
The characteristics of medical retraction notices*

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During the past twenty years, more than ninety retraction notices have been published in biomedical journals. These retractions constitute a unique body of literature that biomedical researchers, bibliographers, and librarians must monitor to reduce scientific use of retracted, invalid papers. An analysis of medical retraction notices shows that very few are prominent in style, format, or placement, in spite of authoritative publication standards formulated by the International Council of Medical Journal Editors. Although researchers are ultimately responsible for the validity of the information they cite in their own publications, biomedical librarians are in a unique position to educate their patrons regarding retracted papers.

During the past twenty years, the publication of letters, announcements, and editorials retracting previously published papers has become a relatively common event in the medical journal literature. Papers are retracted for a variety of reasons, ranging from honest research error to intentional fraud, but regardless of the reason, the retraction notice becomes supremely important to the body of scientific literature. In theory, an article that has been retracted entirely should have no scholarly impact upon the realm of scientific knowledge; in practice, retracted papers often are cited as support for scientific research [1]. Although many reasons for this phenomenon may be valid, one hypothesis is that medical retraction notices are not sufficiently emphasized by their format or placement in medical journals.

When the need for retractions first arose, there was little precedent regarding format or style, and early retractions varied between letter and announcement formats. Some journal editors were reluctant to publish retraction notices [2], and others chose to print retractions for articles that had been published in other journals [3]. Journal editors handled retractions in different ways, some publishing multiple letters

for each retraction [4] and others publishing only their own terse statements acknowledging receipt of such correspondence [5]. The placement of the retractions varied dramatically, as some editors published such notices prominently with editorials [6], while others published them on less significant pages, often hidden at the very back of the issue adjacent to advertisements, announcements, and indexes [7-9]. As time passed, the volume of retraction notices increased, yet no uniformity evolved for the publication of the notices.

By 1984, the National Library of Medicine (NLM) had recognized the importance of retractions to the body of literature and added a Medical Subject Heading (MeSH) term, "RETRACTION OF PUBLICATION." NLM defines a retraction as

a letter to the editor or an editorial stating that an article previously published was based on fraudulent research, that is, research in which deliberately falsified or unsubstantiated data were used [10].

But some gray areas exist in the bibliographic control of retraction notices. The three most troublesome issues for NLM have been journals that do not, as a policy, retract; notices that use terms such as *questionable* or *fraudulent* but do not clearly retract; and studies that are shown to be fraudulent but are never

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retracted in print [11]. Finally, some retractions have been published in forms that are not fully citable, causing policy problems for those agencies that seek to identify retractions in indexes and databases.

Recognizing the problems inherent in the publication of medical retraction notices, the International Committee of Medical Journal Editors (ICMJE) met in Helsinki in 1987 and devised a statement suggesting a uniform format for retractions:

The retraction, so labeled, should appear in a prominent section of the journal, be listed in the contents page, and include in its heading the title of the original article. It should not simply be a letter to the editor. Ideally, the first author should be the same in the retraction as in the article, although under certain circumstances the editor may accept retractions by other responsible persons. The text of the retraction should explain why the article is being retracted and include a bibliographic reference to it.

This statement was published in four prominent journals between February and April of 1988 [12-15]. Thus, journal editors have two sets of closely corresponding guidelines to observe to satisfy the statements of NLM and ICMJE and to ensure that retraction notices are included in MEDLINE.

STUDY METHODOLOGY

Ninety-seven retraction notices published since 1975 were examined for this study. While MEDLINE lists ninety-one retractions under the MeSH term "RETRACTION OF PUBLICATION" as of August 1991, one was deleted because it retracts a news item rather than a research article [16], and seven that do not appear in MEDLINE were added to the study [17-23]. Of those seven retraction notices, five clearly request withdrawal of the article, and two raise serious questions about the viability of the research and request "potential retraction" [24-25]. For the purposes of this study, a retraction notice is a published statement signifying that previously published research is unreliable and should not be used to support further research. A single retraction notice can retract several articles [26], and a single article can be retracted by more than one notice [27-28].

Each retraction notice was examined for characteristics suggested by the recommendations of ICMJE and NLM. Although most of the retractions were published before the official guidelines were established, common sense would indicate that retraction notices should be prominent, informative, and citable. Therefore, the purpose of the comparison was to measure the impact of the ICMJE and NLM recommendations on the format of retraction notices.

