



Muddy waters: Variability in the reporting of conflicts of interest in the biomedical literature

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3 **Muddy waters: Variability in the reporting of conflicts of interest in the biomedical**
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5 **literature**
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7 appear to have influenced the submitted work.
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14 **Standfirst**

15 *Enforced, structured reporting of conflicts of interest is necessary to make disclosures accessible*
16 *and meaningful.*
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3 The Chief Medical Officer of Memorial Sloan Kettering, Dr José Baselga, recently
4 resigned after revelations that he failed to disclose any industry relationships in more than 100
5 publications since 2013 and in 87% of articles that he authored in 2017 despite receiving
6 millions in compensation from pharmaceutical and biotech companies.(1) Stating that his non-
7 disclosure was unintentional, he called on the medical community to “doub[le] down on
8 transparency in our field” and to “continue to work together to standardize the disclosure
9 process.”(1)

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12 Conflict of interest disclosures act as a signal for risk of bias in the design, conduct, and
13 reporting of biomedical research. Researchers have explored the relationship between author
14 financial conflict of interest and bias in research results and interpretation across a variety of
15 fields; some have found a positive association(2-6) and others, no association.(7-9) Thus, the
16 International Committee of Medical Journal Editors (ICMJE) and Committee on Publication
17 Ethics (COPE) recommend that journal editors require published statements declaring authors’
18 conflicts of interest.(10, 11) Despite this consensus in biomedical publishing, data is lacking on
19 the extent, nature, and impact of conflicts of interest due to the self-reported nature of disclosure
20 and variations in reporting practices.(12)

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23 Articles published in journals following the ICMJE recommendations are expected to be
24 published with statements or supporting documents declaring authors’ conflicts of interest,
25 sources of support for the work, and whether the authors had access to the study data.(10) We
26 analysed 1002 randomly sampled biomedical articles and found that authors of 23% disclosed a
27 conflict of interest, 64% disclosed no conflicts, and 14% did not include a disclosure
28 statement.(13) Arriving at these prevalence estimates was challenging because disclosure
29 practices in journals that claim to follow ICMJE recommendations can be inconsistent,
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3 incomplete, and often hard to access. To be able to analyse how conflicts of interest affect
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5 research integrity, we need to be able to access accurate disclosures across the entire body of
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7 literature.(14) However, current disclosure practices represent muddy waters. We highlight key
8
9 problems related to accessibility, semantics, and relevance using illustrations from our
10
11 analysis.(13)

15 16 **The problem of accessibility: 94 pages of supplementary PDFs**

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18 The first key challenge associated with conflict of interest disclosures is locating them.
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20 For most articles, statements are in the online version and portable document format (PDF)
21
22 version of articles. For others, statements are only available online (not in the PDF), in
23
24 supplementary files, on separate webpages, or are unavailable because links to disclosure
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26 statements are broken.
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30 Some journals provide links to a PDF of the authors' uploaded ICMJE form in lieu of
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32 providing complete summaries or sometimes any disclosures in the article. The longest
33
34 supplementary PDF we found totalled 94 pages (for 31 authors).(15) Disclosure statements are
35
36 found in footnotes, endnotes, the body of the manuscript, and in supplemental material. They are
37
38 identified by diverse and largely synonymous headings including "conflict of interest," "COI,"
39
40 "potential conflict of interest," "disclosures" or "disclosure statement," "declaration of interest,"
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42 "sources of funding," and "acknowledgments." Occasionally, articles have multiple conflict of
43
44 interest disclosure statements published in different locations and these statements may contain
45
46 discrepant information.(16, 17)
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51 Conflict of interest statements are frequently conflated with statements about the funding
52
53 of the research presented in the article, making it difficult to separately assess individual authors'
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55 conflicts of interest and study sponsorship. We argue that conflict of interest and funding source
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3 disclosures should be reported and considered separately as there is some evidence to suggest
4 that funding source and author conflict of interest may be independently associated with risk of
5 bias,(2, 18) though the likelihood of confounding is high.(19)
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10 11 **The problem of semantics: 130 ways to state “no conflicts”**

