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# Assessing database accuracy for article retractions: A preliminary study comparing Retraction Watch Database, PubMed, and Web of Science

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**ABSTRACT**

**Objective:** This study aimed to compare the accuracy of metadata for retracted articles in Retraction Watch Database (RWD), PubMed, and Web of Science (WoS).

**Methods:** Twenty general internal medicine journals with an impact factor > 2 were randomly selected. RWD, PubMed, and WoS were used to retrieve all retracted articles published in these journals. Eight metadata variables were examined: journal, title, type of article, author(s), country/countries of affiliation, year of publication, year of retraction, and reason(s) for retraction (assessed only for RWD, as this information was unavailable in PubMed and WoS). Descriptive analyses were conducted to document errors across databases.

**Results:** Thirty-five retractions were identified, and 280 metadata entries ($35 \times 8$) were analyzed. RWD contained the most metadata errors, affecting 16 articles and 20 metadata entries, including seven errors in year of publication, six in article type, six in author names (five misspellings, one missing two authors), and one in country of affiliation. WoS had one error (a missing author), and PubMed had none.

**Conclusion:** The relatively high error rate in RWD suggests that researchers should cross-check metadata across multiple databases. Given the preliminary nature of this study, larger-scale research is needed to confirm these findings and improve metadata reliability in retraction databases.

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Accuracy; PubMed; Retraction; Retraction Watch; Web of Science

## Introduction

Maintaining the integrity of scientific literature is fundamental to the advancement of knowledge and the provision of evidence-based healthcare. However, retractions – wherein published articles are deemed flawed, erroneous, or fraudulent – pose a significant challenge to research integrity.

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Accurately identifying retracted articles is essential for preventing the continued citation and dissemination of unreliable research.

To aid in this process, researchers and health sciences librarians rely on various databases, including Retraction Watch Database (RWD), PubMed, and Web of Science (WoS), to identify retracted articles. While PubMed and WoS provide advanced search functionalities, allowing users to filter publications by type (e.g., "Retracted Publication"), RWD is a centralized repository specifically dedicated to retractions, often offering additional contextual information (2018).

Historically, studies on article retractions have relied primarily on bibliographic databases such as PubMed and WoS. For example, Grieneisen & Zhang (2012) analyzed 42 bibliographic databases, including PubMed and WoS, to extract 4,449 retracted publications from 1928 to 2011 (Grieneisen and Zhang 2012). Fang et al. (2012) conducted a similar analysis but focused solely on PubMed, retrieving 2,047 retracted biomedical and life science articles (Fang, Steen, and Casadevall 2012). More recent studies have followed this approach; for instance, Lievore et al. (2021) used WoS to extract 330 retracted articles (2010–2019) whose authors were affiliated with the 20 most prestigious universities based on the 2020 Times Higher Education global ranking (Lievore et al. 2021).

In recent years RWD has emerged as a widely used tool for retraction research and is often considered the gold standard for aggregated retraction data (Candal-Pedreira et al. 2022). For example, Ribeiro & Vasconcelos (2018) used RWD to analyze the countries of affiliation of 1,623 retracted articles (2013–2015) (Ribeiro and Vasconcelos 2018). Koo & Lin used Web of Science to identify 8,466 retracted articles (2003–2022) and RWD to examine the main reasons for retraction (Koo and Lin 2024). Audisio et al. used RWD to extract and analyze 459 retracted articles (1978–2020) in the cardiovascular literature (Audisio et al. 2022). Kataoka et al. used RWD to identify 525 systematic reviews and 62 clinical practice guidelines that cited retracted articles (Kataoka et al. 2022). Our research team has also used RWD in previous studies. A 2023 study analyzed gender disparities among authors of 438 retracted articles published in 134 medical journals (2003–2022), finding that women were underrepresented among retracted articles authors (Sebo et al. 2023). In another study, we conducted a descriptive analysis of seven retracted articles (2000–2022) from the 15 most prestigious primary care medicine journals (Sebo 2023). In both studies, PubMed was used to extract retracted articles, while RWD provided retraction reasons.

Despite the growing reliance on these bibliographic resources for retraction studies, questions remain regarding the accuracy of the metadata they provide. Previous studies have focused primarily on database coverage and whether retracted articles are correctly flagged as retracted (Bakker and Riegelman 2018; Bakker et al. 2024; Schmidt 2018; Suelzer et al. 2021). These studies have shown that a substantial proportion of retracted

publications are not consistently labeled as such across databases, increasing the risk of continued citation and use of unreliable research. However, to our knowledge, no study has systematically examined the accuracy of key metadata fields – including journal, article title, type of article, author name(s), country/countries of affiliation, publication year, retraction year, and reason(s) for retraction – associated with retracted articles.

