

Review Article

‘Author Contribution Details’ and not ‘Authorship Sequence’ as a merit to determine credit: A need to relook at the current Indian practice

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ABSTRACT

The Medical Council of India (MCI) has made research publications in indexed medical journals an obligatory requirement for promotion of medical teachers. In 2015, MCI guidelines said the first and the second author would receive credit for a research paper. In 2017, the amended guidelines provided credit to the first and the corresponding authors instead. We reviewed the common types of authorship order in medical publications from across the world and noted that before the 1990s, corresponding authors were rarely acknowledged and were not considered more important than any of the co-authors. By 2016, the corresponding author was usually the first or the last author. With an increase in collaborative research globally, more and more papers are published with multiple first, last or corresponding authors. Some journals have revised their Instructions to Authors to acknowledge co-first authors equally. Since 2017, PubMed also displays equal contributors in the author byline while still allowing searches for ‘First author’ and ‘Last author’ supporting the ‘first and last author emphasis’. However, most guidelines mention that the authorship order is a collective decision of the authors. Any association between authorship sequence and credit for an article is debatable. Some journals allow or even insist on authorship statements to explain each contributor’s role. Standardized vocabularies and taxonomies such as the Contributor Roles Taxonomy (CRediT) system can highlight contributions of individual authors. Some suggest doing away with the authorship order altogether. Readers and assessors should look at the ‘author contribution details’ rather than the ‘authorship order’ before drawing any conclusions about contributions of each author.

Natl Med J India 2020;33:24–30

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INTRODUCTION

Assessing medical teachers for promotions is never an easy task. How does one assess true academic achievement? Since there is likelihood for bias in assessing this, the Medical Council of India (MCI) has introduced an objective method for judging eligibility criteria for promotion of teachers in medical institutes of India. In its guidelines, the MCI has considered research publication as a compulsory requirement for promotion. This may be based on the belief that medical teachers who are involved in research activities provide better quality of teaching.¹ They are well-versed in research techniques and continuously contribute to advancement of the field. They are often the most up-to-date on the latest available literature.

The MCI requires that medical teachers must have at least two research publications each for promotions from the position of assistant professor to associate professor and from associate professor to professor. In September 2015, the MCI issued an official clarification on what it considers as a ‘research publication’. The MCI maintained that the researcher must have published his/her article as either the first or the second author in order to be considered for promotion. The Indian Association of Medical Journal Editors called this as ‘too restrictive’ a criterion.¹ In an amendment made in June 2017, the MCI mentioned that for all manuscripts accepted for publication in indexed journals after 5 June 2017, the authorship credit for recruitment and promotions of medical teachers shall be granted to the first and the corresponding authors only rather than the first and second authors.²

A major proportion of all research projects today is a collaborative effort involving multiple team members; crediting only two authors for a publication may restrict the advancement of large collaborative research projects in India. The amended MCI guidelines crediting only the first and second author till 5 June 2017 and then, the first and corresponding authors prompted us to carry out a narrative review of the available literature to answer the following questions: How is the order of authorship determined? How has the trend of authorship order and associated credit changed over the past 20 years? Is there currently any consensus about the credit that must be granted to different authors of a manuscript?

SEARCH STRATEGY

Data for this review were identified by searches on MEDLINE, PubMed, Google Scholar and references from relevant articles using the search terms ‘authorship order’, ‘authorship sequence’, ‘equal authorship’, ‘equal contribution’, ‘MCI+ promotion of medical teachers’ and ‘authorship guidelines’. Only articles published in English between 1999 and 2019 were considered.

ORDER OF AUTHORSHIP

There is no clear-cut criterion for the order of authorship that is followed by all scientific journals. The International Committee of Medical Journal Editors (ICMJE) in its Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly work in Medical Journals, mentions who can be an author and what the roles and responsibilities of the authors are. However, these widely followed recommendations make no mention of any criterion for the order of authorship.

Most journals do not mention in their instructions to authors how the authorship sequence should be determined. It is left to the authors themselves to come to a consensus about who should be named as the first author, who as the second author and so on. The order of authorship is a collective decision of the authors or the study group.

