
Some advanced biostatistics Programs Public Health

Prof. Dr. Salem Al-Wosabi
Prof. of Pure Mathematics
Hodeidah University-Yemen

Introductory Lecture Points:

- ✓ Introduction to Statistics and Its Importance in Scientific Research
 - ✓ The Importance of Statistical Software in Scientific Research
 - ✓ Some Types of Statistical Software and Their properties.
 - ✓ Developments in Statistical Software in Scientific Research.
 - ✓ Challenges and Barriers Faced by Researchers When Using Statistical Software
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Statistics and Its Importance in Scientific Research

In this lecture, we will discuss the vital role that statistics plays in scientific research and the importance of statistical software as modern tools and techniques that fundamentally and centrally assist researchers in the field of scientific research.

This includes study and experiment design, data collection and analysis, and obtaining accurate, reliable scientific results with the ability to interpret these results. We will review the most significant developments in these programs and how they have positively impacted the quality and efficiency of scientific research.

Additionally, we will address the key challenges researchers face when using these programs and the possibilities for overcoming them.

Statistics and Its Importance in Scientific Research

Introduction:

Statistics is a branch of mathematics that serves as the backbone of scientific research. It provides tools and methodologies that enable researchers to:

- ✓ Collect, summarize, and analyze data.
- ✓ Derive conclusions and interpret results systematically and accurately.

Through statistics, raw data can be transformed into valuable information, assisting in understanding phenomena and making informed decisions.

Statistics and Its Importance in Scientific Research

So, the Statistics is concerned with:

- **Data Collection**
- **Data Presentation**
- **Data Summarization**
- **Data Analysis**

This ensures scientifically accurate results, leading to sound and appropriate decisions.

The Importance of Statistics in Scientific Research

1. Data Collection and Presentation (Experimental Design):

- ✓ Assists in systematically designing studies to ensure the collection of accurate and reliable data.
- ✓ Helps determine the appropriate sample size and design questionnaires that minimize bias.

2. Organizing and Summarizing Data:

- ✓ Classifies and arranges data to facilitate later analysis.
 - ✓ Employs techniques like encoding and categorization to simplify data for analysis.
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The Importance of Statistics in Scientific Research

3. Data Analysis:

- **Descriptive Analysis:**

- ✓ Provides numerical and visual summaries such as averages, standard deviations, and charts.
- ✓ Helps researchers understand data distributions and general trends.

- **Inferential Analysis:**

- ✓ Tests hypotheses and determines relationships between variables using statistical tests such as ANOVA and t-tests.
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The Importance of Statistics in Scientific Research

4. Predictive and Quantitative Analysis:

- ✓ Uses statistical models to assess relationships and predict future values based on current data.
- ✓ Assists researchers in interpreting results and making data-driven recommendations.

5. Ensuring Validity and Reliability:

- ✓ Ensures research tools measure what they are intended to (validity).
 - ✓ Confirms consistency of results across repetitions (reliability).
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Importance Statistical Software for Researchers

Statistical software is a vital tool in scientific research, enabling advanced and accurate data analyses that enhance the quality and reliability of research outcomes.

1. Simplifying Data Analysis:

- ✓ Automates complex calculations that would be time-consuming manually.
- ✓ Reduces errors associated with manual data processing.

2. Providing Analytical Tools and Diverse Statistical Methods:

- ✓ Offers a wide range of statistical tests and methods, including variance analysis, regression models, and parametric/non-parametric tests.
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Importance Statistical Software for Researchers

3. Enhancing Research Accuracy and Reliability:

- ✓ Validates hypotheses and survey reliability systematically and accurately.

4. Handling Large and Complex Data Sets:

- ✓ Facilitates the analysis of multi-dimensional and intricate data that traditional methods struggle with.

5. Improving Research Efficiency and Collaboration:

- ✓ Unifies methodologies and simplifies sharing data, analyses, and results among researchers.
- ✓ Enhances collaboration through visual and statistical tools like interactive tables and charts.

