How to write an abstract

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Background

A scientific abstract is a shortened version of a scientific paper. It is, aside from the title, the most frequently read and most easily accessed portion of an article reporting original scientific research.[1] Often, readers of a scientific journal will only read the abstract, choosing to read at length those papers that are most interesting to them. For this reason, and because abstracts are frequently made available to readers by various computer abstracting services, this section should be written succinctly, in order to have the greatest impact in as few words as possible.[2] However, reading an abstract has never been a substitute for reading the entire article, since crucial details of the study are most often not addressed in this section.[3]

Broadly, two types of abstracts exist. Indicative or descriptive abstracts deal with the content of the entire paper, whereas informative abstracts summarise the entire paper and provide an overview of the facts laid out in detail in the paper itself. These days, most abstracts are informative.[4] Respected scientific journals began publishing abstracts in 1956, while structure was not added until 1991.[5]

Only about 50% of research projects that are initially submitted as conference abstracts, will eventually be published as full articles in peer-reviewed journals and full publication may not occur for several years.[6] As a result, a published abstract from a scientific meeting is often the only permanent source of information available on the methodology and results of a research project.

Accurately reflecting the contents of the entire paper seems the most basic requirement for an abstract.[1] However, it was found that 18–68% of 264 abstracts in six major general medical journals, i.e. *Annals of Internal Medicine*, the *British Medical Journal* (BMJ), the *Canadian Medical Association Journal* (CMAJ), the *Journal of the American Medical Association* (JAMA), the *Lancet* and *New England Journal of Medicine* (N Engl J Med), had data in the abstract that were either inconsistent with or absent from the main body of the article.[7] This finding is especially worrying, since abstracts are widely used, often in separation from the original text, and data from the abstracts may be reported and disseminated in other works, other formats, and in the media.[1]

It is against this background that we describe here structures for writing an abstract of an original study or review and the quality criteria used to assess such abstracts.

Summary

Since the abstracts of original papers are one of their most frequently read and most easily accessible elements, they should be as informative and accurate as possible. It is therefore worrying that 18–68% of 264 abstracts from six major general medical journals, were shown to contain data that were either inconsistent with or absent from the main body of the article. This paper provides an overview of published structures for writing an abstract of an original study or review and quality criteria to assess such abstracts. Guidelines for structured abstracts were first proposed in 1987 and have been under continuous review since. Today, nearly all journals request authors to prepare a structured abstract before peer review, preferably in accordance with the IMRAD format (i.e. Introduction, Methods, Results And Discussion) or the 'eight-heading' format (i.e. Objective, Design, Setting, Patients and participants, Intervention(s), Main outcome measures, Results, and Conclusions). In addition, guidelines for structured abstracts for review studies are available. Quality criteria to assess abstracts have been available since 1993. Their use has been associated with decreased discrepancy between the abstract and the main report. Editorial boards of journals are recommended to provide instructions on the components of structured abstracts. Authors should provide accurate data, including the notion if these are preliminary or final. Reviewers should pay increased attention to the quality of the abstract, while readers must retain a cautious and critical reading attitude at all times.

Eur Diabetes Nursing 2007; 4(3): 124–127.

Key Words

Abstract; structure; IMRAD; quality criteria

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Received: 23 April 2007
Accepted in revised form:
01 May 2007

Finally, we make recommendations both for authors, readers, reviewers and editors with regard to writing, reading and publishing abstracts.

Structures of abstracts

The elements of a structured abstract are important because they oblige authors to provide basic information that readers need. Structured abstracts are designed to meet three objectives: (1) to inform readers better, (2) to improve search retrieval, and (3) to facilitate peer review.[4]

We describe two formats for structured abstracts. In 1987 the Ad Hoc Working Group for Critical Appraisal of the Medical Literature proposed guidelines for informative seven-heading abstracts. These guidelines were prepared by Haynes and colleagues at McMaster University, Canada and 358 others from 18 countries.[8] The proposal was for original articles and not for other articles such as editorials, reviews, case reports, etcetera. These seven headings are: (1) objective: the exact question(s) addressed by the article, (2) design: the basic design of the study, (3) setting: the location and level of (clinical) care, (4) patients or participants: the manner of selection and numbers of patients or participants who entered and completed the study, (5) intervention(s): the exact treatment or intervention(s), if any, (6) measurements and results: the methods of assessing patients and key results, and (7) conclusions: key conclusions including direct (clinical) applications.[8]

In 1990 Haynes *et al* reconsidered the structured abstract of clinical research and proposed new, revised guidelines, now including review articles and meta-analysis. They emphasised that the structured abstract should be prepared by authors *before* the manuscript is peer reviewed, to ensure that it accurately reflects the contents of the articles.[9] Box 1 presents the eight headings for structured abstracts for an original article and the six headings for structured abstracts for review articles.

Original article
- Objective: the exact question(s) addressed by the articles
- Design: the basic design of the study
- Setting: the location and the level of (clinical) care
- Patients or the manner of selection and the number of patients participants: or participants who entered or completed the study
- Intervention(s): the exact treatment or intervention(s), if any
- Main outcome measures: the primary study outcome measures as planned before data collection began
- Results: key findings
- Conclusions: key conclusions including direct clinical applications

Review article
- Purpose: the primary objective of the review
- Data sources: a succinct summary of data sources
- Study selection: the number of studies selected for review and how they are selected
- Data extraction: rules for abstracting data and how they were applied
- Results of data synthesis: the methods of data synthesis and key results
- Conclusions: key conclusions, including potential applications and research need

Box 1. Key-information needed for a structured abstracts of an original or review article[9]

