DESCRIPTION OF COURSE UNIT FOR DOCTORAL STUDIES AT VILNIUS UNIVERSITY

Scientific Area/eas, Field/ds of Science	Medical and Health Sciences (M 000): Medicine (M 001); Dentistry (M 002); Public Health (M 004)			
Faculty, Institute, Department/Clinic	Faculty of Medicine Institute of Biomedical sciences Department of Human and Medical Genetics			
Course unit title (ECTS credits, hours)	**Biomedical Statistics** 5 credits (134 hours)			
Study method	**Lectures**	**Seminars**	**Consultations**	**Self-study**
Number of ECTS credits	1	1.2	-	2.8
Method of the assessment (in 10 point system)	Course knowledge is assessed by a cumulative score: - Theoretical knowledge - exam 60%. Test type exam consisting of 40-45 tasks. Each task is scored. The sum of points is equal to 100, which is transferred on a 10-point scale. The test is prepared and stored in the VLE. - Active participation during the course - 20% (asking questions in lecture forums at VLE). The course participant who asked the most questions is evaluated 10, and the activity of others is calculated proportionally accordingly. - Written work - 20%. Analysis of a scientific article (dissertation topic) from a statistical perspective and calculation of the sample size (test power). Participants complete the template provided, which explains the parts to be assessed. The template is discussed during the first session and is available in the VLE. -			

PURPOSE OF THE COURSE UNIT

The objectives of the course are the following: deepen and broaden the knowledge of the application of statistical methods in the analysis of medical and biological data; formulate tasks of data analysis independently; apply appropriate statistical methods for the solution of particular data analysis situations; analyse and evaluate statistical results in published scientific research articles. Doctoral students can choose analysis tools (SPSS, RStudio, Python) to expand the knowledge of data analysis and acquire new practical skills in solving empirical problems in biomedicine.

THE MAIN TOPICS OF COURSE UNIT

1. **Quantitative data analysis.** Mean, standard deviation and standard errors. Normal distribution. Confidence interval for a mean. Comparison of two means: confidence interval, hypothesis testing and p-value. Interpretation of results from statistical analysis using p-values and confidence intervals. More than two average comparison using various variance analysis methods (ANOVA, MANOVA, ANCOVA). Linear regression and correlation. Multiple regression. Evaluation of the regression model adequacy and hypothesis testing about the significance of the regression parameters. Variable transformation in regression analysis. Dummy regression. Regression models, when assumptions are not satisfied.
2. **Binary data analysis.** Probability, risk and odds. Proportions and binomial distribution. Proportions test. Chi-squared, Fisher exact, McNemar tests. Controlling for confounding factors – stratification. Logistic regression. ROC curve for the model goodness-of-fit. Model / test goodness characteristics: sensitivity, specificity, positive and negative predictive values, positive and negative likelihood ratios.

3. **Survival analysis.** Presentation of survival time and comparison of survival trends. Nonparametric survival models. Survival data in regression analysis.

4. **Statistical modelling**. Meta-analysis. Sample size calculation. Summary of statistical methods. Strategies of statistical analysis.

RECOMMENDED LITERATURE SOURCES

1. Peacock, Janet L., and Phil J. Peacock. Oxford Handbook of Medical Statistics, Oxford University Press, Incorporated, 2020. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/viluniv-ebooks/detail.action?docID=6230109.
2. Gierlinski, Marek. Understanding Statistical Error : A Primer for Biologists, John Wiley & Sons, Incorporated, 2016. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/viluniv-ebooks/detail.action?docID=4529318.
3. McDonald, J.H. 2014. Handbook of Biological Statistics (3rd ed.). Sparky House Publishing, Baltimore, Maryland. http://udel.edu/~mcdonald/statintro.html
4. Mangiafico, S.S., 2015. An R companion for the handbook of biological statistics. New Brunswick, NJ. https://rcompanion.org/documents/RCompanionBioStatistics.pdf
5. Kanda, Y. (2013). Investigation of the freely available easy-to-use software 'EZR' for medical statistics. Bone marrow transplantation, 48(3), 452-458. https://www.nature.com/articles/bmt2012244.pdf
6. H. Motulsky. Intuitive Biostatistics: A Nonmathematical Guide to Statistical Thinking. OUP USA; 4 edition (Nov. 2017)
7. J. Ball, V. Bewick, L. Cheek. Medical statistics. https://www.biomedcentral.com/collections/CC-Medical , 2005.
8. M. J. Crawley. Statistics: an introduction using R. J. Wiley, 2015. http://www.bio.ic.ac.uk/research/crawley/statistics/
9. IBM SPSS software: https://www.ibm.com/analytics/spss-statistics-software
10. Statistical software R: https://cran.r-project.org
11. Phyton: https://www.python.org
12. G*Power: Statistical Power Analyses for Windows and Mac. https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower.html

CONSULTING LECTURERS

1. Coordinating lecturer: Audronė Jakaitienė (Prof. Dr.).
2. Algirdas Utkus (Prof. Dr. HP).
3. Nomeda Bratčikovienė (Dr.).
4. Tadas Žvirblis (Dr.).

APPROVED:

By Council of Doctoral School of Medicine and Health Sciences at Vilnius University: 29th of September 2022

Chairperson of the Board: Prof. Janina Tutkuvienė