

2º CICLO DE ESTUDOS
MESTRADO EM EDUCAÇÃO ACADÉMICA E CLÍNICA

Retracted Publications in Medical Education: Systematic Review

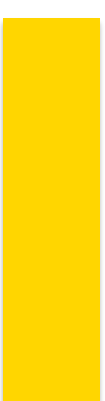
Sara Raquel Gamelas Peres Barbosa Coelho

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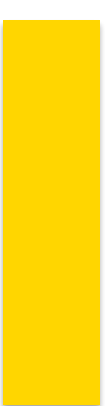
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ORIENTAÇÃO
PROFESSORA DOUTORA LAURA RIBEIRO
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FACULDADE DE MEDICINA



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ABSTRACT

Introduction: Research Integrity is based on fundamental principles, including reliability, honesty, respect, and accountability. Practices that threaten these standards are classified as research misconduct and lead to retraction. Although several medical fields of study have raised retracted publications as a concern, this has not been explicitly investigated in medical education. Hence, the main aim of this study is to examine the characteristics of retracted publications in medical education.

Methodology: An electronic search was performed during June 2023 in three databases: PubMed, Web of Science and Scopus, to identify all the retracted publications in medical education. We extracted the characteristics of the authors, the publication journals, the citations and the retraction notices.

Results: Out of 1005 articles initially identified, a total of 12 publications were included in this systematic review. 50% of the publications were published after 2020, being 42% of the studies from China. The average impact factor of the journals was 3.135 and the *Journal of Healthcare Engineer* published 25% of all publications. Among all the citations found, 74 happened after retraction date and none of them was used as an example of misconduct or to refer to the retraction itself. The most common reasons for retraction were duplicate publication (25%) and systematic manipulation of the publication process (25%), followed by peer review concerns (17%).

Conclusion: As a first approach to analyse the characteristics of retracted publications in the medical education field, this study shows evidence that the number of retracted publications is increasing. Retraction notices tend to be ambiguous and unclear without enough information regarding the request or the reasons of retraction. All of these findings affect the truthfulness and transparency of medical education research and integrity. More efforts need to be done to standardize and improve the retraction notice availability, and researchers, journals, academic institutions and funders have to be more aware and publicise this growing problem, playing a key role to prevent the dissemination of misconduct and fraud in medical education research among the academic and scientific communities.

Key-Words: Medical Education; Retracted Publications; Scientific Misconduct; Scientific Fraud

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LIST OF ABBREVIATIONS, INITIALS, AND ACRONYMS

% - percentage

1st – first

COPE – Committee on Publication Ethics

e.g. – for example

Fig. – Figure

i.e. – that is

FFP – Fabrication, Falsification, and Plagiarism

N - Number

Q – Quartile

QRP – Questionable Research Practices

PRISMA – Preferred Reporting of Items for Systematic Reviews and Meta-Analysis

RRPs – Responsible Research Practices

INTRODUCTION

Research Integrity refers to the “principles and standards that have the purpose to ensure validity and trustworthiness of research” (WCRI, 2023) and is based on fundamental principles, including reliability, honesty, respect, and accountability (ALLEA, 2023). Another core elements for research integrity are rigor; transparency and open communication in declaring conflicts of interest; and care and respect for all participants in and subjects of research (House of Commons, 2018). Practices that might threaten these standards are classified as research misconduct (Stavale et al., 2019) and can compromise the validity and reliability of research results (Wager et al., 2009).

There is evidence that separates three groups of behaviors related with research integrity. Responsible research practices (RRPs) which are the ideal and expected behaviors from researchers; deliberate research misconduct or serious breaches of research integrity which includes fabrication, falsification, and plagiarism (FFP) as the worst behavior; and questionable research practices (QRP) which includes inaccuracy, misrepresentation and bias in research and publishing (House of Commons, 2018; Komić, et al., 2015; WCRI, 2023).

Problems with research can lead to retraction which is a “mechanism for correcting the literature and alerting readers to articles that contain such seriously flawed or erroneous content or data that their findings and conclusions cannot be relied upon” (COPE, 2009). The retraction main intent is to correct the literature and ensure its integrity. Notices of retraction should be published in all journal versions and should refer the reasons of retraction as well as specify who is retracting the publication (Wager et al., 2009). Study retracted publications is important to support measures to avoid misconduct and error (Stavale et al., 2009).

