Medical knowledge and statistical analysis: a savvy alliance in the battle of producing better health decisions

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Thoughtful, unbiased decision-making is one of the core pillars that erect the challenging (and paradoxically passionate) endeavour of the *ars medica*. It is indeed challenging, since physicians are still humans (fortunately), and being human means a myriad of emotional reasoning, heuristic luggage and unfathomable pressures that modulate cognition. This human facet of decision-making is full of fallacy holes (such as scant medical education, the aforementioned inherently human biases, authorship with financial conflict of interests[1], pressure of publishing positive results[2], a heavy proportion of industry funding trials[3], misuse of statistical tools[4], among many others), that are of utter importance and hard to tackle in the daily clinical life.
Fortunately, as an intelligent species, we have developed tools that help us surpass these limitations. Applied statistics is one of these brilliant resources that underpins educated, ingeniously adapted reasoning. And, although this synergic alliance pushes physicians towards better health decisions, rough obstacles continuously arise, even in the solid mathematical grounds of statistics - as one can see in the following example.
Part of producing good evidence lies (i) in the art of asking good, clinically-oriented questions, (ii) thoroughly collect the data and (iii) analyse it cautiously and with the proper tools. Unconsciously, one might think that ensuing the first two syllogisms inevitably leads the same results. Elegantly, Silberzahn R. *et al*, denied this tempting assumption. In a recent study[5], the same data set to answer the same question (whether soccer referees are more likely to give red cards to dark-skin-toned players than to light-skin-toned players) was analysed independently by 29 groups of 61 researchers. Even with a multiphase approach to allow the groups to learn from each other's methods, investigator's beliefs mitigation and subsequent reanalysis, results did vary: 69% of the teams found a statistically significant effect, whereas 31% did not. Interestingly, even with all the pre-specified homogeneity of data, most of the different analytic approaches used were rated as defensible and reasonable between researchers.
These results tremble the statistical power of results drawn with appropriate intellectual honesty, as well the implicit decisional consequences. In real life, polluting issues such P-hacking (the intentional pursuit of significance in a data set), garden of forking paths (refinement of analysis according to patterns recognition) and incentives to find positive results, bring even more noise to the picture - imagine now, as physicians, limited human beings barely with time to keep up with the evolving nature of scientific progress and medical discoveries, how ungrateful is the weight of deciding such consequential and intimate subjects in front of a patient…
Fortunately, promising solutions are available: embracing the behaviors of open science, doing multiple analyses, knowing how to apply and interpret the various methods of scientific research[6] and, more importantly, to nourish constructive ties with other fields of knowledge, such as biostatistics. These are simple, albeit steady steps towards boosting trust in science and making better health decision.

The authors have no conflict of interest to declare.

References

1. Rosa Ahn, et al. Financial ties of principal investigators and randomized controlled trial outcomes: cross sectional study. BMJ 2017;356:i6770
2. Marcia Frellick. A Low P Value May Not Be Important After All. Medscape. Mar 22, 2016.
3. Peter Whitehouse. Lessons and Responses in Alzheimer Disease Research. JAMA 2003;290:115
4. Colquhoun D. 2014 An investigation of the false discovery rate and the misinterpretation of p-values. R. Soc. open sci. 1: 140216.

5. Silberzahn R, Uhlmann EL, Martin DP, et al. Many analysts, one data set: making transparent how variations in analytic choices affect results. Adv Methods Pract Psychol Sci. 2018;1:337-356.
6. Thomas R. Frieden. Evidence for Health Decision Making — Beyond Randomized, Controlled Trials. N Engl J Med 2017;377:465-75.