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A comparison of conflict of interest policies at peer-reviewed journals in different scientific disciplines

Jessica S. Ancker · Annette Flanagin

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Abstract Scientific journals can promote ethical publication practices through policies on conflicts of interest. However, the prevalence of conflict of interest policies and the definition of conflict of interest appear to vary across scientific disciplines. This survey of high-impact, peer-reviewed journals in 12 different scientific disciplines was conducted to assess these variations. The survey identified published conflict of interest policies in 28 of 84 journals (33%). However, when representatives of 49 of the 84 journals (58%) completed a Web-based survey about journal conflict of interest policies, 39 (80%) reported having such a policy. Frequency of policies (including those not published) varied by discipline, from 100% among general medical journals to none among physics journals. Financial interests were most frequently addressed with relation to authors; policies for reviewers most often addressed non-financial conflicts. Twenty-two of the 39 journals with policies (56%) had policies about editors' conflicts. The highest impact journals in each category were most likely to have a published policy, and the frequency of policies fell linearly with rank; for example, policies were published by 58% of journals ranked 1 in their category, 42% of journals ranked third, and 8% of journals ranked seventh (test for trend, $p = 0.003$). Having a conflict of interest policy was also associated with a self-reported history of problems with conflict of interest. The prevalence of published conflict of interest policies was higher than that reported in a 1997 study, an increase that might be attributable to heightened awareness of conflict of interest issues. However, many of the journals with policies do not make them readily available and many of those policies that were available lacked clear

J. S. Ancker (✉)
Department of Biomedical Informatics, Columbia University, 622 W. 168th Street, Vanderbilt Clinic 5th Floor, New York, NY 10032, USA
e-mail: jsa2002@columbia.edu

A. Flanagin
JAMA, 515 N State St., Chicago, IL 60610, USA
e-mail: annette.flanagin@jama-archives.org

definitions of conflict of interest or details about how disclosures would be managed during peer review and publication.

Keywords Conflicts of interest · Competing interests · Publication · Journals · Ethics

Introduction

In scientific publication, a conflict of interest exists when an author has a financial, professional, or personal relationship that could influence or bias that author's decisions, interpretations, conclusions, or publications [1–3]. Particular concern has been directed toward the financial interests of scientific researchers and authors, the relationships between them and the funders of their work, and the risks of financial ties resulting in biased, delayed, and even suppressed publication [4–10]. Although studies have demonstrated and commentators have agreed that conflicts of interest have the potential to impair the integrity of scientific publication [11–14], there has been little consensus on the definition of conflict of interest, on who, in the publication process, can be affected, or on how to manage conflicts of interest during peer review and publication.

Many researchers and commentators have focused primarily on financial conflicts of authors. Yet non-financial interests can be equally important [1–3, 15–19] and conflicts of interest (or competing interests) can affect others involved in the publications process, such as peer reviewers and editors. For example, the Council of Science Editors [3, 18] and the International Committee of Medical Journal Editors [1] address the conflicts associated with both financial and non-financial interests of authors, reviewers, and editors. Other guidelines are limited to financial interests and only as they relate to authors. Some journals consider personal and professional relationships to be a primary concern in terms of potential conflicts of interest (personal email communication, June 22, 2005, Michael Hochberg, PhD). Management strategies also vary. Even strategies that agree in general principles (such as on the need for disclosure) vary in terms of whether disclosure should be to the editor, peer reviewers, and/or readers [1, 15, 18].

The prevalence of conflict of interest policies in peer-reviewed scientific journals appears to vary among different scientific disciplines. A 1997 review of 1,396 high-impact journals across scientific disciplines (primarily, medicine, multidisciplinary sciences, and chemistry) identified 181 journals with conflict of interest policies (13%). In this study, medical journals were overrepresented in the overall sample because medical journals tend to have high impact factors, but they were also more likely to have conflict of interest policies [11]. Other research on conflicts of interest has focused solely on biomedicine or life science disciplines [4, 6–8]. However, a comparison of the prevalence, type, and content of journal conflict of interest policies among multiple different scientific disciplines has not been reported.