The aim of this preliminary study was to compare the accuracy of metadata for retracted articles in RWD, PubMed, and WoS. This evaluation provides insights into the reliability of these databases for researchers and health sciences librarians. By improving awareness of metadata accuracy, this study supports best practices for research integrity and responsible database usage.

## Methods

### *Journal and database selection*

We used Journal Citation Reports (JCR) to randomly select twenty journals from the 112 journals classified under the JCR category "medicine, general & internal," with an impact factor (IF) greater than two. Table 1 presents the selected journals, sorted by IF. We then used three bibliographic databases – RWD, PubMed, and WoS – to extract all retracted articles published in these journals, without time limits. All selected journals are indexed in both PubMed and WoS.

### *Retraction Watch Database (RWD)*

RWD was launched by a team of journalists and researchers, Ivan Oransky and Adam Marcus, in 2010 (2018). It serves as a comprehensive repository dedicated to tracking retractions of scientific articles across diverse disciplines, including biomedicine. RWD aims to promote transparency and integrity in scientific publishing by providing accessible and detailed information about retractions. The database operates through a combination of automated algorithms and manual curation. It continuously monitors retractions reported in scientific journals, alerts users to newly retracted articles, and updates existing entries with additional information as it becomes available. Users can search the database by various criteria, such as journal name, article title, author names, publication year, and reason for retraction. The RWD website describes how the authors gathered the data for their database (2018).

In addition to basic metadata about retracted articles, RWD also provides context and analysis, including discussions of the reasons behind retractions, trends in retraction rates, and profiles of authors and journals

**Table 1.** List of the 20 general internal medicine journals included in the study (sorted by JCR 2022 impact factor) and number of article retractions per journal according to Retraction Watch Database, PubMed, and Web of Science.

| Journal | ISSN | JCR 2022 impact factor | Number of retractions using Retraction Watch Database ($n = 32$) | Number of retractions using PubMed ($n = 25$) | Number of retractions using Web of Science ($n = 26$) |
|---|---|---|---|---|---|
| Journal of Cachexia, Sarcopenia and Muscle | 2190–6009 | 8.9 | 0 | 0 | 0 |
| European Journal of Internal Medicine | 1879–0828 | 8.0 | 7 | 0 | 0 |
| Deutsches Arzteblatt International | 1866–0452 | 7.7 | 0 | 0 | 0 |
| European Journal of Clinical Investigation | 1365–2362 | 5.5 | 3 | 1 | 2[1] |
| Polish Archives of Internal Medicine | 1897–9483 | 4.8 | 0 | 0 | 0 |
| Minerva Medica | 1827–1669 | 4.7 | 1 | 1 | 1 |
| Internal and Emergency Medicine | 1970–9366 | 4.6 | 2 | 2 | 2 |
| Annals of Medicine | 1365–2060 | 4.4 | 0 | 0 | 0 |
| Panminerva Medica | 1827–1898 | 4.3 | 0 | 0 | 0 |
| Journal of Clinical Medicine | 2077–0383 | 3.9 | 7 | 7 | 7 |
| Frontiers in Medicine | 2296-858X | 3.9 | 7 | 7 | 7 |
| Archives of Medical Science | 1896–9151 | 3.9 | 2 | 4 | 4 |
| Medicina Clinica | 1578–8989 | 3.9 | 0 | 0 | 0 |
| Diagnostics | 2075–4418 | 3.6 | 0 | 0 | 0 |
| Journal of Personalized Medicine | 2075–4426 | 3.4 | 1 | 1 | 1 |
| Upsala Journal of Medical Sciences | 2000–1967 | 3.4 | 0 | 0 | 0 |
| Swiss Medical Weekly | 1424–3997 | 2.9 | 1 | 1 | 1 |
| Revista Clinica Espanola | 2254–8874 | 2.9 | 0 | 0 | 0 |
| La Presse Médicale | 2213–0276 | 2.7 | 0 | 0 | 0 |
| Medicina | 1648–9144 | 2.6 | 1 | 1 | 1 |

[1]There are three articles found, but one of them is in fact a retraction notice.

with multiple retractions. This additional information helps users better understand the circumstances surrounding each retraction and facilitates research into patterns of scientific misconduct.