Some Types of Statistical Software

Statistical software facilitates efficient and accurate analysis across various research fields. Below are some popular programs:

1. SPSS (Statistical Package for the Social Sciences)

- ✓ **Features:** Used for data analysis in various sciences and market research. It offers a user-friendly interface, robust statistical analysis tools, and a variety of reporting options.
 - ✓ **Applications:** Comprehensive analytics, Advanced statistics, regression analysis, ANOVA, and factor analysis.
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Some Types of Statistical Software

3. R Programming:

- ✓ **Features:** Open-source, highly customizable, supports complex calculations, and data visualization.
- ✓ **Usage:** Academic research, machine learning, big data analysis.

4. SAS (Statistical Analysis System):

- ✓ **Features:** Comprehensive analytics, strong data management, predictive modeling.
 - ✓ **Usage:** Business analytics, agriculture, health sciences.
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Some Types of Statistical Software

4. Stata:

- **Features:** Focused on regression, time series, and survival analysis with flexible data management.
- **Usage:** Economics, sociology, public health.

5. Minitab:

- **Features:** Quality control, statistical process improvement, intuitive interface.
- **Usage:** Manufacturing, engineering, quality assurance.

6. Excel:

- **Features:** Widely available, basic statistical tools, integration with other applications.
- **Usage:** Entry-level statistical analysis, business reporting.

Some Types of Statistical Software

7. MedCalc:

- **Features:** Designed for medical research, ROC curve analysis, survival analysis, sample size estimation.
- **Usage:** Epidemiology, clinical trials, medical statistics.

8. GraphPad Prism:

- **Features:** Intuitive interface, regression models, ANOVA tools.
 - **Usage:** Biomedical research, pharmacology, life sciences.
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Some Types of Statistical Software

9. Epi Info:

- ❖ **Features:** Free software, survey design, basic and advanced statistical tools.
- ❖ **Usage:** Epidemiological studies, field research, public health surveillance.

10. Python:

- **Features:** Versatile, open-source, supports machine learning, high-quality visualizations.
- **Usage:** Big data, computational biology, AI research.

Some Types of Statistical Software

11. [JMP](#)

- **Features:** A software developed by SAS Institute for interactive visual data analysis. It is particularly known for its dynamic modeling and graphing capabilities.
- **Applications:** Quality improvement, industrial research, and experimental design.

12. [OriginLab](#)

- **Features:** Used for scientific graphing and data analysis. It supports both linear and nonlinear curve fitting, statistical analysis, and 3D graphing.
- **Applications:** Engineering, physics, and life sciences research.

Some Types of Statistical Software

13. [BMDP](#)

- **Features:** A statistical software system that provides a wide range of statistical methods for data analysis, particularly for biostatistics and epidemiology.
- **Applications:** Biostatistics, epidemiology, and psychological research.

14. [CompuSyn](#)

- **Features:** A software used for analysis of drug interaction, particularly in pharmacology. It is used to calculate combination index and dose-response curves.
- **Applications:** Drug synergy analysis and pharmacological modeling.

Some Types of Statistical Software

15. PowerMarker

- **Features:** A statistical tool for analysis of genetic data, specifically for marker-assisted selection and genetic diversity analysis.
- **Applications:** Plant and animal breeding, genetic mapping, and population genetics.

16. PopGene

- **Features:** A tool for population genetic analysis. It is used to compute basic genetic diversity indices and for the analysis of molecular markers.
- **Applications:** Genetic diversity analysis in populations.

Modern Developments in Statistical Software

1. Enhanced Interfaces:

- ❖ Intuitive user-friendly designs and interactive tools for data entry and analysis.

2. Big Data Integration:

- ❖ Improved capabilities for handling large datasets and integrating with cloud computing.

3. AI and Machine Learning Integration:

- Incorporates predictive algorithms and advanced analytical tools for improved accuracy.

