

12: Conclusion

Beware false confidence. You may soon develop a smug sense of satisfaction that *your* work doesn't screw up like everyone else's. But I have not given you a thorough introduction to the mathematics of data analysis. There are many ways to foul up statistics beyond these simple conceptual errors.

Errors will occur often, because somehow, few undergraduate science degrees or medical schools require courses in statistics and experimental design – and some introductory statistics courses skip over issues of statistical power and multiple inference. This is seen as acceptable despite the paramount role of data and statistical analysis in the pursuit of modern science; we wouldn't accept doctors who have no experience with prescription medication, so why do we accept scientists with no training in statistics? Scientists need formal statistical training and advice. To quote:

“To consult the statistician after an experiment is finished is often merely to ask him to conduct a post mortem examination. He can perhaps say what the experiment died of.”

—R. A. Fisher, popularizer of the p value

Journals may choose to reject research with poor-quality statistical analyses, and new guidelines and protocols may eliminate some problems, but until we have scientists adequately trained in the principles of statistics, experimental design and data analysis will not be improved. The all-consuming quest for statistical significance will only continue.

Change will not be easy. Rigorous statistical standards don't come free: if scientists start routinely performing statistical power computations, for example, they'll soon discover they need vastly larger sample sizes to reach solid conclusions. Clinical trials are not free, and more expensive research means fewer published trials. You might object that scientific progress will be slowed needlessly – but isn't it worse to build our progress on a foundation of unsound results?

To any science students: invest in a statistics course or two while you have the chance. To researchers: invest in training, a good book, and statistical advice. And please, the next time you hear someone say “The result was significant with $p < 0.05$, so there's only a 1 in 20 chance it's a fluke!”, please beat them over the head with a statistics textbook for me.

Disclaimer: The advice in this guide cannot substitute for the advice of a trained statistical professional. If you think you're suffering from any serious statistical error, please consult a statistician immediately. I shall not have any liability from any injury to your dignity, statistical error or misconception suffered as a result of your use of this website.

Use of this guide to justify rejecting the results of a scientific study without reviewing the evidence in any detail whatsoever is grounds for being slapped upside the head with a very large statistics textbook. This guide should help you find statistical errors, not allow you to selectively ignore science you don't like.

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