

## Art of reading a journal article: Methodically and effectively

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### ABSTRACT

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#### Background:

Reading scientific literature is mandatory for researchers and clinicians. With an overflow of medical and dental journals, it is essential to develop a method to choose and read the right articles.

#### Objective:

To outline a logical and orderly approach to reading a scientific manuscript. By breaking down the task into smaller, step-by-step components, one should be able to attain the skills to read a scientific article with ease.

#### Methods:

The reader should begin by reading the title, abstract and conclusions first. If a decision is made to read the entire article, the key elements of the article can be perused in a systematic manner effectively and efficiently. A cogent and organized method is presented to read articles published in scientific journals.

#### Conclusion:

One can read and appreciate a scientific manuscript if a systematic approach is followed in a simple and logical manner.

**Keywords:** Articles, journal, reading, research, systematic

### INTRODUCTION

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*“We are drowning in information but starved for knowledge.”*

*John Naisbitt*

It has become essential for the clinicians, researchers, and students to read articles from scientific journals.



heretofore unknown or unusual findings in a well-recognized condition, unique procedure, imaging technique, diagnostic test, or treatment method. Technical notes are description of new, innovative techniques, or modifications to existing procedures. A pictorial essay is a teaching article with images and legends but has limited text. Commentary is a short article on an author's personal opinion of a specific topic and could be controversial. An editorial, written by the editor of the journal or invited, can be perspective (about articles published in that particular issue) or persuasive (arguing a specific point of view). Other articles published in a journal include letters to the editor, book reviews, conference proceedings and abstracts, and abstracts from other journals.[10]

## WHAT TO READ IN A JOURNAL? – CHOOSING THE RIGHT ARTICLE

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Not all research articles published are excellent, and it is pragmatic to decide if the quality of the study warrants reading of the manuscript. The first step for a reader is to choose a right article for reading, depending on one's individual requirement. The next step is to read the selected article methodically and efficiently.[2] A simple decision-making flowchart is depicted in [Figure 1], which helps one to decide the type of article to select. This flowchart is meant for one who has a specific intent of choosing a particular type of article and not for one who intends to browse through a journal.

## HOW TO START READING AN ARTICLE?

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*“There is an art of reading, as well as an art of thinking, and an art of writing.”*

*Clarence Day*

At first glance, a journal article might appear intimidating for some or confusing for others with its tables and graphs. Reading a research article can be a frustrating experience, especially for the one who has not mastered the art of reading scientific literature. Just like there is a method to extract a tooth or prepare a cavity, one can also learn to read research articles by following a systematic approach. Most scientific articles are organized as follows:[2,11]

1. Title: Topic and information about the authors.
2. Abstract: Brief overview of the article.
3. Introduction: Background information and statement of the research hypothesis.
4. Methods: Details of how the study was conducted, procedures followed, instruments used and variables measured.
5. Results: All the data of the study along with figures, tables and/or graphs.
6. Discussion: The interpretation of the results and implications of the study.
7. References/Bibliography: Citations of sources from where the information was obtained.

Review articles do not usually follow the above pattern, unless they are systematic reviews or meta-analysis. The cardinal rule is: Never start reading an article from the beginning to the end. It is better to begin by identifying the conclusions of the study by reading the title and the abstract.[12] If the article does not have an abstract, read the conclusions or the summary at the end of the article first. After reading the abstract or conclusions, if the reader deems it is interesting or useful, then the entire article can be read [Figure 2].

## THE TITLE

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Like the title of a movie which attracts a filmgoer, the title of the article is the one which attracts a reader in the first place. A good title will inform the potential reader a great deal about the study to decide whether to go ahead with the paper or dismiss it. Most readers prefer titles that are descriptive and self-explanatory without having to look at the entire article to know what it is all about.[2] For example, the paper entitled “Microwave processing – A blessing for pathologists” gives an idea about the article in general to the reader. But there is no indication in the title whether it is a review article on microwave processing or an original research. If the title had been “Comparison of Microwave with Conventional Tissue Processing on quality of histological sections”, even the insouciant reader would have a better understanding of the content of the paper.