Being listed as an author of a research manuscript brings academic credit to the authors. Different styles have been suggested by different researchers, journals and universities to help determine the authorship order (Table I). We list a few here.

‘Sequence determines credit’ style

Sometimes, the sequence of authorship determines the academic credit an author gets. Though in the ‘sequence determines credit’ (SDC) style, the authorship order may merely reflect the relative contribution made by each author, some researchers suggest that the first author should get the whole credit for the impact of the article (based on the impact factor of the journal where it is published), the second author should get half the credit, the third author a third, and so on.³ For publications with more than 10 authors, each author after the tenth on the list should get 5% of the credit for the article.

‘First and last author emphasis’ style

The ‘first and last author emphasis’ (FLAE) style is more common than the SDC approach. In this approach, the level of contribution is highest by the first author, followed by the last author and then the second author. The middle authors are those with lesser levels of contribution.

There are suggestions that for articles following the FLAE approach for authorship order, the first author should get the entire credit for the impact, the last author should get half the credit, and the credit of the other authors should be the impact divided by the number of authors but should be a minimum of 5% for each author.³

‘Alphabetical order of authorship’ style

Several researchers especially those working in the field of mathematics and high energy physics prefer to list all members of a collaborating team as authors. The authors are listed alphabetically and equal credit is given to each author for the article’s impact. There is no distinction made for the ‘first author’. The alphabetical order of authorship is rarely used in biomedical research.

‘Partial alphabetical order of authorship’ style

Some research teams even in biomedical research follow a partial alphabetical order of authorship. In this approach, the middle authors are listed in an alphabetical order while the FLAE style is used for the primary (first) and supervisory (last) authors.⁴

‘Percentage contribution indicated’ style

Another approach is to indicate the percentage of contribution made by individual authors in the Acknowledgement or Contributor section of the article.

‘Contribution indicated in byline’ style

Of late, some author teams are agreeing to have their actual contributions listed in the author byline rather than in the ‘Contributors’ section.⁴ This is not a percentage-based quantitative contribution list. The byline lists exactly who did what (Fig. 1).⁵

Several journals now encourage authors to submit an authorship contribution statement that details exactly who did what. Journals such as the Nature research journals have even made this mandatory for all original research papers since over a decade now.⁶

AUTHORSHIP CREDIT FOR MEDICAL TEACHERS IN INDIA

The SDC approach might have been the basis of MCI’s earlier guideline that an assistant professor must have published at least two papers as ‘either first or second’ author to be considered for promotion to the position of associate professor. The SDC approach is not the most common approach for authorship order in biomedical research. A study has found a consistent

TABLE I. Some common styles used for authorship order and contribution of authors

Styles	Details about the style
Sequence determines credit (SDC)	Authorship order reflects the relative contribution of each author. The first author gets the entire credit, the second author gets half credit, the third author gets one-third credit, and so on.
First and last author emphasis (FLAE)	Contribution is highest by the first author, followed by the last author and then the second author.
Alphabetical order of authorship	All authors get equal credit and are listed in the alphabetical order.
Partial alphabetical order of authorship	Middle authors are listed in the alphabetical order while the FLAE style is used for the primary (first) and the supervisory (last) authors.
Percentage contribution indicated	Percentage of contribution of each author is indicated in the ‘acknowledgment’ or ‘contributors’ sections.
Contribution indicated in byline	The byline describes the exact task each author did.

PLoS Biol. 2018 Apr; 16(4): e2004956.

Published online 2018 Apr 19. doi: [10.1371/journal.pbio.2004956](https://doi.org/10.1371/journal.pbio.2004956)

PMCID: PMC5908072

PMID: [29672508](https://pubmed.ncbi.nlm.nih.gov/29672508/)

The gender gap in science: How long until women are equally represented?