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13 The terminology used to refer to conflicts of interest varies widely and includes conflict
14 of interest, competing interest, competing conflict of interest, commercial relationships,
15 declaration of interest, disclosures, duality of interest, financial conflict of interest, financial
16 interest, proprietary or commercial interest, or receipt of benefits.
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23 There is substantial variability in the language authors use to make disclosures, even in
24 the case that they do not have a conflict of interest. Some of the variants change the meaning of
25 the statement (Table 1). We identified 130 unique ways of stating “no conflicts of interest”
26 across the set of 637 articles whose authors declared no conflict of interest,(13) ranging from 1-
27 word to 62-word statements:
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34 The authors have no relevant affiliations or financial involvement with any organization
35 or entity with a financial interest in or financial conflict with the subject matter or
36 materials discussed in the manuscript. This includes employment, consultancies,
37 honoraria, stock ownership or options, expert testimony, grants or patents received or
38 pending, or royalties. No writing assistance was utilized in the production of this
39 manuscript.
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48 Statements range from the simple, “nil” or “none,” to the definitive, “no conflicts of interest
49 exist,” to the common, “no conflicts were declared,” suggesting a different meaning – that
50 conflicts of interest might still exist, but were not disclosed – and emphasising the self-reported
51 nature of disclosure.
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Table 1. Categories of statements indicating there was no conflict of interest (n=637 statements; 130 unique statements)

Category	Examples
Vague “no”	Nil; None; Commercial relationships: none
None exist	There are no conflicts of interest; No author has a conflict of interest; No conflicts of interest exist for either of the authors of this manuscript; No direct or indirect commercial incentive associated with publishing this article; The authors declare they have no conflicts of interest
None declared	None declared; Nothing to disclose; None of the authors has any conflict of interest to disclose; No potential conflicts of interest were disclosed; There were no conflicts of interest to report
No relevant conflicts	No relevant disclosures; The authors have no relevant financial relationships to disclose; The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript this includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending or royalties, no writing assistance was utilized in the production of this manuscript
None in this work	No conflict of interest exists in this paper; We have no conflict of interest related to this work; The authors certify that they have no commercial or associative interest that represents a conflict of interest in connection with the manuscript
No perceived conflicts	The authors declare no relation that could be perceived as conflict of interest; The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported
None to our knowledge	To the best of our knowledge no conflict of interest exists

The problem of relevance: personal fees from 42 entities

Conflicts of interest are context-specific. Authors, editors, peer reviewers and readers must judge the relevance of disclosed interests in relation to the work to evaluate whether a conflict of interest exists. The ICMJE form asks authors to “disclose interactions with any entity that could be considered broadly relevant to the work.” Authors sometimes seek to define relevance in disclosure statements, using adjectives such as “potential,” “relevant,” and

