

Location and Sentiment of Citations to Retracted Publications in Dental Research

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Introduction

Although retractions are still a relatively rare occurrence when considering the whole of research, the rate at which publications are retracted is increasing (Grieneisen & Zhang, 2012). This is problematic because retracted publications can influence future research and science. Inconsistencies in how retracted publications are presented or communicated in journals and databases may contribute to their continued use and citation (Bakker & Riegelman, 2018). Research investigating previously retracted publications have found that they continue to be cited, and cited positively, meaning that they continue to lead to, support, and influence future research (Suelzer et al., 2019; Theis-Mahon & Bakker, 2020; Brown, Bakker, & Theis-Mahon, 2020).

In addition to understanding that articles are being cited and the sentiment of that citation, it may be useful to consider the locations of those citations within papers as well. McCain and Turner (1989) suggested that the location of the citation in a research paper's structure -- the introduction, methods, or discussion -- was indicative of the paper's overall importance to the citing work. They argued that, while citations in the introduction or discussion could be either central or peripheral to the overall argument, those cited in the methods section were always central. The importance of citations incorporated into the introduction and discussion has long been debated. Herlach (1978) argued that papers that had been cited multiple times in a single resource were of greater importance to the work, and that multiple citations most frequently occurred in the introduction and discussion sections. In contrast, Cano (1989) found that, while citations may occur more frequently in the introduction, those citations tend to be perfunctory rather than essential to the citing work. Although beliefs differ on the relative importance of citation in different sections of a paper, there is a general consensus that, as different sections of a scientific paper perform different communicative purposes, the citations within those sections serve similarly different functions.

While there has been extensive debate regarding the meaning of citation in different locations within a scientific text, this debate has not considered the unique complexity of retracted publications and their potential influence on scientific discourse. To more fully describe the potential impact of citation of retracted publications, both the location of the citation and the nature of that citation should be considered.

Methods

In Fall 2018, we downloaded records of all retracted publications included in the Dentistry category of the Retraction Watch database. Bibliographic data, article type, and reason for retraction, as noted by Retraction watch, were recorded. Known item searching was conducted in Scopus and Web of Science to identify articles citing these retracted publications.

Citations were reviewed and further analysis was conducted on articles that were submitted after their retraction notice and limited to English only. We excluded non-English articles due to the nuances involved in a sentiment analysis. Sentiment analysis was based on research conducted by Bar-Ilan and Halevi (2017) and defined as: positive, neutral, and negative. We used Qualtrics to record the location of the citation (introduction, methods, results, discussion, conclusion, and other), the sentence or sentence section citing the retraction, and the nature of the citation (positive, neutral, negative). Double data entry was conducted, and we discussed conflicts until consensus was reached. We then mapped the reason for retraction, as indicated by Retraction Watch, to the three areas described by Bar-Ilan and Halevi (2018): (1) administrative error, such as publishing errors; (2) ethical misconduct, such as plagiarism, duplicate publication, lack of

institutional review board (IRB) approval, or interference with the peer-review process; and (3) scientific distortion, such as data falsification or data fabrication, or unsupported conclusions.

Results

We found 81 publications that had been cited after their retraction. These publications were cited 815 times by 685 English-language publications. Of the 685 citing publications, the majority were in vitro studies (n=150), editorials and opinion pieces (n=140), observational studies (n=115), and case reports (n=95). Animal studies (n=46), randomized controlled trials (n=44), systematic reviews (n=42) and book chapters (n=42) were also represented within this set.

If we consider only research articles -- defined as systematic reviews, randomized controlled trials, observational studies, case reports, animal studies, and in vitro studies (492 items) -- there are 616 citing documents. The breakdown of the location of the citation and sentiment is as follows:

Table 1. Location and sentiment of citation to retracted research articles

		Introduction	Methods	Results	Discussion	Conclusion	Other	Total	
								n	%
Positive		122	22	19	230	1	10	404	65.6
Neutral		94	1	6	89	0	5	195	31.7
Negative		4	0	5	8	0	0	17	2.8
Total	n	220	23	30	327	1	15	616	
	%	35.7	3.7	4.9	53.1	0.2	2.4		

The majority of citations occurred in the discussion (n=327, 53.1%) and introduction sections (n=220, 35.7%). Citations in all sections were overwhelmingly positive (n=404, 65.6%). The highest level of neutral citations occurred in the introduction (94/220, 42.7%) and discussion sections (89/327, 27.2%). Highest levels of positive citations, with the exception of the sole conclusion citation, were in the methods sections (22/23, 95.7%). The highest levels of negative citation occurred in results sections (5/30, 16.7%).

