Media Coverage of Cancer Therapeutics: A review of literature

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ABSTRACT

Background: Information and stories about cancer treatment are increasingly available to patients and the general public through lay media, websites, blogs and social media. While these resources may be helpful to supplement information provided during physician-patient discussions, there is growing concern about the extent to which media reports accurately reflect advances in cancer care. This review aimed to understand the landscape of published research which has described media coverage of cancer treatments.

Methods: This literature review included peer-reviewed primary research articles that reported how cancer treatments are portrayed in the lay media. A structured literature search of Medline, EMBASE and Google Scholar was performed. Potentially eligible articles were reviewed by three authors for inclusion. Three reviewers, each independently reviewed eligible studies; discrepancies were resolved by consensus.

Results: Fourteen studies were included. The content of the eligible studies reflected two thematic categories: articles that reviewed specific drugs/cancer treatment (n=7) and articles that described media coverage of cancer treatment in general terms (n=7). Key findings include the media's frequent and unfounded use of superlatives and hype for new cancer treatments. Parallel to this, media reports over-emphasize potential treatment benefits and do not present a balanced view of risks of side effects, cost, and death. At a broad level, there is emerging evidence that media reporting of cancer treatments may directly impact patient care and policy-making.

Conclusions: This review identifies problems in current media reports of new cancer advances – especially with undue use of superlatives and hype. Given the frequency with which patients access this information and the potential for it to influence policy, there is a need for additional research in this space in addition to educational interventions with health journalists. The oncology community – scientists and clinicians – must ensure that we are not contributing to these problems.

BACKGROUND

People with cancer and their families want information about their diagnosis, available treatment options, and expected outcomes [1]–[3]. Due to time constraints in clinical visits, it is unlikely that all information sharing will come from the treating oncologist [4] [5]. Despite availability of well curated patient dedicated information on professional societies and organization websites, is therefore not surprising that patients with cancer commonly turn to newspapers and online media, websites, blogs and social media as sources of information about cancer treatment options [6], [7],[8]. Those that use the internet to obtain health information believe it facilitates subsequent conversations with their provider and empowers health decision-making [9]. While there are clear benefits for patients who seek information outside clinic visits, there may be challenges in identifying what information is accurate and relevant to their specific circumstances. It can also be challenging to filter the overwhelming information that can be accessed as patients often face an "information anarchy"[10]. Unfortunately, the quality and trustworthiness of the information provided by the media is uneven and may contribute to unrealistic expectations of cancer drugs and their benefits [11]. Indeed, patients with cancer who use the internet for information on cancer diagnosis, treatment and cancer drugs find it overwhelming, conflicting and confusing [9].

New cancer drugs are expensive and commonly associated with small clinical benefits [12][13][14]. While a handful of recently approved cancer medicines are transformative for patient outcomes, multiple studies have shown that the median improvement in survival offered by newly approved drugs is 2-3 months [12]–[14]. However, there is a stark disconnect between this reality and what is reported in the media. News coverage tends to inflate these benefits using superlatives words such as "game changer", "miracle drugs", and "unprecedented" [8], [15].

Even when drugs have substantial benefits, news coverage tends to focus on survival benefits rather than treatment failure and side effects[16]. Skewed reporting may give patients and families unrealistic hopes for their treatment by overstating benefits and minimizing harms [16]. Journalists, philanthropic bodies, research institutions and researchers have all inflated the benefits, used superlatives, and contributed to the hype about cancer drugs [8], [15], [17]. At least a proportion of this "over-hype" in oncology is driven by marketing efforts from pharmaceutical companies that seek to influence physician prescribing [18]. In addition to its impact on patients and families, overblown media reporting of new cancer drugs exerts pressure on policy-makers and influences funding approvals of new drugs [19].

While there are isolated studies that have described this problem, we are unaware of any synthesis of these findings regarding media coverage of cancer therapies. Given the potential for media reports to influence policy and patient care we undertook a scoping review of published literature that empirically describes media coverage of cancer treatment. We were specifically interested in the extent to which these media reports may overstate ("hype") the benefits of new cancer treatments. A search for previous reviews on this topic was done through the Joanna Briggs Institute (JBI) evidence synthesis and the Cochrane database of systematic reviews; none were found.

