



Statistics Done Wrong: The Woefully Complete Guide

By Alex Reinhart

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Scientific progress depends on good research, and good research needs good statistics. But statistical analysis is tricky to get right, even for the best and brightest of us. You'd be surprised how many scientists are doing it wrong. *Statistics Done Wrong* is a pithy, essential guide to statistical blunders in modern science that will show you how to keep your research blunder-free. You'll examine embarrassing errors and omissions in recent research, learn about the misconceptions and scientific politics that allow these mistakes to happen, and begin your quest to reform the way you and your peers do statistics. You'll find advice on:

- Asking the right question, designing the right experiment, choosing the right statistical analysis, and sticking to the plan
- How to think about p values, significance, insignificance, confidence intervals, and regression
- Choosing the right sample size and avoiding false positives
- Reporting your analysis and publishing your data and source code
- Procedures to follow, precautions to take, and analytical software that can help

Scientists: Read this concise, powerful guide to help you produce statistically sound research. Statisticians: Give this book to everyone you know. The first step toward statistics done right is *Statistics Done Wrong*.

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Editorial Review

Review

"If you analyze data with any regularity but aren't sure if you're doing it correctly, get this book." -- Nathan Yau, *FlowingData*

"Of all the books that tackle these issues, Reinhart's is the most succinct, accessible and accurate." -- Tom Siegfried, *Science News*

"A spotter's guide to arrant nonsense cloaked in mathematical respectability." -- Gord Doctorow, *BoingBoing*

From the Author

What goes wrong most often in scientific research and data science? Statistics.

Statistical analysis is tricky to get right, even for the best and brightest. You'd be surprised how many pitfalls there are, and how many published papers succumb to them. Here's a sample:

- **Statistical power.** Many researchers use sample sizes that are too small to detect any noteworthy effects and, failing to detect them, declare they must not exist. Even medical trials often don't have the sample size needed to detect a 50% difference in symptoms. And right turns at red lights are legal only because safety trials had inadequate sample sizes.
- **Truth inflation.** If your sample size is too small, the only way you'll get a statistically significant result is if you get lucky and overestimate the effect you're looking for. Ever wonder why exciting new wonder drugs never work as well as first promised? Truth inflation.
- **The base rate fallacy.** If you're screening for a rare event, there are many more opportunities for false positives than false negatives, and so most of your positive results will be false positives. That's important for cancer screening and medical tests, but it's also why surveys on the use of guns for self-defense produce exaggerated results.
- **Stopping rules.** Why not start with a smaller sample size and increase it as necessary? This is quite common but, unless you're careful, it vastly increases the chances of exaggeration and false positives. Medical trials that stop early exaggerate their results by 30% on average.

About the Author

Alex Reinhart is a statistics Ph.D student at Carnegie Mellon University who received his B.S. in physics at the University of Texas, Austin. He teaches introductory statistics at Carnegie Mellon.

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