International Agency for Research on Cancer (IARC)

Centre International de Recherche sur le Cancer (CIRC).

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SciDoLySe Working Group, January 24, 2019

International Agency for Research on Cancer

World Health Organization

Overview

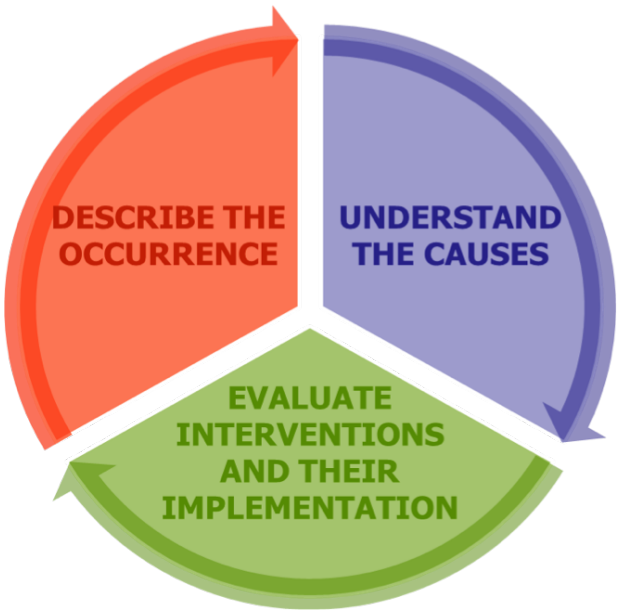
1 Presentation of IARC

2 Cancer Epidemiology

3 Selected topics

4 Conclusion

IARC



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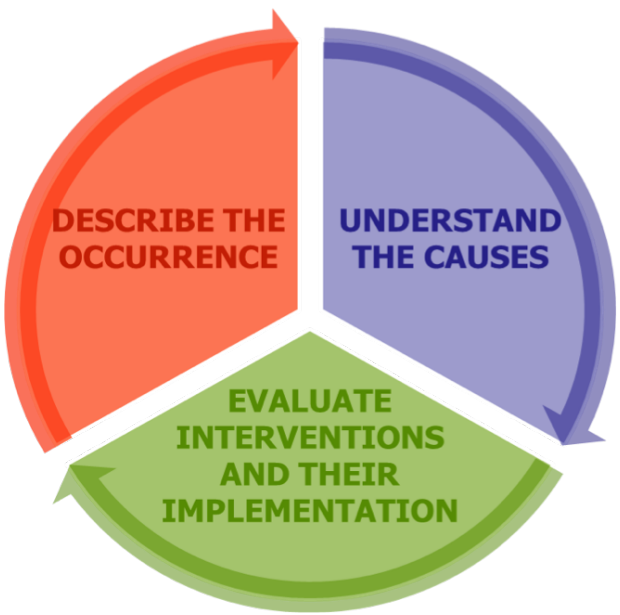
IARC



- Established in 1965 as an autonomous agency of WHO with the aim of promoting international collaboration in cancer research
- Mission
  - Causes and prevention of cancer
  - IARC Monographs/Handbooks/ WHO Classif. of tumours/ GLOBOCAN
  - ...