Research Questions

In this literature review, we sought to understand: 1) the extent, range and nature of research activities on media/press coverage of cancer treatments (medicine, radiotherapy and surgery); 2) to what extent has research been undertaken to understand media coverage of cancer treatments; 3) what types of cancer and what treatments are commonly covered by the media,

and 4) the extent to which media reports over-state the benefit of cancer treatments. Finally, we use the existing literature to identify gaps in knowledge to guide future research efforts.

METHODS

Eligibility Criteria

This literature review included peer-reviewed primary research articles that evaluated how cancer treatments are portrayed in the lay media. Eligible studies had to: (a) evaluate how the media reports advances in cancer treatment; (b) report on specific treatments (i.e., chemotherapy, radiotherapy, and surgical interventions); (c) indicate the type(s) of cancer addressed; (d) be published during January 2012 through May 2022 and; (e) be published in English or available with English translation. The one-decade window was chosen as we were interested in contemporary trends in the era of "precision oncology". Abstracts without full articles were excluded.

Data Sources and Search Strategy

A search strategy was developed with the assistance of an experienced Health Sciences librarian. Using subject headings and keywords, OVID-MEDLINE, EMBASE, and Google Scholar were searched. The full search strategy was initially developed and used for OVID-Medline and EMBASE and later adapted for other databases (Supplemental eTable 1A &B). References of the identified articles were hand-searched through Google scholar. The literature search was performed on March 24, 2022.

Data Capture and Analysis

A single author (FR) reviewed titles and abstracts from the literature search strategy to identify potentially eligible articles. Three authors (FR, JG, CB) reviewed articles in full to determine eligibility. Three authors subsequently (FR, ER, BN) performed data capture on all eligible articles. The primary author (FR), in consultation with the study team, developed a data capture tool that was relevant to the study objectives [8], [15]. The data extraction form was created in Microsoft Excel and was pilot tested by two reviewers (FR and ER). Three reviewers (FR, ER, BR) independently reviewed eligible studies; discrepancies were resolved by consensus. Variables of interest included author name, year of publication, journal, type of media/press searched (newspaper, online, etc.), cancer type, the form of cancer treatment (medicine, radiotherapy, surgery), drug name, FDA approval, endpoints, clinical data available for the drug, use of superlatives, and primary study results.

RESULTS

The initial search yielded 531 articles from OVID and 202 from EMBASE. After reviewing titles and abstracts, we identified 40 potential articles; two duplicate records were removed. An additional 6 articles were identified from hand-searching references of the articles retrieved from databases; 44 articles were therefore screened for eligibility. After screening, 25 articles were reviewed in full; 14 of these met all eligibility criteria.

Study Characteristics

Published studies were authored in five countries: the US (6), Canada (2), Australia (2), UK (3), and France (1). Characteristics and findings of the 14 included studies are shown in Tables 2 and 3. Articles included in this review described reports of cancer medicines (cytotoxic,

targeted therapy, immunotherapy) and surgery; there were no reports of media coverage for radiotherapy. The content of included studies reflected two thematic categories: 1) articles that reviewed specific drugs/cancer treatment (Table 1) (n=7), and 2) articles that described media coverage of cancer treatment in general terms (Table 2) (n=7). Subsequent results will present results in light of these two themes.

Articles that reviewed media coverage of specific cancer treatments

These five articles were led by teams in the US (n=3),Australia (n=1), France(n=1) and Canada (n=2)[8], [15], [19]–[22]. The studies evaluated media reports of multiple cancer medicines and surgery across multiple cancers. Articles by Abola et al and Tayapongsak et al described the use of superlatives in media reports including terms such as "unprecedented", "breakthrough", "miracle", and "revolutionary" [8], [15]. These terms were used by multiple parties including journalists, physicians, industry, patients and politicians [8]. In both studies, it was very clear that the clinical evidence in support of new cancer medicines was much less impressive than reported in the media. In most cases, the medicines associated with hyperbole in media reports were not yet even approved by the FDA; moreover, some reports were based only on animal data [8], [15].

