

Ph.D. in “Life Course Research” – Socio-Demographic Curriculum

Advanced Longitudinal Analysis

Academic Year 2025–2026

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Objectives

This course extends the study of longitudinal data to **sequential and life-course processes** shifting attention to **longitudinal data conceived as trajectories**, where the order, timing, and duration of states are central.

The aim of the course is to:

- Introduce **Sequence Analysis (SA)** as a complementary approach to regression-based panel models for studying life-course processes;
- Provide the theoretical and methodological foundations necessary to construct, visualize, and compare sequences;
- Discuss clustering techniques and validation strategies for identifying typical trajectories;
- Show how sequence-based typologies can be integrated into regression frameworks;
- Present some advancements in event-history analysis.

The course combines a **theoretical and practical approach**. Conceptual foundations of sequence analysis and related longitudinal models will be discussed alongside hands-on applications using the statistical software **R**, primarily through the **TraMineR** package. All course materials will be given available at beginning of the course.

By the end of the course, students will be able to critically assess and apply sequence analysis methods in socio-demographic research.

Program

Monday April 13th (morning) & Tuesday April 14th (morning)

Lecturer: V. Tocchioni

- What Sequence Analysis is and its relevance for socio-demographic research
- From panel data to sequences: how to construct a sequence
- First graphical representations: index plots (iplot) and distribution plots (dplot)
- Dissimilarity measures and clustering approaches
- Dendrogram, silhouette plots

Wednesday April 15th (afternoon) & Thursday April 16th (morning)

Lecturer: D. Bolano

- Different types of sequential data (state sequences, STS; spell data)
- Cluster quality and validation techniques
- What to do after a cluster analysis
- From a single trajectory to multichannel sequence analysis
- Beyond Sequence Analysis: a brief introduction to Markov-based approaches and related approaches

Thursday April 16th (afternoon) Guest Lecturer

“Some solutions to overcome non-proportionality in hazard regression models” – Guest Lecturer: Prof. Massimo Attanasio (University of Palermo)

The seminar introduces several models belonging to the family of extended Cox models. Starting from violations of the proportional hazards (PH) assumption in the Cox model, the seminar will cover non-proportional hazards specifications, including:

- Violations of the proportional hazards (PH) assumption in the Cox model
- Non-proportional hazards specifications:
 - Time-dependent covariates
 - Time-varying effects
 - Stratification
 - Heaviside functions

Suggested Readings

Gabadinho, A., Ritschard, G., Müller, N. S., & Studer, M. (2011). *Analyzing and visualizing state sequences in R with TraMineR*. *Journal of Statistical Software*, 40(4), 1–37. <https://doi.org/10.18637/jss.v040.i04>

Liao, T. F., Bolano, D., Brzinsky-Fay, C., Cornwell, B., Fasang, A. E., Helske, S., Piccarreta, R., Raab, M., Ritschard, G., Struffolino, E., & Studer, M. (2022). *Sequence analysis: Its past, present, and future*. *Social Science Research*, 107, 102772. <https://doi.org/10.1016/j.ssresearch.2022.102772>

Raab, M., & Struffolino, E. (2022). *Sequence Analysis*. *Quantitative Applications in the Social Sciences*. Sage.

Requirements

The course is practical and requires familiarity with quantitative methods and the statistical software R.

Evaluation

Students are required to submit a written project by the end of the week, together with a complete replication package (data and code).