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3 “financial” or contextualising statements by stating that disclosures pertained to “this work,”
4
5 “this study,” “this manuscript,” or “this submitted work.”
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8 In some cases, authors disclose seemingly relevant financial ties, but make statements
9
10 refuting that the disclosed relationship constitutes a conflict of interest.(16) For example, in an
11
12 angiography clinical trial, under the heading “Sources of Funding,” the authors reported
13
14 receiving consulting and speakers fees and unrestricted grants from multiple medical device
15
16 manufacturers with products directly related to the study, but under the heading “Disclosures”
17
18 stated, “None.”(20)
19
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22 When authors make conflict of interest disclosures that include personal and professional
23
24 biographical information or misplaced funding information, the ICMJE classifies these conflicts
25
26 of interest as “miscellaneous.” These kinds of disclosures may obscure clearer signals of risk of
27
28 bias such as disclosure of financial relationships with industry. For example, one article with 17
29
30 authors had a 706-word disclosure statement, which included every type of conflict of interest
31
32 defined by the ICMJE form amongst disclosure of receipt of public funding and honoraria from
33
34 not-for-profit organisations (e.g. public universities, hospitals); one of the authors disclosed
35
36 receipt of personal fees from 42 distinct entities outside of the submitted work, which included
37
38 23 different pharmaceutical and medical device companies.(21)
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42
43 Disclosures containing miscellaneous information often duplicated statements made
44
45 elsewhere in the published article. Despite explicit instruction on the ICMJE form that “public
46
47 funding sources . . . need not be disclosed,” authors sometimes disclose receipt of research
48
49 funding from public or not-for-profit sources during the submitted work, in the past, or for
50
51 unrelated work, duplicating the funding acknowledgements. Similarly, authors sometimes
52
53 disclose their current employment as a conflict of interest, duplicating their affiliation.
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Miscellaneous information may details the existence of a material interest, but one that does not necessarily involve the transfer of money such as intellectual property for which authors receive small or no royalties (e.g. textbooks, scholarly books or patents) and serving as an unpaid consultant. However, designations such as “unpaid consultancy” may mask the nature of the relationship with industry and fail to make transparent other transfers of value such as paid travel.(22)

Discussion

True transparency involves more than just making conflicts of interest available; they need to also be accessible, accurate, complete, and detailed. Despite mostly adhering to the ICMJE policies for including a disclosure statement, there appears to be little consensus around the definition of conflict of interest and inconsistent compliance with the instructions on the ICMJE form. The variability in how conflicts of interest are reported likely relates to differences in journal standards rather than a consequence of author intentions. However, the result is that the policy conversation is focused on addressing the shortcomings of the disclosure system rather than on how to manage relationships that threaten research integrity.

Recent high-profile cases of non-disclosure highlight the difficult position of editors who are frequently without the information or resources to verify authors’ conflicts of interest. Currently, the onus is on authors to disclose, which makes a breach of this honour system all the more a significant violation of trust, and on editors to ensure the accuracy, objectivity, and integrity of the published work.(23) The ICMJE recently revised their policy to include purposeful non-disclosure of conflicts of interest as a form of scientific misconduct.(10) To strengthen transparency while minimising burden on authors and editors, the biomedical research community should develop a public, comprehensive, structured, author-centric database of

financial interests.(24) Organisations such as ORCID are well-placed to act as a repository for such information; journals could develop an interface to allow authors to automatically export relevant entries during manuscript submission.(14) In the absence of a registry, we propose recommendations to assist authors, editors and peer reviewers with identifying, evaluating, and reporting conflicts of interest (Box 1).

Box 1. Recommendations for identification, evaluation, and reporting of conflicts of interest

Recommendations	Current ICMJE recommendation?
Identification	
<ul style="list-style-type: none"> • Require authors to disclose interactions with any entity that could be considered broadly relevant to the work 	Yes
<ul style="list-style-type: none"> • Include dollar values for all financial relationships 	No
<ul style="list-style-type: none"> • Provide details on the nature of the relationship, for example <ul style="list-style-type: none"> - “Consulting for company X regarding drug Y” - “Fees for speaking on topic X to audience Y” - “Unpaid consultant for company X regarding drug Y; company X reimbursed travel and meals for meetings on Z” - “Owner of private practice X, which derives clinical income from intervention Y” 	Partial, “Comments” permitted
<ul style="list-style-type: none"> • Develop processes to verify authors’ disclosures using registries, databases, and online searches 	No
Evaluation	
<ul style="list-style-type: none"> • Provide editors and peer reviewers with full details of authors’ interests and have them evaluate whether a relevant conflict of interest exists according to objective criteria 	No
<ul style="list-style-type: none"> • Require authors to indicate which interests are relevant to the submitted work and state how the interest may have influenced the design, conduct, or reporting of the work 	Partial; author judges relevance
Reporting	
<ul style="list-style-type: none"> • Publish separate statements of study support and author conflict of interest 	No
<ul style="list-style-type: none"> • Provide hyperlinks to a complete summary of the authors’ conflicts of interest in all versions of the published article, which includes a statement of relevance 	Partial

