Scientific Fraud, Publication Bias, and Honorary Authorship in Nuclear Medicine

Thomas C. Kwee[1], Maan T. Almaghrabi[1], and Robert M. Kwee[2]

[1]*Medical Imaging Center, Department of Radiology, Nuclear Medicine, and Molecular Imaging, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands; and* [2]*Department of Radiology, Zuyderland Medical Center, Heerlen, Sittard, and Geleen, The Netherlands*

Our objective was to investigate nuclear medicine scientists' experience with scientific fraud, publication bias, and honorary authorship. **Methods:** Corresponding authors who published an article in one of the 15 general nuclear medicine journals (according to Journal Citation Reports) in 2021 received an invitation to participate in a survey on scientific integrity. **Results:** In total, 254 (12.4%) of 1,897 corresponding authors completed the survey, of whom 11 (4.3%) admitted to having committed scientific fraud and 54 (21.3%) reported having witnessed or suspected scientific fraud by someone in their department in the past 5 y. Publication bias was considered present by 222 (87.4%) respondents, and honorary authorship practices were experienced by 100 (39.4%) respondents. Respondents assigned a median score of 8 (range, 2–10) on a 1- to 10-point scale for their overall confidence in the integrity of published work. On multivariate analysis, researchers in Asia had significantly more confidence in the integrity of published work, with a β-coefficient of 0.983 (95% CI, 0.512–1.454; $P < 0.001$). A subset of 22 respondents raised additional concerns, mainly about authorship criteria and assignments, the generally poor quality of published studies, and perverse incentives of journals and publishers. **Conclusion:** Scientific fraud, publication bias, and honorary authorship appear to be nonnegligible practices in nuclear medicine. Overall confidence in the integrity of published work is high, particularly among researchers in Asia.

Key Words: fraud; medical imaging; nuclear medicine; research; scientific misconduct

J Nucl Med 2023; 64:200–203
DOI: 10.2967/jnumed.122.264679

The contribution of nuclear medicine to health care has developed tremendously over the past decades (*1*). Continued innovations will further bolster the importance of the specialty in clinical medicine (*1*). Scientific publications can be considered paramount to proving the benefit of new technology and clinical applications to nuclear medicine patient care. They also provide an important source of information and inspiration to other researchers to initiate further studies in the same field. To avoid potential patient harm and futile investments, it is crucial that scientific publications be trustworthy and ethical.

Scientific fraud, defined as fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results, has been around for many centuries and still persists (*2,3*). Publication bias, which refers to a greater likelihood that studies with positive results will be published than studies with negative results, is also considered a persistent problem (*4*). Both scientific fraud and publication bias lead to unreliable scientific data in medical journals. Honorary authorship, defined as the intentional misrepresentation of credit to an individual whose contributions to a biomedical article do not meet the criteria for authorship established by the International Committee of Medical Journal Editors (*5*), is a third major undesired phenomenon in the scientific community (*6*). Although honorary authorship may not undermine the validity of scientific data, it is still considered to be unethical and to represent scientific misconduct (*6*).

For nuclear medicine to prosper to its full potential, there should ideally be no place for scientific fraud, publication bias, and honorary authorship. Research into this topic in the field of nuclear medicine has been lacking so far.

The purpose of this study was to investigate nuclear medicine scientists' experience with scientific fraud, publication bias, and honorary authorship.

MATERIALS AND METHODS

Study Design and Participants

A survey study, which was approved by the institutional review board of the University Medical Center Groningen, was conducted among corresponding authors of all articles that were published in the 15 general nuclear medicine journals (according to Journal Citation Reports [https://jcr.clarivate.com]) in 2021. These 15 journals are displayed in Supplemental Table 1 (supplemental materials are available at http://jnm.snmjournals.org). Corresponding authors were excluded if their e-mail address could not be found, if a message could not be delivered to their e-mail address, or if they were from the same institution as the authors of the present work. The remaining corresponding authors received an e-mail with an invitation to participate in a survey on scientific integrity in the field of nuclear medicine, on a voluntary and anonymous basis. This e-mail contained a link to a digital survey that was composed with Qualtrics Core XM survey software (Qualtrics LLC). Eligible participants were first contacted on May 18, 2022, and received reminders on June 1, 2022, June 15, 2022, and August 26, 2022.

