Item Nonresponse and Imputation
SURV 725
1 credit/2 ECTS
Fall 2017, section 1

Instructor(s)
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Short Course Description
Missing data are a common problem which can lead to biased results if the missingness is not taken into account at the analysis stage. Imputation is often suggested as a strategy to deal with item nonresponse allowing the analyst to use standard complete data methods after the imputation. However, several misconceptions about the aims and goals (isn't imputation making up data?) of imputation make some users skeptical about the approach. In this course we will illustrate why thinking about the missing data is important and clarify which goals a useful imputation method should try to achieve (and which not).

Course and Learning Objectives
By the end of the course, students will…

- *understand why the default way of dealing with missing data as implemented in most statistical software is often problematic.*
- *realize that it is better not to account for the missingness instead of applying simplistic imputation methods such as mean imputation or last-observation carried forward.*
- *know what is meant by a missing data mechanism and understand the implication of the different mechanisms.*
- *be familiar with the principle ideas and concepts of multiple imputation.*

Prerequisites
Students should be familiar with generalized linear models and basic probability theory. The statistical software R will be used for illustrations and for (some of) the homework assignments.

Class Structure and Course Concept
This is an online course using a flipped classroom design. It covers the same material and content as an on-site course but runs differently. In this course, you are responsible for watching video recorded lectures and reading the required literature for each unit and then "attending" mandatory weekly one-hour online meetings where students have the chance to discuss the materials from a unit with

the instructor. Just like in an on-site course, homework will be assigned and graded and there will be a final exam at the end of the course.

Although this is an online course where students have more freedom in when they engage with the course materials, students are expected to spend the same amount of time overall on all activities in the course – including preparatory activities (readings, studying), in-class-activities (watching videos, participating in online meetings), and follow-up activities (working on assignments and exams) – as in an on-site course. As a rule of thumb, for each credit offered by a course, students can expect to spend one hour per week on in-class activities and three hours per week on out-of-class activities over the span of a full 12-week term. This is a 1-credit course that runs for 4 weeks. Hence, the total average workload is about 12 hours per week.

Mandatory Weekly Online Meetings

Wednesday, 6:00 p. m. (CET)/ noon (EST)
Meetings will be held online through Zoom. Follow the link to the meeting sessions on the course website on http://jpsmonline.umd.edu/. If video participation via Internet is not possible, arrangements can be made for students to dial in and join the meetings via telephone.

In preparation for the weekly online meetings, students are expected to watch the lecture videos and read the assigned literature before the start of the meeting. In addition, students are encouraged to e-mail questions about the materials covered in the videos and readings of the week to the instructor (joerg.drechsler@iab.de) before the meetings (deadline for sending questions via e-mail is Wednesday, 7:00 a. m. (CET)/1:00 a. m. (EST)).

Students have the opportunity to use the Zoom meeting room set up for this course to connect with peers outside the scheduled weekly online meetings (e.g., for study groups). Students are encouraged to post the times that they will be using the room to the course website forum to avoid scheduling conflicts. Students are not required to use Zoom and can of course use other online meeting platforms such as Google Hangout or Skype.

Grading

Grading will be based on:

- 2 online quizzes (worth 20% total)
- 2 homework assignments (40% total)*
- Participation in the weekly online meetings, engagement in discussions during the meetings and/or submission of questions via e-mail (10% of grade)
- A final online exam (30% of grade)

* Dates of when assignment will be due are indicated in the syllabus.

Technical Equipment Needs

The learning experience in this course will mainly rely on the online interaction between students and the instructor during the weekly online meetings. Therefore we encourage all students in this course to use a web camera and a headset. Decent quality headsets and web cams are available for less than $20 each. We ask students to refrain from using built-in web cams and speakers on their desktops or laptops. We know from our experience in previous online courses that this will reduce the quality of video and audio transmission and therefore will decrease the overall learning experience for all students in the course. In addition, we suggest that students use a wire connection (LAN), if available, when connecting to the online meetings. Wireless connections (WLAN) are usually less stable and might be dropped.

Academic Conduct

Clear definitions of the forms of academic misconduct, including cheating and plagiarism, as well as information about disciplinary sanctions for academic misconduct may be found at

http://www.graduate.umaryland.edu/policies/misconduct.html (University of Maryland) and

https://www.uni-mannheim.de/1/english/research/Good%20Research%20Practice/141119-Satzung%20wiss%20FV%20Senat_en.pdf (University of Mannheim).

Knowledge of these rules is the responsibility of the student and ignorance of them does not excuse misconduct. The student is expected to be familiar with these guidelines before submitting any written work or taking any exams in this course. Lack of familiarity with these rules in no way constitutes an excuse for acts of misconduct. Charges of plagiarism and other forms of academic misconduct will be dealt with very seriously and may result in oral or written reprimands, a lower or failing grade on the assignment, a lower or failing grade for the course, suspension, and/or, in some cases, expulsion from the university.

Accommodations for Students with Disabilities

In order to receive services, students at the University of Maryland must contact the Disability Support Services (DSS) office to register in person for services. Please call the office to set up an appointment to register with a DSS counselor. Contact the DSS office at 301.314.7682; http://www.counseling.umd.edu/DSS/.

