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Analysis of Retracted Publications in the Diabetes Literature

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Abstract

Background: Retraction serves as a critical corrective mechanism in scientific publishing, preventing the spread of flawed or misleading data. This study aimed to systematically analyze the characteristics of retracted articles within the field of diabetes research, highlight potential vulnerabilities in the integrity of diabetes research, and address gaps in understanding the nature and implications of research misconduct in this crucial medical discipline.

Methods: This study aimed to analyze retracted publications in the field of diabetes published from 1978 to 2024 using the Web of Science database. Information from the selected articles was obtained through the Retraction Watch Database. Extracted details included the journal title, type of article, country of origin, publication and retraction dates, number of authors, and reasons for retraction. The collected data were analyzed using descriptive statistical methods.

Results: Between 1978 and 2024, our review revealed 316 retracted articles. The journals Science (n = 1517) and The Lancet (n = 742) accounted for the highest number of these highly cited retractions, while the journals Biomed Research International (n = 31) and Diabetes (n = 15) accounted for the most cited of these retractions. The most common reasons for retraction were investigations initiated by the journal or publisher and concerns related to data integrity. The years with the highest number of retractions were 2023 (n = 91) and 2016 (n = 40), whereas the majority of retracted articles were initially published in 2022 and 2021 (n = 26). Collaborative research involving authors from China (n = 137), the United States (n = 71), and India (n = 24) was most frequently associated with these retractions.

Conclusion: Safeguarding the integrity of scientific literature, particularly in high-stakes fields such as diabetes research, requires a fundamental shift from reactive retractions to multilateral proactive systemic reform. Cultivating an ethical research culture (changing incentives to reward research quality and transparency over quantity by Institutions and funders); empowering researchers (providing the skills for rigorous and ethical research through mandatory, ongoing ethics training); and ensuring vigilant publishing (enforcing clear policies, rapidly investigating issues, and performing transparent retractions to protect the scientific record by journals).

Keywords: Retraction, Article, Publication, Plagiarism, Duplication, Ethics

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Introduction

With the increase in scientific publications worldwide, the phenomenon of scientific misconduct has also received greater attention. Empirical studies indicate that a substantial proportion of retractions in academic literature are attributable to various forms of scholarly misconduct (1, 2). Retractions of published articles pose a significant challenge to the integrity of scientific research, necessitating a thorough examination of their characteristics (1, 3, 4). The primary performance of journals is to address and disclose scientific misconduct or errors. Retractions remain relatively uncommon, with estimates suggesting a frequency of ≤0.02% (5, 6). However, empirical studies indicate a marked rise in retraction rates since the early 2000s, particularly within the medical and life sciences (5,

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↑What is "already known" in this topic:
Retractions are crucial for maintaining the integrity of scientific literature by correcting errors and preventing the dissemination of misleading research. The number of retracted diabetes research articles, like those in other biomedical fields, has risen in recent decades, indicating increased scrutiny and detection of errors or misconduct.

→What this article adds:
High-research-output countries (China, the USA, India, Republic of Korea) have more retractions due to pressure/oversight. International collaborations with high-publication countries also contribute to diabetes research retractions.

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7-10).

Consequently, many researchers have conducted extensive studies on retracted articles in the medical field broadly, as well as within its specialized subdisciplines. Although several studies have focused on retracted medical publications (11-17), and in the specific fields, for instance, ophthalmology (18), obstetrics (19), coronavirus disease 2019 (COVID-19) (20-22), medical imaging (23), cardiovascular medicine (24), pharmacy (25), perioperative medicine (26) and dentistry (27). None has specifically analyzed the diabetes related literature.

Diabetes research plays a critical role in advancing scientific understanding, improving clinical care, and shaping public health policies. Given the disease's global prevalence and impact, high-quality literature is essential for evidence-based practice. However, research misconduct—such as data fabrication, falsification, or plagiarism—poses serious risks by undermining credibility, distorting medical knowledge, and potentially harming patient outcomes.

Therefore, this study is the first to systematically analyze retractions in diabetes literature, addressing a gap in understanding ethical violations in this high-impact medical field. Furthermore, such measures would enhance policymakers' awareness and lay a foundation for fostering ethically sound, equitable, and rigorous research practices and operational measures throughout society. For example, it could help journal offices to implement mechanisms to promptly update citation databases and indexing services to prevent the inadvertent use of retracted work, thereby safeguarding the reliability and integrity of the medical records.

The present research was designed to answer these questions:

RQ1: What is the current status of retracted articles in diabetes literature based on scientometric indicators?

RQ2: Which are the top 10 publications in terms of citations?

RQ3: What is the status of retracted publications in diabetes literature based on country, journal, and publisher?

RQ4: How much is the distance between the publication date and the retraction date of retracted publications in the diabetes literature?

RQ5: What are the reasons for retracting publications in diabetes literature?

RQ6: How is the thematic map of retracted publications in diabetes literature?

RQ7: How is the international cooperation map of retracted publications in diabetes literature?

Methods

A comprehensive scientometric analysis was conducted using data extracted from the Web of Science (WoS) database on February 25, 2024. Developed by Clarivate Analytics, WoS is a leading database for scientometric and bibliometric research, offering high-quality journal indexing, robust citation metrics, extensive historical coverage, advanced analytical tools, interoperability with platforms such as Retraction Watch and InCites, and a broad multidisciplinary scope.

