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1. NON - PARAMETRIC TESTS DR. RAGHAVENDRA HUCHCHANAVAR Junior Resident, Deptt. of Community Medicine, PGIMS, Rohtak 2. Contents • Introduction • Assumptions of parametric and non-parametric tests • Testing the assumption of normality • Commonly used non-parametric tests • Applying tests in SPSS • Advantages of non-parametric tests • Limitations • Summary 3. Introduction • Variable: A characteristic that is observed or manipulated. • Dependent • Independent • Data: Measurements or observations of a variable 1. Nominal or Classificatory Scale: Gender, ethnic background, eye colour, blood group 2. Ordinal or Ranking Scale: School performance, social economic class 3. Interval Scale: Celsius or Fahrenheit scale 4. Ratio Scale: Kelvin scale, weight, pulse rate, respiratory rate 4. Introduction • Parameter: is any numerical quantity that characterizes a given population or some aspect of it. Most common statistics parameters are mean, median, mode, standard deviation. 5. Assumptions • The general assumptions of parametric tests are – The populations are normally distributed (follow normal distribution curve). – The selected population is representative of general population – The data is in interval or ratio scale 6. Assumptions • Non-parametric tests can be applied when: – Data don't follow any specific distribution and no assumptions about the population are made – Data measured on any scale 7. Testing normality • Normality: This assumption is only broken if there are large and obvious departures from normality • This can be checked by Inspecting a histogram Skewness and kurtosis (Kurtosis describes the peakof the curve Skewness describes the symmetry of the curve.) Kolmogorov-Smirnov (K-S) test (sample size is ≥ 50) Shapiro-Wilk test (if sample size is ≤ 50 indicates normality of the distribution) 8. Testing normality 9. Testing normality 10. Testing normality 11. Commonly used tests • Commonly used Non Parametric Tests are: – Chi Square test – McNemar test – The Sign Test – Wilcoxon Signed-Ranks Test – Mann-Whitney U or Wilcoxon rank sum test – The Kruskal Wallis or H test – Friedman ANOVA – The Spearman rank correlation test – Cochran's Q test 12. Chi Square test • First used by Karl Pearson • Simplest & most widely used non-parametric test in statistical work. • Calculated using the formula- $\chi^2 = \sum \frac{(O - E)^2}{E}$ O = observed frequencies E = expected frequencies • Greater the discrepancy b/w observed & expected frequencies, greater shall be the value of χ^2 . • Calculated value of χ^2 is compared with table value of χ^2 for given degrees of freedom. Karl Pearson (1857-1936) 13. Chi Square test • Application of chi-square test: • Test of association (smoking & cancer, treatment & outcome of disease, vaccination & immunity) • Test of proportions (compare frequencies of diabetics & non-diabetics in groups weighing 40-50kg, 50-60kg, 60-70kg & >70kg.) • The chi-square for goodness of fit (determine if actual numbers are similar to the expected/theoretical numbers) 14. Chi Square test • Attack rates among vaccinated & unvaccinated children against measles : • Prove protective value of vaccination by χ^2 test at 5% level of significance Group Result Total Attacked Not-attacked Vaccinated (observed) 10 90 100 Unvaccinated (observed) 26 74 100 Total 36 164 200 15. Chi Square test Group Result Total Attacked Not-attacked Vaccinated (Expected) 18 82 100 Unvaccinated (Expected) 18 82 100 Total 36 164 200 16. Chi Square test χ^2 value = $\sum \frac{(O-E)^2}{E}$ $\frac{(10-18)^2}{18} + \frac{(90-82)^2}{82} + \frac{(26-18)^2}{18} + \frac{(74-82)^2}{82}$ = 8.67 calculated value (8.67) > 3.84 (expected value corresponding to P=0.05) Null hypothesis is rejected. Vaccination is protective. 17. Chi Square test • Yates' correction: applies when we have two categories (one degree of freedom) • Used when sample size is ≥ 40 , and expected frequency of

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