Luke Holman, Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing, **Devi Stuart-Fox**, Writing – review & editing, and **Cindy E. Hauser**, Data curation, Writing – review & editing
Cassidy Sugimoto, Academic Editor

FIG 1. Screenshot of an article from *PLoS Biology* showing an example of how the exact contribution of each author is mentioned in the article byline⁵

FLAE pattern in four of the top medical journals.⁷ These included the *Journal of the American Medical Association*, the *British Medical Journal*, *The Lancet* and the *Canadian Medical Association Journal*. Only articles with more than four authors were studied. Giving credit to the first and second authors only may have been an attempt by the MCI to get rid of the practice of gift/guest authorship.¹ The last author is often a senior researcher based on the FLAE style. The first and second authors may be relatively ‘mobile’ advanced trainees in the department. The last author is often believed to be more stable and thus able to guarantee the integrity of the research work.⁸ However, the ICMJE recommends that each author must ‘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’.⁹ Also, it is, not uncommon to suspect that the last author is a guest or honorary author.¹⁰ More often than not a guest author is the head of the department who has not contributed in any way to the research or writing, but is included only because his name provides extra credibility to the article.¹¹

MCI’s latest guidelines give credit for the article to the ‘first and the corresponding author’ and not the ‘first and second’ author as was the practice earlier. The corresponding author is the one who is designated to form a communication bridge between the team of authors and the editors, publishers and readers. Interestingly, in more than three-quarters of the articles studied, the first author was also the corresponding author.⁷ For such articles, going by the MCI guidelines, only one author would get the credit although all these were multi-authored articles. Though the last author made the highest contribution next only to the first author, they were often not listed as corresponding author in many of the articles. Second authors and authors listed in the middle were also often listed as corresponding author in several articles. In some articles, there were more than one corresponding authors. In such cases, the first author and all the corresponding authors should get the credit for the article as per the MCI rules. Will the new MCI rules prompt researchers to have more number of corresponding authors for an article? Not unlikely!

Some well-established journals also allow multiple ‘mentors who contributed equally’ to the work.¹² Such mentors are usually listed as last authors when following the FLAE approach leading to a possibility of having multiple last authors. It is not

uncommon to have articles with multiple first authors.^{12–14} Will more and more researchers from India now tend to publish as joint first authors in an attempt to avail promotion?

There seems to be no easy solution to the problem of authorship order or any universally acceptable consensus about the credits one should get based on the authorship order.

TRENDS IN ACKNOWLEDGING CORRESPONDING AUTHORS

The perception of authors’ contributions in multi-authored articles is often variable and substantially influenced by the designation of the corresponding author in the byline order. When the first author is the corresponding author, he/she is assumed to have taken the lead in study concept and design and data analysis and interpretation.¹⁵ When the fifth author is the corresponding author in articles with a median of five authors, the perception of the first author’s role decreases and the perceived prestige of the fifth author increases.¹⁵

According to a study, till about the late 1990s, it was rare for papers to mention who the corresponding author was and the mail addresses of all the authors were provided.¹⁶ By the year 2016, the corresponding author was usually the first author, and less commonly, the last author. Most people believed the corresponding author was someone who took full responsibility for a paper and ‘uploaded the files, managed the revisions and wrote the response to reviewers and took responsibility for the paper after publication’. However, there were varied opinions. Only 7% of people surveyed believed the corresponding author was the senior author. A sizeable proportion of respondents believed that the corresponding author was the one who simply uploaded the file. The corresponding author is not necessarily more important than any of his/her co-authors.¹⁷

The corresponding author usually acts as the single point of contact and bridge for communication between the editors/readers and all the co-authors. It is not uncommon for a senior author to designate the juniormost author as the corresponding author as he/she does most of the desk jobs of formatting the manuscript, figures and tables, uploading the manuscript into electronic submission systems, and is the first to deal with all the routine and mundane publication issues.

The ICMJE recommendation states that the corresponding author is one ‘...who takes primary responsibility of communication with the journal...’⁹ Yet, editors should ‘send

copies of all correspondence to all listed authors'. This is much easier today in the world of electronic communication.

Some researchers tend to designate the seniormost author as the corresponding author.¹⁸ The work on a project does not necessarily end upon publication. Even years after the publication, the corresponding author remains responsible for answering any queries raised by the readers as well. This commitment may not be acceptable to some of the research trainees who may have a transient tenure in the department.

