

## No room for ambiguity: The concepts of appropriate and inappropriate authorship in scientific publications

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Authorship is the currency of an academic career. Scientific publications have significant academic and financial implications. Several standard authorship guidelines exist, and the International Committee of Medical Journal Editors (ICMJE) is the most popular amongst them. There are increasing concerns about the ethics of publications with the rise of inappropriate authorship. The most important reason appears to be a lack of knowledge and awareness of the authorship guidelines and what actions constitute unethical behaviors. There is a need to incorporate standard guidelines in medical curricula and conduct structured training and education programs for researchers across the board. The current perspective describes the significant concepts of appropriate and inappropriate authorship, and the possible measures being formulated to shape the future of authorship.

**Key words:** Authorship, Committee on Publication Ethics, Council for Science Editors, ethics, International Committee of Medical Journal Editors, publication

### Access this article online

**Website:**

www.ijo.in

**DOI:**

10.4103/ijo.IJO\_2221\_20

### Quick Response Code:



The Cambridge dictionary defines “authorship” as “the state or fact of being the person who wrote a particular book, article, play, etc.” In a nutshell, it means the creator of a piece of art. Authorships can have significant academic, financial, and overall career implications. In short, it is the currency of an academic career. While authorships in scientific publications come with many privileges, they equally bring many responsibilities. The integrity of scholarly publications is the prime responsibility of the authors, and ensuring appropriate authorship is a crucial component of this responsibility. There are three principles of good authorship; to recognize scientific research as a team sport; to give due credit to all those who deserve them, and protect authors from scientific misconduct.<sup>[1]</sup> The current perspective describes the significant concepts of appropriate and inappropriate authorship.

### What Constitutes an Authorship

There are several guidelines by specific bodies like the International Committee of Medical Journal Editors (ICMJE), Committee on Publication Ethics (COPE), World Association of Medical Editors (WAME), and Council for Science Editors (CSE).<sup>[2-5]</sup> Besides these, other institutional guidelines like those from the National Institute of Health (NIH), Harvard, Cambridge University, or society guidelines like those from the Editor’s Network of the European Society of Cardiology (ESC) also guide their respective members.<sup>[6,7]</sup> This very fact reflects that there are no universally accepted guidelines, and things vary with disciplines, societies, and journals.

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Received: 07-Jul-2020

Revision: 01-Aug-2020

Accepted: 03-Aug-2020

Published: 15-Dec-2020

### The ICMJE Criteria

These are the most popular and widely used criteria among biomedical journals. For one to be eligible for an authorship, all of the following four criteria must be met<sup>[2]</sup>

- (1). Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND
- (2). Drafting the work or revising it critically for important intellectual content; AND
- (3). Final approval of the version to be published; AND
- (4). Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.<sup>[2]</sup>

There is a possibility of erroneously presuming that fulfilling any of these criteria or some of them can make someone eligible for authorship. It is important to remember that each one of these should be fulfilled to be included in a scientific study as an author and those who do not do so, are to be acknowledged. The ICMJE strongly inculcates the need for all the authors to be accountable for their work. The authors should not only be able to identify which author has contributed to what in the research work, but also have confidence in the integrity of their co-authors’ contributions.

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**Cite this article as:** Ali MJ. No room for ambiguity: The concepts of appropriate and inappropriate authorship in scientific publications. Indian J Ophthalmol 2021;69:36-41.

ICMJE encourages all authors who satisfy their first criteria, to participate in the drafting, reviewing, and final approval of the manuscript. This specific aspect of ICMJE has come under criticism, besides a few others.<sup>[8-11]</sup> Most of the criticisms are due to ill-understood concepts. Besides, the values that ICMJE determines to hold would only promote high-quality research.<sup>[12]</sup>

## The WAME Criteria

The initial WAME guidelines were different in relation to ghost authorships but are currently closer to the ICMJE guidelines.<sup>[3,8]</sup> The basic WAME guideline is as follows

Everyone who has made substantial intellectual contributions to the study on which the article is based (for example, the research question, design, analysis, interpretation, and written description) should be an author.

