Annex IV
1.2 Module 2 Advanced Statistics

Aim:

To enable students to comprehend, apply and interpret the results of a range of advanced techniques for the design and analysis of epidemiological studies.

Objectives

Be able to:

1. describe the basis of relevant statistical tests with underlying assumptions in the analysis of epidemiological data
2. develop skill of applying appropriate statistical and computational methods in the current scientific applications
3. interpret and critique the statistical applications used in relevant literature

Topic	Content	Teaching/ Learning Method	Time (Hrs)
Basic Statistics Revision I & II	• Parametric tests: a. T-test: paired & independent t-test, b. Chi-squired test c. Z-test for means and proportions d. Estimation of population parameters e. Assessing normal distribution	Lecture Discussion	3.0
Basic Statistics Revision III & IV-	• Probability and features: a. Joint probability b. Conditional Probability c. Binomial distribution d. Poisson distribution	Lecture Discussion	3.0
Sample size Calculations I & II	• Issues in sample size calculation for: descriptive studies a. cross sectional analytical studies, b. case control studies, c. cohort studies d. clinical trials	Lecture Discussion	3.0
Sampling I & II	• Simple random sampling: Estimation of population mean, proportion & total • Probabilities proportional to size (PPS) • Stratified sampling: Estimation of population mean, proportion &optimal rule for choosing strata • Systematic sampling: Estimation of population mean, proportion & total • Cluster sampling: Estimation of population mean, proportion & total a. Equal & unequal cluster size b. PPS • Two stage cluster sampling • Cluster sampling combined with stratification	Lecture Discussion	3.0

Topic	Content	Teaching/ Learning Method	Time (Hrs)
ANOVA I & II	• One way ANOVA: a. applications b. calculations c. interpretation of ANOVA table d. application & interpretation of post-hoch tests e. Bonferroni adjustment	Lecture	3.0
ANOVA III & IV	• Factorial ANOVA • Main effects & interaction • Calculation • Interpretation of two way ANOVA table • Completely randomized design • Randomised block design	Lecture	3.0
ANOVA V & VI	• Balance incomplete block design, • Latin square design, • Repeated measure ANOVA, MANOVA, ANCOVA	Lecture	3.0
Correlation I & II	• Pearson correlation coefficient: a. calculations b. interpretation c. hypothesis test for r d. partial correlation, correlation & covariance	Lecture	3.0
Regression I & II	• Simple linear regression: a. calculations b. interpretation of regression coefficient c. Standard error & confidence interval	Lecture	3.0
Regression III & IV	• Point prediction • Prediction interval, • Regression & ANOVA • Model assumptions, • Coefficient of determination • Residual analysis	Lecture	3.0
Regression V & VI	• Multiple linear regression: a. Interpretation b. Standardize & un-standardize coefficients c. Model building strategies, d. Adjusted R^2 e. Dummy variables f. Interaction term, g. Multi-co linearity h. Model assumptions i. Residual analysis j. Polynomial models	Lecture	3.0

Topic	• Content	Teaching/ Learning Method	Time (Hrs)
Logistic Regression I & II	• Logistic regression modelI • interpretation of coefficients for dichotomous & continuous variables	Lecture	3.0
Logistic Regression III & IV	• Multiple logistic regression: a. Wald test b. Likelihood ratio test c. Dummy variables d. Model building strategies e. Goodness of fit tests	Lecture	3.0
Non Parametric Methods I & II	• Differences between parametric & non parametric tests • Calculation & Interpretation: a. Mann-Whitney U test b. Wilcoxon rank sum test c. Wilcoxon signed rank test d. Sign test e. Kruskal-Wallis H test f. Friedman ANOVA g. Spearman's rank correlation	Lecture	3.0
Survival Analysis I & II	• Survival data • Type of censoring • Survival function • Hazard function • Life table methods • Kaplan Meier survival curves • Log rank test, Hazard ratio, Proportional hazard assumption • Cocks proportional hazard model: a. model building strategies b. interpretation of regression output	Lecture	3.0
Lot quality sampling I & II	• Description of LQAS: a. ROC curves b. Producers' risk c. Consumers' risk d. Sample size calculation	Lecture	3.0
Poisson Regression I & II	• Applications • Model building strategies • Interpretation of regression output	Lecture	3.0

Topic	• Content	Teaching/ Learning Method	Time (Hrs)
Factor analysis I & II	• Exploratory factor analysis: a. Assumptions, factor loading, b. Eigen values, c. Communalities, d. Factor extraction, e. Interpretation of factor analysis output. • Confirmatory factor analysis: a. Assumptions and interpretation	Lecture	3.0
Total = 54hrs (3.7 credits)			

Reading Material:
1. Hill, A.B., Hill, I.D. (1991.) *Bradford Hill's Principles of Medical Statistics*(12[th]ed.). London, Edward Arnold.
2. Basic Statistical Analysis. Rischard C. Sprinthall
3. Medical Statistics. Betty R Kirkwood and Jonathan A. C. Sterne
4. Using and Understanding Medical Statistics. David E. Matthews and Vernon T. Farewell
5. Biostatistical Analysis. J.H. Zar
6. BMJ Statistical Notes Series
7. The EPI coverage survey. WHO/VB/08.07
8. Bennett S, Woods T, Liyanag MW, Smith DL.A simplified general method for cluster-sample surveys of health in developing countries. World Health Statistics Quarterly 1991. 44 (3); 98-106