

# Ongoing ethical issues concerning authorship in biomedical journals: an integrative review

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**Abstract:** Health professionals publishing within the field of health sciences continue to experience issues concerning appropriate authorship, which have clinical, ethical, and academic implications. This integrative review sought to explore the key issues concerning authorship from a bioethical standpoint, aiming to explore the key features of the authorship debate. Studies were identified through an electronic search, using the PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Scopus databases of peer-reviewed research, published between 2009 and 2014, limited to English language research, with search terms developed to reflect the current issues of authorship. From among the 279 papers identified, 20 research papers met the inclusion criteria. Findings were compiled and then arranged to identify themes and relationships. The review incorporated a wide range of authorship issues encompassing equal-credited authors, honorary (guest/gift) and ghost authorship, perception/experiences of authorship, and guidelines/policies. This review suggests that the International Committee of Medical Journal Editors' (ICMJE) recommended guidelines for authorship are not reflected in current authorship practices within the domain of health sciences in both low- and high-impact-factor journals. This devaluing of the true importance of authorship has the potential to affect the validity of authorship, diminish the real contributions of the true authors, and negatively affect patient care.

**Keywords:** authorship, bioethics, equal credit, ghost, honorary, ICMJE

## Introduction

Over the past 50 years, there has been a significant increase in the volume of research published, accompanied by an increase in the number of multiauthor papers and a decrease in sole-author manuscripts.<sup>1</sup> This may be attributed to the increased complexity of research and collaborations required. To highlight this point, in 2010, PubMed indexed an article that listed 2,080 authors and required 165 lines to list them.<sup>2</sup> However, this raises many questions concerning the contribution of each author and the validity of their authorship. Certainly, multicenter collaboration is one explanation for the increased author numbers; however, other causes have also been identified.<sup>1</sup> These include performance review and academic promotion, funding opportunities, inappropriate use of power by senior colleagues, and inexperienced authors. Pressure on academics to publish in high-impact-factor journals has resulted in an increase in honorary authorship practices in an attempt to maximize publication outputs.<sup>1</sup> When utilized appropriately, authorship offers a track record of accountability, responsibility, and credit; however, an increasing number of senior academics place more value on the number of their publications rather than their contribution.<sup>3</sup>

Publications establish researchers' reputation, reflect their productivity, and may be used to justify academic appointments, promotions, and future research funding.<sup>4-6</sup> Consequently, authorship remains a hotly contested issue, causing angst even among the

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most cohesive and collaborative research teams. The order of authorship traditionally reflects the individual's level of contribution to both research and manuscript development.<sup>7</sup> With no universally accepted guidelines, the first and the last authors are the ones who attain the greatest stature in the majority of research publications.<sup>8</sup> Guidance from individual journals is inconsistent; however, guidelines such as those by the International Committee of Medical Journal Editors (ICMJE) have been designed to provide authors with recommendations to assist with the conduct, reporting, editing, and publication of scholarly work in medical journals. Therefore, the aim of this integrative review is to explore the key bioethical issues concerning the rights of authorship and the factors that influence this process.

## Methods

This study utilized an integrative review methodology. Integrative reviews are rigorous forms of research that seek to review, critique, and synthesize key literature within a specific domain, generating new frameworks and perspectives.<sup>9,10</sup> Integrative reviews critically appraise the literature in an area without the use of statistical analysis. Consequently, integrative reviews hold an international standing embedded in evidenced-based practice.<sup>11</sup>

The rationale for an integrative review methodology was to enable the rigorous evaluation of the strength of the evidence, identify gaps in the literature and the need for further research, and – importantly – identify the authorship-related central issues that provide a significant contribution to this often-contentious area in academia.

## Review process

The framework guiding this integrative review is based on the five stages proposed by Whittemore and Knafl:<sup>12</sup> problem identification, literature search, data evaluation, data analysis, and presentation.

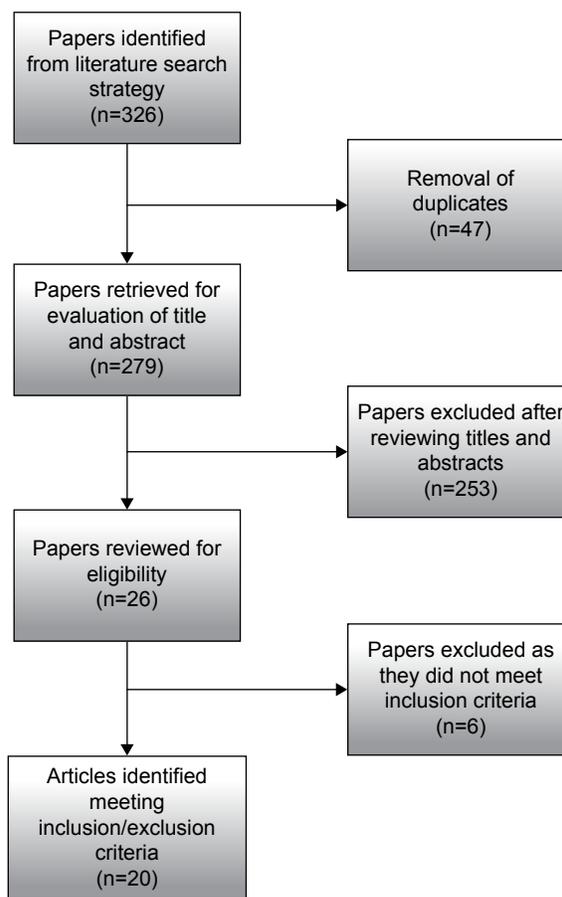
## Search strategy and criteria for inclusion/exclusion