Based on the assumption that prominence depends upon heading, location, and layout, retractions were classified according to the wording of the heading,

Table 1
Headings of retraction notices (n = 97)

Heading	Number (%)
Retraction	66 (68%)
Letter to the editor	3 (3%)
Notification to membership	3 (3%)
Withdrawal/paper withdrawn	3 (3%)
Statement	2 (2%)
Corrigenda/corrigendum	2 (2%)
Questions on the validity	1 (1%)
Warning on uncertainty of results	1 (1%)
Reevaluation of published data	1 (1%)
Correction	1 (1%)
Announcement	1 (1%)
Questionable	1 (1%)
Special notice	1 (1%)
Editorial announcement	1 (1%)
Heading with no indication of retraction or unusual notice	10 (10%)

placement within the issue (including proximity to the front or back of the issue), and page format. Retractions that appear alone on a page or enclosed within a box are considered more prominent than those presented in other formats.

The content of the retraction, as mandated by ICMJE, should include an explanation of why the article is being retracted and a bibliographic reference. These characteristics were noted, as was the number of retractions that included the title of the retracted article.

Retractions were classified according to who requested retraction. Some retractions were not signed but implied the authority of the original authors. Retractions listed in the contents page were noted, as were retraction notices that appeared on numbered pages and were otherwise fully citable.

Finally, all retraction notices published after June 1988 were defined as post-ICMJE retractions for the sake of comparison to retractions published before the official format recommendations. A three-month window was allowed to compensate for those journal issues that might have been in press when the ICMJE recommendations were published.

RESULTS

Of the 97 retraction notices examined, 70 (72%) retract only one article, 17 (18%) retract 2, 6 (6%) retract 3, and 4 (4%) retract 4 articles or more within a single notice. The largest number of publications retracted in one notice is nine articles and a book chapter [29].

Fourteen different headings are found in the ninety-seven notices (Table 1). The word *retraction* appears prominently in the headings of sixty-six (68%) retraction notices. Of the retractions published before the ICMJE recommendations took effect, forty (65%) are labeled *retraction*; after the ICMJE recommendations, twenty-six (74%) are so labeled (Table 2). In

Table 2
Characteristics of retraction notices

Characteristics	Pre-ICMJE (n = 62) Number (%)	Post-ICMJE (n = 35) Number (%)	All (n = 97) Number (%)
Labeled retraction	40 (65%)	26 (74%)	66 (68%)
Prominent on page	41 (66%)	17 (49%)	58 (60%)
Prominent in issue	9 (15%)	8 (23%)	17 (18%)
Listed in contents	55 (89%)	31 (89%)	86 (89%)
Title of article in heading	11 (18%)	12 (34%)	23 (24%)
Not letter to editor	35 (56%)	20 (57%)	55 (57%)
Same first author	29 (47%)	22 (63%)	51 (53%)
Explanation why retracted	59 (95%)	32 (91%)	91 (94%)
Bibliographic reference to retracted article	62 (100%)	35 (100%)	97 (100%)
Fully citable format	59 (95%)	33 (94%)	91 (94%)

addition, ten retraction notices have headings that indicate subject but do not even hint that the results are disputed.

The ICMJE did not define *prominent placement*, but for the purposes of this study, prominence is defined as proximity to the front of the issue and striking page layout. Sixty-two (64%) retractions appear alone on a page or within a page devoted entirely to retractions. Of these, five (5%) run longer than one full page [30–34], generally because an editorial is appended, or because the author of the retraction has chosen to write a lengthy explanation, or because multiple letters constitute a single notice. Seven (7%) retraction notices appear enclosed within a box [35–41]. According to this study’s criteria, 41 (66%) of pre-ICMJE retractions are prominent on a page as compared to 17 (49%) of post-ICMJE retractions (Table 2).

Table 3 shows the relative placement of the retraction notices within the journal issue. For the purposes of this study, *front* means within the first five pages of the issue and *back* means within the last five pages of the issue. All other pages are considered in the *middle*. Only those retraction notices that appear in the front of the issue are considered prominently placed. Before ICMJE recommended a uniform format, 15% of retraction notices were published prominently. That figure climbed to 23% for post-ICMJE retractions (Table 2). The percentage of retractions published within the last five pages of an issue decreased from 65% to 51% after June of 1988.

In eighty-six of the issues containing retraction notices, a reader can glance at the table of contents and see that the issue contains a retraction. Fourteen of these are difficult to find, generally because the heading does not include terminology that indicates a retraction. On the other hand, if the heading of the retraction is *correction*, it is likely that the same heading will be used on the contents page [42]. Two of the retractions are published on the contents page itself, below the listings, but with no entry in the

Table 3
Placement of retraction notices

Placement	Pre-ICMJE (n = 62) Number (%)	Post-ICMJE (n = 35) Number (%)	All (n = 97) Number (%)
First page	1 (2%)	2 (6%)	3 (3%)
Front, other than first page	8 (13%)	6 (17%)	14 (14%)
Middle	13 (21%)	9 (26%)	22 (23%)
Back, other than final page	23 (37%)	8 (23%)	31 (32%)
Final page	17 (27%)	10 (28%)	27 (28%)

table of contents [43–44]. In eleven issues, the contents page gives no indication that the issue contains a retraction notice, although in one case [45], the subsequent issue contains a note on the contents page indicating the omission of the retraction from the previous issue’s contents page [46].

