The biostatistical minimum

Luca Bertolaccini, Alessandro Pardolesi, Piergiorgio Solli

Department of Thoracic Surgery, Maggiore-Bellaria Teaching Hospitals, Bologna, Italy

Correspondence to: Luca Bertolaccini, MD, PhD, FCCP. Department of Thoracic Surgery, Maggiore-Bellaria Teaching Hospitals, Largo Nigrisoli 2, 40133 Bologna, Italy. Email: luca.bertolaccini@gmail.com.

Abstract: Every day in our clinical practice, probability and statistics are used for a broad variety of actions, including the explanation of levels of risk to patients, the access to clinical guidelines, the understanding of research publications, and the writing of investigation papers for analysing numerical data and treatments options. Therefore, an unintentional statistical misconduct may originate from many sources. It is often difficult to detect, and little is known regarding the prevalence or underlying causes of research misconduct among biomedical researchers. The improvements in teaching statistics to thoracic surgeons should improve the thoughtful of statistical concepts and should reduce the incidence of fallacies. The Biostatistical basis should comprise the aspect of the Biostatistics that surgeons should be aware of correctly interpreting in their research findings: the understanding of p-values, confidence intervals, Student's *t*-tests, Z test, chi-square goodness of fit, ANOVA tables, and basic statistical models (linear or logistic regression). The understanding of Biostatistics is essential to all thoracic surgeons, and it is not unaware since most received some statistics lessons in their training. The *Statistic Corner* of the *Journal of Thoracic Diseases* kept the emphasis on Biostatistical methods to applies and when. Thus, various authors wrote about the analyses of several types of outcomes variables, the analyses of study design, the measures of association and impact, and the general strategies for the statistical analyses. Deceptively, these *Statistic Corner* articles have only scratched the surface. Nonetheless, we hope that had provided a stimulus to enhance the skills to interpret Biostatistics.

Keywords: Lung cancer; statistics; methodology; biostatistics

Submitted Sep 03, 2017. Accepted for publication Sep 11, 2017.
doi: 10.21037/jtd.2017.09.94
View this article at: http://dx.doi.org/10.21037/jtd.2017.09.94

Every day in our clinical practice, probability and statistics are used for a broad variety of actions, including the explanation of levels of risk to patients, the access to clinical guidelines, the understanding of research publications, and the writing of investigation papers for analysing numerical data and treatments options (1). Therefore, an unintentional statistical misconduct may originate from many sources. It is often difficult to detect, and little is known regarding the prevalence or underlying causes of research misconduct among biomedical researchers.

In his paper published in the *Statistics Corner* of the *Journal of Thoracic Diseases*, these described the common statistical errors in published medical literature, and how to avoid and detect them (2). Nevertheless, given the leading role of statistics in the production and analysis of scientific data and drawing inferences, most errors are derived from a reduced knowledge of statistical data during medical education. The training of statistics to medical students should start early with addressing the association between undergraduate skills in mathematics and the attitudes towards statistics, and encouraging students to recognise the difference between the two disciplines. The statistical thinking, different from mathematical thinking and focused on context and variability, should be emphasised (3). Therefore, statistical concepts should be introduced and used in daily practice and strengthened throughout targeted courses. The use of interactive teaching methods, where statistics and research methods are incorporated with other subjects, also seems appropriate. The building and reinforcing statistical of learning, throughout the courses organised by surgical or medical societies, seems likely to maintain knowledge and to increase the skills. Online websites are common in general medical education; however, remain challenges about the more mathematically oriented material. The goal should be achieved by closer cooperation between clinical teachers and societies to identify learning opportunities for statistics within the clinical curriculum. The improvements in teaching statistics to thoracic surgeons should improve the thoughtful of statistical concepts and should reduce the incidence of fallacies (1).

The Biostatistics curriculum is a mixture of theory and implementation, reflecting the reality of modelling biological and medical phenomenon. This curriculum includes the analysis of real world datasets, which makes biostatistics somewhat unique in the mathematical world. The concluding product of meeting and integrating these various problems will be the growth of the future generation of biostatistical scientists in many areas of the medical research (4).

Therefore, the role of biostatistics in medical curricula should be addressed. Often termed biometrics in its early days, biostatistics is a discipline with a long history and wide area of application, it examines the application of statistical theory to biological problems of several types. The term biostatistical minimum was not my invention, and it was originated from the "theoretical minimum" of the great Russian physicist Lev Davidovič Landau (5). The theoretical minimum meant everything a physics student needed to know to work under Landau himself. Landau was a complicated man: his theoretical minimum comprised just about everything he knew, which of course, no one else could know. On the contrary, in his beautiful book, Susskind and Hrabovsky used differently the terms theoretical minimum to mean just what you need to know to proceed to the next level (6).

Therefore, the biostatistical minimum should comprise the aspect of the biostatistics that surgeons should be aware of correctly interpreting in their research findings. This minimum includes the understanding of P values, confidence intervals, student's *t*-tests, Z test, chi square goodness of fit, as well as other tests, ANOVA tables, and basic statistical models (linear or logistic regression). Biostatistics is a beautiful child of mathematics with its own set of basic ideas, thoughts and controversies. It characteristically differs from mathematical statistics by incorporating more medically oriented statistical techniques and applications, and less pure probability theory. The teaching of the mathematical subjects in biostatistics is obviously not comfortable. Nonetheless, the principles and the mathematical analyses must be clearly and carefully defined and enlightened (4).

In conclusion, the understanding of biostatistics is important to all thoracic surgeons, and it is not unaware since most received some statistics lessons in their training. From September 2014, the *Statistic Corner* of the *Journal of Thoracic Diseases* kept the emphasis on biostatistical methods to applies and when. Thus, in this biostatistical minimum, various authors wrote about the analyses of several types of outcomes variables, the analyses of study design, the measures of association and impact, and the general strategies for the statistical analyses (7). Deceptively, these *Statistic Corner* articles have only scratched the surface of the Biostatistical minimum. Nonetheless, we hope that had provided a stimulus to enhance the skills to interpret biostatistics. We welcome ideas and proposals, from readers as well as potential authors, regarding other topics within the field of biostatistics.

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. Miles S, Price GM, Swift L, et al. Statistics teaching in medical school: opinions of practising doctors. BMC Med Educ 2010;10:75.
2. Thiese MS, Walker S, Lindsey J. Truth, lies and statistics. J Thorac Dis 2017. [Epub ahead of print].
3. Hannigan A, Hegarty AC, McGrath D. Attitudes towards statistics of graduate entry medical students: the role of prior learning experiences. BMC Med Educ 2014;14:70.
4. Brimacombe MB. Biostatistical and medical statistics graduate education. BMC Med Educ 2014;14:18.
5. Lev Landau's "Theoretical Minimum". @StackPhysics. 2017. Available online: https://physics.stackexchange.com/questions/13861/lev-landaus-theoretical-minimum
6. Susskind L, Hrabovsky G. Classical mechanics: the theoretical minimum. London: Penguin Books, 2014.
7. Bertolaccini L, Viti A, Terzi A. The chicken-and-egg debate about statistics and research. J Thorac Dis 2014;6:1349-50.

Cite this article as: Bertolaccini L, Pardolesi A, Solli P. The biostatistical minimum. J Thorac Dis 2017;9(10):4131-4132. doi:10.21037/jtd.2017.09.94

