# Biostatistics with using R

Educational subject description sheet

## Basic information

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| **Organizational unit**<br>Doctoral School of Medical and Health Sciences<br>**Programme**<br>Interdisciplinary PhD program in English<br>**Mandatory**<br>obligatory<br>**Disciplines**<br>Medical science, Pharmaceutical science, Health science | **Didactic cycle**<br>2023/24<br>**Realization year**<br>2023/24<br>**Lecture languages**<br>english<br>**Block**<br>obligatory for passing a year<br>**Examination**<br>graded credit |

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| **Subject coordinator** | Monika Piwowar |
| **Lecturer** | Monika Piwowar |

| **Period** | **Examination** | **Number of ECTS points** |
|---|---|---|
| Semester 2 | graded credit<br><br>**Activities and hours**<br>classes: 18<br>seminar: 7 | 3.0 |

## Goals

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| C1 | Teaching statistical inference |
| C2 | Using medical databases |
| C3 | Operations using statistical software |
| C4 | Presentation obtained results |

## Subject's learning outcomes

| Code | Outcomes in terms of | Effects | Examination methods |
|---|---|---|---|
| **Knowledge – PhD student knows and understands:** | | | |
| W1 | PhD student knows and understands a scientific research methodology covering theoretical foundations and general issues related to the represented discipline of medical and health sciences taught at the doctoral school | SDEN_W01 | oral answer, project, assignment report |
| W2 | PhD student knows and understands modern concepts, methods and tools for teaching or training activity | SDEN_W07 | oral answer, project |
| **Skills – PhD student can:** | | | |
| U1 | PhD student using his/her knowledge can critically analyze and evaluate the results of scientific research achievements in the discipline represented and his/her contribution to its development; can formulate new solutions to problems within established and modified methodological paradigms; can creatively apply and develop methods, techniques and research tools appropriate for the conducted research; is able to make conclusions based on scientific research results | SDEN_U01 | oral answer, project |
| U2 | PhD student can plan and implement an individual or team research or creative project, also in an international environment | SDEN_U05 | project, assignment report |
| U3 | PhD student can define the purpose and subject-matter of the research, formulate a research hypothesis, develop methods, techniques and research tools and apply them creatively based on the research results | SDEN_U11 | project, assignment report |
| U4 | PhD student can use knowledge from a given scientific discipline to creatively identify, formulate and innovatively solve complex problems or perform research tasks | SDEN_U13 | oral answer, project |
| **Social competences – PhD student is ready to:** | | | |
| K1 | PhD student can identify the need to formulate new research paradigms within the discipline in which is his/her doctoral project is implemented | SDEN_K04 | oral answer |
| K2 | PhD student is ready to think and act in an enterprising way, creating new ideas and seeking innovative solutions with representatives of other disciplines; is prepared for intellectual challenges in scientific/professional and public sphere and taking responsibility for his/her decisions | SDEN_K06 | oral answer |
| K3 | PhD student is ready to take into account in his/her research the solutions proposed by other disciplines of knowledge | SDEN_K09 | oral answer |

## Calculation of ECTS points

| Activity form | Activity hours* |
|---|---|

| | |
|---|---|
| classes | 18 |
| seminar | 7 |
| preparation for classes | 50 |
| preparation for examination | 15 |

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|---|---|
| **PhD student workload** | **Hours**<br>90 |
| **Workload involving teacher** | **Hours**<br>25 |

* hour means 45 minutes

## Study content

| No. | Course content | Subject's learning outcomes | Activities |
|---|---|---|---|
| 1. | Roadmap to biostatistics course and introduction to R | W1 | classes |
| 2. | R syntax  – part 1 | W1, U4 | classes |
| 3. | R syntax – part 2 | W1, U4 | classes |
| 4. | R syntax (with graphical example) – part 3 | W1, K1 | classes |
| 5. | R syntax (with graphical example) – part 4 | W1, U1, U4 | classes |
| 6. | Collecting data for statistical analysis | W1, U2, U3 | classes, seminar |
| 7. | Descriptive statistics | W1, U2, U3, K1, K2, K3 | classes, seminar |
| 8. | Comparison of two means - t student test (two-sample, one sample, and paired) | W1, U2, U3 | classes, seminar |
| 9. | Comparison of more than two means - ANOVA | W1 | classes, seminar |
| 10. | Correlation and linear regression for dependence quantitative variables | W1, U2, U3 | classes, seminar |
| 11. | Chi-square for the dependence of qualitative variables | W1, U2, U3 | classes, seminar |
| 12. | Summary of the course - training before exam | W2, U2, U3 | classes |
| 13. | Exam | W1, W2, U1 | classes |

## Course advanced

### Teaching methods:

computer classes, demonstration, discussion, project method, presentation, group work, computer room, seminar, workshop, lecture, practical classes

| Activities | Examination methods | Credit conditions |
|---|---|---|
| classes | project, assignment report | Participating actively in all classes - complete tasks after each class |

| Activities | Examination methods | Credit conditions |
|---|---|---|
| seminar | oral answer | Preparing a presentation on a given topic and moderating group discussions Final grade: percentage grade thresholds 91%-100% - 5.0 81%-90% - 4.5 71%- 80% - 4.0 61%-70% - 3.5 51%- 60% - 3.0 0-50% - 2.0 |

## Entry requirements

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## Literature

**Obligatory**

1. • Biostatistics (Basic Concepts and Methodology for the Health Science) Wayne W. Daniel • https://www.computerworld.com/article/2497143/business-intelligence-beginner-s-guide-to-r-introduction.html

**Optional**

1. "R forBeginners" Emmanuel Paradis https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf

## Linking with research conducted at the university

Biostatistics is a universal tool for data analysis. It is required in every scientific endeavor.
Turek C, Wróbel S, Piwowar M. OmicsON - Integration of omics data with molecular networks and statistical procedures. PLoS One. 2020 Jul 29;15(7):e0235398. doi: 10.1371/journal.pone.0235398. eCollection 2020.

## Efekty uczenia się

| Kod | Treść |
|---|---|
| SDEN_K04 | PhD student can identify the need to formulate new research paradigms within the discipline in which is his/her doctoral project is implemented |
| SDEN_K06 | PhD student is ready to think and act in an enterprising way, creating new ideas and seeking innovative solutions with representatives of other disciplines; is prepared for intellectual challenges in scientific/professional and public sphere and taking responsibility for his/her decisions |
| SDEN_K09 | PhD student is ready to take into account in his/her research the solutions proposed by other disciplines of knowledge |
| SDEN_U01 | PhD student using his/her knowledge can critically analyze and evaluate the results of scientific research achievements in the discipline represented and his/her contribution to its development; can formulate new solutions to problems within established and modified methodological paradigms; can creatively apply and develop methods, techniques and research tools appropriate for the conducted research; is able to make conclusions based on scientific research results |
| SDEN_U05 | PhD student can plan and implement an individual or team research or creative project, also in an international environment |
| SDEN_U11 | PhD student can define the purpose and subject-matter of the research, formulate a research hypothesis, develop methods, techniques and research tools and apply them creatively based on the research results |
| SDEN_U13 | PhD student can use knowledge from a given scientific discipline to creatively identify, formulate and innovatively solve complex problems or perform research tasks |
| SDEN_W01 | PhD student knows and understands a scientific research methodology covering theoretical foundations and general issues related to the represented discipline of medical and health sciences taught at the doctoral school |
| SDEN_W07 | PhD student knows and understands modern concepts, methods and tools for teaching or training activity |