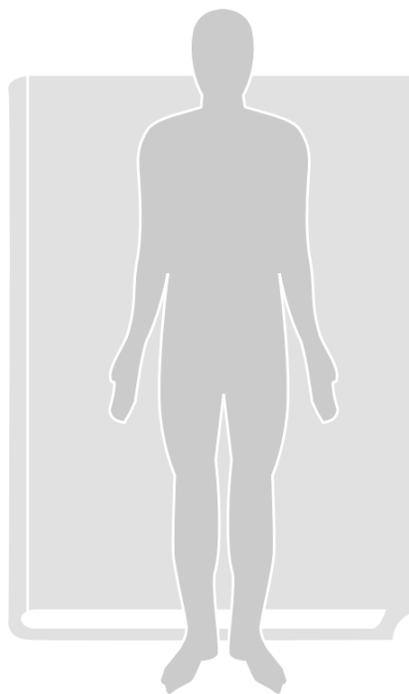


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FEATURE

Publish and prosper: how to write a scientific research article for an academic journal

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Publishing original research in peer-reviewed academic journals is fundamental to the development of evidence-based medicine. For the student author, a publication in a peer-reviewed journal will set their resumé apart from other students and will improve their chances of getting a good job in an interesting area, or getting a headstart into academia.

This article details step-by-step instructions on how to write a scientific paper for publication in a medical journal. These instructions are based on a method devised by Tim Albert, a UK-based medical writing specialist who conducts writing and editing work-shops for health professionals (see www.timalbert.co.uk for details). This method is outlined in Tim Albert's highly commended books on medical writing^{1,2} and details he imparted at the *BMJ* short course for medical journal editors in Christchurch August 5-6 2004. Relevant details from other writing guidelines compiled by the University of Otago Student Learning Centre³, the International Committee of Medical Journal Editors⁴ and the Cochrane Organisation⁵ have also been included where appropriate.

Writing is a process that can be divided into three main elements:

- Planning
- Writing
- Editing

PLANNING

1. Decide on the target audience and the journal you plan to submit your manuscript to. Each journal has specific requirements for writing style and these preferences should be followed.

2. Formulate a one-sentence message consisting of about 12-words. Each publication essentially reports the results of one important finding from an original piece of research.

3. Construct four simple plans; one for each of the following sections: Introduction, Methods, Results, and Discussion. Albert⁶ found a consistent pattern of paragraphs in publications from six major medical journals. Based on a study of 300 articles, the mean number of paragraphs per section was:

Introduction – 2 paragraphs
Methods – 7 paragraphs
Results – 7 paragraphs
Discussion – 6 paragraphs

NB: This pattern of paragraphs can be altered depending on the scale of the research, such as 2-5-5-4 for a shorter article. The 2-7-7-6 formula is an example and not a set of rules.

Restrict your plan to paragraph subject headings that outline your argument and support your message. Avoid details at this stage.

Introduction

1. Establish the nature and significance of the problem by providing background to the topic, i.e. why do the study? Use only important references.
2. Clearly state the specific research objective(s) or the major hypothesis to be tested.

Method

1. Setting of where and when the data was collected.
2. Selection and description of participants including controls.
3. Study design.
4. Technical procedures including apparatus details and references to established methods.
5. Description of new or modified methods.
6. Statistical analysis and computer software.
7. Computer software.

NB: Details should be clear enough for a competent person to be able to reproduce what you did and verify the results.

Results

1. Summary of collected data, such as participants and controls.
2. Efficacy of procedures indicating strength of evidence.
3. Main finding that addresses the primary objective of the study. Display only tables and figures that support or explain the argument of the paper and report only the important trends and observations in the text.
4. Second most important finding. Attempt to follow the order of comparisons in the methods.
5. Additional supportive finding. As with each main finding, report the method of analysis and a measure of uncertainty, such as a 95% confidence interval.
6. Additional supportive finding.
7. Summary of supplementary information accessible in appendices or e-journal.

Discussion

1. State the main findings emphasising the new contributions to the research area and the important conclusions that follow from them.
2. Get rid of bad news by outlining the weaknesses of the study
3. But on other hand... outline the strengths of evidence.
4. Put the findings in context. Compare and contrast the findings by detailing the results from previous studies on the same topic.
5. Unanswered questions and outline future research.
6. Implications and take home message referring to study objectives.

