UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Sas Programming for Clinical Research

2526-1-F8205B025

Learning objectives

The aim of the course is to deepen the students' knowledge of the SAS tools useful for data management, statistical analysis and reporting of clinical and observational studies.

Knowledge and understanding

This course will provide knowledge and understanding regarding:

- The basis of SAS language;

- The main SAS procedures for data management and analysis of clinical data.

Applying knowledge and understanding

At the end of the course the students will be able to:

- Manage database with SAS programming language;

- Write the SAS code to perform principal biostatistical analyses;

- Create reporting for clinical and observational studies.

The course will provide a sound basis in SAS programming in the context of the biomedical sciences.

Contents

· Introduction to the SAS system

· Longitudinal data and SAS

· SAS procedures for the analysis of clinical trials

· The use of SAS macro language to automate processes

· Implementing statistical algorithms in SAS/IML (interactive matrix language)

Detailed program

Course introduction

Importance of the SAS system in clinical research and the role of the SAS programmer in the pharmaceutical industry.

Introduction to the SAS system

The SAS work environment

Data step and proc step

Data import

Examples of procedures

Data management

SAS functions

Two-way tables

Dates and Formats

Data set merge

PROC SQL

Output delivery system (ODS)

Techniques for data management and analysis of longitudinal data in SAS

Selection of the first and last observation for a patient in a longitudinal study

Wide format and long format

Procedures for the analysis of repeated measures

The main procedures for data analysis of a clinical study

Procedures for the analysis of continuous responses

Procedures for the analysis of binary responses

Procedures for the analysis of survival times

SAS procedures for creating tables (PROC TABULATE) and graphs (PROC SGPLOT and PROC SGPANEL)

Use of the SAS macro language process automation

Macro variables

Macro programs

Implementation of statistical algorithms in SAS/IML (interactive matrix language)

Basic operations in SAS/IML

Statistical applications in SAS/IML

SAS/IML and R

Prerequisites

None

Teaching methods

Lessons will be conducted in two modes: in the first, the instructors will present the concepts (lecture mode); in the second, the instructors will interact with the students by proposing problems taken from the biostatistical field, to be solved in groups using the SAS programming language. The students will work on and discuss the problems, while the correction will be carried out together with the instructors (interactive mode).
Approximately, the ratio of hours between lecture and interactive modes will be 1:1. Some lecture mode lessons will be held remotely (with an indicative ratio of 2:1 between in-class and remote lessons).

Assessment methods

Written exam

The exam consists of an exercise in the management and analysis of data from clinical or epidemiological studies, which can be solved using the SAS codes illustrated in class or other codes that may be provided at the time of the exam.
The exam takes place in the laboratory and lasts two hours.
The use of the web and of generative artificial intelligence tools (such as ChatGPT, Gemini, etc.), is not permitted. However, it is permitted to consult the material provided in class (programs and slides), even in electronic format: it will therefore be possible to access e-learning during the exam.

There are no intermediate exams.

The written exam will test the student’s ability to independently use SAS tools in order to solve exercises and

practical problems typical of the context of the biomedical sciences.

At student’s request, an oral examination could be held.

The examination procedures are the same for attending and non-attending students.

Textbooks and Reading Materials

The course material (book excerpts, articles, SAS code, datasets) will be distributed during the course

Semester

Semester II, cycle II

Teaching language

Italian

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING