Media Reporting of Practice-Changing Clinical Trials in Oncology: A North American Perspective

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Disclosures of potential conflicts of interest may be found at the end of this article.

Key Words. Clinical trials • Journalism • Neoplasms • Social media

ABSTRACT

Introduction. Media reporting of clinical trials impacts patient-oncologist interactions. We sought to characterize the accuracy of media and Internet reporting of practice-changing clinical trials in oncology.

Materials and Methods. The first media articles referencing 17 practice-changing clinical trials were collected from 4 media outlets: newspapers, cable news, cancer websites, and industry websites. Measured outcomes were media reporting score, social media score, and academic citation score. The media reporting score was a measure of completeness of information detailed in media articles as scored by a 15-point scoring instrument. The social media score represented the ubiquity of social media presence referencing 17 practice-changing clinical trials in cancer as determined by the American Society of Clinical Oncology in its annual report, entitled Clinical Cancer Advances 2012; social media score was calculated from Twitter, Facebook, and Google searches. The academic citation score comprised total citations from Google Scholar plus the Scopus database, which represented the academic impact per clinical cancer advance.

Results. From 170 media articles, 107 (63%) had sufficient data for analysis. Cohen’s k coefficient demonstrated reliability of the media reporting score instrument with a coefficient of determination of 94%. Per the media reporting score, information was most complete from industry, followed by cancer websites, newspapers, and cable news. The most commonly omitted items, in descending order, were study limitations, exclusion criteria, conflict of interest, and other. The social media score was weakly correlated with academic citation score.

Conclusion. Media outlets appear to have set a low bar for coverage of many practice-changing advances in oncology, with reports of scientific breakthroughs often omitting basic study facts and cautions, which may mislead the public. The media should be encouraged to use a standardized reporting template and provide accessible references to original source information whenever feasible.

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Implications for Practice: North American newspapers, cable news, cancer websites, and industry websites were searched for their reporting on 17 practice-changing clinical trials in oncology as highlighted by the American Society of Clinical Oncology in its 2012 annual report, Clinical Cancer Advances. Accuracy of reporting across media platforms was evaluated, and the social media buzz and academic interest generated by each clinical trial was gauged. The findings represent, to the authors’ knowledge, the first systematic effort to appraise the reporting of practice-changing clinical trials in oncology across various media platforms. Use of a standardized reporting template by the media is proposed to reduce flaws in their reporting of clinical trials to the public.

INTRODUCTION

It is primarily through print and electronic media that clinical trial results and their interpretation are first shared with the public at large. However, Nguyen and colleagues revealed a significant time delay in the release of this information into the public domain [1]. The median time interval from phase III trial completion to public availability of results is 29 months [1]. This delay has potentially profound effects on patient management and counseling, because timely and complete propagation of results can refine patient treatments, outcomes, and safety [2]. Between the end of a clinical trial and its reporting in a peer-reviewed journal, other lay dissemination methods for publicizing trial results assume prominence. These methods include press releases, abstracts, and conference proceedings, which are then selectively reported by mainstream media outlets. A
recent analysis by Sullivan and Purushotham [3], concerning the media reporting of a press release from The Lancet Oncology Commission, revealed errors in information translation from an original scientific press release through the conduits of the print media. Their analysis was in a European context and did not consider the influence of the Internet or social media [4, 5], but, nonetheless, highlighted the weaknesses of media reporting of health information.

According to U.S.-based Health Information National Trends survey data collected in 2008, nearly 39.3% of the U.S. population has searched for information about cancer at some point [6, 7]. The top 3 most frequently used resources for this search were the Internet (55.3%), health-care providers (24.9%), and print materials (13.8%). These data reflect the public’s switch toward electronic media as a resource for information about cancer. Moreover, the Internet and social media are influencing practice and research in oncology [8–13]. The limitations in media reporting attributed to traditional media may also apply to electronic and social media platforms. To our knowledge, no analysis has been performed to characterize the weaknesses and strengths in knowledge translation from initial release of information using lay dissemination methods (e.g., press releases, conference proceedings, and abstracts) through to traditional and social media platforms.