## **ABSTRACT**

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Abstract helps us determine whether we should read the entire article or not. In fact, most journals provide abstract free of cost online allowing us to decide whether we need to purchase the entire article. Most scientific journals now have a structured abstract with separate subheadings like introduction (background or hypothesis), methods, results and conclusions making it easy for a reader to identify important parts of the study quickly.[13] Moreover, there is usually a restriction about the number of words that can be included in an abstract. This makes the abstract concise enough for one to read rapidly.

The abstract can be read in a systematic way by answering certain fundamental questions like what was the study about, why and how was the study conducted, the results and their inferences. The reader should make a note of any questions that were raised while reading the abstract and be sure that answers have been found after reading the entire article.[12]

### **Reading the entire article**

Once the reader has decided to read the entire article, one can begin with the introduction.

## **INTRODUCTION**

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The purpose of the introduction is to provide the rationale for conducting the study. This section usually starts with existing knowledge and previous research of the topic under consideration. Typically, this section concludes with identification of gaps in the literature and how these gaps stimulated the researcher to design a new study.[12] A good introduction should provide proper background for the study. The aims and objectives are usually mentioned at the end of the introduction. The reader should also determine whether a research hypothesis (study hypothesis) was stated and later check whether it was answered under the discussion.

## **MATERIALS AND METHODS**

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This section gives the technical details of how the experiments were carried out. In most of the research articles, all details are rarely included but there should be enough information to understand how the study was carried out.[12] Information about the number of subjects included in the study and their categorization, sampling methods, the inclusion criteria (who can be in) and exclusion criteria (who cannot be in) and the variables chosen can be derived by reading this section. The reader should get acquainted with the procedures and equipment used for data collection and find out whether they were appropriate.

## **RESULTS OF THE STUDY**

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In this section, the researchers give details about the data collected, either in the form of figures, tables

and/or graphs. Ideally, interpretation of data should not be reported in this section, though statistical analyses are presented. The reader should meticulously go through this segment of the manuscript and find out whether the results were reliable (same results over time) and valid (measure what it is supposed to measure). An important aspect is to check if all the subjects present in the beginning of the study were accounted for at the end of the study. If the answer is no, the reader should check whether any explanation was provided.

Results that were statistically significant and results that were not, must be identified. One should also observe whether a correct statistical test was employed for analysis and was the level of significance appropriate for the study. To appreciate the choice of a statistical test, one requires an understanding of the hypothesis being tested. [14,15] [Table 3](#) provides a list of commonly used statistical tests used in scientific publications. Description and interpretation of these tests is beyond the scope of this paper. It is wise to remember the following advice: It is not only important to know whether a difference or association is statistically significant but also appreciate whether it is large or substantial enough to be useful clinically. [16] In other words, what is statistically significant may not be clinically significant.

## DISCUSSION

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This is the most important section of the article where the research questions are answered and the meaning of analysis and interpretation of the data are presented. Usually the study results are compared with other studies, explaining in what aspects they were different or similar. Ideally, no new data should be presented under discussion and no information from other sections should be repeated. [2] In addition, this section also discusses the various strengths and limitations/shortcomings of the study, providing suggestions about areas that need additional research.

The meaning of results and their analyses, new theories or hypotheses, limitations of the study, explanation of differences and similarities with other comparable studies, and suggestions for future research are offered in this section. It is important to remember that the discussions are the authors' interpretations and opinions and not necessarily facts.

## READING THE CONCLUSION (AGAIN !)

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Though conclusion part had been read at the beginning, it is prudent to read it again at the end to confirm whether what we had inferred initially is correct. If the conclusion had not made sense earlier, it may make sense after having perused through the entire article. Sometimes, the study conclusions are included in the discussion section and may not be easy to locate. The questions that can be asked under various sub-headings of an original research paper are presented as a simple questionnaire in [Table 4](#). It is assumed that one who is using this questionnaire has read and analyzed the abstract and then decided to read the entire article. This questionnaire does not critically analyze a scientific article. However, answers to these questions provide a systematic approach to obtain a broad overview of the manuscript, especially to a novice. If one who is new to reading articles, writing answers to these questions and taking notes will help in understanding most aspects of a research article.