Questionnaire

The survey contained 6 closed-ended or semi–closed-ended questions on participant's characteristics (age, sex, country of work, academic degree, academic position, and years of research experience), 2 semi–closed-ended questions on scientific fraud in the past 5 y (by the participant and by colleagues in the participant's department), 2 closed-ended questions on publication bias and honorary authorship

Received Jul. 16, 2022; revision accepted Sep. 6, 2022.
For correspondence or reprints, contact Thomas Kwee (thomaskwee@gmail.com).
Published online Sep. 8, 2022.

in the past 5 y, and 1 closed-ended question on the participant's overall confidence in the integrity of published scientific work in the participant's field. Finally, all participants were given the opportunity to leave any comments in an open text field. All survey questions and possible answer options are displayed in Supplemental Table 2.

Data Analysis

Participants' characteristics were descriptively summarized. Frequencies of reported scientific fraud, publication bias, and honorary authorship were calculated. Associations between overall confidence in the integrity of published work (1- to 10-point scale) versus participant's age, sex, continent (countries were merged into continents), academic degree, academic position, and years of research experience were determined using linear regression analysis. Variables that were significant on univariate analysis were subjected to multivariate analysis. The category with most observations was used as a reference for each nominal variable. Categories with fewer than 10 counts were excluded. All narrative comments provided by the participants in the open text field at the end of the survey were qualitatively analyzed to identify common topics of concern. *P* values of less than 0.05 were considered statistically significant. Statistical analyses were performed with the Statistical Package for the Social Sciences, version 26 (IBM).

RESULTS

Eligible Participants

A total of 2,111 corresponding authors published an article in the 15 journals in 2021. Of these corresponding authors, 185 were excluded because of undeliverable e-mails and 29 were excluded because they were from the same institution as the authors of the present work, leaving 1,897 individuals who were contacted to participate in the survey.

Respondents

A total of 254 (12.4%) of the 1,897 invited corresponding authors completed the survey. Most respondents were aged 35–44 y (31.1%) and male (77.6%); their top-three countries of residence were the United States (16.5%), Italy (12.6%), and Germany (11.8%); and most respondents had a medical doctor degree (60.2%), were a full professor (32.7%), and had more than 10 y of research experience (71.3%) (Supplemental Table 3).

Scientific Fraud

Eleven (4.3%) of the 254 respondents admitted to having committed scientific fraud in the past 5 y, with data manipulation or falsification and misleading reporting being the most common types of scientific fraud (Table 1). Fifty-four (21.3%) of the 254 respondents reported having witnessed or suspected scientific fraud by someone in their department in the past 5 y, with duplicate or redundant publication, misleading reporting, and data manipulation or falsification being the leading types of scientific fraud (Table 1).

Publication Bias

Two hundred twenty-two (87.4%) of the 254 respondents thought that a study with positive results is more likely to be accepted by a journal than a similar study with negative results, 21 (8.3%) thought that this is not the case, and 11 (4.3%) were unsure as to whether there is publication bias.

Honorary Authorship

One hundred (39.4%) of the 254 respondents indicated that they had an author on one of their publications in the past 5 y who actually did not deserve this coauthorship based on the International Committee of Medical Journal Editors criteria, 124 (48.8%) did not, and 30 (11.8%) were unsure as to whether they had experienced honorary authorship practices.

Overall Confidence in the Integrity of Scientific Publications

Respondents assigned a median score of 8 (range, 2–10) on a 1- to 10-point scale for their overall confidence in the integrity of published work (Fig. 1). On multivariate regression, researchers in Asia had significantly more confidence in the integrity of published work, with a β-coefficient of 0.983 (95% CI, 0.512–1.454; $P < 0.001$) (Supplemental Table 4).

Common Topics of Concern

Twenty-two respondents provided additional narrative comments, which are displayed in Supplemental Table 5. Authorship issues were most commonly addressed (with honorary authorship as the leading topic), followed by the generally poor quality of published studies (because of either unintentional or intentional scientific misconduct), and perverse incentives (e.g., financial) of journals and publishers that impede the publication and dissemination of unbiased, high-quality scientific work.

