# How to integrate biostatistics into the curriculum?

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# Biostatitics courses held by the staff of the Department

- Biostatistics for pharmacy students, compulsory course, I. year, 1+1 hours/week lecture and practical, 1992-
- Biostatistics for medical students, elective course, IV-V. years, 2 hours/week 1994- (Hungarian) 1998- (English).
- Biostatistics for Ph.D. students, compulsory course, 2+1 hours/week, 1993-
- Biostatistics for applied mathematical students, compulsory course, 2+1 hours/week, 2005-
- Biomathematics and biostatistics for biology and ecology students, 2+2 hours/week, 2008-
- Medical Physics and Statistics. Compulsory course, for I. year medical students, biostatistics lecture 1 hour/week + elective practical 2 hours/week, 2010-

# Former curriculum

- Earlier biostatistics was taught as a part of the subject „Biophysics”. That time, students studied biostatistics during two months, in 3+2 hours/week, and the biostatistical module finished by a written test.
- The result of this test was added to the exam of biophysics.

From the year 2010/2011 biostatistics is taught by the staff of our Department as a part of the subject „Medical Physics and Statistics”.

# Main changes and challenges in the curriculum

- **Medical physics** and **Biostatistics** is taught *parallel* during the semester as a compulsory course.
- **Exam (common):** 2/3 physics, 1/3 statistics –both parts should be at least passed!!!
- **Lessons:**
  - **Medical physics**
    - Lecture: 2 hours/week
    - Practicals/seminars: 2 hours/week
  - **Biostatistics**
    - Lecture: 1 hour/week
    - Practical: -
  - The total number of lessons per week did not change
    - Lecture: 3 hours/week
    - Practicals: 2 hours/week
  - But how to practice biostatistics?? Solution: „Biostatistical calculations” compulsory elective course, 2 hours/week

# Main changes and challenges (cont.)

- **Biostatistics**
  - Lecture: 1 hour/week
  - Practical:
    - A) nothing
    - B) Biostatistical calculations” compulsory elective course, 2 hours/week
- How to present lectures so that students not choosing practicals could take the exam?
- How to present practicals so that students choosing practicals could take the exam more easily and better?

# Principles of teaching biostatistics

- Theoretical background possibly precise but not too detailed
- We assume elementary mathematical knowledge at secondary school level (calculus?)
- Many practical examples understandable for everybody but possibly related to medicine
- Using manual calculations for simple elementary formulas on small number of cases and using statistical software, to find the appropriate ratio
- Interpretation of results of calculations
- By the end of the semester students recognise the importance of biostatistical knowledge

# Lecture, requirements

- Give an overview about the basic biostatistical methods
- Precise enough but understandable
- Practical examples from the usual life, medical literature
- Students not choosing any practical, be able to take the final exam
- But students choosing the practical „Biostatistical calculation", let it be worth to listen the lecture, and let the exam more easy
- Give an outline to advanced biostatistical methods as well

# Biostatistical calculations (elective practical), requirements

- The subject is designed to give basic biostatistical knowledge commonly employed in medical research and to learn modelling and interpreting results of computer programs (SPSS). The main purpose is to learn how to find the most appropriate method to describe and present their data and to find significant differences or associations in the data set.
- Attendance of the course facilitates the accomplishment of the obligatory course “Medical physics and statistics”.
- **Methods:**
  - Simple calculations manually and by computer
  - Advanced or complicated calculations performed by software
  - Interpretation of results
  - Application the appropriate test to a given experimental design

# Former experiences in teaching biostatistics

- The staff of our department is experienced in teaching biostatistics based on more than 20 years activity.

# Biostatistics lecture syllabus

1. Introduction. Course requirements, training objectives, subject, structure. Introductory examples. Types of data.
2. Population and sample characteristics. Definitions, examples, distribution of a sample, measures of the center and variability, and their properties. Displaying data. Scatter plot.
3. Description of linear relationship: correlation and regression analysis. The equation of the best fitting line, the principle of least squares. Regression using transformations.
4. The basics of probability theory. Experiments, events, operations with events, the concept of probability, rules of probability calculus in special cases. Distribution of variables, some important distributions (uniform, binomial, normal).
5. Statistical estimation, confidence interval.. The standard error of mean. The aim and steps of hypothesis testing, one-sample t-test.
6. Paired t-test, two-sample t-tests. Assumptions. F test for testing equality of variances.
7. Statistical errors, the increase of Type I error, ANOVA models
8. Models of linear and nonlinear regression. The significance of the correlation coefficient, hypothesis tests for the coefficients of regression line.
9. Nonparametric tests using ranks.
10. Contingency table, observed and expected frequencies, degrees of freedom, the chi-square test, assumptions. Special case: a 2x2 table. Odds ratio, relative risk.
11. Diagnostic tests.
12. Survival analysis, life tables, Kaplan-Meier method.
13. Summary, case-studies.

# Course material

- Damjanovich-Fidy-Szöllősi (eds): Medical Biophysics. Medicina, 2009.
- M.J. Campbell, D. Machin: Medical Statistics. A Commonsense Approach. John Wiley & Sons Chichester-New York- Brisbane-Toronto-Singapore , 1993.
- Rice Virtual Lab in Statistics http://onlinestatbook.com/rvls.html
- Lecture notes

Education - Handouts - 2010 1st - Mozilla Firefox

Fájl Szerkesztés Nézet Előzmények Könyvjelzők Eszközök Súgó

SZÓTÁR ANGOL-MAGYAR SZÓT... | Elméleti intézetek | Education - Handouts - 2010 1st

http://www3.szote.u-szeged.hu/dmi/eng/index.php?option=com_content&view=article&id=29&Itemid=25

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# DEPARTMENT OF MEDICAL PHYSICS AND INFORMATICS

University of Szeged, Faculty of Medicine, Faculty of Science and Informatics

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## LATEST NEWS

- Summer School in Angers (2011-07-12)
- Medical Physics oral exams (2011-06-16)
- Physics II. retake practicals (2011-05-08)
- Dr. Dorottya Czövek was awarded an ERS grant (2011-05-05)
- Physics II. practicals make-up labs (2011-05-04)

## USEFUL LINKS

- Summer School Szeged - 2011
- ETR
- ETR CooSpace
- University phonebook
- Faculty of Medicine
- University of Szeged
- Wolfram Alpha
- Mathmodel homepage

## WHO IS ONLINE?

We have 2 guests and 1 member online

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## Handouts

**2010/2011 (1st semester)**

**Faculty of Medicine - Medical physics and statistics I.**

Requirements
Medcical Physics curriculum
**QUESTIONS TO PRACTICE** (Prof. Ferenc Bari)
Lecture:
Medical physics lecture 1 - Introduction (Prof. Ferenc Bari)
Medical physics lecture 2 - Basic Mathematical Tools to describe Physiological Phenomena (Dr. János Karsai)
Medical physics lecture 3 - Mechanics of the human body (Prof. Ferenc Bari)
Medical physics lecture 4 - Mechanical oscillations, resonance (Prof. Péter Maróti)
Medical physics lecture 4 (handout) - Mechanical oscillations, resonance (Prof. Péter Maróti)
Medical physics lecture 5 - Mechanical waves (Prof. Péter Maróti)
Medical physics lecture 5 (handout) - Mechanical waves (Prof. Péter Maróti)
Medical physics lecture 6 - Optics (Dr. Katalin Varjú)
Medical physics lecture 6 - Optics (black and white) (Dr. Katalin Varjú)
Medical physics lecture 7 - Temperature, its measurement, heat, heat transport (Prof. Ferenc Bari)
Medical physics lecture 8 - Principles of fluid mechanics (Prof. Zoltán Hantos)
Medical physics lecture 9 - Physics of biological membranes,diffusion, osmosis (Dr. László Nagy)
Medical physics lecture 10 - Thermodynamics of transport processes (Dr. Lászó Nagy)
Medical physics lecture 11 - Bioelectric phenomena (Prof. Ferenc Bari)
Medical physics lecture 13 - Signals (Prof. Zoltán Hantos)
Practice:
Laboratory practice 1 - Anthropometric measurements
Laboratory practice 2 - Force, work and power
Laboratory practice 3 - Electromyography
Laboratory practice 4 - Acoustics
Laboratory practice 5 - Noninvasive measurement of arterial pressure
Biostatistics:
Biostatistics lecture 1, 2 - Basic statistical concepts (Dr. Krisztina Boda)
Biostatistics lecture 3 - Correlation, regression (Dr. Krisztina Boda)
Biostatistics lecture 4 - The basics of probability theory (Dr. Krisztina Boda)
Biostatistics lecture 5 - Confidence intervals (Dr. Krisztina Boda)
Biostatistics lecture 6 - Hypothesis tests, one sample t-test, paired t-test. (Dr. Krisztina Boda)
Biostatistics lecture 7 - Hypothesis tests, two-sample t-test.(Dr. Krisztina Boda)
Biostatistics lecture 8 - Hypothesis tests, two-sample t-test, analysis of variance.(Dr. Krisztina Boda)

[Magyar] [German]

## LOGIN

Hi stud,

LOG OUT

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# Biostatistical calculations syllabus

1. Introduction. Data sets, types of data, distribution of data, graphical presentations (frequencies, percentages, bar chart, histogram)
2. Summary measures (mean, standard deviation, median, mode, range, quartiles). Figures based on summary measures.
3. Mathematics: equation and graph of the line. Exponential and logarithm function, transformations. Displaying data. Scatter plot.
4. Calculation of simple probabilities and distributions. The use of standard normal table. Sketch of the normal curve and finding some probabilities given the mean and standard deviation
5. Confidence intervals, interpretation.
6. Test 1: descriptive statistics, probability theory.
7. Paired t-test by calculator and by software.
8. Two-sample t-tests. Assumptions. F test for testing equality of variances.
9. One-way ANOVA.
10. Correlation and linear regression
11. Chi-square tests
12. Tests based on ranks. Summary
13. Test 2. T-tests, correlation-regression, -chi-square test
14. Summary, preparation to the exam

# Biostatistical calculations
# Compulsory elective practical course

- **Practice:** 2 lessons per week
  **Form of examination:** practical mark
  **Year/semester:** 1st year, 1. semester
  **Credits:** 2
- The subject is designed to give basic biostatistical knowledge commonly employed in medical research and to learn modelling and interpreting results of computer programs (SPSS). The main purpose is to learn how to find the most appropriate method to describe and present their data and to find significant differences or associations in the data set.
  Attendance of the course facilitates the accomplishment of the obligatory course “Medical physics and statistics”.
- Data sets
  - Data about yourself
  - Real data of medical experiments
- **Forms of testing:** The students have to perform two tests containing practical problems to be solved by hand calculations and by a computer program (EXCEL, Statistica or SPSS). During the tests, use of calculators, computers (without Internet) and lecture notes are permitted. Final practical mark is calculated from the results of the two tests.