## CONCLUSION

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*“Let us read with method, and propose to ourselves an end to which our studies may point. The use of reading is to aid us in thinking.”*

It has become mandatory to read scientific literature to be well-informed of ever-expanding information and/or for better diagnosis, prognosis and therapy. Since there is an abundance of journals and articles, it is critical to develop a modus operandi for achieving a rapid, purposeful, effective and useful method to read these manuscripts. A simple but efficient and logical approach to scientific literature has been presented here for choosing articles and reading them systematically and effectively for a better understanding.

## FOOTNOTES

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## FIGURES AND TABLES

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**Table 1**

1. To update oneself with progress in a particular speciality/field of study
2. To find out a solution for a specific problem-could be diagnostic (tests/methods) or therapeutic (medical/surgical)
3. To know about causation, clinical features, and course of a disorder/disease
4. To understand certain fundamental aspects like pathophysiology
5. To get an idea for carrying out a research work
6. The article has been assigned to be read (for e.g., by an instructor to a postgraduate student)
7. To find support for one's views
8. To impress others

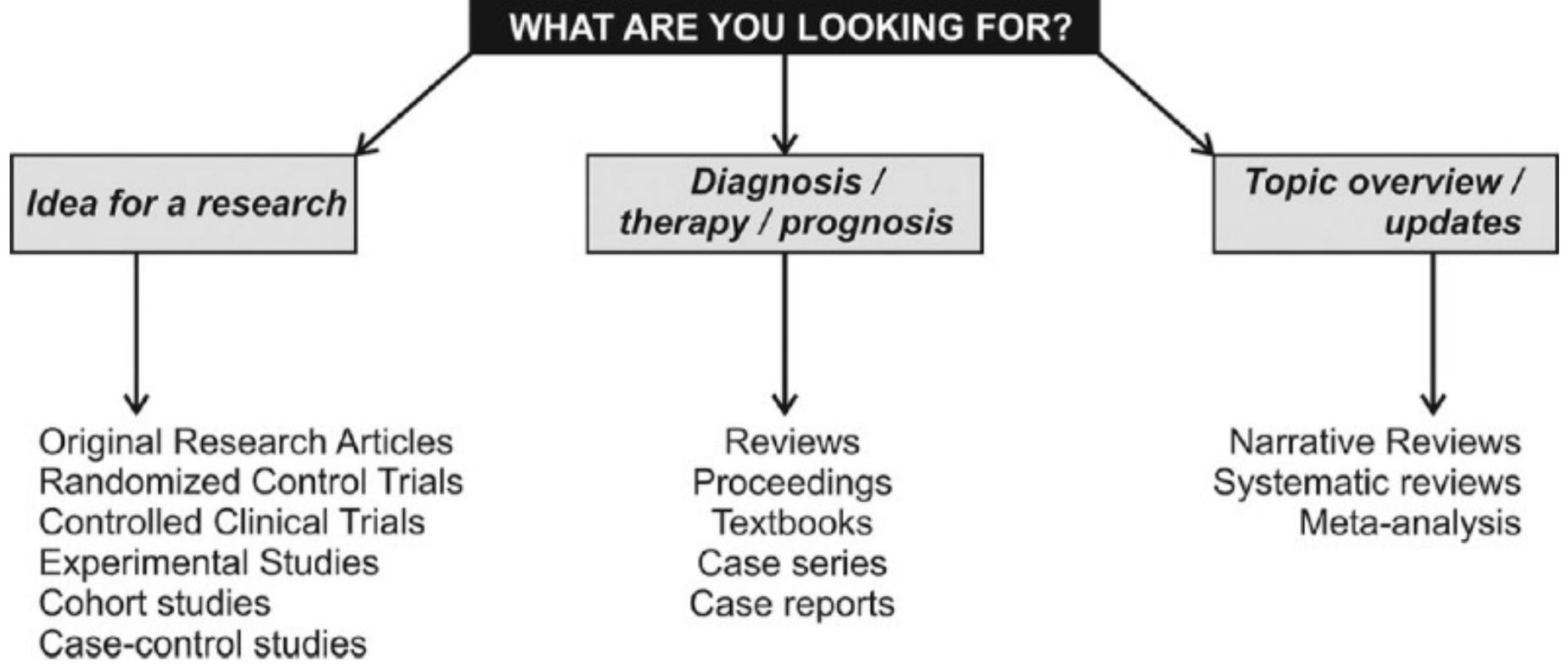
Common reasons for reading journal articles

