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## Integrity in cardiovascular imaging research

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*Published in:*  
Clinical imaging

*DOI:*  
[10.1016/j.clinimag.2023.01.011](https://doi.org/10.1016/j.clinimag.2023.01.011)

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*Document Version*  
Publisher's PDF, also known as Version of record

*Publication date:*  
2023

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Kwee, R. M., Almaghrabi, M. T., & Kwee, T. C. (2023). Integrity in cardiovascular imaging research. *Clinical imaging*, 96, 31-33. <https://doi.org/10.1016/j.clinimag.2023.01.011>

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## Cardiothoracic Imaging

## Integrity in cardiovascular imaging research

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## ARTICLE INFO

## Keywords:

Medical imaging  
 Cardiology  
 Research  
 Scientific misconduct  
 Fraud  
 Trust

## ABSTRACT

**Objective:** To gain more insight in scientific integrity in the field of cardiovascular imaging research by conducting a survey among all corresponding authors who published in cardiovascular imaging journals.

**Methods:** Corresponding authors who published in one of eight major cardiovascular imaging journals in 2021 were requested to complete a questionnaire about scientific integrity in the field of cardiovascular imaging.

**Results:** Responses from 160 corresponding authors were received. The majority of respondents had a medical doctor degree (81.1%), held an academic position (93.8%, of which 44.0% as full professor), and had >10 years of research experience (72.5%). Overall confidence in the integrity of published scientific work in cardiovascular imaging was high, with a median score of 8 out of 10 (IQR 2). 5 respondents (3.1%) declared having committed scientific fraud in the past 5 years and 38 respondents (23.8%) declared having witnessed or suspected scientific fraud by anyone from their department in the past 5 years. 85.6% of respondents think that publication bias is present. 50% of respondents declared that any of their publications in the past 5 years had a co-author who actually did not deserve this co-authorship.

**Conclusion:** Experts in the field report that several forms of scientific fraud, publication bias, and honorary authorship are present in cardiovascular imaging research. Despite these reports of academic dishonesty, overall confidence in the integrity of cardiovascular imaging research is deemed high.

## 1. Introduction

There has been an explosive growth in cardiovascular imaging research since the beginning of the 21st century [1,2]. Technological advances of the past 20 years helped to improve clinical patient management and outcomes [1]. It is of utmost importance that published scientific research is trustworthy. Unreliable data may compromise patient outcome and can lead to unnecessary healthcare costs. Although the prevalence of scientific misconduct in general is not so clear, previous studies have estimated that the prevalence of scientists who have been involved in scientific misconduct may range between 1% and 2% [3]. To our knowledge, there has been no specific investigation to scientific integrity in the field of cardiovascular imaging research. To gain more insight in this matter, we conducted a survey among all corresponding authors who published in cardiovascular imaging journals.

## 2. Methods

The survey was approved by the Medical Ethics Review Committee

of (University Medical Center Groningen). Cardiovascular imaging journals were defined as journals belonging to both the categories “radiology, nuclear medicine & medical imaging” and “cardiac & cardiovascular systems” according to Journal Citation Reports [4]. These journals included *Circulation-Cardiovascular Imaging*, *JACC-Cardiovascular Imaging*, *European Heart Journal-Cardiovascular Imaging*, *Journal of Cardiovascular Magnetic Resonance*, *Journal of Nuclear Cardiology*, *Journal of Cardiovascular Computed Tomography*, *Cardiovascular and Interventional Radiology*, and *International Journal of Cardiovascular Imaging*. Corresponding authors who published in these journals in 2021 were requested by email to complete 11 multiple choice questions and there was an open field to leave narrative comments [5]. Senior authors were specifically contacted for pragmatic purposes, i.e. because their contact information was available. This was not a specific attempt to select senior or advanced investigators. The survey was composed by two radiologists (initials University Medical Center Groningen, both with >6 years of clinical radiology experience and both with >15 years of research experience). Using Qualtrics survey software, the questionnaire was completed anonymously and untraceable to individual persons.

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<https://doi.org/10.1016/j.clinimag.2023.01.011>

Received 28 November 2022; Received in revised form 24 January 2023; Accepted 26 January 2023

Available online 2 February 2023

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Only unique responses could be received. The first email was sent on August 11, 2022. Reminder emails were sent after 2, 4, and 6 weeks. Descriptive statistics were used to explore the data.

