MEDICAL UNIVERSITY - PLEVEN

DEPARTMENT OF PUBLIC HEALTH SCIENCES

APPROVE:
DEAN:
/ Prof. Dr. A. Asparuhov, MD,PhD,DSc/

FROM ACADEMIC YEAR 2019/2020

PROGRAMME

IN MEDICAL STATISTICS

(in accordance with the procedure СОПКО PR 03.08.00-v.01/06)

FOR MEDICAL STUDENTS
IN ENGLISH TEACHING DIVISION
MASTER DEGREE

PLEVEN

2019

Status - Optional
Second year, Fourth semester
Credits: 1,5
Total hours: 30 hours - 15 hours lectures + 15 hours seminars
Faculty
Assoc. Prof. Dr Gena Grancharova, MD, PhD
Assistant Mrs Eleonora Mineva

ANNOTATION
Why medical students should study medical statistics?
Over the past decades the need to train future health professionals in information support to health care delivery, management, and research has increased significantly all over the world.

Knowledge of, and competence in, the application of statistical principles and methods are necessary, not only for an understanding of the biological and medical sciences, but also for effective practice in any of the health professions. Because of the variability of biological, clinical and laboratory data, the science of statistics is necessary and central to their understanding and interpretation.

Every medical student should complete a course of medical statistics because of the following reasons:

- Knowledge of statistics is very important to understand the rationale on which diagnostic, prognostic and therapeutic decisions are based, and to appreciate that medicine is highly dependent on concepts of probability.
- Physicians need to interpret laboratory tests and bedside observations and measurements in the light of physiological, observer and instrument variation.
- Physicians need to understand the statistical and epidemiological facts about the aetiology and prognosis of the diseases in order to give the best advice to their patients about how to avoid or limit the disease effects.
- Physicians generate a great number of statistical data in their everyday practice and they need to know how to use the data for the benefits of their own practice and for the organization and delivery of health care.
- Some physicians might get positions of health managers and they will need to know how to interpret and draw inferences from the indicators that describe the health status, trends and resources on regional, national and global scale.
- In the world of high technologies and globalisation, physicians will need to follow the innovations, to keep abreast of science in their specialty. Statistics will help them to understand published findings and their interpretation in scientific literature.
- The study of statistics will foster the critical and deductive faculties throughout undergraduate studies and after graduation.

The course is designed according to the guidelines of the World Health Organization how to teach medical statistics to medical students.

The content of teaching is organized in two parts:

1.   Descriptive statistics – basic concepts, stages of the research process, sampling and types of samples, classification of variables, organization and presentation of data, distributions, descriptive statistics for qualitative and quantitative variables.

2.   Inferential statistics - statistical analysis of relationship between dependent (effect) and one or more independent (causes) variables, generalization from a sample to a population, confidence intervals, probability, parametric and non-parametric methods of hypothesis testing.

At the end of the course the students should be able to:

- Define the concepts of population and sample, representative sample and sampling methods;
- Determine the different types of variables and their meaning;
- Explain the characteristics of normal distribution, standard normal curve and z scores;
- Characterize two types of skewed distributions – positively and negatively skewed;
- Define the descriptive statistics for qualitative variables, their calculation and graphical presentation;
- Define the measures of central tendency, their calculation and graphical presentation;
- Define measures of spread, their calculation and graphical presentation;
- Use measures of central tendency and spread to establish groups of normality;
- Explain the meaning and use of correlation coefficients;
- Determine the concept of generalisation of data from a sample to a population and all concepts related to this process – probability, sampling error of the mean, confidence intervals and to make simple calculations of confidence intervals;
- Define the main concepts in hypothesis testing – types of hypothesis, type I and type II errors, one-tailed and two-tailed t test, P value;
- Test hypotheses using parametric tests and make conclusions using tables of critical values of t test;
- Test hypotheses using non-parametric test chi-square and tables of its critical values.