Reasons for retraction include several types of scientific misconduct and errors as plagiarism, data fabrication or falsification, unethical author conduct, redundant publications, peer review concerns, data without authorization, copyright infringement, failure to disclose a major competing interest, scientific mistakes, duplication of publication and journal errors (Bolland, et al., 2022; Claxton, 2005; COPE, 2009; Nair et al., 2020; Samp et al., 2012).

The costs of research misconduct and retracted publications can be both human and economics, implying financial costs to funding sources and harm to the careers of those committing misconduct (Stern et al., 2014). There is as well an “Epistemic cost” defined by literature as “the extent to which the retraction distorts scientific knowledge” which magnitude is not estimated yet (Fanelli et al., 2022). A recent study conducted to estimate the epistemic cost of a representative sample of recent retractions concluded that retractions appear to have a modest epistemic cost on meta-analysis. On the other side, many retracted publications are cited and included in meta-analysis, which challenges the purpose of retractions (Fanelli et al., 2022).

The literature suggests that the number of retracted scientific publications has increased, being the scientific fraud and misconduct a growing problem and it is unclear whether it represents a decline of science integrity, an increase in the visibility and accessibility of published articles or if it means an increasing effort done by publishers and editors (Nair et al., 2020; Samp et al. 2012).

In 2009, the Committee on Publication Ethics (COPE) published the first Retraction Guidelines that aimed to advise publishers and editors on expected practices to consider whether a retraction is pertinent and how to issue it (COPE, 2009; Nair et al., 2020; Samp et al., 2012). Although these Guidelines have increased awareness of this problematic reality, some scientists suggests that fraud and misconduct is still underreported (Claxton, 2005; COPE, 2009; Samp et al. 2012).

Once retracted, scientific publications should only be cited in the context of retraction and although it is not dishonest if the citation happens before the retraction, the integrity of the citing publications might be compromised if the citation is essential to the rationale, methodology or results’ interpretation. It is important to correct publications based in references from retracted information, mainly in clinical reviews, guidelines, and meta-analysis and one possibility to achieve it is to automatically notify the authors giving them the opportunity to assess the impact of the retraction and either amend or affirm it (Bolland et al., 2022).

The constant demand of publications may lead the researchers to prioritize quantity over quality, promoting the lack of methodological and ethical rigor (Barbosa et al., 2019). There are results that support that among European medical scientists, the pressure to publish scientific publications contributes to scientific misconduct (Tijdkink, 2014). All scientists must be aware of the great potential for fraud and misconduct so scientific publications with compromised integrity can be immediately retracted and

science can continue truthful and serving mankind (Bolland et al., 2022; Claxton, 2005). In the medical area, misconduct and poor science may lead to invalid conclusions which potentially can misguide patient management and lead to harm (Claxton, 2005; Nair et al., 2020). Many drugs therapy related articles, for example, are retracted for reasons of misconduct and fraud and because there is a delay in time between the original publication and the retraction notice, these fraudulent publications can effect patient care (Samp et al. 2012).

The impact of poor science is unlimited, and it does not depend on cultural aspects. Disciplinary and educational measures are fundamental to reduce the misconduct in science. Journals, funders, academic institutions, and researchers can have an educational and monitor role in preventing research misconduct (Stavale et al., 2019). Good research means that honesty and integrity are expected of every individual and it should be promoted through training and education since under graduation and throughout all the learning stages, respecting consent and confidentiality, having an effective and efficient monitoring, auditing and ethics review mechanisms (COPE, 2000).

The concept of scientific integrity should be introduced in the academic environment. Research integrity means academic honesty and implies responsibility and trustworthiness related to the research production and publication. Medical education should go beyond the practical and scientific domain of the area and equally focus on the ethical and methodological rigor (Barbosa et al., 2019).

