



Retracted Publications in Medical Imaging Literature: an Analysis Using the Retraction Watch Database

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Rationale and Objective: It is currently unknown how many publications in the medical imaging literature are retracted and for which reasons. The purpose of this study was to perform an updated analysis on retracted medical imaging publications using the Retraction Watch Database.

Materials and Methods: The Retraction Watch Database was searched for all retracted publications in the subject category "Radiology/Imaging" (no beginning date limit, search update until April 27, 2022). Reasons for retraction were extracted using standardized coding taxonomy. The number of citations per retracted publication was determined. Spearman's rho was used for statistical analysis.

Results: 192 retractions, originally published between 1984 and 2021, were included. Most retractions originated from China (31.3%), the United States (12.5%), Japan (7.3%), and South Korea (6.3%). The number of retractions increased over the years, especially since 2000 (Spearman's rho=0.764, $p < 0.001$). Delay between original publication and retraction ranged from 0 days to 14 years and 3 months (median of 11 months). Most common reasons for retraction were duplication of article (7.1%), plagiarism of article (6.8%), concerns/issues about data (5.4%), investigation by company/institution (4.5%), and forged authorship (4.0%). Scientific misconduct was deemed present in 107 of 192 retracted articles (55.7%). Retracted articles (of which 138 were listed in Web of Science) received a median of 2 citations (range 0-148, IQR 5).

Conclusion: The number of retracted medical imaging publications continues to increase over time, which could indicate that more compromised research has either been published or discovered. Scientific misconduct was the main cause for retraction.

Keywords: Retracted Publication; Medical Imaging; Radiology; Ethics; Fraud; Scientific Misconduct; Plagiarism.

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INTRODUCTION

Peer-reviewed publications in scientific journals are the cornerstone of modern medicine. Scientific publications need to be trustworthy, because they influence medical decision making. False information could be detrimental to patients and may result in unnecessary health care costs. Unfortunately, publications with unreliable content or data do exist and they result from either unintentional error or scientific misconduct (1–3). Retraction is a method for correcting the literature and alerting the readership to

publications that contain seriously flawed or erroneous data (4). A retraction may also be performed in case of scientific misconduct (4). Retractions in the field of medical imaging may undermine the public and government (i.e., Medicare, Medicaid, insurers) confidence in the quality of the specialty and could affect the reputation of science. There is a scarcity of studies on retracted publications in the field of medical imaging. Using PubMed, Rosenkrantz (3) investigated retracted publications in radiology journals between 1983 and 2013, and suggested that the number of retractions had increased. However, retracted medical imaging publications in nonradiology journals were not evaluated and reasons for retraction were commonly vague or missing (3). In addition, it was commonly unclear whether the retraction was related to an honest error or potential scientific misconduct (3). As such, the exact extent and reasons for retracted publications in the medical imaging literature remain unknown. The Retraction Watch Database (publicly launched in 2018) is currently considered the largest and most comprehensive database on retracted publications that includes reasons for retraction based on a detailed taxonomy system (5,6). Retraction notices by journals and/or publishers can be incomplete

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and sometimes even wrong (6). To overcome this, Retraction Watch locates and double-checks every retraction, which is subsequently entered in their daily-updated database (6). Previous studies using the Retraction Watch Database in the fields of cardiovascular medicine and surgery (7), ophthalmology (8), obstetrics (9), and dentistry (10) showed a trend of increasing retractions over time and that scientific misconduct represented the most common reason for retraction. To our knowledge, there are no previous publications in the field of medical imaging which have used this the Retraction Watch Database. Therefore, the purpose of this study was to perform an updated analysis on retracted medical imaging publications using the Retraction Watch Database.

MATERIALS AND METHODS

The Retraction Watch Database is publicly available (6). Therefore, ethical review board approval was not required for this study.