A systematic search strategy was implemented by combining relevant MeSH terms and keywords related to diabetes and its subtypes. The search encompassed all available records from the database's inception until February 25, 2024, yielding an initial dataset of 888,594 records. Subsequently, the dataset was refined by applying a document type (DT) filter to include only retracted publications, yielding a final subset of 316 records for further analysis. Detailed methodological data are presented in **Error! Reference source not found.**.

Bibliometric metadata were extracted from WoS, including document title, journal name, journal impact factor (JIF), citation count, corresponding author and affiliation, collaborating countries, and author keywords. Additionally, the scientometric indicators of retracted publications in the diabetes literature (eg, H-index (Hirsch's index), average per item, and so on) as given in Table , were extracted. The data were exported in tab-delimited format and processed using Microsoft Excel for preliminary analysis.

To identify retraction reasons (eg, ethical violations, methodological flaws, or data integrity issues), the 316 retracted publications were cross-referenced with the Retraction Watch database.

For bibliometric network visualization, VOSviewer (Version 1.6.20) was employed to generate keyword co-occurrence maps (identifying research hotspots) and international collaboration networks (mapping country partnerships). These visualizations facilitate the detection of dominant research clusters and collaboration trends in the field.

Results

1. What is the status of retracted publications in the diabetes literature based on scientometric indicators?

The status of retracted publications in diabetes literature reveals significant academic impact despite their retraction (**Error! Reference source not found.**Table). H-index of 51 suggests that many of these publications were highly cited, indicating their initial influence on the field.

Table 1. Detailed methodological data for the bibliometric analysis

Area	Description
Scientific database	Web of Science (WoS) core collection
String	(TS=(diabet*) OR TS=("Diabetes Mellitus") OR TS=("Diabetes Insipidus") OR TS=("TYPE 1 DIABETES") OR TS=("DIABETES TYPE 1") OR TS=("DIABETES TYPE 2") OR TS=("TYPE 2 DIABETES")) AND DT=(Retracted Publication)
Document Type	Retracted Publication
Publication year	Until February 25, 2024
Language	No restriction

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Table 2. Status of retracted publications in the diabetes literature based on scientometric indicators

H-Index	Average per item	Publications	Times Cited	Citing Articles
51	37.21	316	11,759	11,453

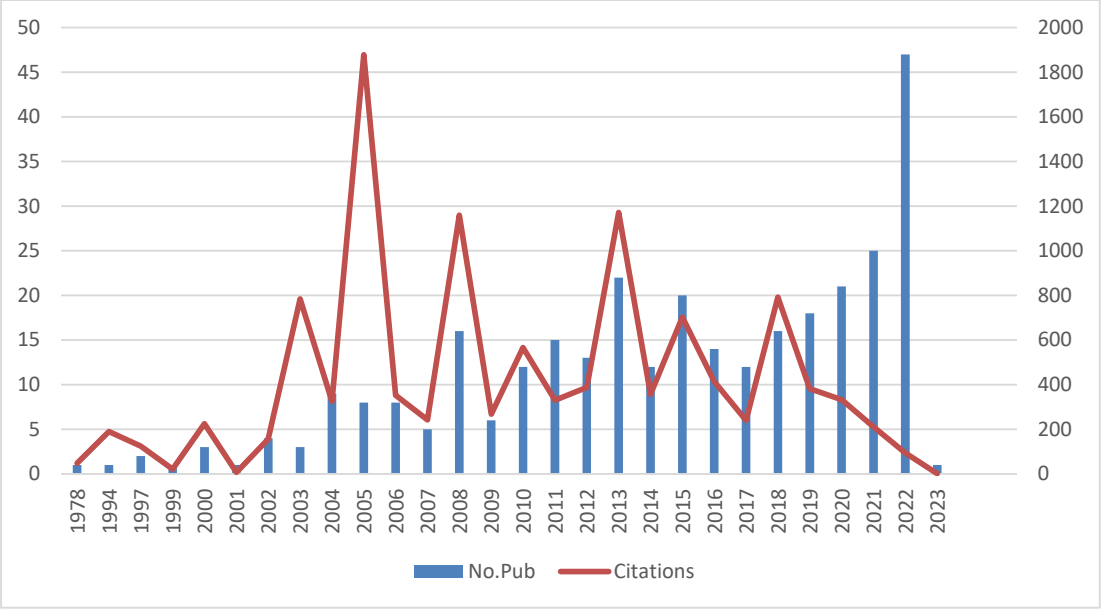

Figure 1. The retraction status of articles in the field of diabetes in different years

On average, each retracted publication was cited 37.21 times, reflecting considerable engagement from the research community before its retraction. The 316 retracted publications collectively amassed 11,759 citations from 11,453 citing articles.

Figure 1 illustrates the trends in retracted publications and their citations in the diabetes literature over time. From 1977 to the early 1990s, the number of retracted publications and their citations remained low. However, starting in the mid-1990s, both metrics show a noticeable increase, with a significant surge after 2000. The number of retracted publications peaks around 2018-2021, with a corresponding sharp rise in citations, reaching over 800 in the same period. Also, the years 2023, 2001, and 1999 have had the lowest rates of article retractions, respectively. However, the number of retracted articles in 2023 may increase over time.

