HOW to REGISTER

step 1) fill in the Application form

https://forms.gle/ddCDRzhJT5euAJeYA

and wait for the acceptance letter.

step 2) proceed to payment as explained in the acceptance letter.

Registration will be effective ONLY after completion of **step 2).**

- Maximum number of participants is **45**.
- Applications are considered in order of receipt.
- Eight places are reserved to PhD students. To apply you have to upload in **step 1)** a short letter (max 200 words) written by your supervisor describing how your PhD project relates to the topic of the course.

DEADLINE for APPLICATION
January 24, 2027

REGISTRATION FEE

Inclusive of teaching material, bus transfer, hotel accommodation and meals (from dinner of April 11 to breakfast of April 16).

General participant:	**1600** €
PhD student:	**1300** €
IBS/SISMEC/ISCB member:	**1500** €

DEADLINE for REGISTRATION
February 14, 2027

OBJECTIVES of the COURSE

Longitudinal data analysis enables deeper understanding and prediction of trajectories and associated events over time. This course provides a toolkit for advanced analysis of longitudinal data, rooted in the mixed modeling theory. Mixed models naturally account for the hierarchical nature of longitudinal data, accommodate repeated measurements at irregular intervals, and are robust to missing-at-random information
Over four days, we will explore three extensions:

Latent class mixed models to address heterogeneity in developmental trajectories. It identifies latent groups of individuals sharing similar mean patterns and links these clusters to external information.

Joint modeling to analyze the association between longitudinal outcomes and time-to-event data. It can be used to account for informative truncation, assess the impact of time-varying exposures on events, or derive individual dynamic predictions.

Latent process modeling to study constructs indirectly measured by one or more outcomes. It extends latent variable models (including Item Response Theory) to analyze trajectories of latent variables over continuous time.

The course will introduce the methods through applications in health research, and include practical R sessions using mainly **lcmm, JLPM** and **JMBayes2** packages.

COORDINATORS

Laura Antolini and Maria Grazia Valsecchi
School of Medicine and Surgery, University of Milano-Bicocca Secretariat: statisticalps@unimib.it

Bicocca Academy

UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

UNIVERSITY OF MILANO-BICOCCA
SCHOOL OF MEDICINE AND SURGERY
B4 Center of Bionformatics, Biostatistics and Bioimaging

StatisticAlps
Winter course on medical statistics……in the Alps
11th Edition

ADVANCED STATISTICAL METHODS FOR THE ANALYSIS OF LONGITUDINAL DATA

Cecile Proust-Lima
Bordeaux Inserm Population Health Research Center, Univ. Bordeaux

BICOCCA ACADEMY

11 – 16 April 2027

PONTE DI LEGNO – BRESCIA, ITALY

PROGRAM

ARRIVAL - 11 APRIL 2027
19.30 Registration
20.00 Welcome Dinner

1st DAY – 12 APRIL 2027
09:00-13:00 with 30 min break
Introduction to Latent Class Mixed Models. How to identify heterogeneous profiles of trajectories from longitudinal data while retaining the nice statistical properties of the mixed models
- Motivation: why account for unobserved heterogeneity in longitudinal trajectories?
- From mixed-effects models to latent class mixed models
- Model formulation and estimation
- Interpretation of latent profiles of trajectory
- Model selection and assessment

13.00 Lunch

14:30-18:00 with 30 min break
Latent Class Mixed Models in practice using the R package lcmm
- Specification and estimation of latent class mixed models
- Estimation challenges and assessment
- Choosing the number of latent classes
- Interpreting and visualizing profiles of trajectories

20:00 Dinner

2nd DAY – 13 APRIL 2027
09:00-13:00 with 30 min break
What about misclassification in LCMM? Theory and Practice
- Why are latent class assignments uncertain?
- Consequences of misclassification
- Accounting for misclassification in subsequent analyses
- Practice in R using the package lcmm

13.00 Lunch

14:30-18:00 with 30 min break
Introduction to the Joint Modeling of longitudinal data and time-to-event data. How to combine mixed models and survival models to simultaneously analyze longitudinal and time-to-event data
- When should we use joint models? The limits of the separate models
- Which questions does joint models address?
- The shared random-effect framework : model formulation, estimation and interpretation
- The latent class framework

20:00 Dinner

3rd DAY – 14 APRIL 2027
08:30-13:00 with 30 min break
Joint Models in practice using the R package JMbayes2
- Specification of shared random-effect models
- Estimation challenges
- Model assessment
- Interpretation
- Individual dynamic predictions

13.00 *Lunch*

Free afternoon

20.00 *Dinner*

4th DAY – 15 APRIL 2027
09:00-13:00 with 30 min break
An introduction to Latent Process Modeling. A unifying framework for the analysis of longitudinal data, bridging mixed models, latent variable models, item response theory (and also joint models or latent class models)
- Distinction between observed data and underlying quantities of interest
- A biostatistical view of Item Response Theory models for repeated questionnaire data
- Extensions to latent class modeling and joint modeling

13.00 Lunch
14:30-18:00 with 30 min break
Latent process models in Practice using the R packages lcmm (and JLPM)
- *Specification and estimation of latent process models for multivariate repeated markers (continuous, binary or ordinal)*
- *Model interpretation*
- *Visualization tools*

19:30 Social Dinner

DEPARTURE – 16 APRIL 2027
8:30

TUTORIALS:
Illustrative analyses using R and discussion of case studies

PREREQUISITES
Basic knowledge of mixed regression models

TUTORS
Matteo Petrosino, Epidemiology Research Unit of the Italian Society for Rheumatology, Milano, Italy
Francesca Graziano, Biostatistics and Clinical Epidemiology, IRCCS Fondazione San Gerardo, Monza, Italy

Participants will have the possibility, during the half-day break, to enjoy sports in the surrounding and spend time for individual study

COURSE VENUE
Hotel Mirella ****
Via Roma 21, Ponte di Legno (BS)
Tel: +39.0364.900500 - Fax: +39.0364.900530
http://www.hotelmirella.it

WEB PAGE
The website **www.academy.unimib.it/statisticalps-advanced-statistical-methods-analysis-longitudinal-data** contains information on how to reach the venue by flight, car or

train and free bus transfer from Bergamo to Ponte di Legno.