by Claudia Clark

Statistical Savvy

In a recent study, researchers found statistical errors in 38% and 25%, respectively, of articles in *Nature* and the *BMJ* (Garcia-Berthou E, Alcaraz C. Incongruence between test statistics and P values in medical papers. *BMC Medical Research Methodology* 2004;4:13. *www.biomedcentral.com/1471-2288/4/13*. Accessed 20 Oct 2004). Although the types of errors detected generally appeared to have little or no impact on the studies' conclusions, the researchers concluded that "statistical practice is generally poor, even in the most renowned scientific journals, and . . . quality of papers should be more controlled and valued".

How can science editors increase their statistical savvy? The following articles offer help.

Lang T. Common statistical errors even you can find. Part 1: Errors in descriptive statistics and in interpreting probability values. AMWA J 2003;18(2):67-71. Part 2: Errors in multivariate analysis and in interpreting differences between groups. AMWA J 2003;18(3):103-7. Part 3: Errors in data displays. AMWA J 2004;19(2):9-11.

This series of articles provides Lang's list of the 24 most common statistical errors appearing in biomedical journals. Lang, senior author of *How to Report Statistics in Medicine: Annotated Guidelines for Authors, Editors, and Reviewers* (Philadelphia: American College of Physicians; 1997), notes that "most errors concern basic statistical concepts and can be easily avoided by following a few guidelines". He begins by presenting five errors often found in descriptive statistics. These include defining variables improperly and using statistical measures inappropriate for the type of data used. Lang lists five more errors that often occur in using probability (*P*) values and interpreting statistical significance, such as equating statistical significance with biologic significance. In the second article, Lang provides a primer on multivariate analyses and describes errors associated with their use. He also identifies mistakes commonly found in presenting and interpreting differences between groups, such as providing estimates but not confidence intervals. The third article focuses on data displays that are confusing. Lang notes, for instance, that a column chart can be deceptive if the baseline does not start at zero, a difficulty known as the "suppressed-zero problem". Lang also emphasizes that tables should convey information, not just hold data. Throughout these papers, statistical terms are italicized and defined when introduced, and simple examples clarify concepts. The reference lists for these articles and those discussed below are valuable in themselves.

Greenhalgh T. How to read a paper: statistics for the non-statistician. I: Different types of data need different statistical tests. BMJ 1997;315:364-6. II: "Significant" relations and their pitfalls. BMJ 1997;315:422-5.

Although overlapping somewhat with Lang's list—for example, noting the importance of selecting tests appropriate to the data—these articles also present other topics. For example, paired and two-tailed tests and outliers are discussed in the first article. In the second article, Greenhalgh includes a discussion of correlation, which she stresses does not necessarily imply causation. Greenhalgh also discusses the importance of calculating and properly interpreting confidence intervals. Examples clarify new concepts in both articles.

Utts J. What educated citizens should know about statistics and probability. Am Statistician 2003;57(2):74-9.

This article, written by the author of *Seeing Through Statistics* (third edition, Belmont, CA: Thomson/Brooks/Cole; 2005), contains "seven ideas . . . that every student who takes elementary statistics should learn and understand". These include recognizing that a statistically significant relationship is not necessarily causal and that a lack of statistical significance may reflect the insufficient size of the sample. Although statistics teachers were the original audience, editors can benefit from this article, which includes examples of errors commonly made by researchers, reporters, and readers. These often familiar and occasionally humorous examples—from fields as diverse as health care, science education, and transportation safety—validate the author's position.

CLAUDIA CLARK *prepared this column while a* Science Editor *intern.*