2. Which are the top 10 publications in terms of citations?

The top 10 retracted publications in the diabetes literature, as listed in Table 3, demonstrate a range of issues that led to their retraction. The most-cited retraction is the 2005 article from Science on Visfatin, which garnered 1517 citations before being retracted in 2007 due to multiple concerns, including data issues and author objections. The second most cited, with 742 citations, is the 2003 Lancet article on combination treatment in renal disease, which was retracted in 2009 for multiple serious concerns, including ethical violations and irreproducible results. Other notable retractions include a 2018 New England Journal of Medicine article and a 2014 Lancet study, each retracted due to significant analytical errors and methodological flaws.

If the authorship pattern report is based on the following categories: single author, dual author, 3 authors, 4 authors, 5 authors, and >5 authors, then most of the top 10 articles follow the more than five-author pattern.

3. What is the status of retracted publications in the diabetes literature based on country, journal, and publisher?

In Table 4, the status of retracted publications in the diabetes literature varies significantly by country, journal, and publisher. The most significant contributor is China, accounting for 137 out of 316 retracted articles (43.35%). The USA follows with 71 retracted publications (22.47%), and India ranks third with 24 retractions (7.60%).

The journal Biomed Research International has the highest number of retracted publications, with 31 (9.81%). Diabetes and oxidative medicine and cellular longevity are also notable, with 15 (4.75%) and 10 (3.17%) retractions, respectively. Hindawi Publishing Group leads among publishers, with 56 retractions (17.72%), followed by Elsevier with 49 (15.51%) and Springer Nature with 39 (12.34%). However, among countries, Germany (n = 9) and Republic of Korea (n = 9); among journals, Frontiers in Physiology (n = 4), Journal of Biological Chemistry (n = 4), and Journal of Clinical Investigation (n = 4); and among publishers, Taylor & Francis (n = 7) and Public Library of Science (n = 7) had the lowest rates of article retractions.

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Table 2. Top ten publications in terms of citations

TI	No. of Authors	SO	TC	PU	PY	RY	Reasons for Retraction
Visfatin: A protein secreted by visceral fat that mimics the effects of insulin	22	SCIENCE	1517	AMER ASSOC ADVANCEMENT SCIENCE	2005	2007	Concerns/Issues About Data Concerns/Issues About Results Investigation by Company/Institution Objections by Author
Combination treatment of angiotensin-II receptor blocker and angiotensin-converting-enzyme inhibitor in non-diabetic renal disease (COOPERATE): a randomised controlled trial	6	LANCET	742	ELSEVIER SCIENCE INC	2003	2009	Bias Issues or Lack of Balance Concerns/Issues About Data Error in Analyses Ethical Violations by the Author Informed/Patient Consent - None/Withdrawn Investigation by Company/Institution Lack of Approval from Company/Institution Results Not Reproducible
Relationship between Clinic and Ambulatory Blood-Pressure Measurements and Mortality	10	NEW ENGLAND JOURNAL OF MEDICINE	354	MASSACHUSETTS MEDICAL SOC	2018	2020	Error in Analyses Error in Dat
ST-segment elevation myocardial infarction in China from 2001 to 2011 (the China PEACE-Retrospective Acute Myocardial Infarction Study): a retrospective analysis of hospital data	10	LANCET	306	ELSEVIER SCIENCE INC	2014	2015	Error in Methods Error in Results and/or Conclusions Retract and replace
Transcription factor 7-like 2 regulates β-cell survival and function in human pancreatic islets	6	DIABETES	217	AMER DIABETES ASSOC	2007	2014	Concerns/Issues About Data Investigation by Company/Institution Investigation by Journal/Publisher Upgrade/Update of Prior Notice Duplication of Image Error in Data Error in Image Investigation by Company/Institution Investigation by Journal/Publisher Objections by Author Unreliable Data Upgrade/Update of Prior Notice
Worldwide burden of cancer attributable to diabetes and high body-mass index: a comparative risk assessment (Retraction of Vol 6, Pg 95, 2018)	6	LANCET DIABETES & ENDOCRINOLOGY	212	ELSEVIER SCIENCE INC	2017	2018	Error in Analyses Error in Methods Error in Results and/or Conclusions Retract and Replace

These data underscore the global nature of retraction issues and highlight specific journals and publishers with higher incidences, pointing to the need for enhanced scrutiny and quality control in scientific publishing.

4. How much is the distance between the publication date and the retraction date of retracted publications in the diabetes literature?

Figures 2 and Table 5 provide insights into the trend and timing of retracted publications in diabetes literature. The graph displays the number of articles published (PY-fre) and retracted (RD-fre) each year from 2000 to 2024. There is a noticeable rise in published and retracted articles over time, with significant peaks in 2016 (n = 40) and 2023 (n = 91).

The distance between the publication and retraction dates varies significantly, indicating that retraction can occur shortly after publication or many years later. For instance, in 2022, a total of 70 articles were published, but only 21 were retracted that same year.

