Editorial

Data manipulation and fabrication in scientific research: are the consequences as simple as we think?

Manipulação e fabricação de dados em pesquisa científica: as consequências são tão simples como pensamos?

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BACKGROUND | Scientific misconduct has been observed throughout the history of science. However, it has grown exponentially in recent decades, an example of which was the time of the COVID-19 pandemic. We reflect on the potential impact of weak evidence from a convincing practice or professional decision-making. This situation can occur due to educational system failures, training of researchers, and even moral and ethical deviations.

KEYWORDS: Scientific Misconduct. Ethics in Publication. Scientific Flaws.

CONTEXTO | A má conduta científica vem sendo observada ao longo da história da ciência, entretanto, nas últimas décadas teve um crescimento exponencial, e um exemplo disso foi a época da pandemia da COVID-19. Ficamos a refletir sobre o potencial impacto que uma evidência frágil pode gerar a partir de um convencimento de uma prática ou tomada de decisão profissional. Isso pode ocorrer devido a falhas no sistema educacional, na formação de pesquisadores e até mesmo a desvios morais e éticos.

PALAVRAS-CHAVE: Má Conduta Científica. Ética em Publicação. Falhas Científicas.

Submitted 05/05/2023, Accepted 08/30/2023, Published 10/16/2023
J. Physiother. Res., Salvador, 2023;13:e5230
http://dx.doi.org/10.17267/2238-2704rpf.2023.e5230
ISSN: 2238-2704
Assigned editor: Ana Lúcia Góes

How to cite this article: Queiroz CO, Lourenço CLM. Data manipulation and fabrication in scientific research: are the consequences as simple as we think?. J Physiother Res. 2023;13:e5230. http://dx.doi.org/10.17267/2238-2704rpf.2023.e5230

The U.S. Department of Research Integrity defines research misconduct as fabrication, falsification, and plagiarism. Fabrication concerns recording, elaborating, and publishing fraudulent results in the scientific field or the media. Falsification is directly related to manipulating equipment, methodological procedure, material, and even altering or omitting results that may modify the study's primary outcomes. Plagiarism can be considered when other people's ideas or results are appropriated without giving credit.[1,2] With this brief introduction, we make it clear to the readers of Journal of Physiotherapy Research that these issues are the central theme of this editorial.

We have been bombarded by numerous portrayals of scientific production in recent years.[3,4] A serious infraction is routinely discovered. One example was the most acute period of the COVID-19 pandemic, in which several articles on the subject were retracted due to scientific misconduct.[5] Retracted articles contribute to widespread misinformation for the press and society. A bibliometric analysis of retractions about COVID-19 on *retractionwatch.com* identified that the retracted articles received great attention through digital media, and preprints can attach a high risk of spreading false information.[6]

Unfortunately, scientific misconduct has proliferated. To illustrate this, we performed a simple search of the PubMed database, from its inception to March 2023, using the search term "retracted"[a]. This search returned more than 10,000 retracted articles. Surprisingly, the most significant number of retracted articles is found in the last two decades (2002-2022), with over 7,000 retractions. When errors are unintentional (unintentional errors can occur due to lack of experience or knowledge about a particular technique, subject, or writing), there is no need to be ashamed of correcting previously published information. People must be frank about their mistakes and clarify them, indicating the reasons for the retraction and the new conclusions.

However, many articles with questionable scientific integrity, which can often be fraudulent, only sometimes have quick retractions. Even those retracted continue to be read and cited for a long time, even after retraction.[7] The retraction was created to correct an error and ensure integrity in the scientific community, which is different from errata[b] cases. Retractions are issued to alert the reader to potential issues identified in the article. The Committee for Ethics in Publications (COPE) indicates that the leading retraction cases are redundant publications, plagiarism, unreliable data, and undisclosed conflicts of interest.[8] Contrary to what one might imagine, scientific misconduct is found in more than predatory or low-impact journals.[9,10]

A well-known case involved articles published in the renowned journals Nature (impact factor 69.5) and Science (impact factor 63.8) in the area of nanotechnology, which involved a Bell Labs researcher (one of the most well-known industrial laboratories in the world). The graphs that composed a figure of the results section of an article were found to be identical between the publications. Thus, an investigation was established between the journal editors, and the article in question was retracted. As a cascading effect, several articles by the same author were retracted in important journals in the area due to misconduct – the most curious fact is that he had an article published every 8 days on average.[9,10]

Systematic reviews are considered the pyramid's pinnacle of the scientific hierarchy and are essential for decision-making based on evidence-based practice.[8] They have been the target of increasing retractions. The leading causes of retractions in this type of study are unreliable data and peer review fraud. Moreover, including articles published in predatory journals can also distort the results and reach erroneous conclusions in the reviews.[11] Some reviews even cite that they followed the Preferred Reporting Items for

[a]Search performed on April 25, 2023, using "retracted" as the search term in "all fields". The following database filters were adopted for study types: Case Reports, Clinical Study, Clinical Trial, Clinical Trial, Phase I, Clinical Trial, Phase II, Clinical Trial, Phase III, Clinical Trial, Phase IV, Comparative Study, Controlled Clinical Trial, Meta-Analysis, Observational Study, Preprint, Randomized Controlled Trial, Review, Systematic Review.
[b]According to the Errata Registration and Publication Guide[12], errata "are corrections to errors identified in an article or other type of document already published". Text is available at: https://wp.scielo.org/wp-content/uploads/guia_errata.pdf. Accessed on 25/04/2023

Systematic Reviews and Meta-Analyses (PRISMA) as a reporting guide. However, they need to adhere to essential items of this guideline.[12] This is troubling given the growing number of evidence synthesis publications and the scientific rigor required in the methodological process of designing and conducting this type of study. In light of this, editors, reviewers, authors, and readers should remain vigilant to unreliable information in evidence summaries that are important for decision-making.