TABLE 1
Types of Reported Scientific Fraud

Type	Among survey respondents (n = 11)*	Among departmental coworkers (n = 54)†
Data fabrication	2	10
Data manipulation or falsification	4	19
Misleading (e.g., selective) reporting	4	26
Plagiarism	2	16
Duplicate or redundant publication	3	28
Other type of publication fraud	1‡	3¶

*Three respondents indicated to have committed multiple types of scientific fraud.

†Twenty-eight respondents indicated to have witnessed or suspected multiple types of scientific fraud among departmental coworkers.

‡"Including authors on papers that did not contribute enough to justify this."

¶"A doctoral candidate pulled together study plans of others and got a grant with his application. This was noticed and he had to withdraw his application," "Ghost authorship," and "Same as above."

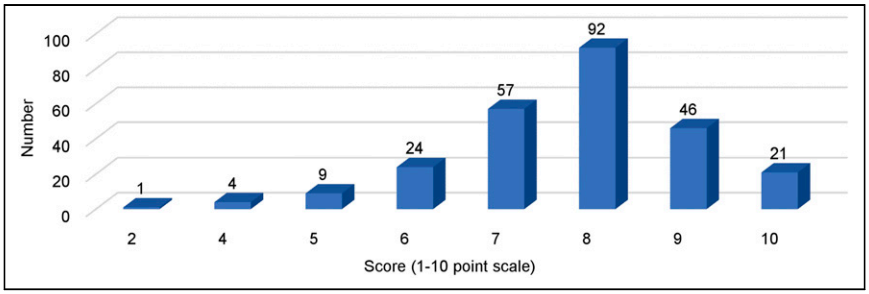

FIGURE 1. Distribution of scores assigned by 254 respondents to their overall confidence in integrity of published work in their scientific field.

DISCUSSION

The reported scientific fraud rates, with duplicate or redundant publication, misleading reporting, and data manipulation or falsification being the leading types of scientific fraud, can be considered a reason for concern. These scientific integrity concerns are further aggravated by the fact that most respondents indicated that publication bias takes place and that a substantial proportion of respondents had faced honorary authorship practices. Overall confidence in the scientific integrity of published work in the field of nuclear medicine was generally high but was quite variable when considering the entire pool of survey participants. Interestingly, researchers from Asia had more confidence in the scientific integrity of published work. It can be speculated that Asian researchers generally regard scientific journals as authoritative (14 of the 15 journals used for the present study are based in Western countries) and therefore trust their publications. However, this finding applies only to the respondents who participated in this survey; more research is necessary to investigate whether this finding can be generalized.

Survey studies similar to the present one have been performed outside the medical imaging field. In a metaanalysis by Fanelli et al. (*7*) that included 18 such studies, 2.0% of scientists admitted to having fabricated, falsified, or modified data or results at least once, and up to 33.7% admitted to other questionable research practices. In addition, in surveys asking about the behavior of colleagues, admission rates were 14.1% for falsification and up to 72.0% for other questionable research practices (*7*). These percentages are considerably higher than those in the present study. This difference may be explained by the fact that the metaanalysis by Fanelli et al. (*7*) included studies that were not related to nuclear medicine and were published between 1998 and 2005. Publication bias and honorary authorship practices in nuclear medicine research have also been an unexplored field so far. Related studies in the specialty of radiology reported both phenomena to be widespread (*8–10*), in line with the results of the present study.

Publication pressure ("publish or perish") and the scramble for research grants have been recognized as important factors that may give rise to fraudulent research (*11–13*), because grants and income, number of publications, publications in high-impact journals, and citations of published research are still regarded as important criteria (either explicit or implicit) for academic appointments and promotions (*14*). Funding bodies and medical journals are often driven by the desire for positive study results, which may also be detrimental to the scientific climate in which researchers have to operate. Banning scientific fraud and lifting the integrity and trustworthiness of nuclear medicine research and of research in general may require a system change taking into account all these different factors.