A systematic search of the PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Scopus databases was conducted. Boolean connectors AND, OR, and NOT were used to combine search terms such as publi\*, author\*, gift, honorary, ghost, “equal credited author,” ethic\*, editorial policies, credit, responsibility, and accountability. In addition, the references of potential papers retrieved were examined to identify any additional papers.

The search criteria incorporated original peer-reviewed research that investigated current issues concerning authorship of biomedical papers published from 2009 to 2014 written in the English language. The 5-year range was implemented to capture current research that reflected the issues concerning the growing indexes of coauthorship and contribution. Papers that were excluded from the review encompassed conflict of interest as they were beyond the scope of this paper. Abstracts, conference proceedings, theses, and editorials were also excluded, as were secondary sources and reviews.

## Data evaluation

The search strategy initially identified 279 papers (Figure 1). The first author (RK) identified 26 potential papers for inclusion based on titles and abstracts. Furthermore, to ensure a rigorous methodology, all authors (RK, LM, and RB) independently appraised the 26 studies based on the inclusion/exclusion criteria. Any disagreements were resolved by consensus discussion. Six papers were subsequently excluded, leaving 20 papers for inclusion in the review.



**Figure 1** Decision trail of included studies describing the ethical concerns of authorship.

## Data extraction and synthesis

A total of 20 papers were summarized and systematically synthesized, and the following data were extracted: Author, year and country of origin, purpose, sample population, and significant findings/outcomes. During the data extraction process, findings were compiled and then thematically analyzed to identify key themes and relationships. Thematic analysis provided a means to identify recurring patterns and content within the full data set and to developing higher-order categories explicit within the literature. Papers reviewed for inclusion were predominantly descriptive and reflective. To capture the breadth and depth of the field, all findings were integrated and synthesized without assessing for methodological quality.<sup>12</sup>

## Results

### Study characteristics

Twenty studies met the inclusion criteria (Table 1) and incorporated a wide range of authorship issues, encompassing honorary (guest/gift) authorship,<sup>13–25</sup> ghost authorship,<sup>14,17,18</sup> equal-credited authors (ECA),<sup>26–28</sup> and authorship criteria and policies.<sup>18,22,29–32</sup> The 20 included papers were conducted across nine different countries, including the People's Republic of China,<sup>26,28</sup> Denmark,<sup>18</sup> Australia,<sup>23</sup> Canada,<sup>13,19,25</sup> Norway,<sup>22</sup> Kuwait,<sup>16</sup> Iran,<sup>17,30</sup> USA,<sup>14,15,20,21,27,29,32</sup> and Croatia.<sup>24,31</sup>

The majority of papers were surveys of authors' experience of authorship. Among the studies that reported ECAs, the first two authors in the byline had equal credit in the majority of cases, with no clear guidance or set criteria provided.<sup>26–28</sup> Of the papers that reported ghost authorship, Mirzazadeh et al<sup>17</sup> stated that 21.43% of authors confessed that they had omitted an author; Vinther and Rosenberg<sup>18</sup> specified that 29% of authors had experienced being omitted from a manuscript or knew of others who were omitted; and Wislar et al<sup>14</sup> detailed that 7.9% of manuscripts (49/622 responses) were found to have ghost authors. Of the papers that reported the author's response rate, the rate of response varied significantly from 15.75% to 85.9%. The ICMJE criteria (Table 2) were the only authorship criteria referred to in the included papers.<sup>33</sup> Four themes emerged and were subsequently categorized as follows: honorary authorship, ghost authorship, the notion of equal contribution, and policies and criteria that guide authorship.

### Honorary authorship

Honorary authors are those who do not meet the criteria for merit and have not made a substantial contribution to research or manuscript development.<sup>14</sup> Nine papers explored

authors' perceptions/experiences of honorary authorship and contributions.<sup>13,18–25</sup> O'Brien et al<sup>19</sup> found that 52% of authors had been listed with an honorary coauthor at some point in their career, with 18% suggesting some coercion. Vinther and Rosenberg<sup>18</sup> reported that 9% of authors had experience of honorary coauthors and 17% of authors had been offered authorship despite failing to meet the ICMJE requirements. Eisenberg et al<sup>21</sup> reported that 27.7% of first authors perceived that at least one coauthor did not make sufficient contributions to merit authorship, while 50.3% stated that one or more coauthors had only performed "nonauthor" tasks. This is also raised in the study by Rajasekaran et al<sup>13</sup> in which nonauthor roles included being head of a department, a medical resident, or a fellow, as well as listing "reviewed manuscript" as justification for honorary authorship.

A significant finding in the studies by Eisenberg et al<sup>20,21</sup> was a significantly lower acceptance of honorary authorship associated with adherence to the ICMJE criteria in institutions that provided policies and education on publication ethics. Ninety-seven percent of authors in the study by Nylenna et al<sup>22</sup> stated that they had knowledge of ICMJE criteria for authorship, with 68% of authors regarding breaches of authorship as misconduct. Those who had fewer than five published papers were more likely to regard these breaches as misconduct than more experienced and senior researchers. Zbar and Frank<sup>25</sup> found that only 1.1% of authors could identify all three ICMJE criteria, and Ivaniš et al<sup>24</sup> found that attitudes toward authorship criteria were related to authors' contributions. However, they did find that the ICMJE criteria are perceived by authors as fundamental for denoting authorship.

Authors from Asia and Europe were more likely than those from North America to perceive that one or more authors were underserving of authorship.<sup>21</sup> Rajasekaran et al<sup>13</sup> found that living outside North America was associated with greater incidence of honorary authorship and customary when department heads automatically accepted honorary authorship. These findings emphasize the hierarchical nature of academic institutions and the difficulty experienced by junior researchers in influencing authorship decisions.<sup>21–23,25</sup> O'Brien et al<sup>19</sup> found that there were negative effects as a result of honorary authorship for the authors and coauthors alike, including personal liability for honorary authors, the dilution of their relative contribution, and the potential for impact on patient care.

Four papers investigated the prevalence of honorary authorship.<sup>14–17</sup> This phenomenon ranged from 17.6% to 56.1%. Al-Herz et al<sup>16</sup> reported that 33.4% of authors

**Table 1** Overview of studies included in our review describing the ethical concerns regarding authorship

Author/s, year, and country	Purpose	Sample	Significant finding/s and outcomes
Akhbue and Lautenbach <sup>27</sup> (2010) (USA)	Identify longitudinal trends and characteristics of explicitly giving authors equal credit in publications in medical journals	Primary research manuscripts with equal-credited authors (ECA) published between 2000 and 2009 in the five general medicine journals with the highest impact factors	The first two authors listed in the by-line received equal credit the majority of the time; however the practice was also applied to authors in nearly every position in the by-line; none of the journals review had a detailed ECA policy.
Al-Herz et al <sup>16</sup> (2014) (Kuwait)	Determine the prevalence of honorary authorship in biomedical publications and identify the factors that lead to its existence	Corresponding authors (n=1,246) of articles published in different biomedical journals in PubMed over a year	33.4% of authors admitted adding people who did not deserve authorship credit; rationales encompassed complimentary (39.4%), avoiding conflict (16.1%), and facilitating acceptance (7.2%); journal specialty, geography, impact factor, and number of authors were significantly associated with honorary authorship; 75% of authors would remove unjustified names
Bonekamp et al <sup>15</sup> (2012) (USA)	Determine the prevalence of honorary authorship in the American Journal of Roentgenology (AJR) and evaluate factors that might influence the perception of honorary authorship	Corresponding authors (n=490) of primary research manuscripts published in AJR in the period 2003–2010	399 authors were unaware of ICMJE, 41 followed no guidelines; 39 departmental guidelines; 91 stated senior members automatically listed, 65% thought this justified; 121 perceived one or more listed made limited authorship contributions; 340 claimed first authorship, drafted manuscript conveying limited information of co-authors
Eisenberg et al <sup>20</sup> (2011) (USA)	Quantify the frequency of perceived honorary authorship and identify specific factors that increase the prevalence within radiology journals	First authors (n=392) of articles published in radiology journals between July 2006 and June 2009	102 first authors perceived one or more made insufficient contribution to merit authorship; 231 stated one or more performed non author ICMJE roles; perceptions of honorary authorship higher with authors who did not follow journal requirements; 96 authors stated departmental head was automatically listed.
Eisenberg et al <sup>21</sup> (2014) (USA)	Quantify the potential effects of geographic factors on the frequency of honorary authorship in radiology journals	First authors (n=328) of papers published in radiology journals between July 2006 and June 2009	91 first authors perceived at least one co-author made limited contributions; 245 unaware of honorary authorship; Asia/Europe experienced greater perception of honorary authorship than North America with departmental heads automatically listed.
Ghajarzadeh <sup>30</sup> (2014) (Iran)	Evaluates the number of authors fulfilling ICMJE authorship criteria and determines the type of contribution	Researchers' names (n=296; 128 original manuscripts) with at least two authors published in Archives of Iranian Medicine, 2005–2007	186 met authorship criteria; 110 were identified as guest authors, 97 of whom qualified to be mentioned in the acknowledgments; order of authors was mainly determined by corresponding authors and secondly by the first author; only 31 authors had read the ICMJE criteria
Ivaniš et al <sup>24</sup> (2011) (Croatia)	Assess the association between authors' perceived importance of contributions and participation in manuscripts	Authors (n=1,014; 235 manuscripts), July 2005–March 2006	765 authors were identified as qualifying under the ICMJE ranking contribution categories higher than non – qualifying authors; attitudes towards authorship criteria were related to authors' contribution for the preparation of the manuscript.
Li et al <sup>26</sup> (2013) (People's Republic of China)	Investigate the prevalence and characteristics of designating ECA	Primary research manuscripts given equal credit in three anesthesia journals, 2002–2011	Increasing trend in proportion of manuscripts with ECA; first 2 authors had ECA in the majority of cases; the last two authors was the second most common; Western Europe largest ECA's followed by Asia and USA; No clear reference to ECA's in their guidelines.