Students at the University of Mannheim should contact the Commissioner and Counsellor for Disabled Students and Students with Chronic Illnesses at http://www.uni-mannheim.de/studienbueros/english/counselling/disabled_persons_and_persons_with_chronic_illnesses/.

Course Evaluation

In an effort to improve the learning experience for students in our online courses, students will be invited to participate in an online course evaluation at the end of the course (in addition to the standard university evaluation survey). Participation is entirely voluntary and highly appreciated.

Class Schedule

Please note that assignments and dates are subject to change. Information (e.g., articles and assignments) posted to the course website supersedes the information noted here.

Unit 1: Introduction & Missing Data Mechanisms

Online meeting (Jörg Drechsler): Wednesday, September 20, 2017, 6:00 p. m. (CET)/ noon (EST)

Online quiz 1: Wednesday, September 20, 2017, midnight (CET)/6:00 p. m. (EST)

Video lecture (Jörg Drechsler): Wednesday, September 13, 2017

Readings:

Carpenter, J. and Kenward, M. (2012). *Multiple imputation and its application*. New York: John Wiley & Sons, Chapter 1.1 to Chapter 1.4.4

Groves, R.M., Fowler, F.J., Couper, M.P., Lepkowski, J.M., Singer, E., Tourangeau, R. (2004) Survey Methodology, Wiley, Chapter 6

Unit 2: Default Strategies of (Not) Dealing with Missing Data and Their Implications

Online meeting (Jörg Drechsler): Wednesday, September 27, 2017, 6:00 p. m. (CET)/noon (EST)

Homework assignment 1: Wednesday, September 27, 2017, midnight (CET)/6:00 p. m. (EST)

Video lecture (Jörg Drechsler): available online Wednesday, September 20, 2016

Readings:

Carpenter, J. and Kenward, M. (2012). *Multiple imputation and its application*. New York: John Wiley & Sons, Remainder of Chapter 1

Little, R.J.A. and Rubin, D.B. (2002). *Statistical Analysis with Missing Data* (2nd ed.), New York: John Wiley & Sons, Sections 3.1, 3.2, and 3.4.

Unit 3: Common Misconceptions Regarding Imputation & Basic Imputation Methods

Online meeting (Jörg Drechsler): Wednesday, October 4, 2017, 6:00 p. m. (CET)/noon (EST)

Quiz 2: Wednesday, October 4, 2017, midnight (CET)/6:00 p. m. (EST)

Video lecture (Jörg Drechsler): available online Wednesday, September 27, 2017

Readings:

Little, R.J.A. and Rubin, D.B. (2002). *Statistical Analysis with Missing Data* (2nd ed.), New York: John Wiley & Sons, Chapter 4.

Brick, J.M. and Kalton, G. (1996). Handling missing data in survey research. Statistical Methods in Medical Research, 5, 215-238. Sections 1 and 3.1.

Recommended (optional):

Brick, J.M. and Kalton, G. (1996). Handling missing data in survey research. Statistical Methods in Medical Research, 5, 215-238. Sections 2 and 4.

Unit 4: More Advanced Imputation Methods & Multiple Imputation

Online meeting (Jörg Drechsler): Wednesday, October 11, 2017, 6:00 p. m. (CET)/noon (EST)

Homework assignment 2: Wednesday, October 11, 2017, midnight (CET)/6:00 p. m. (EST)

Video lecture (Jörg Drechsler): available online Wednesday, October 4, 2017

Readings:

Carpenter, J. and Kenward, M. (2012). *Multiple imputation and its application*. New York: John Wiley & Sons, Chapter 2.1 to Chapter 2.4

Rubin, D.B. (1986). Basic ideas of multiple imputation for nonresponse. Survey Methodology, 12, 37-47.

Recommended (optional):

Rässler, S., Rubin, D.B., Zell, E.R (2007). Incomplete data in epidemology and medical statistics. In: Rao CR, Miller J, Rao DC (eds) Handbook of Statistics, 27, Elsevier, pp 569-601.

Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate imputation by chained equations in R. Journal of statistical software, 45(3).

Final Exam

Due: Wednesday, October 18, 2017, midnight (CET)/6:00 p. m. (EST)

Note: Student access to the course website will be revoked two weeks after the final exam.

	Unit 1	Unit 2	Unit 3	Unit 4
Video available	Wednesday, September 13, 2017	Wednesday, September 20, 2016	Wednesday, September 27, 2017	Wednesday, October 4, 2017
Online meeting	Wednesday, September 20, 2017, 6:00 p. m. (CET)/ noon (EST)	Wednesday, September 27, 2017, 6:00 p. m. (CET)/ noon (EST)	Wednesday, October 4, 2017, 6:00 p. m. (CET)/ noon (EST)	Wednesday, October 11, 2017, 6:00 p. m. (CET)/ noon (EST)
Online quiz due	Wednesday, September 20, 2017, midnight (CET)/ 6:00 p. m. (EST)		Wednesday, October 4, 2017, midnight (CET)/ 6:00 p. m. (EST)	
Homework due		Wednesday, September 27, 2017, midnight (CET)/ 6:00 p. m. (EST)		Wednesday, October 11, 2017, midnight (CET)/ 6:00 p. m. (EST)
Final exam due				Wednesday, October 18, 2017, midnight (CET)/ 6:00 p. m. (EST)