Sample size planning for rank-based multiple contrast tests

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Any preclinical trial should start with meticulous sample size considerations. Errors in statistical planning have severe consequences on conclusions drawn from the data. Also, planning with the wrong number of subjects is ethically unacceptable. Many experiments consist of multiple samples, e.g., when different dose levels are investigated. We develop methods for sample size computations suitable for analyzing several samples without relying on any distributional assumption.

While rank methods have long been established as valuable tools for comparing two or more independent groups, the field has lacked comprehensive statistical planning methods to determine the necessary sample size(s) to detect specific alternatives with predefined power. In response to this need, we introduce new approaches for sample size planning specifically tailored for pseudo-rank-based multiple contrast tests.

We discuss the treatment effects in detail and offer various approaches to approximate variance parameters within the estimation scheme. Additionally, the study conducts a thorough comparison between pairwise and global rank methods. To assess the practicality and accuracy of the proposed sample size estimators, extensive simulation studies have been carried out, demonstrating the reliability of these methods under various conditions. To illustrate the real-world applicability of these techniques, a real data example is presented, showing the potential of the proposed methods in guiding preclinical trial design.