Malicki et al <sup>31</sup> (2012) (Croatia)	Assess how authors describe their contribution to submitted manuscripts without reference to or requirement to satisfy authorship criteria of the ICMJE. Determine whether editorial policies are designed to eliminate gratuitous authorship	Responses of authors (n=1,282) who submitted manuscripts (n=335) to Croatian Medical Journal, March 2009–July 2010, transcribed and matched to ICMJE criteria. 16 medical journals – eight with explicit authorship guidelines and eight without formal authorship policies (n=307; 190 manuscripts), 1986–2006	87% responses matched to ICMJE; 38.6% met ICMJE criteria for research/writing; 31.8% declared conducting research; 9.4% writing; of these, 56.3% stated significant contributions without justification. 13% could not be matched to ICMJE; manuscripts > 8 authors declared more contributions than manuscripts < 8 authors.
McDonald et al <sup>32</sup> (2010) (USA)	Investigate the prevalence of ghost and honorary authors and its determinant factors among Iranian biomedical journals	First or corresponding authors (n=536 authors; 124 manuscripts) published in Iran Journal of Public Health, Journal of Kerman University of Medical Sciences, and Tehran University Medical Journal Faculty, researchers, and PhD students at Oslo University Hospital and the Medical Faculty, University of Oslo (n=654)	Significant trend toward increasing authorship for nearly all journals reviewed; implementation of authorship limitation policies was not significant and does not slow the trend of increasing numbers of authors per manuscript over time
Mirzazadeh et al <sup>17</sup> (2011) (Iran)	Attitudes and practices of scientific authorship at a university hospital and medical school in Norway	Corresponding authors (n=127) of every fourth primary research paper in JAMA (2001–2003), CMAJ (2001–2003), BMJ (1998–2000), and Lancet (1998–2000)	56.1% were identified as honorary authors according to ICMJE criteria; approximately 55% of listed authors were honorary authors; 89% of manuscripts had had at least one honorary author and 20% had >3; 21.43% admitted they had been omitted as authors (ghost)
Nylenna et al <sup>22</sup> (2014) (Norway)	Examine the perception of honorary coauthorship among medical academics and determine whether a potential effect of honorary coauthorship affects patient care	First authors (n=1,182) of three major physical medicine and rehabilitation journals, January 2009–December 2011	97% had knowledge of authorship; 68% regarded breaches as misconduct; <5 publications more likely to regard breaches as misconduct than >50; 58% in authorship disputes; 29% excluded despite perceived merit; 36% experienced pressure from undeserving authors; researchers with <6 years' experience found authorship difficult.
O'Brien et al <sup>19</sup> (2009) (Canada)	Estimate the prevalence of perceived honorary authorship and ICMJE-defined honorary authorship within physical medicine and rehabilitation literature	Authorship policies of 30 bioethics journals	52% listed an honorary co-author in their career; 18% listed authors with commercial relationships; negative effects of honorary authorship included personal liability for honorary authors (29%) co-author contribution dilution (54%); 62% stated honorary co-authorship may negatively affect patient care; 2% stated this phenomenon occurred.
Rajasekaran et al <sup>13</sup> (2014) (Canada)	Determine the percentage of journals that have authorship policies and describe the different provisions contained in journal author policies	Health care researchers' (n=17) experiences and perspectives of the guidelines, regulations, organizational structures, and cultures, which underpin norms of behavior in publication of health research	Perceived and ICMJE- defined honorary authorship 18.0% and 55.2% respectively; the most senior author deciding the authorship order; living outside North America was independently associated with ICMJE- defined honorary authorship; most senior author deciding authorship order was associated with ICMJE- defined honorary authorship
Resnik and Master <sup>29</sup> (2011) (USA)	To explore the experiences of research publications and views on the responsibilities of authorship.		63.3% of bioethics journals no guidance on authorship; 36.7% guidance on contributions meriting authorship; 23.3% on contributions that do not merit authorship; 23.3% require responsibility for contributions/article; 20% provided guidance on which contributions merit acknowledgment but not authorship; 6.7% required description of contributions.
Street et al <sup>23</sup> (2010) (Australia)			Drafting, seniority and supervision were attributions of authorship; gift authorship seen as maintaining relationships, a reward, increase a paper's credibility or collaboration; perceptions differed markedly between disciplines; power differentials concerning authorship were common; little or no discussion about assignment of author order.