Data Collection

After signing a data use agreement, the Retraction Watch Database was searched for all retracted publications in the article subject category “Radiology/Imaging” (search date: April 27, 2022). Conference abstracts and retracted publications which were not directly related to medical imaging were manually excluded. The subject category of the journal (“radiology, nuclear medicine & medical imaging” or other) in which the retracted publication appeared, was extracted from Journal Citation Reports (11). The number and country of origin of the authors, date of the original publication (print publication date), date of retraction notice, and reasons for retraction were extracted using the Retraction Watch Database coding taxonomy system (12). Based on previous literature on retracted publications (13–16), the presence of any of the following reasons was considered as scientific misconduct: duplication, plagiarism, falsification or fabrication of data, images or results, ethical violations by author, lack of Institutional Review Board/ Institutional Animal Care and Use Committee approval, forged authorship, fake peer

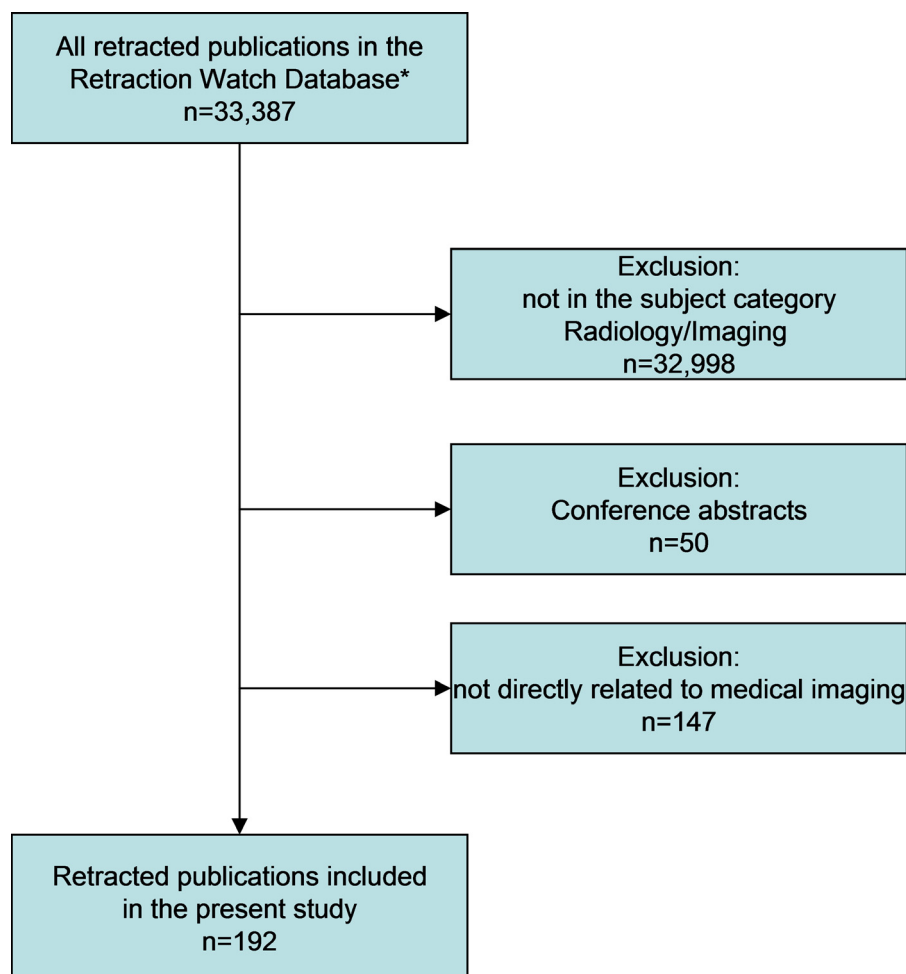


Figure 1. Selection of retracted publications from the Retraction Watch Database. *Updated April 27, 2022 (Color version of figure is available online.)

review (recommending a fake reviewer during the peer-review process), and rogue editor (fraudulent editor, i.e. non-existent or with false credential). The number of citations per retracted publication was determined using Clarivate Analytics's Web of Science (17).

Data Analysis

The collected data were descriptively summarized. The associations between the number of retractions, the number of retractions with scientific misconduct, and the number of retractions by the top 4 countries with most retracted publications, vs. time (by original publication year) were assessed by Spearman's rho. *p*-values <0.05 were considered statistically significant. Statistical analyses were executed using IBM Statistical Package for the Social Sciences (SPSS) version 26 (SPSS, Chicago, IL).

