

How to Write Research Articles in Medical and Public Health Disciplines

Suneeta Kalasuramath¹, Shashikala P², Niranjana G.V.³, Vinodkumar C.S.⁴

¹ Department of Physiology, ² Department of Pathology, ⁴ Department of Microbiology, S.S.Institute of Medical Sciences & Research Center, Davangere, Karnataka, India.

³ Director, Research & Development, Rajiv Gandhi University of Health Sciences, Bangalore, India

[Received: 16/02/2013, Revised: 08/03/2013, Accepted: 11/03/2013]

Abstract

Writing a research article may seem like a daunting task for the inexperienced researcher and at times for those who are experienced!. Nevertheless, this does not need to be the case if the approach is logical and systematic. This article advocates a general way of presenting research articles on any topic and in any field related to medical, dental and public health related disciplines.

This article covers some of the most important aspects of writing a scientific paper. To the extent possible, each of these parts should address, in this order: the problem statement, existing solutions, the new solution(s), assumptions and limitations, analysis, simulation and comparison with best competing solutions.

Key words: Publishing, writing an article, publication.

Introduction:

Communication of research outcome through publication in a scholarly journal is a crucial and essential component of science. Science is a common, articulated, structured, established knowledge of the human race and this is one of many human activities¹. It also is a key link in the educational system, part of the culture of the nation, contributes to overall well-being and security in everyday life, and represents a source of real knowledge of mankind. The exact understanding of science is gained through scientific research^{1,2}. This topmost degree of knowledge is the ability to explore scientific problems^{2,4}. Scientific and professional work is primarily an educational tool, and its content can be presented in different ways. This is mostly based on the authors' personal experiences and their own learning curve towards successful publication.

In most cases, the scientist is a person of extraordinary diligence, which is at the same time, very focused on what it does. If one deals with the

Address correspondence to:

Dr. Niranjana G.V., Director, R & D
Rajiv Gandhi University of Health Sciences, Karnataka,
Bangalore. Email: rguhsdc1@gmail.com

scientific work, can significantly improve the human condition, thus it will make a great effort and sacrifice many daily pleasures¹.

Often, researchers make the mistake of believing that writing an article is a separate phase to be done after completing the entire research. We recommend that researchers start writing much sooner. From the effectiveness perspective, it is not wise to wait for a moment when you feel that you know and understand "everything" needed for writing articles. It is more sensible to start learning to write piece-by-piece, better enabling the perception of what to do and when, and thus aiding the avoidance of unnecessary work⁵. Thus, starting the writing process early gradually lowers the threshold for publishing and through gained experience the chances of getting the work accepted for publication in better journals will improve.

How to start.....motivation:

For a beginner and sometimes for experienced too, writing a research paper may always seem like a daunting task. However, this does not need to be the case if the approach is logical and systematic⁶. You must communicate your work to the world. If

people don't know about it, they won't use it. It's necessary that clear writing requires clear thinking or else it becomes a messed up writing and it becomes a sign of muddled thought. Be kind to your readers as good writing can be a joy; equally an agony for bad writing. These motivational skills transfer to other accomplishments and help you to get started. The first and the foremost important aspect is to consider knowing what the editor expects. Read instruction to authors carefully before a paper is submitted to any journal.

The editor looks into four main facts⁶:

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

Some research that is done out of necessity (i.e. student projects / urgent need of promotion) can never be original and this question should be asked at the outset; before much time and effort is spent writing such articles, that is not likely to be accepted for publication⁷. If you do not write well, why should readers believe you were any more careful in the research itself? Clear and appealing text in one part increases the chances that a reader will go to the next part and eventually use and cite the work⁸.

Prepare a check list and follow the 10 steps⁹ and get started.

1. Find a subject
2. Read a general article
3. Formulate a temporary outline
4. Prepare the preliminary bibliography
5. Prepare a working outline
6. Start taking notes
7. Outline the paper
8. Write a rough draft

9. Edit your paper
10. Write the final draft

Research & problem solving.....goals

One of the noted writer, Mr. Hayes in 1981 said, "Whenever there is a gap between where you are now and where you want to be, and you don't know how to cross that gap, you have a problem." A problem always raises a question. Questions which boggle a researchers mind are; Is research a problem solving exercise? Are there some research activities that do not solve any problems? We believe that this is not the case. If there is no problem to be solved than the allied activity could be a development, implementation, or another type of work. As a result, any research article should just make a clear problem statement. Ill-structured problems require the student to make multiple decisions or judgments about the problem, so set a goal¹⁰.

