IMPRS
INTERNATIONAL MAX PLANCK RESEARCH SCHOOL
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MAX PLANCK INSTITUTE
FOR DEMOGRAPHIC RESEARCH

From decomposition to causal mediation analysis: a multidisciplinary perspective

Course Coordinators: Dr. Joost Oude Groeniger & Prof. Dr. Frank van Lenthe

Start: 28 March 2022
End: 31 March 2022
Location: Online course. Link tba.

Instructors:

- Prof. Dr. Frank van Lenthe
- Dr. Wilma Nusselder,
- Dr. Maarten J. Bijlsma,
- Dr. Anna Pearce,
- Dr. Joost Oude Groeniger

Course description

Decomposition analysis is often used in demography to assess the contribution of different age groups or causes to differences in aggregate measures, such as life expectancy or health expectancy. It decomposes differences/changes into additive contributions. Decomposition of differences in life expectancy is frequently used in demography and public health research and allows to quantify the contribution of different age groups or causes of death to changes in life expectancy over time, between countries or population groups. Decomposition of differences in health expectancy allows in addition to quantify the contribution of mortality differences vs. differences in health, in total, or again by age and cause. Decomposition enables to understand better what is behind observed differences in life and health expectancy and may point at entry points for policy or interventions.

Causal decomposition places decomposition within the counterfactual framework, treating causes of outcomes as intermediate variables that are clustered within groups. For example, men and women (groups) have different historical smoking behaviours (causes), which result in different outcomes (life expectancy). By constructing counterfactuals, e.g. "If men had the same smoking behavior as women, what would their life expectancy have been?" it seeks to add a causal interpretation to decomposition estimates. As such, causal decomposition can be seen as halfway between general decomposition and causal mediation analysis.

Mediation analysis is a key analytical technique to assess the importance of one or multiple pathways linking an exposure to an outcome. It allows researchers to quantify the extent to which an exposure's effect on the outcome can be blocked by

intervening on a particular mediator. Public health research has a long history of using mediation analysis, but traditional mediation methods make a number of assumptions that are often not met. Causal mediation methods enable greater flexibility and provide researchers with the tools to scrutinize the assumptions underlying their analysis.

In this workshop, we will provide an overview of decomposition and mediation methods. We will illustrate the commonalities and differences between these methods, and the assumptions on which they rely. The workshop includes an introduction to causal inference and Directed Acyclic Graphs to show how decomposition and mediation analysis can be used to answer causal questions. There will be opportunities to practice and ask questions during the workshop. Active participation is required.

Organization

The course will be offered as online afternoon sessions from 15:00 -18:00 Central European Time on all four days. Each session is three hours including breaks.

Detailed schedule

Session 1:

Introduction - by Frank van Lenthe
Decomposition - by Wilma Nusselder

Session 2:

Causal decomposition - by Maarten J. Bijlsma

Session 3:

Causal mediation analysis - by Anna Pearce & Joost Oude Groeniger

Session 4:

Advanced methods in mediation - by Joost Oude Groeniger

Course prerequisites

No prior knowledge is required, but it is highly recommended to read (some of) the literature posted under general readings. Basic familiarity with the R programming language is beneficial, but not required.

Examination

Active participation in class is required.

Admission

This course is restricted to IMPRS-PHDS students. Questions about the course should be directed to phds@demogr.mpg.de.

General readings

Elwert, F. Graphical causal models. In: Handbook of causal analysis for social research. Springer, Dordrecht, 2013. p. 245-273.

Hernán M.A. A definition of causal effect for epidemiological research. Journal of Epidemiology & Community Health, 2004;58:265-271.

Naimi A.I., Schnitzer M.E., Moodie E.E., Bodnar L.M. Mediation Analysis for Health Disparities Research. American Journal of Epidemiology, 2016;184(4):315-24.

Nusselder W.J., Looman C.W.N. Decomposition of differences in health expectancy by cause. Demography, 2004;41(2):315-34.

Oude Groeniger J, Burdorf A. Advancing mediation analysis in occupational health research. Scandanavian Journal of Work Environment and Health, 2020;46(2):113-116.

Oude Groeniger, J., de Koster, W., van der Waal, J. Time-varying effects of screen media exposure in the relationship between socioeconomic background and childhood obesity. Epidemiology, 2020, 31(4):578.

Sudharsanan, N. Bijlsma, M.J. Educational note: causal decomposition of population health differences using Monte Carlo integration and the g-formula, International Journal of Epidemiology, 2021, dyab090.

Valeri L, Vanderweele TJ. Mediation analysis allowing for exposure-mediator interactions and causal interpretation: theoretical assumptions and implementation with SAS and SPSS macros. Psychological Methods, 2013;18(2):137-50.

Van der Weele, Tyler J. Marginal structural models for the estimation of direct and indirect effects. Epidemiology, 2009, 18-26.