Original Research Article

How to Read and Interpret a Scientific Article

ABSTRACT

Evidence-based medicine is an approach in clinical practice that uses information that is validated using scientific methods. As such information is disseminated through scientific articles, clinicians should be able to efficiently read and interpret them. This paper introduces the reader to scientific articles and provides a critical appraisal of a selection of relevant literature. Here, the reader is provided with the principles of the critical reading of scientific articles in medicine. These include the basics of study design, article structure, statistical analysis, sources of error, and study limitations. The readers require onlyfundamental knowledge for the accurate selection and interpretation of scientific articles, without the need for extensive methodological expertise.

Keywords: Scientific articles, critical reading, interpretation, publication, clinical practice

1. INTRODUCTION

Despite the importance of critical reading for clinicians and researchers, many individuals within these professions havenot mastered this skill. Approximately 6,000 articles are published every day; therefore, clinicians and researchersmust consistently stay updated with the latest medical literature [1]. However, owing to the availability of scientific content from various databases, critical reading of the existing material is essential for determining whether currently published information can provide healthcare services of higher quality. Alatore describes research as a human activity carried out to acquire knowledge that can be used to understand and manage real-life problems, make discoveries, and establish new inventions [2]. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has stated that an article should effectively communicate the results of research, ideas, and debates in a clear, concise and reliable manner. Therefore, every medical publication must be clear, relevant to the field, and up-to-date [3]. This article aims to explain the proper approach to reading and interpreting an article.

2. ARTICLE TYPES

Scientific articles are classified into primary, secondary, or tertiary articles. Primary articles include original articles, brief reports or communications, and case reports. Secondary sources include systematic reviews with or without meta-analyses, letters to the editor, and research methodology articles. Finally, tertiary articles include narrative reviews, scientific letters, and editorials [4]. Original articles are the most commonly published articles. For an original article to be published in a scientific journal, an original article must present and written in a clear language that is understandable even to readers outside the medical field. They should also be replicable by the reader and well-structured to facilitate easy access to information. The results of the study should answer the research question and fulfill the purpose of the work. Accordingly, we will provide details on the structure and different sections of a research articleresults that have not been previously published but may have been reviewed. They must be short, comprehensive, and written in a clear language that is understandable even to readers outside the medical field. They should also be replicable by the reader and well-structured to facilitate easy access to information. The results of the study should answer the research question and fulfill the purpose of the work. Accordingly, we will provide details on the structure and different sections of a research article.

3. ARTICLE STRUCTURE

Every article starts with a title page that includes the title of the study and the names and affiliations of the authors. Some journals include the dates of submission and acceptance on the title page. This is followed by the abstract, which includes a summary of the study and can have a structured or unstructured format. A structured abstract is typically organized under the following subheadings: introduction, methods, results, and conclusion, while an unstructured abstract does not include subheadings.

The main text of an original article is usually divided into the following sections: Introduction, Methods, Results, and Discussion (IMRAD) [5]. Each section should essentially include specific information that is well-organized in a logical manner. Moreover, the information in each section should be self-contained, coherent, and consistent. Each section should be clear, rigorous, objective, and concise, without any redundancy [6].

The Introduction section should include the research question, the relevance of the study, what is already known, and what still requires evidence. The objective(s) of the study should be stated at the end of the introduction. The Methods section should describe the type of the study (e.g., observational or experimental, prospective or retrospective), the study population and/or sample, and how the authors attempted to answer the research question. The Results section describes the outcomes of the study when the methods were carried out. Preferably, tables, graphics, and figures should be included. The Discussion section should demonstrate the significance of the results in clinical practice. In the following sections, we will provide details on each section of a research article, focusing on the most important components.

3.1 Introduction

In the introduction section, the author must provide background information about the research topic. Therefore, a good practice is to ask certain questions before starting to read an article. For example: When was the last relevant study conducted? Is it a frequently discussed theme? Is it always the same team that writes on the topic? How important is the topic in one's day-to-day life? How does this work fit into a broader context? In this section, the author contextualizes an article related to the theme of the study. At the end of the introduction, the objective of the work is stated which, in most cases, is the initial sentence in the discussion [6]. This is followed by the hypothesis and objectives of the study, as well as how the study can contribute to clinical practice. The objective of a study is what the author is aiming to describe, understand, or evaluate. A well-written introduction is fundamental to the quality of an article because it captures the reader's attention by clearly addressing the research topic.

3.2 Methods

The methods section describes the research protocol that leads to reproducible results when applied under the same conditions. The components of this section can be summarized by the mnemonic "SPLICA," which stands for Study, Patients, Local, Intervention, Criteria, and Analyses [7].
In general, the duration, hypothesis of the study, sample size calculation, statistical analyses, and ethical considerations should be described. One way to build and address a research question is by using the PICO model which stands for Patient/Problem, Intervention, Control/Comparison, and Outcome [8].

