
Articles

How well do structured abstracts reflect the articles they summarize?

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Abstract

Background: Evidence-based medicine requires critical appraisal of published research. This is often done by reading the abstracts alone of published papers. This study examined how well structured abstracts reflect the articles they summarize in medical journals.

Methods: A total of 20 papers reporting original randomized trials were obtained from four general medical journals. Key study details, results, and conclusions were extracted from the full articles. Abstracts were examined to see what information from the article was included, and they were scrutinized for inaccuracies, data not presented in the main body, and ambiguous statements.

Results: Nineteen abstracts (95%; 95% CI 75 to 100%) correctly stated the primary outcome. Eight abstracts (40%; 19% to 64%) were deficient in some way. Three (15%; 3% to 38%) contained incorrect or inconsistent figures or data. Six abstracts (30%; 12% to 54%) contained data not present in the full article.

Discussion: Almost half of the abstracts studied contained some data inconsistent with the full article, or missing altogether. Authors and editors need to ensure that abstracts are of a high quality and accurately reflect the papers they are summarizing. CONSORT guidelines provide helpful indications as to what should be included in abstracts reporting clinical trials.

Introduction

Evidence-based medicine requires healthcare professionals to critically appraise the research knowledge base. With an increasing volume of material being published, this task is becoming ever more difficult. In many cases, readers screen published papers for relevance and usefulness by using the abstract, particularly when accessing the paper on the internet where only the abstract may be available or where a database search has produced a large number of papers. In addition, time constraints mean that professionals may read only the abstract even when the full paper is available. The quality of the abstract is therefore extremely important.^{1,2} In addition, journals may use the abstract to judge the suitability of a paper submitted for publication. A study

by the *BMJ*'s editorial team investigated whether decisions to send submitted papers for external peer review could be made by using just the abstract.³ In 62% of cases a first decision (immediate rejection, send for external review, or refer in-house) could be made using the abstract alone. The *BMJ* now routinely makes screening decisions about reviewing on the basis of the abstract alone.⁴

For all of these reasons, it is vital that abstracts accurately reflect the papers they summarize; however, little work has been carried out to investigate this. Pitkin and colleagues studied abstracts in six general medical journals and found that up to 68% of abstracts contained material that was inconsistent with the main body of the paper.⁵ The study did not examine what material from the main body of the paper was contained within the abstract, or if important information was omitted from the abstract. The authors recommended further study to determine the extent to which important information from articles is included in the abstracts.

We present the findings of a study investigating how well structured abstracts reflect the papers they summarise, using an unselected series of randomized trials reported in four general medical journals.

Methods

All eligible papers (see below) in the *BMJ*, *Lancet*, *JAMA*, and *New England Journal of Medicine (NEJM)* published between 30 April and 14 July 2005 were initially chosen for investigation, the final date being the time at which the study was begun. Working back in time from 14 July 2005 (the start date of the study), papers were obtained until there were five papers from each of the four journals, giving a total sample of 20. This sample size was chosen as being feasible in the time available, as the study was conducted as part of an assessed medical student project. Where two or more versions of a paper were available, the version published in the print journal was used as the principal source. This decision was made to ensure consistency, as each article has a print version, whereas not all have an additional online version. Where there were two versions, the abstracts were identical in each.

Eligibility criteria

Eligible articles were reports of original randomized trials, which included an abstract. Prospective studies following up groups that had been randomized in the past were

included. All other articles, including meta-analyses and non-interventional studies, were excluded.

Review of the papers

The main body of each paper was examined before the abstract was looked at. Key study details, results, and conclusions from the papers were recorded. The abstract was then examined to see which pieces of data from the main body of the paper were included. The abstract was also scrutinised for incorrect figures, data not presented in the main body, and potentially ambiguous statements or data. Where data were found that were missing from the main body of the paper and a longer web version was available, this was examined to see if the data could be found there. For each paper it was recorded whether the primary outcome was identified in the abstract and, if so, how the results were presented – for example, estimated effect sizes, P values, and confidence intervals.

Details of the study design reported in the abstract were recorded and omission of any other points that were potentially important to readers interpreting the paper, such as lack of blinding and departure from protocols, was noted. The abstract was checked to see if the key conclusion(s) from the paper were included. The accuracy of data within the abstract was tested using the same method as Pitkin.⁵ Abstracts were described as “deficient” if there was inconsistency between data in the abstract and the main body, or if data in the abstract were missing from the main paper. Any statements that were unclear or ambiguous were noted.

