tongue and in English might have been even larger in a representative sample of family physicians.

Author Contributions: *Study concept and design, analysis and interpretation of data, and critical revision of the manuscript for important intellectual content:* Gulbrandsen, Schroeder, Milerad, Nylenna. *Acquisition of data:* Gulbrandsen, Schroeder, Milerad. *Drafting of the manuscript:* Gulbrandsen. *Statistical expertise:* Gulbrandsen, Schroeder. *Obtained funding:* Schroeder, Milerad, Nylenna.
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Comparison of Review Articles Published in Peer-Reviewed and Throwaway Journals

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Context To compare the quality, presentation, readability, and clinical relevance of review articles published in peer-reviewed and "throwaway" journals.

Methods We reviewed articles that focused on the diagnosis or treatment of a medical condition published between January 1 and December 31, 1998, in the 5 leading peer-reviewed general medical journals and high-circulation throwaway journals. Reviewers independently assessed the methodologic and reporting quality, and evaluated each article's presentation and readability. Clinical relevance was evaluated independently by 6 physicians.

Results Of the 394 articles in our sample, 16 (4.1%) were peer-reviewed systematic reviews, 135 (34.3%) were peer-reviewed nonsystematic reviews, and 243 (61.7%) were nonsystematic reviews published in throwaway journals. The mean (SD) quality scores were highest for peer-reviewed articles (0.94 [0.09] for systematic reviews and 0.30 [0.19] for nonsystematic reviews) compared with throwaway journal articles (0.23 [0.03], $F_{2,391}=280.8$, $P<.001$). Throwaway journal articles used more tables ($P=.02$), figures ($P=.01$), photographs ($P<.001$), color ($P<.001$), and larger font sizes ($P<.001$) compared with peer-reviewed articles. Readability scores were more often in the college or higher range for peer-reviewed journals compared with the throwaway journal articles (104 [77.0%] vs 156 [64.2%]; $P=.01$). Peer-reviewed article titles were judged less relevant to clinical practice than throwaway journal article titles ($P<.001$).

Conclusions Although lower in methodologic and reporting quality, review articles published in throwaway journals have characteristics that appeal to physician readers.

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"THROWAWAY" JOURNALS ARE characterized as journals that contain no original investigations, are provided free of charge, have a high advertisement-to-text ratio, and are nonsociety publications.[1] Large circulations[1] and readership polls[2] suggest that throwaway journals are more widely read than some peer-reviewed journals in the same subject areas. Despite their popularity, throwaway journals are judged disparagingly as a source of "instant cookbook medicine"[3] and journals that are given away.[4] Indeed, throwaway journal articles[1] are seldom peer reviewed and are almost never cited in the medical literature. They are considered to be of poor quality compared with peer-reviewed journal articles, despite the lack of formal quality comparisons.[1] Given the success of throwaway publications, we sought to understand why so many physicians read them. We assessed the quality, presentation, readability, and clinical relevance of review articles published in a sample of peer-reviewed journals compared with those published in a sample of throwaway journals.

METHODS

We identified all review articles that focused on the diagnosis or treatment of medical conditions published in 5 leading peer-reviewed general medical journals (*Annals of Internal Medicine, BMJ, JAMA, The Lancet*, and *New England Journal of Medicine*) and the throwaway journals with the highest circulation[5] (*Consultant, Hospital Practice,*

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Patient Care, and *Postgraduate Medicine*) between January 1 and December 31, 1998. A 3-stage process was used to identify clinically relevant review articles for inclusion in our sample. First, we identified sections of each peer-reviewed journal that published review articles. Throwaway journals have no designated review sections; therefore, we identified sections most likely to contain review articles. Second, we excluded all review article subsections where the primary focus was not on the clinical diagnosis or treatment of a specific medical condition or sections that published only case studies. Two authors (A.M.B. and P.A.R.) excluded 68 peer-reviewed and 72 throwaway journal articles that did not meet our inclusion criteria. Our cohort included 394 review articles.

