Proposal from the Indian Society for Medical Statistics for
Central Council of Indian Medicine (for Ayurveda Education)
Teaching of Biostatistics, Health Statistics, Medical Statistics, Demography, Informatics, etc.

Undergraduate (BAMS) Curriculum of Biostatistics, Health Statistics, Medical Statistics, Demography, Informatics, etc.	
Syllabus of Ayurvedacharya (BAMS) Extracts from the existing Regulations – Latest available on their website	**Proposed by the Indian Society for Medical Statistics NOT SEEKING ANY INCREASE IN TEACHING – ONLY MORE MEDICAL FOCUS**
3rd year: Paper II- Part B **Health statistics-** Definition, Sources, Uses: Data collection, Classification, Presentation. Vital statistics: Morbidity rates, Mortality rates, Fertility rates. **Health survey-** Proformas for case sheets/practical records/survey/Dinacharya projects etc should be prepared by the respective universities. **4th year:** **4.5 Research Methodology and Medical Statistics – Total marks 50 (Part A-30, Part B-20)** **Part – A: Research Methodology** 4. Types of Research (familiarization of the terms):a) Pure and Applied; b) Qualitative , Quantitative and Mixed; c)Observational and interventional. 5. Research process (Importance of each steps in brief): a. Selection of the topic, b. Review of the literature, c. Formulation of hypothesis, d. Aims and objectives, e. Materials and methods, f. Observations and results, g. Methods of communication of research 6. Research tools – Role of the pramanas as research tools 7. The concept and importance of ethics in research 8. Concept of evidence based medicine and scientific writing 9. Importance of IT in data mining and important research data portals concerned with Ayurved and contemporary medical science (DHARA , PubMed, Ayush Research Portal, Bioinformatics Center, Research Management Information System etc.) **Part – B: Medical-Statistics** 1. Definition, scope and importance of the Medical Statistics 2. Common statistical terms and notations: a. Population, b. Sample, c. Data, d. Variable, e. Normal distribution 3. Collection and presentation of data: a. Tabular, b. Graphical, c. Diagrammatical 4. Measures of location: a. Average, b. Percentile, c. Measures of central tendency:	**3rd year: Paper II- Part B** **NO CHANGE REQUIRED** **4th year:** **4.5 Research Methodology and Medical Statistics – Total marks 50 (Part A-30, Part B-20)** **Part – A: Research Methodology** **MINOR CHANGE** What is called research; 4. Types of Ayurvedic Research – a) Pure and applied, b) Qualitative and quantitative; c) Observational (prospective, retrospective and cross-sectional) and interventional (laboratory experiments and clinical trials) 5. Research process: a) Selection of the topic, b) Review of the literature, c) Formulation of hypothesis, d) Aims and objectives, e) Materials and methods, f) Observations and results, g) Methods of communication of research 6. Research tools – Role of the pramanas as research tools 7. The concept and importance of ethics in research 8. Concept of evidence based medicine and scientific writing 9. Importance of IT in data mining and important research data portals concerned with Ayurved and contemporary medical science (DHARA , PubMed, Ayush Research Portal, Bioinformatics Center, Research Management Information System etc.) **Part – B: Medical-Biostatistics** **INCREASED MEDICAL FOCUS** Medical uncertainties; Need to depend on probabilities; Simple rules of

Arithmetic mean, Median and Mode 5. Variability and its measurement: a. Range, b. Standard deviation, c. Standard error 6. Introduction to probability and test of significance 7. Parametric and nonparametric tests 8. Introduction to commonly used statistical software.	probability; Role of biostatistics in controlling and measuring uncertainties); Tabular and graphical presentation – where to use which diagram, including log-scale) **Clinical assessments –** A. Normal range of medical parameters: Measure of central values (mean, median, mode), why and where to use each; need to assess variation (variance, SD and CV); proper interpretation of mean±2SD range as normal; percentiles and their use in growth charts **Medical data –** A. Sources of medical data; B. Incidence, prevalence, duration of disease and outcomes; Relative risk (RR), attributable risk (AR), odds ratio (OR) and number needed to treat (NNT). C. Sensitivity-specificity of medical tests, Bayes rule for predictivity and its role in diagnostic assessment **Tests of significance may be deleted from the undergraduate course** **The paper wil be set and examined by the teacher of Biostatistics**

