DEPARTMENT OF MEDICAL EPIDEMIOLOGY AND BIOSTATISTICS

C8F2416, Causal Inference for Epidemiologists, 1.5 credits (hec)

Kausal inferens för epidemiologer, 1,5 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus was approved by The Committee for Doctoral Education on 2023-10-31, and was last revised on 2025-09-16. The revised course syllabus is valid from autumn semester 2025.

Responsible department

Department of Medical Epidemiology and Biostatistics, Faculty of Medicine

Prerequisite courses, or equivalent

The students are expected to have taken Epidemiology I, Epidemiology II, Biostatistics I, and Biostatistics II. Exceptions can be made if the students have taken other courses with an equivalent content.

Purpose & Intended learning outcomes

Purpose

This course aims to present causal theory and introduces how concepts and methods can be understood within a general methodological framework.

Intended learning outcomes

After the course the student will:
- be able to use counterfactuals to express and interpret causal queries
- be able to judge when standard statistical methodology is appropriate for causal inference, and when it is not
- be able to use Directed Acyclic Graphs to describe and analyze complex epidemiological scenarios
- be able to use Instrumental Variables to analyze observational data, with additional help from a skilled statistician

Course content

Causal inference from observational data is a key task of biostatistics and of allied sciences such as sociology, education, behavioral sciences, demography, economics, health services research, etc. These disciplines share a methodological framework for causal inference that has been developed over the last decades.

This course presents this unifying causal theory and shows how biostatistical concepts and methods can be understood within this general framework. The course emphasizes conceptualization but also introduces statistical models and methods for causal inference. Specifically, this course strives to a) formally define causal concepts such as causal effect and confounding, b) identify the conditions required to estimate causal effects, and c) use analytical methods that, under those conditions, provide estimates that can be endowed with a causal interpretation. The (causal) methods can be used under less restrictive conditions than the traditional statistical methods. For example, Instrumental Variable methods allow one to estimate the causal effect of an exposure in the presence of unmeasured confounders of the exposure and outcome.

Forms of teaching and learning

Lectures and group discussions.

Language of instruction

The course is given in English

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Forms of assessment

There will be a take-home exam handed out at the last day of the course. Students who fail will be given the opportunity to write at a maximum 2 re-exams. Dates for the re-exams will be announced later.

Course literature

Recommended:
- Hernán MA, Robins JM (2020). Causal Inference: What If. Boca Raton: Chapman & Hall/CRC. http://www.hsph.harvard.edu/faculty/miguel-hernan/causal-inference-book/
- Slides to be handed out during the course.