

Different Patterns of Duplicate Publication

An Analysis of Articles Used in Systematic Reviews

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DUPLICATE PUBLICATION IS THE publication of an article that overlaps substantially with an article published elsewhere.¹ This practice may be acceptable in particular situations. However, authors must acknowledge the main article overtly by using a cross-reference. Covert duplicate publication has been widely disapproved.^{2,3} This practice is wasteful of the time and resources of editors, peer reviewers, and readers, and it is misleading because undue weight is given to observations that are being reported repeatedly. When duplicates are inadvertently included in a systematic review, the conclusion of that systematic review may change.⁴ Finally, covert duplicate publication is dishonest; it undermines the integrity of science.⁵

Little is known about patterns of duplicate publication. Also, characteristics of duplicates are not well understood, and there is no common agreement on how to classify them. We set out to investigate patterns of duplicate publication and to propose a decision tree for their classification. We have chosen systematic reviews as a source of information because duplicates are often identified during the rigorous process of a systematic review.⁶

METHODS

Identification of Duplicates

We used a comprehensive list of systematic reviews (1989 through August 15, 2002) in perioperative medi-

Context Duplicate publication is publication of an article that overlaps substantially with an article published elsewhere. Patterns of duplication are not well understood.

Objective To investigate duplication patterns and propose a decision tree for classification.

Data Sources We searched a comprehensive list of systematic reviews (1989 through August 15, 2002) in anesthesia and analgesia that is accessible on the Internet. We selected published full articles of duplicates that had been identified in these systematic reviews. Abstracts, letters, or book chapters were excluded.

Study Selection and Data Extraction Authors of 56 (40%) of 141 systematic reviews acknowledged identification of duplicates. Duplication patterns were identified independently by all investigators comparing samples and outcomes of pairs of duplicates and main articles. Information on cross-reference, sponsorship, authorship, and publication characteristics was extracted from the articles.

Data Synthesis The 56 systematic reviews included 1131 main articles (129337 subjects) and excluded 103 duplicates (12589 subjects) that originated from 78 main articles. Sixty articles were published twice, 13 three times, 3 four times, and 2 five times. We identified 6 duplication patterns: (1A) identical samples and identical outcomes (21 pairs); (1B) same as 1A but several duplicates assembled (n=16); (2) identical samples and different outcomes (n=24); (3A) increasing sample and identical outcomes (n=11); (3B) decreasing sample and identical outcomes (n=11); (4) different samples and different outcomes (n=20). The prevalence of covert duplicate articles (without a cross-reference to the main article) was 5.3% (65/1234). Of the duplicates, 34 (33%) were sponsored by the pharmaceutical industry, and 66 (64%) had authorship that differed partly or completely from the main article. The median journal impact factor was 1.8 (range, 0.1-29.5) for duplicates and 2.0 (range, 0.4-29.5) for main articles ($P=.13$). The median annual citation rate was 1.7 (range, 0-27) for duplicates and 2.1 (range, 0-31) for main articles ($P=.45$). The median number of authors was 4 (range, 1-14) for duplicates and 4 (range, 1-15) for corresponding main articles ($P=.02$). The median delay in publication between main articles and duplicates was 1 year (range, 0-7 years).

Conclusions Duplication goes beyond simple copying. Six distinct duplication patterns were identified after comparing study samples and outcomes of duplicates and corresponding main articles. Authorship was an unreliable criterion. Duplicates were published in journals with similar impact factors and were cited as frequently as main articles.

