Reducing Errors in Medical and Scientific Publishing

"Despite the importance of high-quality literature in medical and scientific communications, publications are rife with errors."

Objective

High-quality medical publications are essential to evidence-based medical decision-making. We surveyed the importance of minimizing errors in medical publications on quality and evaluated error rates in published articles.

Research design and methods

To assess the importance of reducing errors to quality, we asked pharmaceutical professionals to rate the importance of error-free publications, identify common problems with medical communication agencies, and whether they receive their desired level of quality. Error rates in literature were estimated by MEDLINE search for errata (01/01/2015–09/04/2019). Search results were manually curated to identify and compare articles on frequency and type of errors.

Results

Of 51 respondents, 90% rated error-free deliverables as the biggest determinant of quality. Most common problems identified when working with medical communication agencies included poor writers (31%) and published errors (29%).

MEDLINE search estimated a 1.2% error rate; 63,562 published errata in 5,353,676 articles. Using previously reported data, we calculated a rate 0%–3.3% for errors (with data errors comprising 54.2% of all errors), consistent with several published articles. However, one study examining three medical journals with high impact factors found 82% of published articles had ≥1 error, 74% had ≥1 numerical error, and 18% had methodological errors.

A survey of retracted publications demonstrates the impact of professional medical writing support; 5.0% of retracted articles had a declared medical writer, 7.8% an industry sponsor, and 0.4% both. Professional medical writing support is also associated with higher quality writing.

Conclusions

Despite the importance of high-quality medical publications, a high number of published articles contain errors. Specific quality control processes may minimize errors in medical publishing.

British epidemiologist Archie Cochrane spent his career documenting the variability in treatments given to patients with the same disease. He strongly supported the use of random clinical trials to identify the best treatment practices for patients. His observations led to the concept of evidence-based medicine, whose goal is "to solidify the scientific foundations of medicine and to reduce uncertainties in medical decision making."[1] Therefore, medical and scientific decision makers need access to high-quality data that are clearly and accurately presented, such as medical and scientific journal articles.

Despite the importance of high-quality data in medical and scientific communications, publications still contain many errors. In addition to the implications for the quality of patient care, pharmaceutical, biotechnology, and medical device companies may lose money, market share, and respect if publications have errors and incorrect data.

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"It is often believed that the peer-review process will help minimize errors in publications, but studies have shown this is not the case."

Estimates of error rates in medical literature vary tremendously depending upon the types of errors examined.[2-4] Overall, there is no standard definition for major and minor errors (**Table 1**). Bhatt, et al., assessed 314 papers containing errata in 5 medical journals with impact factors ranging from 14–51.658.[2] A mistake in the data, the most serious error, accounted for 54.2% of errors.[2] Errors in the authors' information and miscellaneous errors accounted for 28.7% of errors, followed by errors in the use of language (14.4%) and citations (2.6%).[2] Overall, the number of errors per issue among the 5 journals ranged from 0.8–1.9.[2]