The present study had some limitations. First, the response rate was 12.4%, and it remains unclear whether this sample was representative of the whole population of nuclear medicine researchers. Second, it can be speculated that corresponding authors frequently also serve as senior authors, as a result of which there may have been underreporting of scientific fraud. Further research is necessary to investigate this speculation. Interestingly, on univariate linear regression, researchers aged 55–64 y had significantly more confidence in the integrity of published work, whereas the opposite was true for assistant professors and those with less than 5 y of research experience—a finding that feeds the hypothesis that there are differences in perceptions on this topic between junior and senior researchers. However, these associations did not remain significant on multivariate analysis. Third, only 11 respondents indicated that they themselves committed scientific fraud, which was too low to investigate which individual factors are associated with performing fraud. Fourth, the results of this study apply only to the past 5 y. Fifth, it remains unclear which publications contained fraudulent data and to what extent this inflicted patient harm and financial damage.

CONCLUSION

Scientific fraud, publication bias, and honorary authorship appear to be nonnegligible practices in nuclear medicine. Overall confidence in the integrity of published work is relatively high, particularly among researchers aged 55–64 y and researchers in Asia.

DISCLOSURE

No potential conflict of interest relevant to this article was reported.

KEY POINTS

QUESTION: What is the experience of nuclear medicine scientists concerning scientific fraud, publication bias, and honorary authorship practices?

PERTINENT FINDINGS: In this survey study among 254 nuclear medicine scientists, 4.3% admitted to having committed scientific fraud in the past 5 y, 21.3% reported having witnessed or suspected scientific fraud by someone in their department in the past 5 y, 87.4% reported publication bias to be present, and 39.4% had experienced honorary authorship practices.

IMPLICATIONS FOR PATIENT CARE: There is considerable room for improvement when it comes to banning scientific fraud and lifting the integrity and trustworthiness of nuclear medicine research, which may be achieved by cultural and policy reforms that involve all stakeholders.

REFERENCES

1. Weber WA, Czernin J, Anderson CJ, et al. The future of nuclear medicine, molecular imaging, and theranostics. *J Nucl Med.* 2020;61(suppl 2):263S–272S.
2. Bauchner H, Fontanarosa PB, Flanagin A, Thornton J. Scientific misconduct and medical journals. *JAMA.* 2018;320:1985–1987.
3. Broad W, Wade N. *Betrayers of the Truth.* Simon and Schuster.

4. Petticrew M. Diagoras of Melos (500 BC): an early analyst of publication bias. *Lancet.* 1998;352:1558.
5. Defining the role of authors and contributors. International Committee of Medical Journal Editors website. http://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html. Accessed October 17, 2022.
6. Quaia E, Crimi' F. Honorary authorship: is there any chance to stop it? Analysis of the literature and a personal opinion. *Tomography.* 2021;7:801–803.
7. Fanelli D. How many scientists fabricate and falsify research? A systematic review and meta-analysis of survey data. *PLoS One.* 2009;4:e5738.
8. Treanor L, Frank RA, Cherpak LA, et al. Publication bias in diagnostic imaging: conference abstracts with positive conclusions are more likely to be published. *Eur Radiol.* 2020;30:2964–2972.
9. Eisenberg RL, Ngo L, Boiselle PM, Bankier AA. Honorary authorship in radiologic research articles: assessment of frequency and associated factors. *Radiology.* 2011;259:479–486.
10. Eisenberg RL, Ngo LH, Heidinger BH, Bankier AA. Honorary authorship in radiologic research articles: assessment of pattern and longitudinal evolution. *Acad Radiol.* 2018;25:1451–1456.
11. Angell M. Publish or perish: a proposal. *Ann Intern Med.* 1986;104:261–262.
12. Rawat S, Meena S. Publish or perish: where are we heading? *J Res Med Sci.* 2014;19:87–89.
13. Harvey L. Research fraud: a long-term problem exacerbated by the clamour for research grants. *Qual High Educ.* 2020;26:243–261.
14. Abbott A, Cyranoski D, Jones N, Maher B, Schiermeier Q, Van Noorden R. Metrics: do metrics matter? *Nature.* 2010;465:860–862.