(Continued)

Table 1 (Continued)

Author/s, year, and country	Purpose	Sample	Significant finding/s and outcomes
Vinther and Rosenberg <sup>18</sup> (2012) (Denmark)	Assess Danish authors' general authorship experiences and views on authorship and authorship criteria	Authors (n=292) of articles published in <i>Ugeskrift for Læger</i> and <i>Danish Medical Journal</i> in 2010, coauthors and contributors, general authorship experiences, and views on authorship and authorship criteria	Authorship order by size of contribution 38%; 22% determined by first author and 11% last author; others alphabetically; 84% knew about ICMJE; 75% agreed fulfillment of ICMJE; 17% offered gift authorship; 16% invited to gift authorship themselves; 29% had experienced ghost authorship.
Wang et al <sup>28</sup> (2012) (People's Republic of China)	Investigate the prevalence and characteristics of designating two or more authors as having "contributed equally" in the area of critical care	Original research articles with ECAs published in the period 2001–2010 in four major journals of critical care medicine	Increasing trend in yearly prevalence of ECA for all the journals; first 2 authors received equal credit in the majority of cases, and found in nearly every position in the by-line; none of the 4 journals reviewed provided guidance to authors concerning equal credit.
Wislar et al <sup>14</sup> (2011) (USA)	Assess the prevalence of honorary and ghost authors in leading general medical journals between 1996 and 2008	Corresponding authors (n=896) who published in six general medical journals with high impact factors in 2008	Honorary authorship or ghost authorship was 21.0%; prevalence of honorary authorship was 25.0% in original research reports, 15.0% in reviews, and 11.2% in editorials, whereas the prevalence of ghost authorship was 11.9% in research articles, 6.0% in reviews, and 5.3% in editorials.
Zbar and Frank <sup>25</sup> (2011) (Canada)	Identify common perceptions of authorship position in the medical research community	First, last, and one randomly selected author in between (n=362) of articles with at least three authors published in 2007 from ten prominent general medical journals and 20 other randomly selected journals	1.1% identified ICMJE; authors stated data acquisition/analysis and interpretation was responsibility of first vs last author; revisions/approval to be first and last authors' responsibility; first author viewed 7 times likely involved with study/writing; last authors 7 times likely viewed as limited contribution/ senior position.

**Abbreviations:** BMJ, British Medical Journal; CMAJ, Canadian Medical Association Journal; ICMJE, International Committee of Medical Journal Editors; JAMA, Journal of the American Medical Association; ECA, equal-credited authors.

**Table 2** ICMJE criteria: defining the role of authors and contributors**ICMJE's recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals**

- 1 Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work
- 2 Drafting the work or revising it critically for important intellectual content
- 3 Final approval of the version to be published
- 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>32</sup>

**Abbreviation:** ICMJE, International Committee of Medical Journal Editors.

admitted to adding people who did not merit authorship. A majority of authors appear to be unaware of ICMJE criteria and, when made aware, became more stringent in their application of authorship criteria. Despite this, hierarchical pressures led a significant percentage of authors who reported that a head/senior was always listed on every manuscript to believe that it was justified.

### Ghost authorship

A ghost author is one not listed on a manuscript but who has nevertheless made substantial contributions that merit authorship.<sup>14</sup> The reader of such manuscripts is thus unaware of the contribution, the perspectives, the affiliations, the influence, or the vested interests of these people. Wislar et al,<sup>14</sup> Mirzazadeh et al<sup>17</sup> and Vinther and Rosenberg<sup>18</sup> all investigated the prevalence of ghost authorship. Mirzazadeh et al<sup>17</sup> found that 21.43% of authors had colleagues who omitted authors from the byline, similar to the 29% reported by Vinther and Rosenberg.<sup>18</sup> Wislar et al<sup>14</sup> who researched six high-impact journals, reported that 7.9% of manuscripts met the criteria for ghost authorship, with no difference between journals that specified authorship requirements and those that did not.

### The notion of equal contribution

The practice of giving equal authorship has become increasingly common as the overall number of authors per manuscript increases.<sup>26,27</sup> Li et al,<sup>26</sup> Wang et al,<sup>28</sup> and Akhabue and Lautenbach<sup>27</sup> all found significant increases in ECA contributions to original research papers over a 10-year period, as well as an increasing trend in the yearly prevalence of ECA manuscripts for all journals reviewed. Across the studies identified,<sup>26–28</sup> the first two authors listed in the byline received equal credit most of the time, with Li et al<sup>26</sup> reporting incidence of 84.9%, Wang et al<sup>28</sup> reporting 75.4%, and Akhabue and Lautenbach<sup>27</sup> reporting 63.7%. Multiple combinations of other-order authors receiving equal credit were reported less often.

The number of authors listed as ECAs varied among the three studies. Li et al<sup>26</sup> found that the median number of authors listed in the byline of ECA manuscripts was between

six and seven, Akhabue and Lautenbach<sup>27</sup> reported a median between four and 13, and Wang et al<sup>28</sup> reported between eight and ten. The median number of ECAs across journals reviewed was two. Across the three studies, 12 journals were reviewed, of which only five journals did not require authors to specify their contributions. Of the journals that required authors to specify their contributions, few made any clear reference to citing ECAs in the author form. The largest number of papers with ECAs was from Europe and North America.<sup>26,28</sup>

### Policies and criteria that guide authorship

A number of committees have been established to try to ensure that only substantive contributors receive appropriate credit. These include organizations such as the ICMJE, World Association of Medical Editors (WAME), Surgery Journal Editors Group Consensus Statement (SJEG), and the Committee on Publication Ethics (COPE). However, these bodies provide only guidelines or recommendations rather than rules. Of these, the best known are the four ICMJE criteria listed in Table 2.

