

## Juha Karvanen (Jyväskylän yliopisto): Study Design in Causal Models

### Abstract:

The causal assumptions, the study design and the data are the elements required for scientific inference in empirical research. The research is adequately communicated only if all of these elements and their relations are described precisely. Causal models with design describe the study design and the missing-data mechanism together with the causal structure and allow the direct application of causal calculus in the estimation of the causal effects. The flow of the study is visualized by ordering the nodes of the causal diagram in two dimensions by their causal order and the time of the observation. Conclusions on whether a causal or observational relationship can be estimated from the collected incomplete data can be made directly from the graph. Causal models with design offer a systematic and unifying view to scientific inference and increase the clarity and speed of communication. Examples on the causal models for a case–control study, a nested case–control study, a clinical trial and a two-stage case–cohort study are presented.