See Article page 1116.

Commentary: Improving cardiothoracic scientific literature by meeting in the middle

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In this issue of the *Journal*, Gritti and colleagues¹ examine the complexity of statistical methods used in cardiothoracic surgery research. The authors are to be congratulated for not only reporting the methods used in published manuscripts of 3 high-impact journals, but also using an objective approach to determine what proportion of the surgical literature is understood by surgeons based on their level of statistical training. Interestingly, 4% of the manuscripts were purely descriptive, not using any statistical methods, and only 16% of articles were understandable with an introductory level of statistical training.¹ Importantly, with an intermediate level of statistical training, including coursework at an undergraduate or early graduate degree level, 83% of articles were understandable. The authors point out that over time, increasingly more complex statistical methods are being used, while training in these methods by surgical trainees is lacking.

According to Karl Pearson, an English mathematician, biostatistician, and founder of the world's first university statistics department at University College in London in 1911, "statistics is the grammar of science." Although we learn grammar throughout our education beginning at a very early age, we also learn mathematics, but the focus is rarely on statistics. Having had minimal training in statistics before beginning a master's degree program in clinical research, I clearly recall reviewing a manuscript with high-level statistical methods as a group exercise on the first day

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CENTRAL MESSAGE

The accuracy of cardiothoracic surgery scientific literature depends on both surgeon scientists and the peer review process.

of class. Although I understood the topic of the manuscript, the methods and results were akin to a foreign language. Fast-forward 2 years after receiving advanced training in statistical methods, I was able to provide an objective critique of the methods used in that manuscript.

As with any other skill set, training matters. The authors suggest that cardiothoracic residencies should include training in statistics, and that the curriculum should include those methods that would yield the greatest degree of understanding of the majority of articles related to the specialty. One way to accomplish this is to create a journal club curriculum with a dual focus on topics in cardiothoracic surgery and common statistical methods and to ensure that not only the clinical implications of the articles, but also the statistical methods are discussed.

Ultimately, the accuracy of scientific literature depends on both surgeon scientists and reviewers and editors. These entities must meet in the middle. The importance of enlisting the expertise of a biostatistician early in the research planning phase cannot be overstated. Ideally, a surgeon scientist begins with a single focused research question and confers with a biostatistician to determine the feasibility of answering that question and choosing the appropriate study design and methods to accurately answer the question. Once the manuscript is submitted to a journal, it is incumbent on the reviewers and editors to provide a high-level review of the entire manuscript. In particular, a statistical review should be provided for each manuscript being considered for

publication to determine whether the methods used are appropriate and accurate and that the conclusions are valid.

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See Article page 1116.

Commentary: Statistics: Embracing the ignorance

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Several years ago, when I was first awarded the honor of performing statistical reviews for the *Journal*, aside from the terror of ignorance (which still persists), I recall the reaction of several of my colleagues—“*JTCVS* has become impossible; we’re submitting elsewhere.” However, with time, with a rising impact factor and an increasing number of submissions, surgeons soon learned that the rigor of the process resulted in articles trusted for their methodological integrity. Gritti and colleagues¹ present a fascinating and provocative dive into the statistical methodology manifest in the 3 leading journals of cardiothoracic surgery.¹ Using a previously validated classification scheme² and a complexity scale based on the level of academic statistical training at which such methods appear, they arrive at some surprising and challenging conclusions: Some 82% of articles require greater than an introductory understanding of statistical methodology. Without assessing complexity, the sheer number of methods applied per article was comparable among the 3 journals. Absent are analyses of trends over time, grading of appropriateness, or exploration of whether there is any difference in the statistical sophistication depending upon whether cardiothoracic surgical articles are published in the leading surgical journals or in their higher impact medical counterparts.

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Normal distribution or insurmountable barrier—a matter of perspective.

CENTRAL MESSAGE

Robust interaction with and engagement of statistical colleagues provide a promising approach to managing the ever-increasing demand for greater statistical sophistication in surgical publication.

Moreover, nowhere do we find specification of the rapidly emerging techniques of machine learning, although many of these might be subsumed into the existing categories of missing data and predictive modeling.

However, most troubling is what do we do with this information? Certainly the journals need to integrate robust statistical assessment into the routine review process—an approach embraced by this and other journals. But what about the wealth of potential authors, say nothing of inquisitive readers, who do not currently possess the requisite skills? Indeed, an aspiring academic surgeon might well consider some formal training in statistical methodology time well spent—although where exactly during crowded training years or perhaps even more saturated practice years that “time” is going to be found is not always simple to answer. And for those of us for whom our training is a distant memory?

When I entered my internship, the internet had not yet been invented. When I finished my formal training, the human genome was decades away from definition.