

FEATURES SECTION

How to . . . write a paper

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Writing a paper may seem like a daunting process for the inexperienced researcher (and sometimes for those who are experienced!). However, this does not need to be the case if the approach is logical and systematic. This article covers some of the most important aspects of writing a scientific paper.

Key words: *Publishing, writing an article, writing for publication*

How to start

When a paper is submitted to any journal, the editor must establish four main facts:¹

- Is the science accurate?
- Is the material new and will it have any impact on clinical practice or add substantially to current knowledge?
- Is the message appropriate for the readership of that journal?
- Has the manuscript been prepared carefully or will major revisions be required to bring it up to the standards required?

This article focuses on the third and fourth issues, and describes a systematic approach to writing a paper.

Is the paper worth writing?

When considering writing any paper, the first question that must be asked is ‘Is this study of sufficient interest to the profession, that it warrants writing a paper?’ Some research that is done out of necessity (i.e. student projects) can never be original and this question should be asked at the outset, before much time and effort is spent writing an article that is not likely to be accepted for publication.

Choice of journal

The next question to be asked is ‘Where do I wish this paper to be published?’ In the current climate of the Research Assessment Exercise, ideally, the chosen journal should have the maximum impact factor and citation index. Tables of these can be obtained from most

libraries and also on the Internet. However, it must also be considered whether the paper you intend to write is appropriate to the style of that journal. For example, is the paper very clinically based or more basic science based, and which type of paper does that journal prefer? Once a decision has been made, obtain a copy of the guidelines for authors straight away so that you start writing the paper in the correct format and do not have to waste time altering everything at the end. This can save a great deal of time and effort. Be careful to adhere to these guidelines, there is nothing more frustrating for a journal’s editorial assistant than to have to go through and correct the format before it can be sent out to referees.

With an increased emphasis on randomized, controlled clinical trials, there has been a definite move away from case reports and ‘this is how I do it . . .’ publications. These types of article are still welcomed by some journals, but it is advisable to check their policy on this first.

Authorship

This can be a difficult issue and should be resolved prior to writing the paper. The important issue is that only those individuals who have made a significant contribution to the paper should be included. Guidelines are available that explain who should be included and in which order.

If an individual has made a contribution to the paper, but not sufficiently so that they can be included as an author, they can be acknowledged instead. Others who have assisted with the writing of the paper can also be mentioned here, for example, those who have read the manuscript and given constructive comments. In addition, any funding bodies should be acknowledged at this point.

Start early

Some of the work towards a publication can start early. For example, the materials and methods section can be written while the research is being conducted, even if it requires revision at a later stage. Doing this also helps focus your thoughts on these important questions:

- What did you do?
- Why did you do it?
- What did you find?
- What does it mean?

Preparation of the manuscript

Writing style

Each author will develop his or her own writing style, but the important issue is that it should be clear and easy to read. This means avoiding jargon, and also avoiding repetition of material in tables, figures and text.

Spelling and grammar

There is no excuse for poor grammar or spelling with the advent of grammar and spell checks on most computers. The choice of English or American spelling will depend on where the journal is published; always ensure you are then using the appropriate spell check on your computer.

The use of abbreviations is accepted by some journals, but not by others and some specify that only internationally standardized abbreviations may be used. If you are not certain, check through past copies of the journal to

ensure what their policy is. If using abbreviations, always write out the word(s) in full on first mention, even if you think it is an established abbreviation. Abbreviations are acceptable for units of measurement and also in tables where space may be limited, in which case they should be explained underneath the table.

Use of numbers

Apart from those accompanying measurements, numbers under 10 should always be spelt out in full, while those of 10 and above can be presented as figures. When both occur in a single sentence, they should both be expressed in figures.² It is also worth remembering that a sentence should never be started with numbers, they should be spelt out in full.

Follow a systematic approach

In medical and dental journals, the structure of a research paper usually conforms to the following format (see Table 1):

- Abstract
- Introduction (usually concluding with Aims of the study)
- Materials and methods
- Results
- Discussion
- Conclusions

It is important to pay special attention to what readers are most likely to look at, e.g. the title, abstract, tables

Table 1 Components of a paper

Component	
Title	Allows the reader to establish the nature of the paper and decide if they wish to read it
Abstract	Many journals request a structured abstract Should be a <u>brief</u> summary — there is usually a word limit which should be adhered to Include key words for Medline listing
Introduction	Includes a brief description of previous work Allows you to demonstrate the need for your study Should end with your hypotheses and the aims of the study
Materials and methods	The materials and methods should include: Description of the methodology used Materials or subjects used (including ethics and consent) Sample size calculation Description of the statistics used
Results	Should include all findings (including negative and non-significant findings) Use tables and figures appropriately
Discussion	Highlight the main findings and compare with previous work Include any limitations of the study Conclude with several key findings
References	References should be checked carefully for accuracy Ensure you are using the correct format for the journal in question

and figures. The title and abstract are often the only part that is accessible electronically, therefore should be subject to the same level of critique as the rest of the paper.³ It is usually worth leaving the abstract and title until the main body of the paper has been written, as it is then easier to write. Avoid attempts at clever or witty titles, and do not use abbreviations in titles. Tables and figures are visual elements and, as such, are often the best way to communicate your findings, as readers frequently focus on these aspects of the publication.

Abstract

Many journals now request that the abstract is structured, i.e. follows the above headings. Even if the journal does not specify this, it is a useful way of writing an abstract, as it is easy for the reader to see your findings.

Introduction

The introduction is what motivates the audience to read a paper and the first sentence is particularly important. The introduction should be concise and include the key papers in that field of research. Immediately prior to submitting the paper, do a last minute literature search just to ensure there are no very recent publications that warrant inclusion. Failure to include the most up-to-date publication that happens to be by the person refereeing your paper is certain to put them in a bad mood!