We compared the authenticity of initial media reports specifically within a North American context involving print media and Internet-based traffic, and we contrasted media and academic impact, following the release of data via lay dissemination methods, concerning 17 practice-changing clinical trials in cancer as determined by the American Society of Clinical Oncology (ASCO) in its annual report, entitled Clinical Cancer Advances 2012 (Table 1) [14].

**Data Extraction**

Data extraction was performed by 2 reviewers (P.A., S.O.) using a 15-point media reporting score instrument (Table 2). This instrument, which has not been formally validated, is a variant of others [15, 16]. The instruments on which ours was based have not been formally validated but have been peer reviewed and subsequently published in high-impact medical journals. Our instrument differs only marginally from others in that we attempt to provide more granularity to the information reported by the media. If discrepancy arose, a third reviewer (P.T.) was involved to arbitrate individual points of discrepancy. For each of the 17 clinical trials, the initial conference proceeding or abstract for each trial was captured together with associated media releases from each of the selected media outlets. Each conference proceeding/abstract and its associated media releases were scored according to whether specific commentary was made to particular variables. An effort was made to extract additional details for certain data points by gathering more specific information pertaining to the reported data. The final rating for the 15-point media reporting score instrument for each article was calculated as the mean score of reviewer ratings. Interrater reliability was determined using Cohen’s $\kappa$ statistic based on the aggregate score [17].
<table>
<thead>
<tr>
<th>Subject</th>
<th>Source</th>
<th>Study/medical journal</th>
<th>Search terms and datea</th>
</tr>
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</table>
- Breast cancer  
- Drug name  
- Everolimus OR Afinitor  
Date  
- September 23, 2011 |
- Breast cancer  
- Drug name  
- T-DM1 OR trastuzumab emtansine OR Kadcyla  
Date  
- June 1, 2012 |
- Esophageal cancer  
- Procedure  
- Radiation  
Date  
- June 4, 2010 |
| Screening with flexible sigmoidoscopy reduces colorectal cancer deaths | No abstract identified, went straight to medical journal article | Schoen et al. [23]/New England Journal of Medicine | Cancer subtype  
- Colon cancer  
- Procedure  
- Sigmoidoscopy  
Date  
- June 4, 2010 |
| Enzalutamide (Xtandi; Astellas Pharma, Tokyo, Japan, http://www.astellas.us) for late-stage prostate cancer | http://meetinglibrary.asco.org/content/68246?format=posterImg&poster=1 [50] | Scher et al. [51]/New England Journal of Medicine | Cancer subtype  
- Prostate cancer  
- Drug name  
- Enzalutamide OR Xtandi  
Date  
- June 1, 2012 |
- Multiple myeloma  
- Drug name  
- Lenalidomide OR Revlimid  
Date  
- June 1, 2012 |
- Breast cancer  
- Drug name  
- Pertuzumab OR Perjeta  
Date  
- December 6, 2010 |
| Regorafenib (Stivarga; Bayer, Leverkusen, Germany, http://www.bayer.com) in metastatic colorectal cancer | http://meetinglibrary.asco.org/content/94460-114 [56] | Grothey et al. [57]/Lancet | Cancer subtype  
- Colon cancer  
- Drug name  
- Regorafenib OR Stivarga  
Date  
- December 6, 2011 |
| Bevacizumab (Avastin; Genentech) in recurrent ovarian cancer | http://meetinglibrary.asco.org/content/94636-114 [58] | Pujade-Lauraine et al. [58]/Journal of Clinical Oncology | Cancer subtype  
- Ovarian cancer  
- Drug name  
- Bevacizumab OR Avastin  
Date  
- June 1, 2012 |