In our study, we retrieved the retractions using the "journal" drop-down menu. The tool suggests the names of journals as soon as we start writing the first letters of the journal we are interested in. We can then

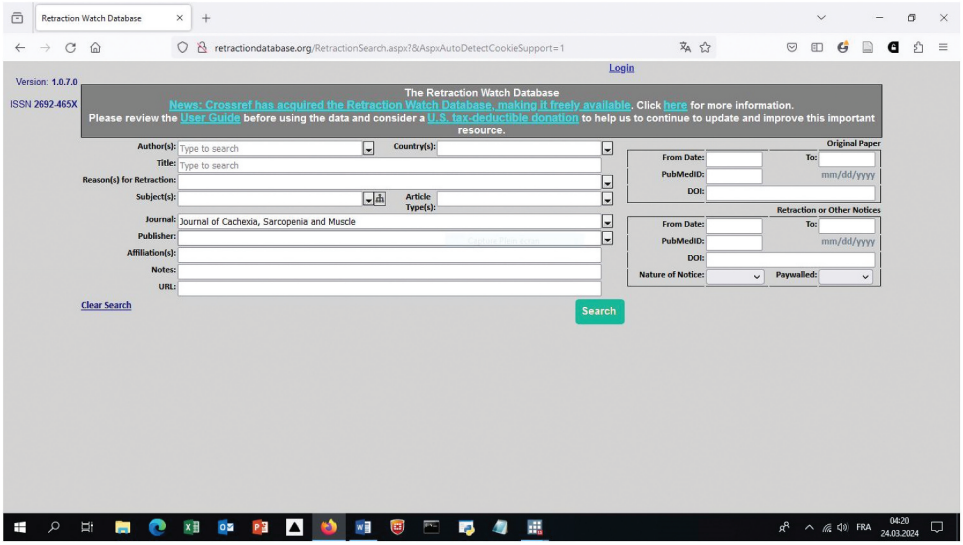


**Figure 1.** Screenshot of Retraction Watch Database showing how to find retracted articles (example for Journal of Cachexia, Sarcopenia and Muscle).

select the journal by clicking on it with the computer mouse. Figure 1 shows a screenshot of RWD with an example of how to retrieve retractions of articles published in "Journal of Cachexia, Sarcopenia and Muscle."

## *PubMed*

PubMed is a widely used database containing citations and abstracts of biomedical literature. Developed and maintained by the National Center for Biotechnology Information (NCBI), it provides access to a vast array of biomedical articles. With its user-friendly interface and extensive coverage of peer-reviewed journals, PubMed plays a pivotal role in facilitating evidence-based practice, biomedical research, and knowledge dissemination within the scientific community.

We used the "PubMed Advanced Search Builder" for our study. We searched for retractions twice, first with journal names and then with the journals' International Standard Serial Number (ISSN), as some journals might have more than one name in PubMed. We extracted article retractions by typing "Retracted Publication" in "Publication Type." For "Journal" the tool offers a drop-down menu and we can click on the journal we are interested in. There is no drop-down menu when searching by the ISSN of the journal. Figure 2 shows a screenshot of the "PubMed Advanced Search Builder" with an example of how to retrieve retractions of articles published in "Journal of Cachexia, Sarcopenia and Muscle" (ISSN = 2190–6009).

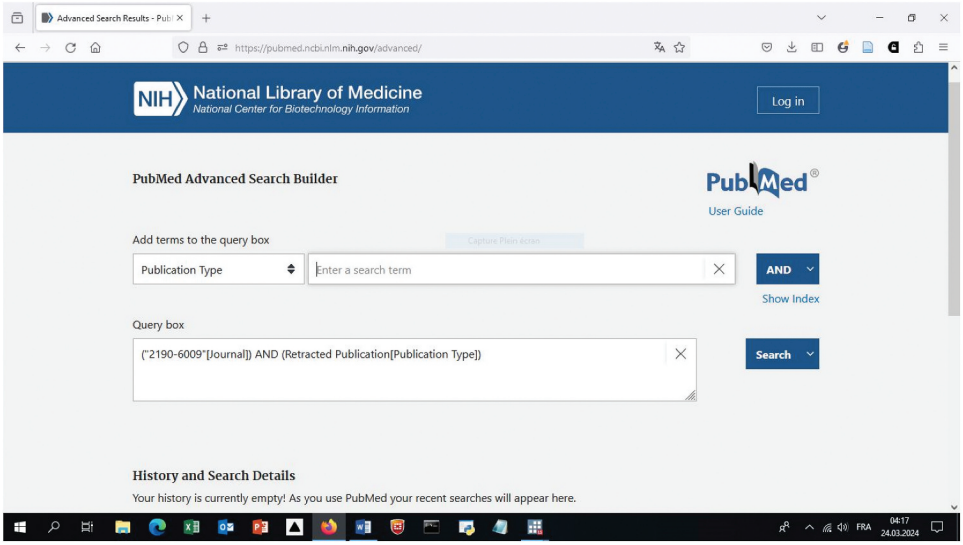


**Figure 2.** Screenshot of the Advanced Search Builder of PubMed showing how to find retracted articles (example for Journal of Cachexia, Sarcopenia and Muscle using the International Standard Serial Number of the journal).

