Statistical Analysis in the Lexis Diagram: Age-Period-Cohort Models

- Start: 2 May 2016, morning
- End: 6 May 2016, afternoon
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Course description

This course provides an introduction to Age-Period-Cohort models, a class of models for demographic rates (mortality/morbidity/fertility/...) observed for a broad age range over a reasonably long time period, and classified by age and date of follow-up and date of birth.

This type of follow-up can be shown in a Lexis-diagram. Individual life-lines can be shown with coloring according to states, or the diagram can just be shown to indicate what ages and periods are covered, and what units of analysis are used. The Age-Period-Cohort model describes the (log) rates by a sum of (non-linear) age- period- and cohort-effects. Now, age (at follow-up), a; period (i.e. date of follow-up), p; and cohort (date of birth), c, are related by $a = p - c$: any one person's age is calculated by subtracting the date of birth from the current date. Hence the three terms used to describe rates are linearly related, and the model therefore requires some caution in parametrization in order to avoid conclusions based on artifacts brought about by this relation.

Formally, APC-models are models where non-linear effects of two variables (such as the time-scales age and calendar time (period)) are considered along with a non-linear effect of their difference (cohort). This also appears for other outcomes than rates, such as continuous measurements, so age-period-cohort modeling is not only confined to analysis of rates.

The problem of two timescales (age, period) and their difference (cohort), appear in more complex form when more than two timescales are considered (for example age, period, disease duration) along with differences between them (cohort, age at diagnosis, date of diagnosis).

Furthermore, analysis of several rates and their relationship by age-period cohort models gives rise to new types of models.

Finally, age-period-cohort models are useful for prediction of rates into the future, although predictions beyond the observation space always poses special problems.

These special topics will be treated along with an overview of some of the proposals suggested in the more recent literature.

Organization

The course will run over five days. There will be one lecture and one practical each morning and afternoon. At the start of the course the lecture will be slightly longer than one hour, toward the end slightly shorter. The practicals will take up the remainder of the three hours of the morning/afternoon slot. The fourth day (Thursday 5th, which is Ascension Day) will be set aside for completion of an assignment.

For a detailed schedule, please visit the course homepage at
http://BendixCarstensen.com/APC/MPIDR-2016

Course prerequisites

Practicals will require use of R, including the `Epi` and the `apc` packages; it is assumed that participants bring a computer with these installed. Further details will appear at the course homepage at http://BendixCarstensen.com/APC/MPIDR-2016

Examination

There will be assignments to each student, and you are expected to write a report of about 10 pages on a practical APC-analysis. Details of the deadline and criteria for a successful course completion will be given later, during the first days of the course.

General reading

It would be helpful if you had read the papers which cover the essentials of the models that we will cover:

- TR Holford. The estimation of age, period and cohort effects for vital rates. Biometrics, 39:311-324, 1983.
- D. Clayton and E. Schifflers. Models for temporal variation in cancer rates. I: Age-period and age-cohort models. Statistics in Medicine, 6:449-467, 1987.
- D. Clayton and E. Schifflers. Models for temporal variation in cancer rates. II: Age-period-cohort models. Statistics in Medicine, 6:469-481, 1987.
- B Carstensen. Age-Period-Cohort models for the Lexis diagram. Statistics in Medicine, 26(15):3018-3045, July 2007.

A very brief overview with links to literature and previous courses is http://BendixCarstensen.com/APC/.