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Retracted Articles in Basic Medical Sciences: Characteristics and Citation Analysis based on Web of Science

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Abstract

Introduction: Parallel to the significant and global expansion of research activities, various examples of research misconduct are also increasing and, in many cases, lead to the retraction of scientific publications. This study aimed to examine the characteristics of retracted papers in the field of basic medical sciences and conduct their citation analysis.

Materials and Methods: This study was conducted using scientometrics and citation analysis. The statistical population comprised retracted papers related to selected fields of basic medical sciences in the Web of Science (n=1576) retrieved by the end of January 2022. The characteristics of these papers and their citations were analyzed.

Results: The countries with the most retracted papers were China, the US, and Japan. The shortest time interval for retraction belonged to pathology (0.07 months). Most retraction petitioners were authors and editorial teams. Most of the retractions involved research misconduct. The highest and lowest number of citations belonged to cell biology and anatomy and morphology, respectively.

Conclusion: The results provide a basic analysis for researchers in basic sciences to better understand the reasons for the retraction of papers. Journals, peer reviewers, and publishers should all play their roles in ensuring adherence to publishing ethics.

Keywords: Retracted Articles, Ethics, Scientometrics, Citation Analysis, Research Misconduct

1. Introduction

Nowadays, researchers must observe ethical and scientific standards and avoid scientific misconduct, including plagiarism, fabrication, manipulation, and fake peer review[1-2]. Many papers with scientific misconduct are identified and retracted by journals sometime after publication. This does not mean that these papers are completely removed; rather, in many cases, the editor or publisher informs the audience about their retraction. Although the retraction of

papers with scientific misconduct removes unethical and inaccurate studies from the scientific literature, citing such articles after retraction seriously challenges the accuracy of scientific efforts [3].

Scientific misconduct is defined as intentional or unintentional behaviors that lead to researchers' full or partial noncompliance with ethical and scientific standards, resulting in retraction. According to the COPE Guidelines, there are various types of scientific misconduct that lead to retraction, e.g., data falsification, manipulation, and distortion; plagiarism; duplicate publication; and fabrication. Based on the COPE Guidelines, data falsification and distortion occur when authors fabricate the data or deliberately distort the research report. Plagiarism refers to the use of other authors' text, images, and data without citing them. Duplicate publication occurs when the same paper is published in more than one journal. Conflicts between authors and the use of previously published data to write a new paper are other reasons for retraction [4].

Although retraction can happen in all domains of science, studies have shown that research in medical sciences is more susceptible to retraction [5-13]. The use of retracted findings in medical research directly harms scientific credibility and may lead to incorrect and even harmful conclusions [14]. The retraction of papers irreparably harms the credibility and international status of journals, as well as the credibility and professional status of authors. It also imposes heavy costs on institutions that provide research grants to researchers [15-16].

Some studies have focused on various dimensions of retraction in medical sciences, demonstrating the importance of monitoring scientific publications in these fields. For example, a review of retracted papers on radiology in the PubMed database showed that the most common reasons for retraction were incorrect results and methods (16 cases) and duplicate publications (16 cases) [17]. A study on retracted papers in the field of orthopedics revealed that 110 retracted papers were published in 67 journals by authors from 22 countries. The most common reason for retraction was fabricated data [18]. Due to the importance of this issue, researchers in other fields of medical sciences such as plastic surgery [8], dentistry [6], pharmaceutical research [7], nursing and midwifery [11], psychiatry [19], general and internal medicine [20], rehabilitation and sports sciences [21], anesthesia [22] and urology [23] have also investigated the reasons for retraction in these domains.

Given the importance and status of basic medical sciences and the lack of research into the status of scientific misconduct in this field, this study aimed to determine the characteristics of retracted papers, examine the nature of scientific misconduct, and analyze the citations made to this field. Basic medical sciences form the foundation of medicine, dentistry, pharmacy, and other clinical domains. The basic medical sciences course shapes medical students' academic progress and promotes their correct understanding of the next levels of medical education. Medical students can solve clinical problems with the knowledge and skills they acquire in the basic sciences course [23]. According to the classification made by the United States National Library of Medicine, basic medical sciences include anatomy, physiology, biochemistry, cell biology, genetics, pharmacology, microbiology, immunology, parasitology, and pathology [24].

