International Programme of Advanced Epidemiology and Statistics (IPAES)

ESCOLA SALUT PÚBLICA
ESCUELA SALUD PÚBLICA
LLATZERET - MENORCA

Causal inference course

September 18th-22nd 2017

Welcome

Welcome to the 1st meeting of the International Programme of Advanced Epidemiology and Statistics. This 1st meeting introduces the **Causal Inference course** which includes three modules: Causal inference with directed graphs, Causal mediation and interaction analysis, and Methods to deal with attrition and missing data. The goal of this course is to empower epidemiologists, biomedical scientists, public health professionals, research clinicians, social scientists, and statisticians to apply causal inference with confidence. The course is taught in English by renowned international lecturers. The programme is held in the *Llazeret* of Maó within the Public Health School of Menorca. Participants will enjoy an intense learning experience in a unique historical environment. The *Llatzeret* is a small island at the port of Maó wherein all boats entering Spain during the 19th century had to stop for quarantine to get a certificate of being free of infection diseases.

Mònica Guxens
Programme director

Modules

Causal Inference with Directed Graphs - *Felix Elwert*

This 2-days module offers an applied introduction to directed acyclic graphs (DAGs) for causal inference from observational data. DAGs are rigorous and accessible tools for understanding and solving complicated causal problems. All causal inference relies on causal assumptions, and DAGs are a graphical notation for these causal assumptions. Analysts can use DAGs to derive the statistical implications of their causal assumptions and determine which statistical associations equal ("identify") causal effects. We will use DAGs to study the identification of causal effects, with particular emphasis on identification by adjustment, which underlies the use of regression and matching techniques for causal inference. We will animate the material with numerous examples from the social and biomedical sciences.

Outline:

1. Counterfactual causality
2. Directed Acyclic Graphs (DAGs)
3. Statistical implications of causal assumptions
4. Causal Identification Analysis
5. Selection bias

Causal Mediation and Interaction Analysis - *Tyler VanderWeele*

This 1.5-day module consists in one part on causal mediation analysis and another one on causal interaction analysis. Mediation analysis concerns assessing the mechanisms and pathways by which causal effects operate. Discussion will be given as to when the standard approaches to mediation analysis are or are not valid. The no-confounding assumptions needed for these techniques will be described. The use and implementation of sensitivity analysis techniques to assess the how sensitive conclusions are to violations of assumptions will be covered, as will extensions to multiple mediators. We will also discuss interaction on additive and multiplicative scales, and their relation to statistical models. We will discuss issues of confounding for interaction analyses and how whether control has been made for only one or both of two exposures affects interpretation. We will discuss conditions under which interaction gives evidence of synergism within the sufficient cause framework, when interaction is robust to unmeasured confounding, and methods attributing effects to interaction.

Outline:

1. Concepts and Methods on Causal Mediation
2. Sensitivity Analysis and Multiple Mediators
3. A Unification of Mediation and Interaction
4. Concepts and Methods on Interaction Analysis
5. Interaction vs. Effect Heterogeneity
6. Mechanistic Interaction

Methods to deal with attrition and missing data - *Xavier Basagaña*

This 1.5-days module will provide methodological tools to overcome potential selection biases induced by attrition, i.e. selected individuals not participating in the study or being lost to follow up, or by having missing information in some of the key study variables. Missing data are ubiquitous in observational and experimental research. An inappropriate analysis of a study with missing data can lead to incorrect inferences, both in terms of bias and in the quantification of uncertainty. We will discuss the potential problems induced by missing data and will provide an overview of two main methods that can deal with such problems, namely inverse probability weighting and multiple imputation. The module will give special focus on the practical implementation of these techniques in realistic settings.

Outline:

1. Implications of attrition and missing data for causality
2. Overview of methods and assumptions
3. Multiple imputations
3. Inverse probability weighting
4. Combination of multiple imputation and inverse probability weighting

Faculty

Felix Elwert

Dr. Elwert is Romnes Vilas Associate Professor of Sociology and Population Health Sciences at the University of Wisconsin–Madison. He holds graduate degrees in sociology and in statistics from Harvard University. His research concerns social demography and social inequality. His methodological research concerns methods for causal inference in observational, quasi-experimental, and experimental settings. He won the first Causality in Statistics Education Award from the American Statistical Association in 2013.

Tyler VanderWeele

Dr. VanderWeele is Professor of Epidemiology at the Harvard T.H. Chan School of Public Health. He holds degrees from the University of Oxford, University of Pennsylvania, and Harvard University in mathematics, philosophy, theology, finance and applied economics, and biostatistics. His research concerns methodology for distinguishing between association and causation in observational research including mediation, interaction and spillover effects. He won the first Causality in Statistics Education Award from the American Statistical Association in 2015.

Xavier Basagaña

Dr. Basagaña is Associate Research Professor in biostatistics at the Barcelona Institute for Global Health. He holds a graduate degree in biostatistics from Harvard University. His research concerns methodology on statistical methods to produce valid interferences in observational studies (e.g. on measurement error and missing data), relationship between extreme temperatures and health, and relationship between air pollution and health.

Who should attend?

The programme is aimed at applied researchers with an interest in causal inference from observational data, in particular for epidemiologists, biomedical scientists, public health professionals, research clinicians, social scientists, and statisticians. Participants should have a good working knowledge of applied regression analysis and an intermediate knowledge level of epidemiology.

Materials

Participants will receive a bound manual containing detailed lecture notes, reading materials, and many other useful features. In the first module, which aims to strengthen your ability to *think through* causal problems, we will work through numerous pencil-and-paper exercises. In the second and third module participants need to bring their laptop computers to participate in the software-based exercises. Software code in SAS, STATA, and R will be provided.

Registration

The registration fee is 1,200€ and includes all course materials, lunch and coffees from Monday September 18th to Friday September 22nd 2017, and the Course Dinner on Tuesday September 19th. Participants have to book their accommodation themselves. We will provide a bus service for the transfer between the hotels and the *Llatzeret*. Further details for registration will be announced shortly. For further information, please contact us at ipaes.emps@gmail.com or visit our webpage http://www.emsp.cime.es.