

“First Author, Second Author, et Int, and Last Author”: A Proposed Citation System for Biomedical Papers

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Papers in biomedical journals commonly have many authors. Because of space limitations, journals often require citations to list at most a few authors. Current criteria for determining which few authors to list often do not provide appropriate allocation of credit and responsibility. Thus, for example, they decrease the validity of citation analysis (which, despite other limitations, can be a useful means of assessing scholarly contributions¹). Uniform and fair rules for citation of authors of multiauthor papers are needed to resolve current problems with crediting individuals with authorship. We propose listing the first author, second author, and last author in references to journal articles that have four or more contributors. This scheme is superior to existing schemes for deciding which authors to list and also to similar schemes that can be envisioned.

Although there are benefits to multiple authorship, there are also controversies.² Recent studies of the number of authors of biomedical publications have demonstrated a general trend of increasing numbers of contributors.³⁻⁵ The mean number of authors per article increased steadily from 3.21 in 1975 to 4.46 in 1995 mainly because of a rise in authorship among professors and department chairpersons.⁵ A survey of radiation-oncology journals showed that about one eighth of papers published from 1983 through 1987

had more than six authors.⁶ More than one third of the reviews in the Cochrane Library contain evidence of “honorary” authors, that is, the scientists mentioned as coauthors without substantial contributions to an article, and “ghost” authors, that is, scientists who contributed to the article without having authorship.⁷ Indeed, editors, researchers, and others in scientific publishing have raised concerns about the increasing number of authors being listed per article, the practices of honorary and ghost authorship, and the danger of the dilution of responsibility when many authors are involved.^{6,8}

It may be impractical to include in printed reference lists all the authors on multiauthor papers, but the electronic journals may not have reason to limit the number of authors listed. MEDLINE no longer limits the number of authors listed. Use of the Uniform Requirements style (the so-called Vancouver style)⁹ for references, which is based on the style of the National Library of Medicine in MEDLINE, encourages having no more than six authors per paper because the Vancouver style precludes citation of more than six. The articles contributed by more than six authors are cited in reference lists as by the first six authors et al, which can result in dropping from the citation the principal investigator whose contributions were critical for conducting and publishing research. This problem is partially resolved in publications that at the end of each paper now provide information about the specific contribution of each author and of contributors who may not be listed as full coauthors at the beginning of the paper. This fair and innovative system does not, however, resolve citation problems produced by the Vancouver group.

It is important to know who was chiefly

responsible for each component of the cited research. Therefore, omitting a senior author or guarantor from a citation of a multiauthor article is a serious shortcoming of the Uniform Requirements style. The principal investigator—the leader of the group or department—is often the one who conceives and designs the study, orchestrates funding, coordinates efforts of collaborators, participates in analysis and interpretation of data, builds consensus among individual contributors, and writes the first draft of the paper or revises drafts for important intellectual content. Results of a cross-sectional mailed survey and a telephone survey of chairs of the 16 Canadian university departments of pediatrics and of deans’ offices of the 16 university medical faculties revealed a consensus that all principal investigators should be listed as authors and that in the case of collective authorship the greatest contribution should be credited to the principal investigator of the group.¹⁰ Another important reason to indicate the designer of a cited paper and coordinator of the contributor team, or guarantor, is to show who is responsible for the scientific integrity of the whole paper and accepts full responsibility for the conduct of the study and for interpreting and reporting the data.^{11,12}

To reconcile the problems in citation of multiple authors, we propose the citation system “first author, second author, et int (and intervening), and last author” for references of journal articles that have four or more contributors. We believe that this proposed system will do three important things: identify key personnel of cited research, discourage unwarranted multiple authorship, and, last but not least, save precious journal space. In this format, the senior author or research-group leader

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Citation System continued

could occupy either the first or last place, but we suggest, for the sake of some consistency, that the name of the guarantor of the paper appear at the end.

One of the possible limitations of the proposed “first author, second author, et int, and last author” system is its length, which persuades against proposing an extended version that would include a third author. The “first and last author et int” suggested by Epstein¹³ is shorter in that it omits the second author. However, as was established by the survey of 184 first authors from a consecutive sample of 200 papers with four or more authors published in 10 leading biomedical journals, the second author and last author generally contribute more than other nonfirst authors.¹⁴ Our personal experience shows that in some instances the nature and extent of contributions of first and second authors cannot be reliably differentiated. The sequence of the first two authors is then arbitrary or alphabetic.

The proposed “first author, second author, et int, and last author” system would not be ideal for papers in which authors are listed solely from largest contribution to smallest. In the past, there has been a general tendency to list the senior author and primary progenitor as a first author. A countervailing and more modern trend, however, is for the established senior scientist to recognize the younger colleague or graduate student who did most of the technical work by giving him or her the first position.¹⁵ This motivates the younger

generation and reflects on the gracious character of the principal investigator, who moves to the position of a last author. Therefore, related systems that would list senior author always first or second would be unfair to junior contributors who might have produced most of the reported data.

Thus, in the “first author, second author, et int, and last author” system, placing the name of senior investigator at the end of the list of authors is relatively short and clear, favors junior investigators, and solves the problem of omitting senior author–guarantor from citation. Because most biomedical publications are the fruit of collaboration of many workers at different levels, with each member bringing different talents and skills, a uniform use of this system will help adequately evaluate citations used in a published paper to justify its experimental design or conclusions. We hope that further discussion of the proposed and related citation systems will result in establishing criteria for citation of multiauthor papers that will be agreeable to both researchers and editors. 🍌

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