Three studies evaluated media reports for specific medicines in breast cancer: trastuzumab and bevacizumab. Booth and colleagues described news coverage of trastuzumab and 17 other cancer medicines that were approved by Cancer Care Ontario during 2000-2005 [19]. Using a Canadian media database, they found 51 media reports of Trastuzumab for breast cancer during in the 3 months after the presentation of pivotal RCTs results (17 reports/month). There was substantially less media coverage of other drugs; the next highest was 1.2 reports. Time to funding approval was much faster with Trastuzumab (3 months) compared to a mean of

31 months for the other cancer medicines. The authors postulated that the degree of media coverage can influence policy-makers and funding decisions [19]. Fralick and colleagues tracked media reports before, during, and after FDA approval and subsequent revocation of approval for bevacizumab in metastatic breast cancer [20]. During the 2002-2013 study period, there was 359 reports. The tone and content of media reports evolved over time, consistent with the policy changes. Over time – as negative trial results emerged - the media articles became less positive in tone, placed greater emphasis on side effects and costs, and were more likely to frame the benefits as small. Vitry et al. also describe the bevacizumab withdrawal story, analyzing reactions of clinicians and patients[22]. There were a variety of perspectives regarding the therapeutic value of bevacizumab, with strong beliefs among cancer survivors that the drug was effective and the risk of adverse effects was manageable. The public's high expectations may have been fueled by overly optimistic media coverage and a limited understanding of the complexity of the scientific evaluation of new medications and the regulatory processes.

Ficko and colleagues analyzed media reports about robotic surgery in the US newspapers [23]. During the study period of 2010-2015, there was a total of 83 articles. Urological and gynecologic were the most reported to use robotic surgery. Most articles discussed several aspects of robotic surgery including; increased cost (55%, 45/83), increased complication (43%, 38/83) and faster recovery (39%, 32/83). The articles were more likely to mention the downsides of robotic surgery rather than the advantages. Using the Altimetric score, Haneef et al. evaluated the online media attention of 729 research studies evaluating cancer treatments[21]. Forty-four percent of the news articles described observational studies, 31% were randomized controlled trials, 14% were phase I/II non-randomized trials, and 11% were systematic reviews or meta-analyses. High Altmetric scores were associated with the presence of a press release, open access

to the article, and a high journal impact factor. There was no significant different in Altmetric score between randomized trials and observational studies.

Articles that reviewed media coverage in general for cancer treatment

Seven articles authored in the US (n=3), UK (n=3) and Australia (n=1) explored media coverage as a general concept for cancer care [16], [24]–[28]. Fishman and colleagues evaluated media reports about cancer in US magazines and newspapers during 2005-2007 [16]. Of the 436 reviewed news reports, 32% (143/436) focused on survival and only 8% (33/436) focused on death and dying. Only 13% (57/436) reported that treatment can fail and 30% (131/436) reported that aggressive treatment can cause toxicities. Thus, the media portrays and overly optimistic view of cancer treatment, outcomes, and prognosis. Amberg et al. reviewed 80 reports from major newspapers in US, UK, and Australia [24]. The 80 reports described primarily epidemiologic and basic science findings (39% and 24% respectively); 29% of reports related to clinical cancer research. The authors identified concerns with the quality of reporting and also a striking gender imbalance whereby news reports disproportionately featured male physicians and scientists. Lewison et al. reported a similar analysis of how cancer research is portrayed by the BBC [25]. Using the BBC archive, the authors searched for reports published during 1998-2006; 170 were identified. Relative to disease burden (13%), breast cancer was over-represented (33%); lung cancer was under-represented (10% articles, 20% disease burden). New cancer medicines were featured in 20% of media reports followed by lifestyle choices and cancer (12%), genetics (9%), and nutrition (8%).

Lewison et al. reviewed UK newspapers during 2010-2015 to identify media reports about the Cancer Drug Fund [26]; 1692 included. The reports were generally very favorable with

calls to extend the program to Wales and Scotland and to increase the overall budget. There was rarely any critical comment on the lack of survival benefit, cost, or severe side effects of the included medicines.

Hicks-Courant and colleagues reviewed 396 news reports related to cancer and personalized medicine (PM) [29]. The term PM was clearly defined in only 27% of articles, 96% of stories reported benefits of PM; 48% described the limitations of PM. Commonly reported benefits included improved treatment (89%), prediction of side effects (30%), disease risk prediction (33%), and lower cost (19%). Confusion about personalized medicine may be exacerbated by media reports. Most reports over-state the benefit of PM which may lead to unrealistic expectations for cancer genomic care.

