

## **Requirements for the Structure and Content of Scientific Publications** (IMRAD Standard)

### **Title**

The title may be reprinted in bibliographies and subject indexes, stored in bibliographic databases and cited in other articles. Therefore, the title is an extremely important component of the paper. A good title of a research paper should **limit to 12 words**, and should:

- Be easy to understand
- Describe the contents of the paper accurately and specifically
- Avoid abbreviations and jargon
- Not include any verb
- Not contain low-impact words such as "Some notes on..." "Investigations on..." "Study of..."
- Report the subject of the research rather than the results
- Follow the style preference of the target journal.

### **Abstract**

The Abstract is a short version of the full paper in 150–250 words.

The Abstract starts with a statement of rationale and objectives and reports the methods used, the main results including any newly observed facts, and the principal conclusions and their significance.

The Abstract should not contain:

- Abbreviations or acronyms
- References to tables or figures in the paper, Literature citations
- General statements

### **1 Introduction**

Introduction defines the nature and extent of the problems studied, relates the research to previous work (usually by a brief review of the literature clearly relevant to the problem), ("Studies showed that ..."), or ("Studies have shown that ...").

Introduction explains the objectives of investigation ("The objective of the current study was...") and defines any specialized terms or abbreviations to be used in what follows.

Introduction leads logically to the hypothesis or principal theme of the paper.

Do not repeat well-known facts nor state the obvious.

### **2 Materials and Methods**

The purpose of this section is to present what has been done, how, and when, and how the data were analyzed and presented.

This section should provide all the information needed to allow another researcher to judge the study or actually repeat the experiment.

The section should include the following:

- Description of the study location (climate, soil, etc., to the extent such information is relevant to the study)
- Materials used, with exact technical specifications.
- Assumptions made and their rationale
- Statistical and mathematical procedures used to analyze and summarize the data.

Methods followed should be described, usually in chronological order, with as much precision and detail as necessary.

Standard methods need only be mentioned, or may be described by reference to the literature. If the method is new it should be described in detail.

### **3 Results**

This section presents the new knowledge; therefore, it is the core of the paper.

The value of the paper depends on what is contained in this (Results) section, and it must be presented in an absolutely clear manner.

It is usually easiest to follow the results if they are presented in the same order as the objectives are presented in the Introduction.

Some guidelines on presenting the results:

- Present the results simply and clearly
- Report only representative data rather than (endlessly) repetitive data
- Do not report large masses of data; reduce them to statistically analyzed summary forms and present in tables or figures along with essential statistical information to facilitate understanding and comparing them
- Repeat in the text only the most important findings shown in tables and graphs; in other words, do not repeat in the text all or many of the data presented in tables and figures
- Include negative data – what was not found – only if useful for interpreting the results
- Include only tables and figures that are necessary, clear, and worth reproducing
- Avoid verbose expressions: e.g., instead of saying "It is clearly shown in..."

Tables and figures are an integral part of a well-written scientific paper, and they appear in the Results section (but there are exceptions). While tables present accurate numbers, figures show trends and features. Do not present the same data in tables and graphs.

### **4 Discussion**

This is the section where the authors explain meanings and implications of the results. The section pulls everything together and shows the importance and value of the work and is therefore the most innovative and difficult part of the paper to write.

The authors' skill in interpreting the results in the light of known facts and using the results as evidence for innovative explanations of the observed behavior should push the frontiers of knowledge and arouse the readers' enthusiasm. Without such an engaging discussion, the reader may leave saying "So what?" and move on to other, more interesting papers.

A good discussion should:

- Not repeat what has already been said in the review of literature
- Relate the results to the questions that were set out in the Introduction
- Show how the results and interpretations agree, or do not agree, with current knowledge on the subject, i.e., previously published work
- Explain the theoretical background of the observed results
- Indicate the significance of the results
- Suggest future research that is planned or needed to follow up
- Deal with only the results reported in the study
- Stay away from generalizations and conjectures that are not substantiated by the results presented

Mismatch between stated objectives and discussion/conclusion is a very common problem in many manuscripts.

Often, authors make superficial statements such as "this work agrees with the work of author X (some unknown author's work)" as though the objective of research was to see if the results agreed with some other author's work published 20 or more years earlier.

Another common problem in Discussion sections is the tendency to move away from the stated objectives and try to "solve all problems."

Here is the example of how differently the results obtained in a scientific research can be interpreted.

*The story is about the elementary school science experiment to show the danger of alcohol:*

*The teacher set up two glasses, one containing water and the other containing gin. A worm was dropped into each glass. The worm in gin died immediately while the worm in water swam around merrily. When the teacher asked the pupils what the experiment showed, little Johnny blurted out "If you drink gin, you won't have worms."*

### **Conclusions**

Conclusions that have been drawn from the results and subsequent discussion.

Conclusions should, rather than just repeating results, state well-articulated outcomes of the study and briefly suggest future lines of research in the area based on findings reported in the paper.

In poor writing, it is not uncommon to find conclusions such as "more research is needed before conclusions can be drawn." In that case, why publish a paper from which conclusions cannot be drawn?

### **References**

The recommended quantity of references is 15–30. The cited papers should be relatively recent.