TRENDS IN ACKNOWLEDGING JOINT CO-FIRST AUTHORSHIP

Today, co-first authorship is common. A study that analysed all research articles published in 12 journals (six high-impact and six mid-level-impact journals) over several years found a dramatic increase in co-first authorship in recent times.¹⁹ For clinically-oriented papers, the percentage of publications with joint first-authors had increased from nearly 0% to 15% during 2000–2015. For basic science papers, the increase was from <3% to 37% during 1990–2015. The authors predict that the number of manuscripts with joint first-authors will level off to 20%–40% in the next few years and is unlikely to increase much beyond that range. They also found several manuscripts with joint senior authors, joint corresponding authors and joint middle authors. This trend of increased number of manuscripts with equal contributors (first, last, middle or corresponding) in recent years is seen in other studies also.^{20–23} Yet, some authors have initially experienced opposition from journals when designating two or more authors for equal contribution and several journals, in their guidelines, say they do not allow designation of co-first authors.²⁴ Some journals, while allowing designation of equal contribution, limit the maximum number of joint first authors and corresponding authors.²⁵ Another trend seen is that equal contributors do not need to share equal place in the authorship order. In articles with more than two authors, even the first and the last authors can share equal contributorship while the middle ones do not.²⁶

Earlier, as there was no standardized format to identify authors claiming joint primary responsibility, readers were more likely to recall and associate the first listed author with the work. It was thus, difficult for readers and other assessors to recognize equal contribution by multiple first authors. Till recently, equal authorship details were found only in the papers themselves. It was usually only mentioned 'in the fine print of a published paper' in the Acknowledgement section or the Contributors section.¹⁹ The main source of information for literature searches such as indexing sites and referenced citations, however, did not provide much information about equal authorship.²⁷

In September 2017, the United States National Library of Medicine (NLM) made an important announcement. Journal publishers can now indicate equal contributorship of authors while submitting citation data to PubMed.²⁸ As a reader, you can now view equal contribution among authors in PubMed's abstract or XML display formats.

Editors of some journals have come together with another suggestion. They ask for all co-first authors to be highlighted in the reference list either by using bold letters or an underline.²⁹ Some journals follow a policy of listing only the first three authors followed by '*et al.*' in the reference list. Though more than three authors are rarely declared as joint first-authors, there are articles with more than 10 authors with equal contribution declared by each.³⁰ When there are more than three co-first authors, it is suggested that all co-first authors must be

listed and highlighted in the reference list. Some journals recognize co-first authors by listing them together in the footer of the article, printing their names in boldface in the reference list and listing all of them when citing in the body of the paper.³¹

Along with highlighting the first author(s), some researchers propose that the corresponding author(s) should also be highlighted when citing an article.¹⁷ There is no standard format for byline position of co-corresponding authors. Sometimes, they may be listed right next to the first authors. When there are joint corresponding authors, in most cases, all authors are listed as corresponding authors.³² Sometimes, the first and the last or the last two authors may be the corresponding authors.³²

GENDER TRENDS IN AUTHORSHIP ORDERS

Even though more and more females enter medical training every year, very few females actually make it to senior academic positions and are lead (first) authors or senior (last) authors in research papers. Males invariably seem to outnumber females at such positions.^{33,34} Though the gender gap in such authorship positions has seen some narrowing in recent years, there is still a long way to go.^{5,33–35}

Even when two authors of different genders claim equal contribution to a research and are indicated in the published manuscript as co-first authors, males are more likely to be listed ahead of their female colleagues in the first author position.^{36,37} The disparity is observed more frequently in articles published in clinical rather than basic science journals.³⁶

There is a need to identify the factors that lead to gender disparities in authorship positions and to introduce reforms to close the gap.

SEARCHING OPTIONS IN THE PUBMED MEDLINE DATABASE

Till 1983, all authors were included in the article bylines in MEDLINE citations.³⁸ From 1983 onwards, the NLM listed only up to 10 personal author names in citations. As a result, several authors, including the last author, may have been left out. From 1996 onwards, NLM started listing a maximum of 25 personal author names. This included the first 24 authors and the last author. As a result, in articles with more than 25 personal author names, the ones listed as number 25 or more (other than the last author) were excluded. However, since mid-2005, the NLM lists all authors in the article's bylines.