In this sense, a recent systematic review with meta-analysis drew the scientific community's attention, both for its theme and the numerous biases. This review aimed to evaluate the immunological adverse effects induced by COVID-19 vaccines. In that study, the researchers concluded that each type of vaccine was associated with an adverse profile different from the others and showed high suspicion of these adverse, post-vaccination events (neurological, ocular, dermatological, hematological, cardiac, and renal).[13] We have some comments and caveats to make about this publication and its results:

1. The authors considered Google Scholar as one of their databases when describing the search methods in the literature. However, the authors should have defined Google Scholar as a "search engine" or even reconsidered its adoption[14];

2. In the review text, no mention was made of its previous registration or the publication of a review protocol. For example, the authors could have adopted the review registration via PROSPERO (International Prospective Register of Systematic Reviews). Registering the review or making its protocol public minimizes overlapping of studies with the same theme, allows readers an in-depth reading of the methods and to evaluate what was pre-specified and performed, judging planning deviations and the introduction of potential biases;

3. The review team comprised only two reviewers, and their roles in the review processes (selection, data collection, risk of bias assessment, and reliance on the evidence) are unclear. This fact, by itself, does not constitute a significant bias but reduces confidence in the transparency and isonomy applied at each stage;

4. The authors must present the complete search strategy for its replication, limiting themselves to presenting only the search terms. Presenting the search strategy for at least one database is crucial for potential replication;

5. The authors used only one database (see comment above about Google Scholar). Although PubMed® is one of the most extensive electronic databases, using it alone does not guarantee maximum coverage of research results, especially on a topic as vital and current as the one discussed in the review;

6. The authors did not use an instrument to assess the risk of bias (e.g., Cochrane Risk of Bias) and confidence in the evidence (e.g., GRADE) of the included studies;

7. The authors indicate that they have performed a meta-analysis of the results of the individual studies but do not specify any details of the statistical procedures employed in the article's methods section, mainly because they include studies with different designs, which should require robust statistical procedures to address this issue.

Briefly, these are some of our concerns about this systematic review with meta-analysis, which, in our view, cast some distrust in the authors' conclusions.

Thus, we reinforce the discourse of scientific training with greater rigor, focused on research integrity. We are left to reflect on how the scientific community and society in general can interpret these results, mainly on the impact of weak evidence and the unfolding of potential scientific denialism based on a mistaken understanding, because erroneous results can be possibly disseminated as "supposedly scientific truth" without a critical reading based on the primary evidence synthesis guidelines.

To conclude this editorial, some central questions need to be answered: What happens to those who practice misconduct? Why is there misconduct? What to do to avoid misconduct? Answering the first question, we mention a case in Brazil in which a professor at the Universidade de São Paulo (USP)

was exonerated, and the title of his doctoral student was revoked due to plagiarism in research. Plagiarism was denounced by researchers at the Universidade Federal do Rio de Janeiro, who claimed authorship of a microscopic image published in 2003, and USP researchers published in 2008. The article was also retracted by the journal Biochemical Pharmacology.[15] The misconduct allegations are very challenging, and not all warrant investigation but require much time for evaluation.[16]

We must reflect on moral and ethical integrity, which must be identified in the training of all professionals, to answer the other two questions. Two aspects can indicate deviations from good practices in science. The first concerns the professionals' potential moral and ethical deviations, which may lead them to corruption. The second aspect points out the flaws in the educational system and researcher training, as bad practices are often due to a lack of knowledge about some fundamental aspects of science.[17] We reinforce that training courses on this theme are worked at all levels, from scientific initiation to post-graduation, and that refresher courses are always implemented for professionals and senior researchers.

Regarding the above, researchers edited and launched a manifesto on the subject during the Sixth World Conference on Research Integrity, held in June 2019 in Hong Kong. This document, named the Hong Kong Principles, lists five principles: responsible research practices, transparent reporting, open science (open research), valuing the different research types, and recognizing all contributions to research and scholarly activity. Although they have the perspective of generating greater recognition for researchers committed to scientific integrity, these principles can also be used as a guide for adopting good scientific practices to make scientific results more reliable, robust, rigorous, and complete.[18] Finally, creating a guidance manual and good practices for data analysis in studies is always advisable and desirable for those involved in data collection and analysis. We have a considerable obligation to ensure the accuracy and integrity of scientific records.

Authors' contributions

Both authors participated in the literature review, drafting, critical review of the editorial, and final approval of the version to be published.

Conflict of interests

No financial, legal, or political conflicts involving third parties (government, companies, and private foundations) were declared for any aspect of the submitted work (including, but not limited to, grants and funding, advisory board membership, study design, manuscript preparation, and statistical analysis).

Indexers

The Journal of Physiotherapy Research is indexed by DOAJ, EBSCO, LILACS and Scopus.

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