## *Web of Science (WoS)*

WoS is a research platform that provides access to a comprehensive collection of scholarly literature across various disciplines, including biomedicine. Developed by Clarivate Analytics, it offers a vast repository of peer-reviewed journals, conference proceedings, and other academic sources. WoS enables researchers to conduct in-depth literature searches, track citations, and analyze research trends.

We used the "Advanced Search Query Builder" for our study. As we did with PubMed, we searched for retractions twice, first with journal names and then with the journals' ISSN. We extracted article retractions by selecting "Retracted Publication" in the "Document Type" drop-down menu (field tag = DT). For "Publication Title" the tool offers another drop-down menu and we can click on the journal we are interested in (field tag = SO). There is no drop-down menu when searching by the ISSN of the journal (field tag = IS). Figure 3 shows a screenshot of the "Advanced Search Query Builder" with an example of how to retrieve retractions of articles published in "Journal of Cachexia, Sarcopenia and Muscle" (ISSN = 2190–6009).

## *Data collection*

For each retracted article identified in RWD, PubMed, and WoS, we consulted the journal in which the article was published to retrieve eight metadata fields: journal, title of the article, type of article, author(s),

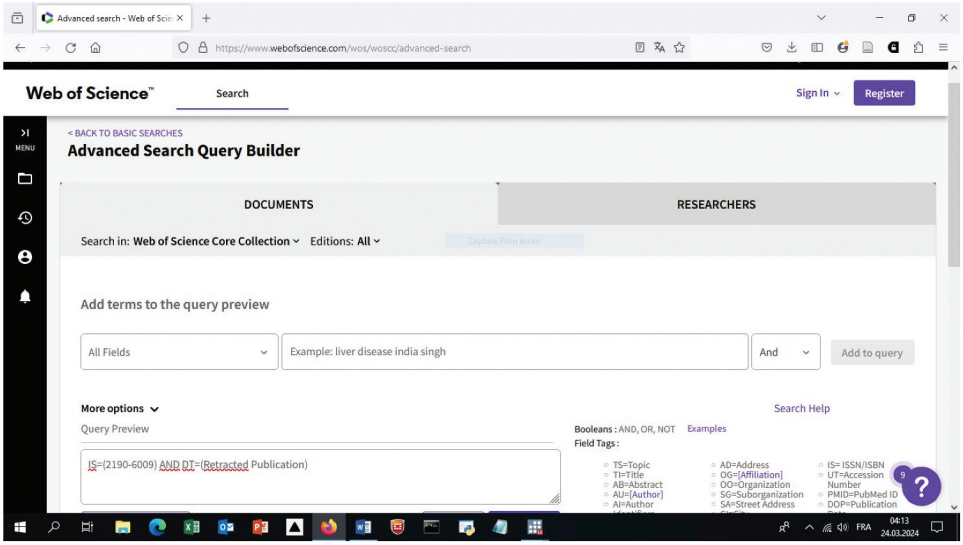


**Figure 3.** Screenshot of the Advanced Search Query Builder of Web of science showing how to find retracted articles (example for Journal of Cachexia, Sarcopenia and Muscle using the International Standard Serial Number of the journal).

country/countries of affiliation, year of publication, year of retraction, and reason(s) for retraction. To retrieve the reason(s) for retraction, we examined the retraction notice published in the journal. This metadata was assessed only for RWD, as this information was unavailable in PubMed and WoS.

We determined the gender of the first and last authors by consulting websites with author photos, including ResearchGate, SciProfiles, and institutional websites of universities or research institutes. Retraction reasons were categorized into four main groups – misconduct, error, misconduct and error, and reason unknown – as done in a previous study (Sebo et al. 2023). For example, plagiarism or data falsification was classified as "misconduct," while errors in data or methodology were classified as "error." If the retraction notice did not specify a reason, the case was classified as "reason unknown."

Study data were collected between February 5 and 10, 2024. Two researchers (PS and MS) manually verified each of the eight metadata fields twice, comparing metadata from the three databases with metadata from the journal website and the retraction notice for the retraction reason (s). Any discrepancies were resolved through discussion. If consensus could not be reached, a third researcher was to be consulted. Figure 4 presents the study flowchart.

