2025/2026

Univerza v Mariboru

Medicinska fakulteta

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Raziskovanje v medicini z biostatistiko**
Course title:	**Research Work in Medicine with Medical Statistics**

Študijski program in stopnja Study programme and cycle	Študijska smer Study option	Letnik Year of study	Semester Semester
Dentalna medicina/Dental Medicine		**1**	**2.**
2. stopnja/2nd cycle			

Vrsta predmeta / Course type	Obvezni/ Compulsory
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Clinical training	Druge oblike študija Other forms of study	Samost. delo Individual work	ECTS
20	**10**	**30**			**60**	**4**

Nosilec predmeta / Lecturer:	**red. prof. dr. Pavel Skok** **doc. dr. Petra Povalej Bržan**

Jeziki / Languages:	**Predavanja / Lectures:**	slovenščina/slovene
	Vaje / Tutorial:	slovenščina/slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**

Vsebina:

Opredelitev pojma znanosti. Razmejitev med strokovnim in raziskovalnim delom kot virom novega znanja. Spoznati splošne metode znanstveno raziskovalnega dela, pomen povezanosti teoreticnih znanj in uporabe v klinicni medicini, algoritmi odlocanja. Raziskovalno delo kot metoda preverjanja klinicnih odlocitev in odgovornega sledenja posledic. Eticna in pravna vprašanja pri raziskovanju v biomedicini. Definiranje odnosov vzrok – posledica v biomedicini in vloga presejalnih testov. Razumevanje osnovnih statisticnih pojmov v biomedicini (incidenca, prevalenca, pozitivna in negativna napovedna vrednost, obcutljivost in specificnost testov, lažno pozitivnih in negativnih rezultatov), pomena relativnega tveganja in razmerja obetov. Razlikovanje prospektivnih, retrospektivnih, epidemioloških, kontroliranih, randomiziranih, kohortnih, primer – kontrola in dvojno slepih vrst raziskav. Pomen racunalniške tehnologije in statisticnih orodij pri znanstveno raziskovalnem delu. Statistični del: raziskovalni proces, kvalitativna in kvantitativna analiza podatkov, osnovni statistični pojmi

Content (Syllabus outline):

Definition of the term science. Boundaries between scientific and research work as sources of new knowledge. Common methods of scientific research, meaning of liasion of theoretical knowledge and and its aplication in clinical medicine, algorithms of decision making. Research work as method of of clinical decisions and responsible consequences following-up testing. Ethical and legislative questions in biomedicne research. Definiton of relationsheep cause – consequence in biomedicine and role of screening tests. Comprehension of basic statistic terms in biomedicine (incidence, prevalence, positive and negative prognostic values, sensitivity and specificity of tests, false positive and negative results), meaning of relative risk and expectation ratio. Distinguishes between prospective, retrospective, epidemiologic, followed-up, randomised, cohort , case – control, and double blind researches. Importance of computer technology and statistic software in scientific research work.
Statistical part: the research process, qualitative and quantitative data analysis, basic statistical concepts (types of variables, probability distributions, central tendency