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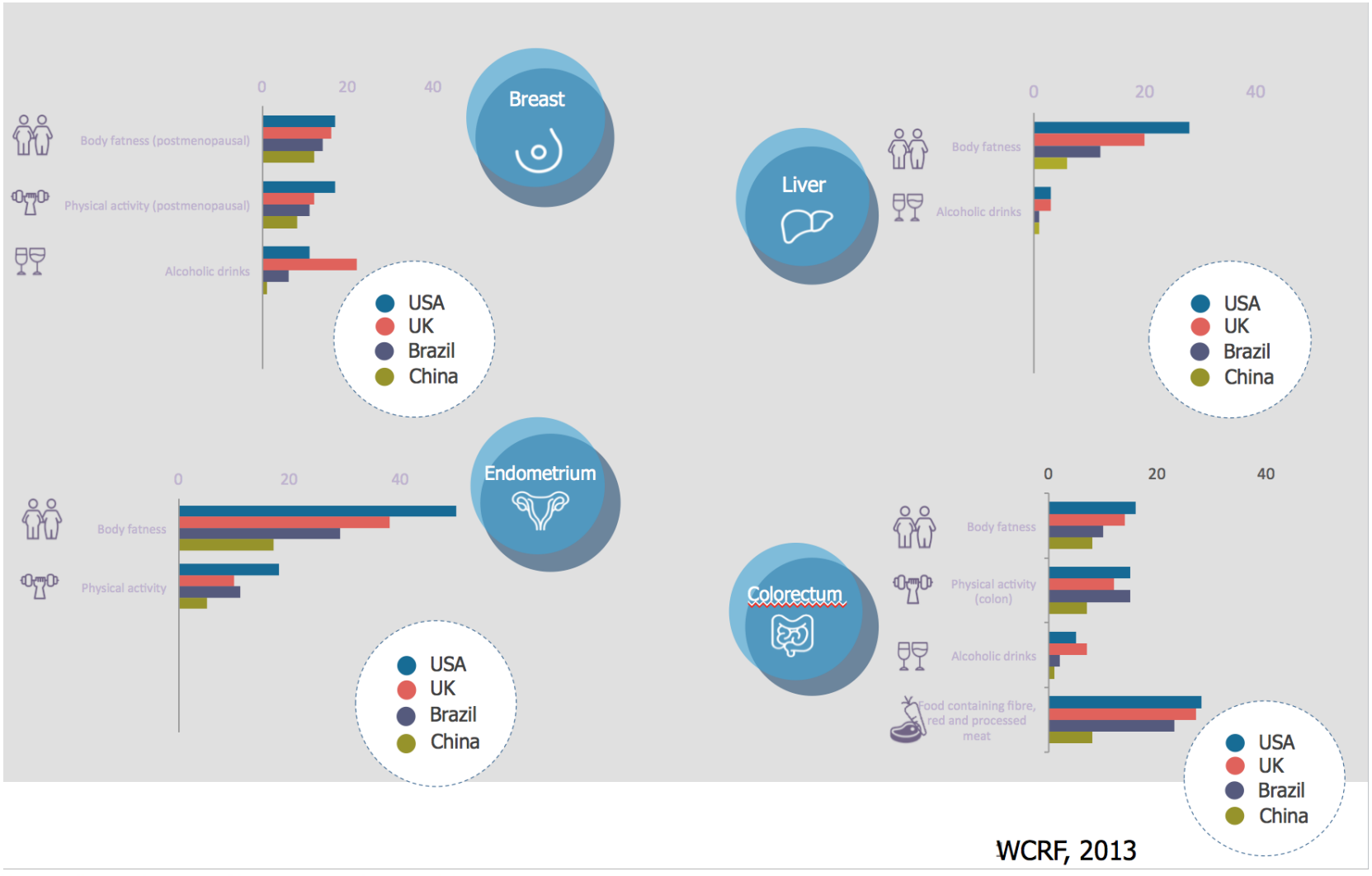