### 3. Results

Responses from 160 of 1906 corresponding authors with deliverable emails (8.4% response rate) were received. Note that there were no individuals who started the survey but did not complete it. Most respondents were aged 35 to 54 years (60.6%), male (80.6%), and came from Europe (46.9%) and North America (34.4%). The majority of respondents had a medical doctor degree (81.1%), held an academic position (93.8%, of which 44.0% as full professor), and had >10 years of research experience (72.5%). Overall confidence in the integrity of published scientific work in cardiovascular imaging was high, with a median score of 8 (IQR 2) on a scale from 0 to 10. However, 5 respondents (3.1%) declared having committed scientific fraud in the past 5 years, including misleading (e.g. selective) reporting ( $n = 4$ ) and a type of publication fraud not further specified ( $n = 1$ ). In addition, 38 respondents (23.8%) declared having witnessed or suspected scientific fraud by anyone from their department in the past 5 years, including data fabrication ( $n = 6$ ), data manipulation/falsification ( $n = 13$ ), misleading reporting ( $n = 22$ ), plagiarism ( $n = 10$ ), and duplicate/redundant publication ( $n = 13$ ), and other type of publication fraud ( $n = 2$ ) among which unauthorized research without consent. Furthermore, 85.6% of respondents think that a study with positive results is more likely to be accepted by a journal than a similar study with negative result (which is also known as publication bias), whereas only 5.6% of respondents think this is not the case. Lastly, 50% of respondents declared that any of their publications in the past 5 years had a co-author who actually did not deserve this co-authorship based on the International Committee of Medical Journal Editors (ICMJE) criteria. [Table 1](#) displays personal experiences, thoughts, and concerns of corresponding authors who left narrative comments to our survey.

### 4. Discussion

The results from our study show that overall confidence in the integrity of published scientific work in cardiovascular imaging is high, as rated by experts who recently published in this field. However, there was a considerable degree of witnessed/suspected scientific fraud (reported by 23.8% of respondents), which seems to contradict the overall impression that data integrity in the field of cardiovascular imaging is not compromised. We speculate that this discrepancy could be explained because the respondents may think fraud is not problematic perhaps due to habituation, because the fraud they have observed or suspected can be considered “minor” and would not actually compromise the main study result, and/or because they want to maintain their belief in the general confidence in their own field of research. There also was a discrepancy between self-reported publication fraud (3.1%) and witnessed/suspected publication fraud conducted by colleagues from the same department (23.8%). There could either be a true difference, lack of self-awareness, or deliberate failure to report self-perpetrated scientific misconduct. Of note, failure to admit “committing” an offense may have been influenced by the wording of question 7 (see also the study limitations below).

Scientific integrity is typically not part of the standard curriculum at medical school and during residency training. In this regard, there may have been respondents that may not be aware that they have done anything wrong, which could have led to an underestimation of the amount of scientific fraud. Medical and/or research institutions could contribute to a greater awareness and understanding of the problem by organizing courses about scientific integrity and the various forms of scientific fraud. In the US, before performing research, the institutional review board already requires basic training in proper human subjects research to be completed. The European Code of Conduct for Research

**Table 1**

Narrative comments from corresponding authors who participated in our survey.

Respondent	Narrative comment
A	Unfortunately 80% of what is published cannot be reproduced, this means you cannot trust the literature, particularly, this is true for papers from the developing countries, very sad but very destructive to science, medical literature is a mess.
B	There is often a strong bias to publish/report positive results from research. Co-authorship on publications without substantial contributions is frequent, sometimes including a more senior researcher increases the likelihood of publication, even if they don't meet full ICMJE criteria for authorship.
C	There is a serious problem in my domain with this paper [blinded].
D	The modern system is bound to promote false results, fabricated data and partial reporting, because of the economic pressure (grant applications, therapy marketing...), the necessity to publish in terms of career and to get further funding and also the huge increase in publication opportunities with the steep increase of open-access (and pay to publish). The system is bound to make noise, of which only 10% or less will be solid.
E	A shift in publication paradigm should be emphasized: no more: how true and significant is the result; rather how false the result publish is. The literature lacks scientific veracity and hence integrity of the truth not because of conscious fraud. Rather, the literature lacks veracity due to most authors trying to force fit irrelevant, incomplete or bad data into a preconceived biased view. Having reviewed over a thousand manuscripts in my career, only a rare one shows that the authors have carefully collected good data and a germane question, understood their data themselves and interpreted it correctly without hype. Not uncommonly, for good data the authors have collected, the data shows a different or even the opposite conclusion than their manuscript concludes. If the data is good on an important point, then I rewrite main segments of the paper for the authors to consider to make the manuscript an important contribution. Interestingly, for about half of such manuscripts on which I rewrite what the data actually shows, the authors are simply incapable of grasping what their data shows, refuse to change it and the paper is rejected. I call this syndrome “data-blindness” that is widespread in medicine as well as larger society, as witnessed by anti-vaxxers, anti-climate change, anti-evolution, anti-immigrants, anti-education (anti-elites), anti-science, all of which are highly prevalent in Texas for example where I live. Lack of veracity in medical scientific literature is not due primarily to overt fraud but to “data blindness”, a specific circumscribed form of stupidity separate from other well functioning brain activity like making money, holding a job, doing other complex tasks.
F	Thank you for letting me participate in your study. I believe in the integrity of the published papers (if the journal is indexed in the JCR). Regarding the co-authorship, I believe that, many times, many of the co-authors do not deserve to be co-authors, based on their contribution to the paper.
G	Not sure if there is a lot of fraud in our field, as much as a tendency to publish more studies of poor quality or small incremental scientific value. One may question whether integrity requires us not to publish such studies.
H	In the UK, the issue is the starting point of four things - 1) Publish or perish and 2) the personality type of many who go into academia and make an early success of it - it is often those with huge drive and determination, who want to be the best. 3) Most cardiology trainees do a PhD here or else it is limits clinical career progression. 4) The peer review process are a joke for many journals.
I	When you add together all the above you have the perfect setup for what your survey eludes to. There is then the thin line between exaggeration and lying which adds even more to this.
J	In original articles, at least 50% of authorships in my department are “given as gifts” to important figures who may advance your career in the future
K	In addition to plagiarism, I think that pressure on editors is more relevant in bad results
L	ICMJE criteria are often violated! A real shame! Autorlists should be much shorter and reflect the work of the investigators! Otherwise Co-authorship does not have any value!
	I think falsified data, manipulated statistic and image documentation, bias and corrupted reviews are - unfortunately - much more common than we want to realize. Most US high impact journals are clearly biased and dependent on money as are the scientific societies and their journals. If you are not part of the society, you are out. It is not as bad