However, requiring authors to state their specific contribution to a manuscript has had little effect on the increasing trend toward multiple authorship,<sup>29</sup> What is also unknown is whether journals verify authors' contributions using guidelines or whether listing of authors' contributions is to only serve as a deterrent for unethical practices.<sup>29</sup> Six studies in this integrative review<sup>18,22,29–32</sup> addressed authorship policies and criteria to determine whether they provide adequate guidance for researchers submitting manuscripts for publication. McDonald et al<sup>32</sup> analyzed 16 medical journals that incorporated 307,190 articles over a 20-year period and found that regardless of the application of contribution substantiation obligations, the number of authors per manuscript increased over time.

Resnik and Master<sup>29</sup> found that 63.3% of journals reviewed offered no guidance on authorship. Of the journals that did provide any authorship guidance, 23.3% offered guidance on contributions that did not merit authorship, 20% gave guidance on contributions that merit acknowledgment,

6.7% asked authors to describe their contributions to the manuscript, and 23.3% were asked to take responsibility for their contributions or the entire manuscript.<sup>29</sup> Guidance provided concerning the merit of authorship ranged from brief statements to exhaustive instructions with specific examples. Ghajarzadeh<sup>30</sup> found that just under half of the corresponding authors in their study (49.21%) had actually read the ICMJE criteria and 62.83% of researchers met the authorship criteria. This left 37.17% deemed honorary, of which 81.18% should have been mentioned only in the acknowledgments. Ghajarzadeh<sup>30</sup> also found similar figures from manuscripts in which authors had not reviewed the ICMJE criteria, suggesting that referral to ICMJE criteria alone do little to ensure their application.

Conversely, 84% of authors in the study by Vinther and Rosenberg<sup>18</sup> claimed that they knew about the ICMJE criteria and 90% agreed that authors should fulfill the first ICMJE criterion, 96% endorsed the second ICMJE criterion, and 99% voted for the third ICMJE criterion. Only 70% described the criteria as “good or adequate”, 9% admitted to not following them, 4% felt they were too restrictive, and 15% were unaware of the ICMJE criteria.

Malicki et al<sup>31</sup> who assessed how authors would describe their contribution without reference to or requirements to satisfy the ICMJE criteria, posed the open-ended question “Why do you think you should be an author?” They found that while 87% of authors’ responses could be matched to ICMJE criteria, only 15.6% clearly declared contributions encompassing the three criteria, 38.6% satisfied both first and second criteria, while the remaining declared contributions that matched only one or zero criterion. Of those who could not be matched, 56.3% claimed that they had made a substantial contribution without declaring what their contribution entailed. Of the sole authors, 41.4% reported contributions that satisfied all three ICMJE criteria, 27.6% reported a single ICMJE criterion, and 31% reported contributions that could not be matched to any of the ICMJE criteria. This may reflect differences in the authors’ perception of ICMJE criteria rather than undeserved authorship.

## Discussion

This integrative review has identified significant differences of opinion among authors on the topic of responsible authorship. Ethical authorship practices and processes are fundamental to the integrity of research.<sup>23</sup> Significant health care practices are influenced by published research and this, in turn, has ethical and legal implications for the society. An author’s record of publications and research grants

greatly influences academic promotion.<sup>23</sup> It is therefore fundamental that education on responsible authorship be part of research-and-development training and not merely an optional component.<sup>34</sup> Teaching responsible authorship and publication practices to undergraduate, higher-degree, postdoctoral, and early-career researchers is an undertaking to not only educate the next generation of researchers about responsible authorship but probably also help to empower and equip them to deal with inappropriate practices and undue pressures in authorship processes.

Organizations such as The Council of Science Editors (CSE), which aims to:

Serve editorial professionals in the sciences by creating a supportive network for career development, providing educational opportunities, and developing resources for identifying and implementing high quality editorial practices<sup>35</sup>

could conduct educational activities, including Webinars, interactive teaching sessions, and workshops, thus allowing participants to navigate through complex issues and promote authorship integrity. Education may also result in a decrease in undeserving and ghost authorships, increased awareness of criteria constituting responsible authorship, and more critical assessment of current cultural norms.

The ICMJE criteria are not reflected in current authorship practices. In August 2013, the ICMJE revised their recommendations for authorship criteria to incorporate a fourth criterion, stipulating the need for accountability for all aspects of the work and requiring authors to identify which coauthors are responsible for specific parts of the manuscript. Substantial cultural change would be required for these ICMJE authorship criteria to be widely upheld. A major impediment would appear to be the lack of consensus on the ICMJE requirements, with many authors happy to accept less than the mandatory four. The body of cross-sectional surveys cited for this review is unlikely to have been able to tap the more complex cultural or systemic issues that may also contribute to a lack of consensus with and adherence to the ICMJE or other publication governing body/committee requirements.

We suggest that new career researchers need to be exposed to ethical thinking early in their publishing career to develop ethical standards and reflective practice. Research and promotion committees could consider evaluation of contributions to articles in which a faculty member is listed as an author or request that the contributions are clearly listed. The designation of clear pathways for reporting and investigating authorship issues may also assist with this process. However, it is apparent that growing interdisciplinary and collaborative

research will continue to require multiple authorship, raising potential concerns around processes of surveillance for ghost authorship.