Questions like, what is the goal? What concepts are used to solve the problem? How can I obtain a solution? Does this solution meet the goal of the problem? are extremely essential. Lack of conceptual understanding of a topic is nonetheless capable of successful problem solving in that same topic. Thus firstly focus on developing knowledge base and then skills base.

Preparation of the manuscript...Guidelines

Scientific papers were written in singular form & loosely structured, in the early 20th Century. Later in 1950 - 1960's increased publication of papers lead to the need for uniformity & standardization. Few editors of medical journals met unofficially in Vancouver, British Columbia, in 1978 to establish guidelines for the format of manuscripts submitted to their journals. The group became known as the Vancouver Group. Its requirements were first published in 1979. This group expanded and evolved into the International Committee of Medical Journal Editors (ICMJE), which meets annually¹¹. This created the Uniform Requirements primarily to help authors and editors in their mutual task of creating and distributing accurate, clear, easily accessible reports of biomedical studies¹². Later on 1965 Sir Bradford Hill, a British

Statistician introduced the IMRAD Format through his successful attempts towards standardization¹². It is now the accepted, recommended by ICMJE & most international scientific journals and standard structured format for writing the text of original research, which enhances comprehension, and clarity of manuscript with no repetition. It has the following four sections (IMRAD format): Introduction, Methods, Results, And Discussion.

Many of the established journals follow this format but the differences between journals do exist but are however, marginal, once you have understood the essence of the key elements. The best solution for a researcher is to follow the structure and terminology of their target journal. Keeping in mind the IMRAD format and the elements of the article, table provides the tips for each section.

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 paper¹³. 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 witty titles, and do not use abbreviations in titles. If photographs of patients are used written permission for publication should always be obtained as per the Helsinki Declaration¹⁴ All tables and figures should be comprehensible without the need to refer to the text, the titles should be self explanatory i.e., each table should have the ability to stand-alone. They should always be referred to at the appropriate point in the text. Give a brief title and a footnote at the bottom of the table containing explanatory matter & explain all nonstandard abbreviations. Common mistakes in results are including citing as first study in the world (Megalomania), emphasizing the strengths of the study more than its weaknesses, reiterating & inflating selected results, going beyond the evidence & drawing unjustified conclusions.

There are several different types of journal manuscripts, including Original Research, Review Articles, Meta analysis, systematic reviews, letter to the editor and Case Studies

Original Research:

This is the most common type of journal manuscript. It may be called an Original Article, Research Article, or just Article, depending on the journal preference. The Original Research format is suitable for many different fields and different types of studies. It includes the IMRAD style i.e full Introduction, Methods, Results, and Discussion sections. Following the guidelines as explained in table 1, practicing this over and over again, and becoming an expert at writing is a satisfying experience.

Review Articles:

Review Articles provide a broad summary of research on a certain topic, and a perspective on the state of the field and where it is heading. They are often written by leaders in a particular discipline after invitation from the editors of a journal. Reviews are often widely read (for example, by researchers looking for a full introduction to a field and highly cited¹⁸. They are often located in the same journals as primary research articles, but do not report original research. Review articles are a great resource if you're looking for an overview of a small topic, with complete and current information. Review articles are well-cited, so they can provide a starting point for more extensive research.

The structure of a review article may differ from the structure of a regular paper due to the optional omission of some basic sections as in IMRAD style. A review article is expected to provide a summary and/or a synthesis of the findings of selected research contributions being published by other authors. The main purpose of a review article is to examine the current state of the relevant publications on a given topic and to initiate a discussion about the research methodologies and the findings related to the said topic. Therefore, a review article should contain a comprehensive list of supporting references being thoroughly cited in the text.

There are various types of review articles that exist¹. By methodological approach: Narrative review (Selected studies are compared and summarized on the basis of the author's experience,

existing theories and models), Best evidence review (focus on selected studies is combined with systematic methods of study-selection and result exploration), Systematic review (Findings from various individual studies are analyzed statistically by strict procedures), Meta-Analyses (used to pool the results of individual studies.); By types of objective, Status quo review (Presentation of the most current research for a given topic or field of research), History review (Development of a field of research over time), Issue review (Investigation of an issue in a specific field of research), Theory / model review (Introduction of a new theory or model in a specific field of research); by types of mandate, Invited reviews (experienced researchers are invited), Commissioned reviews (formal contracts of authors with clients), Unsolicited submissions (researchers develop an idea for a review and submit it to journal editors)

Steps to write the review article:

Since there are various types of review articles, writing style of each type varies. However its critical to keep in mind the following steps^{19,20}.