Statistical analysis

Proportions of abstracts with different characteristics were calculated with exact 95% confidence intervals.⁶

Results

The 20 studies reviewed were all two parallel-group randomized trials, two of which were equivalence trials. Of the 18 superiority trials, six (33%) reported evidence for a difference between groups in the primary outcome. Nineteen papers were first reports of trials and one was a follow-up.

Primary outcome

All but one of the papers (95%) correctly stated the primary outcome or hypothesis in the abstract (table). The other paper inconsistently stated the primary outcome as the proportion of subjects “referred for hospice care” in the abstract and the proportion “enrolled to hospice care” in the main text. Two abstracts (10%) failed to provide any estimates for the primary outcome result, referring only to whether or not there was a “significant difference” between the two groups with respect to the outcome. Twelve abstracts provided a P value for comparison between the two groups. Sixteen abstracts presented the difference between the two groups as either a risk/hazard/odds ratio or a risk difference; the remaining four reported outcomes for the two groups separately. Fifteen abstracts provided a 95% confidence interval for the difference. Ten of the 20 abstracts provided an estimate of the difference between

Accuracy of and primary outcome in 20 structured abstracts in general medical journals

Variable	No (%)	95% CI
Accuracy:		
Deficient	8 (40)	19 to 64
Inconsistency	3 (15)	3 to 38
Omission	6 (30)	12 to 54
Both omission and inconsistency	1 (5)	0 to 25
Ambiguity	4 (20)	6 to 44
Primary outcome:		
Clearly stated	19 (95)	75 to 100
Difference between groups given as a figure	16 (80)	56 to 94
95% CI given	15 (75)	51 to 91
P value given	12 (60)	36 to 81
Difference, CI, and P value given	10 (50)	27 to 73

the two groups, a confidence interval for this difference, and a P value for the comparison.

Other key data

All abstracts mentioned that the study was a randomized controlled trial or a follow-up from a randomized trial, as appropriate. Six of the 19 first reports of trials reported on blinding in the abstract. All 20 abstracts contained the main conclusion from the paper’s discussion section.

Accuracy of data within the abstract

Eight (40%) of the abstracts were deficient (table). Three of these (15%) contained incorrect or inconsistent figures or statements. In one of the papers, the denominator for a proportion was incorrectly reported (207 instead of 107). Another paper misreported the patient eligibility criteria, reporting “osteoarthritis grading of less than or equal to two”, when it should have stated “osteoarthritis grading of greater than or equal to two”.

Six abstracts contained data not present in the main body of the paper; mostly these were additional calculations. Two of these six papers had longer versions available on the internet, but in neither of these were the data in question present in the internet version. One paper contained both an incorrect number and a statement missing from the main article.

Four papers contained ambiguous or unclear statements that did not accurately reflect details from the main body of the paper. One was a paper that mentioned “irritant reactions” in the abstract but did not indicate which symptoms this included. Since this terminology was not used in the main article, the meaning was unclear. A different paper stated a discontinuation rate of 5% for the trial drug but failed to mention that the placebo had a discontinuation rate of 2%.

Discussion

This is the only study to our knowledge that has investigated what material from the main body of an article is contained within the abstract, and whether key information is omitted from the abstract. Our study has shown that some abstracts of randomized controlled trials published in general medical journals are deficient or inaccurate.

Inaccurate or misleading data

Almost half of the abstracts studied contained some data inconsistent with the main body of the paper or missing altogether. This is consistent with the findings of a study conducted in 1999, which found that 39% of abstracts were deficient.⁵ Some of the statements found in abstracts could not be classed as incorrect or missing from the main body of the paper, but were either unclear or potentially misleading – for example, giving the discontinuation rate in the treatment group but not in the placebo group.

The high proportion of papers with inaccurate or misleading data in the abstract is of concern. Some errors may be introduced during the writing process, particularly if there are multiple authors. Further inconsistencies may be introduced when authors revise parts of their manuscript but leave other sections unchanged. Structured abstracts are an improvement compared to traditional ones,⁷ but the quality of abstracts needs further improvement.

Limitations

Though the number of papers reviewed was small, our findings for the accuracy of abstracts were consistent with previous work.⁵ Where two versions of a paper were available, only the print version was selected initially, but where abstracts were found to be deficient, the online version was also examined. A further limitation is that the papers were examined by only one person (PJP). However, the results were objective findings, and the abstracts were each checked twice. The study investigated only papers reporting the outcomes of randomized trials, but there is no reason to suspect that the quality of abstracts for other study types would be any better.

