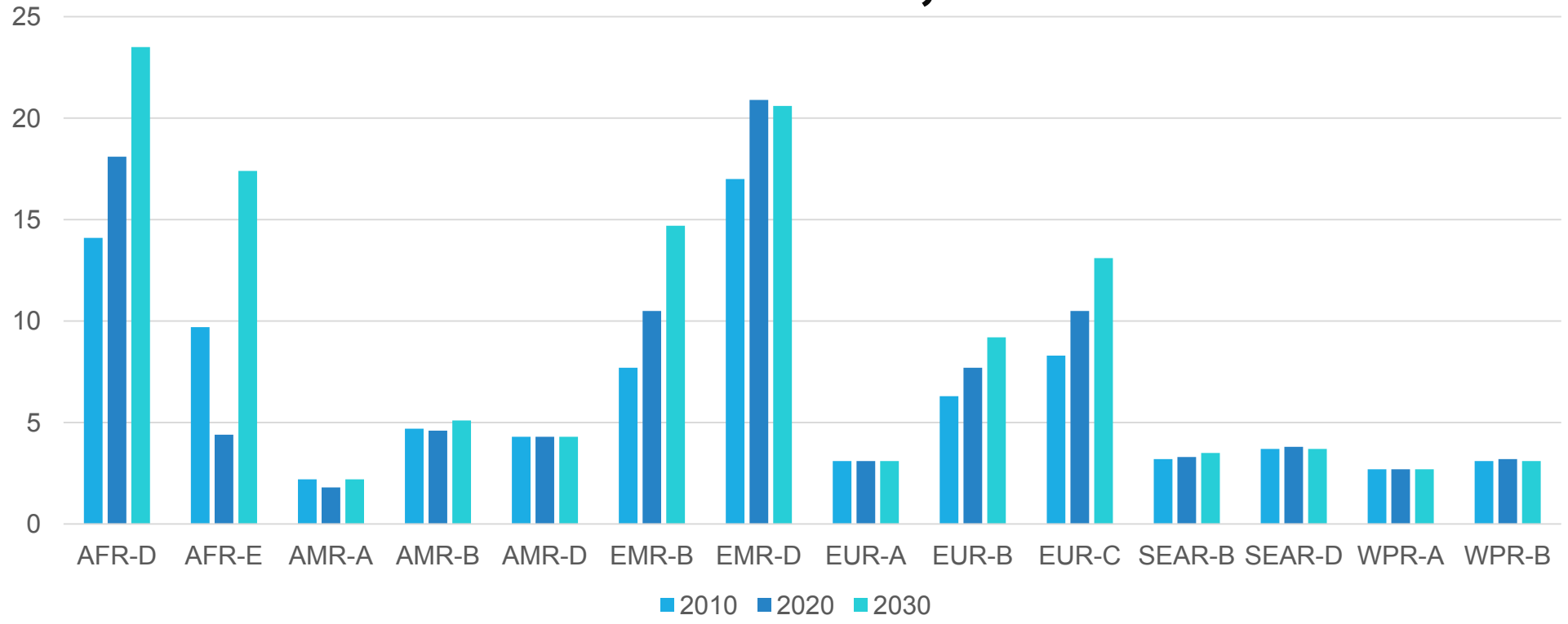
LEAD EFFECTS BEYOND CHILDHOOD



Reuben A, Caspi A, Belsky DW, Broadbent J, Harrington H, Sugden K, Houts RM, Ramrakha S, Poulton R, Moffitt TE. Association of childhood blood lead levels with cognitive function and socioeconomic status at age 38 and with IQ change and socioeconomic mobility between childhood and adulthood. JAMA 2017; 317: 1244-51.

Slide courtesy of Dr. Katarzyna Kordas

PROJECTIONS FOR GLOBAL LEAD EXPOSURE (G/DL) AMONG CHILDREN, 2010-30



Pruss-Ustun et al. (2004) Lead exposure. In: Ezzati M et al., eds. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Geneva, WHO: 1495-1542.

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RECAPITULATION

Write down three take home messages from the lecture

1 take home message = 1 sticky note

Put your sticky notes on the whiteboard

QUESTIONS?