COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Research methods and biostatistics	

Academic staff	Core academic unit(s)
Coordinating: Assoc. prof. Lina Zabulienė (MD, PhD) **Other:** Prof. Jolanta Dadonienė (MD, PhD) Prof. Audronė Jakaitienė (PhD) Assoc. prof. Nomeda Bratčikovienė (PhD) Assoc. prof. Valentas Gružauskas (PhD) Assoc. prof. Tadas Žvirblis (PhD) Dalia Breskuviene Ramune Vaisnore	Faculty of Medicine, M. K. Čiurlionio 21/27, LT-03101, Vilnius Coordinating teacher email: lina.zabuliene@mf.vu.lt

Study cycle	Type of the course unit
Integrated	Compulsory

Mode of delivery	Semester or period when it is delivered	Language of instruction
Mixed (online and(or) classroom)	4th year, 8th semester	English

Requisites	
Prerequisites: No	**Co-requisites (if relevant):** No

Number of ECTS credits allocated	Student's workload (total)	Contact hours	Individual work
5	130	65	65

Purpose of the course unit		
The aim of this course unit/module is to develop the ability to understand and apply research methods in the field of healthcare, analyze key health indicators, plan and conduct biomedical research, perform biostatistical analyses of data, correctly interpret the results obtained from statistical analyses, formulate appropriate and valid conclusions, thereby enhancing the student's awareness of the importance of research and its relevance in clinical practice. Additionally, it aims to foster an analytical and critical approach, and improve the student's ability to critically appraise the results of their own scientific research and the scientific literature.		
Learning outcomes of the course unit	**Teaching and learning methods**	**Assessment methods**
Have knowledge and be able to apply biostatistical methods commonly used in medical research. Be capable of critically analyzing and evaluating scientific literature, including its results and claims, while considering the requirements for different types of research, and distinguishing between levels of scientific evidence.	Lectures, seminars and independent work. The "flipped classroom" method. Analysis of scientific literature. Group discussions. Learning by teaching others. Practical exercises. Feedback.	Cumulative evaluation. Assessment after each seminar. Exam.

Be able to design a biomedical research protocol: independently and as part of a team. This includes planning a biomedical study, formulating a scientific hypothesis, establishing aims and objectives, predicting outcomes, developing a research methodology, designing appropriate statistical methods, independently conducting statistical analysis of data, presenting the results, and drawing scientifically valid analytical conclusions. Be able to develop literature review protocols and create bibliographic lists using bibliographic software independently. Be able to express ideas fluently and persuasively in oral and written forms. Be able to think critically, systematically, and creatively in order to solve problems and make appropriate decisions.		

Content	Contact hours							Individual work: time and assignments	
	Lectures	Tutorials	Seminars	Workshops	Laboratory work	Internship	**Contact hours, total**	**Individual work**	**Tasks for individual work**
Biostatistics	**15**		**24**				**39**	**39**	
1. Understand the purpose of biostatistics and grasp the concepts of population and sample. Learn about methods of sampling, including random and non-random samples. Study variables and understand the characteristics of data in terms of position and dispersion. Explore the empirical rule and gain knowledge about confidence intervals.	3		4				**7**	**7**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
2. Learn to interpret histograms and understand the properties of the normal curve. Gain proficiency in hypothesis testing for one and two samples, including the concept of p-value. Explore methods for testing normality, both parametric and non-parametric criteria. Acquire skills in determining sample size.	2		4				**6**	**6**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
3. Learn to construct frequency tables and cross-tabulations of frequencies. Develop the ability to represent data graphically. Understand the use of the chi-square criterion and the z-criterion. Study hypothesis testing for proportions and learn methods for determining sample size.	2		4				**6**	**6**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
4. Gain proficiency in hypothesis testing with three or more dependent and independent samples. Understand the criteria for multiple comparisons. Study	2		4				**6**	**6**	Preparing for the seminar: listening to the VMA lecture, searching for

analysis of variance (ANOVA) and learn techniques for determining sample size.									information, reading and analysing scientific literature on the lecture topic.
5. Understand the concept of statistical association. Learn about correlation coefficients for quantitative, rank, and nominal variables. Study univariate and multivariate linear regression. Gain knowledge of methods for determining sample size.	3		4				**7**	**7**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
6. Study probability, relative risk, and odds ratio. Explore logistic regression and understand its applications. Acquire skills in determining sample size for logistic regression.	3		4				**7**	**7**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
Research methods	**10**		**16**				**26**	**26**	
Understand the need for and importance of measuring health indicators. Explore the significance of medical research, including its types, design, methods, advantages, and disadvantages. Learn about the legal regulations governing biomedical research.	2						**2**	**4**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
Study methods for analyzing clinical research work. Explore the application of epidemiological research methods in research. Prepare for the final thesis.	2		2				**4**	**4**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
Learn about questionnaires, including their design principles and validity. Understand the importance of pilot studies, including justification for the study's relevance, criteria for subject selection, choice of research methodology, and organization of the research process.	2		4				**6**	**6**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
Study systematic and non-systematic reviews. Develop protocols for systematic reviews, learn database search techniques, and select appropriate literature sources. Gain familiarity with various bibliographic applications and learn to compile a reference list. Explore resources such as the Cochrane Database.	2		6				**8**	**8**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
Learn about clinical trials and the requirements for a biomedical research protocol. Understand the value of journals and articles in disseminating scientific data. Explore methods for disseminating scientific findings.	2		4				**6**	**6**	Preparing for the seminar: listening to the VMA lecture, searching for information, reading and analysing scientific literature on the lecture topic.
Total	**25**		**40**				**65**	**65**	