# Forms of testing

- The students have to perform two tests containing practical problems to be solved by hand calculations and by a computer program (EXCEL, Statistica or SPSS). During the tests, use of calculators, computers (without Internet) and lecture notes are permitted. Final practical mark is calculated from the results of the two tests.
- Test 1. (40 points)
  - Descriptive statistics, one problem to be solved manually and another to be solved by SPSS
- Test 2. (60 points)
  - 1 manual calculation (paired t-test, significance of correlation, evaluation of a 2x2 contingency table )
  - 1 test by SPSS given a data base (paired t-test, two-sample t-test, regression, chi-square test)
  - Interpretation of the result of a given test (software output)

# Data base

- Data about the students themselves. On the first lecture they fill in a questionnaire. The resulting data file contain all important types of variables.
- Data measured on physics practicals (anthropometric data, blood pressure, pulse, etc…)
- Data of earlier medical research
- Data file of scientific papers (downloaded)

# Data base about the students

**Questionnaire**

This questionnaire is an experiment. The resulting data will be written in a data base and will be evaluated on the practical lessons. Please fill in the empty spaces with the appropriate numbers. Please find some "nickname" (not longer than 15 letters) if you would like to find your data in the data base.

Thank you for your contribution:

Krisztina Boda

Nickname: ------------------- □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

Sex (Male-1 , Female-2)----------------------------------------------------------- □

Age in years: ----------------------------------------------------------------- □ □

Body height in centimetres: --------------------------------------------- □ □ □

Body mass in kilograms: ------------------------------------------------- □ □

Body mass in kilograms three years ago: ---------------------------------- □ □

Ideal body height in centimetres: ----------------------------------------- □ □ □

Ideal body mass in kilograms: ---------------------------------------------- □ □

How do you like to eat? ------------------------------------------------------- □

1: I dont like to eat at all
2: I dont like to eat
3: indifferent
4: I like to eat
5: I like to eat very much

Eye colour ------------------------------------------------------------------------ □

1: blue
2: green
3: grey
4: brown
5: black

What is your opinion about biostatistics ? ( 1 :yes, 2 : no )

difficult □

necessary □

interesting □

Are you pleased with using a statistical software? ( 1 :yes, 2 : no) --------- □

Have you heard about any statistical software? ( 1 :yes, 2 : no) ------------ □

QUEST2010.sav [DataSet1] - SPSS Data Editor

1 : ID 1 — Visible: 21 of 21 Variables

| | ID | Sex | Age | Height | Mass | Mass3 | Idealheight | Idealmass | Eat | Eye | Difficult | Necessary |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Male | 19 | 178 | 90 | . | . | . | I like to eat very | brown | . | . |
| 2 | 2 | Female | 20 | 166 | 79 | 70 | 170 | 50 | I like to eat | brown | no | no |
| 3 | 3 | Female | 20 | 173 | 64 | 62 | 173 | 64 | I like to eat very | brown | no | yes |
| 4 | 4 | Female | 33 | 175 | 78 | 75 | 165 | 60 | I like to eat | blue | . | yes |
| 5 | 5 | Female | 25 | 160 | 53 | 53 | 165 | 48 | I like to eat | brown | no | yes |
| 6 | 6 | Male | 18 | 183 | 77 | 81 | 190 | 79 | I like to eat very | brown | no | yes |
| 7 | 7 | Male | 21 | 181 | 68 | 62 | 172 | 70 | I like to eat | black | . | yes |
| 8 | 8 | Male | 18 | 188 | 81 | . | 188 | 89 | I like to eat | black | yes | yes |
| 9 | 9 | Female | 20 | 158 | 55 | 48 | 165 | 46 | I like to eat very | brown | yes | yes |
| 10 | 10 | Male | 19 | 173 | 68 | 55 | 180 | 73 | I like to eat | brown | no | yes |
| 11 | 11 | Female | 18 | 173 | 68 | 60 | 170 | 60 | I like to eat very | green | . | yes |
| 12 | 12 | Female | 22 | 158 | 53 | 53 | 163 | 48 | I like to eat very | black | no | yes |
| 13 | 13 | Female | 19 | 169 | 65 | 62 | 180 | 56 | I don't like to eat | brown | yes | yes |
| 14 | 14 | Male | 27 | 183 | 85 | 80 | 190 | 40 | I like to eat very | green | no | yes |
| 15 | 15 | Female | 20 | 159 | 55 | 55 | 163 | 50 | I like to eat | black | yes | yes |
| 16 | 16 | Male | 20 | 176 | 65 | 60 | 176 | 65 | I like to eat | brown | no | yes |
| 17 | 17 | Female | 22 | 170 | 55 | 54 | 165 | 47 | I like to eat very | black | yes | yes |
| 18 | 18 | Female | 19 | 166 | 52 | 48 | 169 | 54 | I like to eat | brown | yes | no |
| 19 | 19 | Male | 21 | 174 | 67 | 65 | 180 | 75 | indifferent | brown | no | yes |
| 20 | 20 | Male | 19 | 184 | 82 | 76 | . | . | I like to eat very | brown | yes | yes |
| 21 | 21 | Female | 19 | 164 | 54 | 50 | 164 | 54 | I like to eat very | brown | yes | yes |
| 22 | 22 | Male | 17 | 189 | 82 | 65 | 189 | 70 | I like to eat very | green | . | yes |
| 23 | 23 | Male | 20 | 181 | 80 | 72 | 181 | 76 | I like to eat very | brown | no | no |
| 24 | 24 | Male | 20 | 181 | 90 | 88 | 183 | 70 | I like to eat | black | . | . |
| 25 | 25 | Female | 25 | 168 | 56 | 57 | 168 | 58 | I like to eat | brown | no | no |
| 26 | 26 | Male | 19 | 183 | 60 | 67 | 188 | 78 | I like to eat | brown | yes | no |
| 27 | 27 | Female | 25 | 165 | 48 | 55 | 170 | 50 | indifferent | brown | no | yes |
| 28 | 28 | Female | 20 | 162 | 48 | 45 | . | . | indifferent | brown | no | no |
| 29 | 29 | Female | 21 | 165 | 49 | 47 | 169 | 52 | indifferent | brown | yes | no |
| 30 | 30 | Male | 19 | 184 | 90 | 80 | 190 | 83 | I like to eat | brown | yes | yes |
| 31 | 31 | Female | 27 | 160 | 51 | 47 | 165 | 48 | I like to eat | brown | yes | yes |
| 32 | 32 | Male | 21 | 176 | 65 | 64 | 180 | 70 | I like to eat | black | yes | yes |
| 33 | 33 | Female | 29 | 162 | 46 | 46 | 175 | 55 | I like to eat | green | no | yes |
| 34 | 34 | Male | 19 | 174 | 85 | 78 | 178 | 83 | I like to eat | blue | no | yes |
| 35 | 35 | Male | 19 | 170 | 74 | 70 | 180 | 75 | I like to eat very | brown | yes | yes |

Data View / Variable View — SPSS Processor is ready

[QUEST2010.xls]

