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DEVELOPMENT OF STATISTICAL PROCESSING IN SCIENTIFIC AND CLINICAL RESEARCH

Mamatkhanova Gulnora Makhmudovna
Fergana Medical Institute of Public Health, Senior Lecturer, PhD

Abstract
This article provides a comprehensive analysis of the historical formation, stepwise development, current methodological foundations, and future directions of statistical methods in medical and clinical research, including integration with artificial intelligence. The evolutionary path from the historical roots of biostatistics to modern meta-analysis, randomization and machine learning is consistently demonstrated.

Keywords: biostatistics, randomization, meta-analysis, systematic review, evidence-based medicine, correlation, regression, p-value, confidence interval, Cochrane, RCT, machine learning, descriptive statistics, hypothesis testing, sample size

Introduction

Statistical methods modern medical science language and without them, as a basis clinical the results objective evaluation, hypotheses test and population level conclusions release possible not. However this situation historically slowly, two from the century more than within the period In the 19th century, Karl Pearson, Ronald Fisher and William Gosset works because of appearance was first statistic instruments of the 20th century between come clinical to research moved ; in 1948 held first randomized clinical from the test after statistics scientific medicine central on top of Today 's PubMed data per day " meta-analysis " query in the database by 2023 More than 30,000 people arrived publication will be found. In 2025 health storage in the field artificial to the intellect dedicated scientific affairs number 49,394 reach, by 2024 relatively almost two even increased. These numbers statistic methodology in medicine intense from developing evidence gives and his/her history, stages and prospects systematic statement to grow necessity further strengthens.

Literature Comment

Biostatistics founders When it comes to, the most primarily the work of Carl Pearson (1857–1936) remember falls : it was in 1893 average quadratic deviation and variation coefficient current made in 1898 and many variable regression the basics created. Fleiss JL and Cohen J. (1973) scientific compromise kappa coefficient, which measures medical to research implementation diagnostic statistics industry to a new level take Sackett DL and others (1996) in the fundamental manual "Evidence-based Medicine" to the evidence based medicine five main step described - this work clinical statistics optional from the method mandatory to the standard Moher D., Liberati A. and co-authors (2009) PRISMA protocol announcement systematically comments and meta-analyses report Dedov II and Shestakova MV (2019) Russian to the language customized biostatistics in the manual

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danger ratio, confidence interval and NGO indicators clinical to practice current in the process of important contribution added.

Main Part

Statistics to medicine The beginning of the 19th century from the middle started. To the numbers based medical from the first examples of observation one as plague epidemic during John Snow (1854) The spread of disease in London map compiled, epidemiological statistics the foundation put it. Later Florence Nightingale (1857) military hospital death statistics graphic in the form presented Good health storage in the system statistic to the information based decision acceptance to do first sample created in the 19th century at the end Karl Pearson correlation, regression and chi-square test invention did ; William Gosset invented the Student t-test in 1908. working came out - this test is still clinical in research the most many used from methods one. Ronald Fisher in 1925 dispersion analysis of variance (ANOVA) and random choice principle confirming, modern experimental design basis created.

20th century middle clinical research in the methodology turn It was a turning point. 1948 in February British by Dr. Austin Bradford Hill tuberculosis to the disease against streptomycin efficiency assessment for held first randomized clinical test (RCT) modern clinical statistics birth date is considered. Randomization principle of groups comparability provide and selection mistakes minimize for statistic basis as This discovery was confirmed. clinical statistics in development paradigm exchange by designating gave: from this since scientific hypothesis not only observation, maybe control made experiment based on test It was necessary. In the 1970s and 1980s Archie Cochrane (1972) in his famous “Efficiency and technology: health storage according to random in "Reflections" clinical research the results systematize generalization necessity This idea was first proposed in 1993. his/her in honor of named international Cochrane of cooperation organization to be completed take came - this organization current more than 40,000 per day the scientist combined without medical of knowledge reliable warehouse - systematic comments base shaping is coming.