**Table 2**

<b>Primary literature</b>	<b>Secondary literature</b>
Original research articles	Narrative reviews
Surveys	Systematic reviews
Case report/case series	Meta-analysis
Conference proceedings and abstracts	Book reviews
Editorial	Guidelines
Correspondence/letters to the editor	Commentary

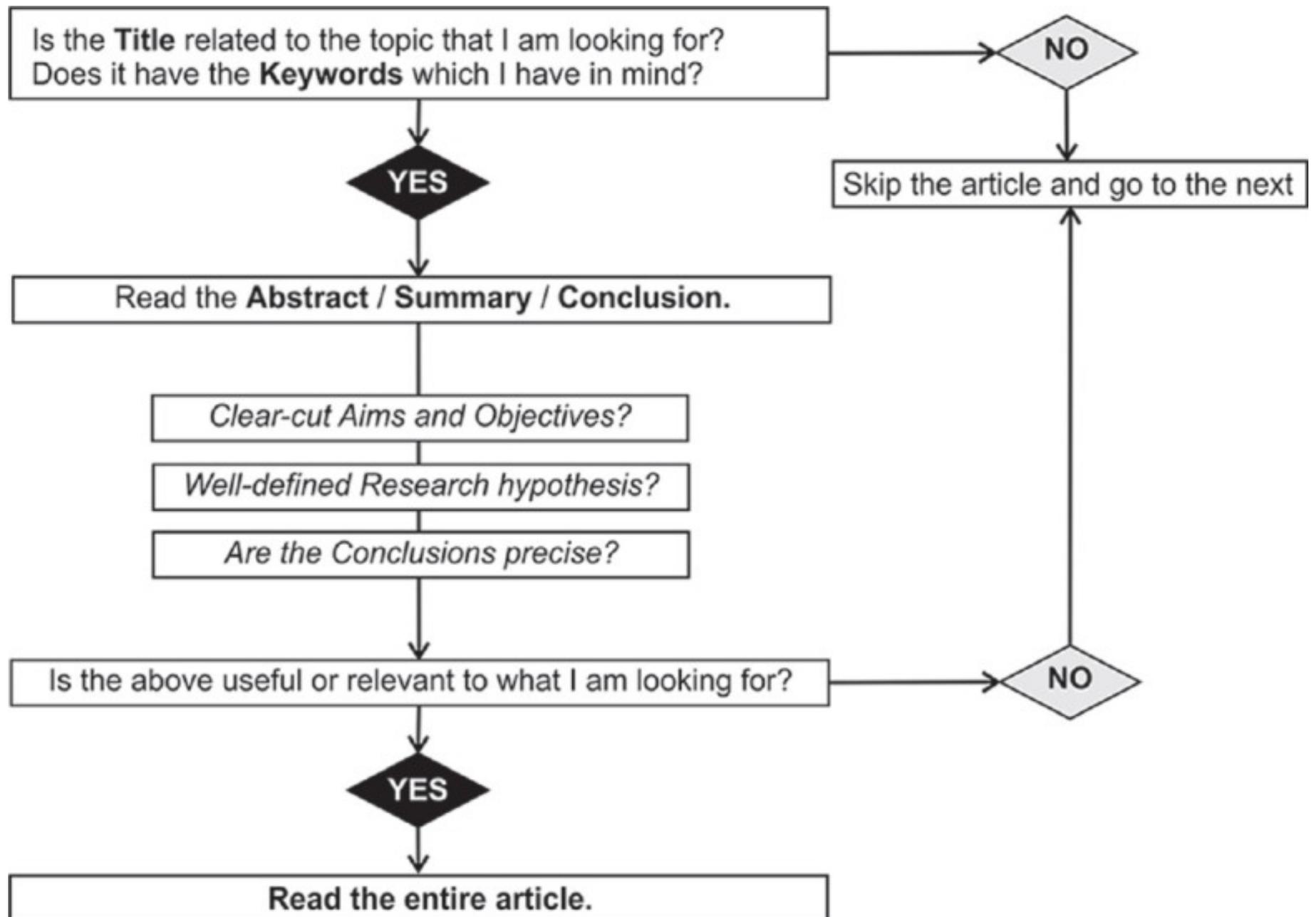
Types of articles published in a journal