Postgraduate (MD) Curriculum of **Biostatistics, Health Statistics, Medical Statistics, Demography, Research Methodology, Informatics, etc.**	
Syllabus for Post Graduate course in Ayurveda **Extracts from the existing Regulations** **– Latest available on their website**	**Proposed by the Indian Society for Medical Statistics** **NOT SEEKING ANY INCREASE IN TEACHING** **– ONLY MORE MEDICAL FOCUS**
Paper-I: Research Methodology and Medical Statistics **Part A: Research Methodology** 1.Introduction to research: Definition of the term research; Definition of the term anusandhan; Need of research in the field of Ayurveda 2.General guidelines and steps in the research process: Selection of the research problem; Literature review: different methods (including computer database) with their advantages and limitations; Defining research problem and formulation of hypothesis; Defining general and specific objectives; Research design: observational and interventional, descriptive and analytical, preclinical and clinical, qualitative and quantitative; Sample design; Collection of the data; Analysis of data 3. Preparation of research proposals in different disciplines for submission to funding agencies taking EMR-AYUSH scheme as a model scientific writing and publication skills. 4. Familiarization with publication guidelines- Journal specific and CONSORT guidelines; Different types of referencing and bibliography; Thesis/Dissertation: contents and structure. Research articles structuring: Introduction, Methods,	**Paper-I: Research Methodology and Medical Statistics** **Part A: Research Methodology** **– No change required. Everything is clearly mentioned. Just add the following for better clarity** Basics of clinical trials; data management; scoring; reporting results; and limitations of scientific research. **PART B** **MEDICAL BIOSTATISTICS: INCREASED MEDICAL FOCUS** **Medical Biostatistics to do elementary research and to understand and critically evaluate published research paper**s **Introduction –** Medical uncertainties; Need to depend on probabilities; Simple rules of probability; Role of biostatistics in controlling and measuring uncertainties); Tabular and graphical

Results and Discussions (IMRAD)
5. Classical methods of research.
6. Comparison between methods of research in Ayurveda (Pratigya, Hetu, Udaharana, Upanaya, Nigaman) and contemporary methods in health sciences.
7. Different fields of research in Ayurveda.
8. Literary Research – Introduction to manuscriptology: Definition and scope. Collection, conservation, cataloguing; Data mining techniques, searching methods for new literature; Search of new concepts in the available literature; Methods for searching internal and external evidences about authors, concepts and development of particular body of knowledge.

9. Drug Research (Laboratory-based) – Quality control and standardization aspects.
12. Clinical research: Introduction to clinical research methodology identifying the priority areas of Ayurveda; Basic knowledge of the following: Observational and Interventional studies; Descriptive & Analytical studies; Longitudinal & cross sectional studies; Prospective & retrospectives studies; Cohort studies; Randomized controlled trials (RCT) & their types; Single-case design, case control studies, ethnographic studies, black box design, cross-over design, factorial design; Errors and bias in research; New concepts in clinical trial Adaptive clinical trials/ Good clinical practices (GCP); Phases of clinical studies: 0,1,2,3, and 4.
13.Survey studies - Methodology, types, utility and analysis of qualitative research-methods, concepts of in-depth interview and focus group discussion.
14. Introduction to bioinformatics, scope of bioinformatics, role of computers in biology. Introduction to Data base: Pub med, Medlar and Scopus. Accession of databases.
PART B
MEDICAL STATISTICS:
1. Definition of statistics : Concepts, relevance and general applications of Biostatistics in Ayurveda
2. Collection, classification, presentation, analysis and interpretation of data (Definition, utility and methods)
3. Scales of measurements - nominal, ordinal, interval and ratio scales; Types of variables – Continuous, discrete, dependent and independent variables; Type of series – Simple, continuous and discrete
4. Measures of central tendency – Mean, Median and Mode.
5. Variability: Types and measures of variability – Range, Quartile deviation, Percentile, Mean deviation and Standard deviation
6. Probability: Definitions, types and laws of probability
7. Normal distribution: Concept and properties, Sampling distribution, Standard error, Confidence interval and its application in interpretation of results and normal probability curve.
8. Fundamentals of testing of hypotheses: Null and alternate hypotheses, type I and type 2 errors; Tests of significance ; Parametric and non-parametric tests; Level of significance and power of the test, 'P' value and its interpretation,