Literature in scientific integrity demonstrates that although several medical fields of study have raised retracted publications as a concern, mainly in the clinical area, this has not been explicitly investigated in medical education. Therefore, the main aim of this study is to examine the characteristics of retracted publications in medical education. Specifically, this study aims to analyse the characteristics of the authors, the publication journals, the citations and the retraction notices of the retracted publications.

METHODOLOGY

A systematic review of the literature was led guided by the question: What are the characteristics of the retracted publications in medical education research? The review was conducted and reported according to the Preferred Reporting of items for Systematic Reviews and Meta-Analysis (PRISMA) Guidelines (Page et al., 2023).

Search Strategy and Study selection

An electronic search was performed during June 2023 in three different databases: PubMed, Web of Science and Scopus, using the following algorithms: [(medical education) OR (medical teaching)) OR (medical learning)] AND (retracted publication). There was no time or language filter applied.

Inclusion Criteria

All the retracted publications in medical education were included in this review. Publications were deemed eligible according to the criteria defined by PICO tool:

- . P (Population) – Publications in medical education
- . I (Intervention) – Retracted Articles
- . C (Comparison) – N/A
- . O (Outcomes) – The characteristics of the retracted publications

Exclusion Criteria

Were excluded from this review all the publications outside the medical education field, systematic reviews, meta-analysis, letters, opinion articles and conference communications.

Data extraction

After title and abstract screening, the full text of all eligible publications was obtained. For all eligible studies were extracted details of each retracted publication: year of publication, number of authors per publication and 1st and last authors affiliation and number of retracted publications. Were extracted the characteristics of publication journals: publication journal, quartile, and impact factor (Clarivate, 2023). To characterise the citations were extracted the number of citations of every publication (from google scholar) and all of them have been analyzed to find out if they happened

before or after the retraction. For all the citations done after retraction were analysed its context as well as time (in years) between the retraction and the citation. For the characteristics of retraction, were searched the notices of retraction.

To distinguish the citations done before and after retraction date, the ones done in the year of the retraction date were considered “citations before retraction”.

To assess the notices of retraction, were analysed the COPE retraction guidelines: Notices of retraction should: Be linked to the retracted article wherever possible (i.e., in all online versions); Clearly identify the retracted article (e.g., by including the title and authors in the retraction heading or citing the retracted article); Be clearly identified as a retraction (i.e., distinct from other types of correction or comment); Be published promptly to minimise harmful effects; Be freely available to all readers (i.e., not behind access barriers or available only to subscribers); State who is retracting the article; State the reason(s) for retraction; Be objective, factual and avoid inflammatory language (COPE, 2009).

The reasons of retraction were classified accordingly to the reasons found in the eligible publications: ambiguous claims and conflicting sources, data manipulation, peer review concerns, duplication, systematic manipulation of the publication process and unethical author conduct.

To identify whether a publication has or has not a watermark to categorize the retraction, the publications were searched in different databases and if at least one of them did not have a watermark, was considered as not having “watermarking”.

All the retracted publications that have an associated retracted notice were considered to “Be published promptly to minimize harmful effects”.

The eligible publications were divided into different areas of medical education accordingly with the studies found: self-regulated learning, medical humanities programs, discipline construction, clinical learning, palliative care teaching, research skills teaching, virtual reality, problem-based learning and individual learning style.

RESULTS

Identified publications

A total of 1005 articles were identified through database screening based on the initial searching. After duplicated publications were removed (n=128), the remaining 877 were screened in two steps. First 827 publications were excluded based on the title followed by 29 studies excluded based on the abstract. The remaining 21 publications were eligible for full article reading, from which 9 were excluded for not meeting the inclusion criteria. Finally, the remaining 12 publications were included in this systematic review (Dodani et al., 2009; Ge et al., 2022; Lloyd-Williams & Dogra, 2004; Malik et al., 2019; Movchun et al., 2021; Mumtaz et al., 2009; Najafinejad et al., 2021; Potyk et al., 2018; Xiao et al., 2022; Xu et al., 2022; Zhou et al., 2021; Zhu et al., 2022) (fig 1).