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cine (anesthesia, analgesia, and critical care) that is regularly updated through searches in electronic databases, hand-searching of specialty journals, and contact with experts.⁷ The average methodological quality of these reviews was considered satisfactory.⁸

We selected all systematic reviews of anesthesia and analgesia topics that ac-

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knowledgeable identification of duplicates. If there was no information on duplicates, we contacted the authors of the reviews and asked them if there were none. We only considered duplicates that were published as full articles. We excluded abstracts, letters, and book chapters. We also disregarded a duplicate when it was excluded from a review for reasons that were not related to duplication (ie, for validity reasons). We regarded duplicates as such independent of whether they had a cross-reference or not. If systematic reviews had overlapping topics and included the same articles, we considered each article only once. We did not search systematically for additional duplicates. We obtained hard copies of all duplicates and of corresponding main articles.

Characteristics of Duplicates and of Main Articles

We identified clusters (ie, groups of ≥ 2 articles) that originated from a single study. We then designated duplicates and corresponding main articles within each cluster. Several duplicates could originate from a main article, and several main articles could be the origin of a duplicate. We regarded the oldest or the largest article of a cluster as the main article, irrespective of whether it had been considered the main article or duplicate by the authors of the systematic reviews.

From each main article and duplicate, we extracted information on cross-reference, sponsorship, publication characteristics, and authors. A cross-reference was considered clear if the corresponding article was acknowledged and referenced (for instance, in the bibliography or in a footnote) and the link between the 2 articles was evident.¹ It was considered unclear if the corresponding article was referenced, but the relationship between the articles was obscured. Pharmaceutical sponsorship was assumed if (1) it was disclosed as such; (2) a pharmaceutical company provided funds or study material; (3) the publishing journal was sponsored (for instance, the article ap-

peared in a journal supplement); or (4) an author was an employee of a pharmaceutical company. All other funding was regarded as nonpharmaceutical. Impact factors were taken from the Institute for Scientific Information *Journal Citation Report*,⁹ but they were coded as "missing" for journal supplements. Citation numbers were taken from the *Science Citation Index Expanded*¹⁰ and were converted to annual rates. We compared authors of duplicates and main articles; depending on the degree of similarity, we distinguished between articles as having complete, incomplete, or no matching of authorship.

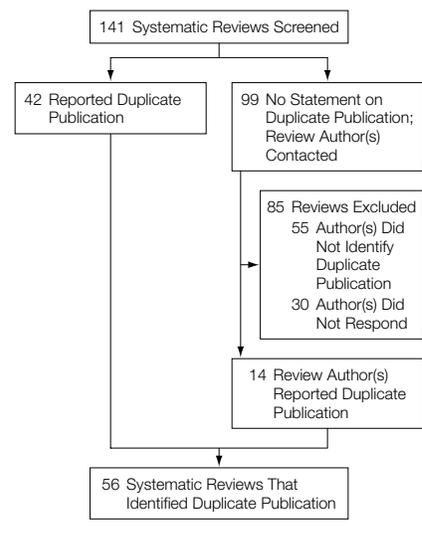
Decision Tree and Duplication Patterns

Using a randomly chosen subset of 25 clusters, 2 of the authors (G.P. and B.W.) searched for suitable criteria to define the link between duplicates and main articles. The matching of study samples and the matching of study outcomes were the best criteria that we found. Four combinations and thus duplication patterns were possible: (1) identical samples and identical outcomes; (2) identical samples and different outcomes; (3) different samples and identical outcomes; and (4) different samples and different outcomes.

Analysis

All investigators independently read all main articles and duplicates, designated clusters, assembled pairs of duplicates and main articles within each cluster, and applied the proposed decision tree to assign each duplicate to 1 of the 4 proposed duplication patterns. Consensus was reached by discussion. If there was uncertainty about duplication, we asked the authors of the suspicious articles for clarification. Data from pairs of main articles and duplicates were compared using the Wilcoxon signed rank test; for clusters with 2 or more duplicates, mean values of data from duplicates were taken. $P < .05$ indicated statistical significance. All statistical analyses were performed using STATA statistical software (Version 8, STATA Corp, College Station, Tex).