# Anthropometric data

Anthropometrics.sav [DataSet2] - SPSS Data Editor

File Edit View Data Transform Analyze Graphs Utilities Window Help

1 : Massmean 92 Visible: 21 of 21 Variables

| | Massmean | MassSD | Mass1 | Mass2 | Mass3 | sex | Heightmean | HeightSD | Height1 | Height2 | Height3 | Hipmean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 92.00 | .00 | 92.3 | 92.3 | 92.3 | female | 180.00 | .60 | 180.5 | 179.5 | 179.3 | 119.00 |
| 2 | 72.00 | .10 | 71.7 | 71.6 | 71.6 | male | 174.00 | .20 | 173.6 | 174.0 | 173.9 | 92.00 |
| 3 | 48.00 | 1.00 | 49.0 | 47.0 | 48.0 | female | 165.00 | .30 | 165.0 | 165.5 | 165.5 | 87.00 |
| 4 | 75.00 | .00 | 75.0 | 75.0 | 75.0 | male | 185.00 | .10 | 185.0 | 184.9 | 185.0 | 80.00 |
| 5 | 92.00 | .20 | 91.9 | 92.3 | 92.0 | male | 176.00 | .70 | 176.6 | 176.7 | 175.5 | 97.00 |
| 6 | 50.00 | .30 | 50.0 | 50.5 | 50.0 | female | 166.00 | .00 | 166.0 | 166.0 | 166.0 | 88.00 |
| 7 | 75.00 | .90 | 75.5 | 76.3 | 74.5 | male | 181.00 | 1.00 | 181.6 | 180.0 | 181.7 | 88.00 |
| 8 | 49.00 | 1.00 | 50.0 | 48.0 | 49.0 | female | 161.00 | .70 | 161.1 | 160.0 | 161.2 | 70.00 |
| 9 | 91.00 | .60 | 90.9 | 90.0 | 91.0 | male | 181.00 | .30 | 181.0 | 180.5 | 180.5 | 98.00 |
| 10 | 56.00 | 1.00 | 56.0 | 57.0 | 55.0 | male | 180.00 | 1.00 | 179.0 | 181.0 | 180.0 | 81.00 |
| 11 | 70.00 | .20 | 69.5 | 69.9 | 69.5 | female | 169.00 | .60 | 169.3 | 168.8 | 168.1 | 98.00 |
| 12 | 60.00 | .30 | 60.5 | 60.5 | 60.0 | male | 175.00 | .30 | 174.5 | 175.0 | 175.0 | 83.00 |
| 13 | 67.00 | 1.50 | 69.0 | 66.0 | 67.0 | male | 173.00 | 1.30 | 174.5 | 172.1 | 172.3 | 97.00 |
| 14 | 90.00 | .20 | 90.3 | 90.4 | 90.1 | male | 185.00 | .70 | 185.5 | 185.7 | 184.4 | 90.00 |
| 15 | 88.00 | .40 | 88.4 | 88.6 | 87.8 | male | 176.00 | .20 | 176.3 | 176.1 | 176.5 | 100.00 |
| 16 | 87.00 | .20 | 87.6 | 87.2 | 87.3 | male | 172.00 | .50 | 172.9 | 172.3 | 171.9 | 97.00 |
| 17 | 104.00 | .40 | 104.8 | 104.1 | 104.3 | male | 175.00 | .40 | 174.6 | 175.4 | 175.3 | 111.00 |
| 18 | 75.00 | .90 | 75.0 | 75.0 | 73.5 | male | 186.00 | .60 | 185.5 | 186.6 | 186.3 | 83.00 |
| 19 | 70.00 | .80 | 70.0 | 70.5 | 69.0 | male | 177.00 | .40 | 177.2 | 177.1 | 177.8 | 89.00 |
| 20 | 83.00 | .80 | 83.5 | 82.0 | 82.4 | male | 182.00 | .30 | 182.2 | 181.7 | 181.8 | 98.00 |
| 21 | 57.00 | .60 | 57.0 | 56.0 | 57.0 | female | 168.00 | .20 | 167.5 | 167.6 | 167.9 | 77.00 |
| 22 | 63.00 | .00 | 62.8 | 62.8 | 62.8 | male | 172.00 | .20 | 171.9 | 171.5 | 171.5 | 91.00 |
| 23 | 63.00 | .10 | 63.6 | 63.4 | 63.4 | male | 176.00 | .40 | 176.0 | 176.2 | 175.4 | 97.00 |
| 24 | 88.00 | .30 | 87.8 | 87.2 | 87.6 | male | 180.00 | .20 | 180.3 | 180.2 | 180.5 | 102.00 |
| 25 | 72.00 | .20 | 72.5 | 72.3 | 72.1 | male | 177.00 | .10 | 177.2 | 177.0 | 177.1 | 96.00 |
| 26 | 75.00 | .10 | 75.2 | 75.1 | 75.1 | male | 182.00 | .20 | 182.1 | 181.7 | 181.9 | 93.00 |
| 27 | 54.00 | .20 | 53.9 | 53.5 | 53.5 | female | 163.00 | .40 | 162.5 | 163.2 | 162.5 | 83.00 |
| 28 | 57.00 | .10 | 56.9 | 57.0 | 56.9 | female | 164.00 | .20 | 164.5 | 164.1 | 164.1 | 93.00 |
| 29 | 61.00 | .10 | 60.6 | 60.7 | 60.8 | female | 170.00 | .10 | 170.5 | 170.5 | 170.4 | 89.00 |
| 30 | 60.00 | .50 | 59.0 | 59.5 | 60.0 | female | 177.00 | .50 | 177.5 | 176.6 | 177.0 | 91.00 |
| 31 | 52.00 | .00 | 52.1 | 52.1 | 52.1 | female | 172.00 | 1.00 | 171.2 | 173.0 | 171.5 | 80.00 |
| 32 | 56.00 | .30 | 55.5 | 56.0 | 56.0 | female | 169.00 | .00 | 169.0 | 169.1 | 169.0 | 86.00 |
| 33 | 66.00 | 1.00 | 67.0 | 65.0 | 66.0 | female | 173.00 | .80 | 172.6 | 172.7 | 174.0 | 96.00 |
| 34 | 77.00 | .20 | 77.5 | 77.1 | 77.4 | male | 181.00 | .20 | 181.0 | 180.9 | 181.2 | 80.00 |
| 35 | 56.00 | .40 | 55.7 | 55.0 | 55.8 | male | 172.00 | .30 | 172.0 | 172.5 | 172.3 | 81.00 |

Data View | Variable View

SPSS Processor is ready

Start | Total Comman... | 2 Microsoft O... | Microsoft Powe... | Education - Fo... | Output1 [Docu... | QUEST2010.sa... | Anthropomet... | HU | 16:12

# Lecture-slides. Introduction

## Testing hypotheses, motivating example III.

ORIGINAL CONTRIBUTION

Effect of Glucosamine ... Disability in Patients ... Low Back Pain and D... Lumbar Osteoarthriti...

A Randomized Controlled Tr...

**Primary Outcome Measure**

The primary outcome measure used was the Norwegian version of the RMDQ,[25] which is a widely used, back-specific, self-administered measure of pain-related disability. Greater levels of disability give higher numbers on a 24-point scale.

Results

**Table 2.** Primary and Secondary Outcomes

| Assessment (Range) and Time of Evaluation | Mean SD (95% CI)[a] Glucosamine (n = 125) | Placebo (n = 125) | Treatment Effect[b] | P Value[c] |
|---|---|---|---|---|
| RMDQ (0 to 24) | | | | |
| Baseline | 9.2 (8.4 to 10.0) | 9.7 (8.9 to 10.5) | NA | NA |
| 6 wk | 7.0 (6.1 to 7.8) | 7.1 (6.3 to 7.9) | −0.1 (−1.3 to 1.0) | .82 |
| 3 mo | 5.8 (5.0 to 6.6) | 6.5 (5.7 to 7.3) | −0.7 (−1.8 to 0.5) | .24 |
| 6 mo | 5.0 (4.2 to 5.8) | 5.0 (4.2 to 5.8) | 0.0 (−1.1 to 1.2) | .72 |
| 1 y | 4.8 (3.9 to 5.6) | 5.5 (4.7 to 6.4) | −0.8 (−2.0 to 0.4) | .50 |

**CONCLUSION**

No significant differences were found between glucosamine and placebo during the intervention period or at 1-year follow-up. Both interventions improved functional status by the end of treatment by a similar amount. No serious adverse events were associated with either of the study agents. Based on our results, it seems unwise to recommend glucosamine to all patients with chronic LBP and degenerative lumbar OA. Further research is needed to clarify whether glucosamine is advantageous in an alternative LBP population.

# Lecture-slides. Summary measures

## Measures of the center

- **Mean:**

$$\bar{x} = \frac{x_1 + x_2 + \ldots + x_n}{n}$$

- **Mode: is the most frequent number**
- **Median: is the value that half the membe[r] of the sample fall below and half abov[e] In other words, it is [t] middle number whe[n] the sample element[s] are written in numer[ical] order**

## Measures of variability (dispersion)

- The **range** is the difference between the largest [...] number
- **Percent[...]** value be[...]
- **Quartil[e...]**
- **The var[...]**
- **The sta[...]**

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## Example

- **Data: 1 2 4 1, in ascending order: 1 1 2 4**
- **Range: max-min=4-1=3**
- **Quartiles:**
- **Standard deviation:**

**Percentiles**

| | Percentiles | | |
|---|---|---|---|
| | 25 | 50 | 75 |
| Weighted Average(Definition 1) | 1.0000 | 1.5000 | 3.5000 |
| Tukey's Hinges | 1.0000 | 1.5000 | 3.0000 |

| $x_i$ | $x_i - \bar{x}$ | $(x_i - \bar{x})^2$ |
|---|---|---|
| 1 | 1-2=-1 | 1 |
| 1 | 1-2=-1 | 1 |
| 2 | 2-2=0 | 0 |
| 4 | 4-2=2 | 4 |
| Total | 0 | 6 |

$$SD = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{6}{3}} = \sqrt{2} = 1.414$$

Krisztina Boda Biostat 1. 36

# Lecture-slides. T-test

## Example from the medical literature

Differential Effect of Uro
Normal Subjects and Patie

Melissa Lim, BBiomedSc; Suzy Honisett,
Paul Komesaroff
Andrew Kompa, BSc, PhD;

Lim et al U-II in Heart Failure 1213

Demographic Indexes

Statistical Analysis

Data are expressed as mean± were analyzed by trend test. analyzed overall by 2-way, re son between groups for individ by Student's unpaired *t* test. gender, were analyzed by $\chi^2$ appropriate. A 2-tailed probab statistically significant.