## The CSE Criteria

The CSE white paper is a detailed document addressing the issues of ethics in scientific publications.<sup>[4]</sup> According to the CSE criteria, authors are individuals identified by the research group to have made substantial contributions to the reported work and agree to be accountable for these contributions. In addition to being accountable for the parts of the work he or she has done, an author should be able to identify which of their co-authors are responsible for specific other parts of the work. In addition, an author should have confidence in the integrity of the contributions of their co-authors. All authors should review and approve the final manuscript.<sup>[4]</sup>

The CSE has proposed a new authorship model based on 11-role authorship contributions [Table 1], which can be used as a checklist.<sup>[5]</sup> It is critical to know that none of them alone provides eligibility for an authorship, but a combination of two or three, an appropriate minimum, which may circumstantially vary. A single contribution can be acknowledged without authorship. This modified model is being proposed to enhance clarity, author responsibility, and overall transparency.

## NIH Criteria

NIH criteria are a bit more flexible and provide greater details. The eligibility criteria for authorship includes

1. Original idea, planning, and inputs for study design and interpretation of results
2. Active intellectual contributions

**Table 1: 11-role CSE authorship contributions<sup>[5]</sup>**

1. Concept
2. Design
3. Supervision
4. Resources
5. Material
6. Data collection and/processing
7. Analysis and/interpretation
8. Literature search
9. Writing
10. Critical review
11. Others (Novel contributions)

3. Supervision with active involvement in the project
4. Novel provision of resources
5. Original experimental work
6. Data acquisition and analysis beyond the basic
7. Drafting of the manuscript.

On similar lines are the authorship guidelines by major institutions like Harvard, Cambridge, Oxford. The base rules are significant intellectual contributions and accountability for their work. Apart from these, there are numerous proposals or modifications based on specific contexts like surveys, authorships for industry-driven research, short-term researchers, international collaboration, or multiauthor publications.<sup>[13-20]</sup>

## The Order and Number of Authors

The order of authorship partly reflects the varying levels of contribution and hence has a value in what it conveys to the readership. There are no standard guidelines that dictate the order of authorship, but the general consensus is that it should be decided at the beginning of the study based on the roles assigned to each of the authors. The decision for order and designations as “first-author,” “corresponding author,” and “last-author” should ideally be a collective decision and be documented in minutes of a meeting to avoid authorship conflicts at a later date. There is a better clarity on the designation of “first author,” usually bestowed to the person who has drafted the initial manuscript and fulfilled all the criteria of an authorship.<sup>[18,21]</sup> The “last author” is usually the senior author who acts as a guarantor for the manuscript. The “last authors” are also commonly the corresponding authors, but this is not a rule, and occasionally, the designated corresponding authors can be different from the ‘last authors’.<sup>[18,21]</sup> All the other authors, who satisfy ICMJE criteria but whose contributions are not judged to be equivalent of the first or senior author, are called middle authors.

There are no standard guidelines for the number of authors. There is an increasing trend of multi-author publications across the disciplines.<sup>[22,23]</sup> However, several journals provide limits on authorship numbers based on their policies and types of articles. The number of authors in biomedical research is increasing due to growing multi-centric and multi-disciplinary collaborations.<sup>[24,25]</sup> This approach is useful for answering particular research questions and enhances its citation potential due to its internationally collaborative nature. However, there are concerns about salami publications, inflated citations, and underserving authorships. Such group authorship studies need not be necessarily representing high-quality research.<sup>[21,25]</sup> Besides, a large number of authors in a study potentially dilute the merit or credit that each individual deserves. The group authorship papers also render themselves more vulnerable to authorship disputes, and penalties arising from such disputes can occasionally be unfair for many authors, who may have been innocent. Hence, ICMJE criteria should be taken more seriously in group authorships, and every effort must be made to ensure all four criteria are fulfilled.

## Co-Contributing Authorships

Several journals have provisions for co-contributorship, such as “co-first authors” or “joint-first authors,” and “joint-corresponding author” or “joint-last author.”<sup>[21,26-28]</sup> The scientific literature has seen a significant increase in such “co-authorships” in recent times. The basic premise is to allocate due credit for “equal contribution.”

While this is a good idea to allocate deserving merit, it has the potential for undue authorships. Hence, where applicable, the authors should provide a separate statement (usually published as a footnote on the first article page) listing out the details of the equal contribution. The authors can also take help from contributorship taxonomy to specify the exact roles that justify equal contribution.