Figure 1. Flowchart of Systematic Reviews



RESULTS

Identification of Duplicates

Of 141 systematic reviews, 42 reported spontaneously on duplicates (FIGURE 1). We contacted the principal authors of the other 99 and 69 (70%) responded. Fourteen had identified duplicates without reporting on them. Thus, authors of 56 (40%) of 141 systematic reviews acknowledged identification of duplicates.¹¹⁻⁶⁶ These reviews were published between 1989 and 2000 and covered a wide range of topics in anesthesia and analgesia (TABLE 1). Forty-six reviews (82%) considered data from randomized controlled trials and a meta-analysis. The authors of the 56 reviews regarded 1234 articles as potentially valid and eligible for inclusion. However, 1131 were main articles with data on 129337 subjects and 103 were recognized as duplicates with data on 12589 subjects. Thus, the prevalence of duplicates independent of whether they had a cross-reference or not was 8.3% and duplicated data was 8.9% (Table 1).

Characteristics of Duplicates and of Main Articles

The 103 duplicates originated from 78 main articles; thus, there were 181 articles in 78 clusters. Data from 60 articles were published twice, 13 three times, 3 four times, and 2 five times.

Sixty-three percent of the duplicates had no cross-reference at all (TABLE 2); the prevalence of covert duplication in this cohort of systematic reviews was 5.3% (65/1234). Twelve percent of the duplicates were translations.

Of those, only 1 had a clear cross-reference. Thirty-four (33%) declared pharmaceutical sponsorship; of those, 16 were published in a supplement. The number of authors of main articles was higher (median, 4; range, 1-15) than

that of corresponding duplicates (median, 4; range, 1-14) ($P=.02$). For 64% of pairs of duplicates and corresponding main articles, there was no matching or only incomplete matching of authorship. The median number of

Table 1. Included Systematic Reviews

| Setting | No. of Systematic Reviews | Total No. | | Main Reports | | Duplicate Reports | | References |
|------------------------------------|---------------------------|-------------|----------------|--------------|-----------------|-------------------|------------------------------|------------|
| | | Reports | Subjects | No. | No. of Subjects | No. (% of Total) | No. of Subjects (% of Total) | |
| Postoperative nausea and vomiting* | 13 | 306 | 46 769 | 286 | 40 014 | 20 (6.5) | 6755 (14.4) | 11-23 |
| Albumin | 9 | 113 | 6944 | 96 | 6229 | 17 (15.0) | 715 (10.3) | 24-32 |
| Oral analgesics | 7 | 134 | 25 011 | 126 | 23 810 | 8 (6.0) | 1201 (4.8) | 33-39 |
| Epidural for surgery | 5 | 170 | 11 741 | 145 | 10 151 | 25 (14.7) | 1590 (13.5) | 40-44 |
| Transfusion | 5 | 139 | 17 048 | 131 | 16 529 | 8 (5.8) | 519 (3.0) | 45-49 |
| Epidural for labor | 3 | 21 | 4115 | 17 | 3739 | 4 (19.0) | 376 (9.1) | 50-52 |
| Intra-articular morphine | 2 | 37 | 2096 | 34 | 1950 | 3 (8.1) | 146 (7.0) | 53, 54 |
| Enderarterectomy† | 2 | 18 | 4118 | 17 | 4043 | 1 (5.6) | 75 (1.8) | 55, 56 |
| Miscellaneous‡ | 10 | 296 | 24 084 | 279 | 22 872 | 17 (5.7) | 1212 (5.0) | 57-66 |
| Total | 56 | 1234 | 141 926 | 1131 | 129 337 | 103 (8.3) | 12 589 (8.9) | |

*The quantitative impact of duplicates of ondansetron trials on meta-analysis has been previously analyzed.⁴

†Local anesthetic vs general anesthesia.

‡Prevention of postoperative pulmonary complications; epidural analgesics; cerebrospinal fluid drainage; preoperative tests; morphine for postoperative pain; prevention of injection pain with propofol; recovery from general anesthesia; premedication for anxiety; postoperative delirium; and spinal hematoma.