Assessment strategy	Weight %	Deadline	Assessment criteria
Assesment of seminars (practical part):	**50 %**	At each seminar	Questions and practical exercises during assessment. Maximum score for the test is 10 points. The exam is taken after all tests have been completed.
Practical assignment of Biostatistics part (6 assessments)	25 %		
Practical assignment of Research methods part (4 assessments)	25 %		
Exam:	**50 %**	According to timetable ITPC	Exam consists of 2 written parts: biostatistics and research methods A score for each part of the exam is given.
Theoretical assignment of Biostatistics part (6 assessments)	25 %		
Theoretical assignment of Research methods part (4 assessments)	25 %		
Final Evaluation	100 %	At the end of course unit/module	The final grade (FG) is based on the cumulative score system and is calculated as the arithmetic mean of the grades of Biostatistics and Research Methods parts: *FG = 0.25xBS_T + 0.25xBS_E + 0.25xRM_T + 0.25xRM_E* [BS – part of biostatistics, MDM – part of research methods, T – tasks/tests during seminars; E – exam]. Both parts of biostatistics and research methods are considered successful if the cumulative score from seminar assessments and exams is 5 or higher. The cumulative score is calculated to the nearest hundredth without rounding

Author (-s)	Publishing year	Title	Issue of a periodical or volume of a publication	Publishing house or web link
Required reading				
J. Dadonienė	2019	Recommendations how to prepare and defend the final theses for medical programme students		Available at: https://www.mf.vu.lt/en/studies/undergraduate-studies-2/integrated-studies/final-thesis
J. Dadonienė, K. Žagminas A. Beržanskytė	2013	Introduction to research methodology		Available at: https://www.vu.lt/site_files/LD/Introduction_methodology_2013.pdf
Lingard L.	2018	Writing an effective literature review : Part I: Mapping the gap.	Perspect Med Educ. 2018;7(1):47-49.	Available at: https://pubmed.ncbi.nlm.nih.gov/29260402/
Lingard L.	2018	Writing an effective literature review : Part II: Citation technique.	Perspect Med Educ. 2018;7(2):133-135.	Available at: https://pubmed.ncbi.nlm.nih.gov/29500746/
Chidambaram AG, Josephson M.	2019	Clinical research study designs: The essentials.	Pediatr Investig. 2019;3(4):245-252.	Available at: https://pubmed.ncbi.nlm.nih.gov/32851330/
Murphy A, Bolderston A.	2021	Writing your first paper: An informal guide for medical radiation sciences professionals.	J Med Imaging Radiat Sci. 2021;52(3):456-465.	Available at: https://pubmed.ncbi.nlm.nih.gov/34281795/
Murphy A, Bolderston A.	2022	Writing your first paper Part 2: Submission, review, and post-publication	. J Med Imaging Radiat Sci. 2022;53(3):478-486.	Available at: https://pubmed.ncbi.nlm.nih.gov/35717378/
Karp N.A.	2010	R Commander: an Introduction		Available at: http://cran.r-project.org/doc/contri

				b/Karp-Rcommander-intro.pdf
Open Access Software Environment R		R Project		Available at: https://cran.r-project.org/
Recommended reading				
White SE. eds.	2020	Basic & Clinical Biostatistics, 5e.		McGraw Hill. Available at: Basic & Clinical Biostatistics, 5e | AccessMedicine | McGraw Hill Medical (mhmedical.com)
Harris JD, Quatman CE, Manring MM, Siston RA, Flanigan DC.	2014	How to write a systematic review.	Am J Sports Med. 2014;42(11):2761–8.	Available at: https://pubmed.ncbi.nlm.nih.gov/23925575/
Pati D, Lorusso LN.	2018	How to Write a Systematic Review of the Literature.	HERD. 2018;11(1):15-30.	Available at: https://pubmed.ncbi.nlm.nih.gov/29283007/
Page MJ, et al	2021	The PRISMA 2020 statement: an updated guideline for reporting systematic reviews.	BMJ. 2021;372:n71.	Available at: https://pubmed.ncbi.nlm.nih.gov/33782057/
da Costa BR, Jüni P.	2014	Systematic reviews and meta-analyses of randomized trials: principles and pitfalls.	Eur Heart J. 2014;35(47):3336–45.	Available at: https://pubmed.ncbi.nlm.nih.gov/25416325/
Bowers D.	2019	Medical statistics from scratch – an introduction for Health Care Professionals	4th Edition	Wiley