<ul style="list-style-type: none"> • Report how conflicts of interest were assessed and whether and how they were managed 	No
<ul style="list-style-type: none"> • Consider novel ways to quickly and clearly communicate the presence of relevant conflicts of interest such as a traffic light labelling system 	No

While a public database could improve the accuracy and accessibility of conflict of interest disclosure, it does not directly solve the problem of relevance. Conflicts of interest exist in relation to a specific context – in this case, the published work. Current reporting practices tend to rely on authors to judge relevance prior to disclosure, though journal policies and procedures and editorial discretion may also influence what gets reported. However, even when relationships are disclosed, there is no way for a reader to evaluate the conflict because necessary contextual information is typically lacking. The ICMJE recommends that authors report details on the funding source and the specific role of the sponsor in the design, conduct and publication of the research; there is not an equivalent requirement for author conflicts of interest.⁽¹⁰⁾ For example, when an author discloses personal fees from multiple for-profit, not-for-profit, and public entities, there is rarely information about the scope or extent of the relationships, how the scientific work relates to a company's products, or the specific reason for the receipt of payment. The result is that although the practice of conflict of interest disclosure is widespread, we struggle to make the disclosure purposeful.

With a focus on enhancing transparency, however, what is missing in the debate about disclosure is accountability: how have the researchers' conflicts of interest shaped the published work, and what measures have been taken to safeguard research integrity? Currently, accountability is placed on research consumers who are tasked with accessing and evaluating conflict of interest disclosures for risk of bias. This is problematic as some suggest that

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3 disclosure may backfire, including increasing a consumer's trust in biased judgement,(25) or that
4 consumers may fail to pay attention to or find disclosures meaningful.(26) In some instances,
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6 journals may consider disclosure to be insufficient and may prohibit the publication of certain
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8 types of articles if the authors have conflicts of interest. For example, several journals do not
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10 accept editorials, narrative reviews, or education articles from authors who have financial
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12 relationships with a manufacturer of a product related to the article's topic.
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17 Enforced and structured reporting of conflicts of interest would enable large-scale
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19 retrospective studies of the association between conflicts of interest and research results and
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21 conclusions. Future work should also consider randomised trials of novel structured reporting
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23 interventions to assess author, editor, peer reviewer, and consumer usability and acceptability,
24
25 and the effect on assessment of risk of bias in published work.
26
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28 **Conclusion**

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31 Conflict of interest disclosures should help us to evaluate risk of bias in biomedical
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33 research but currently serve only to muddy the waters. Instead of providing an obvious and clear
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35 signal to readers of biomedical research, current practices obfuscate the underlying relationships
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37 or flood the signal with noise. To improve consistency, we need greater consensus around the
38
39 definition of conflict of interest and harmonisation of practices across journals and publishers.
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41 We recommend changes in reporting practices to separate authors' conflicts of interest from
42
43 funding statements, make statements consistent and immediately visible on all articles, and move
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45 to enforced, structured reporting.
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Key messages

- Disclosures of conflicts of interest in published biomedical articles are highly variable in terms of location, format, wording, and content.
- Inconsistency creates problems related to the accessibility, semantics, and relevance of disclosures making it difficult to assess their prevalence and impact on research design and reporting.
- For conflict of interest disclosures to be meaningful, disclosures must be complete, accurate, detailed, and visible.

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22 **Contributors and sources**

23
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26 writing, and editing of this paper. QG conducted the descriptive analyses of conflict of interest
27 reporting and is the guarantor. The corresponding author (QG) attests that all listed authors meet
28 authorship criteria and that no others meeting the criteria have been omitted.
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36 **Public and patient involvement**

37
38 We did not involve the public or patients in this work.
39
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