To explore differences between scientific fields, we conducted a study of the prevalence and types of conflict of interest policies at peer-reviewed journals in 12 different scientific disciplines as defined by the Institute for Scientific Information: astronomy/astrophysics, biological sciences, biology, chemistry, engineering

(multidisciplinary), medicine (general and internal), medicine (research and experimental), physics, plant sciences, psychology, sciences (multidisciplinary), and zoology.

Methods

Twelve scientific categories were selected from the Institute for Scientific Information's 2004 Journal Citation Reports (http://www.isinet.com/) to represent a range of physical sciences, engineering disciplines, and life sciences (including non-medical categories such as plant sciences). The total number of journals ($n = 7$ in each category) was limited so that two researchers could review their policies within a relatively short time and avoid the effects of any secular trends. In each category, the seven journals with the highest journal impact factor were selected. Impact factor is defined as citations in the current year divided by the number of citable articles published in the two previous years (http://www.isinet.com/), and is a proxy for journal prestige and quality [20]. This sample represented a mean of 9.9% of the journals in each category; the proportion ranged from 5.1% (7/138 in plant sciences) to 15.6% (7/45 in the multidisciplinary sciences and astronomy/astrophysics categories). The journals are listed in the Appendix.

The published polices of the 84 journals (August through October, 2004) were reviewed to determine whether they included policies on conflicts of interest. First the Web site of each journal was searched for a policy and the electronic submission links were followed to locate any electronic conflict of interest forms. If neither of these searches produced evidence of a policy, the instructions for authors were examined in printed issues of the journal published in 2004.

In a Web-based survey (May though July, 2005), editorial representatives of the journals were asked additional questions about journal policies and procedures about conflicts of interest for authors, peer reviewers, and editors. The Web-based survey consisted of 33 multiple-choice questions, most of which included an open-ended ''other'' option, and two open-ended free answer questions. The questions and the Web interface for the survey were pilot tested for clarity and usability by a group of journal editors who were not included in the final survey, and revisions were incorporated into the final version. Editorial representatives of journals were contacted by e-mail or telephone and invited to participate in the survey. No incentives for participation were provided. The survey was reviewed and approved by the Columbia University Institutional Review Board, and all participants granted written informed consent. Data were stored and analyzed in SPSS 10.0 (SPSS Inc., Chicago, IL) and SAS 9.1 (SAS Institute Inc., Cary, NC).

Results

Review of published policies

Of the 84 journals, 28 (33%) had publicly available conflict of interest policies published in instructions for authors or editorials. The frequency of such publicly

available journal policies varied widely across disciplines, from 100% among general medical journals to none among journals in biology, multidisciplinary engineering, multidisciplinary physics, and zoology (Table 1).

All the published policies advised or required disclosure of conflicts of interest to the journal; two journals' policies also banned authors with conflicts of interest from submitting review articles and opinion articles (e.g., editorials and commentaries). Twenty-seven journal policies discussed financial conflicts, and 11 addressed non-financial types of conflicts.

Of the 28 journals with published policies, 15 (54%) provided no definition of conflict of interest. Two journals' policies requested authors to indicate the monetary value of a specific financial interest, and six journal policies specified some limits on time (either duration or recency of the financial tie).

Policies were implemented in a variety of ways: by simply publishing the policy; by requiring authors to acknowledge receipt of the policy; by requiring authors to declare conflicts of interest; by requiring authors to declare that they had no

Table 1 Frequency and types of published conflict of interest policies for authors among 84 journals in 12 scientific disciplines

ISI category	No. with policy for authors/ total *n*	'Conflict of interest' explained through:		Financial interests defined by:		Potential conflict managed through:	
		Definition	Examples	Monetary limit	Time limit[a]	Disclosure	Ban[b]
Medicine, general and internal	7/7	3/7	6/7	0	4/7	7/7	2/7
Chemistry-multidisciplinary	6/7	6/6	6/7	0	0	6/6	0
Multidisciplinary sciences	4/7	3/4	2/4	2/4	2/4	4/4	0
Psychology	4/7	0	2/4	0	0	4/4	0
Medicine, research and experimental	3/7	1/3	3/7	0	0	3/3	0
Plant sciences	2/7	0	0	0	0	2/2	0
Astronomy/ astrophysics	1/7	0	0	0	0	1/1	0
Biological sciences	1/7	0	0	0	0	1/1	0
Biology	0/7	–	–	–	–		–
Engineering-multidisciplinary	0/7	–	–	–	–		–
Physics-multidisciplinary	0/7	–	–	–	–		–
Zoology	0/7	–	–	–	–		–
All	28/84 (33%)	13/28 (46%)	19/28 (68%)	2/28 (7%)	6/28 (21%)	28/28 (100%)	2/28 (7%)