One way to resolve this issue may be to allow attribution of the contribution of individuals to a paper when that contribution is insufficient to justify authorship.<sup>36</sup> Determining authorship is a complex and often-controversial process and requires goodwill and honesty from all parties. Misappropriated authorship or scientific dishonesty remains a concern for editors of journals and academics “who work to ensure fidelity in attribution of ideas and work to the appropriate individuals.”<sup>32</sup> To mitigate any confusion or further conflict, discussions concerning attribution need to be instigated early in the development of any collaborative publication.

Editors could play a more active role in addressing inappropriate authorship by providing clear and unambiguous policies that inform and define deserving authorship and promote research and authorship integrity. Seats of education could also take responsibility by ensuring that their graduates are well versed in responsible authorship practices and understand the impact and ethical implications on the health care profession and beyond. Ultimately, improvement requires commitment and dedication from the individual primary or corresponding authors and a growing culture of reflective practice from other collaborators. As it stands, it would appear that laxity around adherence to guidelines bears few punitive consequences that would encourage practice change and there is a lack of a culture of individual and communal reflection on contribution.

## Limitations and strength of evidence

This integrative review is limited by the small number of original papers that were identified for evaluation and because the studies included were not assessed for methodological quality. It is possible that some papers may have been missed despite undertaking a thorough and rigorous systematic search across the relevant databases for published studies. Our integrative review incorporated studies that investigated high-impact journals and, therefore, may not be representative of journals with a lower impact factor. In addition, a majority of papers only surveyed published authors and therefore the opinions of nonpublished authors are unknown. In these cross-sectional surveys, the more complex aspects of processes, systems and cultures, and challenges related to any attempts to change practice were untapped. Studies were largely based on self-reported surveys from authors of manuscripts and, therefore, may have underreported the

prevalence of misappropriated authorship and perhaps missed key issues in the framing of the inquiry. Recall bias needs to be taken into consideration when evaluating these results because memories can be influenced by the passage of time. Of importance, the ICMJE criteria were revised in 2013 to include a fourth criterion concerning each author’s responsibility to be accountable for all aspects of their work ensuring accuracy or integrity. All papers included in this review were based on the former three criteria recommendations and this may limit the applicability of our findings. Notwithstanding these identified limitations, this review does highlight the prevalence of inappropriate authorship, as defined by the guidelines, in a diverse group of countries, suggesting a plurality of perceptions and attitudes among authors in relation to current issues concerning authorship.

## Conclusion

This review has ascertained that authors’ attitudes toward authorship do not always reflect those of the ICMJE criteria. Despite attempts to implement such criteria, inappropriate authorship practice remains a frequent phenomenon within health care literature. This review also suggests that there is a need for more substantive research in this area that would investigate processes, systems, and cultural practice, as well as embrace qualitative, longitudinal, and interventional research that moves beyond the cross-sectional survey and more thoroughly investigates the phenomenon. One should not underestimate the consequences of inappropriate authorship practice because the publication process primarily relies on the notions of trust and professional integrity. A culture of nontransparency around authorship potentially calls into question the research findings themselves. It is fundamental that educators and editors are aware of the prevalence of misappropriated authorship (including ghost authorship) to structure training, policies, and guidelines that aim to curb these practices and provide the much-required support for a culture of integrity, responsibility, and reflective practice in authorship. There remains a fundamental need for research and academic institutions to support a culture of integrity in research publication. This should be incorporated into both undergraduate and postgraduate curricula. Finally, the issue of appropriate authorship needs to remain open to robust professional enquiry and debate.

## Disclosure

The authors alone are responsible for the content and writing of this paper. The authors report no conflicts of interest in this work.