Educational forms:
- Lectures
- Practical training in computer classroom

Methods of education:
- Interactive lectures
- Practical training with SPSS v.24
- Decision making on multiple choice tests

Control and assessment:

- Two preliminary tests during the semester.
- Assessment of individual performance on the tests
- Final examination test

THEMATIC PLAN OF LECTURES

№	LECTURES
Lecture 1 **2 hours**	**Introduction to Statistics.** Population and sample. Types of study. The research process. **Sources and types of data.** Summarizing and presenting data.
Lecture 2 **2 hours**	**Distributions.** Normal distribution. Standard scores and standard normal curve. Asymmetric distributions. **Simple descriptive statistics for categorical data.**
Lecture 3 **2 hours**	**Descriptive statistics for quantitative data. Measures of central tendency.** Characteristics and comparison of the mean, mode, median. **Quantiles.** Characteristics and determination of different quantiles. **Percentiles.**
Lecture 4 **2 hours**	**Descriptive statistics for quantitative data. Measures of spread.** Characteristics of the range, interquartile range, standard deviation, variance. The concept of "norms" and "normal groups' limits".
Lecture 5 **2 hours**	**Correlation.** Types of correlation. Characteristics of the correlation coefficients. Pearson's and Spearman's correlation coefficients. Correlation and causation. **Regression.**
Lecture 6 **2 hours**	**Inferential statistics. Statistical estimation: from sample to population.** Point and interval estimation. Basic concepts: standard error, probability, probability coefficient, degree of freedom, confidence interval. Basic steps in rates' and proportions' estimation.
Lecture 7 **3 hours**	**Inferential statistics. Hypothesis testing.** Basic concepts: null and alternative hypotheses, directional and non-directional hypotheses, statistical significance, types I and II errors. Basic steps in hypothesis testing. **Parametric tests** – one-sided and two-sided t-test. **Inferential statistics. Hypothesis testing. Nonparametric tests -** chi-square ($\chi2$). Summarisation

THEMATIC PLAN OF CLASSES

№	PRACTICAL TRAINING
Practical training 1 2 hours	**Introduction to Statistics.** Population and sample. Types of study. The research process. **Sources and types of data.** Summarizing and presenting data. **Practical training using IBM SPSS Statistics Version 24 for Windows.**
Practical training 2 2 hours	**Distributions.** Normal distribution. Standard scores and standard normal curve. Asymmetric distributions. **Simple descriptive statistics for categorical data. Practical training using IBM SPSS Statistics Version 24 for Windows.**
Practical training 3 2 hours	**Descriptive statistics for quantitative data. Measures of central tendency.** Characteristics and comparison of the mean, mode, median. **Quantiles.** Characteristics and determination of different quantiles. **Percentiles. Practical training using IBM SPSS Statistics Version 24 for Windows.**
Practical training 4 2 hours	**Descriptive statistics for quantitative data. Measures of spread.** Characteristics of the range, interquartile range, standard deviation, variance. The concept of "norms" and "normal groups' limits". **Practical training using IBM SPSS Statistics Version 24 for Windows.**
Practical training 5 2 hours	**Correlation.** Types of correlation. Characteristics of the correlation coefficients. Pearson's and Spearman's correlation coefficients. Correlation and causation. **Regression. Practical training using IBM SPSS Statistics Version 24 for Windows.**
Practical training 6 2 hours	**Inferential statistics. Statistical estimation: from sample to population.** Point and interval estimation. Basic concepts: standard error, probability, probability coefficient, degree of freedom, confidence interval. Basic steps in interval estimation of rates and proportions. **Practical training using IBM SPSS Statistics Version 24 for Windows.**
Practical training 7 2 hours	**Inferential statistics. Hypothesis testing.** Basic concepts: null and alternative hypotheses, directional and non-directional hypotheses, statistical significance, types I and II errors. Basic steps in hypothesis testing. **Parametric tests** – one-sided and two-sided t-test. **Practical training using IBM SPSS Statistics Version 24 for Windows.**

№	PRACTICAL TRAINING
Practical training 8 1 hour	**Inferential statistics. Hypothesis testing. Nonparametric tests -** chi-square ($\chi 2$). Summarisation. **Practical training using IBM SPSS Statistics Version 24 for Windows.**

METHODS OF CONTROL

DURING THE SEMESTRE

During the semester students complete two multiple choice tests on the two basic parts of statistics - descriptive and inferential statistics. The threshold to pass both tests successfully is 60% right answers. Students also get bonuses for taking part in oral discussions during the practical training classes.

The mark at the end of the semester is an average of the two tests results.