(continued)
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<tr>
<th>Subject</th>
<th>Source</th>
<th>Study/medical journal</th>
<th>Search terms and datea</th>
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<tbody>
<tr>
<td>Cabozantinib (Cometriq; Exelixis; South San Francisco, CA, <a href="http://www.exelixis.com">http://www.exelixis.com</a>) in medullary thyroid cancer</td>
<td><a href="http://meetinglibrary.asco.org/content/94113-114">http://meetinglibrary.asco.org/content/94113-114</a> [59]</td>
<td>Schoffski et al. [60]/Journal of Clinical Oncology</td>
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<td>• Cabozantinib OR Cometriq</td>
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<td></td>
<td></td>
<td></td>
<td>• June 1, 2012</td>
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<tr>
<td>Carboplatin and pemetrexed combination in non-small-cell lung cancer</td>
<td><a href="http://meetinglibrary.asco.org/content/95863-114">http://meetinglibrary.asco.org/content/95863-114</a> [61]</td>
<td>Zukan et al. [62]/Journal of Clinical Oncology</td>
<td>Cancer subtype</td>
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<td>• Lung cancer</td>
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<td>• Carboplatin and pemetrexed OR Paraplatin and Alimta</td>
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<td>• May 31, 2013</td>
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<tr>
<td>Vismodegib (Erivedge; Genentech) for basal cell carcinoma</td>
<td><a href="http://meetinglibrary.asco.org/content/99743-114">http://meetinglibrary.asco.org/content/99743-114</a> [63]</td>
<td>Sekulic et al. [64]/New England Journal of Medicine</td>
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<td>• Basal cell carcinoma OR skin cancer</td>
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<td>• Vismodegib OR Erivedge</td>
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<td>• June 1, 2012</td>
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<tr>
<td>Pazopanib (Votrient; Novartis) for soft tissue sarcoma</td>
<td><a href="http://meetinglibrary.asco.org/content/97682-114">http://meetinglibrary.asco.org/content/97682-114</a> [65]</td>
<td>van der Graaf et al. [66]/Lancet</td>
<td>Cancer subtype</td>
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<td>• June 1, 2012</td>
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<td>Olanzapine (Zyprexa; Eli Lilly, Indianapolis, IN, <a href="https://www.lilly.com">https://www.lilly.com</a>) for chemotherapy-induced nausea and vomiting</td>
<td><a href="http://meetinglibrary.asco.org/content/93399-114">http://meetinglibrary.asco.org/content/93399-114</a> [67]</td>
<td>Navari et al. [68]/Supportive Care in Cancer</td>
<td>Cancer subtype</td>
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<td>• Cancer (nonspecific)</td>
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<td>• Drug name</td>
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<td>• Olanzapine OR Zyprexa</td>
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<td>• June 1, 2012</td>
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<tr>
<td>Duloxetine (Cymbalta; Eli Lilly) for chemotherapy-induced peripheral neuropathy</td>
<td><a href="http://meetinglibrary.asco.org/content/91721-114">http://meetinglibrary.asco.org/content/91721-114</a> [69]</td>
<td>Smith et al. [70]/Journal of the American Medical Association</td>
<td>Cancer subtype</td>
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<td>• Cancer (nonspecific)</td>
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<td>• Duloxetine OR Cymbalta</td>
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<td>• June 1, 2012</td>
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<td>Factors in elderly patients that increase chemotherapy risks</td>
<td><a href="http://meeting.ascopubs.org/cgi/content/abstract/25/18_suppl/9040">http://meeting.ascopubs.org/cgi/content/abstract/25/18_suppl/9040</a> [71]</td>
<td>Soubeyran et al. [72]/Journal of Clinical Oncology</td>
<td>Cancer subtype</td>
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<td>• Cancer (nonspecific) AND elderly</td>
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<td>• Chemotherapy (nonspecific)</td>
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<td></td>
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<td></td>
<td>• June 1, 2012</td>
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<tr>
<td>Predicting risk for chemotherapy-induced adverse effects in elderly patients</td>
<td><a href="http://meetinglibrary.asco.org/content/48232-74">http://meetinglibrary.asco.org/content/48232-74</a> [73]</td>
<td>Hurria et al. [74]/Journal of Clinical Oncology</td>
<td>Cancer subtype</td>
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<td>• Cancer (nonspecific) AND elderly</td>
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<td>• Chemotherapy (nonspecific)</td>
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<td>• June 4, 2010</td>
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</table>

aDate of general public access to conference proceeding and/or abstract with reporting of results from clinical trial.
Outcomes
There were three primary outcomes: media reporting score, social media score, and the academic citation score.