Table 1. Comparison of definitions of errors

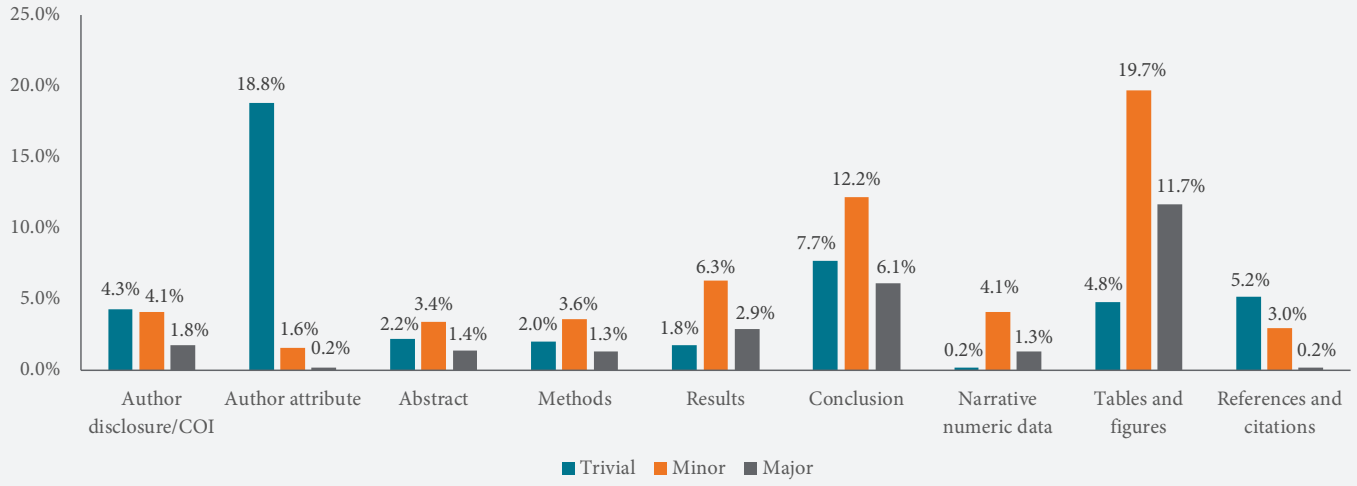
Major errors	Minor errors
Errata in safety or efficacy data[2]	Reference incorrect or missing information[2,3]
Incorrect recommendations[2]	Spelling errors or typos[2,3]
Incorrect nomenclature[2]	Grammar errors[2]
Mistakes in statistical calculations[3]	Changes in writing style[2]
Mistakes that compromised validity of Methods or Conclusions[3]	Errors in authors' names, titles, affiliations[2,3]
Numbers in abstract do not match numbers in text[4,8]	Incorrect correspondence information[2]
Poor justification for conducting the study[8]	Disclosure, funding, acknowledgement, or copyright information incorrect[2]
Biased randomization process[8]	Mistakes in figure legends[3]
No sample size calculation reported[8]	Findings explained insufficiently[3]
Unknown reliability and validity of outcome measures[8]	Errors in facts that don't change meaning or results[3]
Failure to analyze data on an intention-to-treat basis[8]	Abstract, Results, or Discussion not coherent with Methods[4]
Poor response rate[8]	Numerical (counts do not match)[4]
Unjustified conclusions[8]	Transposition of numbers or letters[4]
Inconsistent denominator[8]	No ethics committee approval[8]
	Ineligible or nonrandomized cases not explained[8]
	Inconsistency between data in text and tables[8]
	Failure to identify word transposition in text leading to wrong interpretation of results[8]
	Hawthorne effect (subjects alter behavior because they know they're being observed)[8]

The percentages of errors in different sections of a manuscript varies, but studies show high rates of errors in all sections. Ezeala, et al., analyzed errors in 42 manuscripts published in 8 biomedical journals in Africa and Asia over a 5-year period.[6] Independent reviewers assessed the errors in each manuscript and found 85.7% of Methods sections contained errors, while 71.4% of Discussion sections, 69.0% of Reference sections, 66.7% of Introduction sections, and 66.7% of Results sections contained errors.[6]

"Quality assurance and control processes, such as those employed at AlphaBioCom, will help to ensure the medical and scientific communications are as close to perfect as possible."

A retrospective evaluation of errata in 20 English-language general medicine and cardiovascular journals classified the errata by severity and type.[6] The most common location for a major error was in a table or figure, followed by the Conclusion and Discussion sections. There were similar results seen for minor errors; trivial errors were most commonly seen in the author attributes (**Figure 1**).[7]

Figure 1. Type and severity of errata found in retrospective review of 20 journals (adapted from Hauptman, et al.)



To determine a general error rate in medical publications, we performed a PubMed search of all indexed articles from January 1, 2015–September 4, 2019 and gathered the number of published errata. A total of 5,353,676 papers were indexed, with 63,562 published errata; this is a published error rate of 1.2% over the 56-month period. Our results are consistent with other published studies. For example, some minor errors may be overlooked by reviewers who believed the editorial staff would fix these errors, but overall, more than half of all major errors were not identified or corrected.

Castillo, et al., looked at post-publication errors in 5 imaging journals and found a total of 158 errata in 8,910 articles, leading to an error rate of 1.77%.[3] The errata were categorized as typos, factual or image-related (minor errors); and statistical calculations or foundational errors (major errors). Using the reported data, we calculated the total error rate for the 5 journals, ranging from 0.7%–3.6%—the rate of minor errors was 0.66%–3.3%, and the rate of major errors was 0%–0.3%.

