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Letters to the Editor

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Reporting Significance Values Precisely

To the Editor:

Modern computer technology has made it possible to present the statistical significance (p value) of experimental results in a more precise fashion than has been historically possible. Traditionally, it has been the custom to state the significance of a test statistic, such as a t or x^2, in an approximate way. Such phrases as "the difference was not significant," "with p between .10 and .05," "p was less than .05," or "p was less than .05 and greater than .01" are typical of the way significance values have been reported.

Because exact values are difficult to compute with the aid of mechanical desk calculators, both scientists and statisticians used approximate values in their work. They focused on the most interesting values needed in experimental work and preparing tables, namely, significance values which were near zero. Fewer significance values were needed or tabled near .10 than near .01, and very few values greater than .10 were supplied, since they were less necessary and more difficult to compute.

Modern computers have made possible much more precise computation of significance. Indeed, for every statistical result, most modern computer programs will supply a significance value as well. While the values can be calculated accurately to about 15 digits as a matter of course, such a level of exactitude is of little scientific interest. Somewhat more precision is useful than has been traditionally reported.

I have formulated, and recommend, the following rule of thumb for presenting significance values:

If $p > .10$, show two digits, e.g., $p = .68$ or $p = .12$.

If $.10 > p > .01$, show three digits, e.g., $p = .042$, $p = .051$, or $p = .002$.

If $p < .001$, show the order of magnitude, e.g., $p < .001$, or $p < .0001$.

It is less effort to say "p = .68" than "p was not significant." The former is more informative, for there is an interesting difference between p = .12 and p = .68, though both are insignificant: while one value is not even close to significant, the other may be close enough to warrant duplication or expansion of an experiment. Conversely, the difference between p = .052 and p = .048 is fairly meaningless, though one would normally be considered significant and the other insignificant. The only way to see this difference is if three digits are reported; whereas for values greater than .10, two digits are adequate.

Any experimental result with a significance value of less than .001 is usually so significant that the focus of discussion is no longer the level of significance of the result but more subtle issues of pattern in the data or the scientific meaning of the result. Few would question that the observed result with $p < .001$ reflects a real difference rather than an unlikely chance outcome. Thus, since it is unnecessary to examine small significance values in the same detail as larger values, an exact report of such a value to several digits is not useful.

David W. Smith, MPH, PhD
Statistical Research Laboratory
The University of Michigan
Ann Arbor, MI 48104