Conversely, 91 articles were retracted in 2023, indicating a lag in identifying issues. The data highlights the im-

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Table 3. Continued

TI	No. of Authors	SO	TC	PU	PY	RY	Reasons for Retraction
Remission in models of type 1 diabetes by gene therapy using a single-chain insulin analogue	5	NATURE	187	NATURE PUBLISHING GROUP	2000	2009	Results Not Reproducible Unreliable Results
Effects of vitamin D supplementation on glucose metabolism, lipid concentrations, inflammation, and oxidative stress in gestational diabetes: a double-blind randomized controlled clinical trial (Publication with Expression of Concern. See vol. 112, pg. 1406, 2020)	5	AMERICAN JOURNAL OF CLINICAL NUTRITION	164	OXFORD UNIV PRESS	2013	2020	Concerns/Issues About Data Concerns/Issues About Results Investigation by Journal/Publisher Updated to Retraction Concerns/Issues About Data Upgrade/Update of Prior Notice
Multimorbidity - not just an older person's issue. Results from an Australian biomedical study	8	BMC PUBLIC HEALTH	160	BMC	2010	2011	Duplicate Publication through Error by Journal/Publisher
Alpha-lipoic acid supplementation and diabetes	2	NUTRITION REVIEWS	154	OXFORD UNIV PRESS INC	2008	2012	Concerns/Issues about Referencing/Attributions Euphemisms for Plagiarism Plagiarism of Text

TI= Title, SO= Source, TC= Total Citations, PU= Publisher, PY= Publication Year, RY= Retraction Year

Table 4. Status of retracted publications in the diabetes literature based on country, journal, and publisher

Rank	Country			Journal			Publisher		
	Name	Record Count	% of 316	Name	Record Count	% of 316	Name	Record Count	% of 316
1	Peoples R China	137	43.354	Biomed Research International	31	9.810	Hindawi Publishing Group	56	17.722
2	USA	71	22.468	Diabetes	15	4.747	Elsevier	49	15.506
3	India	24	7.595	Oxidative Medicine And Cellular Longevity	10	3.165	Springer Nature	39	12.342
4	Japan	21	6.646	Disease Markers	8	2.532	Wiley	22	6.962
5	Italy	13	4.114	Plos One	7	2.215	Amer Diabetes Assoc	15	4.747
6	Saudi Arabia	13	4.114	European Review For Medical And Pharmacological Sciences	6	1.899	Lippincott Williams & Wilkins	12	3.797
7	England	11	3.481	Life Sciences	6	1.899	Oxford Univ Press	9	2.848
8	Iran	10	3.165	Frontiers In Physiology	4	1.266	Frontiers Media Sa	8	2.532
9	Germany	9	2.848	Journal Of Biological Chemistry	4	1.266	Public Library Science	7	2.215
10	South Korea	9	2.848	Journal Of Clinical Investigation	4	1.266	Taylor & Francis	7	2.215

portance of ongoing scrutiny and the variability in the retraction timeline, as some retractions occur within a few years (eg, 2020 with 13 publications and 23 retractions), while others can take over a decade (eg, 2011 with 20 publications and 12 retractions). This trend underscores the ongoing challenges in maintaining scientific integrity and the need for vigilance in monitoring published research.

Figure 3 illustrates the distribution of retraction timeframes for articles in the diabetes literature, categorized by the number of years between publication and retraction. The majority, 83%, of articles were retracted within 5 years of publication, highlighting a relatively quick identification of issues in these studies. Another 12% were retracted between 5 and 10 years after publication, indicating a more extended period before retraction. A smaller fraction, 4%, of articles were retracted between 10 and 15 years after publication, and only 1% were retracted between 15 and 20 years. Notably, no articles were retracted >20 years after publication. The data underscore that while most retractions occur relatively soon after publication, a significant number of studies remain in the literature for extended periods before being retracted, emphasizing the need for continuous, long-term scrutiny of scientific research.

5. What are the reasons for retracting publications in the diabetes literature?

Table 6 categorizes the reasons for retracting publications in the diabetes literature, highlighting the diverse issues that can undermine scientific integrity. The most frequent reason is investigations by journals or publishers, accounting for 85 retractions, followed by concerns or issues about data, which prompted 55 retractions. Image duplication and investigations by companies or institutions are also significant, causing 49 and 46 retractions,

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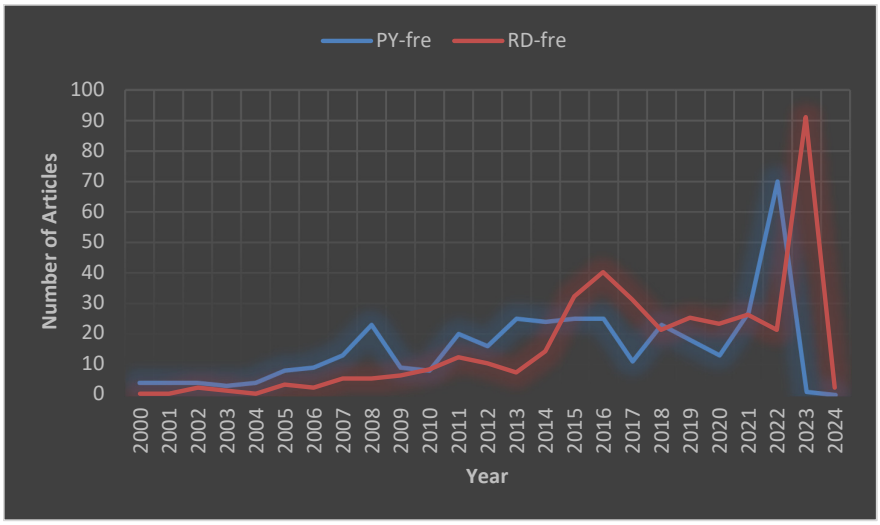

