Statistics: nuisance – tool – necessity?

Dear Readers and Authors,

One of an editor's duties is to do the final proofreading of a manuscript. I have found that errors in the statistical evaluation of data are the most frequent reason for corrections at that stage. In this respect, one could say that statistics is a nuisance, for me at least. I also remember thinking statistical evaluation was a nuisance early in my scientific career, when I started conducting "research". Back then I did not understand statistical methods and did everything the wrong way due to lack of training.

Now the wiser, I understand how to apply statistics as a tool. As with any tool, knowledge of some basic principles is necessary to use it properly. For instance, if you have a data set you want to analyze statistically, you must ask yourself right at the outset: "Are the data independent?" This will strongly determine which test you can use or not (ANOVA requires independent data). The other fundamental question you must ask is: "Are the data normally distributed?" This will help you decide whether to use ANOVA (for data following a normal distribution) or non-parametric tests (for skewed distributions). Here you are dealing with two different worlds, one dealing with means and standard deviations (normally distributed) and the other reporting medians and percentiles (skewed distribution). Do not mix these worlds in your reporting!

Looking at the results of your analysis using ANOVA, if you find significant interactions in a two- or three-way set-up, you cannot talk about main effects anymore; instead, you must compare individual cells with each other.

Your experimental design will have a profound influence on which test to choose. Within an ANOVA, for example, there are different post-hoc tests regarding whether your "n" was the same in all groups and whether you are interested in all possible comparisons or only a few. When it comes to reporting, I very often see that authors perform a two-way ANOVA, but report this as if it were a one-way ANOVA, which is not correct. In presenting results of two-way designs in a table, you must compare within rows and within columns separately.

Finally, be careful when talking about significance! This is basically the level of error (eg, 5% or 1% or less) you are willing to accept. Therefore, everything that is worse than that is not statistically significant, which means you cannot attribute the resulting difference to the experimental set-up (in other words, it is just random). Thus, "trends" or "differences" have NO meaning whatsoever even if your values are just barely higher than your defined level of error or statistical significance.

The best way to avoid statistical nuisances for yourself and the editor is to consult a statistician, unless your design is very straightforward. And please do so BEFORE you even start your experiment; in the long run, it will save you a lot of trouble. If we later have to consult an expert statistician, it prolongs the review and publishing process.

Is statistics a necessity? Of course, because as soon as you produce numerical data, you must know if they are relevant or not. We owe this to our readers. To prevent reporting random results we MUST use statistics. When it comes to interpretation, of course we must apply our clinical and medical knowledge to discuss whether a statistically significant difference is also clinically relevant.

Hoping that authors will follow my advice, we can look forward to a win-win situation. We will improve the quality of the *Journal of Adhesive Dentistry* by reporting sound data and at the same time have a happy editor!

Sincerely yours,
Jean-François Roulet