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Title, abstract, key words and references in biomedical articles

KEYWORDS: Medicine; Research; Writing; Publishing; abstracting and Indexing; Subject Headings

ABSTRACT

Scientists frequently communicate the results of their work in research reports. When writing scientific articles, authors must follow instructions and requirements of standard article format. A scientific paper should have, in proper order, a Title, Abstract, Introduction, Material and Methods, Results, Discussion, Conclusion and Literature. A title should be the fewest possible words that accurately describe the content of the paper. It should attract researchers' attention in order to be included in their investigation. An abstract is a short summary of the article. It concisely summarizes results and conclusion so that essential details of the paper can be understood in 100 - 250 words. The most commonly used are structured abstracts. Key words are provided below the abstract and describe the medical concepts characteristic for the whole article. Assign at least one, and an average of 5 to 10 key words. Indexing in biomedicine means using the Thesaurus of the American National Library of Medicine: Medical Subject Headings. It provides easy and fast access to precise information using key words assigned to each document. Reference citation is obligatory and integral part of scientific articles. It provides communication among the authors and binds scientific papers as well as whole scientific knowledge in certain fields.

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INTRODUCTION

Results of scientific and professional research in the biomedical field appear quickly in public as publications at disposal to the world of science. When writing scientific articles, authors must follow instructions and requirements of standard article format (1-8). A scientific paper should have, in proper order, a Title, Abstract, Introduction, Material and Methods, Results, Discussion, Conclusion and Literature. Each part is of importance and deserves special attention.

TITLE

A title should be the fewest possible words that accurately describe the content of the paper. It should clearly indicate the contents and the problem, that is the object of paper providing its inclusion into certain scientific disciplines and areas. There are indicative and informative titles. Indicative reveal the area of investigation, and not answers the paper might offer, whereas informative titles convey messages of the paper on all its relevant elements. The title of the paper is the most often encountered part of any paper and it is the thing that editors and editorial boards, as well as organizational committees of scientific or professional congresses see first. Very often their decision whether the paper is going to be accepted for publication or not, depends on the title itself. Readers first scan the title in the contents of journals, in abstract bases, full-text bases and on Internet. The titles should attract researchers' attention in order to be included in their investigation. Sometimes, relevant papers are missed on "first pass" because they are not written by certain generally accepted rules. Unfortunately, there is not much guidance how to construct a title (1-10). Vancouver Requirements indicate that titles should be concise and informative (10); whereas instructions from New England Journal of Medicine state that they should be concise and descriptive, but not declarative. This means that authors should resist the challenge to condense the whole paper into the title.

In order to attract attention, titles should contain easily understandable, not too technical terms. It should be attractive, as concise as possible, but provide sufficient information. Style of writing and number of words in the title depend on the topic and on those who the paper is written for (health workers, specialists, scientists in the same or broader scientific field or general population). Many journals now limit title submission to 10 to 12 words, that is 100 characters. The titles should be written with distinct letters, not underlined and without a full stop at the end. Avoid subtitles and supertitles. Titles should never contain abbreviations, chemical formulas, trade names and jargon.

ABSTRACT

An abstract is a short summary of the article. It concisely summarizes results and conclusions so that essential details of the paper can be understood in 100 - 250 words. It is either indicative or informative. Indicative or descriptive abstracts deal with the contents of the paper, whereas informative abstracts readers about the objectives, methods, results and conclusions of a scientific article. Most abstracts are informative. They are designed to define each part of the paper in one or two sentences. Many journals require that abstracts consist of the same parts as the paper itself. Structuring of articles dates back to year 1665. The most commonly used and recommended structure is IMRAD format, which includes Introduction, Methods, Results and Discussion. At the end of 90s of the 20th century, clinical investigations and review articles started using structured abstracts (11-13). Ad Hoc Working Group for Critical Appraisal of the Medical Literature suggested authors of articles with direct clinical implications to write their abstracts with seven explicitly defined headings: Objective, Design, Setting, Patients, Interventions, Measurements and Main Results, and Conclusions and with a partially controlled vocabulary (14). The structured format was proposed to make literature searches more accurate. Guidelines have been suggested for review arti-

