MedicalBiostatistics.com

Integrated Curriculum of Medical Biostatistics for Medical and Allied Professionals (PG course as part of Research Methodology)

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The course must be renamed as Medical Biostatistics instead of just Biostatistics so that its medical component is highlighted and it is considered as one of the medical subjects instead of an alien mathematical subject. The following curriculum justifies this. Every topic must be supported by examples from contemporary medical literature. Medical exercises can be given wherever the administration is supportive but those are not necessary.

Medical uncertainties: Omni-presence of aleatory and epistemic uncertainties; sources of medical uncertainties; probabilistic nature of all medical decisions (diagnosis, treatment and prognosis)

Evaluation of probabilities: Essential empiricism, need for collection of reliable data, data analytics, medical decisions with the help of simple rules of probability

Qualitative and quantitative measurements: Nominal, ordinal and metric scales of measurement; advantages and pitfalls of categorizing medical measurements into normal and abnormal, and other categories

Presentation of medical data: Features of good tables; graphical presentation in terms of bar, histogram, curve, scatter, pie, line, etc. – where to use which diagram

Normal range of medical parameters: Measure of central values, and why and where we need mean, median and mode; need to assess variation in terms of variance, SD and coefficient of variation; need to explore the statistical distribution of values; elementary kinds of statistical distribution of medical measurements – Gaussian and skewed distributions, and how they affect the mean ± 2SD and other normal ranges; proper interpretation of normal range in the context of patient management

Clinical assessment: Individual assessment in terms of probability using normal range and statistical distribution of medical measurements; combining several measurements by scoring systems; use and misuse of individual and hospital records for patient management

Health surveys: Effect of random and nonrandom selection of the subjects; community assessment in terms of incidence, prevalence, duration of disease and mortality; elements of

health surveys – questionnaires, schedules and proforma – proper recording, training and data entries; random and nonrandom sampling methods

(UG – Demography: Age-sex structure (population pyramid); dependency ratio; mortality and fertility indicators; reference to the need of standardization (no details); causes of death and International Classification of Disease; indicators of health infrastructure; indicators of mental and social health)

Medical studies: Exploratory and descriptive studies; antecedent–outcome relationship in analytical studies; observational (merits and demerits of prospective, retrospective and cross-sectional) studies; medical experiments on biological specimens and animals; phases of clinical trials; controlled and uncontrolled trials; need for randomization, blinding and matching; equivalence and noninferiority trials

Assessment of medical tools: Sensitivity-specificity and predictivity, Bayes rule and the effect of prevalence; ROC curves for overall performance and for best cut-offs

Medical generalizations: Need to go from individual measurements to generalized conclusions; sampling error; standard errors of sample summaries; types of statistical generalizations – the concept of confidence intervals and tests of significance; philosophical basis of statistical inference – null and alternative hypotheses, Type I and Type II errors and need to control them; statistical power and sample size

Estimations of medical values: Point and interval estimates of means, proportions and differences

Assessment of risk factors for medical outcomes: Relative (RR) and attributable risks (AR); odds ratio (OR); differences and similarities between the two; where to use which

Comparison of two treatment modalities: Comparison of means of quantitative measurements (Student t-test, Gaussian conditions, and reference to nonparametric tests); comparison of efficacies (proportions) by chi-square test; comparison with RR, AR and OR; comparison with number needed to treat; bioequivalence and area under the concentration curve

Relationship between two medical measurements: Simple linear regression and correlation for quantitative measurements; use in explaining and prediction; criteria for causal inference

Further topics: Mention (no details) of – ANOVA for comparison of means in three or more groups, chi-square test for qualitative data, difference-in-differences approach, logistic regression, multiple regression, multivariate methods, survival analysis, etc.