

## Accuracy of references in four laboratory animal science journals.

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Searching for a large number of references is a time consuming process, in particular when references cited by other authors turn out to be incorrect. In spite of availability of online literature databases and computer-based bibliography management systems, it seems as if this problem remains ubiquitous. Several reference accuracy studies have been published in different general and specialist biomedical journals (de Lacey *et al.* 1985; Doms 1989; Evans *et al.* 1990; Key & Roland 1977; McLellan *et al.* 1992; Nishina *et al.* 1995; Poyer 1979; Roach *et al.* 1997; Siebers & Holt 2000), but none covering laboratory animal science journals.

On average, previous results show an error rate of 35-50% (range 4-67%). This suggest that authors do not thoroughly check the original references or may not even read them (i.e. copying from articles who had previously cited the paper). It is generally agreed that the authors are primarily to blame for errors (de Lacey *et al.* 1985; Doms 1989; Nishina *et al.* 1995; Poyer 1979; Roach *et al.* 1997; Siebers & Holt 2000), but the responsibility of editors and peer reviewers should be clarified in this regard (Key & Roland 1977; Evans *et al.* 1990; Roach *et al.* 1997).

The aim of this study was to determine the accuracy of references in four laboratory animal science journals.

### *Materials and Methods*

Issue no 2/2000 of the journals Comparative Medicine, Contemporary Topics in Laboratory Animal Science, Laboratory Animals and Scandinavian Journal of Laboratory Animal Science were chosen for review. The two former journals use Vancouver styled references, whereas Laboratory Animals use Harvard styled references. The Scandinavian Journal of Laboratory Animal Science reference style is a somewhat modified version of the Medline format for journal titles.

For each of the four issues the references from the articles were consecutively numbered. Random numbers were then generated from Excel to select references. In Comparative Medicine random numbers covered 16 out of 18 articles; in Contemporary Topics in Laboratory Animal Science 9 out of 10, in Laboratory Animals all 14, and in Scandinavian Journal of Laboratory Animal Science all 3 articles were covered.

References cited in original articles, brief communications, editorials and review articles were checked for accuracy with Medline. If any of the four journals was not covered by Medline, Web of Science Citation Index was used instead. Since both Contemporary Topics in Laboratory Animal Science (1996) and Scandinavian Journal of Laboratory Animal Science (1997) are relatively new in the Web of Science Citation Index, unlisted older references of these two journals were checked with original article.

Excluded from the present study were cited references from journals not listed in Medline/Web of Science Citation Index, journals before 1965, books, proceedings from conferences, abstracts, dissertations, personal communication, web pages and references that were "in press". The first eighty references of the generated random numbers which were included in the databases were compiled for each of the four journals (Table 1).

References containing no error were classified as correct; if an error existed in any element, the reference was classified as incorrect. When a citation did not match its Medline counterpart, it was cross-checked with Web of Science Citation Index, or with original article. Each article was checked for author names (including correct number (unless author number four was listed as *et al* due to reference style), order, initials and spelling), title of article, journal title (including proper Index Medicus abbreviation for the shortened references), year, volume, and page numbers. Misplacement of commas, dots, colons, small letter instead of capital letter, inclusion/exclusion of space between elements etc. were not considered erroneous.

### *Results*

The majority of all references checked were correct (Table 1).

The most common citation errors were incorrect spellings of authors' names and partial omissions of titles of articles (Table 2). Error in journal titles were more common in journals using Vancouver style references.

### *Discussion*

Consistent with previous reports, many references contained an error in at least one element of citation. This suggest that the use of previously published papers for a quick bibliography may be a risky business, since more than one out of five references checked had at least one error (Table 1). The average inaccuracy rate of references of the

four laboratory animal science journals does not seem to differ from the average reference error reported in general medical journals (de Lacey *et al.* 1985; Poyer 1979; Siebers & Holt 2000) or in other specialist medical journals (Evans *et al.* 1990; Key & Roland 1977; McLellan *et al.* 1992; Nishina *et al.* 1995; Roach *et al.* 1997). Moreover, a comparison between the present results with those of previous reports suggests that there does not seem to be any association between numbers of reference errors and impact factor of individual journals (Poyer 1979; Siebers & Holt 2000).

Incorrect spelling of author names and partial omissions of article titles were the two most common errors (Table 2). This is consistent with what has been reported previously for other journals. Although the impact factor of a particular journal may not itself necessarily reflect the quality of its articles, it is often used as an easy measure of the quality of research papers, in particular within different specialist fields. A reference with an error in the journal title may potentially affect the impact factor of the cited journal. This is likely to be the case if there are few citations (denominator) compared to few articles (numerator) published each year. This risk may possibly decrease if abbreviations of journal titles are not used in reference lists.

Accuracy of references may be improved if authors download directly from Medline into their reference lists. However, also when references are directly downloaded from Medline, the records may require manual correction. Typical errors include suffixes (e.g. Jr), double-barrelled surnames (e.g. de, du, van der, etc.) and corporate authors (cited as [no authors listed] when they are not, unlike Lancet editorials which are anonymous).

The present results may serve as a reminder to authors, editors and peer reviewers that they need to be more careful of citation accuracy when striving for their common goal of scientific excellence and optimisation of journal impact.

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Table 1 Number of errors per reference

	Comparat Med		Contemp Top Lab Anim Sci		Lab Anim		Scand J Lab Anim Sci	
	F	%	F	%	F	%	F	%
0	59	73.7	50	62.5	62	77.5	61	76.3
1	19	23.7	24	30.0	15	18.8	17	21.2
2 or more	2	2.6	6	7.5	3	3.7	2	2.5
Total	80	100	80	100	80	100	80	100

Table 2 Frequency and percentage of errors.

	Comparat Med		Contemp Top Lab Anim Sci		Lab Anim		Scand J Lab Anim Sci	
	F	%	F	%	F	%	F	%
Author name(s)	6	26.1	11	29.7	12	54.6	7	33.3
Title of article	6	26.1	12	32.4	6	27.3	8	38.1
Journal title	3	13.0	9	24.4	1	4.5	1	4.8
Year	0	0	1	2.7	0	0	1	4.8
Volume	4	17.4	3	8.1	1	4.5	1	4.8
Page numbers	4	17.4	1	2.7	2	9.1	3	14.2
Total	23	100	37	100	22	100	21	100