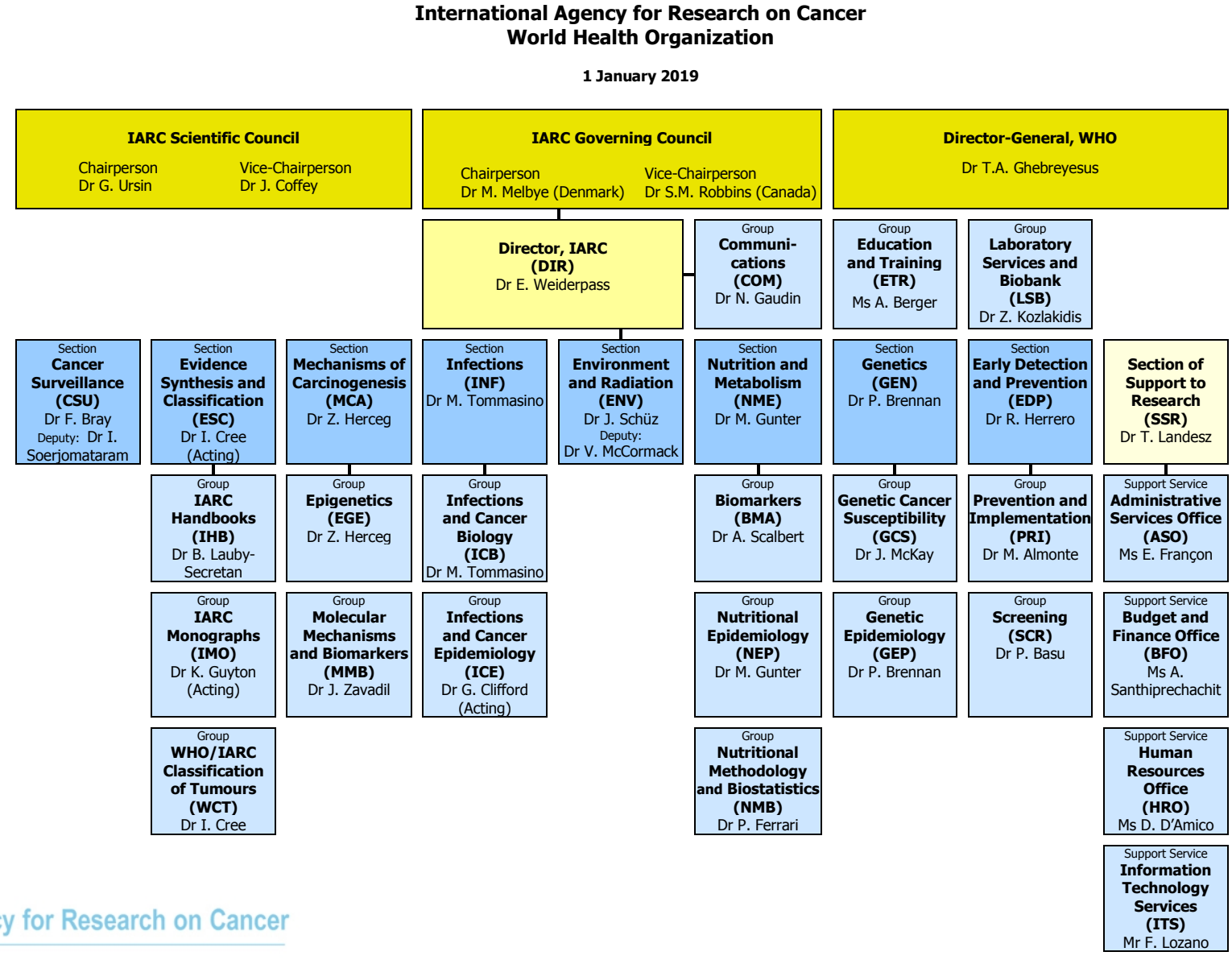
Example: Population attributable fractions of cancer



