**Statistical analysis of repeated measurements and clustered data**

**Aim and study objectives:**

This advanced statistics course will give you and introduction to the most common repeated measurement designs used in medical research. The aim of the course is to teach you to:

* understand and interpret the analyses of various repeated measurement designs including baseline follow-up studies, cross-over trials, and reproducibility of measurement methods, as well as analyses of clustered designs (e.g. multi-level models), and of mixed type.
* perform your own analyses using R statistical software.
* use model diagnostics to assess the validity of your analyses.
* make suitable presentations of the results from your analyses.
* understand the statistical consequences of different kinds of study designs.

**Content**

This course is concerned with the analysis of correlated quantitative data arising e.g. when collecting data repeatedly on the same persons, animals, or tissue over time or on different locations of the body, or when observations are clustered as from patients in a multi-center study, siblings or pups belonging to the same litter. Appropriate statistical models for analysis will be exemplified and statistical errors arising with other frequently employed analyses will be discussed. Topics include analysis of baseline follow-up studies, longitudinal data analysis, multi-level and variance component models, analysis of cross-over trials, and reproducibility of measurements methods. We will further discuss the potential biases that occur due to missing data and statistical methods for handling these. A thorough introduction to linear mixed models for quantitative outcomes will be given, while generalized linear mixed models and marginal models (aka generalized estimating equations) for the analysis of binary, ordinal, and count data are more briefly touched upon by the end of the course. Computer exercises with R statistical software will be given.

**Statistical software**

You must bring your own labtop with R and R Studio installed to participate in the exercise classes. Note that if you have never used R before we strongly recommend that you complete a course on R programming before attending this course.

**Textbook**

Many of the analyses taught are covered by G.M. Fitzmaurice, N.M. Laird, & J.H. Ware. Applied Longitudinal Analysis, 2nd ed., John Wiley & Sons, 2011. You are not required to buy the book, but we recommend it. Note: Students at the University of Copenhagen have free access to the e-book through the Royal Library. Lecture notes and R-demos are available from the course webpage.

**Prerequisites**

Basic knowledge of statistics, e.g. corresponding to the course “Basic statistics for health researchers” and R programming at beginner level.

**Language**

English.

**Form**

Forum lectures and computer exercises.

**Dates**

14, 17, 21, 24, 28, 31 May 2024, all days 8-15 (lunch break 11-12).

**Course location**

CSS

**Course director**

Associate professor Julie Lyng Forman, Department of Biostatistics

**Teachers**

Associate professor Julie Lyng Forman, associate professor Brice Ozenne and others.

**Course secretary**

Susanne Kragskov Laupstad, Department of Biostatistics, e-mail: skl@sund.ku.dk