Modern clinical statistics one how many independent, but mutual related directions cover takes. Descriptive statistics the most main layer, data collection general descriptive indicators - average value, median, standard deviation, quartiles - via presented Without this step, any next analysis becomes meaningless. The hypothesis try t-test, Mann–Whitney U-test, chi-square, ANOVA and their nonparametric alternatives clinical in groups the differences measurement for main are instruments. p-value concept - 0.05 threshold with - 20th century clinical since the middle of of articles standard has been part of. However, in the last decade p-value only criterion as use sharp criticism under taken and confidence interval and effect size (Cohen's d, odds ratio, NNT) calculation mandatory is being calculated. Correlation and regression analysis. Pearson, Spearman correlation coefficients two variable between statistic contact measures. Logistics regression binary results for (danger factors on the likelihood of disease impact, many variable regression and one how many of factors joint the impact assessment for used. Meta-analysis and systematic Commentary. By Gene Glass in 1976 current The term "meta-analysis" was used many similar of research statistic synthesis means. GRADE system using evidence reliability level is evaluated using a funnel plot publishing house publication bias is determined. Today on the day meta-analysis and systematic comments evidence hierarchy the most high on the step stands.

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Results

Statistical methodology development analysis following important the results showed. Quality level increase. According to PubMed data according to, the last 20 years inside meta-analysis, systematic comment and RKT publications annual growth pace all other publication of the types high. This trend clinical low quality of the community observation from research high level experimental to designs the passage shows.

Report standards CONSORT (for RCTs), PRISMA (for meta-analysis) for), STROBE (tracking research for), TRIPOD+AI (artificial intellect models for, 2024) as international standards clinical statistics transparent, repetitive and report giver to the point brought. In 2024 announcement TRIPOD+AI protocol made artificial intellect based on clinical research for methodological the rules first times standardized. Machined of learning enter coming. In 2025 health storage in the field modern to cars related mature scientific publications number by 2024 relatively almost two even increased to 2,966 reached. Deep Deep Learning models radiology, oncology and in pathology images analysis in doing clinical experts with to compete able to accuracy to the level Multimodal Foundation Models are expected to be implemented by 2024. 5 times more in 2025 compared to increasingly, clinically that a new era is beginning in practice Real world data (RWD) of place. 2019–2021 by the FDA among 31 % of new drugs approved have real- world information (electronic health storage records, registers) evidence as used. This indicator clinical from laboratory tests of statistics to real populations to the analyses expanding from going evidence gives.

Discussion

Statistical methodology development no when human of your mind only technician exercise not - he is a new medical doctor every time necessities to the surface new methods when it comes demand The first RKT was established in 1948. tuberculosis disease treatment reliable the way find necessity gave birth to ; meta-analysis methodology In the 1970s many small of tests opposite the results generalization problem appearance when formed ; modern with car study and medical information size human power from the border exceed departure as a result It has become a necessity. Today on the day biostatistics in the field two main problem The first is the p-value. only criterion as lean problem. Many famous journals, including The American Statistician (2019), set the $p < 0.05$ threshold too much more attention of focus scientific to the results damage to deliver open announcement did. Effect size, practical importance and confidence interval such as indicators from p-value less not, maybe often even more important that clinical researchers by realizing The second is artificial. intellect models results in the interpretation transparency problem. TRIPOD+AI standard appearance to be this on the road important step although, clinical of AI predictions in the environment interpretation still not standardized. Uzbekistan and Central Asia in the region this of the matter additional relevance there is: local medical in education biostatistics as a special science enough is not taught, this and clinical research to the quality directly impact Medicine in institutes biostatistics and research methodology independent course as current to grow regional scientific potential in increasing important step will be.

Medical and clinical in research statistic processing of giving development two century-old the way pressing past - descriptive from statistics randomized clinical trials, meta-analysis and artificial to the intellect based analysis to methods. Each stage medicine in front of new problems that arise solution

find out of necessity born. Modern biostatistics to the evidence based medicine basis, clinical of decisions objective support and scientific of knowledge reliability provider only remains a mechanism.

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