Figure 2. Distance between the publication date and the retraction date retracted publications in the diabetes literature

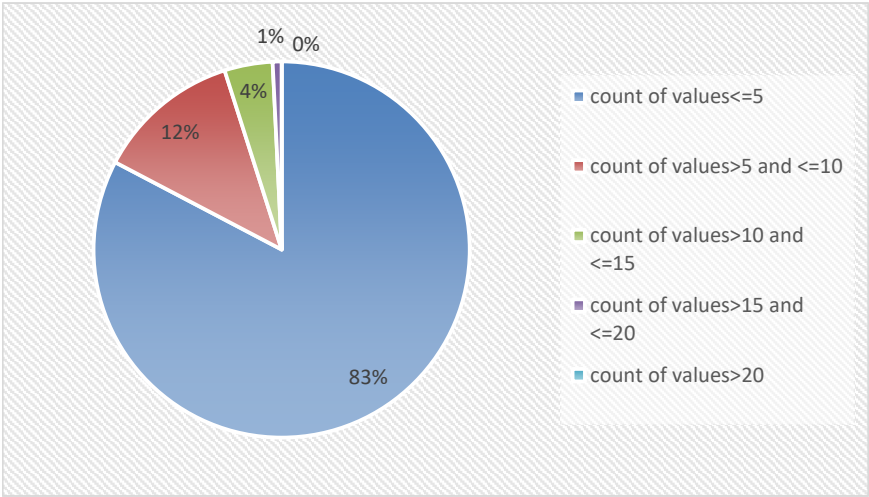

Figure 3. The percentage of retraction of articles in the given time periods

Table 5. Distance between the publication date and the retraction date of retracted publications in the diabetes literature

Row	Year	PY-fre	RD-fre	Row	Year	PY-fre	RD-fre
1	2024	0	2	14	2011	20	12
2	2023	1	91	15	2010	8	8
3	2022	70	21	16	2009	9	6
4	2021	27	26	17	2008	23	5
5	2020	13	23	18	2007	13	5
6	2019	18	25	19	2006	9	2
7	2018	23	21	20	2005	8	3
8	2017	11	31	21	2004	4	0
9	2016	25	40	22	2003	3	1
10	2015	25	32	23	2002	4	2
11	2014	24	14	24	2001	4	0
12	2013	25	7	25	2000	4	0
13	2012	16	10				

respectively. Other notable reasons include unreliable results (29 retractions), concerns about images (28 retractions), and article duplication (25 retractions). Less frequent but essential causes involve plagiarism, data errors, and referencing or attribution issues. Rare reasons, such as ethical violations by authors, lack of third-party approval, and copyright claims, resulted in one retraction. Less frequent but essential causes involve plagiarism, data errors, and referencing or attributions issues. Rare reasons, such as ethical violations by authors, lack of approval from third parties, and copyright claims, resulted in one retraction. These infrequent occurrences highlight the critical role of diligence and ethical conduct in academic publishing. Maintaining data integrity, providing proper attribu-

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Table 6. Reasons for retracting publications in the diabetes literature

Row	Reason	Frequency	Row	Reason	Frequency
1	Investigation by Journal/Publisher	85	36	Legal Reasons/Legal Threats	7
2	Concerns/Issues About Data	55	37	Concerns/Issues About Authorship	6
3	Duplication of Image	49	38	Conflict of Interest	6
4	Investigation by Company/Institution	46	39	Duplication of Data	6
5	Notice - Limited or No Information	30	40	Error in Methods	6
6	Unreliable Results	29	41	Error in Text	6
7	Concerns/Issues About Image	28	42	Falsification/Fabrication of Image	6
8	Duplication of Article	25	43	Error in Results and/or Conclusions	5
9	Investigation by Third Party	22	44	Fake Peer Review	5
10	Manipulation of Images	22	45	Lack of IRB/IACUC Approval	5
11	Upgrade/Update of Prior Notice	21	46	Retract and Replace	5
12	Plagiarism of an Article	19	47	Objections by Third Party	4
13	Error in Data	17	48	Duplication of Text	3
14	Error in Image	16	49	False Affiliation	3
15	Concerns/Issues about Referencing/Attributions	15	50	Plagiarism of Text	3
16	Objections by Author	15	51	Randomly Generated Content	3
17	Concerns/Issues with Peer Review	14	52	Concerns/Issues about Human Subject Welfare	2
18	Date of Retraction/Other Unknown	14	53	Ethical Violations by the Author	2
19	Withdrawal	11	54	Lack of Approval from the Author	2
20	Concerns/Issues About Results	9	55	Notice - Lack of	2
21	Error in Analyses	9	56	Plagiarism of Image	2
22	Misconduct - Official Investigation/Finding	9	57	Withdrawn to Publish in a Different Journal	2
23	Paper Mill	9	58	Cites Retracted Work	1
24	Results Not Reproducible	9	59	Concerns/Issues about Third-Party Involvement	1
25	Unreliable Data	9	60	Copyright Claims	1
26	Author Unresponsive	8	61	Error by Journal/Publisher	1
27	Breach of Policy by Author	8	62	Error by Third Party	1
28	Euphemisms for Plagiarism	8	63	Error in Cell Lines/Tissues	1
29	Falsification/Fabrication of Data	8	64	Informed/Patient Consent - None/Withdrawn	1
30	Misconduct by Author	8	65	Lack of Approval from Third Party	1
31	Original Data not Provided	8	66	Misconduct by Third Party	1
32	Unreliable Image	8	67	Not Presented at Conference	1
33	Updated to Retraction	8	68	Notice - Unable to Access via current resources	1
34	Euphemisms for Duplication	7	69	Rogue Editor	1
35	False/Forged Authorship	7			

