

Interuniversity Attraction Pole P5/24 Statistical Techniques and Modeling for Complex Substantive Questions with Complex Data

Web: www.stat.ucl.ac.be/IAP/



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Course "Mixed Models and Incomplete Data"

Instructor(s): Geert Molenberghs (UHasselt), Geert Verbeke (K.U.Leuven)

Dates: Wednesday February 22 (11:00am – 17:30pm) and Thursday February 23 (9:00am – 16:00pm), 2006.

Location: K.U.Leuven, Justus Lipsiuszaal (08.16), Erasmushuis, Blijde Inkomststraat 21, 3000 Leuven, Belgium (see map)

Short description of the course: We first present linear mixed models for continuous hierarchical data. The focus lies on the modeler's perspective and on applications. Emphasis will be on model formulation, parameter estimation, and hypothesis testing, as well as on the distinction between the random-effects (hierarchical) model and the implied marginal model. Apart from classical model building strategies, many of which have been implemented in standard statistical software, a number of flexible extensions and additional tools for model diagnosis will be indicated. A number of illustrations and worked examples will be given based on the SAS procedure MIXED.

Second, mixed-effects models for non-Gaussian data will be discussed, with a strong emphasis on the generalized linear mixed model. Apart from hierarchical binary data, the cases of count data and ordinal data will be treated as well. To usefully introduce this theme, a brief review of the classical generalized linear modeling framework will be presented. Similarities and differences with the linear mixed model will be discussed. Care will be taken in explaining the numerical diffculties encountered when fitting this type of models to data, since the optimization process involves non-trivial integration. Numerical integration will be contrasted with alternative methods, such as, for example, PQL and MQL. Marginalization of the generalized linear mixed model will be given detailed treatment. The primary software tool will be primarily the SAS procedures NLMIXED and GLIMMIX.

Third, the non-linear mixed model will be treated. Apart from a number of general applications, the specific situations of pharmacokinetic and pharmacodynamic data will be considered. Numerical complexities occurring when maximizing the likelihood will be discussed.

Fourth, when analysing hierarchical and longitudinal data, one is often confronted with missing observations, i.e., scheduled measurements have not been made, due to a variety of (known or unknown) reasons. It will be shown that, if no appropriate measures are taken, missing data can cause seriously jeopardize results, and interpretational diffculties are bound to occur. Methods to properly analyze incomplete data, under flexible assumptions, are presented. Key concepts of sensitivity analysis are introduced.

Method of working: As a result of the course, participants should be able to perform a basic analysis for a particular longitudinal data set at hand, using linear, generalized linear, and non-linear tools for longitudinal data. Based on a selection of exploratory tools, the nature of the data, and the research questions to be answered in the analyses, they should be able to construct an appropriate statistical model, to fit the model within the SAS framework, and to interpret the obtained results. Further, participants should be aware not only of the possibilities and strengths of a particular selected approach, but also of its drawbacks in comparison to other methods.

The course will be explanatory rather than mathematically rigorous. Emphasis is on giving sufficient detail in order for participants to have a general overview of frequently used approaches, with their advantages and disadvantages, while giving reference to other sources where more detailed information is available. Also, it will be explained in detail how the di_erent approaches can be implemented in the SAS package, and how the resulting outputs should be interpreted.

Language: English

Prerequisites: Throughout the course, it will be assumed that the participants are familiar with basic statistical modelling, including linear models (regression and analysis of variance), as well as generalized linear models (logistic and Poisson regression). Moreover, pre-requisite knowledge should also include general estimation and testing theory (maximum likelihood, likelihood ratio).

Literature (books, readers): Copies of the transparencies used in the course (these copies will be distributed during the course) will be distributed. Additional readings (not distributed during the course) are :

- Verbeke, G. and Molenberghs, G. (2000) *Linear mixed models for longitudinal data*. New York: Springer-Verlag.
- Molenberghs, G. and Verbeke, G. (to appear in 2005) *Models for discrete longitudinal data*. New York: Springer-Verlag.

Target group: PhD-students and researchers who wish to learn how to perform a basic analysis for a particular longitudinal data set at hand, using linear, generalized linear, and non-linear tools for longitudinal data.

Minimum number of participants: 10 (maximum 70)

Certificate: yes

Fees

PhD students and post-docs from IAP P5/24, K.U.Leuven, UHasselt, IOPS	Free, except for course materials for non-IOPS members
Other PhD students and postdocs, IOPS staff members, IOPS alumni	€ 72; Additional costs for course materials
Other participants	€ 252; Additional costs for course materials
Participants without a job	€ 12 registration fees; Additional costs for course materials

Registration is mandatory!

→ for PhD students and post-docs from IAP P5/24 and K.U.Leuven: Emmy Bergen Psychology Department Tiensestraat 102 B-3000 Leuven – Belgium E-mail: Emmy.Bergen@psy.kuleuven.ac.be

→ for all other participants: Susañña Verdel (IOPS Secretary) Faculty of Social and Behavioral Sciences P.O. Box 9555 2300 RB Leiden - The Netherlands E-mail: iopssecr@iops.nl Voice: +31 (0)71 527 38 29

Final registration date: February 6, 2006

Cancellation: No refund is made for cancellations within one week before the start of the seminar.

Accomodation (rates are only tentative):

Bed & Breakfast De Werf, Hogeschoolplein 5, 3000 Leuven; € 23 phone: +32 476 96 42 41; e-mail: dewerf@chello.be; website: www.dewerf-leuven.be

Gasthof De Pastorij, Sint Michielsstraat 5, 3000 Leuven; € 55-60-90 phone: +32 16 82 21 09; e-mail: depastorij@yahoo.com; website: www.depastorij.be

Hotel Ibis, Brusselsestraat 52 , 3000 Leuven; € 70 phone: +32 16 29 31 11; e-mail: h1457@accor-hotels.com

Hotel La Royale, Martelarenplein 6, 3000 Leuven; € 57 phone +32 16 22 12 52; e-mail: hotel@laroyale.be; website: www.laroyale.be

Paters Oblaten, Pellenbergstraat 160, 3010 Kessel-Lo; € 15 phone: 32 486 40 54 90