

Robustness of repeated measures ANOVA with non-normal data and very small sample size

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Poster

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Abstract

Background. Recent studies have shown that repeated measures ANOVA is generally robust to violations of normality, provided that the assumption of sphericity is satisfied. However, further research is needed as these studies do not consider sample sizes smaller than 10. **Objective.** To analyse the robustness of the F-statistic in terms of Type I error rate with 19 non-normal distributions (both known and unknown) with skewness values ranging from 0 to 2.31, kurtosis values ranging from 0 to 8 and a very small sample size ($N = 5$). **Method.** A Monte Carlo simulation study was performed with data drawn from the aforementioned distributions, using covariance matrices with epsilon values approximately equal to 1 (assumption of sphericity satisfied). The number of repeated measures was also manipulated ($K = 3, 4$ and 6). Type I error was interpreted according to Bradley's liberal criterion, whereby a procedure is robust if the Type I error rate is between 2.5% and 7.5%. **Results.** The F-statistic showed robust behaviour, with Type I error rates within the required range [2.5% - 7.5%] in all but three conditions, which corresponded to distributions with the largest deviations from normality (skewness and kurtosis coefficients from 2 and 6). In these conditions the F-statistic was liberal. **Conclusions.** The F-statistic is generally robust to non-normality with very small sample sizes across a wide variety of distributions. However, if the deviation from normality is extreme, a larger sample size is needed. Researchers are therefore advised to plan for an adequate sample size if the data are expected to show extreme deviation from normality. This research was supported by grant PID2020-113191GB-I00 from the MCIN/AEI/10.13039/501100011033.

Keywords

sphericity, robustness, skewness, kurtosis, anova

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