**Figure 1**



Schematic flowchart of the first step in choosing an article to read

**Figure 2**



Decision-making flowchart to decide whether to read the chosen article or not

**Table 3**

## Descriptive statistics

Mean, median, range, and standard deviation

Tables/graphs

Percentages

Sensitivity and specificity

## Inferential statistics (hypothesis testing)

Parametric tests (for quantitative data)

Normal curve test (Z test)

Comparing two sample means or proportions

Student's  $t$  test

Testing for differences between the mean values of two groups of data

Unpaired  $t$  test (two independent samples)

Paired  $t$  test (matched or paired samples)

Analysis of variance

To compare means in three or more groups

Pearson correlation coefficient

For testing the strength of the association between two variables

Linear regression

For predicting the value of one variable based on the value of one or more other measured variables

Non-parametric tests (for quantitative data)

Wilcoxon signed rank test (matched data)

Mann-Whitney rank sum test (two independent groups)

Kruskal-Wallis test (for comparing three or more groups)

Non-parametric tests (for qualitative data)

Chi-square test (several groups and several outcomes, unmatched data)

McNemar test (several groups and several outcomes, matched data)

Fisher's exact test (two groups, two outcomes)

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Parametric tests assume an underlying normal (bell-shaped) distribution, whereas non-parametric tests do not

Basic statistics commonly used in scientific publications

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**Overall**

1. What was the article type?
2. What was the title?
3. Who were the authors?

**Introduction**

4. What was the research problem?
5. Was there any mention of previous studies on this topic?
6. Why was this study performed (the rationale)?
7. What were the aims and objectives of the study?
8. What was the study (research) hypothesis?

**Materials and methods**

9. How did the researcher attempt to answer the research question?
10. How was the sampling done?
11. How were they grouped (categorized)?
12. What were the inclusion criteria?
13. What were the exclusion criteria?
14. What procedures were followed?
15. Which variables were measured?
16. What equipment/instruments were used for data collection? Were they appropriate?
17. What statistical methods/tests were employed? Were they apt for evaluation?

**Results**

18. What were the key findings?
19. Were all the subjects present in the beginning of the study accounted for at the end of the study?
20. Were the results reliable?
21. Were the results valid?
22. Which results were statistically significant?
23. Which results were statistically non-significant?
24. Were the tables/graphs easy to comprehend?

**Discussion**

25. Did the results answer the research question?
26. What were the authors' interpretations of the data?
27. Was the analysis of the data relevant to the research question?
28. How were these results different/similar when compared to other studies?
29. What were the strengths of the study?

29. What were the strengths of the study?
30. What were the limitations of the study?
31. Were there any extrapolations of the findings beyond the range of data?

#### Conclusions

32. What were the conclusions?
33. Were the authors' conclusions based upon reported data and analysis?
34. Were the conclusions reasonable and logical?
35. Will the results be useful in clinical practice or for further research?
36. Was the study worth doing?
37. Does the reader have any questions unanswered by the article?

#### References

38. Were the references cited according to journal's requirement?
  39. Were all the citations correct?
  40. Were all the references cited in the text?
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Questionnaire for original research articles

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