Given the significance of basic medical sciences in the education of health professionals and these professionals' role and status in maintaining and improving the health of society, studying scientific misconduct in this field can assist in proper financial planning to conduct high-quality research. This study thus investigated the characteristics of retracted papers related to basic medical sciences.

2. Materials and Methods

Design and setting(s)

This descriptive study was conducted using scientometric techniques.

Participants and sampling

The research population comprised all retracted papers related to basic medical sciences indexed in the Web of Science. The fields searched in the Web of Science included Allergy, Anatomy and Morphology, Cell Biology, Genetics and Heredity, Immunology, Microbiology, Parasitology, Pathology, Pharmacology and Pharmacy, and Physiology. The papers were collected from the database without any time limit until the end of January 2022.

Data collection

To perform an advanced search of the Web of Science, the terms related to each subgroup of basic medical sciences were searched in the subject categories of the database. To collect the data, the Web of Science Category search tag (WC) was used to search the subject categories of this database (such as WC= allergy). Then, the retrieved items were limited by applying the Retracted Publication filter from the Article Type section. After applying the filters, the

bibliographic data of the papers were extracted from this database and saved as a Microsoft Excel file.

Data analysis

The data were analyzed using descriptive statistics (frequency, percentage, and mean) in Microsoft Excel 2019.

3. Results

Table 1 presents the information on the number of retracted papers divided by the selected fields of basic medical sciences in the Web of Science.

Of the 1576 retracted papers in the Web of Science, the contribution of cell biology to retraction was higher than that of the other fields (34%), followed by pharmacology and pharmacy (about 24% of the retracted papers). The lowest number of retracted papers belonged to allergy, anatomy and morphology, and parasitology (each with less than 1%).

Table 2 provides information about the 10 countries with the most retracted papers. This information was extracted based on the corresponding authors' organizational affiliation.

China had the highest number of retracted papers (n= 577), followed by the US (n=322) and Japan (n=129). The minimum, maximum, and mean time interval of article retraction is presented in Table 3.

The shortest interval for retraction was observed in pathology (0.07 months), while the longest period belonged to cell biology (1264.30 months). In the field of allergy, it took an average of 21.67 months for a paper to be retracted (the shortest interval), whereas in cell biology, retraction took an average of 52.33 months (the longest interval).

The retraction petitioners are listed in Table 4. According to Table 4, which was extracted based on retraction notices, most petitions for retraction were made by editors (713 documents, including 292 documents by the editor alone and 421 documents together with other people participating in the publication of the paper), followed by authors (678 documents, including 480 documents by the authors alone and 198 documents with other people participating in the publication of the paper).

Ten types of scientific misconduct observed in the retracted papers are presented in Table 5.

According to Table 5, which was extracted based on retraction notices, the most misconduct in the retracted papers involved *research misconduct* (837 documents, including 779 documents for research misconduct alone and 58 documents with other research misconducts), followed by *overlap* (272 documents, including 236 documents for overlap alone and 36 documents with other research misconducts).

The numbers of citations before and after retraction in various fields of basic medical sciences are presented in Table 6.

Most citations belonged to cell biology (n=24,550), of which 17,548 citations were made before the retraction and 4,290 citations were made after the retraction. Moreover, the fewest citations belonged to anatomy and morphology (n=121), of which 45 citations were made before and 55 after the retraction.

Table 1. The Number of Retracted Articles in Selected Fields of Basic Medical Sciences

Row	Fields	Number of papers	Percentage of total
1	Cell biology	536	34.01
2	Pharmacology and pharmacy	371	23.54
3	Immunology	196	12.44
4	Microbiology	195	12.37

5	Genetics	102	6.47
6	Pathology	79	5.01
7	Physiology	69	4.38
8	Allergy	10	0.63
9	Parasitology	10	0.63
10	Anatomical science and morphology	8	0.51
Total		1576	100

Table2. Ten Countries with the Most Retracted Papers in Selected Fields of Basic Medical Sciences

Row	Country	Number of Articles
1	China	577
2	The United States	322
3	Japan	129
4	India	85
5	South Korea	55
6	Iran	48
7	Germany	43
8	England	35
9	Italy	35
10	Canada	21

Table 3. Time Interval of Retraction in Selected Fields of Basic Medical Sciences