Compare the r
The sample m
caused by cha

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## How to

- If H0 is true, the compu statistic has a t-distribut with 25 degrees of free
- Then with 95% probabil t-value lies in the „acce region"
- Check it: now t=-1.059
- The p-value is the shad area, p=0.28. The proba of the observed test sta is or more extreme in ei direction when the null hypothesis is true.

Krisztina Boda

## How to get the t-value using statistical software – given sample size, sample mean and sample SD?

- Using SPSS, t-test is performed on sample data. Given only sample characteristics, it is difficult to get t.value.
- Excel:

| | Group I | Group II |
|---|---|---|
| N | 14 | 13 |
| Mean | 50 | 56 |
| SD | 4 | 4 |
| **Results** | | |
| Mean difference | | -6 |
| SE of mean difference | | 1.540658 |
| Df | | 25 |
| t-value | | -3.89444 |
| two-sided p | | 0.000649 |

| | Group I | Group II |
|---|---|---|
| N | 14 | 13 |
| Mean | 50 | 56 |
| SE | 4 | 4 |
| SD | 14.96663 | 14.42221 |
| **Results** | | |
| Mean difference | | -6 |
| SE of mean difference | | 5.66493 |
| Df | | 25 |
| t-value | | -1.05915 |
| two-sided p | | 0.299659 |

Krisztina Boda 25

# Lecture slides. Use of the data of the students in the lecture

## Answer to the motivated example (mean age of boys and girls)

**Group Statistics**

| | Sex | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Age in years | Male | 84 | 21.18 | 3.025 | .330 |
| | Female | 53 | 20.38 | 3.108 | .427 |

- The mean age of boys is a litlle bit higher than the mean age of The standard deviations are similar.

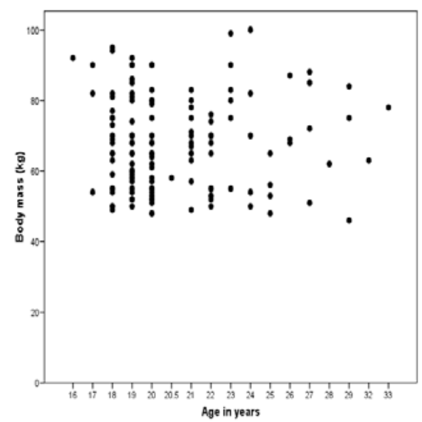
**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | L |
| Age in years | Equal variances assumed | .109 | .741 | 1.505 | 135 | .135 | .807 | .536 | |
| | Equal variances not assumed | | | 1.496 | 108.444 | .138 | .807 | .540 | |

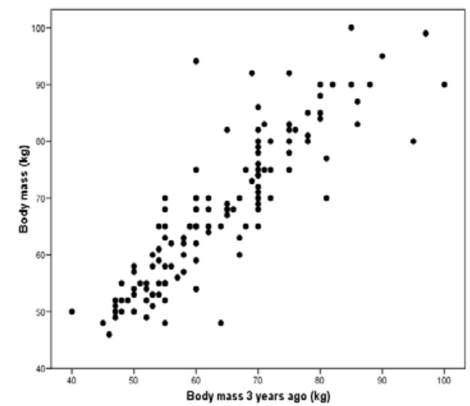
- Comparison of variances (F test for the equality of variances): p=0.741>0.05, not significant, we accept the equality of variances.
- Comparison of means: according to the formula for equal variances t=1.505. df=135, p=0.135. So p>0.05, the difference is not significar Although the experienced difference between the mean age of boys girls is 0.816 years, this is statistically not significant at 5% level. W show that the mean age of boys and girls is different.

## Significance of the correlation

### Other examples




r=0.018, p=0.833




r=0.873, p<0.0001

# Practical problem-sheets

**A questionnaire**

1. Identification number. □□□
2. Gender □
   - 1: male
   - 2: female
3. Age (year) □□
4. Education □
   - 1: No
   - 2: elementary
   - 3: secondary
   - 4: university
5. Body mass (kg) □□
6. Height (cm) □□□
7. Eye colour □
   - 1: blue
   - 2: green
   - 3: grey
   - 4: brown
   - 5: black
8. Hobby
   - sport □
   - music listening □
   - collecting stamps □
   - dancing □
   - fine arts □
   - other......................... □

Create variables using the questionnaire! Let' s define the following variables (no more than 8 characters are valid for name of a variable):
1.ID 2.GENDER (Nomimal) 3.AGE (Quantitative)
4.EDUCATIO (Ordinal) 5.WEIGHT (Quantitative) 6.HEIGHT (Quantitative)
7.E_COLOUR (Nomimal) 8.SPORT (Binary) 9.MUSIC (Binary) 10.STAMP (Binary)
11.DANCE (Binary) 12.FINEART (Bináris/Dichotomous) 13.OTHER (Binary)

**Create this dataset using EXCEL.**

| ID | GENDER | AGE | EDUCATIO | WEIGHT | HEIGHT | E_COLOUR | SPORT | MUSIC |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 1.00 | 20.00 | 3.00 | 65.00 | 185.00 | 3.00 | 1.00 | 1.00 |
| 2.00 | 2.00 | 17.00 | 3.00 | 60.00 | 170.00 | 4.00 | 1.00 | 2.00 |
| 3.00 | 1.00 | 22.00 | 3.00 | 62.00 | 177.00 | 2.00 | 2.00 | 1.00 |
| 4.00 | 2.00 | 28.00 | 4.00 | 62.00 | 176.00 | 4.00 | 2.00 | 1.00 |
| 5.00 | 1.00 | 9.00 | 1.00 | 32.00 | 148.00 | 4.00 | 2.00 | 2.00 |
| 6.00 | 1.00 | 5.00 | 1.00 | 19.00 | 125.00 | 3.00 | 2.00 | 2.00 |
| 7.00 | 2.00 | 26.00 | 3.00 | 70.00 | 166.00 | 4.00 | 2.00 | 2.00 |
| 8.00 | 1.00 | 60.00 | 4.00 | 75.00 | 180.00 | 1.00 | 1.00 | 1.00 |
| 9.00 | 2.00 | 35.00 | 3.00 | 49.00 | 155.00 | 4.00 | 2.00 | 1.00 |
| 10.00 | 2.00 | 51.00 | 4.00 | 61.00 | 162.00 | 4.00 | 2.00 | 1.00 |
| 11.00 | 1.00 | 17.00 | 2.00 | 61.00 | 178.00 | 4.00 | 2.00 | 1.00 |
| 12.00 | 2.00 | 50.00 | 2.00 | 65.00 | 164.00 | 4.00 | 2.00 | 2.00 |
| 13.00 | 1.00 | 9.00 | 1.00 | 30.00 | 130.00 | 2.00 | 1.00 | 2.00 |
| 14.00 | 2.00 | 10.00 | 1.00 | 40.00 | 135.00 | 1.00 | 2.00 | 1.00 |
| 15.00 | 1.00 | 19.00 | 3.00 | 86.00 | 187.00 | 3.00 | 1.00 | 1.00 |
| 16.00 | 1.00 | 22.00 | 3.00 | 67.00 | 179.00 | 4.00 | 2.00 | 2.00 |
| 17.00 | 1.00 | 25.00 | 3.00 | 103.00 | 186.00 | 4.00 | 1.00 | 1.00 |
| 18.00 | 1.00 | 29.00 | 4.00 | 74.00 | 176.00 | 1.00 | 1.00 | 1.00 |
| 19.00 | 2.00 | 27.00 | 4.00 | 67.00 | 164.00 | 4.00 | 1.00 | 1.00 |
| 20.00 | 1.00 | 19.00 | 3.00 | 70.00 | 180.00 | 4.00 | 1.00 | 1.00 |

**Practice**

**Discrete variables: Distributions, Absolute and relative frequencies, column charts**

1.1. Characterize the **GENDER** variable: **GENDER** (1=boy, 2=girl).

| | Frequency | Relative frequency |
|---|---|---|
| Boy | | |
| Girl | | |
| Total | | |

Create a barchart! Make scale on y-axis!

Frequency chart: Boy, Girl — Gender

Relative frequency barchart: Boy, Girl — Gender

1.2. Characterize the **EDUCATIO(n)** variable!

| | Frequency | Relative frequency |
|---|---|---|
| No | | |
| Primary school | | |
| Secondary school | | |
| University | | |
| Total | | |

Create a barchart! Make scale on y-axis!

Frequency chart: No, Primary, Secondary, University

Relative frequency barchart: No, Primary, Secondary, University

1.3. Create an piechart using **EDUCATIO(n)** variable!

**SPSS:**

1.4. Open the SMALLQUEST.SAV data file! Repeat the characterization of both GENDER and EDUCATIO variables using SPSS commands!

1.5. Open the **Breast cancer survival.sav** data file! Characterize the discrete variables!

# Exam

- **Physics**: test-exam, multiple choice
- **Biostatistics**: manual evaluation of an exam-sheet with the following parts:
  - 5 theoretical questions
  - 1 descriptive statistics problem
  - 1 hypothesis test
- ONLY a given formula-sheet and calculator can be used

**Biostatistics exam sample sheet**

EHA:…….. Name:....................................: .............. Date:……….

**Give short answer to the following questions! 40 p.**

1. The two main types of variables
2. What is the relationship between the standard deviation (SD) and the variance?
3. The meaning and properties of the coefficient of correlation ( r )
4. The meaning of a confidence interval
5. The principle of finding the equation of the regression line

**Solve the following problems! Total: 60 p.**

1. 2.17. Given the following of the following small sample: X: 4 ; 1 ; 5 ; 5 ; 0, calculate mean and standard deviation, and sketch a mean-SD chart: **20 p**

Mean (5 p) ………………

Standard deviation (10 p) …………………….