In addition, the study design should be clearly described. For example, it should be stated whether it is a prospective, retrospective, or cross-sectional study, whether it is a randomized single- or double-blinded study, and whether it is an interventional study or a systematic review. In addition, the quality of the work is determined by this section, and any defects in the methods can lead to negative comments on the study. Such defects include problems in biasrandomization and blinding, and the occurrence of systematic errors and bias resulting from improper classification or selection. Bias can lead to the overestimation or underestimation of the results. [9]. The methods section should also include the inclusion and exclusion criteria for the study subjects. The former refers to the characteristics that make the study reliable and standardized, such as demographics and clinical aspects. The latter includes characteristics that can be a source of bias and compromise the validity of the results [10].

After reading the methods section, it is pertinent to pose specific questions. Some of these are summarized as follows:Is the study design suited to fulfill the aims of the study? Is the study confirmatory, exploratory, or descriptive in nature? What specific study type was chosen, and does it effectively address the study's objectives? Is the study's endpoint clearly and precisely defined [10]?

3.3 Results

The results section presents the outcomes of the study. It usually includes text supported by well-organized tables and figures. For example, a diagram can be used to describe the study population. This section should include the answer to the main research analyzing the subgroups. It should not describe the methods in detail or explain the reasons behind the results because these are described in other sections.

In the results section, the significance of differences between groups is determined using appropriate statistical methods and is typically denoted by the letter p. If the p-value is less than 0.05, it indicates a significant difference between the groups, and the null hypothesis is rejected. Another parameter that is included in this section is the confidence interval. It represents the pre-specified range of values within which the observed mean deemed acceptable. A 95% confidence interval indicates that if the study were repeated 100 times using the same methodology, the observed average would fall within the confidence limits in at least 95 instances [11].

3.4 Discussion

The discussion section should confirm that the objectives of the study have been met and explain the importance of the results in the clinical context. This section could be divided into four segments. The first segment includes a summary of the resultsand demonstrates whether the initial research objectives were achieved. Generally, the first sentence of the discussion responds to the last sentence of the introduction, which is called the key sentence. The second segment involves a critical evaluation of the work, including comparisons of the findings of the current study with those of previous studies. The third segment focuses on highlighting thefuture implications of the work and the originality of the study. The fourth segment offers concluding remarks on the study, explaining the contribution of the study to the current state of knowledge on the research topic. The discussion primarily involves the authors' interpretation of the results and the implications of the study. This section should be clear, consistent, accurate, and easy to communicate to the reader.

3.5 Conclusions

The conclusions must be in accordance with the study objectives. The authors should base their conclusions solely on the findings of their own research and not extrapolate from other studies. Additionally, the conclusion may include gaps in the existing literature on the subject and propose potential directions for future studies.

FINAL CONSIDERATIONS

Following the main text of an article, statements regarding fundingand conflict of interest related to the article are included. Previous studies have demonstrated that the results of scientific articles for which the authors have declared a conflict of interest are better than those for which none was declared [8].

In summary, a scientific article is more appealing when it features a compelling title; a well-structured and consistent summary; a clear and concise hypothesis; simple, clear, and well-organized methods; explanatory results; engaging discussion; coherence between research questions, results, and discussion; and methodological congruence.

Reading scientific papers is an important task in the medical field. A reader should maintain focus and avoid being biased regarding the topic. To quickly gauge the relevance of an article, it is advisable to begin with the title, as it provides insights into the study's objectives, design, and the population under investigation. Then, the reader should proceed to scanthe abstract, which serves as a succinct summary of the article. However, there is no specific technique for quickly reading an entire article. The reader would eventually discover the most suitable reading technique after accumulating sufficient experience. For example, the reader can start by scanning the figures and charts and then carefully reading the article, looking for the research question, and then asking: Is this study necessary for me and the community? It is important to reread the article and take notes while reading, which improves understanding and memorizing the information included in the article. The reader should ask further questions and summarize the article in a few sentences.

After the final reading of the scientific work, some questions should be asked to assess the quality of the study. For example: Did the results answer the research questions? Are the selected methods appropriate? Were all solutions considered? Have the study limitations been addressed? Does the study include any source of bias? Is this study useful? Can the study be reproduced? If all the answers to all questions were positive, then the scientific work is of good quality. Further credibility criteria can be used to further assess the quality of a scientific article. These include the study design, method of randomization and data collection, masking techniques, efficacy and effectiveness of the methods, the follow-up time, the loss of follow-up (>20% of the work lost quality), and the inclusion and exclusion criteria [2].Du prel et al. described a checklist for evaluating a scientific article concerning the design, inception, implementation, analysis, and evaluation of the study [10].

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