Fields	The Shortest Time Interval (months)	The Longest Time Interval (months)	The Average Time Interval (months)
Cell biology	0.93	1264.30	52.33
Pharmacology and pharmacy	0.56	245.83	44.47
Immunology	24.33	189.77	65.91
Microbiology	0.53	168.43	34.74
Genetics	1.03	141.8	36.65
Pathology	0.07	127.00	24.42
Physiology	2.03	310.46	52.26
Allergy	0.57	60.87	21.67
Parasitology	4.07	193.87	38.70
Anatomical science and morphology	1.97	59.40	36.71

Table 4. The retraction petitioners

Row	Retraction Petitioners	Number of Documents
1	Authors	480
2	Chief Editor	292
3	Chief Editor/Publisher	236
4	Authors/Chief Editor/ Publisher	105
5	Journals	76
6	Authors/Chief Editor	76

7	Publisher	45
8	Institutions	27
9	Authors/Journals	7
10	Authors/Institutions	4
11	Authors/Publisher	4
12	Journals/Authors	2
13	Institutions/Chief Editor/ Publisher	2
14	Chief Editor/Institutions	2
15	Not Reported	227

Table 5. Scientific Misconduct in the Retracted Papers

Row	Types of Scientific Misconduct	Number of Documents
1	Research Misconduct	779
2	Overlap	236
3	Plagiarism	109
4	Unintentional Mistake	101
5	Multiple Publications	85
6	Research Misconduct/ Overlap	36
7	Authorship Issues	22
8	Accidental Republication of the Article by the Journal	21
9	Fake Peer Review	20
10	Research Misconduct/ Plagiarism	22

Table 6. Citations Status of Retracted Papers in Basic Medical Sciences

Fields	All Received Citations	Citations before Retraction	Citations after Retraction
Cell biology	24550	17548	4290
Pharmacology and pharmacy	6903	3949	1577
Immunology	6535	4073	1641
Microbiology	5181	2423	1991
Genetics	4346	2542	1277
Pathology	1036	386	414
Physiology	1670	1001	429
Allergy	349	306	10
Parasitology	226	129	60
Anatomical science and morphology	121	45	55
Total	50917	32402	11744

4. Discussion

This study reviewed the retracted papers in selected fields of basic medical sciences and performed their citation analysis. China, the US, and Japan respectively had the most retracted papers in the Web of Science. Panahi and Soleimanpour [25] also found that the most retracted papers related to hematology were from the US. Mohamadloo and Batooli [26] examined the retracted papers in Scopus and found that the US, England, and Australia had the highest number of retracted papers. Morovati and Erfanmanesh [27] also examined the retracted papers in Springer and reported that China, Iran, and the US had the most retracted papers. Moreover, Morovati and Riahinia [28] investigated the retraction of papers related to endocrinology and metabolism and showed that most retracted papers were from the US. Although most of these studies have examined different fields of medicine, examination of the geographical origin of retracted papers in the selected fields of basic medical sciences indicates that all of them originated in countries with a long research history. The US and China have had more retracted papers compared to other countries in most studies. The ratio of publications is the highest in these countries due to the large number of researchers and their extensive research activities; therefore, it would be expected to find more retracted papers by authors based in these countries. One should also keep in mind the research policies of these countries and the conditions under which these papers were published. The type of journals that have published these papers and the nature of the review processes can also affect the submission and publication of papers with false information.

The shortest time interval for retraction of papers in the selected fields of basic medical sciences belonged to pathology, while the longest interval belonged to cell biology. Bennett et al. [29] examined retracted papers in the field of obstetrics and gynecology and

showed that the time interval between the publication and retraction of papers was one year on average. In Panahi and Soleimanpour's study [25], the average retraction time for hematology articles was 50.83 months. Rosenkrantz [17] reviewed the retracted papers on radiology and reported that the average retraction time after publication was 2.7 years. The retraction time can depend on the importance of the subject in scientific communities, the basic or applied nature of the article, and the system plagiarism and duplication check by the journals. In some cases, the results of some papers are distorted, or fictitious groups of patients are involved; the identification of such papers is time-consuming and arduous.

As for retraction petitioners, most petitions were made by authors, editorial groups, or jointly by the editor and the publisher. In the study by Morovati and Erfanmanesh [27], most retractions followed the petitions made by the editor, members of the editorial board, and the publisher. According to Panahi and Soleimanpour [25], the most retraction petitions came from the authors. Such petitions can be made by different groups and individuals, but in various fields of medical sciences, most petitions come from groups affiliated with journals (editors or publishers), followed by authors themselves. It seems that journal editors conduct reviews after publishing papers, or authors themselves accept their mistakes and ask for a retraction. Still, if journals provide notices and reasons for retraction, the credibility of authors and journals will be preserved in the scientific community.