Other medical journals

The four journals included in this study are general medical journals with a large readership and full-time editorial staff. Further research addressing abstract quality in other types of journal would be informative.

Guidelines for abstracts

Journals vary in their specifications for abstracts. Of the four journals in this study, *NEJM* and the *Lancet* both request semi-structured abstracts of no more than 250 words, with headings Background, Methods, Results/Findings and Conclusions/Interpretation.^{8,9} *JAMA* and the *BMJ* allow 300 words but give more structured headings.^{10,11} In its advice to authors, *JAMA* states: “No information should be reported in the abstract that does not appear in the text of the manuscript.”¹⁰ The *Lancet* says: “If space is short, report only the primary outcomes.”⁹ The *BMJ* now specifies that for reports of clinical trials, the abstract should include absolute event rates in both groups, the relative risk, and a number needed to treat or harm, with corresponding 95% confidence interval.¹¹ These guidelines had not been produced at the time this study was conducted.

The CONSORT (Consolidated Standards of Reporting Trials) statement was devised to guide authors in reporting clinical trials, to ensure that key information was presented

in a uniform format.¹² These guidelines have been endorsed by many medical journals, including the four in this study.¹³ The guidelines offer some advice regarding abstracts, mainly relating to the study design, and appear to be set to ensure that the study is correctly indexed in electronic databases so that other users find them when searching. CONSORT has recently published an extension for abstracts, with new guidance as to what should be included in structured abstracts.¹⁴ Research has shown that journal-based programmes to improve abstract quality can be successful. We support the inclusion of the extended CONSORT guidelines in the requirements of individual journals, given the findings of this paper. A follow-up study investigating the effect of new guidelines on future abstract quality would be useful, using these findings as a baseline.

This project was initially conducted as an assessed “student selected component” for the MBChB course at the University of Bristol, conducted by PJP and supervised by TJP. JLP provided support with the data analysis. All three authors contributed to the final manuscript.

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Self-archiving, metrics, and mandates

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Open access (OA) means free online access to published research articles. Some 2.5 million research articles are published every year in 25,000 peer-reviewed journals across all fields and all languages. The authors of those articles are employed and their research is funded so that it can be used, applied, and built on. The degree to which the research is used, applied, and built on is called its impact. The number of times an article is cited is one measure of impact.

Because researchers' salaries and funding depend on the impact of their research and because impact in turn depends on access, researchers have always wanted to maximize access to their work. Now the web makes it possible for all researchers to "self-archive" their articles in institutional repositories (see roar.eprints.org). Self-archived articles are preprints or postprints that the author deposits in an online repository and that are freely accessible. Thus, they do not substitute for the peer-reviewed journal articles,¹ but rather supplement the limited or expensive access that publishers provide (in much the way reprints were sent to requesters in the paper era). The OA versions come in a variety of forms. They can be the publisher's pdf; the author's revised, refereed, and accepted final draft; or an unrefereed preprint. Some have full references to the publisher's URLs and DOIs.

Estimating the value of OA

If maximal impact is the goal and if citations are one measure of impact, an important way to estimate the value of OA is to measure the increase in citations of articles that are made OA. A series of studies of citation counts across more than a dozen fields—beginning with computer science,² then physics,³ then the biological and social sciences and the humanities⁴—have consistently found that OA articles are cited 25% to over 250% more than non-OA articles. That is called the OA impact advantage. The figure shows this effect for a variety of fields. More detailed data by field can be found at opcit.eprints.org/oacitation-biblio.html.

The method is simple: the metadata on all the articles indexed by the ISI science and social science indexes (on a licensed CD-ROM) are fed to a software robot that trawls the web to try to find an OA version of each article. On the average, about 15% of articles are being self-archived today. Once the free versions are found, the logarithms of their citation counts are compared with those for non-OA articles in the same journal and year. The OA:non-OA citation ratio is the OA advantage. Some fields, such as chemistry, have low rates of self-archiving (the American Chemical Society is particularly opposed to OA), so OA and non-OA in such fields cannot now be compared. However, in other fields,

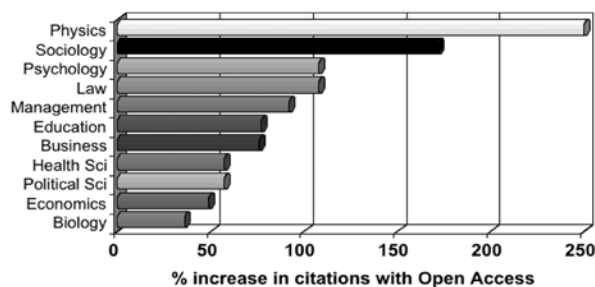
such as physics, self-archiving has been extensive. For astrophysics papers posted as preprints in arXiv.org, Kurtz et al found that "the effect of e-printing on citation rates in astronomy and physics is significant."⁵

Does quality make a difference?