300 staff, from about 50 countries...



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Overview

1 Presentation of IARC

2 Cancer Epidemiology
- Basics of epidemiology
- Examples of available data

3 Selected topics

4 Conclusion

Epidemiology

- etiological epidemiology: analysis of determinants of health and disease conditions
- Cornerstone of public health: identification of
  - risk factors for disease
  - targets for preventive healthcare
- Mostly relies on biology to better understand disease processes and statistics to make efficient use of the data and draw appropriate conclusions.

Recipe of standard epidemiological studies for noncommunicable diseases

1. Use biological knowledge to identify an exposure (lifestyle, environmental, etc.) and a disease of interest.
1. Build up a cohort study and record information regarding potential confounders
3. Study the statistical association of exposure and disease, after conditioning on confounders.
    - Logistic regression, Survival Analysis, multiple tests correction, etc.

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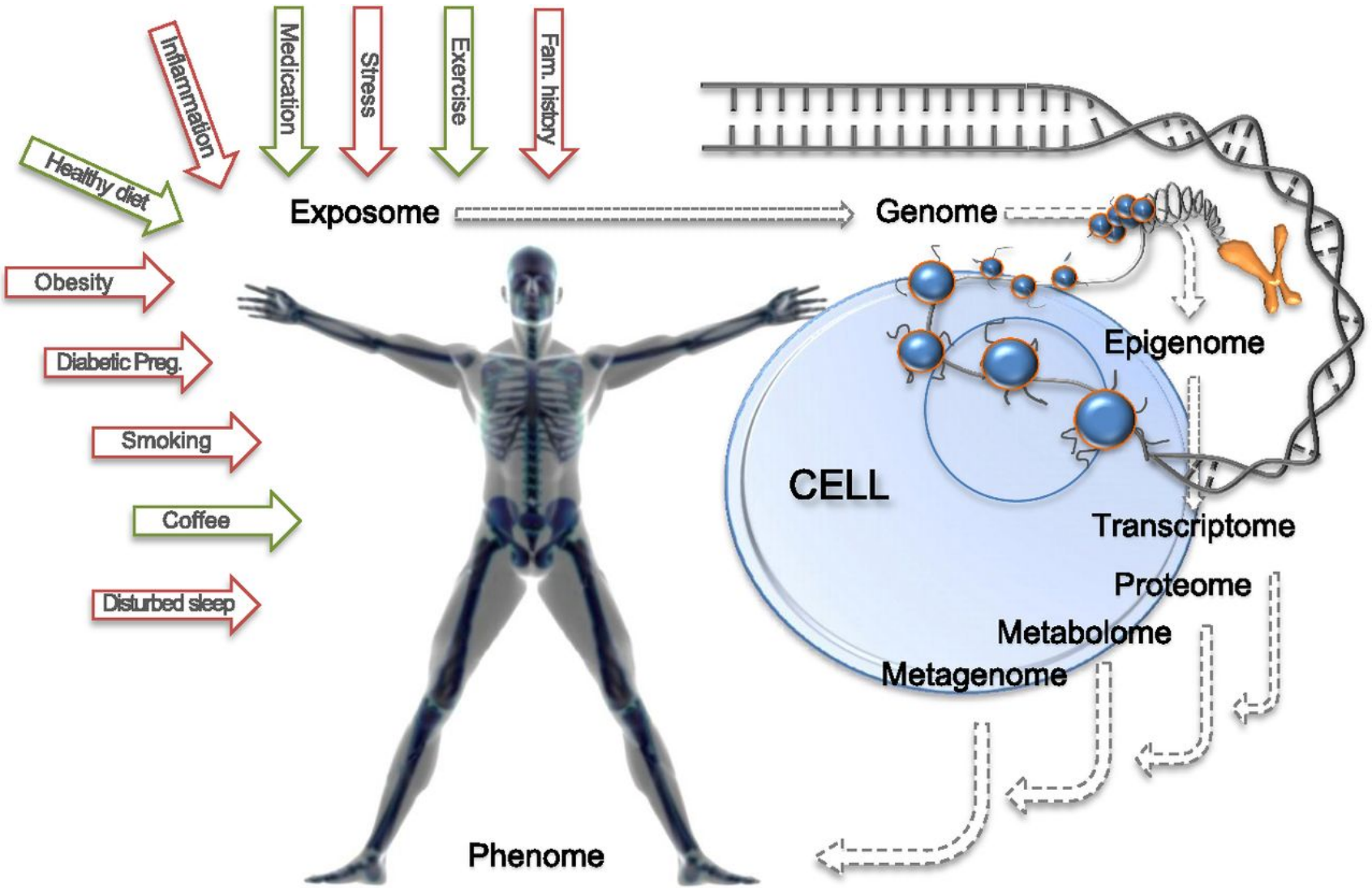
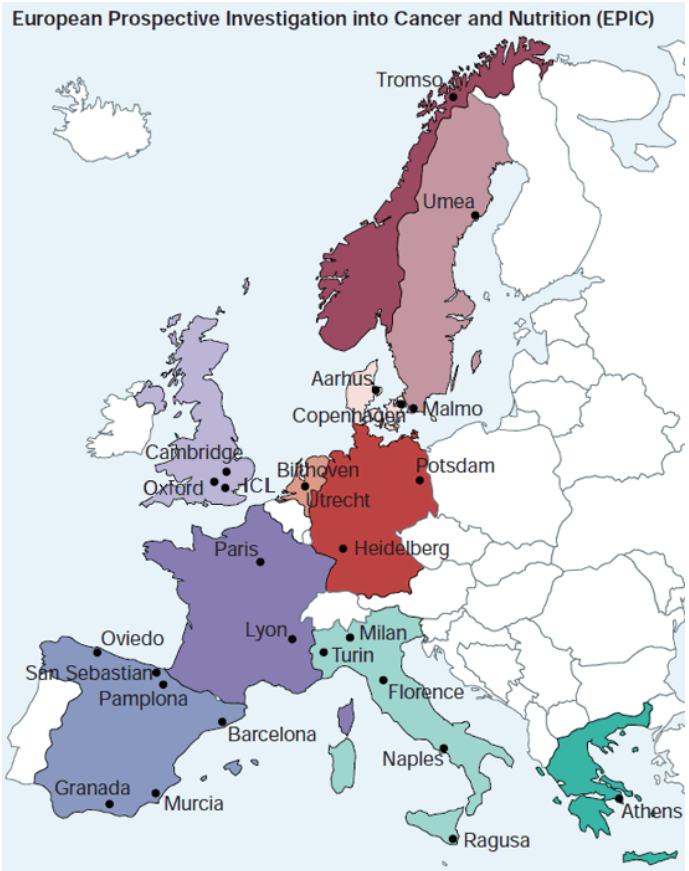
   - Logistic regression, Survival Analysis, multiple tests correction, etc.
4. Discuss potential biases in the study (Association Vs. Causation)
5. Results need to be reproduced in other studies, be biologically plausible, etc. to be considered as relevant from a causal point-of-view.