Each article was classified as either a systematic or a nonsystematic review. To identify systematic reviews, we used an approach based on the comprehensive search strategy outlined by Hunt and McKibbon.[6] Two trained reviewers (J.L.G. and Y.C.K.) independently evaluated methodologic and reporting quality using the Barnes and Bero[7] quality scoring assessment tool. This instrument is a modification of the Oxman et al[8,9] and Mulrow[10] instruments. The quality score was based on 12 questions that evaluated the purpose of the review, review strategy, inclusion and exclusion criteria, quality assessment, combining of study results, summarizing of study findings, limitations, and support provided for conclusions. Each question was scored as 0 (no), 1 (partial), or 2 (yes). The final score was a percentage, in which higher scores indicate better quality. As an additional measure of quality, we counted the references cited.

Presentation was evaluated using the article's font size (ie, small or large), use of color, and numbers of tables and figures. To quantify readability, we used 2 validated readability formulas[11]: the Flesch reading ease index[12] and the Gunning Frequency of Gobbledygook (FOG) index.[13] Scores were based on sentence and word length. The Flesch index generates scores from 0 to 100 (higher scores indicate easier reading); a score of 30 or lower was associated with a college-level reading ability. The Gunning FOG index scores also reflect reading difficulty (lower scores indicate easier reading); a score of 17 or more was considered too difficult for medical writing.[11]

Six physicians who were recent graduates in full-time clinical practice (see "Review Article Study Group") independently rated the clinical relevance of all 394 articles in 2 ways. First, physicians blinded to the journal name read a computer-generated random list of all article titles and indicated their agreement (1=strongly disagree; 5=strongly agree) to 2 statements: (1) this article may provide useful information for my practice, and (2) I would consider reading this article. Second, the reviewers evaluated the clinical relevance of all 30 heart disease articles (heart disease was one of the most frequent topics). The physicians independently read each article and used the scale to respond to the following statements: (1) the article addresses an important issue; (2) the topic is of interest to me; (3) the topic is relevant to my practice; (4) the article provides practical strategies for physicians such as myself; and (5) I will use the information to help care for patients. Tables were also evaluated.

The quality scores obtained by the 2 reviewers were very consistent; hence, the quality score assigned was the mean score. To evaluate the clinical relevance of all of the 394 review article titles and the subset of the 30 heart disease articles, we calculated the mean score obtained from the 6 physician reviewers. Differences in continuous variables among the 3 types of articles (ie, peer-reviewed systematic review, peer-reviewed nonsystematic review, and nonsystematic review articles published in the throwaway journals) were compared using analysis of variance. We used χ^2 tests to assess differences in categorical variables. Analyses were performed using SPSS version 10 (SPSS Inc, Chicago, Ill) and for all tests $P<.05$ was considered significant.

RESULTS

Of the 394 articles in our sample, 16 (4.1%) were classified as peer-reviewed journal systematic review articles, 135 (34.3%) as peer-reviewed journal nonsystematic review articles, and 243 (61.7%) as throwaway journal review articles. Most peer-reviewed articles (n=126, 83.4%) were classified by MEDLINE as tutorial reviews. Systematic reviews were published exclusively in the peer-reviewed journals.

Quality scores were highest for the 16 systematic review articles. The mean (SD) quality score was 0.94 (0.09) for the peer-reviewed systematic review articles compared with 0.30 (0.19) for the peer-reviewed nonsystematic review articles and 0.23 (0.03) for nonsystematic review articles published in throwaway journals ($F_{2,391}=280.8$, $P<.001$). Peer-reviewed journal articles provided significantly more references than throwaway journal articles (53.6 [36.8] vs 14.4 [11.6]; $P<.001$).

