LETTER TO THE EDITOR

My experience in biostatistical advice.

For five years I have been working as a statistician in health sciences. In this period I have done statistical analyses and participated in the generation of many research projects. Now I want to share some reflections and raise some questions about my experience as "statistical adviser".

Among the people who have requested my advice (graduate students, researchers, teachers and students), I have recognized the following issues:

Difficulties in identifying the type of variables included in the study. In some cases, variables to be studied are not even clearly recognized. This hinders communication between the researcher and the statistician, since many times they are like two people speaking different languages.

There is no certainty as to when a descriptive or inferential analysis must be performed. In many cases inferential analysis cannot be carried out because there is no compliance with statistical assumptions. In other cases, the contribution that descriptive analysis can make is the most relevant element to generate evidence.

In general, the "ubiquitous" p-value of statistical significance tests is given too much importance. In many cases, if not all, researchers are not fully aware of the possible weaknesses of the p-value. For example, statistical significance can always be achieved by using a sufficiently large sample size, even in cases when very low p-value is required ($p<0.01$).

There is little understanding of confidence intervals. This hinders a real understanding of the results of the statistical analysis and, consequently, the possibility of applying them in clinical practice is lost.

In most cases, the discussion and conclusion sections overemphasize statistical significance, the ubiquitous p-value. This plays against the clinical or practical relevance of the difference obtained between the different groups and/or interventions.

There is a poor internalization of the concept of statistical power, as well as of the concepts of Type I and II errors.

Enthusiasm for applying a large number of significance tests for the same study (thinking that with more "statistical analyses" the report will have more "weight") and neglecting the increase in type I error, resulting in spurious significant results.

Measures of effect size are rarely used to report the results of a study, although in most cases this type of measures has a high information power regarding the impact of a factor, condition or intervention.

Many times statistical advice becomes methodological advice. The lack of clarity regarding the study variables is only an example of the lack of precision that usually affects the application of the scientific method.

There are many difficulties in estimating sample size. In some cases, researchers think that any sample size is acceptable and in others, they use certain "magic" numbers (such as larger than 100, or larger than 500, etc.). In just a few cases, researchers are aware of the need to make a statistical estimate; however, they usually ignore the basic parameters to make such an estimate (expected difference, statistical power of the test, level of significance, etc.), parameters that must be provided by the researcher and not the statistician.

Self-deception. There are usually false expectations and beliefs with respect to objectivity in decision-making before doing a research. In many cases, statistics are used as a tool to achieve "the truth", neglecting critical analysis of the data.

Regarding the questions I can add:

What is the minimum knowledge of methodology a statistician should have to provide statistical advice? (The statistician's knowledge of methodology is not in question here)

What or who can validate a person as a methodologist?

How much knowledge of statistics should a methodologist have?

How much knowledge of statistics and methodology is the minimum required by a researcher?

- Regarding the recurring problem of calculating sample size, I would like to cite Luis Carlos Silva: *Many "professional methodologists" can put (and indeed they do) inexperienced researchers in serious problems by demanding from them a jus-*

tification of the sample size. They may have just calculated it by replicating information found in the literature or by taking into consideration their budget restrictions. However, in the vast majority of cases, I fear that inquisitors would find themselves in similar difficulties if, instead of devoting themselves to asking questions, they had to answer them. In such a case, perhaps they would resort to the application of formulas, which, as explained, are as highly subjective as choosing sample size guided by one's own common sense.[1]

Considering the above, I would like to make some recommendations from my own ignorance and experience:

- Statistics should be considered as a guide and not as "the last word". It is necessary to lower the profile of statistics, to place it where it belongs, considering it as a tool and not as "the tool".

- Statistics and methodology should be taught to all those involved in the research process. It is necessary that they all have a minimum knowledge and the skills necessary to take part in the research process by communicating appropriately with the rest of the team.

- Many times advice should find a balance between what should be done and what has been asked for.

Lastly, a warning: All of the above is subject to change, as my experience and knowledge increase, so I second what Jacob Cohen said "things I have learned (so far)."

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REFERENCES.

1. Silva Ayçaguer LC. Cultura estadística e investigación científica en el campo de la salud: una mirada crítica. Madrid: Ed. Díaz de Santos; 1997.