Inflammation
Medication
Stress
Exercise
Fam. history
Healthy diet
Exposome
Genome
Obesity
Diabetic Preg.
Epigenome
Smoking
CELL
Coffee
Transcriptome
Disturbed sleep
Proteome
Metabolome
Metagenome
Phenome

The EPIC cohort (IARC and Imperial College of London)



- ~ 500,000 participants recruited over 1992-1999 across 10 European countries
- Originally designed to investigate the relationships between diet, nutritional status, lifestyle and environmental factors, and the incidence of cancer and other chronic diseases (CVD, Diabetes, etc.)
- > 15 years of follow-up (still ongoing)
  - ~ 50,000 incident cancers

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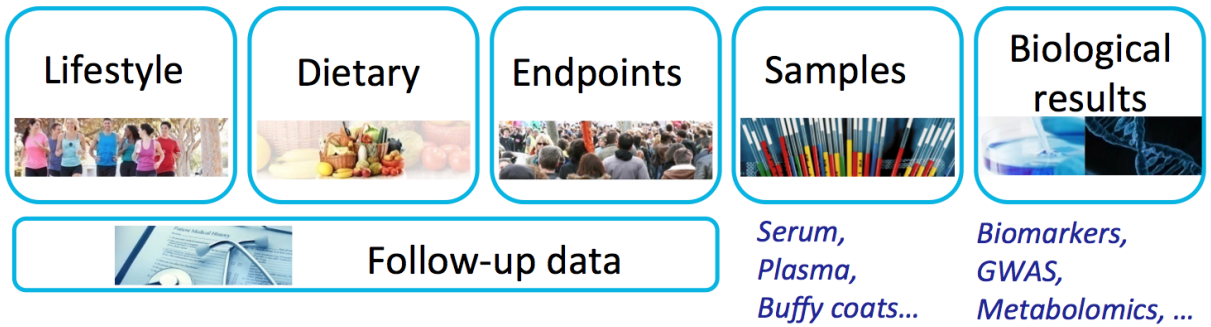

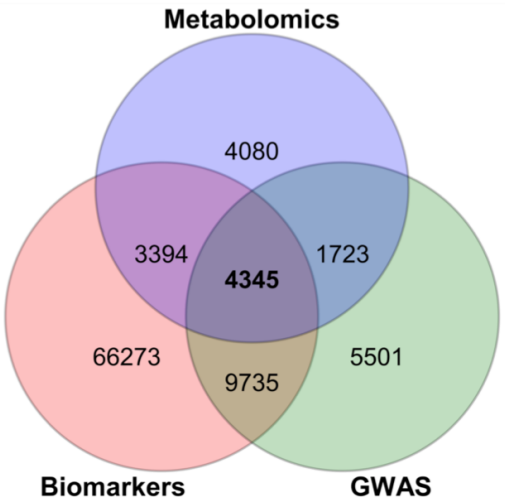

- ex: ~ 50,000 EPIC subjects with GWAS (controls + cases of cancers for various cancer sites)

Other datasets

- 'Standard cohorts':
  - UK Biobank (500K obs, 15K cancers: 2.3K Breast cancers, etc.)

- Medico-administrative datasets: through reimbursements of medical expenses, hospital stays, etc., it (virtually) describes the complete medical history of (virtually) all the population.
  - SIDIAP (Catalonia), SNDS (France)