Material and methods

The section should give a sufficiently clear overview of what was done so that the study could be repeated. It can be difficult striking the balance between brevity and completeness, but the reader must be able to assess:⁴

- What type of study was performed? (i.e. was it a randomized controlled clinical trial or was it a . . . ?)
- How many subjects (or samples) were included?
- Who were the subjects?
- Where did the subjects come from?
- What were the inclusion and exclusion criteria?
- What intervention (if any) was offered?
- How long was the follow-up (if relevant)?
- What was the response rate (for surveys/questionnaires)?
- What outcomes were measured and how?
- What statistical tests were used?

If ethical approval was required for the study, always start this section with a short sentence stating that ethical approval was granted by the ethics committee of whichever institution was involved. In addition, if consent was obtained this must also be mentioned. Ethical issues

are of vital importance in today's research climate and it is important to acknowledge that this has been treated seriously.

If the method is complex it may be worth considering the use of a figure or flow diagram to clarify the situation. Appendices may be used if necessary, for example, to provide details of a particular analysis.

It is also important to avoid confusing the reader by having the same thing called by several different names, so pay attention to how you name things that appear repeatedly in the text.

Included within this section is the statistical analysis. Sample size and power are important issues, with journals increasingly expecting evidence that a sample size calculation was undertaken using, for example, Altman's nomogram⁵ or one of the computerized packages. The other area that has become important in recent years is the use of Confidence Intervals, with many journals preferring these to the use of the standard deviation.

Results

The results should be presented in a clear concise format. A question that is often asked is whether data should be put in tables or presented in the text. In general, if there are only a few factors to be considered (for example, gender distribution) they may be better presented in the text. Otherwise, try to present data in tables or figures for clarity. However, one point worth stressing is to avoid including tables with large amounts of data as readers will find it off putting and very difficult to read. It is also worthwhile considering presenting data as a graph, rather than a table, as graphical representation is often easier to follow. All tables and figures should be comprehensible without needing to refer to the text, and the titles should be self-explanatory. They should always be referred to at the appropriate point in the text. The required style for tables should be checked carefully as many journals specify that no grid lines should be included. Illustrations should be of good quality, especially photographs, line drawings and cephalometric tracings.

Discussion

The discussion aims to summarize your work and put it into perspective. It is important to acknowledge potential limitations of the study — no article is perfect, but equally these limitations should not be ignored. The work must also be put in context, for example, is the study generalizable and what are the clinical implications. Always remember to comment on the clinical significance of your findings. It is all very well to conclude that the use of a certain type of functional appliance results in a statistically significant increase in mandibular

growth of 0.3 mm per year, but is this really of clinical significance?

Conclusions

The paper should finish with four or five salient conclusions from the work. It is useful to present these as bullet points as this provides maximum impact.

References

The accuracy of the references is the authors' responsibility; therefore, check them carefully. Many referees select one or two references at random and check them. If there are inaccuracies in the references, it tends to reflect badly on the paper as a whole. It is also important to make sure that the correct reference style for that journal is used both within the text and the reference list. There are two main types of reference system:

- *Vancouver system*: this system uses superscript numerals in the text and the references are in the order in which they appear in the text.
- *Harvard system*: this system uses the name of the first author and the date of the paper and the references are then in alphabetical order.

Avoid cross-referencing from other articles without having read the original paper, remember that you may be committing inaccurate interpretations of previous work to print — with your name implicated!

Finishing the paper and final checks

Useful feedback

It is helpful at this stage to ask a colleague(s) to read the paper in order to ensure that it reads well and is understandable. In addition, ask someone to look hard for flaws and be constructively 'critical' in the same way that the referees will be. Then, incorporate useful feedback into the next draft of the paper before it is sent off. Always make sure you keep previous drafts of the manuscript on your computer in case you need them later.

The finished product and final checks

When the paper is finished, it is very useful to put it aside for a few days and then re-read it — a surprising number of errors may be found! Additional comments can also be added at that stage when you return to the paper refreshed.

Always check for consistency, particularly with respect to data and headings, which should be consistent across

the text, tables and figures. Also eliminate any 'clutter', for example, repetitions and jargon. Check carefully for any aspects that may appear ambiguous and amend them accordingly.

Prior to sending the manuscript, double check that it is in accordance with the journal's instructions. Also, ensure that, if you have used previously published material, you have written permission to reproduce it. If there is any way that individual patients can be identified, then either ensure that you have that individual's written permission or the content of the paper should be modified to protect the patient's identity.

After the paper has been sent

Most journals acknowledge receipt of the paper. If you do not receive this within 3–4 weeks, it is worth checking that it has been received. The refereeing process can take time, so avoid the temptation to enquire about the status of your paper too soon!

Revisions

If the paper is returned to you requesting revisions, make sure these are done as quickly as possible. Think very carefully about all aspects that have been raised and discuss the appropriate way to proceed with your co-authors. When the revised manuscript is returned, always include a covering letter detailing your responses to each of the points raised by the referees. It makes it much easier for the editor to assess whether the issues raised have been addressed appropriately.

Checking the proofs

When proofs are sent to the authors, they frequently have to be returned very quickly in order to fit in with the publisher's schedule. However, even with these time constraints, always check the proofs carefully as this is your responsibility. Areas where errors can frequently occur are data tables and references, so check these carefully. Always keep a copy of the proofs for your own records.

Rejection

If the paper is rejected, it may be that the study had a fundamental flaw (i.e. the sample size was too small or the methodology inappropriate) or it may just be that the paper is inappropriate for that journal. The editor's letter will usually give some indication of which applies and whether it is worth submitting elsewhere. Above all,

do not be despondent at this stage, act on the referees' reports and consider trying again.

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