ISI—Institute for Scientific Information. Percentages have been rounded

[a] Duration or recency

[b] For some or all types of articles

conflicts of interest; or by requiring authors to complete a disclosure form or checklist. Of the 28 journals with author policies, 27 required disclosure to the journal; 18 of 23 journals with conflict of interest policies for peer reviewers required such disclosure, as did 18 of 22 journals with policies for editors. Although these policies stated that disclosures were required, it was not clear how the requirement was enforced (for example, whether electronic submission was blocked for manuscripts lacking conflict of interest forms).

Two journal policies stated that disclosures would be shown to peer reviewers, four stated that disclosures would *not* be shown to peer reviewers; the remaining 22 (79%) did not specify how or whether disclosures would be used in the peer review process. Fifteen of the 28 policies (54%) stated that disclosures could be published (generally, at the editors' discretion); the remaining 13 (46%) did not specify whether disclosures might be published.

Journals with higher impact factors were more likely to have published conflict of interest policies. Journal rank was strongly and linearly associated with likelihood of having a published policy (2-tailed Cochran-Armitage test for trend, $p = 0.003$; Fig. 1). The median impact factor for journals with published policies was 10.8 (interquartile range, 7.5 to 17.7), and for journals without policies it was 4.1 (interquartile range, 3.0 to 6.1; $p < 0.001$ by 2-tailed Wilcoxon rank-sum test).

Survey

Representatives from 49 of the 84 journals (58%) completed the survey. Participation rates varied by discipline, with 100% participation among representatives of general and internal medicine journals and multidisciplinary journals, followed by psychology (86%) and plant sciences (71%) and with no participation from representatives of chemistry journals (Table 2).

Of the 49 journals represented by survey participants, 39 (80%) were reported to have a conflict of interest policy in place of any type (for authors, peer reviewers, or editors). Frequency of policies varied by discipline, with a high of 100% among general medical journals, and none among the physics journals (Table 2).

Survey respondents indicated that financial interests were most frequently addressed with relation to authors and that policies for peer reviewers most often

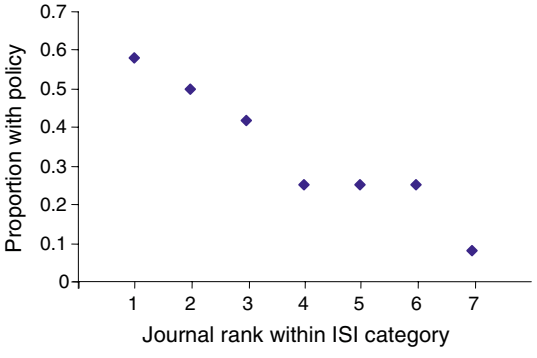

Fig. 1 Journals with higher rank were more likely to publish a conflict of interest policy (2-tailed Cochrane-Armitage test for trend, $p = 0.003$). For example, policies were published by 7 of the 12 journals ranked first in their ISI category (58%), 5 of 12 journals ranked third in their category (42%), and 1 of the 12 journals ranked seventh (8%).

Table 2 Frequency of participation, any policy, and financial and non-financial policies from survey

ISI category	No. respondents (% of those contacted)	No. with any CoI policy (% of respondents)	Policy covers		
			Both financial and non-financial issues, *n*	Financial only, *n*	Non-financial only, *n*
Medicine, general and internal	7 (100)	7 (100)	6	1	0
Multidisciplinary sciences	7 (100)	6 (86)	4	1	1
Psychology	6 (86)	4 (67)[a]	2	0	1
Plant sciences	5 (71)	5 (100)	5	0	0
Astronomy–astrophysics	4 (57)	3 (75)	3	0	0
Medicine, research-experimental	4 (57)	4 (100)	2	1	1
Zoology	4 (57)	3 (75)	0	1	2
Biological sciences	3 (43)	3 (100)	1	0	2
Biology	3 (43)	2 (67)	1	0	1
Engineering-multidisciplinary	3 (43)	2 (67)	0	0	2
Physics-multidisciplinary	3 (43)	0	–	–	–
Chemistry	0	NR	NR	NR	NR
All	49 (58)	39 (80)	24 (62)	4 (10)	10 (26)