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Table 1 (continued)

Respondent	Narrative comment
	in (Northern) Europe, but it is coming, and the pharma industry and other with money interest are governing most of what is published in 'scientific' and public media. Typically, the "old" and "acknowledged" specialties use their power to decide and govern what is right and how things should be conceived and published, but the world needs a new and fresh start with a totally different organization of health care and a completely different review system based in unbiased reviewers only.
M	I had an unpleasant ethics experience with a PhD student some years back. The problem was identified and we withdrew the manuscript before publication.
N	I consider co-authorship as the currency to correspond for the time/work invested by collaborators in my research directions/interest. In order to make tangible and meaningful contributions, keeping my collaborators happy and engaged is much more important than meeting the ICMJE criteria.
O	I appreciate your survey and hope to see your results.
P	Confidence on integrity is not the same for the whole field, i.e. I doubt the integrity of the data and analyses from one major group only.

Integrity recommends offering training in research integrity to ensure that academic staff conducts research according to the highest scientific and ethical standards [6]. However, a recent study has shown that leading European universities adopted different training approaches in delivering good scientific practices to PhD students [6]. Furthermore, research integrity education at the institutional level was shown to be not available in many research-intensive universities in Europe [6]. The findings from our survey may help to further increase awareness about scientific integrity and putting it in the focus of research institutions.

Publication bias appears to be a major problem, as indicated by most respondents (85%). This could be tackled by journal editors by accepting more studies with negative results. Half of respondents declared presence of honorary authorship in any of their publications in the past 5 years. Possible strategies to counter honorary authorship include journal restrictions to the maximum number of authors per article, restricting the number of authors to those who entirely fulfill each of the four ICMJE criteria, and a more active role of journals towards checking the appropriateness of authorship [7].

To our knowledge, our study is the first to explore scientific integrity in cardiovascular imaging research. Our findings are in line with recent studies in the fields of general radiology and nuclear medicine, which also reported an overall high confidence in the integrity of published work but a comparable degree of undesired practices such as scientific fraud (4.3 to 5.9% self-reported fraud and 21.3% to 27.4% suspected fraud by their colleagues), publication bias (84.5% to 87.4%), and honorary authorship (40.6% to 39.4%) [8,9]. In a study that was published more than ten years ago, the prevalence of perceived honorary authorship among general radiology journals was 26.0% [10]. Thus, the prevalence seems to have increased.

Our study has some limitations. First, the response rate of 8.4% may be considered relatively low. A high response rate is desirable because of precision and power. Although it has been reported that a low response rate is not necessarily predictive of non-response bias [11], this may often not be the case. Non-response bias could, in addition to people simply being embarrassed to report themselves, have led to an underestimation of the reported rate of academic dishonesty. However, because of the anonymous nature of our survey, we do not know the characteristics of the non-respondents and we could not evaluate whether there were systematic differences between respondents and non-respondents. Nevertheless, the responses and concerns of 160

experts give valuable information that should be considered by the cardiovascular imaging community. In addition, most respondents had a high level of experience, with 72.5% having >10 years of research experience. Second, this study lacked statistical power to explore which researcher-related factors (such as age, gender, geographical location, academic position, and years of experience) are independently associated with scientific fraud. Third, it could be argued that the wording of some questions of our survey could have been better. For instance, the word "committed" (question 7) may be associated with criminal activity and may make the person less likely to answer in the positive. Thus, the survey could have included items that are not labelled "misconduct" or "fraud" but rather activities described more explicitly as simple actions (not judgments). In addition, the wording "Have you witnessed or do you suspect that anyone.." (question 8) makes it a double question that may cloud the distinction between when someone actually knows that scientific fraud happened and when someone just suspects it. Fourth, because we preserved the anonymity of respondents, we did not investigate which scientific publications were fraudulent.

In conclusion, our survey shows that several forms of scientific fraud, publication bias, and honorary authorship are considered to be present in cardiovascular imaging research. Despite these reports of academic dishonesty, overall confidence in the integrity of cardiovascular imaging research is deemed high.

### Conflicts of interest

All authors have no conflicts of interest to declare.

### Acknowledgements

This study did not receive any funding.

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