NB: Do not detail information previously given in the Introduction or the Results section.

this stage: subediting by supervisors or colleagues can focus on this. The article can be translated into the style favoured by the targeted journal at a later stage. 'People are fairly suspicious of what they have written in this way,' writes Albert'. 'But they usually find that their message has come across clearly, and that the structure... is unusually well paced and clear' (p 53).

EDITING

Wait at least one night before re-writing the first-draft. The re-writing process is divided into two stages; macro-editing, which looks at the structure and clarity of the message, and micro-editing, which looks at the details.

Macro-editing

1. The Yellow Marker Test:

Use a yellow highlighter to identify the writing's structure by underlining essential sentences that move the argument forward. The first sentence of each paragraph is important and should be highlighted to ensure an argument is intelligible. The highlighted sentences should be able to be read in order and make sense. The remaining sentences in each paragraph should support and flesh out the argument. The supporting information should be in decreasing order of importance. If the highlighted sentence is in the middle of a paragraph it should be moved. If no sentences are highlighted then consider removing the paragraph. If several sentences are highlighted within a paragraph, the paragraph may be overloaded.

NB: An alternative writing style is IMRAD or introduction, method, result and discussion. This technique is traditionally used in scientific writing but is boring and it should just be used in the abstract (see below).

Micro-editing

1. Avoid long sentences.

You should have 4-5 sentences every 100 words but not all sentences should be 20-25 words long. The sentence length should not go beyond 30 words.

2. The active voice is better than the passive.

The best way to start a sentence in English is with the subject. A sentence constructed in the active voice consists of a subject, a verb and an object respectively, e.g. 'the dentist called the helpdesk'. The passive voice is when the object of the action becomes the subject of the sentence, i.e. 'the helpdesk is called by the dentist'. Traditionally, scientific writers use the passive because it is thought to be more objective than the active and currently some journals still prefer the passive voice (see ref. 1, p48). This style, however, leads to writing that lacks clarity.

NB: The passive voice should be used in abstracts and when writing the first sentence of an article to put the more interesting part at the beginning; e.g. 'More than 180 trillion leisure hours were lost to work in 2004 according to a report released Monday by Boston University's School of Lifestyle Management'.⁷

3. Replace long words with shorter ones.

4. Ensure the accuracy of specific details and facts.

5. Check the grammar.

6. Polish the style.

7. Improve the presentation of the tables and figures.

8. Write the title based on the style exhibited by the journal.

Obtain the Instructions to Authors and an article from the target journal. Use the article to indicate how the title and references should be written, and the instructions to guide the style by which you write the covering letter, title page and abstract. Uniform requirements for manuscripts submitted to biomedical journals written by the International Committee of Medical Journal Editors can be viewed at www.icmje.org/index.html

9. Write the abstract.

The abstract should be written in the passive voice using the IMRAD structure (but follow the preference of the journal). Begin with an introduction (the background and objectives), followed by a summary of the method (study subjects, setting, design and analysis) and then the interesting bits, the results (the main findings with statistical significance) and the primary conclusions with implications. Usually an abstract is not more than 250 words. Review or discussion papers should include a summary rather than an abstract.

CONCLUSION

Publishing an article in a peer-reviewed academic journal will enhance your medical career by revealing you have the potential of a maturing author, researcher and clinician. Fortunately, writing a scientific research article is a relatively straight-forward process. The instructions outlined in this methodological paper will assist with the writing process and produce a well structured article that delivers a clear message to the target journal and audience.

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4. Construct four key sentences that expand on the message. A reader should be able to only read these four sentences to clearly understand the significance of the research. The four key sentences are:

- The first sentence in the Introduction that explains the reason the research was conducted. Typically it is factual and informative, e.g. 'There has been much discussion recently about ...' or a shocking statistic or trend to hook the reader in to continue to read the article.
- The last sentence in the Introduction that describes what the author aimed to do. For example, 'In this study we will investigate...'
- The first sentence in the Discussion that describes the main finding, such as 'This study found clear evidence that ...'
- The last sentence in the Discussion that provides a conclusive and clear explanation of the implications of the research findings.

WRITING

Start writing. Create an outline of each section. Write a logical flow of big ideas using natural language as if you're speaking to a knowledgeable friend at a café or an informed colleague in the tearoom. Write in short bursts of about 20 minutes without stopping or reviewing. Move from sentence to sentence writing each section in turn. Gaps can be filled later. Do not be too analytical about grammar and exact references at

