Clínica y Salud 24 (2013) 47-54

Clínica y Salud

www.elsevier.es/clysa

Recommendations for the use of statistics in Clinical and Health Psychology

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INFORMACIÓN ARTÍCULO

Historia artículo:
Recibido: 25/09/2012
Aceptado: 15/11/2012

Keywords:
Clinical and Health Psychology
Methodological recommendations
Statistical use
Publication Rules

ABSTRACT

The generation of scientific knowledge in Psychology has made significant headway over the last decades, as the number of articles published in high impact journals has risen substantially. Breakthroughs in our understanding of the phenomena under study demand a better theoretical elaboration of work hypotheses, efficient application of research designs, and special rigour concerning the use of statistical methodology. Anyway, a rise in productivity does not always mean the achievement of high scientific standards. On the whole, statistical use may entail a source of negative effects on the quality of research, both due to (1) the degree of difficulty inherent to some methods to be understood and applied and (2) the commission of a series of errors and mainly the omission of key information needed to assess the adequacy of the analyses carried out. Despite the existence of noteworthy studies in the literature aimed at criticising these misuses (published specifically as improvement guides), the occurrence of statistical malpractice has to be overcome. Given the growing complexity of theories put forward in Psychology in general and in Clinical and Health Psychology in particular, the likelihood of these errors has increased. Therefore, the primary aim of this work is to provide a set of key statistical recommendations for authors to apply appropriate standards of methodological rigour, and for reviewers to be firm when it comes to demanding a series of sine qua non conditions for the publication of papers.

Recomendaciones para el uso de estadísticos en Psicología Clínica y de la Salud

Palabras clave:
Normas de publicación
Psicología Clínica y de la Salud
Recomendaciones metodológicas
Usos estadísticos

RESUMEN

La generación de conocimiento científico en Psicología ha experimentado una importante progresión durante las últimas décadas, ya que el número de artículos publicados en revistas con factor de impacto ha incrementado sensiblemente. Los avances en la comprensión de los fenómenos objeto de estudio exigen una mejor elaboración teórica de las hipótesis de trabajo, una aplicación eficiente de los diseños de investigación y un gran rigor en la utilización de la metodología estadística. Por esta razón, sin embargo, no siempre un incremento en la productividad supone alcanzar un alto nivel de calidad científica. Los usos estadísticos pueden ser, en general, una fuente de efectos negativos sobre la calidad de la investigación, tanto por el grado de dificultad que la comprensión y aplicación de algunos métodos requiere, como por la comisión de un conjunto de errores como, sobre todo, por la omisión de información fundamental para evaluar la adecuación de los análisis realizados. A pesar de que haya notables trabajos dedicados a la crítica de estos malos usos, publicados específicamente como guías de mejora, la incidencia de mala praxis estadística todavía permanece en niveles mejorables. Dada la creciente complejidad de las teorías elaboradas en la psicología en general y en la psicología clínica y de la salud en particular, la probabilidad de ocurrencia de tales errores se ha incrementado. Por este motivo, el objetivo fundamental de este trabajo es presentar un conjunto de recomendaciones estadísticas fundamentales para que los autores consigan aplicar un nivel de rigor metodológico adecuado, así como para que los revisores se muestren firmes a la hora de exigir una serie de condiciones sine qua non para la publicación de trabajos.

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1130-5274/$ - see front matter

DOI: http://dx.doi.org/10.5093/cl2013a6

In the words of Loftus (1996), "Psychology will be a much better science when we change the way we analyse data". Empirical data in science are used to contrast hypotheses and to obtain evidence that will improve the content of the theories formulated. However it is essential to establish control procedures that will ensure a significant degree of isomorphism between theory and data as a result of the representation in the form of models of the reality under study.

Over the last decades, both the theory and the hypothesis testing statistics of social, behavioural and health sciences, have grown in complexity (Treat and Weersing, 2005). Hence, the degree of sophistication in quantitative research in the area of Psychology in general and in the area of Clinical and Health Psychology in particular, is increasing in such a way that the novice researcher is faced with such a variety of options that he/she can feel mixed up sometimes. Anyway, the use of statistical methodology in research has significant shortcomings (Sesé and Palmer, 2012).

This problem has also consequences for the editorial management and policies of scientific journals in Psychology. For example, Fiona, Cummings, Burgman, and Thomason (2004) say that the lack of improvement in the use of statistics in Psychology may result, on the one hand, from the inconsistency of editors of Psychology journals in following the guidelines on the use of statistics established by the American Psychological Association and the journals' recommendation and, on the other hand from the possible delays of researchers in reading statistical handbooks.