Table 2. Characteristics of Main Reports and Duplicates*

| Characteristics of Reports | Patterns of Duplicate Publication | | | | | | | |
|---|-----------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | Reports | | 1 | | 2 | 3 | | 4 |
| | Main | Duplicate | A | B | | A | B | |
| Total | 78 | 103 | 21 | 16 | 24 | 11 | 11 | 20 |
| Cross-references | | | | | | | | |
| None | 67 (86) | 65 (63) | 16 (76) | 9 (56) | 13 (54) | 6 (55) | 9 (82) | 12 (60) |
| Unclear | 5 (6) | 18 (17) | 4 (19) | 1 (6) | 6 (25) | 1 (9) | 2 (18) | 4 (20) |
| Clear | 6 (8) | 20 (19) | 1 (5) | 6 (38) | 5 (21) | 4 (36) | 0 | 4 (20) |
| Translations | NA | 12 (12) | 6 (29) | 0 | 0 | 1 (9) | 5 (45) | 0 |
| Acknowledged sponsorship | | | | | | | | |
| Pharmaceutical | 30 (38) | 34 (33) | 7 (33) | 13 (81) | 1 (4) | 2 (18) | 6 (55) | 5 (25) |
| Nonpharmaceutical | 19 (24) | 26 (25) | 3 (14) | 0 | 9 (38) | 3 (27) | 0 | 11 (55) |
| None declared | 29 (37) | 43 (42) | 11 (52) | 3 (19) | 14 (58) | 6 (55) | 5 (45) | 4 (20) |
| Authors per report | 4 (1-15) | 4 (1-14)† | 4 (1-11) | 1 (1-11) | 5 (1-12) | 4 (2-7) | 5 (1-9) | 5 (1-14) |
| Different degrees of matching of authorship | | | | | | | | |
| None | NA | 8 (8) | 2 (10) | 5 (31) | 0 | 0 | 0 | 1 (5) |
| Incomplete | NA | 58 (56) | 7 (33) | 3 (19) | 16 (67) | 9 (82) | 8 (73) | 15 (75) |
| Complete | NA | 37 (36) | 12 (57) | 8 (50) | 8 (33) | 2 (18) | 3 (27) | 4 (20) |
| Duplicated subjects per report | NA | 56 (1-1044) | 60 (1-1044) | 169 (22-982) | 52 (26-500) | 46 (20-56) | 105 (25-260) | 45 (16-202) |
| Year of publication | 1989 (1971-1998) | 1990 (1973-1999) | 1993 (1978-1998) | 1991 (1978-1995) | 1987 (1976-1997) | 1990 (1973-1996) | 1995 (1993-1999) | 1986 (1974-1994) |
| Delay in years of publication between main report and duplicate | NA | 1 (0-7) | 1 (0-4) | 0.5 (0-7) | 1 (0-5) | 2 (0-5) | 1 (0-1) | 1 (0-6) |
| Annual citation rate | 2.1 (0-31) | 1.7 (0-27) | 2.0 (0-27) | 1.5 (0-7) | 1.1 (0-19) | 3.2 (0.2-21) | 1.5 (0.6-2.3) | 2.0 (0-15) |
| Impact factor of publishing journal | 2.0 (0.4-29.5) | 1.8 (0.1-29.5) | 1.5 (0.3-3.9) | 1.4 (0.5-2.0) | 1.5 (0.1-8.8) | 2.7 (0.5-29.5) | 1.4 (1.1-2.5) | 2.0 (0.9-7.1) |

Abbreviation: NA, not applicable.

*Values expressed as number (percentage of total of column) or median (range). See "Methods" section for explanation of patterns of duplicate publication.