## Responsibilities of a Corresponding Author

The corresponding author takes the primary responsibility of acting as a guarantor and the accountable person on behalf of all the authors. As the name suggests, this author is a designated point of communication with the journal during the pre and post-publication processes.<sup>[2,4,21]</sup> The corresponding author also has responsibilities to ensure that the manuscript complies with the journal's recommendations, style, and administrative requirements besides ethics approval and clinical trial registrations (where needed). The corresponding author should also coordinate the response to peer-review comments, requests for additional information, appropriate revisions, and formulating rejoinder in case of criticism in form of a letter to editor. Several journals intimate all the authors upon the submission of a manuscript. This ensures that not only one of the ICMJE criterion is being followed and also makes everyone aware of the details and can bring out authorship disputes, if any, in the initial stages itself. Occasionally, the guarantor can also be an author other than the first and corresponding author. The concept of a guarantor is a person who takes responsibility for the work integrity and would defend the work, should the need arise.

## What does not Constitute an Authorship

To promote appropriate authorship, it is equally important to clearly lay down the criteria of what does not constitute an authorship, to reduce the ambiguity and enhance the clarity. According to most of the guidelines, each of the following alone does not constitute an authorship, although substantial works amongst these are to be acknowledged.<sup>[2,4,6]</sup>

1. General supervision of project without active involvement
2. Supervisory training and education
3. Mentoring of the first author without substantial contribution to the study
4. Provision of financial resources
5. Non-novel contribution of other resources
6. Routine technical work
7. Basic data analysis
8. Reading and commenting on the manuscripts
9. General coordination of the study
10. Writing assistance and technical editing.

## Awareness and Compliance of Authorship Guidelines

The awareness of ICMJE guidelines reported in the literature varies from 27% to 97% and could be explained by multiple factors like geography, teaching curricula in medical schools, and institutional efforts for awareness amongst authors and the scientific community at large.<sup>[29-32]</sup> The awareness of the source of such authorship guidelines is even more dismal. Interestingly, surveys showed that even though the knowledge of authorship guidelines was low, most participants (68%–73%) regarded a violation of ICMJE guidelines as scientific misconduct.<sup>[30,32]</sup> The

significance of awareness as the first critical step in stemming scientific misconduct cannot be overemphasized. There is a need to disseminate the crisp ICMJE criteria (since most medical journals use this),<sup>[33]</sup> more so in the developing world through well-structured training and educational programs.

Author surveys and analysis of self-reported contributions to biomedical journals bring forth a matter of concern for compliance to popular authorship guidelines. Of the 804 self-reported authorship contributions to a specific journal, only 61% (487/804) met all the ICMJE criteria.<sup>[34]</sup> Of the 186 manuscripts assessed, 47% (88/186) had instances where those who were supposed to be acknowledged were erroneously given authorships.<sup>[34]</sup> It was noticed that the compliance to guidelines was more frequently met by the first and the last authors compared to others on the by-line. The fulfillment rate of all ICMJE criteria varied between 40–68%<sup>[24,34-36]</sup>, and papers that assessed honorary authorships place the figure between 0.5–21% across biomedical journals.<sup>[37,38]</sup> It was also noted that the author by-line could also reflect the probability of adherence to all the ICMJE criteria. Those placed in the middle had a higher chance of not adhering to all the guidelines.<sup>[24]</sup> These studies mostly reflect a lack of knowledge or an overall understanding of the authorship guidelines. It is unlikely that these were intentional misconducts since most were authors reported.

## Contributorship Models

The efforts to promote better authorship credits and enhance scientific accountability led to the birth of several contributorship models.<sup>[4,8,39]</sup> Numerous journals have mandated the additional declaration of a contributorship statement. Such journals create a taxonomy model, where each author has to declare what their individual contributions have been specifically. For example, conceptualization, study design, recruiting subjects, data analysis, drafting of manuscript, critical revisions, etc., In addition, the authors must disclose their individual functional roles. For example, in what capacity (principal investigator, statistician, co-investigators) are individual authors performing the study. This is believed to enhance the transparency, although there are concerns about its efficacy in reducing unethical practices. The models are designed in a way so as to inform the readers of the details about individual contribution, which is likely to promote authors' public accountability for their work. One significant step forward in contributorship models is the development of a high-level taxonomy model called the 'CRediT' (contributor roles taxonomy).<sup>[40]</sup> This system is designed with 14-roles [Table 2] and permits the allocation of multiple roles to a single author as also a single role with multiple authors.<sup>[40]</sup> Besides, it facilitates disclosure of the degree of contributions as "lead," "equal," or "supporting" for a designated role. This can significantly help in multi-centric studies or those with a large number of authorships.