tion, and respecting copyright are paramount to ensuring the reliability and trustworthiness of scholarly work. Addressing these less frequent but significant factors contributing to retractions is essential for upholding the integrity of the scientific record.

6. How is the thematic map of retracted publications in the diabetes literature?

The thematic map of retracted publications in the diabetes literature, as visualized in VOSviewer, highlights interconnected themes in diabetes research (Figure 4). The central nodes in this map include "insulin resistance," "gene expression," and "diabetes mellitus," indicating that these topics are heavily researched and interlinked in retracted publications. Surrounding these central nodes are related themes such as "diabetic nephropathy," "risk factors," "diabetic retinopathy," and "hyperglycemia," suggesting a broad scope of interconnected subtopics. Additionally, nodes like "mechanism," "pathways," and "PPAR-gamma" indicate a focus on the underlying biological mechanisms and molecular pathways involved in diabetes. The map also includes nodes for specific conditions and factors such as "cardiomyopathy," "collagen," and "fibrosis," highlighting the diverse implications and complications associated with diabetes. This thematic clustering reflects the complexity and multifaceted nature of diabetes research, emphasizing the interconnectedness of various biological, clinical, and epidemiological factors in studying diabetes and its complications.

7. How is the international cooperation map of retracted publications in the diabetes literature?

The international collaboration map generated by VOSviewer (as depicted in Figure 5) provides a visual representation of the collaborative relationships present within the realm of retracted diabetes research publications. Notably, China emerges as the most prominent node within this network, a visual indicator of its central and significant role in the landscape of retracted publications in diabetes research. This prominence suggests that a considerable portion of retracted diabetes-related studies involved researchers or institutions based in China. Beyond China, several other countries also manifest as notable nodes in the VOSviewer map. India, Japan, and Italy are among these, signifying that these nations have also made substantial contributions to diabetes research that, unfor-

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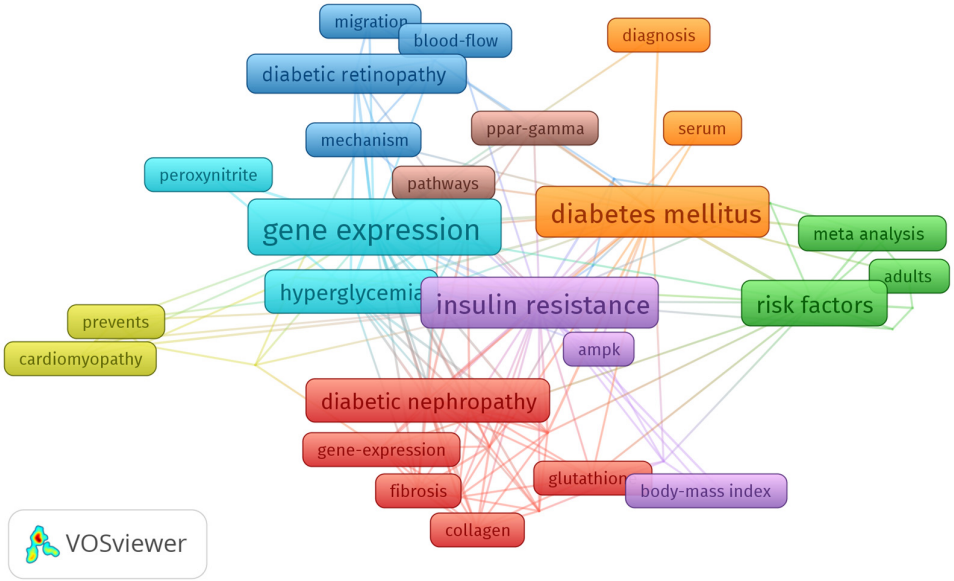

