EDITORIAL

Science, bad science, pseudoscience and the research in nursing neurosciences

Ciencia, mala-ciencia, pseudociencias y la investigación en enfermería neurológica

José María Morán García

The approval in November 2018, jointly by the Ministry of Health, Consumer Affairs and Welfare and the Ministry of Science, Innovation and Universities, of the Health Protection Plan Against Pseudo-therapies has brought to the table society’s need to identify practices that, used as alternatives and to complement ordinarily prescribed treatments, can imply a risk to patients if not based on knowledge, evidence or scientific method. In coming months, measures will be implemented with which the Government seeks to fulfill the constitutional mandate of health protection, on the one hand, by identifying substances, products, activities or services with purported health purposes for which there is insufficient scientific evidence or knowledge to guarantee their effectiveness or safety and, on the other, proposing measures to prevent pseudo-therapies being taught in the Spanish university system, either through regulated courses (bachelor’s or master’s degree) or as separate courses taught by the universities themselves. They also seek to remove pseudoscience from all health centres, both public and private, so that they cannot offer any alternative treatments that have not been endorsed by science.

The first steps of the plan have already been implemented and in March 2019 the Government published the first list of 73 practices lacking any scientific rigour that include: fruit therapy, Tibetan bowls, marine essences, gemmotherapy and colon hydrotherapy, and have identified another 66 that are being assessed including acupuncture, acupressure, homoeopathy, reiki and osteopathy.

The ministries in charge are highlighting the importance for society, and particularly for health professionals, to understand and interpret the results of health science research correctly. This can be hugely difficult, due, among other factors, to the simultaneous appearance in the literature of rigorous scientific results, and what could be classed as bad science or pseudoscience.

The latter, subject to scientific method, generate knowledge that can be verified or disproved by the community of investigators by rigorous replication of studies published in scientific journals. On paper, this is a strict procedure that ensures that only sufficiently proven research results that have undergone a process of review by experts in the area of research (peer review) prior to their publication can come into the public domain. In practice, there can be additional circumstances where research studies that have not been correctly substantiated (pseudoscience), and oth-
ers that have been pure and simply badly conducted (bad science) also enter the public domain. Fortunately, the scientific method process does not end with the publication of the article in a scientific journal: it is after publication that the post-peer review process starts, when investigators worldwide can report their concern regarding the published results of any research study.

Thus, science, bad science and pseudoscience produce a similar result: scientific articles that, once published, even in the most prestigious of the international journals, must be meticulously scrutinised by readers, with critical judgement, without taking it for granted that their review process has generated an unshakable truth. Bad science is, if anything, more difficult to identify. These are studies that could be developed with foundations, hypotheses, methodologies and conclusions that appear to follow conventional and appropriate scientific methodology but contain obsolete methodology, inappropriate experimental designs, erroneous statistical analyses, and poor practice in general. In many cases this bad science can be involuntarily created by investigators, due, generally, to a lack of appropriate knowledge of research methodology; in other cases they simply reflect poor practice and hidden interests. Pseudoscience is false science, these are research studies that might appear to be rigorous scientific research studies, but lack the appropriate methodology, and are classed as biased when results contrary to the hypothesis raised in the study are interpreted. Therefore, bad science and pseudoscience are not the same thing, but they do have the same consequences: both generate a knowledge vacuum or no knowledge at all, they add nothing to the body of knowledge on the subject under study but their results hinder the growth of science-based discipline.

In light of the incontestable fact that some published studies are developed on what we understand to be bad science or pseudoscience, and in many cases both at once, the scientific community must increase their efforts through post-peer review to detect these problems, and flag up the lack of rigour in some studies. This problem could be resolved, therefore, if these studies were removed from the scientific literature. However, it is another incontrovertible fact that the scientific journals are generally very reluctant to remove published articles, which they rarely do, at best they merely publish the comments by the authors who have detected the error along with the questioned article. At the beginning of 2018, a total of 5631 retracted articles were detected in PubMed, of which only 60 included the generic term “nursing”.

Studies based on the possible effectiveness of pseudotherapies are common bad science and pseudoscience niches. They are characterised, firstly, by their cursory and often erroneous analyses that are not supported by the conclusions reached by the authors, and secondly, as being steeped in bias – the highest current indicator of pseudoscience – and within it, confirmation bias, where the authors then claim that the results of their study have produced a positive result regardless of the fact that all the evidence shows otherwise.

Acupuncture is one of these 66 techniques that the Government is examining as a possible pseudotherapy. A clinical trial was published in Aging Clinical and Experimental Research in 2015, whose conclusions recommended the use of the technique as an appropriate method to reduce sleep disorders in patients with Alzheimer’s disease. In August 2016 a comment from the post-peer review of the study was published that flagged up extremely serious problems detected in the paper that affected the design, monitoring, analysis and interpretation of the results and that in no way supported the conclusion reached by the authors. The authors were given the opportunity to clarify the inconsistencies of their paper, but they did not do so. Neither did the journal retract the article. The result is that to date the original paper has been cited in 8 subsequent studies, all of which highlight the positive effect of acupuncture on sleep disorders in Alzheimer’s patients, including a systematic review, a crucial evidence source for evidence-based practice, since it summarises the results in the literature in an unbiased and methodical manner. Therefore, the final result is that the literature, the body of knowledge on the subject under study, is becoming full of information that is not based on scientific evidence. Furthermore, a study whose conclusions are at best dubious (if not discredited) has further consequences: on the one hand, research resources are being wasted – time, money and personnel – in investigating along lines using the results of this study as the basis, and on the other, the body of knowledge on the subject – Alzheimer’s disease and sleep disorders – is being filled with pseudoscience, because the results of previous research studies are being used in a biased manner.

Along identical lines, a clinical trial published in 2016 in BMC Complementary and Alternative Medicine claimed to demonstrate the effect of acupuncture on cognitive impairment after a stroke compared to treatment with nimodipine. The authors concluded that acupuncture should be used in conjunction with conventional treatment with nimodipine because this would improve the progression of cognitive impairment in patients who had suffered a stroke. Again, by post-peer review a reanalysis of the data presented in the original paper was possible, which concluded that, although some of the results presented by the authors appeared correct, in general, they showed that acupuncture combined with nimodipine did not produce better outcomes than nimodipine monotherapy. Again, the authors were offered the opportunity to defend their work, and they did not respond in this case either. And again, the journal did not remove the paper. The result is that to date 4 further papers have used this article as the basis to justify their research studies.

We are faced, therefore, with a serious problem that is making it difficult to interpret the literature and is generating uncertainty among health professionals. Gray et al., in 2017, identified 37 systematic literature reviews focussing on nursing research that included references to retracted clinical trials; of these, 23 included a retracted nursing clinical trial as part of its analysis, and 5 had been published after the retracted articles that they included; in other words, one of the major exponents of scientific evidence included citations from clinical trials that had already been withdrawn from the literature. There is no doubt that including a withdrawn clinical trial in a systematic review potentially undermines the integrity of the conclusions reviewed. This begs the question, if this is happening with studies that
have been withdrawn, what might be happening with the literature that has not been retracted?

The Government intends to examine the scientific literature in depth to determine whether certain techniques are or are not pseudotherapies. An arduous task lies before them in attempting to separate the wheat from the chaff, science from pseudoscience and bad science. Nurses, in applying evidence-based practice, must take this same path. It is no longer enough to search for evidence in the renowned scientific journals, we must go further and climb to the next step, which will enable us to scrutinise a published research study and decide whether or not it is science.

References

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