## The Concepts of Inappropriate Authorship

Inappropriate authorships are defined in simple terms as those which do not follow all the standard criteria for authorships. The advent of "Publish or Perish" era has only worsened it. The pressures of publishing for career advancements, grants, and promotions combined with an increased number of scientific papers, and multi-author studies can partly explain the abuse of authorship criteria.<sup>[41-43]</sup> The evolution of contributorship models, as discussed earlier, partly helps to stem this malaise.

**Table 2: 14-Roles of the CRediT taxonomy system<sup>[40]</sup>**

1. Conceptualization
2. Resources
3. Funding acquisition
4. Methodology
5. Investigation
6. Software
7. Data curation
8. Formal analysis
9. Validation
10. Visualization
11. Project administration
12. Supervision
13. Writing - original draft
14. Writing - review and editing

## Types of Inappropriate authorships

Types of inappropriate authorships are as follows: <sup>[4,8,20-21,42-47]</sup>

1. **Guest Authorship:** If an authorship is bestowed upon an individual with a sole intention to increase the chances of acceptance or citations or enhance the work's visibility, it is considered guest authorship. The guest authors are usually prominent academic researchers, but who have not contributed substantially to the study to deserve an authorship
2. **Gift/Honorary Authorship:** If an authorship is bestowed upon an individual who has not contributed substantially to the study but is given a place in author by-line with an intention to either please them or from expectation of a return favor or secondary to threats (coercive authorship) or from a fear of unwarranted backlash. A typical example of this is the inclusion of head of the departments or people in power at respective institutions. Other examples could be a mutual support authorship or swap authorship, where a mutual agreement takes place between two researchers (mostly working in similar areas) to bestow authorship upon each other in their respective papers (without substantial contribution) intending to artificially enhance their productivity
3. **Ghost Authorship/Orphan Authorship:** When an individual satisfies the criteria to be an author, but is left out of the author by-line, it constitutes a ghost authorship. It can be two folds – one who is left out in spite of contribution, for example, a student or a junior researcher. The other is an individual who has contributed but does not want to be named, for example, an employee of a pharmaceutical industry or industry-hired professional writers. These are also called as orphan authorships. Particular industry-sponsored trials, and their results can be seen through the lens of conflict of interest. Hence, specific writers may be employed who by-pass unfavorable results or pick and choose what to present. Since they are not mentioned on the author by-line, they remain hidden (ghost authors)
4. **Anonymous Authorship:** Publishing scientific papers anonymously or under pseudonyms constitutes anonymous authorships and is unethical since it violates the basic principles of public accountability for one's work
5. **Forged Authorship:** When an individual is bestowed with an authorship without his knowledge or consent with an

intention to enhance the chances of its acceptance or for other unethical reasons

6. **Theft Authorship:** This is an act of misappropriating someone else's work and publishing it as their own. This is a grave offence of plagiarism.

## The Burden of Inappropriate Authorships

To believe that inappropriate authorships are rare would not be true.<sup>[30-32,48-49]</sup> A survey of 6 peer-reviewed medical journals showed the prevalence of guest authorship in 16% of research articles and 41% of Cochrane reviews.<sup>[50,51]</sup> Ghost authorship was demonstrated in 13% of research articles and 11% of Cochrane reviews.<sup>[50,51]</sup> However, there is a risk of inflating the ghost-writing prevalence or conflating it with other ethical issues.<sup>[52]</sup> Gift authorship was the most common form of inappropriate authorship across the globe, with some studies from the Indian subcontinent reporting that 65.1% of their surveyed respondents observed its presence.<sup>[53]</sup> It is also not uncommon to note the reporting by different geographical areas regarding the significant prevalence of researchers experiencing pressures to include undeserving authors or denying deserving authorship.<sup>[30,32,46,53]</sup>