(vrste spremenljivk, verjetnostne porazdelitve, mere centralne tendence in mere variabilnosti), osnove statističnega sklepanja (frekvenčna porazdelitev, ničelna domneva, standardna napaka, interval zaupanja), univariatna statistična analiza (predstavitev podatkov:tabelarna, grafična), univariatni statistični testi, bivariatna statistična analiza (odvisnosti med spremenljivkama), bivariatni parametrični testi (t-test, korelacija, ANOVA, t- test za odvisne vzorce), bivariatni neparametrični statistični testi. (Mann-Whitney U test, neparametrična korelacija, hi-kvadrat test, Kruskal-Wallis H test, Median test, neparametrični statistični testi za odvisne vzorce). Osnove genetike, anatomije in fiziologije laboratorijskih živali. Primerjava laboratorijskih živali in človeka, prednosti in slabosti živalskih modelov. Etika pri delu z laboratorijskimi živalmi. Osnove zakonodaje na področju laboratorijskega dela in dela z laboratorijskimi živalmi. Celični in tkivni modeli v predkliničnem raziskovanju. Gensko spremenjeni organizmi in njihova vloga v predkliničnih raziskavah. Elektro- in opto-fiziološke metode. Obdelava in statistična analiza podatkov pri predkliničnem raziskovanju. Pregled literature in dostop do znanstvene literature. Publiciranje v predkliniki. Pregled sodobnih laboratorijskih metod. Seminarske vaje: metode statistične genetike za iskanje povezav genotip/fenotip.	and measures of variability), basics of statistical conclusions (frequency distribution,null hypothesis, standard error, confidence interval), univariate statistical analysis (presentation of data: tables, graphs), single variant statistical tests, bivariate statistical analysis (dependence between variables), bivariate parametric tests (t - test, correlation, ANOVA, t-test for paired samples), bivariate nonparametric statistical tests (Mann - Whitney U test, non-parametric correlation, chi-square test, Kruskal - Wallis H test and the median test, nonparametric statistical tests for dependent samples). Basic genetics, anatomy and physiology of laboratory animals. Comparison between laboratory animals and humans, advantages and disadvantages of animal models. Animal research ethics.Legislation in the field of laboratory work and work with laboratory animals. Cellular and tissue models in basic medical research Genetically modified organisms and their role in basic medical research. Electrical and optical methods in basic medical research Statistical analysis of data in basic medical research. Literature review and access to scientific literature. Publishing in basic medical research. Review of modern laboratory methods. Seminars work: methods of statistical genetics for the search for genotype / phenotype.

Temeljni literatura in viri / Readings:

Temeljni viri:

1. Denzin N. K., Yvonna S. Lincoln Y. S. (ed.) The SAGE handbook of qualitative research / 5th ed. - Thousand Oaks [etc.] : SAGE, cop. 2018.

Dopolnilni viri:

1. Beauchamp TL, Childress JE. Principles of biomedical ethics, 5th ed. Oxford University Press, Oxford 2001.
2. Fox. J.G.: The mouse in biomedical research. Second edition. Volume I & II. Academic Press, 2006.
3. Pawley J. Handbook of Biological Confocal Microscopy. 3rd ed. Springer, 2006.
4. Zakon o zaščiti živali (ZZZiv-UPB3),Uradni list RS, št. 38/2013 z dne 3. 5. 2013.
5. Pravilnik o pogojih za izvajanje poskusov na živalih. Uradni list RS, št 37/2013, 29. 4. 2013.
6. Robert Nussbaum, Roderick McInnes, Huntington Willard. Thompson & Thompson Genetics in Medicine. 8th ed., Philadelphia: Elsevier, 2015

Cilji in kompetence:	**Objectives and competences:**
Poglavitni cilj predmeta je pridobitev nekaterih teoretičnih znanj in praktičnih veščin, ki jih potrebuje raziskovalec pri raziskovalnem delu v biomedicini. Spoznati osnove raziskovalnega dela v biomedicini in bioznanostih, povezavo in pomen epidemiologije, biostatistike in njenih orodij (statisticnih testov, vrednotenja), vloga izsledkov na odločanje. Študenti bodo znali na osnovi pregleda znanstvene literature ugotoviti trenutno stanje znanja na področju določene biomedicinske problematike, odkriti še neodgovorjena relevantna znanstvena vprašanja, postaviti hipotezo in načrtovati biomedicinsko študijo, ki bo ustrezno ovrednotila hipotezo. Študenti bodo sposobni napisati in izvesti raziskovalni projekt s katerim	The major aim of the course is to gain the theoretical knowledge and practical skills needed for a researcher in biomedical research. Acquiring of basic knowledge about researching in biomedicine and biosciences, relationship and importance of epidemiology, biostatistics and their tools (statistic tests, evaluation) importance of findings for decision making. Students will be able to perform systematic review of scientific literature and to establish the state–of-art in the specific biomedical research topic. Students will be able to identify relevant open scientific questions, to set the apropriate hypothesis and to design biomedical study to evaluate the hypothesis. Students will be able to write and execute the research project to answer specific clinical