- Abstract headings are consistent with structured abstract format
- Data in abstract are consistent wit text, tables, and figures
- Data or information in the abstract are presented in the text, tables, or figures
- Years of study and length of follow-up are provided
- Results for main outcome measures are presented in results section (avoid selective reporting)
- Results are quantified with numerators, denominators, odds ratios, and confidence intervals where appropriate
- Absolute differences, rather than relative differences, are presented wherever possible (e.g. 'mortality declined from 6% to 3% rather than mortality declined by 50%')
- For randomised trials, analysis is identified as intent-to-treat or evaluable patient analysis
- For surveys, response rate is provided in results or design
- For multivariate analysis, factors controlled for in model are briefly summarised
- Conclusions follow from information contained within the abstract

Box 2. Quality criteria for abstracts[1]

Then, six years later in 1996, the editors of the Annals of Internal Medicine realised that the structured abstracts did not provide adequate context for a study and required authors to add a 'background' heading.[10] The most recent contribution was made in 2004. Being concerned that abstracts may give readers the impression that the research has no flaws, the editors of the Annals of Internal Medicine included a new section: 'limitations'. This heading is located immediately before 'conclusions' and should help readers to decide on the external validity of the study results.[10]

In addition to the ten-heading abstract, based on the work of

- Question/objective sufficiently described?
- Design evident and appropriate to answer study question?
- Subject characteristics sufficiently described?
- Subjects appropriate to the study question?
- Controls used and appropriate?
- Method of subject selection described and appropriate?
- If random allocation to treatment groups was possible, is it described?
- If blinding of investigators to intervention was possible, is it reported?
- If blinding of subjects to intervention was possible, is it reported?
- Outcome measure well defined and robust to measurement bias? Means of assessment reported?
- Confounding accounted for?
- Sample size adequate?
- Post hoc power calculations or confidence intervals reported for statistically non significant results?
- Statistical analyses appropriate?
- Statistical tests stated?
- Exact p-values or confidence intervals stated?
- Attrition of subjects and reason for attrition recorded?
- Results reported in sufficient detail?
- Do the results support the conclusions?

Box 3. Quality criteria for abstracts[13]

Haynes *et al*,[8–10] the most commonly used structure for abstracts is the IMRAD format: Introduction, Methods, Results, And Discussion.[11] A cross sectional study showed that in a randomly selected sample of articles, published between 1935 to 1980 in four leading journals in Internal Medicine, i.e. *BMJ*, *JAMA*, *Lancet*, and the *N Engl J Med* the IMRAD structure began to be used in the 1940s, was adopted by 80% of articles in the 1970s, and in the 1980s was the only structure adopted by these journals for original papers.[11]

Among 304 original articles in the top 30 journals, 188 (61.8%) had structured and 116 (38.2%) had unstructured abstracts. Of these abstracts, 125 (66.5%) used the IMRAD format and 63 (33.5%) used the eight-heading format of Haynes *et al*. A total of 21 journals requested structured abstracts in their instructions to authors; eight journals requested the eight-heading format, and one journal requested it only for intervention studies.[12]

The editor and editorial board of *European Diabetes Nursing* states that 'The abstract should be a concise summary of the whole paper, not just the conclusions, and must be understandable without reference to the rest of the paper. It should contain no citation of other published work'. Except for book reviews and editorials, the maximum length of abstracts is restricted to 250 words.

Quality criteria for abstracts

In 1993 the editors of *JAMA* published quality criteria for abstracts which were developed not only to improve accuracy, but also to improve the quality of what was reported.[1] These criteria are made up of 11 items and are presented in Box 2. The *JAMA* tested if instituting the quality criteria improved abstract quality. Half of 21 original research articles published in November 1997 in *JAMA* had some discrepancy between the abstract and the text, while no discrepancies were identified in 27 articles published in the *JAMA* of November 1998.[1]

Another set of quality criteria for abstracts, consisting of 19 items, was published by Timmer *et al*.[13] This set is presented in Box 3. For each applicable item, 0–2 points are awarded (two if fully met, one if partially met, zero if not met). In addition, points are awarded based on the study design and based on whether randomisation was present (0–5). The maximum possible total is 43 ((19 * 2) + 5)). For each item that is not applicable, such as blinding of subjects in basic science research, two points are subtracted from 43, resulting in the total possible score. The summary score is thus calculated by dividing the total score achieved by the total possible score.[13]

Since the quality of the abstract and the quality of the research are often intertwined, the criteria sets rate both.

Discussion and recommendations

Because abstracts are the only substantive portion of an article indexed in many electronic databases, and the only portion many readers read, authors need to be careful that abstracts reflect the content of an article accurately. Since the quality of the presentation of information in an abstract is associated with the scientific quality of the research, standardised methods for assessing formal abstract quality may result in more informative and useful abstracts.[13,14] Moreover, it was reported that high abstract quality scores are associated with higher chances for acceptance for presentations as for publication in journals with higher impact factors.[13]

Thus, the editorial boards of journals need to provide instructions to their authors on, amongst other issues, the components of the abstract. In addition to the formats and items presented in this paper, we recommend adding one more item: is it mentioned if results are preliminary or final? This enables readers to establish if the abstract is the only

permanent source of information available on the methodology and results of a research project and, if so, to value the information in the abstract accordingly.

Authors should then write a structured abstract as specified by the journal to which they have chosen to submit their work. Reviewers of manuscripts should pay increased attention to the quality of the abstract; it should truly reflect the study, both in terms of specific data and overall message. Currently, readers should be cautious and not just assume that information reported in the abstract accurately reflects that in the text. To better equip readers in the critical reading of scientific literature use can be made of a method like READER: Relevance, Education, Applicability, Discrimination, and overall Evaluation.[15] The specific responsibility belongs to editors, reviewers and authors: they must improve the quality of abstracts to help ensure that study findings pull off the maximum possible benefit.

Conflict of interest statement:
None

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