Chart (5 p) ……………………………

2. The following table shows the results of placebo and aspirin in an experiment, with the number of people in each treatment group who did and did not develop thromboses. Decide whether the aspirin had or had not effect on thrombus formation. **40 p.**

| | Developed thrombi | Free of thrombi |
|---|---|---|
| Placebo | 10 | 5 |
| Aspirin | 10 | 20 |

Find the value of the test statistic, and give your conclusion. (alfa=0.05, *2table=3.84)

Name of the test (2 p)……………………

Null hypothesis (3 p)……………………

Assumption (5 p)………………………………

Test statistic: (10 p)……………………..

Degrees of freedom: (5 p)……………………

Decision about the significance: (10 p)…………………..: ………………………..

Interpretation: (5 p) ………………….

**Biostatistics exam sample sheet**

EHA:…….. Name:....................................: ............. Date:……….

1. When is a distribution skewed to the right?
2. Calculation of the sample median
3. Properties of the normal distribution
4. Decision rules of the one-sample t-test
5. When to use nonparametric tests?

**Solve the following problems!** **Total: 60 p.**

1. In a study, systolic blood pressure of 10 healthy women was measured. The mean was 119, the standard error 0.664. Calculate the 95% confidence interval for the population mean! (a=0.05, $t_{table}$=2.26).: **(20 p)**

Data (5 p):
Mean…………
SE……………..
$t_{table}$=……………
Lower limit (5 p) ……………….
Upper limit (5 p)………………..
Meaning of this interval (5 p)…………………………….

2. On the physics practicals the waist circumference was measured. The measurement was repeated three times. The relationship of the first two measurements was examined by linear regression. Interpret the results below (coefficient of correlation, the significance of correlation . null hypothesis, t-value, p-value, the equation of the regression line. **40 p**.

**Model Summary**

| R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|
| .980 | .960 | .960 | 2.267 |

The independent variable is Waist circumference 1.

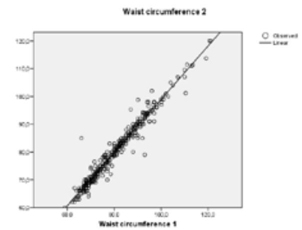
**ANOVA**

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Regression | 44733.495 | 1 | 44733.495 | 8707.197 | .000 |
| Residual | 1849.511 | 360 | 5.138 | | |
| Total | 46583.007 | 361 | | | |

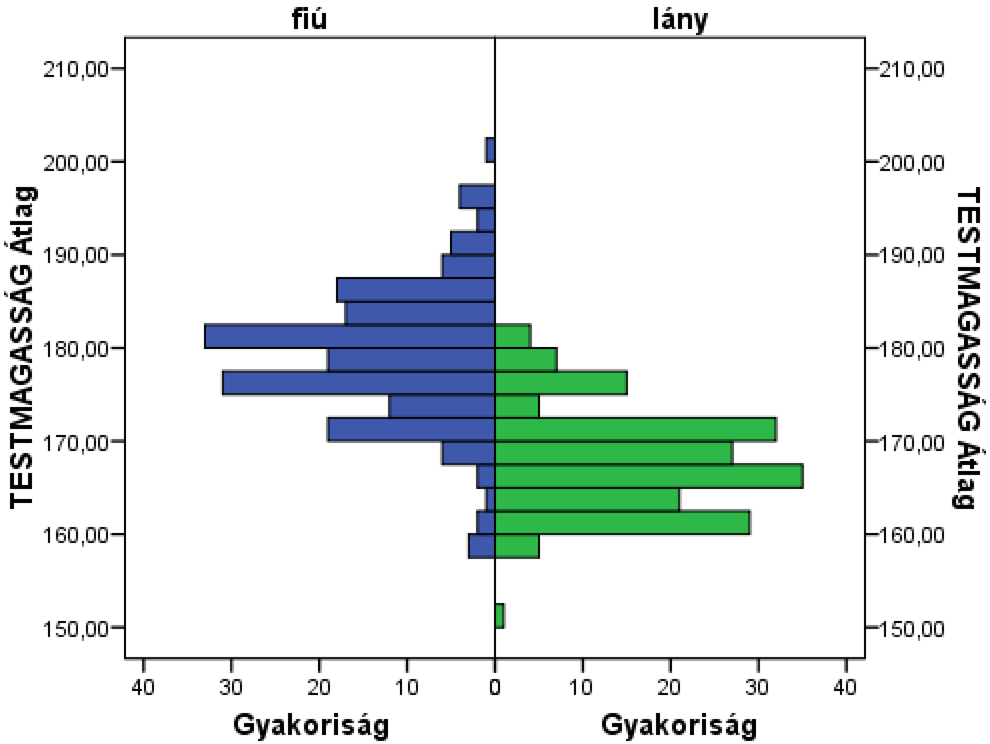
The independent variable is Waist circumference 1.

**Coefficients**

| | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| Waist circumference 1 | .960 | .010 | .980 | 93.312 | .000 |
| (Constant) | 3.061 | .832 | | 3.678 | .000 |




Coefficient of correlation (5 p)…………………… Meaning:………………………..
Null hypothesis for the significance of correlation: (5 p) ……………………
Test statistic ( 5 p)………………..
p-value (5 p)…………………..
Significance: (10 p)……………………
Equation of the regression line: (5 p)………………………………
Interpretation (5 p): ………………………………………..



fiú
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210,00
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TESTMAGASSÁG Átlag
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20
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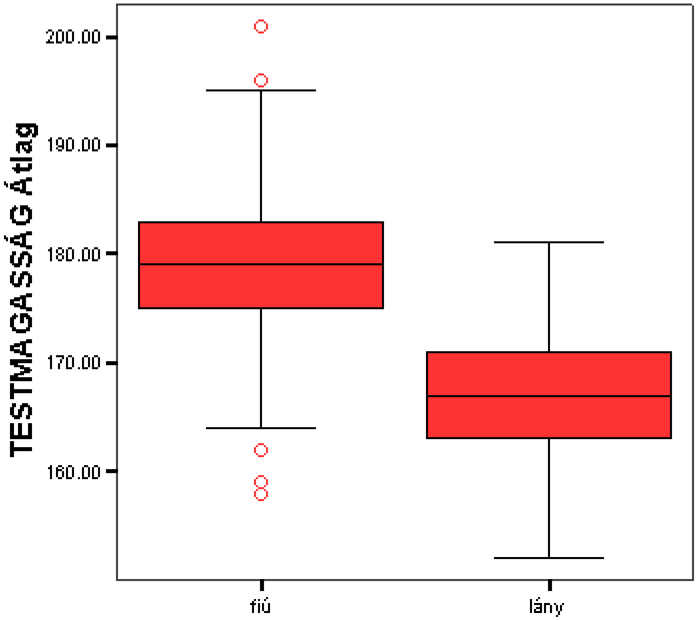
Gyakoriság
Gyakoriság

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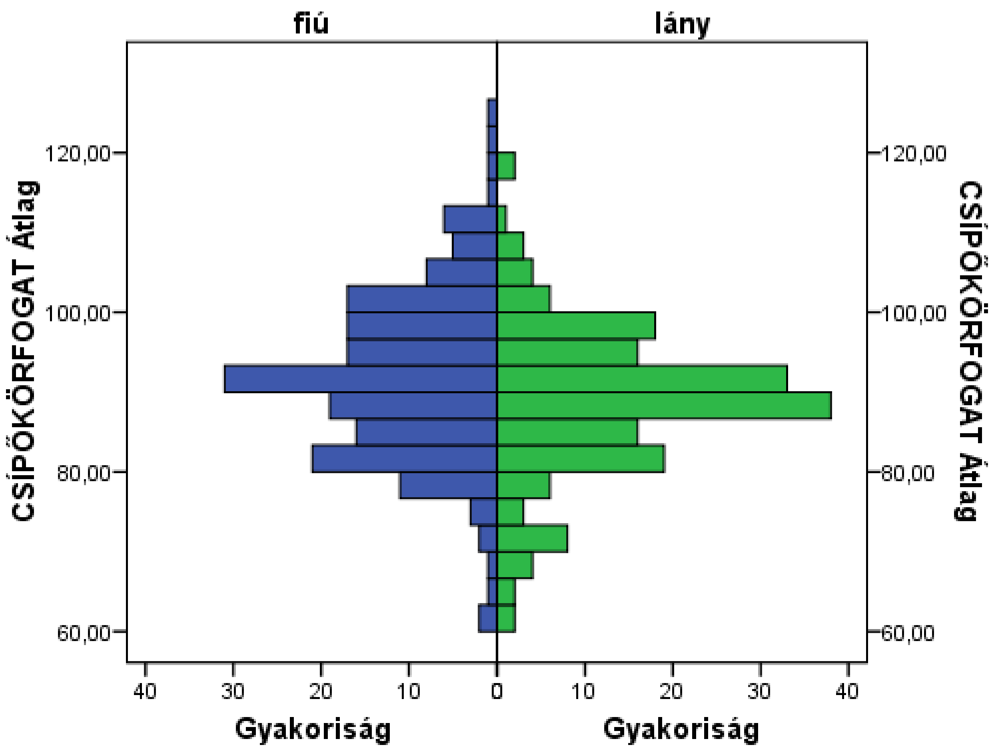
fiú
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CSÍPŐKÖRFOGAT Átlag
120,00
100,00
80,00
60,00
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30
20
10
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Gyakoriság