Figure 4. Thematic map of retracted publications in the diabetes literature

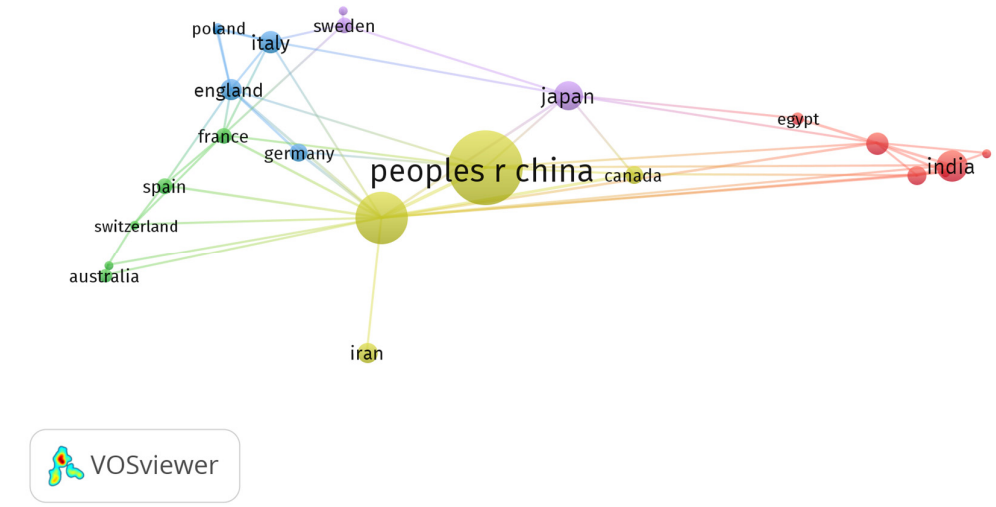

Figure 5. International cooperation map of retracted publications in the diabetes literature

tunately, resulted in retractions. The prominence of these countries as nodes underscores the global distribution of issues that lead to publication retractions in this field. The map further illustrates strong collaborative links among specific nations, revealing the intricate web of international research partnerships. China, in particular, demonstrates robust collaborative connections with several other prominent research nations, including the United States, Canada, Germany, England, and Italy. These connections highlight the frequency and intensity of joint research endeavors between these countries in the field of diabetes, some of which have, regrettably, led to retracted publications. Other countries, such as Iran, Egypt, and Sweden, are also represented on the map, though their nodes appear smaller. This indicates a less pronounced, but still relevant, level of participation in collaborative diabetes research that has led to retractions. While their involvement may be less extensive than that of the leading nations, their presence on the map reinforces the global scope of the issue. This observation strongly underscores the need for enhanced scrutiny and more rigorous evaluation of research practices, particularly in collaborative projects spanning multiple countries and institutions, to maintain the integrity and reliability of published scientific findings in diabetes research.

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Discussion

The retraction of scientific papers serves as a mechanism to correct the scholarly record when necessary. Articles may be withdrawn for a range of reasons, such as intentional data manipulation, absence of required ethical approvals (including IRB clearance), misuse of statistical methods, or other breaches of research ethics. Several earlier investigations have explored the features and patterns associated with retracted publications (28-30). An earlier review of Medline retraction notices spanning 1988 to 2008 reported that the most frequent causes for retraction were honest mistakes or irreproducible results (40%), research misconduct (28%), and duplicate publication (17%). These results were largely consistent with a previous analysis of Medline articles from 1982 to 2002, which found that 27% of retractions were due to misconduct, while the majority (62%) were attributable to errors. In contrast, a more recent study by Fang et al, analyzing over 2,000 retracted articles in the biomedical and life sciences, found that scientific misconduct accounted for 67.4% of retractions, with only 21.3% resulting from errors (29, 31) which is consistent with the results of this study.

Unethical conduct remains a significant obstacle to the progress of scientific research. Between 2010 and 2023, the number of medical articles retracted due to ethical violations has varied. The primary causes of these retractions included problems with ethical approvals, concerns about data integrity, and issues with informed consent. Most of the retracted articles were indexed in reputable, well-recognized databases (29). This is consistent with the results of this study.

In this study, between 1978 and 2024, 316 retracted articles were cited a total of 11,759 times. In the study by Budd et al., which examined retractions in the Medline database from 1966 to 1997, a total of 235 retracted articles were cited 2,034 times following their retraction notices. Upon closer inspection of 299 of these citations, the retraction was explicitly acknowledged in only 19 cases (29, 32, 33). In 2010, Neal et al reported that merely 5% of articles citing a publication retracted due to scientific misconduct acknowledged the retraction (29, 34). These findings indicate that retracted articles are often still cited as if they were valid, which can contribute to the dissemination of errors throughout the scientific literature (29).

The distribution of retraction timeframes for articles in the diabetes literature, categorized by the number of years between publication and retraction. The majority, 83%, of articles were retracted within five years of publication, highlighting a relatively quick identification of issues in these studies. Ozair's study in 2021 demonstrated that the median time to retraction after publication was 1.45 (3.08) years (35). Retractions typically receive far less attention than the original publications and can often be overlooked. Researchers might cite retracted articles unknowingly, either because the retraction notice was issued after their manuscript was submitted, because electronic reference management tools do not automatically update to reflect retractions, or because they are referencing print versions without being aware of subsequent retraction (36).

In this study, retractions stemming from ethical violations showed two prominent peaks in 2023 and 2016, with a smaller peak observed in 1995. While some articles across various biomedical disciplines indicate a rising trend in retraction numbers over time, others do not corroborate this pattern. Variations across biomedical subfields, countries, and time periods may explain these discrepancies (9, 27. 37-39). Our study spans 1978 to 2024, covering more than 10 years and including over 316 articles, which we consider sufficient to detect emerging trends. By emphasizing more recent data, we also aim to offer an up-to-date perspective on retractions resulting from ethical violations.

The leading causes of retraction were, in order of frequency, Investigation by Journal/Publisher, Concerns/Issues About Data (any question, controversy, or dispute about any of the data), Duplication of Image, and Investigation by Company/Institution. Retraction analyses across different disciplines, time periods, and databases highlight a variety of causes, including plagiarism, duplication, errors, data fabrication or falsification, unreliable data, and other forms of fraud (19, 39-43).