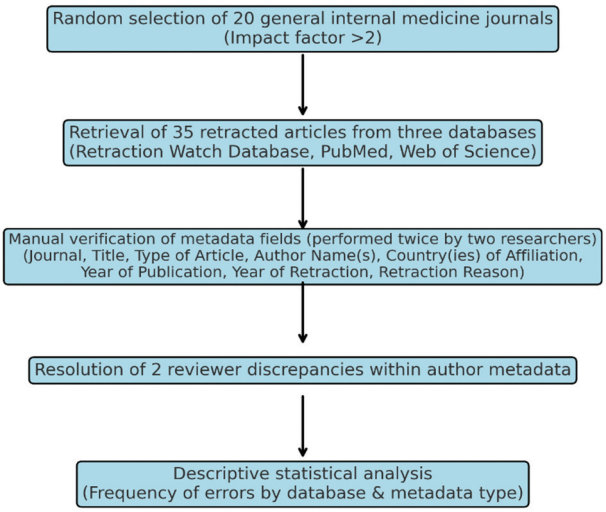


**Figure 4.** Flowchart of the study.

### *Statistical analyses*

The study data were analyzed descriptively. Categorical variables were summarized using proportions, while numerical variables were described using medians, interquartile ranges (IQR), and minimum and maximum values. The total number of retractions for the twenty selected journals was estimated as the combined number of retractions identified across RWD, PubMed, and WoS. For each database, we documented the number of articles with at least one error in any of the eight metadata fields examined, as well as the number of articles with at least one error in each specific metadata field. This study complies with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guideline for cross-sectional studies. All analyses were performed using STATA 15.1.

### *Ethical approval*

As this study did not involve the collection of personal health-related data, it did not require ethical review under current Swiss legislation.

## Results

### *Description of the retractions*

A total of 35 retracted articles were identified across RWD, PubMed, and WoS. Table 2 presents the main characteristics of these articles. The number of retractions per journal ranged from seven in three journals (European

**Table 2.** Characteristics of 35 retracted articles published in 20 selected general internal medicine journals with an impact factor greater than 2.

| Variable | N | % | Median (IQR, min-max) |
|---|---|---|---|
| **Journal** | | | |
| European Journal of Internal Medicine, Journal of Clinical Medicine, Frontiers in Medicine | 7 each | 20.00 each | |
| Archives of Medical Science | 5 | 14.29 | |
| European Journal of Clinical Investigation | 3 | 8.57 | |
| Internal and Emergency Medicine | 2 | 5.71 | |
| Journal of Personalized Medicine, Medicina, Minerva Medica, Swiss Medical Weekly | 1 each | 2.86 each | |
| **Type of article** | | | |
| Research article | 15 | 42.86 | |
| Review article | 13 | 37.14 | |
| Case report | 3 | 8.57 | |
| Letter to the editor | 2 | 5.71 | |
| Editorial, Historical article | 1 each | 2.86 each | |
| **Authors' affiliation (country)** | | | |
| China | 13 | 37.14 | |
| More than one country of affiliation | 6 | 17.14 | |
| Netherlands | 5 | 14.29 | |
| Italy | 4 | 11.43 | |
| USA | 2 | 5.71 | |
| Saudi Arabia, South Korea, Spain, Switzerland, Turkey | 1 each | 2.86 each | |
| **Reason for retraction** | | | |
| Misconduct | 21 | 60.00 | |
| Unknown | 7 | 20.00 | |
| Error | 6 | 17.14 | |
| Misconduct and error | 1 | 2.86 | |
| **First author's gender** | | | |
| Male | 20 | 57.14 | |
| Unknown | 9 | 25.71 | |
| Female | 6 | 17.14 | |
| **Last author's gender** | | | |
| Male | 24 | 68.57 | |
| Unknown | 7 | 20.00 | |
| Female | 4 | 11.43 | |
| **Number of authors** | | | 5 (5, 1–15) |

(*Continued*)

**Table 2.** (Continued).

| Variable | N | % | Median (IQR, min-max) |
|---|---|---|---|
| 3 | 7 | 20.00 | |
| 7 | 5 | 14.29 | |
| 2, 4, 9 | 4 each | 11.43 each | |
| 6 | 3 | 8.57 | |
| 1, 8 | 2 each | 5.71 each | |
| 5, 10, 11, 15 | 1 each | 2.86 each | |
| **Year of publication** | | | 2019 (13, 1997–2023) |
| 2021, 2022 | 6 each | 17.14 each | |
| 2019 | 5 | 14.29 | |
| 2007, 2008 | 3 each | 8.57 each | |
| 2010, 2016, 2023 | 2 each | 5.71 each | |
| 1997, 2003, 2006, 2013, 2018, 2020 | 1 each | 2.86 each | |
| **Year of retraction** | | | 2022 (12, 2003–2024) |
| 2023 | 15 | 42.86 | |
| 2011 | 8 | 22.86 | |
| 2020, 2022 | 3 each | 8.57 each | |
| 2003, 2005, 2013, 2014, 2021, 2024 | 1 each | 2.86 each | |

Journal of Internal Medicine, Journal of Clinical Medicine, and Frontiers in Medicine) to zero in ten journals. The majority of the retracted articles were research articles ($n = 15$) or review articles ($n = 13$). The articles were published between 1997 and 2023 (median = 2019) and retracted between 2003 and 2024 (median = 2022). Most of the authors were affiliated with universities or research institutes in China ($n = 13$), and for six articles, multiple countries were listed as affiliations. Men were overrepresented as first and last authors of retracted articles, with 20 first authors being men versus 6 women, and 24 last authors being men versus 4 women. The gender of nine first authors and seven last authors could not be determined.

