

Department of Psychology, Stockholm University  
Doctoral program in Psychology, fall semester 2023

**Syllabus: Data analysis and causal inference in observational studies for social and medical research (*draft version, may be subject to change*)**

The aim of the course is to provide skills for research based on observational studies from a causal inference perspective. This includes skills in research methodology such as measures of occurrence and effect, study design, and potential random or systematic errors. The course also aims to provide skills in data analysis using commonly used methods for analyses of observational studies such as logistic regression and survival analyses.

**Course code**

Doctoral program: PS1DA01

**Prior knowledge**

The course assumes basic knowledge in statistical test theory and regression modeling such as linear regression.

**Learning outcomes**

After completing the course, you are expected to have improved your ability to:

*In terms of knowledge and understanding.*

- Understand the causal inference framework and counterfactual thinking
- Describe and contrast different types of commonly used study designs for observational studies
- Identify different sources of bias and recognize how these can be explicated using causal diagrams
- Discuss the concepts of confounding, effect modification/interaction and mediation

*In terms of: Skills and abilities*

- Design an appropriate study in relation to research aims and available data
- Formulate regression models for dichotomous outcomes and time-to-event data and interpret the results.
- Implement regression analyses to adjust for confounding

*In terms of: Judgement and approach*

- Critically evaluate scientific papers with regard to methodological aspects
- Make causal interpretations based on design, analyses and results

**Course content**

The course will cover the following topics:

Causal Inference

Directed Acyclic Graphs (DAGs)

Measures of outcomes

Measures of associations between exposure and outcome

Study design

Systematic and random errors

Logistic regression

Survival analysis

Introduction to longitudinal analysis

Interaction  
Mediation

### **Teaching: In real life and online**

The course consists of lectures and workshops. Most lectures and workshops will take place in real life, but a few lectures will be delivered via zoom.

### **Activities**

The lectures will cover the basics on research methodology and data analysis, with a focus on causal inference. The workshops will focus on specific methodological issues such as review of research articles from a methodological perspective or application regression models to analyze data. The data used in workshops, as well as articles that should be read before the workshops, will be provided to the student during the course.

### **Literature**

Rothman K (2012). *Epidemiology: An introduction*. New York, NY: Oxford University Press,  
*Chapter 3 What is causation? p23-37*  
*Chapter 4 Measuring disease occurrence and causal effects p38-68*  
*Chapter 5 Types of epidemiological studies p69-109*  
*Chapter 7 Dealing with biases p124-147*  
*Chapter 8 Random error and the role of statistics p148-163*  
*Chapter 11 Measuring interactions p198-210*

Hernán MA, Robins JM (2020). *Causal Inference: What If*. Boca Raton: Chapman & Hall/CRC.  
*Chapter 1 A definition of causal effect p3-10*  
*Chapter 3 Observational studies p27-38*  
*Chapter 4 Effect modification p43-52*  
*Chapter 5 Interaction p57-67*  
*Chapter 6 Graphical representation of causal effects p71-83*  
*Chapter 17 Causal survival analysis p221-231*  
*Chapter 23 Causal mediation p317-323*

Vittinghoff E., et al. *Regression Methods in Biostatistics*  
*Chapter 6 Logistic regression*

Allison, Paul. A. (2014). *Event History and Survival Analysis*. Thousand Oaks, CA: Sage.

Twisk JWR *Applied Longitudinal data analysis for epidemiology: A practical guide*, Second Edition  
2013, Cambridge University Press  
*Chapter 1 Introduction p1-5*  
*Chapter 7 Dichotomous outcome variables p119-140*  
*Chapter 8 Categorical and “count” outcome variables p141-162*

Naimi A. et al. An introduction to g methods, *International Journal of Epidemiology*, Volume 46,  
Issue 2, April 2017, Pages 756–762, <https://doi.org/10.1093/ije/dyw323>

Gunasekara F.I. et al, Fixed effects analysis of repeated measures data, *International Journal of Epidemiology*, Volume 43, Issue 1, February 2014, Pages 264–269, <https://doi.org/10.1093/ije/dyt221>

Approximately 5 additional empirical articles, links will be provided in Athena

Date, time and room: see Athena