Finding the forest through the trees in statistics: let the Statistical Primers in EJCTS/ICVTS guide you

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EDITORIAL

Evidence-based medicine is the cornerstone of modern medicine. With increasing regulations from governments and insurance companies, the need to provide and continuously improve quality of care is one of the duties of being a physician practicing in the 21st century. Advances in our understanding of the human body and the technology we use to diagnose and treat patients, has, through greater understanding, led us to an era in which we can no longer practice 'what we believe in' but have to practice based on evidence.

Clinical guidelines committees should ideally include physicians with experience in producing and interpreting evidence from clinical studies in combination with methodologists [1]. Consequently, these guidelines will provide important evidence-based answers to different clinical questions for a large readership, meaning that individual physicians do not have to engage in such a complex task. However, guidelines often provide broad recommendations to guide decision-making yet lack nuances that physicians encounter in everyday practice. While many physicians acknowledge the need to use clinical guidelines for decision-making, one important aspect is often forgotten: physicians can only provide evidence-based care if they have at least a basic knowledge of statistics to interpret and judge the evidence.

But are statistics really crucial in our work as physicians? Learning how to do a coronary artery bypass graft (CABG) procedure, a video-assisted thoracoscopic surgery (VATS) lobectomy, or a valve-sparing aortic root replacement require many hours of training. So should we distract ourselves occasionally and move from the operating room to a statistics course? The answer is simple: yes, we should. Despite general negligence towards statistics, evidence suggests that 97% of physicians agree that statistics are useful in everyday clinical work [2]. More importantly, 63% of physicians agree that their clinical practice could

improve if they had better statistical knowledge on, for example, critically evaluating clinical research and understanding risks, but also elaborating on treatments to other physicians and patients. Ironically, there is enough evidence to support the statement that physicians do not understand basic statistics [3]. A number of studies have shown that physicians in different countries fail to answer the majority of basic statistical questions [3–6]. In a survey of 277 internal medicine residents out of 11 residency programs in the US, Windish and colleagues found that residents answered correctly a mean of 41.5% of 20 questions on statistical knowledge and interpretation of results [7]. Remarkably, only 10.5% could correctly interpret a Kaplan-Meier analysis, only 11.9% could interpret 95% confidence intervals and statistical significance, and only 37.4% could interpret an odds ratio from a multivariable regression analysis; the cardiothoracic and vascular surgery literature is largely based on such analyses.

Organizations such as the General Medical Council in the UK as well as the World Health Organization have recommended including statistics in the medical education [3]. However, even though statistics is being taught at most medical schools around the world, one of the reasons for a lack of statistical knowledge is that many of these courses are relatively short as opposed to clinical courses, and basic in comparison to what is needed to adequately perform clinical research and interpret evidence. Indeed, if previous training or coursework in biostatistics was performed, the mean score on statistical knowledge and interpretation of results increased only modestly from 37.9% to 45.2% in the study from Windish and colleagues ($p=0.001$) [7], even though these questions included basic statistical knowledge. With increasing use of complex statistical methods [8] that are mystifying even for advanced statisticians [9], we risk generating a huge gap between the medical literature and clinical practice [10].

But it is never to late to learn. The European Associations For Cardio-Thoracic Surgery (EACTS) has recognized the need for education amongst its members, and have appropriately adopted the slogan *"Raising Standards Through Education and Training"*. Naturally, this includes continuous improvements in surgical skills, but we should not forget that techniques in the operating theatre have often been extensively studied using statistics. The EACTS has therefore embraced more statistical education, starting with a series of "Research in Medicine" sessions at the annual meeting, with the goal of familiarizing clinicians with research methodology, basic to advanced statistical background, and tutorials on how to perform analyses, so that clinicians can better produce and interpret evidence to support clinical guidelines and ultimately influence their clinical practice. After its initiation in Amsterdam in 2015 with 3 sessions, the number of sessions has increased to 6 in Barcelona in 2016, to 9 in Vienna in 2017.

While the sessions have been a great success with a large attendance ranging from both junior and senior researchers and surgeons, many are not able to attend the annual meeting in general. To increase the impact of these "Research in Medicine" sessions, the European Journal of Cardiothoracic Surgery (EJCTS) and the Interactive CardioVascular and Thoracic Surgery (ICVTS) are publishing a series of Statistical Primers. The importance of medical statistics in the EACTS journals has already been made clear, with approximately 1 in 4 papers reviewed by a statistician. These short articles summarize a particular statistical topic presented at the EACTS 2017 Annual Meeting, Vienna, by providing a background, overview of analysis methods, practical implemental tools, pitfalls to consider, recommendations for use, and an example that is elaborative to clinicians. The topics to be covered range from simple statistical concepts to advanced methods (**Figure 1**) that span several overlapping fields of evidence-based medicine. The primers are written by physicians and

surgeons with expertise in quantitative methods in collaboration with medical statisticians. In addition to the guide for statistical and data reporting guidelines from the EJCTS/ICVTS [11], these Statistical Primers should inform, educate, and guide researchers and clinicians on how to perform and interpret studies. As well as reinforcing conventional medical statistics methodology, they also promote a raft of relatively more contemporary methods that are increasingly being utilized in evidence-based medicine.

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Figure 1. Topics of Statistical Primers