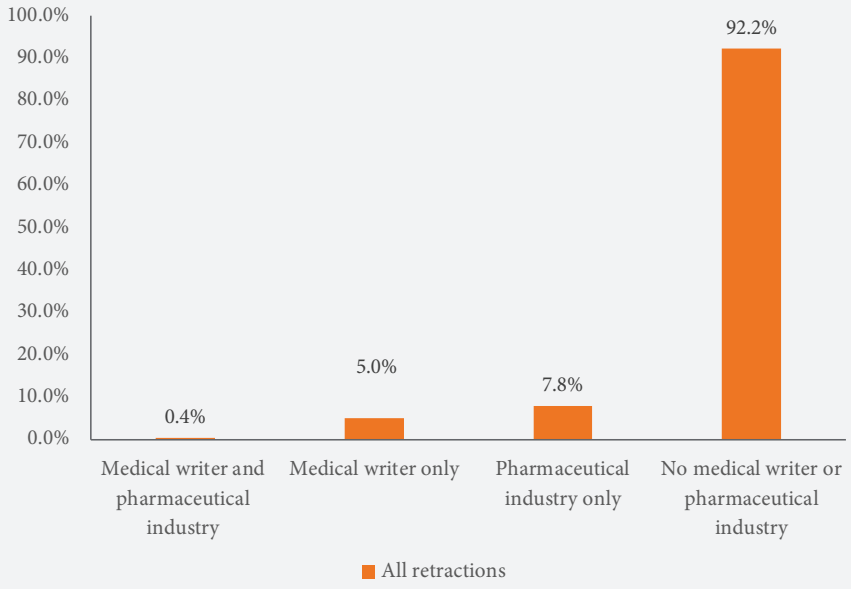
Some studies suggest errors in published medical journals are higher than previous rates indicate. Costantino, et al., analyzed 125 articles that met specific inclusion criteria in 3 top medical journals.[4] Errors were classified as methodological (eg, inconsistency with methods section), numerical (eg, no explanation of why patients were missing), and slips (eg, incorrectly writing "283" for "238").[4] Overall, 102 of the 125 articles (82%, 95%

confidence interval [CI] 74%–88%) had at least 1 error.[4] A numerical error was identified in 74% (95% CI 65%–81%) of the articles and methodological errors were found in 18% (95% CI 11%–25%) of the articles.[4] Five articles (4%, 95% CI 1%–9%) contained a severe error, where numbers in the abstract did not match the numbers in the full text.[4] While these errors often did not change the outcome of the studies or publication, it is unknown if the "fixed" errors may be indicative of other, uncorrected errors.

Many editors and authors believe the peer-review process minimizes errors in publications, but studies do not support this. Baxt, et al., used a fictitious manuscript containing 10 major and 13 minor errors to determine if peer review catches errors in publications.[8] A total of 262 reviewers completed the peer-review process on the manuscript and recommended acceptance, rejection, or revision. The reviews were analyzed for the number of errors each peer reviewer identified. Reviewers who recommended rejecting the manuscript identified the most errors in the manuscript, correctly identifying 39.1% (95% confidence interval [CI] 36.3–41.9%) of major errors and 25.2% (95% CI 23.0–27.4%) of minor errors. While the authors suggest some minor errors may be overlooked by reviewers in the belief that the editorial staff would fix these errors, more than half of the major errors were not identified or corrected.

The goal of evidence-based medicine is to provide healthcare professionals with solid scientific evidence to aid patient care. Data errors will result in misinformed healthcare providers who will be unable to make the best recommendations for their patients' care. Woolley, et al., surveyed English-language retracted human research publications between 1966 and February 18, 2008 to determine the impact of professional medical writers and pharmaceutical industry-sponsored research.[9] Overall, 4.97% of retractions surveyed used a professional, declared medical writer; 7.78% of retractions had a pharmaceutical industry sponsor (**Figure 2**). Publications with both a declared medical writer and a pharmaceutical industry sponsor accounted for 0.43% of retracted articles.

Figure 2. Medical writer and pharmaceutical industry support in retracted publications (adapted from Woolley, et al.)



Errors in medical and scientific publications are unacceptable; all companies and authors should strive for a zero-error rate. Quality assurance and control processes, such as those employed at AlphaBioCom, will help to ensure the medical and scientific communications are as close to perfect as possible.

References

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