Whatever the cause, the fact is that the empirical evidence found by Sesé and Palmer (2012) regarding the use of statistical techniques in the field of Clinical and Health Psychology seems to indicate a widespread use of conventional statistical methods except a few exceptions. Yet, even when working with conventional statistics significant omissions are made that compromise the quality of the analyses carried out, such as basing the hypothesis test only on the levels of significance of the tests applied (Null Hypothesis Significance Testing, henceforth NHST), or not analysing the fulfilment of the statistical assumptions inherent to each method. Hill and Thomson (2004) listed 23 journals of Psychology and Education in which their editorial policy clearly promoted alternatives to, or at least warned of the risks of, NHST. Few years later, the situation does not seem to be better. This lack of control of the quality of statistical inference does not mean that it is incorrect or wrong but that it puts it into question.

Apart from these apparent shortcomings, there seems to be is a feeling of inertia in the application of techniques as if they were a simple statistical cookbook –there is a tendency to keep doing what has always been done. This inertia can turn inappropriate practices into habits ending up in being accepted for the only sake of research corporatism.

Therefore, the important thing is not to suggest the use of complex or less known statistical methods "per se" but rather to value the potential of these techniques for generating key knowledge. This may generate important changes in the way researchers reflect on what are the best ways of optimizing the research-statistical methodology binomial. Besides, improving statistical performance is not merely a desperate attempt to overcome the constraints or methodological suggestions issued by the reviewers and publishers of journals. Paper authors do not usually value the implementation of methodological suggestions because of its contribution to the improvement of research as such, but rather because it will ease the ultimate publication of the paper.

Consequently, this work gives a set of non-exhaustive recommendations on the appropriate use of statistical methods, particularly in the field of Clinical and Health Psychology. We try to provide a useful tool for the appropriate dissemination of research results through statistical procedures.

Statistical Recommendations

In line with the style guides of the main scientific journals, the structure of the sections of a paper is: 1. Method; 2. Measurement; 3. Analysis and Results; and 4. Discussion. Authors will include accordingly the statistical information related to his/her research.

1. Method

1.1 Designs

It is necessary to provide the type of research to be conducted, which will enable the reader to quickly figure out the methodological framework of the paper. Studies cover a lot of aims and there is a need to establish a hierarchy to prioritise them or establish the thread that leads from one to the other. As long as the outline of the aims is well designed, both the operationalization, the order of presenting the results, and the analysis of the conclusions will be much clearer.

Sesé and Palmer (2012) in their bibliometric study found that the use of different types of research was described in this descending order of use: Survey (31.8%), Quasi-experimental (28.4%), Experimental (19.7%), Theoretical (7.5%), Instrumental (3.2%), Qualitative (2.6%), Meta-analysis (1.4%), among others. It is worth noting that some studies do not establish the type of design, but use inappropriate or even incorrect nomenclature. In order to facilitate the description of the methodological framework of the study, the guide drawn up by Montero and León (2007) may be followed.

1.2 Population and Samples

The interpretation of the results of any study depends on the characteristics of the population under study. It is essential to clearly define the population of reference and the sample or samples used (participants, stimuli, or studies). If comparison or control groups have been defined in the design, the presentation of their defining criteria cannot be left out. The sampling method used must be described in detail, stressing inclusion or exclusion criteria, if there are any. The size of the sample in each subgroup must be recorded. Do not forget to clearly explain the randomization procedure (if any) and the analysis of representativeness of samples. Concerning representativeness, by way of analogy, let us imagine a high definition digital photograph of a familiar face made up of a large set of pixels. The minimum representative sample will be the one that while significantly reducing the number of pixels in the photograph, still allows the face to be recognised. For a deeper understanding, you may consult the classic work on sampling techniques by Cochran (1986), or the more recent work by Thompson (2012).

Whenever possible, make a prior assessment of a large enough size to be able to achieve the power required in your hypothesis test. There are statistical programmes that enable you to carry out these tasks in a simple way, such as G*Power (Erdfelder, Faul, & Buchner, 1996), or the R programme (R Development Core Team, 2012), which are free and can be downloaded directly from the Internet.

1.3 Assignment

Random assignment. For a research which aims at generating causal inferences, the random extraction of the sample is just as important as the assignment of the sample units to the different levels of the potentially causal variable. Random selection guarantees the representativeness of the sample, whereas random assignment makes it possible to achieve better internal validity and thereby greater control of the quality of causal inferences, which are more free from the possible effects of confounding variables.