bodo odgovorili na določena klinična vprašanja s pomočjo rezultatov biokemijskih in genetskih laboratorijskih preiskav. Študenti bodo poznali in razumeli delovanje najpomembnejših tehnologij za raziskovanje na področju biomedicine, predvsem biokemije in genetike, in bodo znali uporabiti tehnologije za reševanje relevantnih kliničnih vprašanj.	questions using the results from biochemical and genetic laboratory investigations. Students will understand the working the state-of-art laboraty technology most relevant for biomedical research, including biochemistry and genetics, and will be able to use the technology to adress relevant clinical issuses.
Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: pomena znanosti, kriticnega vrednotenje izsledkov raziskav v biomedicini in preverjanje domnev. Sposobnost analize znanstveno raziskovalnih prispevkov, vsebinska in kvalitativna. Prenosljive/kljucne spretnosti in drugi atributi: nacrtovanje raziskave, pomen natancnosti in tocnosti pri zbiranju podatkov in izvajanju raziskave, obdelava in kvantitativna/kvalitativna interpretacija pridobljenih rezultatov v skladu z znanimi dejstvi in pridobljenimi novimi spoznanji.	Knowledge and understanding: knowledge and understanding of science, critical assessment of the research results in biomedicine and hypothesis testing. Ability of scientific research contributions, content and quality analyse. Transferable/key skills and other attributes: research planning, meaning of precision and accuracy in data collection, carrying out of the research, data processing, quantitative and qualitative interpretation of results according to known facts and new findings.
Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (interaktivna) Seminar Vaje (seminarske 10 , praktične 20)	Lectures (interactive) Seminars Tutorial (seminar 10, practical 20)

Načini ocenjevanja:	**Delež (v %) / Weight (in %)**	**Assessment:**
Način (izpit, ustno izpraševanje, naloge, projekt) ŠTUDIJSKE OBVEZNOSTI ŠTUDENTOV Glede na sklep Senata z dne 13. 6. 2011 je za študente obvezna 50 % udeležba na predavanjih. POGOJI ZA PRISTOP K POSAMEZNEMU PREVERJANJU ZNANJA: opravljen seminar in vaje. **Računalniški izpit**	**100 %**	Type (examination, oral, coursework, project): ACADEMIC OBLIGATIONS OF STUDENTS According to the decision of the Senate on June 13, 2011, 50% attendance at lectures is obligatory for students. REQUIREMENTS FOR ACCESS TO INDIVIDUAL KNOWLEDGE CHECKING: completed seminar assignment and exercises **Computer exam**

Reference nosilcev / Lecturer's references: PAVEL SKOK

1. MAHNIČ, Aleksander, PINTAR, Špela, SKOK, Pavel, RUPNIK, Maja. Gut community alterations associated with Clostridioides difficile colonization in hospitalized gastroenterological patients with or without inflammatory bowel disease. Frontiers in microbiology. Sep. 2022, vol. 13, str. 1-8, ilustr. ISSN 1664-302X. https://doi.org/10.3389/fmicb.2022.988426, DOI: 10.3389/fmicb.2022.988426. [COBISS.SI-ID 120477443], [JCR, SNIP, WoS do 14. 4. 2023:

2. GORENJAK, Mario, JEZERNIK, Gregor, KRUŠIČ, Martina, SKOK, Pavel, POTOČNIK, Uroš. Identification of novel loci involved in adalimumab response in Crohn's disease patients using integration of genome profiling and isoform-level immune-cell deconvoluted transcriptome profiling of colon tissue. Pharmaceutics. [Online ed.]. Sep. 2022, vol. 14, issue