The reasons for retraction varied. After categorization, twenty-one articles were retracted for "misconduct", seven for "unknown reason", six for "error",

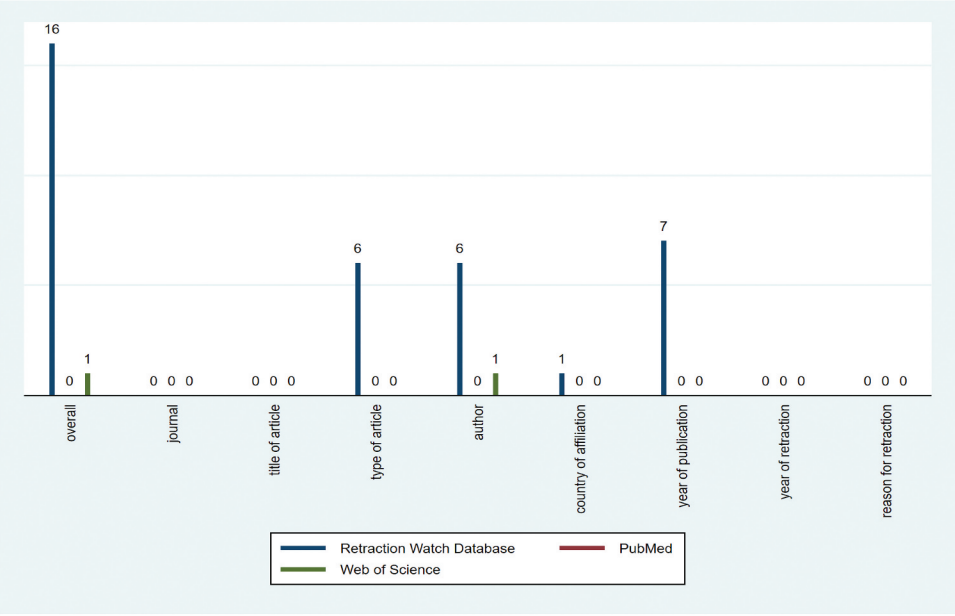


**Figure 5.** Number of metadata errors for Retraction Watch Database, PubMed, and Web of Science ($n = 35$ retracted articles published in 20 selected general internal medicine journals with an impact factor greater than 2). *Overall* represents the number of articles with at least one error in any of the eight metadata fields examined (*Journal, Title of article, Type of article, Author, Country of affiliation, Year of publication, Year of retraction, and Reason for retraction*). For each category, the count reflects the number of articles with at least one error in that metadata field, not the total number of errors. For example, if one article has a single error in the *Author* field, another has two errors, and a third has none, the count for *Author* would be 2, as it reflects the number of affected articles rather than individual errors.

and one for both "misconduct and error". The seven articles retracted by the European Journal of Internal Medicine in 2011 were classified as having an unknown reason, but all involved the same author, Jan Willem F. Elte.

## *Analysis of metadata accuracy*

The Supplementary Material contains the complete metadata for all 35 retracted articles analyzed in this study, including the following variables: journal, title of article, type of article, author(s), country/countries of affiliation, digital object identifier (DOI), year of publication, year of retraction, reason(s) for retraction according to the journal, reason(s) for retraction according to RWD, database(s) in which the article was correctly marked as retracted, and metadata error descriptions. Figure 5 presents, for each database, the number of articles with at least one error in any of the eight metadata fields examined, as well as the number of articles with at least one error in each specific metadata field.

A total of 280 metadata entries were analyzed for RWD, corresponding to eight metadata fields for 35 retractions, and 245 metadata entries for PubMed and WoS, corresponding to seven metadata fields for 35 retractions. Metadata accuracy varied across databases. In RWD, 20 metadata entries (7.1%) had at least one error, while WoS had only one metadata error (0.4%), and PubMed had none. The single metadata error in WoS involved a missing author name, Yi Liu, in the author list of one article. In total, 16 articles in RWD (45.7%) contained at least one metadata error, while 19 articles (54.3%) contained no errors. Among the 16 articles with at least one metadata error, 12 contained only one erroneous metadata field, while 4 contained multiple erroneous metadata fields.