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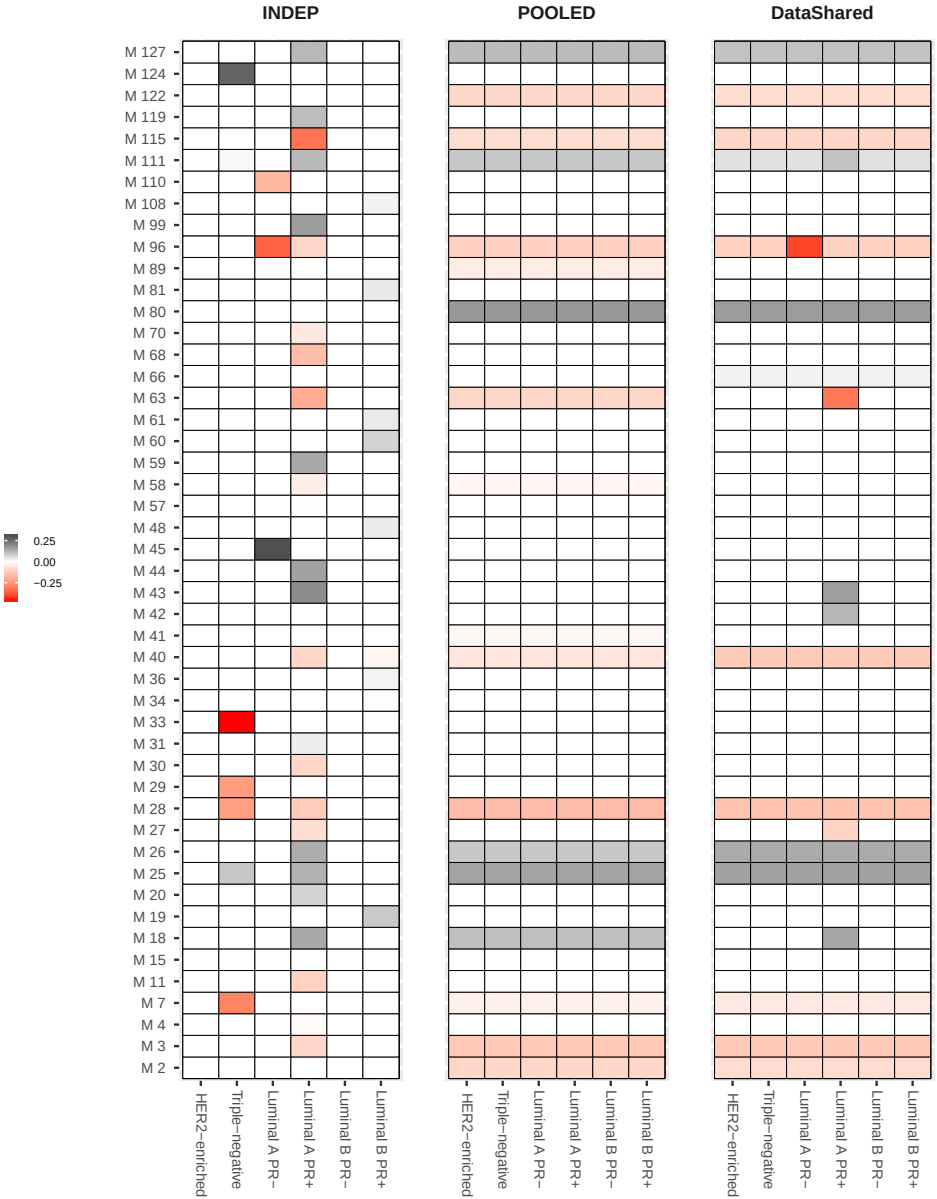
Structured sparsity: case-control studies with several subtypes of cases



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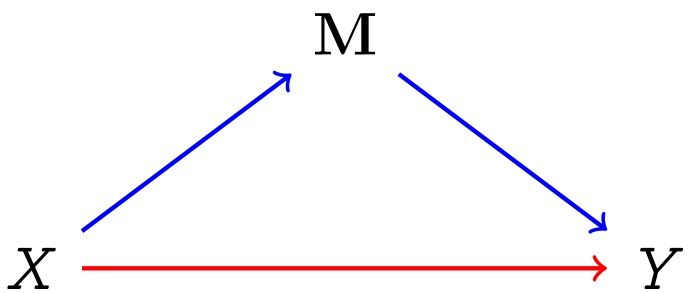
High-dimensional mediation analysis



- $\mathbf{M}$: vector of metabolites
- Identification of combination(s) of metabolites mediating the X-Y relationship

Network analysis, Causality

- Infer networks of metabolites, etc.: undirected graph models
- Infer causal relationships: directed graph models
- Causal inference: recent tools developed in computer science and statistics.

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Conclusion

- Plenty of data available at IARC today (.. GDPR..)
- Even more tomorrow (repeat measures, consortia, etc.)
- We're keen to collaborate with statisticians, computer scientists, etc. and go beyond our current practice.
- And/or to participate in the supervision of students with a mathematical background and interests in cancer epidemiology.