- Read the article very carefully, taking note of words, phrases, and concepts you need to research, define, and look up meanings for.
- Research the terms online or at a good library. Take good, clear notes which can be turned into paragraphs later.
- Discuss the topic of the article with someone involved in that field of endeavor.
- Put aside a considerable period of time to include all the interviewing and researching.
- Begin your drafting, and make sure you adopt a style that either summarizes, critiques, or reviews the material at hand. A review is much more than a description: you need to understand, analyze and interpret, and if you are asked, offer a personal opinion.
- It is sensible to write the first paragraph last. In this way, your analysis is presented in an appropriate way. Then put all the paragraphs together, and devise an insightful article review.

- A summary of the assigned article must be written. The main points must be enumerated and described in a brief way.
- An evaluation of the article must also be provided: this means you must assess the importance of the article's content
- The amount of text should be well balanced with the number of figures so that the addressed issues are clearly stated in a simple and efficient way.
- Should transform the presented information into an inspirational material for future studies.
- Must have verifiable scientific facts, logic and reasoning but not on inconclusive arguments or personal interest.
- An extensive literature review is needed and a lot of technical details concerning different aspects of the scientific investigation
- Should cite a multitude of journal papers, books, theses/dissertations, conference proceedings, etc.
- Decide whether the information in the article is important, relevant, of high standard, and whether it provides new information on the subject it covers.
- You must conclude by writing an opinion about how the subject can be improved, or whether all the necessary information is present in the article, and it forms a completed picture of the topic
- The inclusion of proprietary textual/graphical content, the use of tables, illustrations or any kind of borrowed materials from journals, books or other publishing media, as well as personal information of other authors must be done with the permission of the publishers/authors, which must be explicitly mentioned in the review article.

Case Studies:

These articles report specific instances of interesting phenomena. A goal of Case Studies is to make other researchers aware of the possibility that a specific phenomenon might occur²¹. This type of study is often used in medicine to report the occurrence of previously unknown or emerging pathologies.

Steps to write the case study²²⁻²⁶

Table of Content of Original Article

Title	Allows the reader to establish the nature of the paper and decide if they wish to read it
	Familiarise and analyse yourself with the types of titles in the target journal
	Do not use abbreviations, unnecessary “and” words
	A very long title is not good
Abstract	Should be a brief summary — there is usually a word limit which should be adhered to
	Outline the background, scope, methods and conclusion
	State the purpose of the study
	It should emphasize new and important aspects of the study
	It contains no references
Key words	Use only 3 to 6 key words or short phrases that capture the main topics
Introduction	Introduce the specific ‘problem’
	Summarise relevant arguments and data to give the reader a firm sense of the issue
	Demonstrate a logical continuity between earlier and current work (this helps to develop breadth and scope of your work)
	Should end with your hypotheses, rationale and the aims of the study
Materials and methods	Describe clearly how the research is done as follows
	What type of study was performed?
	Description of the the set-up and research methods precisely
	Materials or subjects used (including ethics and consent)
	Sample size calculation
	Description of the statistics used
	Should include all findings (including negative and non-significant findings)
Results	Identify the key results of your research are and present them clearly
	Use tables and figures appropriately
	Use the funnel principle; from more general to more specific points and compare with previous work
	Do not interpret your results in this section
	Avoid including tables with large amounts of data, as readers will find it very difficult to read
Discussion	It summarize your work and put it into perspective
	Include any limitations of the study
	Do not repeat in detail data or other material given in the other sections
	comment on the importance of your findings.
Conclusion	must be in line with the previous sections and should not present totally new results.
	Consider the implications (i.e., support vs non support for your position on the issue).
	Unjustified conclusions not supported by the data should never be made
Acknowledgements	All those who have helped in the work at some stage, but are not the author
	Support from Chief of the department
	Financial and material help
	Intellectual help, scientific advice, data collection, participation in trial, review of draft
References	References should be checked carefully for accuracy
	Ensure you are using the correct format for the journal in question (vancouver / harvard system)
	Proofread carefully to avoid plagiarism and technical errors
	should be numbered consecutively in the order in which they are first mentioned in the text