presentation – where to use which diagram, including log-scale)
Medical measurements – Scales (nominal, ordinal, interval and ratio scales); Types of variables (continuous, discrete, dependent and independent variables)
Clinical assessments – A. Normal range of medical parameters: Measure of central values (mean, median, mode), why and where to use each; need to assess variation (variance, SD and CV); need to explore statistical distribution of values (Gaussian and skewed distributions, binomial distribution for proportions); proper interpretation of mean±2SD range as normal; percentiles and their use in growth charts
Medical data – A. Incidence, prevalence, duration of disease and outcomes; Relative risk (RR), attributable risk (AR), odds ratio (OR) and number needed to treat (NNT). B. Sensitivity-specificity of medical tests, Bayes rule for predictivity. C. Hospital statistics – their merits and demerits
Medical generalizations – A. Sampling methods; sampling fluctuations; standard errors of mean and proportion; types of statistical generalizations (the concept of confidence intervals (CIs) and tests of significance with their medical implications); null and alternative hypotheses; Type I and Type II errors and need to control them; statistical power and sample size. B. Comparison of means (Student t test, one-way ANOVA, Wilcoxon and Kruskal-Wallis test; comparison of efficacies, RR and OR by chi-square test. C. CIs for mean, proportion and their differences
Medical relationships – Need to study relationship between medical measurements; simple linear and nonlinear regression and correlation, their validity in explaining and prediction; Criteria for causal inference
Sample size – The concepts of statistical power and reliability; role of sample size; calculation of sample size for CIs and tests of hypotheses on mean, proportion and their differences
Vital statistics – Measures of fertility and mortality
Basics of clinical trials – Phases of trials; Randomization and blinding
Introduction to software packages (SPSS, Epi-Info and Stata/SAS)

statistical significance and clinical significance 9. Univariate analysis of categorical data: Confidence interval of incidence and prevalence, odds ratio, relative risk and risk difference, and their confidence intervals 10. Parametric tests: 'Z' test, Student's 't' test: paired and unpaired, 'F' test, Analysis of variance (ANOVA) test, repeated measures analysis of variance 11. Non parametric methods: Chi-square test, Fisher's exact test, McNemar's test, Wilcoxon test, Mann-Whitney U test, Kruskal-Wallis with relevant post-hoc tests (Dunn) 12. Correlation and regression analysis: Concept, properties, computation and applications of correlation, Simple linear correlation, Karl Pearson's correlation co-efficient, Spearman's rank correlation. Regression - simple and multiple. 13. Sampling and sample size computation for Ayurvedic research: Population and sample; Advantages of sampling; Random (Probability) and non-random (Non-probability) sampling; Merits of random sampling; Random sampling methods-simple random, stratified, systematic, cluster and multiphase sampling; Concept, logic and requirement of sample size computation, computation of sample size for comparing two means, two proportions, estimating mean and proportions. 14. Vital statistics and demography: computation and applications - Rate, Ratio, Proportion, Mortality and fertility rates;Attack rate and hospital-related statistics 15. Familiarization with the use of statistical software like SPSS/Graph Pad	Theory paper to be set and examined by the biostatistics teacher. **Practical : 100 Marks** NO CHANGE REQUIRED. The examiner must be a teacher of biostatistics not less than the rank of Assistant Professor **Thesis: No change required except that all theses may have a certificate from the biostatistics teacher that appropriate biostatistics methods have been used to confirm the results**

Practical : 100 Marks
Practical Research Methodology; Medical Statistics :
Statistical exercise of examples from Topic number 4, 5, 8-12, 14, 15.
Records to be prepared.
Distribution of marks (practical):
1. Instrumental spotting test   – 20 marks
2. Clinical protocol writing exercise on a given problem   – 20 marks
3. Records:
4. Research methodology   -10 marks
5. Medical statistics   -10 marks
6. Viva-Voce   -40 marks

Teaching Staff for Health Statistics, Medical Statistics, Demography, Research Methodology, etc. & Ancillary Staff for Data Entry, Data Analysis and Informatics Activities.	
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Staff for Hospital 28. Statistician part time No teaching staff provided for biostatistics/medical statistics/research methodology/computers College website required - page 5 No ancillary staff except data entry operator on contractual basis Computers provided in different sections (Administration, Library, Registration) but no mention of internet, networking, maintenance staff, etc.	**Staff and facilities for Medical Biostatistics and Research Methods** Teaching of Biostatistics in all undergraduate colleges with no MD will continue with part-time teacher not less than the rank of Assistant Professor. All colleges with MD course must have a qualified teacher of Biostatistics. Besides teaching, this person will provide statistical and research methodology assistance to the faculty and PG students – thus improve the research environment and research level. S/He can also be in-charge of the medical record section of the hospital and of the computer system and website of the college. For this s/he will be provided a Technical Assistant. Teaching Staff: Assistant Professor – 1 (MSc in Statistics/Biostatistics/Medical Statistics/Health Statistics. Desirable: PhD and at least 2 years' research experience and training in Computers) Non-Teaching Staff: Technical Assistant – 1 (BCA or Graduate with Computer Science/Computer Applications)