**Report**

| Páciens neme: | | TESTTÖMEG Átlag | TESTMAGASSÁG Átlag | CSÍPŐ KÖRFOGAT Átlag | DERÉK KÖRFOGAT Átlag | Csípőkörfogat /derékkörfogat |
|---|---|---|---|---|---|---|
| fiú | N | 181 | 181 | 181 | 181 | 181 |
| | Mean | 75.6972 | 178.8398 | 91.4751 | 86.0000 | 1.0717 |
| | Std. Deviation | 13.81377 | 7.26879 | 10.68622 | 10.50926 | .12710 |
| | Minimum | 50.00 | 158.00 | 61.00 | 65.00 | .74 |
| | Maximum | 129.00 | 201.00 | 126.00 | 121.00 | 1.42 |
| lány | N | 181 | 181 | 181 | 181 | 181 |
| | Mean | 59.7845 | 167.6133 | 88.6519 | 74.0000 | 1.2152 |
| | Std. Deviation | 8.09204 | 5.58914 | 9.75109 | 8.74960 | .18609 |
| | Minimum | 46.00 | 152.00 | 62.00 | 60.00 | .68 |
| | Maximum | 92.00 | 181.00 | 119.00 | 105.00 | 1.51 |
| Total | N | 362 | 362 | 362 | 362 | 362 |
| | Mean | 67.7409 | 173.2265 | 90.0635 | 80.0000 | 1.1434 |
| | Std. Deviation | 13.83021 | 8.57417 | 10.31250 | 11.37281 | .17460 |
| | Minimum | 46.00 | 152.00 | 61.00 | 60.00 | .68 |
| | Maximum | 129.00 | 201.00 | 126.00 | 121.00 | 1.51 |

# Exam results

- The experiences of the first year are positive: the knowledge of the students was found to be satisfactory, and students had a favourable opinion about biostatistics.
- The exam mark from biostatistics was higher for those students who attended „biostatistical calculations" (3.25±1.41) related to those who did not attend it (2.66±1.44).
- We hope that using this method of teaching, biostatistical knowledge of the students will be deeper and they will use it successfully during their study or later in their usual life.

# Exam results

**Biostatistics exam mark, 1st trial * Attended biostatistical calculations? Crosstabulation**

| | | | Attended biostatistical calculations? NO | Attended biostatistical calculations? Yes | Total |
|---|---|---|---|---|---|
| Biostatistics exam mark, 1st trial | 1 | Count | 48 | 63 | 111 |
| | | % within Biostatistics exam mark, 1st trial | 43.2% | 56.8% | 100.0% |
| | 2 | Count | 32 | 57 | 89 |
| | | % within Biostatistics exam mark, 1st trial | 36.0% | 64.0% | 100.0% |
| | 3 | Count | 19 | 80 | 99 |
| | | % within Biostatistics exam mark, 1st trial | 19.2% | 80.8% | 100.0% |
| | 4 | Count | 35 | 88 | 123 |
| | | % within Biostatistics exam mark, 1st trial | 28.5% | 71.5% | 100.0% |
| | 5 | Count | 20 | 96 | 116 |
| | | % within Biostatistics exam mark, 1st trial | 17.2% | 82.8% | 100.0% |
| Total | | Count | 154 | 384 | 538 |
| | | % within Biostatistics exam mark, 1st trial | 28.6% | 71.4% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 25.621[a] | 4 | .000 |
| Likelihood Ratio | 25.772 | 4 | .000 |
| Linear-by-Linear Association | 18.829 | 1 | .000 |
| N of Valid Cases | 538 | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 25.48.

# Exam results

**Group Statistics**

| | Attended biostatistical calculations? | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Biostatistics exam mark, 1st trial | NO | 154 | 2.66 | 1.448 | .117 |
| | Yes | 384 | 3.25 | 1.405 | .072 |

p<0.001, the difference is significant

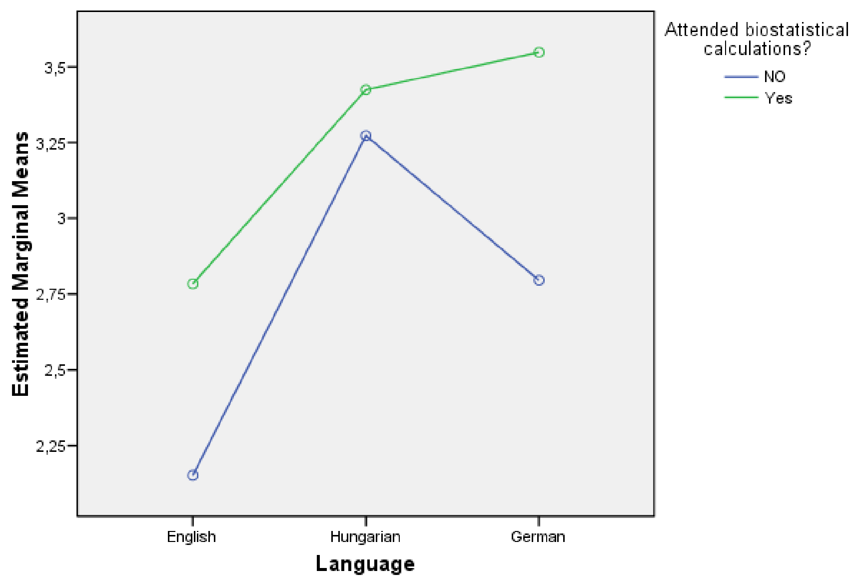
# Exam results

**Descriptive Statistics**

Dependent Variable: Biostatistics exam mark, 1st trial

| Language | Attended biostatistical | Mean | Std. Deviation | N |
|---|---|---|---|---|
| English | NO | 2.15 | 1.361 | 66 |
| | Yes | 2.78 | 1.522 | 111 |
| | Total | 2.55 | 1.492 | 177 |
| Hungarian | NO | 3.27 | 1.353 | 44 |
| | Yes | 3.42 | 1.326 | 231 |
| | Total | 3.40 | 1.329 | 275 |
| German | NO | 2.80 | 1.424 | 44 |
| | Yes | 3.55 | 1.234 | 42 |
| | Total | 3.16 | 1.379 | 86 |
| Total | NO | 2.66 | 1.448 | 154 |
| | Yes | 3.25 | 1.405 | 384 |
| | Total | 3.08 | 1.442 | 538 |

**Estimated Marginal Means of Biostatistics exam mark, 1st trial**




p<0.001, the difference is significant

**Tests of Between-Subjects Effects**

Dependent Variable: Biostatistics exam mark, 1st trial

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 108.390[a] | 5 | 21.678 | 11.441 | .000 |
| Intercept | 3305.381 | 1 | 3305.381 | 1744.488 | .000 |
| Language | 66.204 | 2 | 33.102 | 17.470 | .000 |
| Biostatcalc | 24.134 | 1 | 24.134 | 12.737 | .000 |
| Language * Biostatcalc | 6.539 | 2 | 3.270 | 1.726 | .179 |
| Error | 1008.011 | 532 | 1.895 | | |
| Total | 6226.000 | 538 | | | |
| Corrected Total | 1116.401 | 537 | | | |

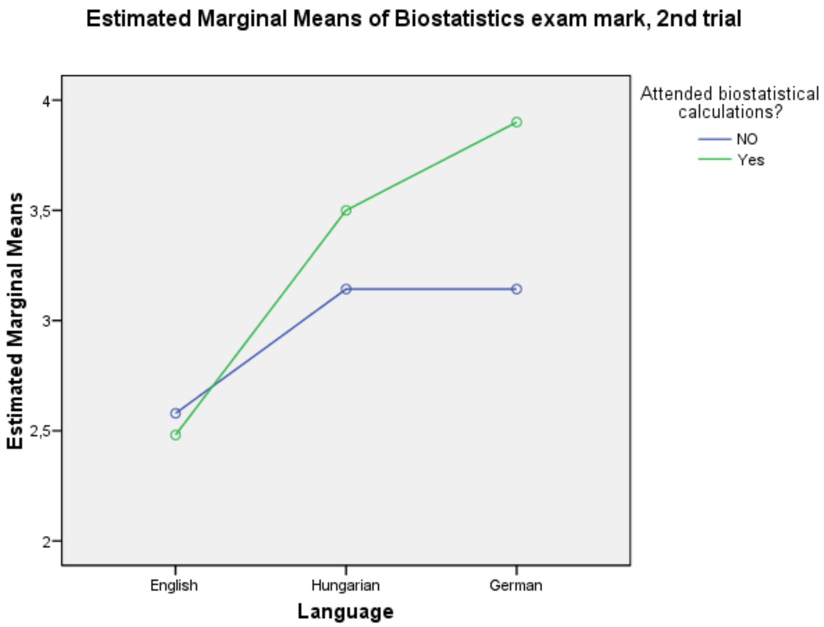
a. R Squared = .097 (Adjusted R Squared = .089)