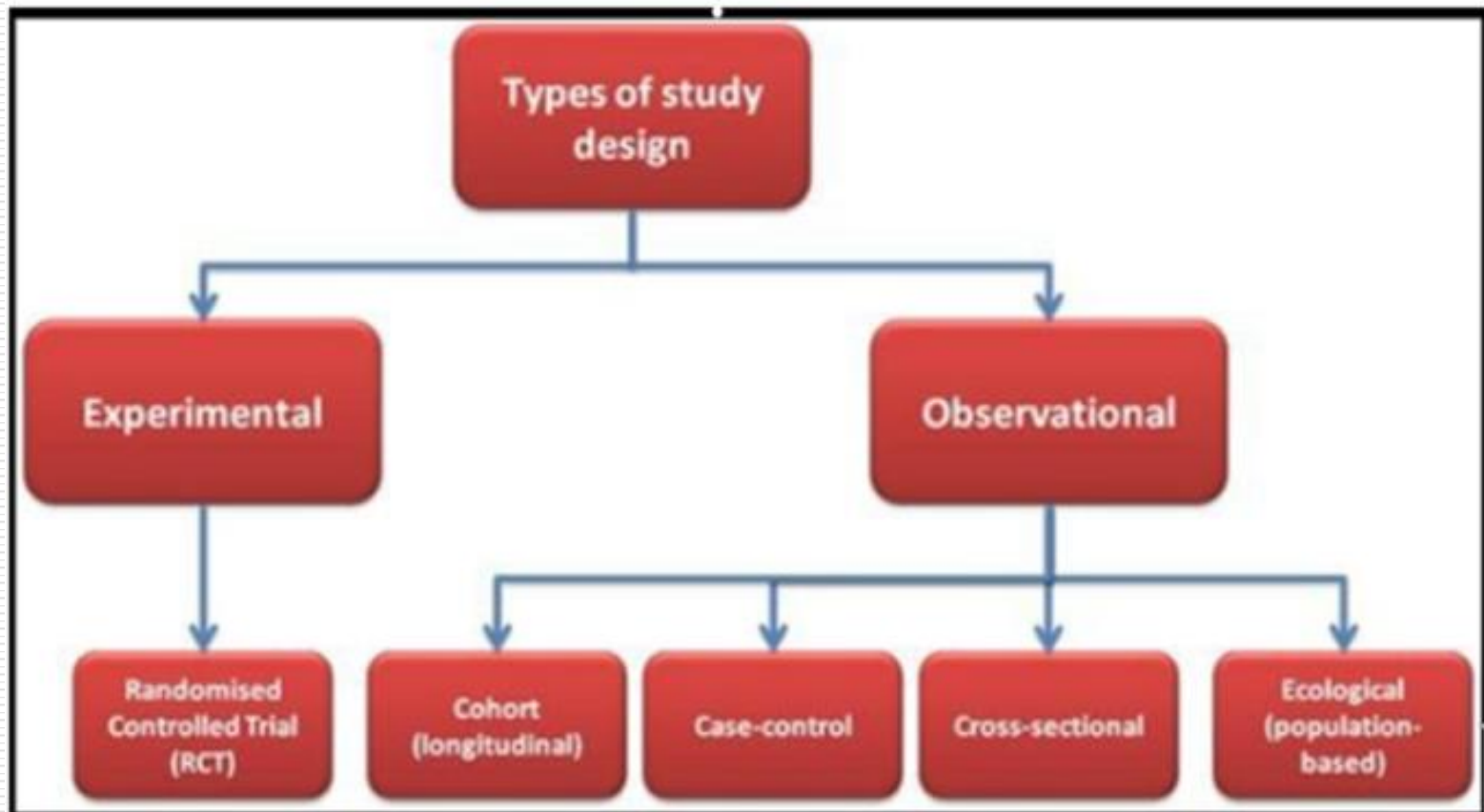
4. Open Source and Community Support:

- Tools like R and Python are constantly evolving through large, active user communities.

Some challenges facing researchers

- Limited technical expertise in advanced software features.
 - High costs associated with licensed software.
 - Difficulties managing large datasets effectively.
 - Language barriers in software documentation.
 - Lack of training opportunities in specialized tools.
 - Integration challenges with other platforms or data sources.
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Index: The types of medical and health studies



Index: The types of medical and health studies

من أنواع الدراسات الطبية والصحية

الدراسات الثانوية



الدراسات الثانوية فتشمل:

- مراجعة مجموعة كبيرة من الدراسات الأولية وجمعها وفحصها ومقارنتها للحصول على نتائج أشمل وأدق.

ومن أنواعها:

- المراجعة البحثية (reviews)
- تحليل ميتا (Meta analyses).

الدراسات الأولية



الدراسات الأولية، وتشمل ثلاثة أنواع:

- الدراسات الأساسية
(basic medical study)
- الدراسات السريرية
(clinical study).
- الدراسات الوبائية
(epidemiological study)



Thank you for all..
