

Retracted Publications in Biomedicine: Cause for Concern

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Abstract

Retractions of articles and citations to retracted work continue to be a cause for concern. In 1999, Budd et al. found 235 retracted publications in the biomedical literature for a 30-year period. Nearly 40% were retracted because of misconduct. The current study found 1,164 retracted articles in the 12-year period between 1997 and 2009. Of the 1,112 articles included for analysis, 55% were retracted for some type of misconduct. While this number represents a small minority of the total number of publications in biomedicine, it is still substantial, and the impact of the retracted works can be significant. In PubMed, notifications of retractions are connected to the original publication; the retraction information appears when a retracted article is retrieved in a search. Citations to retracted articles should, theoretically, be minimal. Despite these notifications of retraction in PubMed and elsewhere, the articles continue to receive citations. The 1999 study found that the retracted articles received more than 2,000 post-retraction citations, with less than 8% of the citations acknowledging the retraction in any way. Preliminary examination of the present data set illustrates that continued citation remains a problem. Of 391 citations analyzed, only 6% acknowledge the retraction. Because of potential clinical and research implications of continued use of work retracted due to

error and (especially) misconduct, the current study is intended to alert information professions and information users about the challenges inherent in the literatures of many fields, particularly biomedicine.

Introduction

At times and for a variety of reasons, it can be necessary for a published article to be retracted. While retracted articles represent a small minority of all published articles, there is continued concern about the phenomenon of retraction. In a recent report in the *Times Higher Education*, Corbyn notes that the rate at which scientific articles are retracted has increased tenfold in the past twenty years.¹ Concern about the reasons and frequency of retraction is especially true in the field of biomedicine where researchers and clinicians must rely on current and valid information.

Several commentators have emphasized the need for enhanced awareness of ethical issues related both to research and to publication. Tobin asserts higher ethical research standards is vital lest the public trust in biomedical research erode.² In an editorial in *Lancet*, Horton urges researchers to avoid citing retracted works in order to create distance between themselves and cases of misconduct.³ Farthing speaks about the ethical issues related to publishing research and says that the scientific community may need to insist on

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the examination of primary research records (such as laboratory notebooks) to prevent, especially, misconduct.⁴ Walter and Campanario separately call for more convenient and pervasive identification of retracted publications so as to prevent further citation.^{5,6} Walter wonders if development and greater use of electronic access to published works may diminish the citation to retracted articles. One of the strongest statements is by Sox and Rennie who argue “scientific misconduct is endemic, so the scientific community must prove its response.” They recommend having authors indicate that they have checked National Library of Medicine databases, verifying that that are not citing retracted work.⁷

The reasons for retraction are important primarily because of the impact the original work can have on subsequent research. For example, if a paper is retracted because tissue samples used in the research was contaminated (even if the contamination was unknown to the researchers), that research may well be invalid. Any clinical treatments that might have been based on such work would have to be foregone until further research could be conducted. The problems with misconduct can be even more profound. As Trikalinos et al. state, “Of the different types of misconduct, falsification is more egregious and typically affects the veracity of the report more than plagiarism, faked author or ethics approval, or duplication.”⁸ At times the instances of misconduct are highly publicized and create consternation among the public *and* the scientific community. As perhaps the most prominent recent example, South Korean researcher Hwang Woo Suk claimed to have made a major breakthrough in stem cell reproduction by cloning. Published in the prominent journal *Science*, Hwang’s work, which the South Korean government had committed US\$65 million for further research, was fabricated.⁹ Few cases receive so much attention, but the stakes can be very high.

Retractions: 1997–2009

In an article published more than a decade ago, Budd et al. examined retractions statements in biomedical journals.¹⁰ They found that, of the 235 retracted articles in biomedicine in the 30 years from 1966 through 1996, almost 40% were retracted because of misconduct and that the retracted articles received more than 2,000 post-retraction citations. More than 92% of those citations made no mention of the retracted nature of the cited article.¹¹ The current study updates

Budd et al. (1999), using similar methodology and covering a 12-year period.