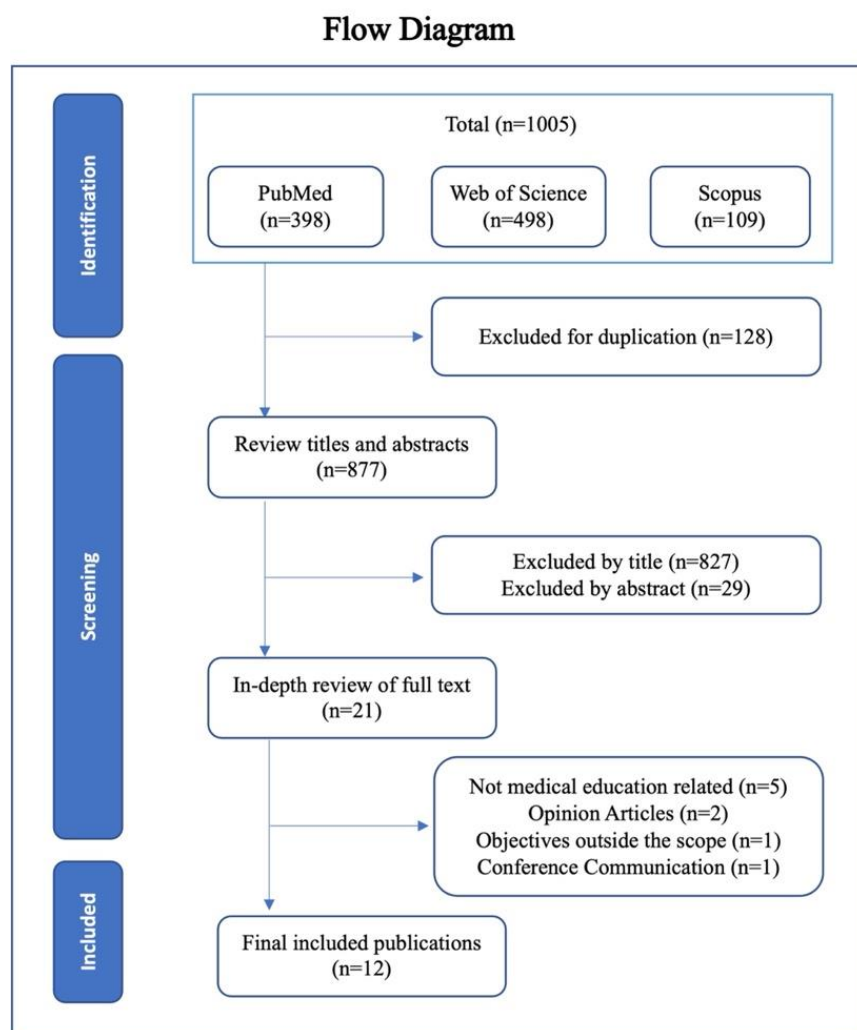


Figure 1 - Flow Diagram for searching and selection processes.

Characteristics of retracted publications

The oldest retracted publication included in this review is from 2004 and the most recent is from 2022, being 6 (50%) of the studies published after 2020 (fig 2).