## References

- Walker R, Sykes L, Hemmelgarn B, Quan H. Authors' opinions on publication in relation to annual performance assessment. *BMC Med Educ*. 2010;10(1):21.
- Marusic A, Bosnjak L, Jeroncic A. A systematic review of research on the meaning, ethics and practices of authorship across scholarly disciplines. *PLoS One*. 2011;6(9):e23477.
- Wagena EJ. The scandal of unfair behaviour of senior faculty. *J Med Ethics*. 2005;31(5):308.
- Bennett D, Taylor D. Unethical practices in authorship of scientific papers. *Emerg Med*. 2003;15(3):263–270.
- Welker JA, McCue JD. Authorship versus “credit” for participation in research: a case study of potential ethical dilemmas created by technical tools used by researchers and claims for authorship by their creators. *J Am Med Inform Assoc*. 2007;14(1):16–18.
- Bhandari M, Einhorn T, Swiontkowski M, Heckman J. Who did what? (Mis)perceptions about authors' contributions to scientific articles based on order of authorship. *J Bone Joint Surg Am*. 2003;85(8):1605–1609.
- Feeser VR, Simon JR. The ethical assignment of authorship in scientific publications: issues and guidelines. *Acad Emerg Med*. 2008;15(10):963–969.
- Baerlocher M, Newton M, Gautam T, Tomlinson G, Detsky A. The meaning of author order in medical research. *J Investig Med*. 2007;55(4):174–180.
- Russell CL. An overview of the integrative research review. *Prog Transplant*. 2005;15(1):8–13.
- Torraco R. Writing integrative literature reviews: guidelines and examples. *Hum Resource Dev Rev*. 2005;4(3):356–367.
- Soares C, Hoga L, Peduzzi M, Sangaleti C, Yonekura T, Silva D. Integrative review: concepts and methods used in nursing. *Rev Esc Enferm USP*. 2014;48(2):335–345.
- Whittemore R, Knaff K. The integrative review: updated methodology. *J Adv Nurs*. 2005;52(5):546–553.
- Rajasekaran S, Shan RL, Finnoff JT. Honorary authorship: frequency and associated factors in physical medicine and rehabilitation research articles. *Arch Phys Med Rehabil*. 2014;95(3):418–428.
- Wislar JS, Flanagan A, Fontanarosa PB, DeAngelis CD. Honorary and ghost authorship in high impact biomedical journals: a cross sectional survey. *BMJ*. 2011;343(7835):d6128.
- Bonekamp S, Halappa VG, Corona-Villalobos CP, et al. Prevalence of honorary coauthorship in the American Journal of Roentgenology. *AJR Am J Roentgenol*. 2012;198(6):1247–1255.
- Al-Herz W, Haider H, Al-Bahhar M, Sadeq A. Honorary authorship in biomedical journals: how common is it and why does it exist? *J Med Ethics*. 2014;40(5):346–348.
- Mirzazadeh A, Navadeh S, Rokni M, Farhangniya M. The prevalence of honorary and ghost authorships in Iranian bio-medical journals and its associated factors. *Iran J Public Health*. 2011;40(1):15–21.
- Vinther S, Rosenberg J. Appearance of ghost and gift authors in Ugeskrift for Læger and Danish Medical Journal. *Dan Med J*. 2012;59(5):A4455.
- O'Brien J, Baerlocher M, Newton M, Gautam T, Noble J. Honorary coauthorship: does it matter? *Can Assoc Radiol J*. 2009;60(5):231–236.
- Eisenberg RL, Ngo L, Boiselle PM, Bankier AA. Honorary authorship in radiologic research articles: assessment of frequency and associated factors. *Radiology*. 2011;259(2):479–486.
- Eisenberg RL, Ngo LH, Bankier AA. Honorary authorship in radiologic research articles: do geographic factors influence the frequency. *Radiology*. 2014;271(2):472–478.
- Nylen M, Fagerbakk F, Kierulf P. Authorship: attitudes and practice among Norwegian researchers. *BMC Med Ethics*. 2014;15(1):53.
- Street JM, Rogers WA, Israel M, Braunack-Mayer AJ. Credit where credit is due? Regulation, research integrity and the attribution of authorship in the health sciences. *Soc Sci Med*. 2010;70(9):1458–1465.
- Ivaniš A, Hren D, Marušić M, Marušić A. Less work, less respect: authors' perceived importance of research contributions and their declared contributions to research articles. *PLoS One*. 2011;6(6):e20206.
- Zbar A, Frank E. Significance of authorship position: an open-ended international assessment. *Am J Med Sci*. 2011;341(2):106–109.
- Li Z, Sun YM, Wu FX, Yang LQ, Lu ZJ, Yu WF. Equal contributions and credit: an emerging trend in the characterization of authorship in major anaesthesia journals during a 10-yr period. *PLoS One*. 2013;8(8):e71430.
- Akhbar E, Lautenbach E. “Equal” contributions and credit: an emerging trend in the characterization of authorship. *Ann Epidemiol*. 2010;20(11):868–871.
- Wang F, Tang L, Bo L, Li J, Deng X. Equal contributions and credit given to authors in critical care medicine journals during a 10-yr period\*. *Crit Care Med*. 2012;40(3):967–969.
- Resnik DB, Master Z. Authorship policies of bioethics journals. *J Med Ethics*. 2011;37(7):424–428.
- Ghajarzadeh M. Guest authors in an Iranian journal. *Dev World Bioeth*. 2014;14(1):15–19.
- Malicki M, Jeroncic A, Marusic M, Marusic A. Why do you think you should be the author on this manuscript? Analysis of open-ended responses of authors in a general medical journal. *BMC Med Res Methodol*. 2012;12:189.
- McDonald RJ, Neff KL, Rethlefsen ML, Kallmes DF. Effects of author contribution disclosures and numeric limitations on authorship trends. *Mayo Clin Proc*. 2010;85(10):920–927.
- International Committee of Medical Journal Editors. *Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals*. 2013. Available from: [http://www.icmje.org/urm\\_main.html](http://www.icmje.org/urm_main.html)
- Kalichman MW. Overview: underserved areas of education in the responsible conduct of research: authorship. *Sci Eng Ethics*. 2011;17(2):335–339.
- Council of Science Editors. 2011. Available from: <http://www.councilscienceeditors.org/>
- Amy B, Liz A, Altman M, Marjorie H, Jo S. Beyond authorship: attribution, contribution, collaboration, and credit. *Learn Publ*. 2015;28(2):151–155.

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