Media Reporting Score
The media reporting score was a lay dissemination measure of the completeness of information detailed in media articles. Similar data extrapolation was previously described by others [16].

Social Media Score
The social media score was a lay dissemination measure of the extent of social media attention per CCA and was calculated from the cumulative sum of Twitter feeds plus Facebook Boolean searches within 1 month of initial release of the conference proceeding and/or abstract per CCA. This simplified altmetrics method has been used elsewhere [18].

Academic Citation Score
Citation counts were harvested from Google Scholar (http://scholar.google.ca/) and Scopus (http://www.scopus.com/home.url) databases. This represented the academic impact per CCA. A similar calculation has been made by others [19]. Three primary databases exist that track citation counts for published articles: Web of Science, Google Scholar, and Scopus [20], of which Web of Science is the oldest. These databases reportedly produce quantitatively and qualitatively different citation counts [21], with Scopus offering approximately 20% more coverage and wider journal range than Web of Science, and Google Scholar delivering retrieval of even the most obscure information but sometimes with inconsistent accuracy [22]. No one of these three resources is the answer to all citation tracking needs.

Statistical Analysis
Cohen’s $\kappa$ coefficient assessed the degree of interrater agreement for counts per the 15-point media reporting score instrument. A coefficient of determination to estimate accuracy was calculated as $k^2$. The Kruskal-Wallis one-way analysis of variance-by-ranks test with post hoc analysis by Dunn’s test compared media reporting scores across media outlets, and the Pearson’s correlation coefficient measured the association between social media score and academic citation score. Statistica version 12 (Statsoft, Tulsa, OK, http://www.statsoft.com) was used for statistical analyses.

RESULTS
Sixteen of 17 CCAs had a conference proceeding and/or abstract that marked the initial release of information into the public domain; 1 CCA did not have a conference proceeding and/or abstract but went straight to journal publication [23]. From 170 potential media articles, 107 (63%) media articles were captured for analysis (Fig. 1). Not all media outlets reported on these clinical trials at the time of their first public dissemination of results. Only 5 (4.7%) media articles were identified to revisit coverage of a CCA once it was available as an original journal publication. These five articles all concerned breast cancer research.

Table 2. Media reporting score instrument

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Data absent</th>
<th>Data present</th>
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<tbody>
<tr>
<td>1. Author</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
</tr>
<tr>
<td>2. Source</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<tr>
<td>3. Study population</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<td>4. Phase of study</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<td>5. Study design</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<td>6. Exclusion criteria</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<td>7. Intervention</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<tr>
<td>8. Comparator</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<tr>
<td>9. Outcomes/benefits</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<td>10. Adverse events</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<tr>
<td>11. Costs</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
</tr>
<tr>
<td>12. Study limitation(s)</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
</tr>
<tr>
<td>13. Author conclusion(s)</td>
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<td>14. Funding source</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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<tr>
<td>15. Industry ties</td>
<td>Not reported ☐</td>
<td>Reported ☐</td>
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Cohen’s κ coefficient revealed a high level of interrater reliability using the media reporting score instrument (κ: 0.97; 95% confidence interval: 0.95–0.99). The coefficient of determination was 94%. Reporting practices by media outlet are shown in Table 3. In descending order of frequency, omitted items from media coverage of the CCAs were study limitations, exclusion criteria, conflict of interest, and other. In descending order of frequency, media reporting score for each media outlet showed most comprehensive reporting for industry, cancer websites, newspapers, and cable news (Kruskal-Wallis H test: 8.52; degrees of freedom: 3; p < .05) (Fig. 2). Among media outlets, cancer websites had the highest frequency of linkage to original CCA data and information (Fig. 3).