FINAL EXAM

At the final exam students complete multiple-choice test of 30 questions covering all the content of teaching. They have to manage to calculate some descriptive and inferential statistic indicators and assess those using tables of critical values for t-criteria and chi-square to determine the probability level and make appropriate right conclusions. The minimum level of performance should be 60% to pass this part, i.e. 18 right answers. For each right answer above 18 they get 0.25 points.

Final assessment mark is calculated as 30% of the average semestrial mark (A) + 70% of the final test mark (B). Students may get some bonus for regular attendance of lectures.

Final mark = (0,30 x A*) + (0,70 x B*)

Both parts A + B should be different from Poor (2.00), i.e. A and B be at least equal to 3.00 to proceed to calculation of the final mark, which then is rounded to whole numbers – average 3.00, good 4.00, very good 5.00 and excellent 6.00

CREDITS

Overall credit for the discipline is 1.5 (55 credit points)
Credit points are collected through:
1. Attendance and participation in practical training – 15 credit points
2. Attendance of lectures – 15 credit points
3. Individual results from the two tests during the semester - 10 credit points
4. Individual results from the final test - 15 credit points

THE ROLE OF MEDICAL STATISTICS WITHIN THE ACADEMIC PLAN

Medical Statistics is an optional subject and is placed in second year, fourth semester. This is first subject to introduce medical students to the area of research methodology and it is not only providing specific knowledge but also contribute to their broaden views on medical science, problems of probability and assessment of clinical results.

EXPECTED RESULTS

The main expected result of studying medical statistics is mastering of fundamental principles in medical science and acquiring ability for critical evaluation of clinical tests and scientific publications.

EXAMINATION SYNOPSIS IN MEDICAL STATISTICS
for 2019/2020 academic year
Specialty "Medicine", English Division,
Second year, fourth semestre
January 2020 examination session

1. Introduction to statistics. Population and sample. Types of studies.
2. The research process – planning, sampling, sources and types of bias.
3. Questionnaire design.
4. Sources and types of data. Summarizing and presenting data. Scales of measurement.
5. Descriptive statistics for categorical data – ratios, proportions, percentages, rates.
6. Descriptive statistics for quantitative data. Measures of central tendency – mean, mode, median.
7. Measures of spread – range, interquartile range, standard deviation, variance.
8. Data distributions. Normal distribution – characteristics. Non-normal distributions. The normal curve. Standard scores. Standard normal curve.
9. The concept of "norms" or "normal limits". Percentiles.
10. Analyzing relationships. Correlation. Linear and non-linear correlation. Correlation coefficients.
11. Correlation and causation. Regression.
12. Introduction to inferential statistics and hypothesis testing. Types of hypotheses. Probability.
13. From sample to population. Confidence interval.
14. Analyzing differences among groups – chi-square.
15. Measuring the differences between group means – Student's t-tests (one-sided and two-sided t-test).

RECOMMENDED SOURCES

1. Presentations of lectures
2. **Free course of Medical statistics** https://www.open.edu/openlearn/science-maths-technology/medical-statistics/content-section-0?active-tab=description-tab
3. Michael J. Campbell, David Machin, Stephen J. Walters. **Medical Statistics: A textbook for the Health Sciences, 4th Edition, Wiley.** ISBN: 978-0-470-02519-2 June 2007, pp. 344 https://www.amazon.com/Medical-Statistics-Textbook-Health-Sciences/dp/0470025190
4. Oxford handbook of Medical Statistics by Janet L. Peacock and Philip J. Peacock. Oxford University Press, 2011
5. Bailar, J.C., Fr. Mosteller. Medical Uses of Statistics. NEJM Books, 1986, p. 426
6. Beaglehole R., R. Bonita, T. Kjellstrom. Basic Epidemiology. 2nd edition, WHO, Geneva, 2006, p.219
7. Campbell, M. J., D. Machin. Medical Statistics - a Commonsense Approach. 3rd edition. Wiley, 1999, p. 203
8. Hassard, T. H. Understanding Biostatistics. Third edition. Mosby Year Boor, St. Louis, 1991, p.292
9. Elementary Statistics and Probability Tutorials and Problems – available online at https://www.analyzemath.com/statistics.html
10. Online MCQ available at: http://itfeature.com/statistical-sources/statistics-mcqs/mcqs-basic-statistics
11. Online Statistics available at: http://itfeature.com/statistical-sources/statistics-mcqs

The programme has been developed by

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