The errors in RWD were distributed across multiple metadata fields, affecting publication year, article type, author name(s), and country/countries of affiliation. Errors in publication year were found in seven articles, all of which were from the European Journal of Internal Medicine, where the year of publication was systematically misrecorded. These articles, published between 2006 and 2008, were wrongly recorded as having been published in 2011. Errors in author names were found in six articles. These included spelling mistakes, such as "Ping Zhu" recorded as "Pin Zhu" and "Maja Kovacevic" written as "Kaja Kovacevic," as well as missing authors. Errors in article type were found in six articles. Some articles originally published as review articles, letters to the editor, or historical articles were incorrectly classified as research articles or commentaries in RWD. Finally, one error was found in the country of affiliation field. For two articles, a single metadata entry contained multiple errors. In one article published in Frontiers in Medicine, the author list was missing two names, Hua Zhao and Yi Liu. In another article published in Frontiers in Medicine, the country of affiliation entry was missing five countries: Australia, Croatia, Cyprus, Spain, and the USA.

### *Quality control and verification*

To ensure accuracy, two independent reviewers manually verified all metadata fields twice. Two discrepancies were identified, both related to author name misspellings, and these were resolved through discussion. A third reviewer was not needed.

## Discussion

### *Summary of findings*

By combining three databases (RWD, PubMed, and WoS), we identified 35 retracted articles from the twenty general internal medicine journals selected for the study. These retractions were mainly research or review articles

published between 1997 and 2023. Metadata errors were frequent in RWD, affecting 16 of 35 articles (46%) and 20 of 280 metadata entries (7%), including seven errors in the year of publication, six in article type, six in author names, and one in country of affiliation. WoS had one metadata error (a missing author), and PubMed had none.

### *Comparison with existing literature*

Previous studies have primarily focused on identifying and assessing the coverage of retracted articles across bibliographic databases, rather than evaluating the accuracy of the metadata associated with these publications (Bakker and Riegelman 2018; Bakker et al. 2024; Schmidt 2018; Suelzer et al. 2021). These studies found substantial inconsistencies in how databases flag retracted articles, with many retractions either not labeled as such or inconsistently marked across different platforms. The findings underscore the challenges of identifying retracted literature, particularly the lack of consistency in how retractions are displayed across databases.

Our study provides a novel contribution by assessing the accuracy of key metadata fields. Our findings reveal that while PubMed and WoS demonstrated high accuracy, RWD contained a substantial number of metadata errors, particularly in article type, author names, and publication years. Unlike previous studies that focused on whether an article was labeled as retracted, our work highlights the risks of relying on bibliographic databases without verifying metadata accuracy. This distinction is crucial, as incorrect metadata – such as a misspelled author name or an incorrect publication year – can impact citation tracking, systematic reviews, and research integrity efforts. Given these findings, we emphasize that researchers and librarians should not only cross-reference multiple databases for retraction identification but also verify metadata accuracy directly from journal-published retraction notices, particularly when using RWD.

A possible explanation for the higher error rate in RWD is its reliance on manual data entry and curation, unlike PubMed and WoS, which use automated indexing systems. This manual process increases the likelihood of typographical errors, misattributed affiliations, and incorrect metadata.

While PubMed and WoS demonstrated high metadata accuracy, they do not extract or display retraction reasons, instead directing users to journal-published retraction notices. In contrast, RWD manually collects and records retraction reasons, but this human transcription process introduces a risk of errors and inconsistencies. Relying solely on RWD for retraction reasons without verifying journal notices may lead to misinterpretations and inaccuracies in research conclusions.

### Patterns and trends in article retractions

The examination of retractions within twenty general internal medicine journals provides significant insights into the landscape of scholarly integrity and publication practices. With 35 retractions identified across the selected journals, it is evident that retractions are not isolated incidents but rather a recurring phenomenon within the scientific community. This finding is consistent with previous studies highlighting the prevalence of retractions in scholarly literature, whether in the biomedical sciences or other disciplines (Fang, Steen, and Casadevall 2012; Grieneisen and Zhang 2012; Lievore et al. 2021; Ribeiro and Vasconcelos 2018; Steen et al. 2013; Wager and Williams 2011).

The variation in retraction rates among journals underscores potential differences in editorial rigor, peer review processes, and adherence to ethical standards. Journals with higher retraction rates may warrant closer scrutiny to identify systemic issues contributing to these retractions. In addition, the predominance of retractions in research and review articles suggests potential vulnerabilities in the research validation process, where errors or misconduct may occur during data collection, analysis, or reporting.