cle abstracts with six headings: Purpose, Data Identification, Study Selection, Data Extraction (including how data were assessed for quality), Results of Data Synthesis (including relevant descriptive statistics), and Conclusions (including future research needs and applications) (15). Detailed structured abstracts are recommended also for conference papers. The structured abstracts received significantly higher quality scores than non-structured abstracts and are more relevant. The advantage of structured abstracts is that they are more explicit and it is easier to understand the text written in shorter paragraphs, repeating the format of the whole paper. Structuring helps authors not to omit relevant data. The structured abstract is intended to make it easier for the reader to select important details and to assess the value and applicability of the study. Structured abstracts remind readers about the whole paper, and reveal errors regarding used methodology. Structured abstracts in English are convenient to non-English authors, but they are applied only to original, review and conference articles and not to case reports, original meta-analyses and so on. The structured abstracts are longer, require more space, variations regarding page format may be obstacles in searching bibliographic and abstract data bases, require a technical term glossary, limit author's style and creativity. They contain the most significant data from the paper, and some use them as primary source of information, without reading the whole article.

Apart from titles, abstracts are the most frequently read parts of articles. Abstracts should stand alone, below the title or at the end of the article. Writing a good abstract requires time and considerable attention to details. Words should be chosen carefully, both in the title and in the abstract. It should be easy to understand without reading the whole paper. Writing an abstract is a very important part of work. Very often the decision whether the paper is going to be accepted for publication or not, depends on the title and abstract. In abstract bases abstracts fully represent the contents of a complete paper. A well-prepared abstract will enable the reader to identify the basic content of the paper quickly and accurately and determine its relevance to their interest. The author has about 15 seconds to convince readers to read the rest of the paper. Abstracts should be written after the investigation is finished and the article written. They are mostly written in the same language as the article, but are also translated into one of the world languages. Authors should use terms familiar to readers, easy to understand, without ambiguities and full, connected sentences in a single paragraph that is several paragraphs in structured abstracts. Do not repeat information contained in the title or article. Do not state information or conclusions that are not stated in the article. Abstracts should be written in the past tense and in third person singular. Omit all references to the literature and the tables or figures, and omit obscure abbreviations and acronyms, even if they are defined in the main body of the paper.

KEY WORDS

Papers should contain key words provided below the abstract. Key words describe the medical concepts characteristic for the whole article. Assign at least one, and an average of 5 to 10 key words. They are of great help to those creating databases, to indexers in cross-indexing scientific articles and to users providing easy access to scientific sources. Indexing includes semantic processing of documents, content analysis and assigning key words to the analyzed article. It is necessary due to information explosion, huge quantities of knowledge and need for its methodical organization. Indexing in biomedicine means using the Thesaurus of the American National Library of Medicine: Medical Subject Headings (MeSH) (16), which has been accepted as a standard by biomedical libraries and journals all over the world. It provides easy and fast access to precise information using key words assigned to each document.

It is favorable for authors to assign key words themselves. Unfortunately, they often do it incorrectly, although in the field of biomedicine there are strict rules - Vancouver Requirements (10) according to which Medical Subject Headings (16) descriptors are to be used. The Thesaurus is available in Index Medicus, in MEDLINE on CD, and on the site of American National Library (17). It contains standard vocabulary terms that describe concepts covered in the database. When writing key words one should use English language and respect certain rules when assigning single, or multiple word subject headings as well as punctuation signs.

In certain cases regulations allow Non MeSH headings, if adequate headings are not available in the Thesaurus. In such cases apply a hierarchically "higher" term with a broader meaning than the one we wished to use. MeSH subject heading vocabulary changes are updated annually.

If authors are not sure if they have assigned good key words, that is descriptors and qualifiers, they may use words from the title and search the MEDLINE database and find out key words assigned by indexers of the US National Library of Medicine and if necessary make corrections of their own. If an article contains an abstract in Serbian language, authors should also provide key words in Serbian language, that is translate the English ones.

Using current information technology, Internet, abstract databases, full text databases and electronic publications it is possible to search literature using any word from the text, or a normative glossary, if available. Such searches provide a huge quantity of information, but only a small number is relevant. That is why highest precision is achieved using adequate descriptors.