Since 2006, it is possible to search PubMed by 'First Author' and by 'Last Author'. The search tag [lastau] does not work for last authors which are study groups or corporate names; it works only for personal author names. Although the NLM does not mention why last author search has been included, it may be providing an informal nod to the FLAE style. But the MCI does not seem to agree. Earlier, it gave importance to the first and second authors (SDC style) and now gives importance to the first and the corresponding authors having totally ignored any special credit for the last authors.^{1,2}

The NLM supports the ICMJE's recommendation to list only the first six authors followed by '*et al.*' when listing cited references. If this is followed, a senior author of a multi-authored article may lose visibility in the citation if he/she is listed as the last author as per the FLAE style.

Though NLM has started to accept submissions of 'equal contributors' and these can be viewed in the display format, it still does not support search for 'equal contributors' on PubMed.²⁸

RECOGNIZE AND GIVE CREDIT

By simply looking at the author order in the byline of an article, we cannot determine an individual's contribution. For example, even in an article published in a journal that follows the commonly used FLAE system, we do not know who ran the study on the subjects, who collated the data, who analysed it, who wrote the first draft, etc. As a result, those looking at the article byline to determine an author's contribution may end up undervaluing the role of co-authors.

Some journals are now beginning to use a more standardized system of author acknowledgement called the Contributor Roles Taxonomy (CRediT) system developed by the Consortia

Advancing Standards in Research Administration Information. This system uses 14 roles to describe each contributor's specific role in the study and the paper.³⁹ These roles do not necessarily define what constitutes authorship. It merely says who did what and encourages authors to list all contributions by those who are listed as authors or named in the Acknowledgement section. It is likely that one contributor fulfilled more than one roles or one role was assigned to multiple contributors. When multiple individuals are assigned the same role, the degree of contribution can be conveyed by describing their role as 'lead', 'equal' or 'supporting'. It is also recommended that the CRediT tagged contributions are coded in such a way



FIG 2. Screenshot of an article from *eLife* showing the article byline where authors are listed⁴⁰