9, str. 1-16, ilustr. ISSN 1999-4923. https://doi.org/10.3390/pharmaceutics14091893, https://www.mdpi.com/1999-4923/14/9/1893, DOI: 10.3390/pharmaceutics14091893. [COBISS.SI-ID 120609795], [JCR, SNIP, WoS do 18. 8. 2023:

3. FIJAČKO, Nino, MASTERSON CREBER, Ruth, GOSAK, Lucija, ŠTIGLIC, Gregor, EGAN, Dominic, CHAKA, Brian, DEBELJAK, Nika, STRNAD, Matej, SKOK, Pavel. Evaluating quality, usability, evidence-based content, and gamification features in mobile learning apps designed to teach children basic life support: systematic search in apps stores and content analysis. JMIR mhealth and uhealth. 2021, vol. 9, issue 7, str. 1-16, ilustr. ISSN 2291-5222. https://mhealth.jmir.org/2021/7/e25437, DOI: 10.2196/25437. [COBISS.SI-ID 72125699], [JCR, SNIP, WoS do 2. 3. 2024:

4. GORENJAK, Mario, ZUPIN, Mateja, JEZERNIK, Gregor, SKOK, Pavel, POTOČNIK, Uroš. Omics data integration identifies ELOVL7 and MMD gene regions as novel loci for adalimumab response in patients with Crohn's disease. Scientific reports. 2021, vol. 11, str. 1-12, ilustr. ISSN 2045-2322. https://www.nature.com/articles/s41598-021-84909-z, https://doi.org/10.1038/s41598-021-84909-z, DOI: 10.1038/s41598-021-84909-z. [COBISS.SI-ID 54882051], [JCR, SNIP, WoS do 7. 11. 2023:

5. ĆERANIĆ, Davorin, ZORMAN, Milan, SKOK, Pavel. Interleukins and inflammatory markers are useful in predicting the severity of acute pancreatitis. Bosnian journal of basic medical sciences. 2020, vol. 20, no. 1, str. 99-105, ilustr. ISSN 1840-4812.
https://www.bjbms.org/ojs/index.php/bjbms/article/view/4253/1234, http://dx.doi.org/10.17305/bjbms.2019.4253, DOI: 10.17305/bjbms.2019.4253. [COBISS.SI-ID 6734655], [JCR, SNIP, WoS do 1. 3. 2024: št. citatov (TC): 14, čistih citatov (CI): 14, DOI: 10.14528/snr.2020.54.2.2991. [COBISS.SI-ID 20636931]

6. SKOK, Pavel, SKOK, Kristijan. Urgent endoscopy in patients with "true foreign bodies" in the upper gastrointestinal tract : a retrospective study of the period 1994-2018 = Notfallendoskopie bei Patienten mit Fremdkörpern im oberen Gastrointestinaltrakt : eine retrospektive Studie von 1994 bis 2018. Zeitschrift für Gastroenterologie. Mär. 2020, jg. 58, nr. 3, str. 217-223, ilustr. ISSN 0044-2771. https://www.thieme-connect.com/products/ejournals/abstract/10.1055/a-1062-9011, DOI: 10.1055/a-1062-9011.

7. SKOK, Pavel, SKOK, Kristijan. Gut microbiota and the pathophysiology of cardiovascular disease. Archives of Medical Science. 2021, [v tisku][str. 1-24], ilustr. ISSN 1896-9151. https://www.archivesofmedicalscience.com/Gut-microbiota-and-the-pathophysiology-of-cardiovascular-disease,127177,0,2.html, DOI: 10.5114/aoms/127177. [COBISS.SI-ID 57512195], [JCR, SNIP]

