The Hebrew University of Jerusalem

Syllabus

Practical Statistics and Data Analysis for Bio Medical Research - 94309

Last update 08-10-2023

<u>*HU Credits:*</u> *2*

<u>*Degree/Cycle:*</u> *2nd degree (Master)*

<u>*Responsible Department:*</u> *Bio-Medical Sciences*

<u>*Academic year:*</u> *0*

<u>*Semester:*</u> *1st Semester*

<u>*Teaching Languages:*</u> *English*

<u>*Campus:*</u> *Ein Karem*

<u>*Course/Module Coordinator:*</u> *Mr. Sharif Abugosh*

<u>*Coordinator Email:*</u> [*Sharif.abugosh@mail.huji.ac.il*](mailto:Sharif.abugosh@mail.huji.ac.il)

<u>*Coordinator Office Hours:*</u> *By appointment*

<u>Teaching Staff:</u>
  Mr. Sharif Abu-Gosh,
Ms. Noa Gazit

<u>Course/Module description:</u>
  The course will deal with topics in statistical inference suitable for medical and biomedical research.
The topics discussed in the course:
1.Parametric and non-parametric hypotheses tests about the average, median and proportion in the population.
2.Errors and power of hypotheses tests and determining sample size.
3.Relationship between variables and construction of linear models for statistical inference.
4.Survival analysis.
5.Control of decision errors.
6.Graphical presentation of the data and analysis of results.
7.we will learn in depth how to use the GraphPad Prism software to perform all the required calculations and statistical operations, including producing relevant graphs.

<u>Course/Module aims:</u>
  Acquiring tools for students engaged in medical and biomedical research, for the purpose of carrying out the statistical part of their research. The tools include:
1)Theoretical explanations of the statistical tests and models.
2)Explanation and training on how to perform the statistical tests and construction the models manually (for the purpose of deepening the understanding).
3)Explanation and instruction on how to perform the statistical tests and construction the models using the GraphPad Prism software (to increase practical ability)
4)An explanation of the form of reporting and analyzing the results and drawing conclusions.

<u>Learning outcomes - On successful completion of this module, students should be able to:</u>
  Upon completion of this course, students will be able to:
1. understand the topic of hypothesis testing and get to know the statistical tests (parametric and non-parametric) used in medical and biomedical research.
2. Know how to choose the most suitable statistical test for the given hypotheses

and perform it manually or with the GraphPad Prisem software.

3. Understand the concepts of hypothesis testing errors and test power and know how to calculate them and determine the sample size.

4. Understand the subject of the relationship between the variables and the regression model, know how to construction the model and how to make predictions from it manually and with the help of GraphPad Prisem software.

5. Understand the meaning of the survival analysis, build a function and the survival curve and perform some relevant tests manually and with the help of the GraphPad Prism software.

6. Understand the issue of control over decision errors and use appropriate tools to achieve control over errors.

7. Know how to produce the appropriate graphs for each test or statistical model with the help of GraphPad Prisem. software

8. Analyze the results obtained from the software and know how to report it.

<u>Attendance requirements(%):</u>
   80%

Teaching arrangement and method of instruction: Lecture + weekly assignments

<u>Course/Module Content:</u>
   1) Instruction on how to implement and operate the GraphPad Prism software, an explanation of the data file structures, the statistical functions, the output files and the various graphs.

2) General repetition of the subject of hypothesis testing: the null and the alternative hypothesis, the level of significance and the test statistic.
Hypothesis testing for a one sample: parametric method (One sample t-test) and non-parametric method (Wilcoxon test).

3) Hypothesis testing for two independent samples: parametric method (unpaired t-test) and non-parametric method (Mann-Whitney test).
Hypothesis testing for two dependent samples: parametric method (paired t-test) and non-parametric method (Wilcoxon test).

4) A general repetition of the subject of hypothesis testing for proportion.
 Hypothesis testing for a single sample proportion assuming the normal approximation (One sample t-test), and when not assuming the normal approximation (Binomial test).

5) Proportion hypothesis testing for two independent samples assuming the normal approximation (Unpaired t-test) and when not assuming the normal approximation (Fisher's test).
Proportion hypothesis testing for two dependent samples: assuming the normal approximation (paired t-test) and when not assuming the normal approximation (McNemar's test).

6) Type I and type II errors and statistical power: Definition and calculate the errors

and the power, sample size calculates based on the errors rate.
7) Categorical data analysis: relationship strength between categorical variables and testing significance based on the Chi-Square test and Fisher's exact test.
8) Hypothesis testing for three or more independent samples: parametric method (ANOVA test) and non-parametric method (Kruskal - Wallis test).
Proportion hypothesis testing for three or more independent samples: Chi-Square test.
9) Repeated measurements for three or more dependent samples: parametric method (Repeated - measures ANOVA) and non-parametric method (Friedman test).

Proportion hypothesis testing for three or more dependent samples: Cochrane Q test.
10) Relationship between quantitative variables: Pearson index, simple and multiple linear regression model, and the predictions of the models.
11) Survival analysis: explanation of the meaning of the concept, building the survival function, drawing the Meir Kaplan curve and performing the Log-Rank test.
12) The ROC curve: explanation of the meaning of the concept, the calculation of the sensitivity and specificity, the drawing of the curve and the calculation of the area under the curve (AUC).

<u>Required Reading:</u>
 none

 <u>Additional Reading Material:</u>

 <u>Grading Scheme:</u>
  Written / Oral / Practical Exam 80 %
  Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 20 %

<u>Additional information:</u>
  Submitting at least 75% of the weekly assignments is a condition to take the final exam.