† $P=.02$ compared with main reports.

duplicated subjects was 56 (range, 1-1044). The median year of publication of main articles was 1989 (range, 1971-1998) and duplicates was 1990 (range, 1973-1999). The median delay in publication between duplicates and corresponding main articles was 1 year (range, 0-7 years). Two thirds of duplicates were published within 2 years before or after the corresponding main article (FIGURE 2). Median annual citation rates of duplicates and main articles were similar (1.7 vs 2.1; $P=.45$). Median impact factors of the publishing journals were also similar (1.8 vs 2.0; $P=.13$). Most journals that published duplicates and main articles belonged to the *Journal Citation Report* subject categories of *anesthesiology, critical care medicine, general and internal medicine, pharmacology and pharmacy, and surgery*.⁹ The median impact factor of these journals was 0.9 (range, 0-29.5).

Decision Tree and Duplication Patterns

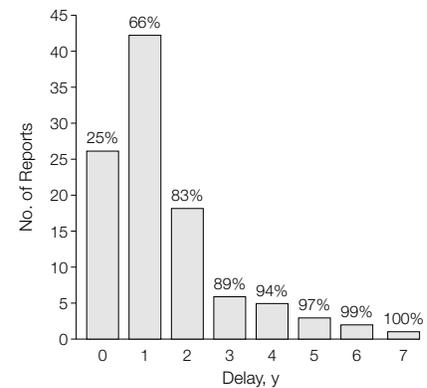
The decision tree eventually yielded 6 distinct patterns of duplication (ie, 4 patterns according to the possibilities of combinations of similarity of study sample and similarity of study outcomes and 2 subgroups) (FIGURE 3). All pairs of duplicates and main articles could be assigned to 1 of the 6 patterns; none of the articles fell into several categories.

Patterns showed particular characteristics (Table 2). A pattern 1A duplicate was a reproduction of an already published article using an identical sample and outcomes. The first published article was considered the main article. Most 1A duplicates (76%) had no cross-reference at all to the main article. Almost one third (29%) were translations; only 1 had a cross-reference. Pattern 1B duplicates were similar to 1A duplicates. However, 2 or more main articles were assembled to produce yet another article. We regarded all contributing articles as main articles, independent of order of publication. Pattern 1B duplicates had the highest proportion of pharmaceutical

sponsorship (81%)—63% were published in supplements and had pharmaceutical sponsorship. Pattern 1B had the highest number of duplicated subjects (median, 169), and their delay in publication was shortest (median, 0.5 years). There was the smallest number of authors (median, 1), and the highest proportion of articles with non-matching authorship (31%). Pattern 2 duplicates originated from 1 study sample but reported on different outcomes. The first published article was considered the main article. Pattern 2 duplicates had the highest proportion of unclear cross-references (25%), a high proportion of nonpharmaceutical sponsorship (38%), and the lowest annual citation rate (median, 1.1). Pattern 3A and 3B duplicates were about increasing or decreasing trial size. Pattern 3A consisted of expanded articles that were written when new data were added to a preliminary article. These articles had the longest delay in publication (median, 2 years), the highest annual citation rate (median, 3.2), and were published in journals with the highest impact factors (median, 2.7). Pattern 3B consisted of articles that documented parts of a large trial and reported identical outcomes. None of these duplicates had a clear cross-reference, 55% declared pharmaceutical sponsorship, 45% were translations (none of which had a cross-reference), and the number of duplicated subjects was high (median,