Within the heading, only twenty-three (24%) of the retraction notices include the full title of the original article, as ICMJE requests. Inclusion of a title within the heading became more frequent after June 1988 (from 18% to 34%) (Table 2), but this still remains one of the least-observed conventions in the publishing of retraction notices.

The format of retractions is roughly evenly divided between announcements and letters to the editor. For this study, an announcement is defined as a text that stands alone on a page as a statement or letter; an announcement may be boxed or set off from other words on the page by a heading. Only two retractions fall outside those categories, one published as a short article [47] and one appearing as a response to an article refuting the article [48]. Little change occurred in the frequency with which retractions were published as letters to the editor after 1988.

Because a single retraction notice often will include more than one request or will retract more than one article, it is difficult to describe with complete accuracy the status of all signatories requesting retraction. Retractions published without signatures, but that imply the authority of the first author, are so categorized [49–50]. As shown in Table 2, the percentage of retractions signed by the first author of the retracted paper has risen from 47% to 63% since the publication of the ICMJE recommendations.

The great majority (94%) of retractions contain an explanation for the withdrawal of the paper from the scientific literature. Only six notices offer no reason for the retraction [51–56].

All retraction notices appropriately document the article(s) being retracted. This is an obvious requirement for any retraction notice, and it has been fully observed, whether the citation appears within the heading, in the text, or as a footnote to the text of the retraction.

NLM has decreed that, to be included in MEDLINE, retractions must be fully citable. Ninety-one (94%) of the retractions appear in fully citable form on numbered pages. Of the remaining six, one is on an unnumbered table of contents page [57] and five simply appear on unnumbered pages [58–61]. In each of these five cases, pagination follows as though the pages containing retraction notices were numbered, and the notices appear on the contents pages with numbers. Since the ICMJE uniform format recommendations were published, no improvement in citability has occurred (Table 2).

DISCUSSION

Three years have passed since ICMJE formulated a recommendation for uniform format of medical retractions, yet only minimal improvement in format can be observed among the thirty-five retractions published since then. Only one retraction notice can be said to adhere to all the parameters included in these guidelines [62]. Retraction notices published after formulation of the ICMJE guidelines were more likely to be labeled *retraction*, to be placed within the first five pages of the issues, to include the title of the retracted paper in the heading, and to be signed by the first author of the retracted paper (Table 2). In spite of such improvements, significant format problems remain. For example, though incidence of prominent placement within the issue has risen from 15% to 23%, the figure remains disappointing. The vast majority of retractions still do not contain the title of the original article within the heading. Too many retractions, roughly half, continue to be published as letters to the editor. Finally, there has been no improvement in the percentage of notices that explain why the article is being retracted or the percentage of notices that are placed prominently on the page.

This inattention of the biomedical publishing community to establishing and maintaining a uniform format for retraction notices has resulted in a critical lack of visibility for such publications. While NLM has struggled to identify and index retraction notices, it seems likely that researchers about to publish do not routinely recheck their reprints and citations in MEDLINE. The ultimate result is that information regarding the invalidity of some scientific research is not being disseminated to, and recognized by, the community it seeks to inform.

Some of the most ubiquitous format problems in medical retractions are the same problems that make them difficult for a regular reader of a particular biomedical journal to identify. At the top of the list is placement within an issue. At least three notices published at the end of the issue in the Kornhauser Health Sciences Library's collection were removed accidentally by a commercial bindery [63–65]. Retraction no-

tices that are buried within lengthy editorials and run for several pages [66] can be just as difficult to identify as the concise notice placed at the end of an article that refutes the original, flawed paper [67]. Retractions that are published in the letters section, retractions that give no clue in the heading, notices that list multiple retractions in tiny print—all of these formats cause problems, not just for the casual subscriber, but also for the thorough and attentive reader, for the MEDLINE indexer, and for the librarian.

Some journal editors have utilized helpful format features for medical retraction notices. Boxed retractions and notices that appear starkly alone on the page are among the most prominent. Retractions located within the first five pages of an issue, yet not hidden in advertisements or in the letters section, are certainly more visible than those located farther back. While 76% of the notices examined for this study include no hint of the title or subject of the retracted article in the heading, the 24% that do are highly likely to catch the eye of a reader who researches and publishes in that topical area. Certainly the most effective format for any such notice features the word *retraction* in bold type near the top of the page.