Based on notifications of retraction in PubMed, 1,164 articles were retracted between 1997 and September 2009. Fifty-two articles were excluded from analysis either because they were written in a foreign language or could not be acquired after due diligence (defined as two unsuccessful interlibrary loan requests). Of the 1,112 retractions included for analysis, 50 were partial retractions and 1,062 retracted the original article in entirety. The median time from publication to retraction was 17 months (mean = 29 months; range = 0–304 months).

Another element of the study was determining who issued the retraction (Table 1). One or more of the authors retracted 598 (54%) of the articles; 328 (29%) were retracted by the editors; 79 (7%) by some combination of the authors, editors, and publisher (e.g. authors and editors or editors and publisher); 56 (5%) by the publisher; it was unclear who retracted 30 (3%) of the articles; 17 (2%) by the research institution or an investigating committee; and 4 (less than 1%) by an agreement between the publisher and research institution.

TABLE 1
Issuer of Retraction
(Total Number of Retractions = 1,112)

Issuer	Number (%)
Author(s)	598 (54%)
Editor(s)	328 (29%)
Combination of authors, editors, publishers	79 (7%)
Publisher	56 (5%)
Unclear	30 (3%)
Research institution or investigating committee	17 (2%)
Publisher and research institution	4 (less than 1%)

Reason for retraction was also determined (Table 2). Retraction because of misconduct, defined as a clearly stated admission or judgment of wrongdoing on the part of one or more of the authors constituted 486 (44%) retractions. Retraction because of presumed misconduct, where serious questions about the work were raised by coauthors, editors, or others, accounted for 152 (14%) retractions. An example of presumed misconduct reads as such: “I [the co-au-

TABLE 2
Reason for Retraction
(Total Number of Retractions = 1,112.)

Reason	Number (%)
Misconduct, admitted	486 (44%)
Misconduct, presumed	152 (14%)
Could not replicate results	127 (11%)
Error: problems with data	113 (10%)
Error: problems with method, analysis, interpretation	76 (7%)
Error: problems with sample	31 (3%)
Accidental duplication, publisher	26 (2%)
Accidental duplication, author	10 (less than 1%)
Other	19 (2%)
No reason given	72 (6%)

thor] have learned that Fig. 3 was fabricated by the first author. The data supporting the rest of the paper have been 'lost' and therefore I cannot verify the accuracy of those data."¹² Retraction of 127 (11%) articles occurred because the results of the study could not be replicated. Two hundred twenty articles were retracted because of some kind of error. These errors fell into three categories: problems with the data in 113 (10%); error in methods, analysis, or interpretation in 76 (7%); and problems with the sample in 31 (3%). No reason was given for 72 (6%) retractions.

Accidental duplicate publication was a new category revealed in the current study: 26 (2%) were due to accidental duplication by the editors and/or publisher and 10 (less than 1%) retractions were accidental duplicate publication by the author(s). Sanchez and Mazzone's retraction statement was an example of accidental duplicate publication by the authors: "A preliminary version of a review article was published in error on 16 October 2006. The correct version of the article had previously been published in *Cardiovascular Ultrasound*. The authors have agreed that the preliminary version should be retracted."¹³ The remaining 19 retractions were due to idiosyncratic reasons. Examples of idiosyncratic reasons include retractions of retractions,^{14,15} inappropriate political bias or slander,^{16,17} and the ambiguous "for complicated reasons."¹⁸

Citations to Retracted Articles

Following Budd et al., citations to the retracted papers were also examined. In order to allow some time for the retraction statement to be readily apparent to

scholars conducting their own research, a period of one year is allowed. If the retraction statement appeared in the year 2000, citations received by the retracted article from the year 2001 on are counted as "post-retraction" and analyzed. Citation information was retrieved from the Scopus database in December 2010. Citing articles were examined further to obtain an understanding of the citation practices of biomedical and other scientists. Based on preliminary samples, the retracted status of the cited work remained largely unacknowledged. Of 391 citing articles examined, 22 (6%) acknowledge the retraction; 369 (94%) make no mention of the retraction. Information on articles retracted in 2000 and 2005 is given below.