RESULTS

The selection of retracted publications is displayed in Figure 1. 192 retracted medical imaging publications were included in the present study (Table 1). 45 of 192 retracted publications (23.4%) were published in a journal belonging to the JCR subject category "radiology, nuclear medicine & medical imaging". 119 retracted publications (62.0%) were published in a nonradiology journal indexed in JCR and 28 retracted publications (14.6%) were published in a journal which was not indexed in JCR. The number of authors per retracted publication ranged between 1 and 14 (median of 5). Most retracted publications originated from China (31.3%), followed by the United States (12.5%), Japan (7.3%), and South Korea (6.3%). 10.9% of retracted publications were multinational (i.e., with authors from multiple countries). The original publications were published between 1984 and 2021. The number of all retractions increased over the years, especially since 2000 (Spearman's rho=0.764, *p* <0.001) (Fig 2). The number of retractions by each of the top 4 countries with most retracted publications also increased over the years (China: Spearman's rho=0.818, *p* <0.001; the United States: Spearman's rho=0.408, *p* = 0.011; Japan: Spearman's rho=0.571, *p*<0.001; and South Korea: Spearman's rho=0.403, *p* = 0.012). The delay between the original publication and retraction ranged from 0 days to 14 years and 3 months (median of 11 months). Reasons for retraction are displayed in the Supplementary Table. The most common reasons were duplication of article (7.1%), plagiarism of article (6.8%), concerns/issues about data (5.4%), investigation by company/institution (i.e., an evaluation of allegations by the affiliations of one or all of the authors) (4.5%), and forged authorship (fraudulent use of an author name in submitting a manuscript for publication) (4.0%). The reason for retraction was unclear (limited or no information) in 5.9%. Scientific misconduct was deemed present in 107 of 192 retracted articles (55.7%). The number of retractions with scientific misconduct has also increased over the years (Spearman's rho=0.704, *p* <0.001). The retracted

TABLE 1. Characteristics of 192 Retracted Medical Imaging Publications.

Journal JCR subject category	- Radiology, nuclear medicine & medical imaging: 45 publications (23.4%) - Other: 119 publications (62.0%) - Not listed in JCR: 28 publications (14.6%)
Number of authors	- In all publications: 949 - Per publication: 1-16 (median 5) - In multiple publications: 34
Number of retracted publications by country of origin of the author(s)	China: 60 (31.3%) United States: 24 (12.5%) Japan: 14 (7.3%) South Korea: 12 (6.3%) India: 7 (3.6%) United Kingdom: 6 (3.1%) Iran: 5 (2.6%) Germany: 4 (2.1%) Russia: 4 (2.1%) Egypt: 3 (1.6%) Greece: 3 (1.6%) Italy: 3 (1.6%) Morocco: 3 (1.6%) Turkey: 3 (1.6%) France: 2 (1.0%) Romania: 2 (1.0%) Spain: 2 (1.0%) Algeria: 1 (0.5%) Australia: 1 (0.5%) Belgium: 1 (0.5%) Brazil: 1 (0.5%) Chile: 1 (0.5%) Croatia: 1 (0.5%) Czech Republic: 1 Denmark: 1 (0.5%) (0.5%) Saudi Arabia: 1 (0.5%) Thailand: 1 (0.5%) Multiple countries: 21 (10.9%) Unknown: 4 (2.1%)
Delay between original publication and retraction	0 days - 14 years and 3 months (median 11 months)

articles (of which 138 were listed in Web of Science) received a median of 2 citations (range 0–148, IQR 5).

DISCUSSION

The number of 192 retracted publications can be considered relatively small given the large number of medical imaging publications since 1984, which amounts to more than 398,323 (3). However, these 192 retracted publications may represent only the tip of the iceberg because not all published research that is compromised by serious errors or misconduct may be retracted. The increased number of retractions over time may simply be explained by a larger number of erroneous and/or fraudulent research that is being published.