REFERENCE CITATION

Reference citation is obligatory and integral part of scientific articles. It provides communication among the authors and binds scientific papers as well as whole scientific knowledge in certain fields. Citing scientific sources means quoting results, ideas, considerations, definitions, tables, figures, schemes, texts and so on, published in scientific papers or available in some other way. References, also known as "literature" and "bibliography", are listed at the end of a paper. Intellectual integrity, good scientific practice and ethical principles apply to citation of literature as well as to professional and scientific information.

Each citation from the list of references must be cited in the text, and each citation from the text must be listed in references. If we literary cite author's words, we must put them in quotation marks and note the number of citation in parenthesis. If the citation is too long, it can be paraphrased. In that case identify the source of information without quotation marks. There are many reasons for citation (1,18,19). It is of importance that references should include complete and accurate data so that they could be identified and found. However, citation must be done in accordance with generally accepted citation rules such as Uniform requirements for manuscripts submitted to biomedical journals (10) which is a numerical type and authors must strictly follow these rules. Arabic numerals are used in the text in parenthesis, by order of appearance, whereas the reference list also follows the rule in regard to their appearance in the text. This type is also used by US National Library of Medicine and is based on standards of American National Standards Institute (ANSI) referring to bibliographic references. Vancouver requirements include examples of reference citation from various sources of information, with precise data, their sequence and corresponding punctuation marks (10).

Examples of reference citation in the last Vancouver Requirements from 1997 deal with written sources (books, journals, congress reports...) (10). Computer communication provided access to information other than printed. Internet, huge quantity of information, easy and fast access, great number of web sites, full-text data bases are the reasons why users consider Internet the first choice in searching for information. Methodology of scientific research requires citation of sources of information in the list of references in order to provide information for other researchers. In contrast to unchangeable printed documents, information from Internet continuously changes and can be corrected. For example, Internet sites change addresses or disappear with great frequency as well as their contents. That is why there are special citing guidelines for citing electronic sources. Web site of the US National Library of

Medicine provides citation guides for electronic sources (17). These guidelines are based on ISO standards. However, analyzing these guidelines, we have attempted to find basic data on Internet "documents" including the author, title, place of publication, publisher, extent of the item and so on, and discovered that it was neither easy nor a successful task.
It is a standard practice for a citation to indicate that a publication is not in print format by placing after the title a word that describes the specific non-print medium - medium designator. The appropriate medium designator is placed in brackets. Because of volatile nature of electronic publications, three dates are important in citing them: the first when the publication was placed on the Internet or was copyrighted, the second date of any update or revision, and the third when the person doing the citing saw the publication. The first two dates are often absent, but it is very important to identify the date of citation.
Here are some sample Internet citations (20):
For a book:
Graber MA, Toth PT, Herting RL Jr. University of Iowa family practice handbook [Internet]. 3rd ed. Iowa City (IA): University of Iowa College of Medicine; 1997 Jul, ©1992-2000 [modified 2000 Nov 28; cited 2001 Mar 7]. Available from: http://www.vh.org/Providers/ClinRef/FPHandbook/FPContents.html
For a journal article:
Cruz AA, Coehlo RP, Lucchesi MC. Uper eyelid shape and position in the association of Graves' disease and myasthenia gravis. Digital J Ophtalmol [Internet]. 2000 [modified 2001 May 10; cited 2001 Mar 5];6(1):[about 6 paragraphs]. Available from:
http://www.djo.harvard.edu/meei/OA/Cruz/OA.html
For a home page:
NursingWorld [Internet]. Version 3.2. Washington: American Nurses Association; ©1995-2001 [cited 2001 Mar 12]. Available from:
http://www.ana.org/

CONCLUSION

Scientists frequently communicate the results of their work in research reports. The most important parts of a scientific paper are the Title, Abstract, Key Words and References. They are typically distinct sections, but always represent the paper as a whole and have a significant role in scientific communication. When writing scientific papers, these sections deserve special attention. Following instructions and recommendations for their construction, papers get more attractive for publishers, journal editors, organizational committees of scientific meetings and so on. Thus, their impact on researchers is getting even more valuable.

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