Quite often, a retraction notice will be an unfortunate blend of both positive and negative features; for example, it might appear prominently on a page with a bold, obvious headline and be signed by all authors of the original work, yet be buried on the last page of the issue, behind the announcements. The *Journal of Clinical Investigation (JCI)*, for example, has repeatedly published retractions that appear alone on the page with the heading *retraction*, yet the journal editor routinely compromises the effectiveness of those notices by publishing them on unnumbered pages [68–71]. While NLM originally announced that retraction notices must be fully citable to be included in MEDLINE, indexers repeatedly have overcome the format problems of *JCI* retraction notices by counting the pagination and adding page numbers to these notices. Thus, they appear in MEDLINE with page numbers that are not evident in the issues. That is not to say that *JCI* is the only journal that withholds pagination from medical retraction notices. *Experientia* published a retraction on an unnumbered table of contents page and MEDLINE indicates that the page number is "P preceding 429" [72].

The fact that MEDLINE goes beyond stated policies to include retraction notices that do not fulfill minimum criteria for citability makes it even more puzzling that at least seven retraction notices have not been added to the database [73–79]. In six of these cases, the retractions are signed by at least one author of the original, flawed publication [80–85]. While two [86–87] avoid making specific requests for retractions, asking instead for "potential retraction," four clearly request retraction, contain explanations for the re-

quest, and include full citations to the retracted articles. The seventh notice is a journal editor's announcement that editorial support for the paper has been withdrawn based on the conclusion of the National Institute of Mental Health that the work was never carried out [88]. At least five of these retraction notices certainly appear to fulfill NLM's published criteria for inclusion under the MeSH term "RETRACTION OF PUBLICATION." The two notices that request potential retraction should be as visible as retraction notices if, in fact, they do not fulfill NLM's strict criteria for retractions. Yet, for whatever reason, this information is not available on MEDLINE at this writing and therefore is correspondingly less available to the medical research community.

SUMMARY AND CONCLUSION

The business of declaring a biomedical paper flawed and retracting it from the body of literature is an inexact undertaking, fraught with legal, ethical, and scientific complications. It is a phenomenon that has exploded within a research community that never expected to see yet another retraction. But well over a hundred articles have been retracted in the past two decades, and biomedical librarians are finding themselves responsible for imparting information regarding retractions to patrons.

Clearly, medical retractions should pose a professional challenge to health sciences librarians. The current mission statement of the Medical Library Association states that the association is "dedicated to improving health through professional excellence and leadership of its members in the . . . provision of information services and educational programs . . ." [89]. Yet, according to Pfeifer, startlingly few academic health sciences librarians surveyed in 1990 considered themselves "highly aware" of this issue, and even fewer had implemented policies to educate their patrons about medical retractions [90]. Librarians cannot afford to be uneducated about scientific fraud and retracted publications. Because of their contact with scientific researchers and responsibility for educational programs within the library, biomedical librarians are in a unique position to inform the scientific community about retractions.

To be sure, solutions to scientific fraud and publication of retraction notices do not fall within the control of the biomedical librarian. But the librarian does have the power to highlight these issues within the library community. The most straightforward method of increasing patron awareness of retracted articles is to tag the pages of all such articles that are held by the library. Any note affixed to the first page of a retracted article must include a citation to the retraction notice as well as an indication that the article is invalid. But patrons who work from reprint

files in their offices will not necessarily benefit from tagging, so librarians also need to devise ways of educating patrons outside the journal stacks. One way is to mount displays on biomedical retractions, either in library display cases or on bulletin boards. Many libraries publish a newsletter or acquisitions list that could include an article on the dangers of citing works that may have been retracted. Finally, a list of retracted papers may be obtained from MEDLINE and kept current with periodic updates; every health sciences library should make such a list available for the patron who needs to check the references of a paper about to go to press.

In 1989, NLM added another MeSH term designed to inform researchers about retracted papers. "RETRACTED PUBLICATION" allows a MEDLINE searcher to print a single list of all papers that have been identified in MEDLINE as retracted. Because the title fields of these papers also have been enhanced with a parenthetical statement referring to the retraction notice, a search that yields a retracted article, regardless of subject heading used, also will yield a reference to the retraction notice.

Lack of MEDLINE indexing and lack of uniform format guidelines for medical retraction notices are problems of the past. Medical journal editors now have format guidelines, and they have begun to make improvements in retraction notice format. NLM has introduced two new MeSH terms and implemented online tagging of retractions and retracted papers. What is needed now is the involvement of the library community to bring that information to the researcher who has not necessarily read the issue that retracts an article to be cited, or the physician who has a reprint file that is not rechecked periodically in MEDLINE for retraction and errata tags. Retracted publications will always cause problems within the body of scientific literature. The effort to reduce those problems must now be joined by biomedical librarians.

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