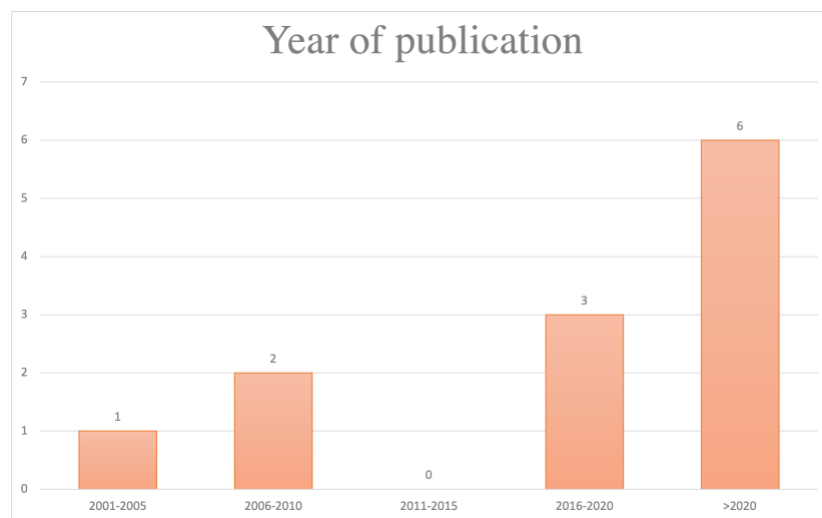


Figure 2 - Year of Publication graphic

Table 1 - Characteristics of the authors

	N (%)
Number of Authors per publication	
1-2	1 (8)
3-4	6 (50)
5-6	3 (25)
> 6	2 (17)
1st and last author affiliation	
Iran	1 (8)
USA	3 (25)
China	5 (42)
Pakistan	1 (8)
UK	1 (8)
Russia	1 (8)
1st author number of retracted publications	
1	10 (83)
2	2 (17)
Last author number of retracted publications	
1	12 (100)

Of all the publications, 6 (50%) have between 3 and 4 authors, 3 (25%) between 5 and 6, 2 (17%) more than 6 and 1 (8%) only 2 authors. The first and last author affiliations from the retracted publications included in this review are the same for all the 12 publications and are from six different Countries, being the largest number of retractions from China (42%) (table 1). Two (17%) of the 1st authors of the publications have at least 2 retracted publications. All the last authors have only 1 retracted publication.

Table 2 - Characteristics of publication journals

	N (%)
Journal of Publication	
Journal of graduate Medical Education	1 (8)
Journal of healthcare engineering	3 (25)
The Journal of the Pakistan Medical Association	1 (8)
Postgraduate medical journal	1 (8)
Global Public Health	1 (8)
Computational and Mathematical Methods in Medicine	2 (17)
Cureus Journal of Medical Science	1 (8)
Education and Information Technologies	1 (8)
Journal Quartile	
Q1	2 (17)
Q2	5 (42)
Q3	3 (25)
Q4	1 (8)
N/A	1 (8)
Journal of Publication Impact Factor	
Maximum	5.5
Minimum	0.13
Mean	3.135

The 12 remaining articles were published in eight different Journals. The *Journal of Healthcare Engineer* published 3 (25%) of all the publications (Table 2). The average impact factor of the various journals was 3.135, being the maximum 5.5 and the minimum 0.13. Regarding the journal's quartiles, 5 (42%) are in Q2, 3 (25%) Q3, 2 (17%) Q1 and 1 (8%) Q4 (table 2).

Table 3 - Characteristics of citations

Citations	
Maximum citations in a publication	54
Minimum citations in a publication	0
Mean citations of publications	11
Citations on publications	N (%)
Publications without citations	3 (25)
Publications with citations only before date of retraction	5 (42)
Publications with citations only after date of retraction	1 (8)
Publications with citations before and after date of retraction	3 (25)
All citations (N°)	136
Citations before retraction	62
Citations after retraction	74
Citations after retraction context	N (%)
Introduction	14 (19)
Methodology	2 (3)
Results	1 (1)
Discussion	36 (49)
Introduction and discussion	3 (4)
Results and discussion	1 (1)
Book chapter	1 (1)
Master degree chapter	1 (1)
Not possible to identify	15 (20)
Time between retraction and citation	N (%)
Less than 2 years	11 (15)
2 to 5 years	19 (26)
More than 5 years	44 (59)

Retracted articles have been cited on average 11 times. The most highly cited retracted publication has been cited 54 times and there are 3 (25%) publications without any citation. Five (42%) retracted publications were cited only before retraction date, 1 (8%) was cited only after retraction date and 3 (25%) were cited both before and after retraction date (table 3).

Among all the citations found (136), 62 were done before and 74 after retraction date. Regarding the citations done after the retraction date, besides the 15 that are not able to be identified, none of them were used as an example of misconduct or to refer to the retraction itself. Thirty-six (49%) were used to support information in the article's discussion and 14 (19%) in the introduction (table 3).

From all the citations done after retraction date, 11 (15%) were cited less than 2 years after retraction date, 19 (26%) between 2 and 5 years and 44 (59%) more than 5 years after retraction date (table 3).