# Exam results

**Descriptive Statistics**

Dependent Variable: Biostatistics exam mark, 2nd trial

| Language | Attended biostatistical | Mean | Std. Deviation | N |
|---|---|---|---|---|
| English | NO | 2.58 | 1.407 | 38 |
| | Yes | 2.48 | 1.379 | 52 |
| | Total | 2.52 | 1.384 | 90 |
| Hungarian | NO | 3.14 | 1.276 | 21 |
| | Yes | 3.50 | 1.149 | 104 |
| | Total | 3.44 | 1.174 | 125 |
| German | NO | 3.14 | 1.153 | 21 |
| | Yes | 3.90 | .876 | 10 |
| | Total | 3.39 | 1.116 | 31 |
| Total | NO | 2.88 | 1.325 | 80 |
| | Yes | 3.20 | 1.305 | 166 |
| | Total | 3.10 | 1.318 | 246 |




p<0.001, the difference is significant

# Exam results

**Exam trial how many times? * Attended biostatistical calculations? Crosstabulation**

| | | | Attended biostatistical calculations? | | |
|---|---|---|---|---|---|
| | | | NO | Yes | Total |
| Exam trial how many times? | .00 | Count | 0 | 18 | 18 |
| | | % within Exam trial how many times? | .0% | 100.0% | 100.0% |
| | 1.00 | Count | 77 | 218 | 295 |
| | | % within Exam trial how many times? | 26.1% | 73.9% | 100.0% |
| | 2.00 | Count | 65 | 127 | 192 |
| | | % within Exam trial how many times? | 33.9% | 66.1% | 100.0% |
| | 3.00 | Count | 14 | 38 | 52 |
| | | % within Exam trial how many times? | 26.9% | 73.1% | 100.0% |
| | 4.00 | Count | 0 | 1 | 1 |
| | | % within Exam trial how many times? | .0% | 100.0% | 100.0% |
| Total | | Count | 156 | 402 | 558 |
| | | % within Exam trial how many times? | 28.0% | 72.0% | 100.0% |

# Our plans

- Topics remain almost the same
- The exam will be also a test-exam from biostatistics
- Drawback
  - impersonal
  - Students must see erroneous statements
  - Simple mistake in calculation causes fail of the question
  - More difficult to check relationships
- Advantage
  - objective
  - Equal measure for everybody
  - Allows big group of students
  - Relatively small time
  - Less examiner

# Is biostatistics difficult?

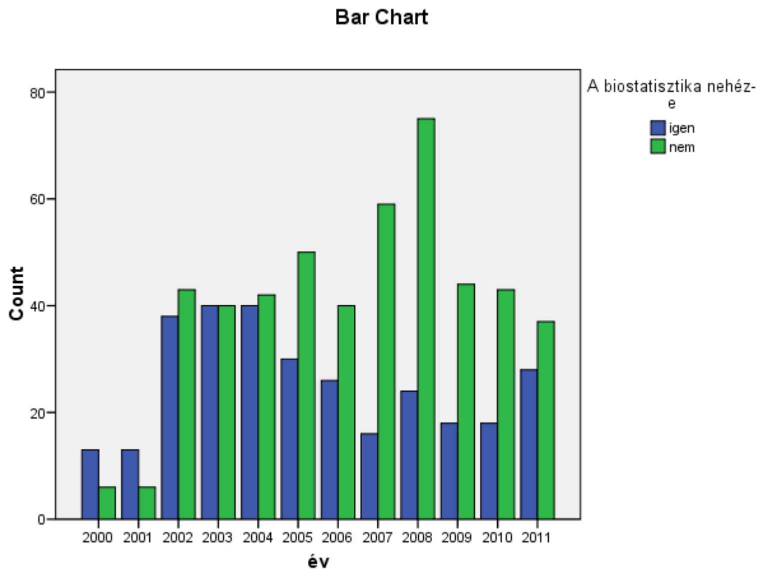
**év * A biostatisztika nehéz-e Crosstabulation**

| | | | A biostatisztika nehéz-e | | Total |
|---|---|---|---|---|---|
| | | | igen | nem | |
| év | 2000 | Count | 13 | 6 | 19 |
| | | % within év | 68.4% | 31.6% | 100.0% |
| | 2001 | Count | 13 | 6 | 19 |
| | | % within év | 68.4% | 31.6% | 100.0% |
| | 2002 | Count | 38 | 43 | 81 |
| | | % within év | 46.9% | 53.1% | 100.0% |
| | 2003 | Count | 40 | 40 | 80 |
| | | % within év | 50.0% | 50.0% | 100.0% |
| | 2004 | Count | 40 | 42 | 82 |
| | | % within év | 48.8% | 51.2% | 100.0% |
| | 2005 | Count | 30 | 50 | 80 |
| | | % within év | 37.5% | 62.5% | 100.0% |
| | 2006 | Count | 26 | 40 | 66 |
| | | % within év | 39.4% | 60.6% | 100.0% |
| | 2007 | Count | 16 | 59 | 75 |
| | | % within év | 21.3% | 78.7% | 100.0% |
| | 2008 | Count | 24 | 75 | 99 |
| | | % within év | 24.2% | 75.8% | 100.0% |
| | 2009 | Count | 18 | 44 | 62 |
| | | % within év | 29.0% | 71.0% | 100.0% |
| | 2010 | Count | 18 | 43 | 61 |
| | | % within év | 29.5% | 70.5% | 100.0% |
| | 2011 | Count | 28 | 37 | 65 |
| | | % within év | 43.1% | 56.9% | 100.0% |
| Total | | Count | 304 | 485 | 789 |
| | | % within év | 38.5% | 61.5% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 47.800[a] | 11 | .000 |
| Likelihood Ratio | 48.643 | 11 | .000 |
| Linear-by-Linear Association | 23.207 | 1 | .000 |
| N of Valid Cases | 789 | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.32.



# Is biostatistics necessary?

**év * A biostatisztika szükséges-e Crosstabulation**

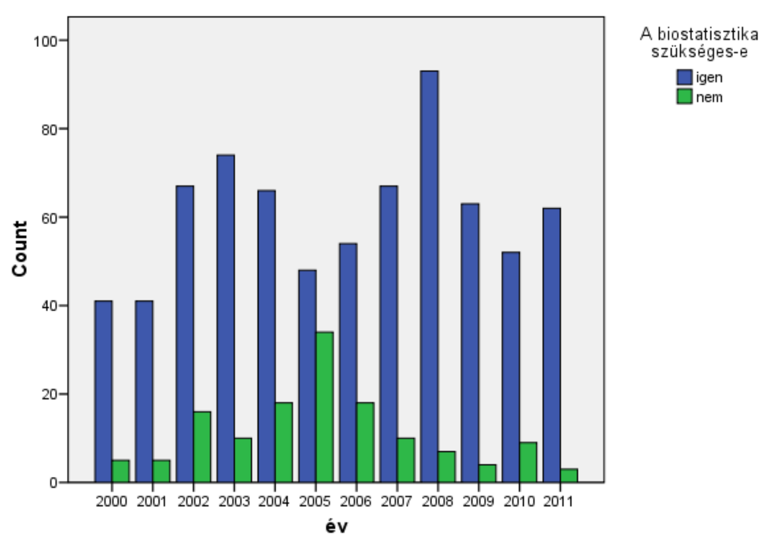
| | | | A biostatisztika szükséges-e | | Total |
|---|---|---|---|---|---|
| | | | igen | nem | |
| év | 2000 | Count | 41 | 5 | 46 |
| | | % within év | 89.1% | 10.9% | 100.0% |
| | 2001 | Count | 41 | 5 | 46 |
| | | % within év | 89.1% | 10.9% | 100.0% |
| | 2002 | Count | 67 | 16 | 83 |
| | | % within év | 80.7% | 19.3% | 100.0% |
| | 2003 | Count | 74 | 10 | 84 |
| | | % within év | 88.1% | 11.9% | 100.0% |
| | 2004 | Count | 66 | 18 | 84 |
| | | % within év | 78.6% | 21.4% | 100.0% |
| | 2005 | Count | 48 | 34 | 82 |
| | | % within év | 58.5% | 41.5% | 100.0% |
| | 2006 | Count | 54 | 18 | 72 |
| | | % within év | 75.0% | 25.0% | 100.0% |
| | 2007 | Count | 67 | 10 | 77 |
| | | % within év | 87.0% | 13.0% | 100.0% |
| | 2008 | Count | 93 | 7 | 100 |
| | | % within év | 93.0% | 7.0% | 100.0% |
| | 2009 | Count | 63 | 4 | 67 |
| | | % within év | 94.0% | 6.0% | 100.0% |
| | 2010 | Count | 52 | 9 | 61 |
| | | % within év | 85.2% | 14.8% | 100.0% |
| | 2011 | Count | 62 | 3 | 65 |
| | | % within év | 95.4% | 4.6% | 100.0% |
| Total | | Count | 728 | 139 | 867 |
| | | % within év | 84.0% | 16.0% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 67.044[a] | 11 | .000 |
| Likelihood Ratio | 61.962 | 11 | .000 |
| Linear-by-Linear Association | 6.034 | 1 | .014 |
| N of Valid Cases | 867 | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.37.