As outlined in TABLE 1, throwaway journal articles were more likely to use tables, figures, color, and larger font size compared with review articles published in peer-reviewed journals. Among the 378 nonsystematic review articles, 228 throwaway journal articles (93.8%) used color compared with only 77 (57.0%) of the peer-reviewed journal articles. All of the throwaway journal articles and none of the peer-reviewed journal articles used a large font size. Articles published in throwaway journals were judged to be easiest to read. Among the 378 nonsystematic review articles, the mean Flesch score was significantly higher in throwaway journal articles than in the peer-reviewed journal articles (23.7 [15.4] vs 15.8 [17.7]), indicating that throwaway journal articles were easier to read ($P<.001$). More scores were in the college level or higher range for the peer-reviewed journal articles compared with the throwaway journal articles (104 [77.0%] vs 156 [64.2%]; $P=.01$). Using the Gunning FOG index, mean (SD) scores were significantly lower in the throwaway journal articles compared with the peer-

reviewed journal articles (17.2 [2.9] vs 19.2 [3.3]) indicating that throwaway journal articles were easier to read ($P<.001$). Peer-reviewed journal articles were significantly more likely than throwaway journal articles to score in the range judged too difficult even for medical writing (67.4% vs 53.5%; $P=.009$).

Peer-reviewed journal article titles were judged to be significantly less relevant to clinical practice than throwaway journal article titles. When the physicians reviewed the article titles and were asked whether the article provided useful information for their clinical practice, throwaway journal articles were rated more relevant (mean [SD], 3.89 [0.55]) compared with peer-reviewed nonsystematic (3.50 [0.67]) or systematic (3.41 [0.73]) review articles ($F_{2,391}=20.7$, $P<.001$). Similarly, when the physicians reviewed article titles and were asked whether they would consider reading the article, throwaway journal articles were rated as an article they were more likely to read (3.74 [0.59]) compared with peer-reviewed nonsystematic (3.34 [0.69]) or systematic (3.17 [0.84]) review articles ($F_{2,391}=20.2$, $P<.001$).

TABLE 2 outlines the reviewers' assessment of the clinical relevance of the subset of 30 heart disease management articles. Compared with the peer-reviewed journal articles, throwaway journal articles were judged more likely to address important issues and be a topic of interest to the physicians. Furthermore, throwaway journal articles provided tables that were significantly easier to understand ($F_{2,27}=5.5$, $P=.01$), helped to clarify the text ($F_{2,27}=9.5$, $P=.001$), and provided information relevant to clinical practice ($F_{2,27}=13.5$, $P<.001$).

Table 1. Presentation and Readability of Review Articles (N = 394) Published in Peer-Reviewed and Throwaway Journals in 1998*

	Peer-Reviewed Articles				
	Systematic Reviews (n = 16)	Nonsystematic Reviews (n = 135)	Throwaway Journal Articles (n = 243)	$F_{2,391}$	*P* Value
Presentation					
No. of tables	2.4 (1.7)	2.1 (1.6)	2.6 (1.6)	3.8	.02
No. of figures	1.4 (1.5)	2.5 (2.1)	3.2 (3.2)	4.6	.01
No. of photographs	0	0.98 (1.5)	1.9 (3.1)	8.6	<.001
Color used, No. (%)	0	77.0 (57.0)	228 (93.8)	124.33†	<.001
Readability					
Flesch index score[12]	11.7 (19.0)	15.8 (17.7)	23.7 (15.4)	12.5	<.001
Gunning FOG index score[13]	19.1 (2.4)	19.2 (3.3)	17.2 (2.9)	19.0	<.001

*Data are presented as mean (SD) unless otherwise indicated. For the Flesch index, a lower score indicates more difficult reading. For the Gunning Frequency of Gobbledygook (FOG) index, a higher score indicates more difficult reading.
†The χ^2_2 test was conducted.