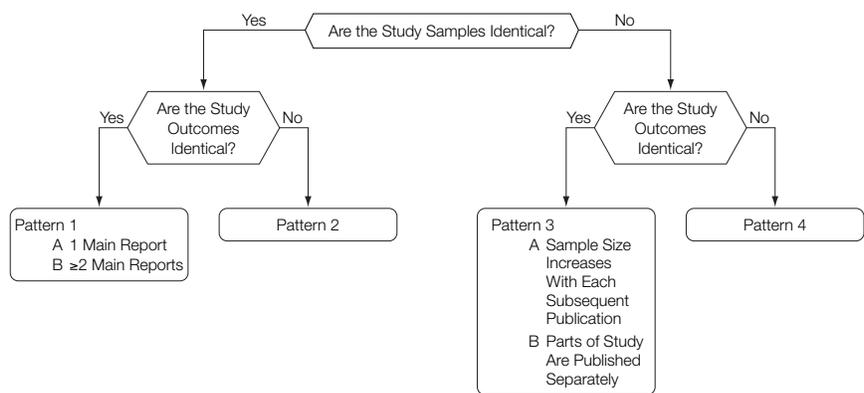
105). In two 3B clusters, authors selected 2 or more (but not all) groups of an already published randomized trial to produce a new article. For both 3A and 3B patterns, the article reporting on the largest study sample was regarded as main article, independent of whether it was published before or after the duplicate. In pattern 4 duplicates, both samples and outcomes were different from the main article. Confirmation of duplication was only possible through contact with the original authors. These duplicates had a high proportion of nonpharmaceutical sponsorship (55%) and incomplete matching of authors (75%). The article reporting on the largest study sample was regarded as main article.

Figure 2. Delay in Years of Publication Between Main Reports and Duplicates



Percentages on the top of columns are cumulative relative frequencies.

Figure 3. Decision Tree for Identification of Patterns of Duplicate Publication



COMMENT

We systematically analyzed a cohort of 103 duplicates and 78 corresponding main articles and were able to identify 6 mutually exclusive patterns of duplication. Our decision tree was based on 2 criteria: similarity of study samples and similarity of study outcomes. Authorship was not a suitable criterion; depending on the duplication pattern, authors of between 18% and 57% of duplicates and main articles matched completely.

Some duplication patterns showed typical features. A pattern 1A duplicate, for instance, corresponds to what is usually known as a copy. For pattern 1B, it may be assumed that an author who is not necessarily involved in research or development of a drug is asked by a pharmaceutical company to assemble some main articles on that drug for a publicity article. The duplicate is then typically published in a sponsored supplement. Both short delay between the publication of main articles and duplicates and changing authorship make it difficult to identify duplication through peer review. Also, supplements are not always peer-reviewed.⁶⁷ Pattern 2 duplicates represent the well-known fragmentation of scientific information; this may lead to what was previously termed *the least publishable unit*.⁶⁸ This practice was associated with nonpharmaceutical sponsorship and unclear or missing cross-references. Publicly funded researchers may be driven to produce multiple articles to justify previously received grants. Pattern 3A duplication has been described as a *meat extender*.⁶⁹ It is the expanding of a preliminary article through the addition of more data to produce the definitive article. These duplicates were published in journals with the highest impact factors and the articles had the highest citation rates, suggesting that they were about new and perhaps innovative treatments. Early dissemination of preliminary data about new treatments is often warranted. However, this does not justify the high rate of articles without a cross-reference to the preliminary article. Pat-

tern 3B may be seen as the opposite of pattern 3A. Typically, a multicenter trial (the main article) is fragmented and individual parts (the duplicates) are published separately; this has been called *disaggregation*.⁵ Multicenter trials are often multinational, large, and sponsored by pharmaceutical companies. Indeed, 3B duplicates were often translations, included a high number of duplicated subjects, and were frequently sponsored by the pharmaceutical industry. Pattern 4 was the most chaotic practice described herein; both study sample and outcomes of duplicates and main articles were different despite evidence that both articles originated from the same study. Definite confirmation was only possible through contact with the authors. It was particularly disturbing that all pattern 3B and 4 duplicates were described as randomized controlled trials, although it was impossible to maintain the initial study architecture, and thus randomization. Authors of systematic reviews may choose to exclude a duplicate cluster when these patterns are involved.