One question is whether article-quality differences are a factor in OA–non-OA differences. Self-selection for quality is indeed one of five potential factors that contribute to the OA advantage: (1) early advantage (earlier OA, more citations); (2) quality advantage (the top 10% of articles benefit more from OA than the bottom 90%); (3) use advantage (more downloads of OA articles); (4) competitive advantage; and (5) quality bias (selectively making better articles OA). However, the last two effects vanish when all articles are self-archived, for instance, if mandates are put into place. Kurtz et al (in astrophysics) and Moed (in condensed-matter physics) concluded that authors' selective archiving of their higher-quality papers is indeed one of the factors that influence whether they deposit them in the arXiv repository before publication in a journal.^{6,7}

We have compared the usual, spontaneous self-selected self-archiving with self-archiving mandated by authors' institutions.⁸ If the OA advantage were due all or mostly to self-selection (quality bias), the advantage should be smaller or non-existent for mandated self-archiving, which reduces or eliminates self-selection bias, particularly in institutions that have already approached 100% compliance, such as CERN. But there is no detectable difference in the OA advantage (for CERN or the other three mandating institutions: Queensland University of Technology, the University of Minho, and the University of Southampton), so the overall contribution of the quality bias is very small.

Association of open access and citation rate



Data: Brody and Harnad, 2004³; Hajjem, Harnad, and Gingras, 2005⁴

The effects of embargoing access for 6 to 12 months have not yet been estimated. It is hard to measure the amount of loss in use and citations when OA is delayed. It would no doubt vary among fields (some of which develop faster than others), but research suggests that delay results in not just a temporary but a permanent loss in the research cycle: fewer accesses, fewer uses, fewer citations.⁶ Because the items just listed propagate in parallel, this means less productivity and progress.

Although examining surges at the end of an embargo is not the most effective or direct way of testing the OA advantage, Brody and others have found indications of download increases when one item in arXiv is cited in another, newly deposited item in arXiv, and citation increases when an item is newly deposited.^{9,10} They have also found a correlation between early downloads and later citations⁹ and shown that in physics, the interval between an item's first being deposited and its beginning to be cited keeps shrinking as self-archiving grows.

Zeno's paralysis

Despite the OA advantage and despite the link between impact and researchers' salaries and funding, only 15% of researchers are self-archiving spontaneously today. I have dubbed that paradox "Zeno's paralysis" (it has at least 34 easily remedied causes: see eprints.org/openaccess/self-faq/#32-worries).¹¹ Institutions and funders already mandate that their researchers must publish (or perish); they are now also beginning to mandate that they self-archive to maximize their research impact. Thirty one universities and research institutions and 30 research funders worldwide already mandate OA self-archiving, and several even bigger multi-institutional and national funding agency mandates have been proposed and are under consideration (eprints.org/openaccess/policysignup/).

The UK has the strongest momentum toward OA. The first and one of the most widely used (free) softwares for creating OA institutional repositories was developed in the UK (eprints.org, University of Southampton). The UK Parliamentary Select Committee was the first to recommend mandating OA self-archiving, and six of the seven UK research councils have already mandated it. In addition, the UK has a Research Assessment Exercise (RAE) in which the research impact of every department of every UK university is ranked by an assessment panel and each department is awarded substantial top-sliced research funding in proportion to its rank. The panel's rankings turned out to correlate highly with citation counts in most fields (for example, 0.91 in 1996 and 0.86 in 2001 in psychology).¹² Panel rankings are now being converted to metrics.

Richer metrics

Besides citation counts, OA will provide a rich spectrum of potential metrics, including download counts, download and citation growth and decay rates, book citation counts (from Google Books and Google Scholar), and co-citations. OA versus non-OA download counts, however, are much harder to compare than citations. Studies are just beginning, and downloads need to be tested jointly

with other potential metrics. In 2008, the RAE conducted a parallel exercise—both metrics and panel rankings—in which the metrics can be validated and calibrated against the panel rankings, discipline by discipline. The outcome of the validation exercise can now be used to create research-impact metrics. A prototype scientometric engine, citebase (citebase.eprints.org), has already been developed that can apply the metrics not only to navigation and evaluation but as an incentive to motivate and accelerate OA self-archiving and OA self-archiving mandates worldwide.¹³⁻¹⁵

What next?