In 2000, 18 papers were retracted. Four of the retracted papers received no citations post-retraction. The remaining 14 papers received 325 citations, with one receiving 168. Of the 247 citing articles available at the authors' institution, only 14 (6%) acknowledge the retraction in some capacity, including 3 self-citations that deny any wrong-doing. The clear majority of citations, 193 (78%), are mentions of the retracted papers as parts of literature reviews or other background sections of the articles. These mentions are tacitly positive; that is, they imply that the retracted articles represent valid work. Perhaps of special note are the 40 citations (16%) that make substantive mention of the retracted papers. These mentions tend to occur in the methodology, findings, or discussion sections of citing papers. They describe the retracted articles favorably and, at times, indicate that the retracted papers provided bases for the later work—all without acknowledging the retracted nature of the article.

In 2005, 67 articles were retracted. Post-retraction, the 67 retracted articles received 965 citations, with one receiving 126. Of the 144 citing articles examined, only 8 (6%) acknowledged the retraction. Of particular interest are the post-retraction citations patterns of five articles retracted in 2005 for misconduct (described below).

Eric T. Poehlman retracted four articles in 2005, admitting that he "intentionally omitted a material data point" in order to make an association "appear more significant than was actually the case"¹⁹ and because "reported data were falsified and fabricated."²⁰ Sox and Rennie confirm that work by Poehlman retracted in other years continues to be cited.²¹ Post-retraction, the four articles retracted in 2005 were cited 71 times. None of the 49 articles available at the

Times Higher Education, August 20, Accessed January 6, 2011, <http://www.timeshighereducation.co.uk/story.asp?storycode=407838>.

2. Tobin, Martin J. 2000. "Reporting Research, Retraction of Results, and Responsibility." *American Journal of Respiratory and Critical Care Medicine* 162(3 Pt 1):773-4.

3. Horton, Richard. 1999. "Scientific Misconduct: Exaggerated Fear but Still Real and Requiring a Proportionate Response." *Lancet* 354(9172):7-8.

4. Farthing, M. J. G. 2000. "Research Misconduct: Diagnosis, Treatment and Prevention." *British Journal of Surgery* 87(12):1605-9.

5. Campanario, Juan M. 2000. "Fraud: Retracted Articles Are Still Being Cited." *Nature* 408(6810):288.

6. Walter, Garry. 2000. "Rubber Stamping' Retracted Papers." *Bulletin of the Medical Library Association* 88(1):85.

7. Sox, Harold C., and Drummond Rennie. 2006. "Research Misconduct, Retraction, and Cleansing the Medical Literature: Lessons from the Poehlman Case." *Annals of Internal Medicine* 144(8):609-13.

8. Trikalinos, Nikolaos A., Evangelos Evangelou, and John P. A. Ioannidis. 2008. "Falsified Papers in High-impact Journals Were Slow to Retract and Indistinguishable from Nonfraudulent Papers." *Journal of Clinical Epidemiology* 61(5):464-70.

9. Kakuk, Peter. 2009. "The Legacy of the Hwang Case: Research Misconduct in Biosciences." *Science and Engineering Ethics* 15(4):545-62.

10. Budd, John M., MaryEllen Sievert, Tom R. Schultz, and Caryn Scoville. 1999. "Effects of Article Retraction on Citation and Practice in Medicine." *Bulletin of the Medical Library Association* 87(4):437-43.

11. *Ibid.*

12. Brown, Kevin E. 2001. "GB Virus C/Hepatitis G Virus Replicates in Human Haematopoietic Cells and Vascular Endothelial Cells." *Journal of General Virology* 82(Pt 11):2837.

13. Sanchez, Pedro L., and Anna M. Mazzone. 2006. "Retraction: C-reactive Protein in Aortic Valve Disease." *Cardiovascular Ultrasound* 4:42.

14. "A Statement from the BMJ Group." 2008. *Journal of Clinical Pathology* 61(9):1072.