Table 4 - Characteristics of Retraction

N (%)	
Notice of Retraction available	
Yes	10 (83)
No	2 (17)
Notices of Retraction (COPE guidelines)	
	Yes No
Linked to the retracted article wherever possible (i.e., in all online versions)	10 (100) 0 (0)
Clearly identify the retracted article (e.g., by including the title and authors in the retraction heading or citing the retracted article)	10 (100) 0 (0)
Be clearly identified as a retraction (i.e., distinct from other types of correction or comment)	10 (100) 0 (0)
Be published promptly to minimize harmful effects	10 (100) 0 (0)
Be freely available to all readers (i.e., not behind access barriers or available only to subscribers)	10 (100) 0 (0)
State who is retracting the article	2 (20) 8 (80)
State the reason(s) for retraction	9 (90) 1 (10)
Be objective, factual, and avoid inflammatory language.	10 (100) 0 (0)
Reasons for Retraction	
Ambiguous claims and conflicting sources	1 (8)
Data Manipulation	1 (8)
Peer Review Concerns	2 (17)
Duplicate Publication	3 (25)
Systematic manipulation of the publication process	3 (25)
Unethical author conduct	1 (8)
Unknown	1 (8)
Who request the retraction	
Author	1 (8)
Journal/Publisher/Editor	2 (17)
Not Known	9 (75)
Time between publication and retraction (in months)	
<12	4 (30)
12-23	7 (54)
24-35	0 (0)
> 36	1 (8)
Maximum	96
Minimum	2
Mean	19
Watermarking	
Yes	5 (42)
No	7 (58)

Out of the 12 eligible articles, 10 (83%) have a retraction notice available. Out of the 10 retraction notices available, 10 (100%) comply with six of the COPE retraction guidelines: linked to the retracted article wherever possible; clearly identify the retracted article; be clearly identified as a retraction; be published promptly to minimize harmful effects; be freely available to all readers; and be objective, factual, and avoid inflammatory language. One (10%) notice of retraction did not state the reason of retraction and 8 (80%) did not state who was retracting the article (table 4).

The most common reasons for retraction were duplicate publication (25%) and systematic manipulation of the publication process (25%), followed by peer review concerns (17%). The remaining publications were retracted for ambiguous claims and

conflicting sources (8%), data manipulation (8%) or unethical author conduct (8%). One article did not have description of any specific reason for retraction. Two (67%) of the retractions were requested by the journal/publisher/editor, 1 (8%) by the author(s) and 9 (75%) are not described (table 4).

Regarding the delay of retraction after publication, 7 (54%) publications have between 12 and 23 months between publication and retraction, 4 (30%) less than 12 months and 1 (8%) more than 36 months. The highest time between publication and retraction is 96 months (table 4).

Seven (58%) publications have at least one online platform where there is no watermark or any other indication of the retraction.

Out of the 12 retracted publications, 3 (25%) investigate about problem-based learning, 2 (17%) virtual reality, 1(8%) self-regulated learning, 1(8%) medical humanities programs, 1(8%) discipline construction, 1(8%) clinical learning, 1(8%) palliative care teaching, 1(8%) teaching research skills and 1(8%) individual learning styles.

DISCUSSION

In this systematic review, the characteristics of retracted publications in medical education were examined, focusing on the details of the authors and characteristics of the retractions, journals of publication and citations.

Regarding the years of the retracted publications, the research shows that the number of them has increased in recent years, as 50% of the retracted publications are from after 2020. These findings are similar with some previous research in retracted publications that seems to follow the same trend (Chauvin et al., 2019; Chen et al., 2013; Rapani et al., 2020). It is still uncertain whether this is the result of an increase of (intentional or not) scientific misconduct and fraud or if it is the evidence that the adoption of the COPE guidelines is accelerating the detection of unreliable publications (Nair et al., 2020; Rapani, et al. 2020; Samp et al. 2012).

Analyzing the results of this review, 50% of the eligible studies were performed by 3 to 4 authors. Li et al. (2018), for example, also identified 4 as the median number of authors of retracted publications and suggest that complexity of research may be reflected by the number of authors, due to the requirement of multi-expertise and collaborative work. On the other hand, the increase in the average number of authors per publication brings other ethical challenges and depreciates the value of authorship credit as well as responsibilities (Hosseini et al., 2022).