Reference nosilca / Lecturer's references: PETRA POVALEJ BRŽAN

1. GUZELJ, Domen, GRUBELNIK, Anže, GREIF, Nina, POVALEJ BRŽAN, Petra, FLUHER, Jure, KALAMAR, Žiga, MARKOTA, Andrej. The effect of body temperature changes on the course of treatment in patients with pneumonia and sepsis : results of an observational study. *Interactive journal of medical research*. 2024, vol. 13, no. 1, [article no.] e52590, str. 1-10, ilustr. ISSN 1929-073X. https://www.i-jmr.org/2024/1/e52590, DOI: 10.2196/52590. [COBISS.SI-ID 187728131]
2. GABROVEC, Tina, DRAGAR, Jana, GUZELJ, Domen, POVALEJ BRŽAN, Petra, REBOL, Janez. Comparison of perioperative electrophysiological measurements and postoperative results in cochlear implantation with a slim straight electrode. *Applied sciences*. 2023, vol. 13, issue 5, [article no.] 3292, str. [1]-11, ilustr. ISSN 2076-3417. https://www.mdpi.com/2076-3417/13/5/3292, https://doi.org/10.3390/app13053292, DOI: 10.3390/app13053292. [COBISS.SI-ID 144499459], [JCR, SNIP, WoS, Scopus]
3. OCEPEK, Andreja, EKART, Robert, POVALEJ BRŽAN, Petra, BEVC, Sebastjan. Simply adding oral nutritional supplementation to haemodialysis patients may not be enough: a real-life prospective interventional study. *Frontiers in nutrition*. Oct. 2023, vol. 10, [article no.] 1253164, str. 1-9, ilustr. ISSN 2296-861X. https://www.frontiersin.org/articles/10.3389/fnut.2023.1253164/full, https://doi.org/10.3389/fnut.2023.1253164, DOI: 10.3389/fnut.2023.1253164. [COBISS.SI-ID 177507843], [JCR, SNIP, WoS, Scopus]

5. SCHWEIGHOFER, Nina, RUPREHT, Mitja, MARČUN-VARDA, Nataša, CAF, Primož, POVALEJ BRŽAN, Petra, KANIČ, Vojko. Epicardial adipose tissue: a piece of the puzzle in pediatric hypertension. *Journal of clinical medicine*. 2023, vol. 12, issue 6, str. [1]-10, ilustr. ISSN 2077-0383. https://www.mdpi.com/2077-0383/12/6/2192, https://doi.org/10.3390/jcm12062192, DOI: 10.3390/jcm12062192. [COBISS.SI-ID 146701571], [JCR, SNIP, WoS up to 21. 2. 2024: no. of citations (TC): 1, without self-citations (CI): 1, without self-citations per author (CIAu): 0.17, Scopus up to 1. 3. 2024: no. of citations (TC): 1, without self-citations (CI): 1, without self-citations per author (CIAu): 0.17]
project: IRP-2019/02-02; financier: Univerzitetni klinični center Maribor
6. VIŠKOVIĆ, Klaudija, MARINELLI, Annibale, NEDELJKO, Katrin, POVALEJ BRŽAN, Petra, BOGDANIĆ, Nikolina, BEGOVAC, Josip. High prevalence of lower extremity medial arterial calcification in HIV-infected patients with and without chronic renal disease: a vascular ultrasound cross-sectional study. *The Open AIDS journal*. 2023, vol. 17, e187461362212230, str. 1-9. ISSN 1874-6136.
https://www.openaidsjournal.com/VOLUME/17/ELOCATOR/e187461362212230/FULLTEXT/, DOI: 10.2174/18746136-v16-e221226-2022-11. [COBISS.SI-ID 157887235], [SNIP, Scopus]
7. KLANJŠEK, Petra, PAJNKIHAR, Majda, MARČUN-VARDA, Nataša, MOČNIK, Mirjam, GOLOB JANČIČ, Sonja, POVALEJ BRŽAN, Petra. Development and validation of a new screening tool with non-invasive indicators for assessment of malnutrition risk in hospitalised children. *Children*. 2022, vol. 9, issue 5, str. [1]-16. ISSN 2227-9067. https://doi.org/10.3390/children9050731, https://www.mdpi.com/2227-9067/9/5/731, DOI: 10.3390/ children9050731. [COBISS.SI-ID 108194307], [JCR, SNIP]