- Determine what your case study will be about. Think about the problems. Begin by the usual method of referencing. Take notes and remember to keep track of your sources for later citations in your case study.
- Choose a case site. Think of a location, an organization, company, or individuals who are dealing with that problem. Plan and set up interviews with these people.
- Begin your interviewing process. Talk to individuals at your case site about the issue. Ask what they have tried to do to solve the problem, their feelings about the situation, and what they might do differently.
- Ask open-ended questions that will provide you with information about what is working, how the situation developed, which parties are involved, and what a typical day is like. Stay away from yes or no questions, or you may not get the information you are seeking.
- Analyze your information. You will need to take the information you gathered in your library and internet research along with your "case" information from the interview and determine which items pertain most to the problem. Organize all of your information in the same place.
- Write the case study. The case study should have the following sections: Introduction, Background, Describe the case and finally the concluding paragraph which should wrap it up with possible solutions, without solving the case per se. It might make some final solutions, while leaving it open to the reader to come up with a different answer.

Submission & review.....polishing;

Carry out the following

- Do try to be as clear and explanatory as you can, using advanced language and reasoning skills.
- Do use a style compatible with the article you are working on and the journal you have planned to submit.
- Do examine the evidence supporting the argument of the article, check the references, and give an opinion about their value and quality.

- Do work in an organized fashion, and save and back-up all your notes and drafts.
- Do write tight paragraphs for each point made.

It is helpful to get useful feedback 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.

Do pay attention in polishing your article like transitions between sentences in order for the reader to easily understand the positioning of different sentences. It must be clear whether sentences are parallel, opposed, or have a logical continuum. Consequently, words such as in addition, also, however, nevertheless, or consequently can be used for this purpose

Issuesauthorship, language, plagiarism.

Authorship:

This can be a difficult issue and should be resolved prior to writing the paper. According to the International Committee of Medical Journal Editors (ICMJE)²⁰, all persons designated as authors should have made significant contribution in the work and should be able to own public & intellectual responsibility for its contents. All "authors" should have seen and approved the final version as submitted for publication. Guidelines²⁷ are available that explain who should be included and in which order. It should be decided at the outset of the study, which roles qualify as author, corresponding author or qualify as acknowledgments.

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.

Language:

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 specifies that only internationally standardized abbreviations may be used²⁸. If you are not certain, check through past copies of the journal to formal written language like, discipline-specific terminology, general scientific idiom grammatical choices typical for the type of article you are writing, including use of articles, typical usage of verb tenses in different sections of the article, preference for active or passive voice, use of punctuation, capitals, abbreviations. Important aspect to be considered before submitting are,^{29,30}.

- Don't forget to point out and define the central concept or premise of the article in question.
- Don't omit the important opening and closing sentences of influence. Make sure your thesis statement is valid.
- Don't neglect the observation that you are writing to a brief, and you must follow it to the letter.
- Don't skimp on reading thoroughly, researching in depth, and writing succinctly and clearly.
- Don't ignore the fact that grammar, syntax, punctuation and the words you choose are equally significant to when you write an essay.

Plagiarism:

"Plagiarism...means trying to pass off someone else's work as your own." Plagiarism (derived from a Latin word for kidnapper) means using another person's language or ideas without acknowledgement." Fundamentally, plagiarism is the offering of the words or ideas of another person as one's own.

