



An Interesting Take on Statistical Science

The Art of Statistics: How to Learn from Data. By David Spiegelhalter; Basic Books; New York; 2021. ISBN 978-1-5416-7570-4; pp. 448; \$18.99 (paperback)

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“To put it bluntly, statistics can be difficult.” (p. 379)

What does a physician who murdered over two hundred of his patients, the sexual habits of men and women in England, and a jar full of jellybeans have in common? Statistics, of course! Through the use of interesting and engaging case examples, *The Art of Statistics*, written by David Spiegelhalter, chair in the Centre for Mathematical Sciences at the University of Cambridge, introduces statistical science to solve “real-world” problems with little mathematical skill required. Intended for “both students of statistics who are seeking a non-technical introduction to the basic issues, and general readers who want to be more informed about the statistics they encounter both in their work and in everyday life,” this book “focuses on conceptual issues rather than technicalities” and, thankfully, “features only a few, fairly innocuous equations” (pp. 16, 17).

The Art of Statistics begins with a description of the “PPDAC” structure, a technique for statistical investigation and education used throughout the book, which includes the following: Problem (start with a question); Plan (develop an appropriate design); Data (collect, manage, clean); Analysis (sort data, construct tables and graphs, look for patterns, and generate a hypothesis); and Conclude (interpret, communicate, and come up with new ideas). The author defines and describes relatively simple statistical principles, such as binary versus nonbinary data, validity and reliability, types of variables, relative and absolute risk, odds ratios, mean, median, mode, range, standard deviation, and statistical significance. Early in this volume, the author, whose hope it is to empower the reader to “question numbers that they encounter in their

daily life” (p. 17), describes how statistics can be used to mislead. For example, data can be presented in either a negative or positive frame (e.g., mortality instead of survival rates) and the scale or axis of a graph altered, the latter of which is reportedly how Purdue Pharma sold oxycontin as a medication lacking addiction potential [1].

Dr. Spiegelhalter discusses many concepts important to physicians’ understanding of the medical literature, including representative sampling, appropriate randomization, the power of a test, and correlation versus causation. He describes principles required for a proper medical treatment trial, such as inclusion of both an intervention and control group; random allocation into treatment or placebo; the intention to treat principle (i.e., if a participant is in the treatment arm but fails to adhere to the treatment, the participant is still included in the treatment data); equivalence of all treatments in both arms; de-identification of both participants to treatment and those assessing final outcomes; and minimizing dropouts and measuring all participants. Dr. Spiegelhalter notes the importance of looking beyond a single study for information and suggests reliance on meta-analysis, when possible. He uses many examples that will likely be of interest to physician readers, such as the risk of heart attack for patients allocated to statins versus placebo and the additional survival rate benefits for women with breast cancer who are prescribed various standard treatments.

In my opinion, one of the most important chapters in this book, “How We Can Do Statistics Better,” encourages the reader to assess statistical claims and question the data that are presented. This segment includes “Ten Questions to Ask When Confronted by a Claim Based on Statistical Evidence” and suggests specific queries related to the trustworthiness of the numbers, the source, and the interpretation. As Dr. Spiegelhalter writes, “Although statistical science may appear a highly technical subject, it always takes place in the context of a society to which its exponents bear a responsibility” (p. 371).

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From an educators' standpoint, how might *The Art of Statistics* be used to enhance teaching? In a small group setting, for example, the chapters describing elementary statistical principles are written with engaging examples and could be incorporated into a classroom discussion of these concepts. In addition, the discussion of medical trials might be worthy to include as a prerequisite to journal club. The conclusion of the book ends with “ten simple rules for effective statistical practice” (pp. 379, 380) and a thorough glossary of terms, which may also be utilized when discussing scientific articles.

Although there are many relevant concepts for physicians in this book, there are certainly those that are quite complicated and not likely of interest or benefit to those reading this review, such as machine learning and artificial intelligence and alternatives to the Bayesian theorem. I thought I had a strong grasp of the material early in this book, but by the end, I felt as if I were sitting in on an upper-level college statistical course. In summary, I may not be able to pass a statistical

examination after finishing this well-written book, but I am certainly left with the sense that statistics may actually be interesting.

Declarations

Disclosures The author states that there is no conflict of interest.

Reference

1. Edwards J. How Purdue Pharma used misleading charts to hide Oxycontin's addictive power. Available from: <https://www.cbsnews.com/news/how-purdue-used-misleading-charts-to-hide-oxycontin-addictive-power/>. Accessed 2/11/2022.

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