**Bar Chart**



# Is biostatistics interesting?

**év * A biostatisztika érdekes-e Crosstabulation**

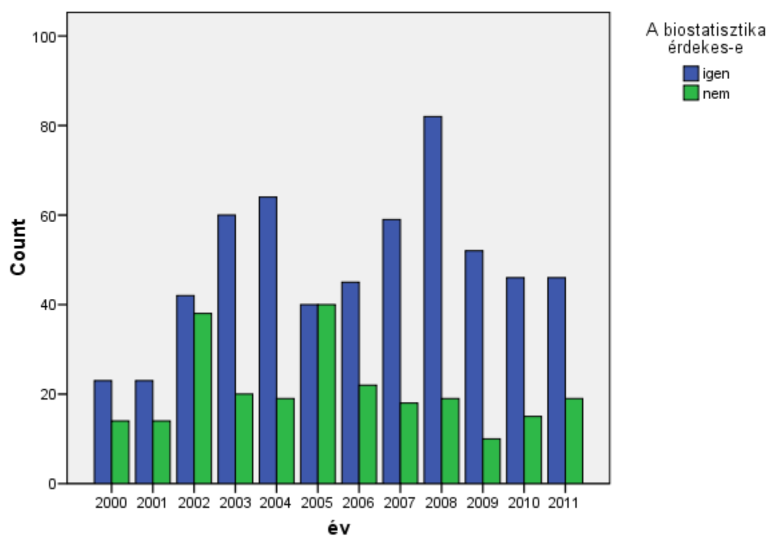
| | | | A biostatisztika érdekes-e | | Total |
|---|---|---|---|---|---|
| | | | igen | nem | |
| év | 2000 | Count | 23 | 14 | 37 |
| | | % within év | 62.2% | 37.8% | 100.0% |
| | 2001 | Count | 23 | 14 | 37 |
| | | % within év | 62.2% | 37.8% | 100.0% |
| | 2002 | Count | 42 | 38 | 80 |
| | | % within év | 52.5% | 47.5% | 100.0% |
| | 2003 | Count | 60 | 20 | 80 |
| | | % within év | 75.0% | 25.0% | 100.0% |
| | 2004 | Count | 64 | 19 | 83 |
| | | % within év | 77.1% | 22.9% | 100.0% |
| | 2005 | Count | 40 | 40 | 80 |
| | | % within év | 50.0% | 50.0% | 100.0% |
| | 2006 | Count | 45 | 22 | 67 |
| | | % within év | 67.2% | 32.8% | 100.0% |
| | 2007 | Count | 59 | 18 | 77 |
| | | % within év | 76.6% | 23.4% | 100.0% |
| | 2008 | Count | 82 | 19 | 101 |
| | | % within év | 81.2% | 18.8% | 100.0% |
| | 2009 | Count | 52 | 10 | 62 |
| | | % within év | 83.9% | 16.1% | 100.0% |
| | 2010 | Count | 46 | 15 | 61 |
| | | % within év | 75.4% | 24.6% | 100.0% |
| | 2011 | Count | 46 | 19 | 65 |
| | | % within év | 70.8% | 29.2% | 100.0% |
| Total | | Count | 582 | 248 | 830 |
| | | % within év | 70.1% | 29.9% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 46.555[a] | 11 | .000 |
| Likelihood Ratio | 45.678 | 11 | .000 |
| Linear-by-Linear Association | 12.886 | 1 | .000 |
| N of Valid Cases | 830 | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.06.

**Bar Chart**



# Are you pleased to use SPSS on the practicals?

**év * Örül-e a szoftver megismerésének Crosstabulation**

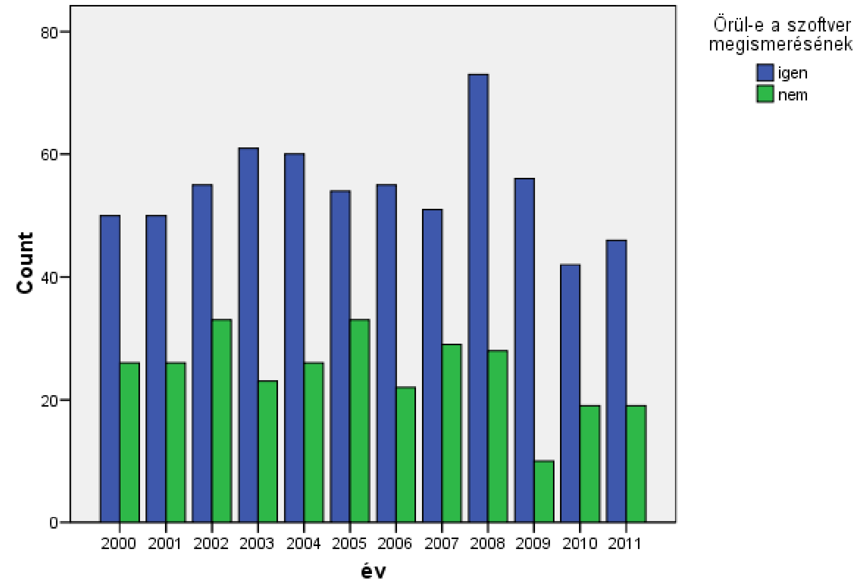
| | | | Örül-e a szoftver megismerésének | | |
|---|---|---|---|---|---|
| | | | igen | nem | Total |
| év | 2000 | Count | 50 | 26 | 76 |
| | | % within év | 65.8% | 34.2% | 100.0% |
| | 2001 | Count | 50 | 26 | 76 |
| | | % within év | 65.8% | 34.2% | 100.0% |
| | 2002 | Count | 55 | 33 | 88 |
| | | % within év | 62.5% | 37.5% | 100.0% |
| | 2003 | Count | 61 | 23 | 84 |
| | | % within év | 72.6% | 27.4% | 100.0% |
| | 2004 | Count | 60 | 26 | 86 |
| | | % within év | 69.8% | 30.2% | 100.0% |
| | 2005 | Count | 54 | 33 | 87 |
| | | % within év | 62.1% | 37.9% | 100.0% |
| | 2006 | Count | 55 | 22 | 77 |
| | | % within év | 71.4% | 28.6% | 100.0% |
| | 2007 | Count | 51 | 29 | 80 |
| | | % within év | 63.8% | 36.3% | 100.0% |
| | 2008 | Count | 73 | 28 | 101 |
| | | % within év | 72.3% | 27.7% | 100.0% |
| | 2009 | Count | 56 | 10 | 66 |
| | | % within év | 84.8% | 15.2% | 100.0% |
| | 2010 | Count | 42 | 19 | 61 |
| | | % within év | 68.9% | 31.1% | 100.0% |
| | 2011 | Count | 46 | 19 | 65 |
| | | % within év | 70.8% | 29.2% | 100.0% |
| Total | | Count | 653 | 294 | 947 |
| | | % within év | 69.0% | 31.0% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 14.546[a] | 11 | .204 |
| Likelihood Ratio | 15.505 | 11 | .161 |
| Linear-by-Linear Association | 3.162 | 1 | .075 |
| N of Valid Cases | 947 | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.94.

**Bar Chart**



# What statistical software do you know?

**melyeket**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 884 | 92.3 | 92.3 | 92.3 |
| | dBaseIII, IV, V, Excel | 1 | .1 | .1 | 92.4 |
| | DOS, Norton Commander, Windows | 1 | .1 | .1 | 92.5 |
| | DOS, Windows | 1 | .1 | .1 | 92.6 |
| | Excel | 17 | 1.8 | 1.8 | 94.4 |
| | EXCEL | 1 | .1 | .1 | 94.5 |
| | Excel, SPSS | 1 | .1 | .1 | 94.6 |
| | Excel, Statistic-For, Windows | 1 | .1 | .1 | 94.7 |
| | Excel, Windows, Worl1 | 1 | .1 | .1 | 94.8 |
| | Excel, Word | 1 | .1 | .1 | 94.9 |
| | Excel, Word, Paint, Power Poin | 1 | .1 | .1 | 95.0 |
| | Excel, World | 1 | .1 | .1 | 95.1 |
| | EXCEL, WORLD | 1 | .1 | .1 | 95.2 |
| | Excel; dBase | 2 | .2 | .2 | 95.4 |
| | exel,word | 1 | .1 | .1 | 95.5 |
| | Mathelica, EXCEL, Word | 1 | .1 | .1 | 95.6 |
| | mathematic | 1 | .1 | .1 | 95.7 |
| | Microcoft | 1 | .1 | .1 | 95.8 |
| | Ministat | 1 | .1 | .1 | 95.9 |
| | MS Statistic | 1 | .1 | .1 | 96.0 |
| | NC, DOS, Windows | 1 | .1 | .1 | 96.1 |
| | Office meg ilyenek. | 1 | .1 | .1 | 96.2 |
| | Qvakc 3; Medal of Havor Us Off | 1 | .1 | .1 | 96.3 |
| | SAS | 3 | .3 | .3 | 96.7 |
| | SPSS | 12 | 1.3 | 1.3 | 97.9 |
| | SPSS, | 1 | .1 | .1 | 98.0 |
| | SPSS, EXCEL | 2 | .2 | .2 | 98.2 |
| | SPSS, SAS | 1 | .1 | .1 | 98.3 |
| | SPSS,Mathlab, Excell | 1 | .1 | .1 | 98.4 |
| | szövegszerkesztő, stratégia1, | 1 | .1 | .1 | 98.5 |
| | Windows | 5 | .5 | .5 | 99.1 |
| | Windows XP | 1 | .1 | .1 | 99.2 |
| | Windows, DOS | 2 | .2 | .2 | 99.4 |
| | Windows, Novell | 2 | .2 | .2 | 99.6 |
| | Windows; Word; Power Point; Ma | 1 | .1 | .1 | 99.7 |
| | Word; Excel | 2 | .2 | .2 | 99.9 |
| | WORLD, EXCEL | 1 | .1 | .1 | 100.0 |
| | Total | 958 | 100.0 | 100.0 | |

# Summary

- Teaching biostatistics during 4 months (instead two months) made possible to slightly expand the topics.
- On the practicals besides of some manual calculations, mainly the use and interpretation of a software was studied
- The data files were highly related to the physics practicals: measurements made on physics practicals were used on biostatistics lessons
- The exam consists also from two parts: failing biostatistics means failing the whole subject as well -> biostatistics has a greater respect.

„If had only one day left to live, I would live it in my statistics class: it would seem so much longer."

(http://davidmlane.com/hyperstat/humorf.html)