References

1. Masic I. How to Search, Write, Prepare and Publish the Scientific Papers in the Biomedical Journals. *Acta Inform Med.* 2011;19(2):68–79.
2. Gasparyan YA, Ayvazyan L, Kitas DG. Biomedical journal editing: elements of success. *CMJ.* 2011;52:423–428.
3. Marusic A. Importance of Ethical Publishing in Developing Countries. *Acta Inform Med.* 2012;20(1):4
4. Marusic A. Problems of editors with authorship in small medical journals. *The International Journal of Occupational and Environmental Medicine.* 2011;2(3):130–132.
5. Moher D, Weeks L, Ocampo M, et al. Reporting guidelines for health research: a review. *Journal of Clinical Epidemiology.* 2011;64(7):718–742.
6. Garfunkel JM, Merrill RE. How to write a scientific paper and get it published. *Adolesc Med* 1994; 5: 405–18.
7. Cunningham SJ. How to write a paper. *Journal of Orthodontics*, March 2004; 31(1): 47-51.
8. Michael Ernst, Writing a technical paper, April 2005, www.cs.washington.edu/homes/mernst/advice/write-technical-paper.html.
9. Roberta H. Markman, Peter T. Markman, Marie L. Waddell, [http://books.google.co.in/books/about/10_Steps_in_Writing_the_Research_Paper.html?Barron's Educational Series, 2001](http://books.google.co.in/books/about/10_Steps_in_Writing_the_Research_Paper.html?Barron's_Educational_Series,2001).
10. Greenhalgh T. How to Read a Paper. *The Basics of Evidence Based Medicine.* London: BMJ Publishing Group, 1997.
11. Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication. Updated November 2003. Available at www.icmje.org/index.html.
12. Nicolaides A, Thornton E. The process of writing a scientific paper. *Int Angiol* 2000; 19: 184–90.
13. International Committee of Medical Journal Editors Welch HG. Preparing manuscripts for submission to medical journals: the paper trail. *Effect Clin.Pract* 1999; 2: 131–7.
14. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA.* 2000 Dec 20; 284(23):3043-5.
15. Ridley, D. The literature review – a step-by-step guide for students. 2008, Sage Publications, London.

16. Huth, E.J. 'Writing and Publishing in Medicine', (3rd ed.). 1999, Baltimore: William & Wilkins
17. Bourner T. The research process: four steps to success. In: Greenfield T, ed. Research Methods: Guidance for Postgraduates. London: Arnold; 1996.
18. Jonassen, D. H., (1997). Instructional design models for well-structured and illstructured problem-solving learning outcomes. Educational Technology Research and Development, 45, 65-90.
19. Nurrenbern, S. C., & Pickering, M., (1987). Concept learning versus problem solving: Is there a difference? Journal of Chemical Education, 64, 508-510.
20. International Committee of Medical Journal Editors (ICMJE). Uniform requirements for manuscripts submitted to biomedical journals: writing and editing for biomedical publication. Philadelphia: ICMJE; [updated 2006 Feb; cited 2006 Oct 1]. Available from: <http://www.ICMJE.org>.
21. Martyn C. Case reports, case series and systematic reviews. Q J Med, 2002; 95:197-8.
22. Durbin CG. Effective use of tables and figures in abstracts, presentations, and papers. Respir Care 2004; 49:1233-7.
23. Janicek M. Clinical case reporting in evidence-based medicine. Oxford: Butterworth- Heinemann; 1999.
24. Fenton JE, Khoo SG, Ahmed I, Ullah I, Shaikh M. Tackling the case report. Auris Nasus Larynx 2004;31:205-7.
25. Cohen H. How to write a patient case report. Am J Health Syst Pharm 2006;63:1888-92.
26. McCarthy LH, Reilly KE. How to write a case report. Fam Med 2000; 32:190-5.
27. Uniform requirements for manuscripts submitted to biomedical journals. JAMA 1997; 277: 927-34.
28. Squires BP. Case reports: what editors want from authors and peer reviewers. CMAJ 1989;141:379-80.
29. Helene Hutchison, The Hutchison Guide of Writing Research Papers. 1973, 179. New York: Glencoe Press.
30. Porter Perrin, Writer's Guide and Index to English, 1959, 635, Third Edition Chicago: Scott Foresman,.

How to cite this article;

Suneeta K, Shashikala P, Niranjana GV, Vinodkumar CS. How to write research article in medical and public health disciplines J Pub Health Med Res 2013;1(1):1-8

Funding: Declared none

Conflict of interest: Declared none



*The **Vancouver system** takes its name from a meeting in Vancouver, BC, Canada, in 1978. This style is the citation style used by most biomedical journals and many scientific journals. It is maintained by the International Committee of Medical Journal Editors (ICMJE) and known as the Uniform Requirements for Manuscripts Submitted to Biomedical Journals. This was further developed by the National Library of Medicine in the U.S, whose version should be considered as the authoritative style according to the British Medical Association (BMA). Later on ICMJE edition was documented following which several versions of the Uniform Requirements were published. As of 2004, the editors of Haematologia decided simply to "invite" their authors to visit www.icmje.org for the 2003 revision of the Uniform requirements.*