Statistical Literacy for Healthcare Professionals: Why is It Important?

Many young entrants to a medical school presume that they have left mathematics and other quantitative sciences behind, and will not have to deal with these henceforth in life. In fact, for many, the raison d'être for pursuing medicine is their lack of interest or proficiency in numerical methods. Thus, they are often taken aback when they learn that, even for pursuit of medicine and medical research, they are expected to learn and know statistics – "a branch of mathematics dealing with the collection, organization, analysis, interpretation, and presentation of data."[1]

The thinking about medicine and statistics being mutually exclusionary is clearly misplaced. In fact, the two sciences have a close relationship. It may surprise many medical professionals to learn that the origin of statistics as science is often dated to the publication of *Natural and Political Observations on the Bills of Mortality* by John Graunt in 1663.[2] In this work, he analyzed the data on weekly deaths in London to obtain an estimate of the city's population at the time, identified that there were more male births than female births (in a ratio of 107-100) and constructed the first-ever life table. Ever since, the science of statistics has continued to be important for health sciences, leading to the evolution of "Medical Statistics" (as it is usually referred to in the UK) or "Biostatistics" (in North America). These branches cover a wide variety of applications of statistics to medicine and health sciences, including epidemiology, public health, clinical research, and demography.

So why does a usual clinician or clinical researcher need to learn statistics? Systems that engineers and scientists in the physical sciences work with have relatively fixed responses. For instance, if one were to release several similar balls with the same velocity from a height, each of these will follow an identical path. By contrast, medical professionals deal with a biological system, with inherent variability. For instance, if several healthy persons are exposed to a pathogen under similar circumstances, their responses often vary widely – from no infection, through asymptomatic infection, to mild or even severe, and fatal disease. If such a person is administered a vaccine before exposure and does not develop the disease, this variability makes it hard to conclude that the vaccine is protective. Instead, one needs to study several persons with and without the vaccine, and then apply statistics, to conclude that any difference observed between the two groups could not have arisen by chance alone. The use of statistics thus allows a clinical researcher to draw reasonably accurate inferences, despite the uncertainty inherent in the biological systems.

The need for statistics in medicine extends beyond research – into daily clinical practice. Every patient-physician encounter is imbued with statistics – although we usually fail to recognize this. For a man presenting to an emergency room with chest pain, several diagnoses are possible. The brain of a trained physician combines several elements of history and clinical findings to arrive at one or a few diseases that are highly likely in him, a few that are possible but less likely and several that are highly unlikely. His brain then matches this list of diagnoses with performance characteristics – such as sensitivity, specificity, and predictive values – of various diagnostic tests,[3,4] to select a few tests that are most likely to be helpful. And then follows the choice of treatment that is most likely to succeed. Each of these steps involves the use of statistical principles – such as the probability theory, and the Bayes' theorem. All this happens imperceptibly. However, a physician who understands the principles underlying this process can be expected to do better – just like an engineer who does not merely use a machine but also understands how it works.

And finally, although most medical professionals do not undertake formal research, they do need to read and interpret research. Medicine is ever changing. Not only are new diagnostic techniques and treatments being developed, but, every now and then, new diseases appear that one had not encountered in the past – for example – severe respiratory distress syndrome, Ebola virus infection, nonalcoholic fatty liver disease, to name a few. Hence, a few years after leaving the medical school, a medical professional's practice of medicine is often quite different from what one started with. To keep abreast of the new developments, one needs to appraise the literature on these and assess their reliability and applicability to one's patients. This requires statistical literacy.

From the aforesaid, it should be amply clear that statistical literacy is as important a skill for medical professionals, as is the ability to obtain a clinical history, percuss, palpate and auscultate.

To this end, the proposal of Annals of Cardiac Anaesthesia to publish a series on "Statistical methods" is highly commendable and should be useful to its readers.

Rakesh Aggarwal

Department of Gastroenterology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, India

Address for correspondence: Prof. Rakesh Aggarwal, Department of Gastroenterology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow - 226 014, Uttar Pradesh, India. E-mail: aggarwal.ra@gmail.com

References

1. Anonymous. Statistics. Available from: https://www.en.wikipedia.org/wiki/Statistics. [Last accessed on 2018 Aug 28].

2. Anonymous. Natural and Political Observations Made Upon the Bills of Mortality (Graunt 1676). Available from: https://www.en.wikisource.org/wiki/Natural_and_Political_Observations_Made_upon_the_Bills_of_Mortality_(Graunt_1676). [Last accessed on 2018 Sep 03].

3. Ranganathan P, Aggarwal R. Common pitfalls in statistical analysis: Understanding the properties of diagnostic tests-part 1. Perspect Clin Res 2018;9:40-3.

4. Ranganathan P, Aggarwal R. Understanding the properties of diagnostic tests – Part 2: Likelihood ratios. Perspect Clin Res 2018;9:99-102.

How to cite this article: Aggarwal R. Statistical literacy for healthcare professionals: Why is it important? Ann Card Anaesth 2018;21:349-50.