The temporal distribution of retractions (2003–2024, median = 2022) raises questions about the factors driving retraction trends over time. Possible explanations include increased awareness of research integrity issues, evolving publication standards, and advancements in detection methods (Fanelli 2013). The increase in retractions over time, which is not solely linked to the rise in scholarly output, has also been observed in other studies (Gaudino et al. 2021; Grieneisen and Zhang 2012; Lievore et al. 2021; Steen et al. 2013). The disproportionate representation of Chinese-affiliated authors among retracted articles prompts reflection on potential cultural, institutional, or systemic factors influencing research conduct and reporting practices. Previous studies, across multiple disciplines, have highlighted China's prominence in retractions (Candal-Pedreira et al. 2022; Rivera and Teixeira da Silva 2021; Sebo 2024; Sebo and Sebo 2025). Understanding the underlying factors behind this trend is crucial for developing targeted interventions to promote research integrity and ethical conduct globally. Finally, the overrepresentation of men as authors of retracted articles is a well-documented phenomenon (Decullier and Maisonneuve 2023; Fang et al. 2013; Pinho-Gomes et al. 2023; Sebo et al. 2023).

### Implications for researchers and health sciences librarians

Given the findings of this study, database users – including researchers and health science librarians – should exercise caution when using RWD and should verify retracted articles across multiple databases.

For researchers, ensuring the accuracy of retraction metadata is critical for maintaining research integrity, particularly in systematic reviews and bibliometric studies. Inaccurate metadata – such as incorrect publication years, misclassified article types, or misspelled author names – can lead to misinterpretation of retraction data, citation of flawed studies, and potential biases in research synthesis. To mitigate these risks, researchers should cross-check metadata across multiple databases and, when possible, consult original retraction notices published by journals. Furthermore, those conducting large-scale bibliometric analyses should be aware that manual data entry in RWD increases the likelihood of transcription errors, which could influence trends in retraction studies. Developing standardized verification protocols and incorporating automated validation tools may help improve metadata reliability and minimize the risk of propagating misinformation in scientific literature.

Understanding and managing retractions is also essential for health sciences librarians, who play a pivotal role in supporting evidence-based practice by ensuring that medical and scientific information is accurate, up-to-date, and reliable. Librarians frequently assist clinicians and researchers in navigating databases and filtering information, including retracted literature. They are often responsible for guiding users on best practices for literature searches and ensuring access to tools that enhance scholarly integrity. Moreover, health sciences librarians are increasingly tasked with educating patrons about research transparency, the implications of retractions, and the tools available to detect them. By comparing RWD, PubMed, and WoS in terms of metadata accuracy, this study offers valuable insights that can inform librarians' recommendations and support their efforts to curate high-quality, reliable resources within medical collections. These insights are critical for enhancing library services and fostering a culture of research integrity across healthcare institutions.

### *Limitations*

Several limitations must be acknowledged. First, reliance on database searches may lead to incomplete identification of retractions, as not all retractions are systematically indexed, and some may be subject to reporting biases. However, the combined use of three complementary databases (RWD, PubMed, and WoS) likely minimized this risk. Second, the focus on general internal medicine journals could limit the generalizability of the findings to other disciplines, though similar results would likely be observed for journals indexed in PubMed and WoS. Third, this study is preliminary, with a modest sample size (20 journals, 35 retractions, and 280 metadata entries). Further research should include larger datasets to confirm our results. Fourth, the retrospective nature of the study prevents

the establishment of causal relationships in retraction trends. Although no time frame restrictions were imposed, all retrieved retractions fell between 1997 and 2023, reflecting database coverage rather than a pre-defined selection criterion. Fifth, geographical biases may have influenced the findings, as retraction policies, reporting practices, and editorial oversight vary across countries. Some databases may underrepresent retractions from lower-income countries or non-English-language journals, leading to an incomplete assessment of global retraction trends. In this study, all the retracted articles came from journals based in Western countries, potentially limiting the representation of retractions from other regions. Finally, although metadata verification was conducted independently by two researchers, the process remains subject to human interpretation. Future research should investigate automated approaches to improve metadata validation.

## Conclusion

In this study, we manually examined 280 metadata fields across 35 retractions and identified 20 erroneous metadata entries in RWD and one in WoS, with none in PubMed. The most common errors in RWD were incorrect publication years, misclassified article types, and misspelled author names.

Though this study is preliminary and based on a small dataset, our findings highlight the risk of metadata errors in RWD and emphasize the importance of verifying metadata across multiple sources rather than relying solely on RWD. This study provides useful insights into metadata accuracy issues, but further research is needed to confirm our results. Future studies should examine larger datasets and could incorporate automated approaches to detect metadata errors.

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## Author's contribution

Conceptualization: PS and MS; Project administration: PS and MS; Formal analysis: PS; Writing-original draft: PS.

## Data availability statement

The data associated with this article are available in Supplementary Material #1.

## Ethical approval

As this study did not involve the collection of personal health-related data, it did not require ethical review in accordance with current Swiss legislation.

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