## Authorship Disputes and their Resolution

Recognizing a manuscript with a potential for an authorship dispute is the usual first step. The COPE guidelines are probably the most detailed yet lucid that usually guide editors in identifying manuscripts that may have such issues.<sup>[53]</sup> The broad signs include the following<sup>[53]</sup>

1. Industry-funded study without authors from the sponsor group
2. Authors who are not related from the research area of the manuscript
3. Addition or deletion of authors without a notification
4. Mismatch of language quality within the manuscript.
5. Impossibly prolific author
6. Unduly long author by-line
7. Inability of the corresponding author to respond to reviewer comments
8. Vague acknowledgements
9. Unspecified contributorship
10. Similar articles published by different authors.

It is important to note that there may be some exceptions; for example, language mismatch can result from the authors taking help from language editors for specific sections of the manuscript or the cover letter. Hence, these are broad guidelines and need not necessarily implicate a scientific misconduct. COPE has laid out guidelines for best authorship practices that include the fundamental principles of following the guidelines and allowing transparency within the whole process, encouraging awareness of emerging standards (CRediT system), and defining and addressing the specific authorship problems.<sup>[53]</sup> The COPE guidelines give detailed flowcharts to guide journals and their editors with policies to adopt in case of authorship disputes. Table 3 outlines the broad measures to avoid authorship disputes.

## Role of the Journals in Ensuring Appropriate Authorships

The role of the journals in ensuring appropriate authorships is often misunderstood and can be a subject of confusion, should

**Table 3: Broad measures to avoid authorship disputes**

Enhancing awareness of standard authorship guidelines
Incorporating the guidelines in major medical curricula
Dedicated training and education of all researchers
Students/juniors should learn to humbly negotiate due authorship
Deciding authorship and its order early on in the project
Changes to initially decided authorship, if any, be collectively agreed upon
Documenting minutes of collective meetings and decisions.
Changes to authorship following submission should be notified to the journal
Corresponding authors must fulfil their journal obligations
Submission of specific contributorship statements with the manuscript
Cross check the manuscript with plagiarism software before submission
Institutions should encourage anonymous reporting of authorship abuse
All stakeholders to encourage transparency in the whole process of publication

an authorship dispute arise. In this regard, the primary role of the journal is to clearly list out the authorship criteria and its guidelines in a transparent manner. It is in the journal's interest to explicitly state the authorship criteria without undue paraphrasing or general reference.<sup>[54]</sup> The ultimate responsibility to ensure adherence to all these guidelines rests with the authors. It is authors' collective responsibility to make sure that they adhere to all the listed guidelines. It is neither the responsibility of the journals nor their editors to decide on who qualifies for an authorship or who does not. Besides, journals also have a very limited role in arbitrating authorship disputes, and policing authors' research integrity is beyond their scope.

### Shaping the Future of Authorships

The concepts of authorship are not set in stone, and there are constant efforts to revise, restructure, and update the guidelines as per evolving needs. The primary issue today is to define the term "substantial contribution" and how to qualify it or quantify it. While the existing contributorship models are a step forward, expanding it to the concepts of contributorship badges would be helpful.<sup>[21]</sup> Here, each badge is linked to one ICMJE criterion and includes all the authors who have contributed to that particular role. The proposal of the Contributor-specific index appears appealing to quantify the relative contributions by assigning numerical values for each of the contribution.<sup>[18,21,32,55]</sup> In this way, one can get due credit for their work as each contribution's merits are listed. The citation credit is currently enjoyed by all the authors. Going forward, certain 'author matrices' can be employed to reflect the relative contribution and the potential creditworthiness of each author in relation to a citation. While we keep improvising on all these metrics, two key factors that would influence the future of authorships are trust and the responsibility towards future generations. Trust is fundamental to any ethical scientific publication, and authorships are no exceptions. The senior authors should encourage involvement and hand-hold the juniors in every significant aspect of publication. Besides, these measures would partly help the seniors fulfill their moral and ethical obligation to promote the academic careers of their juniors. Teaching and endorsing good authorship practices would ensure their much desirable transfer to future generations. As Isaac Asimov said:

"There is a single light of science, and to brighten it anywhere is to brighten it everywhere."

### Financial support and sponsorship

Hyderabad Eye Research Foundation.

### Conflicts of interest

There are no conflicts of interest.

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