Of the 30 citations in the results section, 26 of these citations were in systematic reviews, including all the negative citations in our analysis. The remainder of these systematic review citations were positive (16/30, 53.3%) and neutral (5/30, 16.7%). Of the citations in the methods section, the majority of citing articles were in vitro studies (12/23, 52.2%), followed by observational studies (3/23, 13%), randomized controlled trials (3/23, 13%), systematic reviews (2/23, 8.7%), animal studies (2/23, 8.7%), and 1 case report (4.3%).

Most of the citations were to publications retracted due to ethical misconduct (285/616, 46.3%), scientific distortion (268/616, 43.5%), administrative error (42/616, 6.8%), and unknown reasons (21/616, 3.4%). There were no negative citations recorded for publications retracted due to unknown reasons or administrative error.

Table 2. Location and sentiment of citation to research articles retracted due to administrative error

		Introduction	Methods	Results	Discussion	Conclusion	Other	Total	
								n	%
Positive		7	3	2	18	0	1	31	73.8
Neutral		7	0	0	4	0	0	11	26.2
Negative		0	0	0	0	0	0	0	-
Total	n	14	3	2	22	0	1	42	
	%	33.3	7.1	4.8	52.4	-	2.4		

Table 3. Location and sentiment of citation to research articles retracted due to ethical misconduct

	Introduction	Methods	Results	Discussion	Conclusion	Other	Total
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							n	%	
Positive		59	11	9	101	0	3	183	64.2
Neutral		47	1	0	50	0	1	99	34.7
Negative		0	0	2	1	0	0	3	1.1
Total	n	106	12	11	152	0	4	285	
	%	37.2	4.2	3.9	53.3	-	1.4		

Table 4. Location and sentiment of citation to research articles retracted due to scientific distortion

		Introduction	Methods	Results	Discussion	Conclusion	Other	Total	
								n	%
Positive		52	8	8	105	1	5	179	66.8
Neutral		34	0	6	31	0	4	75	28.0
Negative		4	0	3	7	0	0	14	5.2
Total	n	90	8	17	143	1	9	268	
	%	33.6	3.0	6.3	53.4	0.4	3.4		

Table 5. Location and sentiment of citation to research articles retracted due to unknown reasons

		Introduction	Methods	Results	Discussion	Conclusion	Other	Total	
								n	%
Positive		4	0	0	6	0	1	11	52.4
Neutral		6	0	0	4	0	0	10	47.6
Negative		0	0	0	0	0	0	0	-
Total	n	10	0	0	10	0	1	21	
	%	47.6	-	-	47.6	-	4.8		

Discussion

Both citation and retraction are nuanced. Articles may be retracted for innocuous reasons and citations do not always indicate support or endorsement of an article or an idea. However, in this study, we found that the vast majority of citations to retracted publications were positive, regardless of reason for retraction or location of the citation.

Retracted publications continue to be cited and influence future research. Although our analysis focuses on the dental literature the sentiment analysis reveals that in most cases there is no indication that researchers or authors are aware of or acknowledge the retracted status of a publication. The substantial presence of citations to these retracted publications in the introduction and discussion may suggest that they are continuing to be cited to support the necessity or context of a paper. However, papers are also citing retracted publications in the method section, indicating that they influence how studies are being developed and conducted.

The continued citation of articles retracted due to scientific distortion is also problematic. One could argue that there is value in articles retracted because of administrative error since this does not impact the scientific integrity of the research. Some content may be valid for articles retracted because of ethical misconduct; however, the continued positive or neutral citation of articles retracted due to scientific distortion is problematic. As these papers are retracted due to falsified or fabricated data or similar issues, their positive citation may be indicative of an inappropriate ongoing influence of scientific research.

The retracted status of publications is inconsistently represented both across a range of and within single databases and journals (Bakker & Riegelman, 2018; Suelzer et al., 2020). The continued citation of papers retracted due to scientific distortion raises questions regarding the potential connection to their representation. Journals, publishers, and vendors should consider the development and implementation of interoperable standards that facilitate a consistent representation of retraction and, subsequently, minimize or mitigate the potential impact of these publications.

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