We do not know if these cases of duplication happened deliberately, accidentally, or by negligence. Duplicate publication may be acceptable to foster dissemination of important scientific information, for instance, through translation of a pivotal trial into another language. Then, however, we would expect a cross-reference to unmistakably show the relationship between the translation (ie, the duplicate) and the main article. There were 12 translations; only 1 had a cross-reference to the main article. Seventeen percent of duplicates cited the corresponding main article but left the reader unaware of the relationship between the 2 articles. In another study, partial referencing was found in 11% of duplicates.⁷⁰ Sixty-three percent of the duplicates had no cross-reference at all to the main article; the prevalence of covert duplication in the reviewed literature was 5%. Estimates of duplicate publication have been reported by others who concentrated on (1) a particular drug class⁶ or a single drug⁴; (2) the literature in nursing⁷¹ or

surgery⁷²; or (3) 1 journal.^{70,73-75} To adequately appraise the significance of our estimate, 2 issues have to be considered. First, as in previous studies,⁶ our estimate concerns covert duplication. Second, we focused on published full articles that were considered for inclusion in systematic reviews. Most reviews included randomized controlled trials only. Also, impact factors of the journals that published main articles and duplicates were higher than those of all journals in the corresponding categories of the *Journal Citation Report*. This suggests that articles from mainly higher ranking journals were included in these systematic reviews. Impact factors and citation rates of duplicates and main articles were similar; it is tempting to believe that duplicates are often cited erroneously by authors who believe that they are citing a main article.⁴

Limitations

There are several limitations to this study. First, we focused on articles from anesthesia and analgesia; the proposed classification may not be generalizable to other clinical areas. Second, further studies may find yet another pattern of duplication or a combination of those described herein; additional criteria may help to refine our classification. Third, we analyzed duplicates that were identified in a published list of systematic reviews in perioperative medicine⁷; selection bias cannot be ruled out. However, this is unlikely because these reviews had been gathered through systematic searches and the list had not been compiled with the purpose of studying duplicate publication. Fourth, our estimate of covert duplicate publication may be flawed. We may have overestimated the true prevalence because we included systematic reviews only when duplication was acknowledged. Or, we may have underestimated the true prevalence because many reviews did not include any statement about duplicate articles. Even after contact with the authors of the reviews, it was sometimes unclear if they knew about this potential pitfall. Some had identified du-

plicates but they, or the editors and peer reviewers, did not judge the information important enough to be mentioned in the article. Also, we ignored duplicates that were excluded from the systematic reviews for validity reasons or that were abstracts, letters, or book chapters. Fifth, we did not quantify the impact of covert duplicate publication on systematic reviews. It has been shown previously that removing duplicated data may change the results of a systematic review.⁴ It was not our intention to replicate this finding.

Conclusion

Duplicate publication in the medical literature is a reality, but it may not necessarily be harmful. However, to produce an article that overlaps substantially with an already published article without adequate cross-referencing is misconduct. We have shown that duplication goes beyond simple copying. The proposed classification distinguishes mutually exclusive patterns of duplicate publication and may become a useful tool for those who have to deal with duplication (ie, editors, peer reviewers, and authors) in systematic reviews. Because systematic reviews are produced by conducting an exhaustive literature search and critical appraisal, they are an effective way to unearth duplication. Indeed, authors of systematic reviews frequently encounter serious difficulties while dealing with duplicate articles;^{4,5,76,77} they should be encouraged to make duplication public. A statement on duplication could also be included in the Quality of Reporting of Meta-analyses checklist for the reporting of systematic reviews.⁷⁸ Exposure of cases of duplicates is likely to improve awareness and lower the tolerance of this publication malpractice.

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Study concept and design: von Elm, Poglia, Walder, Tramèr.

Acquisition of data: von Elm, Poglia.

Analysis and interpretation of data: von Elm, Poglia, Walder, Tramèr.

Drafting of the manuscript: von Elm, Walder, Tramèr. **Critical revision of the manuscript for important intellectual content:** von Elm, Poglia, Walder, Tramèr.

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