In this study, most cases of misconduct involved research misconduct. Mohamadloo and Batooli [26] also showed that plagiarism, misconduct, and data fabrication are among the main reasons for retraction. Morovati and Riahinia [28] concluded most retractions in the field of endocrinology and metabolism were due to duplicate publication and manipulation. Panahi and Soleimanpour [25] reported scientific misconduct as the most common reason for the retraction of hematology papers. King et al. [13] also found that duplicate publication in the field of surgery was one of the main reasons for retraction. Dal-Ré and Ayuso studied the reasons and time of the retraction of genetics papers and reported that data fabrication and plagiarism were the most important reasons for retraction [30]. Therefore, despite the many reasons for retraction, research misconduct is the main reason. The findings presented in retracted papers are unreliable, and if they are presented to the scientific community, they can lead to incorrect therapeutic decisions or policies. After research misconduct, plagiarism was the most frequent reason for retraction, which is mainly due to authors' lack of attention to referencing or the unauthorized use of figures, data, and text. Although these cases can be identified quickly through plagiarism detection software, the identification of research misconduct is more difficult and time-consuming and requires more scrutiny from journals.

The highest and lowest number of citations received belonged to the domains of cell biology and anatomy and morphology, respectively. Rosenkrantz [17] showed an average citation of 10.9 to retracted articles. In Panahi and Soleimanpour's study [25], the average number of citations before the retraction of hematology papers was 15 times per article, and the total number of citations received by retracted articles in this field was 1560. Nair et al. [22] studied the reasons for the retraction of papers related to anesthesia and found that the most cited article was cited 197 times. Other retracted papers were cited only once by other papers after retraction. After publication, papers may receive citations as this is part of the research process; however, if retracted papers receive a citation after being retracted, it could be because they received a negative citation, i.e., other papers point out that these results lack scientific credibility and are, therefore, not to be trusted. It is also possible that the paper had been downloaded and cited by other researchers before receiving the retraction tag, and this was revealed much later due to the long process of publication.

5. Conclusion

Depending on its cause, the retraction of published papers can potentially have serious consequences for conducting research, presenting results, and the career trajectory of the authors of such papers. Scientific communities should encourage researchers to adhere to ethical considerations in publishing. Journals should also clearly and precisely mention the reasons for retraction. Although there is no single guideline for institutions, journals, and scientific societies to deal with retraction, manuals such as the guidelines of the Committee on Publication Ethics can be helpful. It seems that, despite the fact that journals mention in the description section of their websites that they have accepted membership in the Publication Ethics Committee, they have not in all cases adhered to the principles and guidelines provided by this system. This is important because the relevant guidelines of the Publication Ethics Committee clearly explain the review processes as well as the duties that peer reviewers, editorial board, and editors have regarding accepting an article. Therefore, possible errors by

journals in accepting an article in which one or more types of research misconduct have occurred may be due to the lack of complete familiarity of the aforementioned groups with the guidelines of this committee.

The retraction of papers published in selected fields of basic medical sciences occurred for various reasons; the results of the current study provide a basic analysis for researchers to better understand these reasons and pay more attention to guidelines on publication ethics. Furthermore, journals, peer reviewers, publishers, and research institutions should all help build a culture of trust and transparency and pay attention to publication ethics.

There were some limitations to this study. The study was solely based on the classification of the Web of Science, and more retracted papers may have been retrieved by searching for specialized key terms in each domain. Moreover, the study was limited to the information contained in the retraction notices, while the history of retraction was not examined using reliable secondary sources for further verification.

Similar studies should be conducted in other fields of medical sciences using different scientific databases such as Scopus or PubMed. Moreover, future studies should measure the level of awareness of editors and reviewers about retraction.

Ethical Considerations

Compliance with ethical guidelines

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Author's contributions

All authors contributed to the study conception and design. Conceptualization was conducted by Tabarraei Natanzi and Panahi; methodology, data collection, and data analysis were performed by Tabarraei Natanzi and Soleimanpour; data interpretation was performed by Tabarraei Natanzi, Panahi, Asadzandi and Soleimanpour. The first draft of the manuscript was written by Asadzandi, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Conflict of interest

The author(s) declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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