

Editorial

Writing a research article: advice to beginners

Writing research papers does not come naturally to most of us. The typical research paper is a highly codified rhetorical form [1,2]. Knowledge of the rules—some explicit, others implied—goes a long way toward writing a paper that will get accepted in a peer-reviewed journal.

be assumed that the human genome is the same worldwide, whether the results of a local quality improvement project have wider relevance requires careful consideration and argument.

Primacy of the research question

A good research paper addresses a specific research question. The research question—or study objective or main research hypothesis—is the central organizing principle of the paper. Whatever relates to the research question belongs in the paper; the rest doesn't. This is perhaps obvious when the paper reports on a well planned research project. However, in applied domains such as quality improvement, some papers are written based on projects that were undertaken for operational reasons, and not with the primary aim of producing new knowledge. In such cases, authors should define the main research question *a posteriori* and design the paper around it.

Generally, only one main research question should be addressed in a paper (secondary but related questions are allowed). If a project allows you to explore several distinct research questions, write several papers. For instance, if you measured the impact of obtaining written consent on patient satisfaction at a specialized clinic using a newly developed questionnaire, you may want to write one paper on the questionnaire development and validation, and another on the impact of the intervention. The idea is not to split results into 'least publishable units', a practice that is rightly decried, but rather into 'optimally publishable units'.

What is a good research question? The key attributes are: (i) specificity; (ii) originality or novelty; and (iii) general relevance to a broad scientific community. The research question should be precise and not merely identify a general area of inquiry. It can often (but not always) be expressed in terms of a possible association between X and Y in a population Z, for example 'we examined whether providing patients about to be discharged from the hospital with written information about their medications would improve their compliance with the treatment 1 month later'. A study does not necessarily have to break completely new ground, but it should extend previous knowledge in a useful way, or alternatively refute existing knowledge. Finally, the question should be of interest to others who work in the same scientific area. The latter requirement is more challenging for those who work in applied science than for basic scientists. While it may safely

Structure of the paper

Once the research question is clearly defined, writing the paper becomes considerably easier. The paper will ask the question, then answer it. The key to successful scientific writing is getting the structure of the paper right. The basic structure of a typical research paper is the sequence of Introduction, Methods, Results, and Discussion (sometimes abbreviated as IMRAD). Each section addresses a different objective. The authors state: (i) the problem they intend to address—in other terms, the research question—in the Introduction; (ii) what they did to answer the question in the Methods section; (iii) what they observed in the Results section; and (iv) what they think the results mean in the Discussion.

In turn, each basic section addresses several topics, and may be divided into subsections (Table 1). In the Introduction, the authors should explain the rationale and background to the study. What is the research question, and why is it important to ask it? While it is neither necessary nor desirable to provide a full-blown review of the literature as a prelude to the study, it is helpful to situate the study within some larger field of enquiry. The research question should always be spelled out, and not merely left for the reader to guess.

The Methods section should provide the readers with sufficient detail about the study methods to be able to reproduce the study if so desired. Thus, this section should be specific, concrete, technical, and fairly detailed. The study setting, the sampling strategy used, instruments, data collection methods, and analysis strategies should be described. In the case of qualitative research studies, it is also useful to tell the reader which research tradition the study utilizes and to link the choice of methodological strategies with the research goals [3].

The Results section is typically fairly straightforward and factual. All results that relate to the research question should be given in detail, including simple counts and percentages. Resist the temptation to demonstrate analytic ability and the richness of the dataset by providing numerous tables of non-essential results.

The Discussion section allows the most freedom. This is why the Discussion is the most difficult to write, and is often the weakest part of a paper. Structured Discussion sections have been proposed by some journal editors [4]. While strict

Table 1 Typical structure of a research paper

Introduction
State why the problem you address is important
State what is lacking in the current knowledge
State the objectives of your study or the research question
Methods
Describe the context and setting of the study
Specify the study design
Describe the ‘population’ (patients, doctors, hospitals, etc.)
Describe the sampling strategy
Describe the intervention (if applicable)
Identify the main study variables
Describe data collection instruments and procedures
Outline analysis methods
Results
Report on data collection and recruitment (response rates, etc.)
Describe participants (demographic, clinical condition, etc.)
Present key findings with respect to the central research question
Present secondary findings (secondary outcomes, subgroup analyses, etc.)
Discussion
State the main findings of the study
Discuss the main results with reference to previous research
Discuss policy and practice implications of the results
Analyse the strengths and limitations of the study
Offer perspectives for future work

adherence to such rules may not be necessary, following a plan such as that proposed in Table 1 may help the novice writer stay on track.

References should be used wisely. Key assertions should be referenced, as well as the methods and instruments used. However, unless the paper is a comprehensive review of a topic, there is no need to be exhaustive. Also, references to unpublished work, to documents in the grey literature (technical reports), or to any source that the reader will have difficulty finding or understanding should be avoided.

The basics

Having the structure of the paper in place is a good start. However, there are many details that have to be attended to while writing. An obvious recommendation is to read, and follow, the instructions to authors published by the journal (typically found on the journal’s website). Another concerns non-native writers of English: do have a native speaker edit the manuscript. A paper usually goes through several drafts before it is submitted. When revising a paper, it is useful to

Table 2 Common mistakes seen in manuscripts submitted to this journal

The research question is not specified
The stated aim of the paper is tautological (e.g. ‘The aim of this paper is to describe what we did’) or vague (e.g. ‘We explored issues related to X’)
The structure of the paper is chaotic (e.g. methods are described in the Results section)
The manuscripts does not follow the journal’s instructions for authors
The paper much exceeds the maximum number of words allowed
The Introduction is an extensive review of the literature
Methods, interventions and instruments are not described in sufficient detail
Results are reported selectively (e.g. percentages without frequencies, <i>P</i> -values without measures of effect)
The same results appear both in a table and in the text
Detailed tables are provided for results that do not relate to the main research question
In the Introduction and Discussion, key arguments are not backed up by appropriate references
References are out of date or cannot be accessed by most readers
The Discussion does not provide an answer to the research question
The Discussion overstates the implications of the results and does not acknowledge the limitations of the study
The paper is written in poor English

keep an eye out for the most common mistakes (Table 2). If you avoid all those, your paper should be in good shape.

Thomas V. Perneger
Quality of Care Unit, Geneva University Hospitals
Geneva, Switzerland
Patricia M. Hudelson
Department of Community Medicine,
Geneva University Hospitals
Geneva, Switzerland

References

1. Huth EJ. *How to Write and Publish Papers in the Medical Sciences*, 2nd edition. Baltimore, MD: Williams & Wilkins, 1990.

2. Browner WS. *Publishing and Presenting Clinical Research*. Baltimore, MD: Lippincott, Williams & Wilkins, 1999.

3. Devers KJ, Frankel RM. Getting qualitative research published. *Educ Health* 2001; **14**: 109–117.

4. Docherty M, Smith R. The case for structuring the discussion of scientific papers. *Br Med J* 1999; **318**: 1224–1225.