The combined social media score for all 17 CCAs was 4,311 (Fig. 4). Among the 10 different malignancies represented in the ASCO annual report, the 3 clinical trials concerning breast cancer generated a total social media score of 1,727, which represents approximately 40% of all tweets and Facebook pages generated. The social media score was weakly correlated with academic citation score (Pearson’s r = .24) (Fig. 5). There was a positive trend between social media score and academic citation score. However, sensitivity analysis showed that exclusion of the 3 breast cancer clinical trials negated this weak positive correlation (Pearson’s r = .21).

**DISCUSSION**

To our knowledge, this study represents the first systematic effort to compare reporting of practice-changing clinical trials in oncology across various media platforms. A number of interesting findings and their implications deserve to be highlighted. First, there are a number of weaknesses concerning the accurate representation of clinical benefits, adverse events, and conflicts of interest across media platforms. These shortcomings are not new but are well documented in the medical literature [19, 24–28]. This is of particular concern given the time it takes for clinical trial data to be formally released into the public domain [1]. Poor knowledge translation to patients weakens their ability to participate in better decision-making about their care. We propose that use of a standardized reporting template would reduce flaws in media reporting of clinical trials in oncology. Others have suggested that medical journals embed quality-of-evidence ratings in article summaries and create incentives for inclusion of these ratings in lay media reports [29].

Second, media articles from all outlets neglected to consistently provide a link to the original CCAs on which their articles were based. Cancer websites were least at fault, followed by industry websites, newspapers, and cable news (Fig. 3). Although barriers to distribution of this information exist in the form of copyright restrictions and fees for publication, we encourage media articles to provide references to original source data and other repositories (e.g., clinicaltrials.gov) whenever feasible. Clear referencing plus a statement regarding the level of evidence and commentary on the maturity and quality of the clinical research are key items that would enhance the integrity of media reports of clinical trials [26]. Significant failure of media outlets to explicitly report clinical trials as funded by the pharmaceutical industry has been reported [25], and this unfortunate trend continued in our analysis at a rate of 75% for cable news, 41% for newspapers, and 22% for cancer websites (Table 3).

Third, we identified a discordance between altmetrics and the estimated academic impact of the CCA (Fig. 4). According to our sensitivity analysis, the relationship between altmetrics and academic impact is nonlinear when clinical trials concerning breast cancer are excluded. This finding may be explained by the disproportionate public interest for particular cancer types versus the academic impact a research study realizes via citations received. Breast cancer is a notable example in our analysis: It dominates the social media landscape and garners a disproportionately high altmetric compared with other cancers, which, in turn, distorts the typical nonlinear relationship between altmetrics and academic impact seen for other malignancies combined. A number of reports have documented the overrepresentation of breast cancer in online news and social media [30, 31]. Consequently, clinical trials in oncology with high academic impact may not always garner equal media attention and vice versa. This said, others have argued for a potential correlation between altmetrics and subsequent prediction of academic impact [19]. Our interpretation that altmetrics may not correlate with citations may be skewed because of a suboptimal number of data points plus a limited period of follow-up. Finally, our data mining revealed that media coverage of these practice-changing clinical trials peaked at the time of conference proceedings and/or abstract release, and yet was minimal with the release of the peer-reviewed journal publication (66% vs. 3%, respectively).

Our study is unique in that we addressed not only traditional media sources and their performance as a conduit for dissemination of clinical information to the public but we expanded on this to consider the broader impact of social media. A recent Pew Research study reported that 77% of online health seekers begin at a search engine such as Google, Bing, or Yahoo [32]. But social media are rapidly gaining adoption as the platform for exchange among clinicians at conferences [33], among patients [31,
Social media lack the integral tools needed to ensure only accurate representation of clinical trials results. However, Twitter and Facebook are increasingly accessed by patients with cancer as forums for unregulated commentary concerning personal experiences with malignancy, as well as opinions regarding clinical trials and cancer treatments [34]. Commentators range from health professionals to the nonexpert. Industry has been slow to engage in social media, probably fearing regulatory penalties, potential for bad public relations, or the unknown [11].