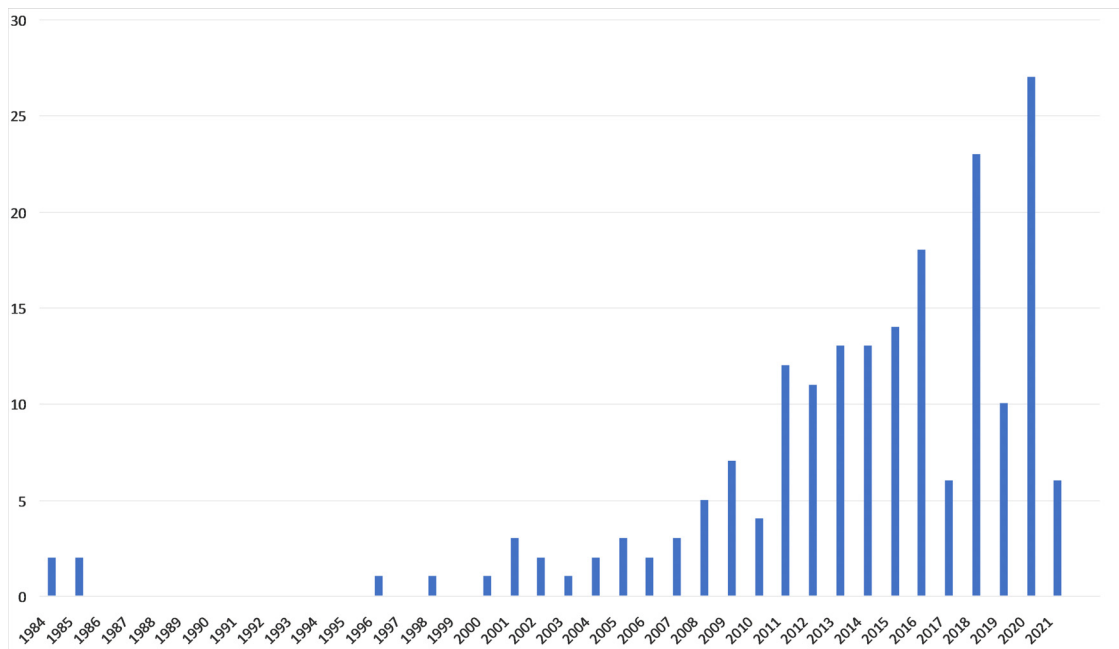


Figure 2. Number of retracted publications sorted by publication year of the original publication (updated until April 27, 2022). (Color version of figure is available online.)

However, the increased availability of online articles since the 2000s may have improved public control, which, together with a larger commitment of editors and researchers, could also have led to a larger number of retractions. As such, the rise in retractions could potentially be interpreted as growing scientific integrity rather than an increase in scientific misconduct (18). Scientific misconduct was present in more than half of retracted publications in our study cohort. There was a considerable variation in delay between the original publication and retraction (median of 11 months), and retracted articles received a median of 2 citations.

Duplication and plagiarism, the most common reasons for retraction, could be countered by increased awareness of manuscript reviewers and the use of plagiarism detection software (19). Retractions due to concerns about the validity of study data may be reduced by data sharing and control before publication. Forged authorship, another common reason for retraction, could be countered by journals by requiring a statement from each individual author attesting to the nature of their participation in the preparation of a given manuscript (20).

Scientific misconduct, present in most retracted publications, has multiple potential causes, including career and funding pressures ("publish or perish"), inadequate institutional oversight, financial conflicts of interest, lack of training, deterioration of ethical norms, and social deviance (21). The Committee on Publication Ethics (COPE) provides editors and publishers a detailed guideline on the detection and handling of potential scientific misconduct (22). However, not all scientific misconduct may be noticed. Authors have primary responsibility for the scientific integrity of their work. Imposing sanctions could be a way to avoid misconduct.

However, there is still no global clarity on which sanctions may be appropriate (23).

One previous study by Rosenkrantz investigated retracted publications in radiology journals up to 2013 (3). Our study provides an updated analysis and also included retracted medical imaging publications which were published in nonradiology journals (192 retracted publications were included in the current study vs. 48 in the study by Rosenkrantz (3). Our data indicated that the upward trend of retracted publications has further increased since 2013. In addition, our study also provided a detailed analysis of reasons for retraction using standardized taxonomy (12) and revealed that scientific misconduct was the main cause for retraction.

Our study has some limitations. First, we did not determine the exact proportion of retracted publications with respect to all publications in the field of medical imaging. However, the list of journals with potential medical imaging publications is so long that it is almost impossible to manually extract all medical imaging-related articles. Second, we could not assess whether the rise of retracted publications was due to an absolute increase of erroneous and/or fraudulent research, or due to a greater public control. Third, it still remains to be determined whether retracted publications had a negative impact on subsequent research and patient care.

In conclusion, the number of retracted medical imaging publications continues to increase over time. This could indicate that more compromised research has either been published or discovered. Scientific misconduct was the main cause for retraction.

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SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.acra.2022.06.025.