China represents 42% of the findings of 1st author affiliation and accordingly to Bhatt (2020), China is in the top 5 countries in the World with the highest number of retractions.

Out of all the 1st and last authors of the studies included in this systematic review, two 1st authors appears in more than one retracted publication (two), in some cases between several publications, which can indicate that these represent isolated cases of retraction and therefore are not a result of organized systems ignoring the principles of research' ethics and integrity (Rapani et al., 2020).

Nagella & Madhugiri (2020) noticed that a journal with a higher impact factor retracts more when comparing with one with a lower impact factor. This could happen because the first are more read and consequently more examined or because the high impact journals tend to publish strongly positive studies which can induce data fabrication (Nagella & Madhugiri, 2020). Among all the retracted publications, the highest journal

impact factor noticed was 5.5, being the median number 3.135. Fifty nine percent of the publications were published in journals Q1 and Q2.

The number of citations found after retraction (74) which was also noticed by other studies (Chen et al., 2013; Rapani et al. 2020), proves that new research may still use a citation originating from retracted publications which means that retraction by itself is unlikely to eliminate the risk of its use by different authors. Chen et al. (2013) also pointed that the citations' validity verification is likely to become very challenging as more and more studies are becoming attached to retracted publications and researchers take their validity for granted. Citation of retracted publications represents a major problem for the scientific community (Rapani et al., 2020). Moylan & Kowalczyk (2016) argues that the fact that retraction notices are rarely cited themselves suggest that the publications' retraction are not known by the readers, which is consistent with the results of this systematic review: none of the citations that happened after retraction were used as an example of misconduct or to refer to the retraction itself. Chauvin et al. (2019) suggest the withdrawal of the retracted publications full texts to be replaced by a complete and comprehensible retraction notice as a possible solution for the problem.

Various other retraction-related studies suggest that most retracted publications are due to misconduct and fraud (Chauvin et al., 2019; Li et al., 2018; Moylan & Kowalczyk, 2016; Rapani et al., 2020). These were not the findings of this systematic review, although 25% of the eligible publications were retracted due to Systematic manipulation of the publication process, which is not a clear and detailed description of the reasons of retractions as it is recommended by COPE guidelines (COPE, 2009). Other studies also suggest that it is common to find only generic and unclear retraction notices (Rapani et al. 2020).

Out of the 12 publications, 10 (83%) had a retraction notice associated and available. Although all of them have fulfilled at least 6 out of 8 of the COPE retraction guidelines, 8 out of 10 do not state who requested the retraction. Stavale et al. (2019) highlights that the existence of a reporting retraction standard instrument could promote ethical policies considerations and a uniform publication of retractions. Disciplinary and educational actions are essential to increase the awareness on publication ethical issues and to prevent malpractices and misconduct.

Considering the time between the publication of the original article and the retraction notice, our findings show a median number of 19 months, which goes along with other

studies in retracted publications (Chauvin et al., 2019; Moylan & Kowalczyk, 2016). Moylan & Kowalczyk (2016) demonstrated that articles retracted due to misconduct took longer (approximately 12 months) to retract comparing with articles retracted due to honest error (approximately 6 months).

Even though watermark can be an effective method of easily identify the retracted publications (Nair et al., 2020), the findings of this study show that 58% of our sample can be found online without any kind of mark or any indication that the publication was retracted. This can explain the fact that 74 of the citations were done after retraction.

CONCLUSION

As a first approach to analyse the characteristics of retracted publications in the medical education field, this study shows evidence that the number of retracted publications is increasing. Scientific misconduct and fraud found in the retracted publications can have a negative impact in the credibility of the growing field of medical education. Retraction notices tend to be ambiguous and unclear without enough information regarding the request or the reasons of retraction. Some of the publications remains fully available online with no watermark or any notification that have been retracted, which can be related with the fact that citations of retracted publications continues to happen after retraction. All of these findings affect the truthfulness and transparency of medical education research and integrity. More efforts need to be done to standardize and improve the retraction notice availability, and researchers, journals, academic institutions and funders have to be more aware and publicise this growing problem, playing a key role to prevent the dissemination of misconduct and fraud in medical education research among the academic and scientific communities.

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