Further analyses will be needed to test and validate the data from the 2008 RAE. Once the metrics are validated field by field against the panel rankings, each with its own (beta) weights for each metric, then OA versus non-OA impact can be compared with the full metric equation and each of its validated components. Metric displays can then also be built into the repository and harvesting software so that anyone can use OA metrics for evaluation and navigation, (and authors can also see directly the benefits conferred by OA). OA through self-archiving is optimal and inevitable for research, researchers, their institutions and funders, the vast research and development industry, and the taxpaying public that funds research. OA scientometrics is poised to usher in the OA era at long last.

For more information, visit www.ecs.soton.ac.uk/~harnad

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When I use a word: The very last word

What is the last word in the dictionary? Easy to answer, you might think. But there is a problem. We talk blithely about “the dictionary,” as if there was only one. But there are many, even among monolingual dictionaries of English. And they don't all end with the same headword.

Samuel Johnson's dictionary (1755) ends with zootomy, “dissection of the bodies of beasts.” *Collins English Dictionary* (6th edition) makes a better stab: Zyrian, the language spoken by the people of the Komi, in the erstwhile Soviet Union. Zyrian belongs to that curious group of languages, the Finno-Ugric (one of two branches of Uralic, the other being Samoyed). Its main members, despite the geographical divide, are Finnish and Hungarian; it also includes Estonian, Vogul (or Khanti), Ostyak (or Mansi), and the language of Sibelius's Karelia.

The *Chambers Dictionary* (9th edition, 2003) does better still: zythum, a kind of barley beer brewed by the ancient Egyptians and others. And a zytheptery is a brewery, got by adding hepsein (to boil). Hepsein also meant to smelt metals and to digest food, reminiscent of another Greek word, pepsis, meaning digestion or fermentation. And the yeast in zythum was called zyme, which gives us enzyme, a word that the Heidelberg physiologist Wilhelm Kühne introduced in 1877 to describe substances such as pepsin.

The *Oxford English Dictionary* (2nd edition) takes us further still: zyxt, which turns out to be, wait for it, an obsolete Kentish form of the second person singular present indicative of see. In other words, zyxt is “seest [thou].”

Now the *OED* is pretty comprehensive, but Philip Gove's controversial *Webster's Third New International Dictionary* (1961) went one better: zyzzogeton, a genus of large American leaf-hoppers having the pronotum tuberculate and the front tibiae grooved (well that's what the dictionary says).

No dictionary that I've seen has this other candidate: zyzzya, from *Zyzyya fuliginosa*, a marine sponge found in the South Seas. It contains pyrroloiminoquinone alkaloids belonging to the makaluvamine family, which inhibit the enzyme topoisomerase II and so produce a cytotoxic action by cleavage of DNA. And zyzzyposide (modelled on etoposide) would be a great name for an anticancer drug.

However, this is trumped by *The American Heritage Dictionary of the English Language* (4th edition, 2000), which has unearthed zyzzyva, any of various tropical American weevils of the genus *Zyzyva*, and by *The Random House Unabridged Dictionary* (1997) with Z-zero particle, one of three particles, intermediate vector bosons, that are thought to transmit the weak nuclear force.

Finally, turn to *Mrs Byrne's Dictionary of Unusual, Obscure and Preposterous Words* (yes really) of 1974. Mrs Byrne, a concert pianist and composer, was Jascha Heifetz's daughter, Josefa, so it is not surprising that the last word in her dictionary is musical: zzxjoanw, pronounced ziks-jo'-un and defined as a Maori drum. But anyone with the least smattering of Maori would look suspiciously at those zeds, the ex, and the jay. Here's a sample of the real thing, from the famous haka: “Tenei te tangata puhuruhuru nana mei i tiki mai whakawhiti te ra.” Zzxjoanw turns out (*Word Ways*, November 1976) to have been invented by Rupert Hughes for inclusion in his *Music Lovers' Encyclopedia* of 1914, where he says that it is pronounced “shaw” and means “1. Drum. 2. Fife. 3. Conclusion.”

To which one the only possible concluding response is “Pshaw,” followed by a bout of heavy zzzz-ing.

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