NR—no responses to survey; ISI—Institute for Scientific Information. Percentages have been rounded

[a] One psychology journal did not respond to question about type of policy

addressed non-financial conflicts (Table 3). Twenty-eight (72%) of the respondents with journal policies reported having addressed authors' conflicts. Financial disclosure to the journal was required in 21 (75%) of these journal policies. In cases of financial conflict, respondents from 15 journals reported requiring authors to declare that they had no financial conflicts (54%), and respondents from 4 journals (14%) reported that authors were barred from publishing some or all types of articles.

Respondents from 23 journals with policies (59%) addressed peer reviewers' conflicts. Disclosure of financial conflicts to the journal was required in 18 (78%); in cases of financial conflict, reviewers were asked to turn down reviewing opportunities in 17 (74%) or could be barred from reviewing in 11 (48%). Respondents from 22 journals (56%) had policies addressing editors' conflicts. Financial disclosure to the journal was required in 18 of these policies (82%); editors were barred from editing articles in cases of financial conflict by 14 (64%) and required to avoid all financial conflicts by 1 journal.

Among the 28 journals with policies for authors, respondents from 9 journals stated that all author disclosures of conflict of interest were published and 9 more stated that some were published. Respondents from 4 journals reported that all

Table 3 Frequency and types of conflict of interest policies reported by respondents to survey (n = 49)

ISI category	No. with any CoI policy	No. with policy (policy types)			
		For authors	For reviewers	For editors	For all participants—authors, reviewers, and editors
Medicine, general and internal	7	7 (1f, 6b)	5 (5b)	6 (1f, 5b)	5
Multidisciplinary sciences	6	5 (1f, 4b)	4 (1nf, 3b)	4 (3b, 1na)[a]	2
Psychology	4	3 (2b, 1na)[a]	3 (1nf, 2b)	2 (1nf, 1b)[a]	1
Plant sciences	5	3 (2b, 1na)	3 (3b)	3 (3b)	1
Astronomy–astrophysics	3	1 (1b)	2 (2nf)	2 (2b)	0
Medicine, research-experimental	4	4 (2f, 1nf, 1b)	1 (1b)[a]	2 (2b)[a]	1
Zoology	3	1 (1f)	2 (2nf)	1 (1nf)	0
Biological sciences	3	2 (1nf, 1b)	1 (1nf)	2 (2nf)	0
Biology	2	1 (1b)	1 (1nf)	0	0
Engineering-multidisciplinary	2	1 (1nf)	1 (1nf)	0	0
Physics-multidisciplinary	0	0	0	0	0
Chemistry	NR	NR	NR	NR	NR
All	39 (80%)	28 (72%) (5f, 3nf, 18b, 2na)[a]	23 (59%) (9nf, 14b)[a]	22 (56%) (1f, 4nf, 16b, 1na)[a]	10 (26%)

Key: f—financial only; nf—non-financial only; b—both; na—no answer; NR—no responses to survey; ISI—Institute for Scientific Information. Percentages have been rounded

[a] Additional policies reported as being in development

disclosures were shown to peer reviewers, 1 indicated that none were shown to reviewers, 5 indicated that some were shown to reviewers, and 13 indicated that the disclosures were reviewed by the editors. (Numbers do not sum to 28 because respondents could choose more than one answer.) When asked whether the journal had a procedure for handling situations when undisclosed financial conflicts of interest were discovered after publication, respondents from 13 journals indicated that their policy provided no guidance on this topic. However, 18 respondents indicated that they might ask the author for an explanation, 14 indicated that they might print a correction or clarification, and 5 indicated they might report the finding to the author's institution or funding agency.

Respondents from 3 journals reported that their policies addressed only non-financial conflicts; 2 of the 3 did not publish these policies.