The adoption of Twitter and Facebook by patient groups is also trickling down to professionals in oncology [33]. An example of this is ASCOConnection.org, which offers an exchange platform for ASCO members only to discuss clinical practice [35]. The limitations of the Twitter and Facebook platforms are many: a lack of censorship, the anonymity of posts, and the widespread absence of strict adherence to the principles of evidence-based medicine [30]. These criticisms often leveled at traditional media are widely prevalent on social media, too, and with fewer options for regulation. Information from both traditional and social media alike can fortify patients with unrealistic expectations about their cancer care [8]. Indeed, oncologists typically view Internet-derived information as having both positive and negative effects on clinical encounters with patients [36]. Although challenging, effective knowledge translation may help bridge the gap between patient expectations and the treatment outcomes reported from clinical trials [37]. Moreover, oncologists may need to be more active participants in directing patients to the most appropriate sources of information [38].

**Study Limitations**

There are limitations in this study that are inherent in its design. Inspection of media reporting of all 17 practice-changing clinical trials was not possible because of incomplete media coverage; only 63% of articles (107 of a possible 170) were part of our analysis. Our sample size is a limitation and further evaluation with a larger sample size is needed to confirm our reported findings. However, the coefficient of determination was 94%, which demonstrates a high degree of accuracy for the data captured herein [17].
Our analysis primarily concerned media reporting stemming from prestigious scientific meetings. But media attention based on research published in high-quality, peer-reviewed medical journals is more credible than news generated from scientific or press meetings that divulge preliminary findings that have not yet been through the peer-review process [27, 39]. However, it should be noted that our data reflected the first, and typically only, media reporting of these 17 clinical trials. By the time studies appeared in peer-reviewed journals, there was typically no further media interest. Moreover, we purposely selected the ASCO Clinical Cancer Advances 2012 as a framework for our analysis because almost all 17 studies led to publication, which is not always the case for abstracts presented at scientific meetings [27]. We sampled only three primary networks, three newspapers, and three cancer websites. However, there is reason to believe that we captured a sizeable audience in our analysis given the popularity of these sources with the public [40].

As with any content analysis of the media, some subjectivity is inherent. We used an instrument that has not been formally validated, although similar instruments used by others have been peer reviewed and published in the highest-impact medical journals [16]. The basis for selecting specific coding variables was to identify the common deficiencies in media reporting to the public [3, 16, 41]. Our counting method may have inflated the social media score, but we attempted to minimize this by using strategies detailed by others when counting tweets and Facebook pages [19]. The academic citation score, which is limited by being a citation-based yardstick of scientific impact, may also overestimate because of possible duplication between databases [20, 21, 42]. The academic citation score is only one of several possible metrics that could have been used. Although altmetrics is primarily designed to be of value to investigators, institutions, and publishers, our use of altmetrics was only to represent the level of public engagement with a particular clinical trial. Our data are limited by not capturing engagement outside of social media platforms.

It is primarily through print and electronic media that clinical trial results and their interpretation are shared with the public at large. Knowledge translation to the public about therapeutic advances in oncology should not lead to unrealistic expectations. The media in all its forms should emphasize accuracy over sensationalism. More effective knowledge translation via the media is one mechanism whereby patient expectations can be better managed before patients arrive at the oncology clinic. Although oncologists may be able to improve patients’ understanding, this may come at the cost of...
patients’ satisfaction with their oncologist. Understanding how patients navigate this network of information resources may help clinicians and educators guide patients toward appropriate, high-quality media [43] and, in so doing, strengthen the oncologist-patient relationship.

CONCLUSION

Unfortunately, media outlets appear to have set a low bar for coverage of many practice-changing advances in oncology. Media reporting of scientific breakthroughs often omits basic study facts and cautions, which may mislead the public. To improve reporting practices generally, we suggest the use of a standardized reporting template and the provision of references to original source data. This is feasible across media platforms.

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DISCLOSURES

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