SCIENCE and The Lancet were the 2 journals that stood out by far in the number of highly cited retracted articles. The journals Biomed Research International (n = 31) and The Diabetes (n = 15) accounted for most of these retractions. This outcome has been linked to a “publish first, judge later” mentality. A significant portion of retracted articles appeared in journals indexed in well-recognized databases. The high frequency of retractions in these reputable journals may reflect their wide readership, which provides greater opportunities for scrutiny and feedback from experienced researchers. Such feedback can help identify and report ethical breaches, leading to the retraction of articles that fail to meet ethical standards. No country or journal is entirely immune to publishing unethical research. An essential strategy for preventing ethical violations is to ensure that publications are widely accessible to the scientific community, enabling knowledgeable readers to detect and report both minor and major errors (15).

The prevalence of themes such as "insulin resistance," "gene expression," and "diabetes mellitus" in retracted publications is no coincidence. It stems from a combination of the scientific importance, commercial pressure, governmental policies, and the technical complexity of these areas, which together create a perfect environment for both intentional fraud and questionable research practices. "Diabetes mellitus" is the overarching field, and "insulin resistance" is one of its most fundamental pathological mechanisms. Research in these areas is massive because diabetes is a global pandemic, driving immense research funding and publication pressure. Also, this area is directly linked to the development of multi-billion-dollar drugs (eg, metformin, SGLT2 inhibitors, GLP-1 agonists like Ozempic); hence, discoveries here have tremendous commercial potential. "Gene expression" is the modern frontier of diabetes research. Understanding which genes are turned on/off in diabetes is key to unlocking new genetic, diagnostic, and therapeutic insights.

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Gene expression data is vast and complex. Its analysis requires sophisticated skills. Researchers may intentionally or unintentionally conduct studies leading to errors.

Overall, the current study doesn't show that research in insulin resistance or gene expression is inherently unethical. Instead, it highlights that these are high-value, high-stakes, and technically complex areas of study. This combination attracts both the best scientists and, unfortunately, the worst actors. The pressure to publish groundbreaking findings in these central topics creates an environment where ethical boundaries are sometimes crossed, leading to a disproportionate number of retractions.

In the country-level analysis, China, the USA, the Republic of Korea, and India emerged as leading contributors. Multiple studies on retractions in the biomedical literature have similarly identified these countries (15, 23, 43-47). Several factors may influence these findings. Countries leading in retractions often have large populations and sizable research communities, suggesting that assessing retractions relative to the number of researchers could provide a more precise perspective. Furthermore, early-career or less-experienced researchers, particularly in developing countries, may be more susceptible to ethical lapses. High levels of competition in the scientific arena can increase pressure on researchers, potentially contributing to unethical practices (15). The rise in retractions of Chinese scientific articles is linked to the country's rapid growth in research output. China's publication volume, exceeding one million articles in 2023, has increased scrutiny, leading to a higher rate of retraction as issues are more readily identified (48).

Conclusion

This study highlights the complex and evolving nature of scientific retractions, particularly those arising from ethical violations. Over the examined period (1978–2024), a discernible upward trend in the number of retracted articles was observed, reflecting both increased scrutiny and persistent ethical challenges within the scientific publishing ecosystem. A critical concern revealed by this study is the continued citation of retracted articles, often without acknowledgment of their retraction status. This persistent citation of invalidated research poses significant risks to the integrity of scientific knowledge and highlights the need for more robust systems of citation alerting and database synchronization. Taken together, these findings underscore the importance of proactive strategies to minimize research misconduct and its consequences. These may include mandatory research ethics training, stricter editorial oversight, transparent peer-review processes, and enhanced post-publication monitoring mechanisms. Additionally, efforts should be directed toward educating researchers, particularly early-career scientists, about the implications of retraction and the critical need to avoid citing retracted work. While retractions play a vital role in maintaining the self-correcting nature of science, they also reveal systemic weaknesses that must be addressed through coordinated action among academic institutions, publishers, funding bodies, and individual researchers. Ensuring the integrity of the scientific record requires sustained commitment to ethical standards, transparency, and accountability across all levels of the research enterprise.

Suggestions for Future Research

Comparative analysis of retraction rates across different scientific disciplines.

Examination of the impact of editorial policies and peer-review processes on preventing the publication of articles with a high risk of retraction.

Evaluation of the effectiveness of reference management software and alert systems in identifying retracted articles.

Analysis of the motivations and organizational structures of research institutions in countries with high retraction rates.

Investigation of researchers' awareness and attitudes toward article retraction and their citation behaviors.

Development of predictive models for article retraction based on publication patterns, authorship, and data characteristics.

Study of the consequences of citing retracted articles in future research and science policy-making.

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Conflict of Interests

The authors declare that they have no competing interests.

Authors' Contributions

Somayeh Parvin: Conceptualization, data gathering, data analysis, writing—review & editing;

Mahshid Lotfi: investigation, writing—original draft, writing—review & editing;

Mohsen Nouri: investigation, methodology, writing—review & editing.

Ethical Considerations

This study was conducted with the approval of the ethics committee of Abadan University of Medical Sciences, Iran (IR.ABADANUMS.REC.1402.155).

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Data availability

The data underlying the results of this study can be obtained from the corresponding author upon reasonable request.

AI Use Statement

N/A.

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