The 39 journals with any type of policy (for authors, peer reviewers, and/or editors) were more likely to report a recent history of problems with financial (13 of

39) and non-financial (15 of 39) conflicts than were journals without any policies (0 of 10 for financial, 2 of 10 for non-financial).

Survey respondents confirmed that not all policies were publicly available. Of the 28 journals with conflict of interest policies for authors, 4 were not publicly available because they were unwritten or unpublished ($n = 2$) or were sent individually to authors ($n = 2$). Of the 23 journals with policies for peer reviewers, 12 were not publicly available because they were unwritten or unpublished ($n = 2$) or sent individually to reviewers ($n = 10$). Of the 22 journals with policies for editors, 11 were not publicly available because they were unwritten or unpublished ($n = 2$) or sent individually to editors ($n = 9$).

Discussion and conclusion

In this sample of 84 high-impact peer-reviewed journals from 12 different scientific disciplines, published conflict of interest policies were common in general and internal medicine, chemistry, multidisciplinary sciences, and psychology journals, but less common or absent in other scientific disciplines. The highest impact journals in each category were most likely to have a published policy, and the frequency of policies dropped linearly with impact factor ranking. The subsequent survey found that many journals without publicly available conflict of interest policies nevertheless have in-house policies, suggesting that the prevalence of policies might be higher than the rate captured by the review of published policies.

Among journals with policies responding to the survey, most had polices directed toward authors (72%) followed by policies directed toward peer reviewers (59%), and editors (56%). Journals in general and internal medicine, multidisciplinary sciences, psychology, and plant sciences were more likely than journals in other disciplines that responded to the survey to have policies in place for all 3 participants in the publication process: authors, peer reviewers, and editors. Most journals responding to the survey with policies (62%) discussed both financial and non-financial interests. Requiring disclosure of potential financial conflicts was the most common published strategy for managing financial conflict of interests. However, many journals with conflict of interest policies do not make them publicly available to readers or prospective authors (14% of policies for authors, 52% of policies for peer reviewers, and 50% of policies for editors were not published). Moreover, many of the published policies lack definitions of conflict of interest, examples of conflicts or relevant interests, and other information such as the intended use of disclosures and consequences of conflict of interest declarations.

Journals with policies were overrepresented in the survey portion of this study. Although publicly available policies were identified for only 33% of the journals (28/84), 80% of the journals that responded (39/49) to the survey reported having a policy. A few reported having policies that were not written or published; these would not have been identified in a review of published policies. It is unclear why some journals would have conflict of interest policies but not make them readily and publicly available to readers and prospective authors and reviewers. A reported history of conflict of interest problems was associated with having a policy on

conflict of interest; both experience with problems and existence of a policy may be associated with an interest in conflict of interest that may have influenced an editor to participate in the survey.

The overall prevalence of published conflict of interest policies in peer-reviewed scientific journals in 2004 was higher than that reported by Krimsky and Rothenberg in 1997 (33% vs. 13%) [11]. The rate of policies among the subset of journals that responded to our survey was even higher (80%). The increase could be attributable to heightened awareness of conflict of interest issues in recent years or to the different journals included in each study. Although both studies targeted high-impact journals, the present study included only the highest impact journals and the data showed an association between higher journal impact factors and the likelihood of having a conflict of interest policy. Although the 1997 study included a larger sample of journals, those journals represented a narrower range of scientific disciplines (primarily medicine, multidisciplinary sciences, and chemistry). The present study covered a wider range of scientific disciplines, including those for which conflict of interest policies were not publicly available or did not exist at all (i.e., biology, multidisciplinary engineering, multidisciplinary physics, and zoology).

This study is limited by the numbers of journals selected for inclusion, the selection of high-impact peer-reviewed journals versus low-impact journals, and a survey response rate of 58%. In addition, low participation rates by representatives of some of the scientific disciplines (i.e., chemistry, engineering, physics, and biology) limit the ability to assess non-published policies and practices of the journals in those fields. Nevertheless, this appears to be the first study to report comparisons of conflict of interest policies and practices among peer-reviewed journals in a broad range of scientific disciplines, including non-life sciences. Although this study assessed whether journals with policies used a disclosure form or checklist, the survey did not specify whether the disclosure form was open-ended or a closed checklist. The survey did not ask about when in the submission process the disclosure forms were collected (e.g., at the time of manuscript submission, before revision, or as a condition of acceptance), nor whether authors' failure to provide disclosures of conflicts of interest resulted in a delay or halting of the editorial process. Each of these areas would be useful to include in future studies of the policies and procedures used by journals to manage authors' conflict of interest disclosures.