15. Friedberg, Errol C., and Steven A. Leadon. 2003. "Corrigendum to 'Retraction' [DNA Repair 2 (2003) 361]." *DNA Repair* 2:1157.

16. Gabbard, Glen O., and Paul Williams. 2006. "A Retraction and Apology. A Boycott by Passport." *International Journal of Psychoanalysis* 87(Pt 1):263.

17. Suci-Foca, Nicole, and Robert Lewis. 2001. "Edito-

rial. Anthropology and Genetic Markers." *Human Immunology* 62(10):1063.

18. Liu, H., H. Y. Zhang, B. C. McPherson, T. Baman, S. Roth, Z. Shao, X. Zhu, and Z. Yao. 2003. "Role of Opioid Delta1 Receptors, Mitochondrial K(ATP) Channels, and Protein Kinase C during Cardiocyte Apoptosis." *Journal of Molecular and Cellular Cardiology* 35(3):337.

19. Poehlman, Eric T. 2005. "Influence of Endurance Training on Energy Intake, Norepinephrine Kinetics, and Metabolic Rate in Older Individuals. Poehlman E, Gardner A, Goran M. *Metabolism* 1992;41 (September):941-8." *Metabolism* 54(9):1267.

20. ———. 2005. "Menopause, Energy Expenditure, and Body Composition." *Acta Obstetrica et Gynecologica Scandinavica* 84(11):1131.

21. Sox and Drummond. "Research Misconduct, Retraction, and Cleansing."

22. Poehlman, Eric T., Andrew W. Gardner, Paul J. Arciero, Michael I. Goran, and Jorge Calles-Escandon. 1994. "Effects of Endurance Training on Total Fat Oxidation in Elderly Persons." *Journal of Applied Physiology* 76(6):2281-7.

23. deTayrac, Renaud, Xavier Deffieux, Stephane Droupy, Aurelia Chauveaud-Lambling, Laurence Calvanese-Benamour, and Herve Fernandez. 2004. "A Prospective Randomized Trial Comparing Tension-Free Vaginal Tape and Transobturator Suburethral Tape for Surgical Treatment of Stress Urinary Incontinence." *American Journal of Obstetrics & Gynecology* 190(3):602-8.

24. "Comment on Notice of Retraction." 2005. *American Journal of Obstetrics & Gynecology* 192(2):339.

25. Wai, Clifford Y. 2009. "Surgical Treatment for Stress and Urge Urinary Incontinence." *Obstetrics and Gynecology Clinics of North America* 36(3):509-19.

26. Latthe, Pallavi M., Richard Foon, and Philip Toozs-Hobson. 2007. "Transobturator and Retropubic Tape Procedures in Stress Urinary Incontinence: A Systematic Review and Meta-analysis of Effectiveness and Complications." *BJOG* 114(5):522-31.

27. Sung, Vivian W., Mark D. Schleinitz, Charles R. Rardin, Renee M. Ward, and Deborah L. Myers. 2007. "Comparison of Retropubic vs Transobturator Approach to Midurethral Slings: A Systematic Review and Meta-analysis." *American Journal of Obstetrics & Gynecology* 197(1):3-11.

28. Novara, Giacomo, Antonio Galfano, Rafael Boscolo-Berto, Silvia Secco, Stefano Cavalleri, Vincenzo Ficarra, and Walter Artibani. 2008. "Complication Rates of Tension-Free Midurethral Slings in the Treatment of Female Stress Urinary Incontinence: A Systematic Review and Meta-analysis

of randomized Controlled Trials Comparing Tension-Free Midurethral Tapes to Other Surgical Procedures and Different Devices.” *European Urology* 53(2):288–308.

29. Elsevier. 2011. “Elsevier Policy on Article Withdrawal.” Accessed January 6. http://www.elsevier.com/wps/find/intro.cws_home/Article%20Withdrawal.

30. International Committee of Medical Journal Editors. 2009. “Corrections, Retractions, and ‘Expressions of Concern.’” Accessed January 6, 2011. http://www.icmje.org/publishing_2corrections.html.