Table 2. Clinical Relevance of Review Articles on Heart Disease (N = 30) Published in Peer-Reviewed and Throwaway Journals in 1998*

	Peer-Reviewed Articles				
General Content Question	Systematic Reviews (n = 4)	Nonsystematic Reviews (n = 9)	Throwaway Journal Articles (n = 17)	$F_{2,27}$	*P* Value
The article addresses an important issue	3.85 (1.01)	4.40 (0.33)	4.66 (0.31)	5.4	.01
The topic is of interest to me	3.63 (0.81)	3.83 (0.71)	4.43 (0.39)	5.3	.01
The topic is relevant to my practice	3.21 (1.29)	3.46 (1.04)	4.21 (0.59)	3.6	.04
The article provides practical strategies for physicians such as myself	3.04 (1.19)	3.30 (0.98)	4.00 (0.56)	4.0	.03
I will use the information to help care for patients	3.04 (1.19)	3.32 (0.90)	3.88 (0.55)	2.9	.07

*Data are presented as mean (SD).

COMMENT

We found that review articles published in throwaway journals were easier to read than review articles published in peer-reviewed medical journals. Review articles published in throwaway journals were rated consistently better than articles published in peer-reviewed journals on virtually all measures of presentation, readability, and the clinical relevance of the message. As expected, peer-reviewed journal articles were of superior methodologic and reporting quality relative to articles published in throwaway journals. These findings are consistent with the large body of evidence showing that peer-reviewed medical journals produce articles of superior quality compared with those published in non–peer-reviewed journals.[14-16]

The simplest way of writing is not always the best.[17] Complex messages may require complex writing to convey accurate information. Through the use of color,[18,19] larger font size,[18-20] and the incorporation of more graphics,[19] many peer-reviewed journals have attempted to improve the appeal of the scientific material they publish to their readership. Despite these efforts, our findings suggest that peer-reviewed journal articles lag behind the throwaway journal articles in these communication techniques.

Our study has several limitations. First, review article quality scoring instruments reward articles that are systematic reviews. Many articles in our sample were not intended to be systematic reviews. Nonsystematic reviews can provide valuable information. However, systematic review articles are the only type of review that has been shown to minimize bias. Second, our physician reviewers may not be representative of all physicians; all had a clinical focus and were recent graduates. Third, titles may not be the best way to judge clinical relevance but play an important role in

attracting readers' attention and influence the decision of whether to read an article.

A balance needs to be achieved between presenting high-quality information and communicating the message. Throwaway journals do not serve the same markets as peer-reviewed journals and are largely supported by advertising; therefore, their editors may choose to publish articles for which there are enthusiastic sponsors. In contrast, peer-reviewed journals may be more likely to tackle difficult and sometimes less popular topics. Although lower in methodologic and reporting quality, review articles published in throwaway journals possess characteristics that are appealing to physician readers.

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Press Releases
Translating Research Into News

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Context While medical journals strive to ensure accuracy and the acknowledgment of limitations in articles, press releases may not reflect these efforts.

Methods Telephone interviews conducted in January 2001 with press officers at 9 prominent medical journals and analysis of press releases (n=127) about research articles for the 6 issues of each journal preceding the interviews.

Results Seven of the 9 journals routinely issue releases; in each case, the editor with the press office selects articles based on perceived newsworthiness and releases are written by press officers trained in communications. Journals have general guidelines (eg, length) but no standards for acknowledging limitations or for data presentation. Editorial input varies from none to intense. Of the 127 releases analyzed, 29 (23%) noted study limitations and 83 (65%) reported main effects using numbers; 58 reported differences between study groups and of these, 26 (55%) provided the corresponding base rate, the format least prone to exaggeration. Industry funding was noted in only 22% of 23 studies receiving such funding.

Conclusions Press releases do not routinely highlight study limitations or the role of industry funding. Data are often presented using formats that may exaggerate the perceived importance of findings.

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MEDICAL JOURNALS WORK hard to ensure that articles fairly represent study findings and to acknowledge important limitations, work that may be undone by the time research findings reach the news media. Medical journal press releases are perhaps the most direct way that

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