Scientific journals have increased their attention to conflict of interest policies and have directed policies not only to authors but also to peer reviewers and editors. However, a number of journals still do not have publicly available descriptions of their policies, and many of those policies that are available lack clear definitions and important details. Moreover, the prevalence and types of conflict of interest policies differ among different scientific disciplines, with some disciplines not having any such policies. Conflicts of interest are ubiquitous, and no science is invulnerable to the potential influences and biases associated with conflicts of interest. More comprehensive and publicly available policies in all scientific disciplines may help improve communication about conflicts of interest between authors, peer reviewers, editors, and readers of scientific journals.

Acknowledgment Previous presentations: Parts of this study were previously presented at the Council of Science Editors Retreat on Conflicts of Interest, October 31, 2004, Oakbrook, Ill; and the Fifth International Congress on Peer Review and Biomedical Publication, September 17, 2005, Chicago, Ill.

Appendix; Journals included in study, in decreasing order of impact factor within ISI category

Astronomy–astrophysics: Annual Review of Astronomy, Astrophysical Journal, Astrophysical Journal Supplement Series, Astronomical Journal, Monthly Notices of the Royal Astronomical Society, Astroparticle Physics, New Astronomy

Biological sciences: Trends in Ecology and Evolution, Annual Review of Ecology, Evolution, and Systematics, Ecological Monographs, Ecology Letters, Global Change Biology, The American Naturalist, Molecular Ecology

Biology: The FASEB Journal, Bioessays, Biological Reviews, Quarterly Review of Biology, Journal of Biological Rhythms, Philosophical Transactions of the Royal Society of London Series B-Biological Sciences, Proceedings of the Royal Society of London Series B-Biological Sciences

Chemistry: Chemical Reviews, Accounts of Chemical Research, Chemical Society Reviews, Angewandte Chemie-International Edition, Journal of the American Chemical Society, Nano Letters, Topics in Current Chemistry

Engineering-multidisciplinary: Nanotechnology, Combustion and Flame, International Journal for Numerical Methods in Engineering, Computer Methods of Applied Mechanics and Engineering, Engineering Analysis with Boundary Elements, Journal of the Audio Engineering Society, Composites Part B-Engineering

Medicine-general and internal: New England Journal of Medicine, Journal of the American Medical Association, Lancet, Annals of Internal Medicine, Annual Review of Medicine, BMJ, Archives of Internal Medicine

Medicine-research and experimental: Nature Medicine, Journal of Experimental Medicine, Journal of Clinical Investigation, Trends in Molecular Medicine, Molecular Therapy, Gene Therapy, Human Gene Therapy

Multidisciplinary sciences: Nature, Science, Proceedings of the National Academy of Sciences of the USA, IBM Journal of Research and Development, Scientific American, Annals of the New York Academy of Sciences, Naturwissenschaften

Physics: Reviews of Modern Physics, Physics Reports-Review Section of Physics Letters, Reports on Progress in Physics, Physical Review Letters, Physics Today, Physics Letters B, Journal of Physical and Chemical Reference Data

Psychology: Annual Review of Psychology, Psychological Bulletin, Psychological Review, Psychotherapy and Psychosomatics, Psychosomatic Medicine, Cognitive Psychology, Mental Retardation and Developmental Disabilities Research Reviews

Plant biology: Annual Review of Plant Biology, Trends in Plant Science, The Plant Cell, Current Opinion in Plant Biology, Annual Review of Phytopathology, Plant Journal, Plant Physiology

Zoology: Journal of Comparative Neurology, Journal of Animal Ecology, Behavioral Ecology and Sociobiology, Animal Behaviour, Behavioral Ecology and Sociobiology, Developmental & Comparative Immunology, Journal of Zoological Systematics and Evolutionary Research

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