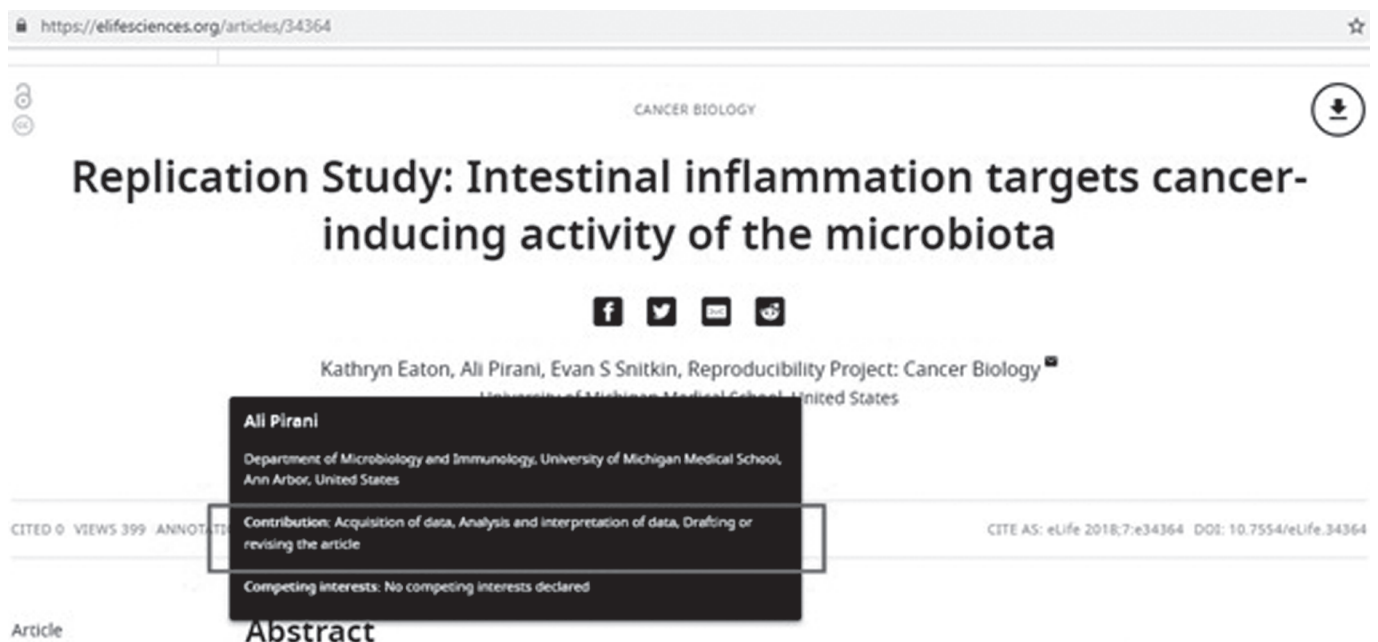


FIG 3. Screenshot of an article from *eLife* showing an example of how the specific contributions of an individual author are listed using the CRediT taxonomy⁴⁰

that they can be machine-readable. An example of the CRediT system of listing the author contributions is shown in Figs 2 and 3. Figure 2 is a screenshot of an article from *eLife*.⁴⁰ When we click on an individual author's name, a dropdown menu appears listing the author's specific contributions to the article (Fig. 3).

This may be difficult to use in the print copy of the journal. Some journals allow the option to include an Authors' Information section that provides a possible solution.

DOING AWAY WITH FIRST AUTHORS AND LAST AUTHORS

In a visionary article published in *Nature* in 2018, Kiser⁴¹ identifies 'an undeclared disincentive for researchers to build unconventional collaborations' across disciplines. There is a mismatch between the perceived 'need for transdisciplinary research to solve complex problems' and the scarce importance given to 'middle authors' who might have made important contributions to the project. Many journals today require authorship statements declaring contributions of each author. Yet, senior faculty members while assessing candidates based on contribution narratives, still look at the number of 'first-author' and 'senior-author' papers they have to their credit. Kiser feels it is time to think of an innovative method where there are no first authors or last authors. It is time to 'ditch the ordered listing of authors' as it acts as a spanner in the wheel of collaborative research initiatives. Davey Smith *et al.*⁴² challenge the concept of authorship listing and suggest moving from an authorship model to a contributorship model 'like the credits that roll at the end of a film'.

CONCLUSION

Our review of the literature found no clear consensus about authorship orders and what they mean. We suggest readers should refrain from drawing conclusions about authorship order and its implications.

Once we stop attaching any credit to the authorship sequence and assume it to be only a mutual agreement of the authors, the assessors will become curious about the 'author contribution details', which are anyway being submitted to journal publishers these days.⁴³ When assessors pay more attention to the 'author contribution details' than to the 'authorship sequence' as a metric to assess contribution, their evaluation will be more meaningful, relevant and transparent. In addition, it will be a strong incentive for each researcher to contribute effectively, productively, and in innovative ways to the overall research, encourage collaboration among researchers, and possibly discourage guest and honorary authorship that often plagues research publications.

The ICMJE says nothing about the authorship order. The Good Publication Practice for Communicating Company-Sponsored Medical Research⁴⁴ and the Committee on Publication Ethics⁴⁵ insist that the authorship order must be a collective decision of all the authors. The Council of Science Editors also suggests that the authorship order should be a 'collective decision of the authors or study group'.⁴⁶ Any disagreements or disputes should be resolved by the authors themselves.

The World Association of Medical Editors representing more than a thousand journals from 92 countries mentions the following in its authorship policy:⁴⁷

'The authors themselves should decide the order in which authors are listed in an article. No one else

knows as well as they do their respective contributions and the agreements they have made among themselves. Many different criteria are used to decide order of authorship. Among these are relative contributions to the work and, in situations where all authors have contributed equally, alphabetical or random order. Readers cannot know, and should not assume, the meaning of order of authorship unless the approach to assigning order has been described by the authors.'

Conflicts of interest. None declared

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