Sabel et al evaluated 727 media reports of celebrities with breast cancer[27]. Reports increased over time corresponding to celebrities going public about their breast cancer treatment. Among those celebrities who underwent prophylactic bilateral mastectomy, in 60% (27/45) of articles there was no mention of genetics, family history or risk. Media reports of celebrity breast cancer disproportionately describe decisions of bilateral prophylactic mastectomy; this could influence the decision-making of women in the general population.

Macaulay evaluated how the media report the decision-making of the National Institute for Health and Care Excellence (NICE), with a particular focus on the NICE document that did not recommend Trastuzumab Emantansine for breast cancer[28]. Nineteen records were extracted (6 national newspapers, 6 regional newspapers, 3 broadcasters, and 4 other). Seven out of nineteen articles centered on the reaction of a patient or physician, all of whom were especially critical of the NICE decision. Three out of nineteen articles focused on the proposed high price of the new drug, with two of those articles criticizing the pharmaceutical company.

The author concluded that the media continues to be hostile toward NICE's decisions not to fund oncology drugs, focusing more on patient reactions than the challenges of allocating scarce health care resources to optimize care.

DISCUSSION

In this scoping review, we identified peer-reviewed studies which describe how cancer treatments are portrayed in the media. Several important findings have emerged. First, there is limited research on this topic; our review identified only 14 studies. This is an important gap in knowledge considering that almost all patients will seek treatment information from lay media sources[7]. Moreover, most media reports focus on cancer medicines reflecting the general pharmaceuticalisation of cancer care. There are very limited data related to new technologies in surgery and none on radiotherapy. Second, we have observed into two major themes of research; 1) studies which describe media reporting of specific treatments, and 2) studies which describe reporting about cancer in general. Third, we found that media reporting is prone to unfounded use of superlatives and hype. This is a major problem in our field as it may cause harm by promoting toxic and marginal therapies that patients pursue with unrealistic expectations. Fourth, media reports seem to emphasize potential treatment benefits (which may be over-stated) and do not present a balanced view of risks of side effects, cost, and death. Finally, there is emerging evidence that media reporting of cancer treatments may have a direct impact on patient care and policy-making; depending on the quality of reporting, these impacts may be helpful or harmful to patients.

Accurate reporting of cancer research findings is critical to inform physicians, patients, the public, and policy-makers. Dissemination of of this information can play an important role in

distilling the complex content of scientific research and clinical oncology for a lay audience [30], [31]. Prior work has shown that patients have inaccurate expections and optimism of the curative potentials of some cancer drugs [32]; unbalanced reporting in the lay media contributes to these problems. Unrealistic expectations may lead to patients demanding tests and treatment which expose them to unnecessary risks and costs with little potential for benefit[22], [28] [33], [34]. Data from this scoping review demonstrates that the science behind many news reports come from observational studies that either claim one treatment is better than another, or describing a putatiuve association between diet/lifestyle and cancer outcomes. There is growing recognition within oncology that many of these observatioanl analyses are flawed methodologically and likely to report suprious associations [24], [35], [36].

Media and journalists are not the only source of misinformation in our field. Spin and hype exist within scientific articles published by oncologists including celebrating very small improvements in clinical trials and using exploratory subset analyses to find ”benefit” in the context of a negative RCT [37]–[39]. Spin is problematic in abstracts of oncology RCTs [38], [40] which may be the only section of a trial report read by oncologists and journalists. It is also increasingly recognized that press releases issued by univeristies and hospital research institutes contribute to problems of hype and spin.

Positive bias toward reporting cancer drug benefits may relate to the influence of industry marketing strategies and to increase their viewership [20]. Some media reports relate drugs which have not yet been given to humans [8], [15]. However, not all media reporting of cancer policy is misfounded; the study of Bevacizumab was one example where reproting very closely followed the evolution of science and policy and the study of robotics illustrated a

balanced view of the potential downsides [20] [24]. Additionally, where there is a demonstrated benefit, media and lay press have facilitated early access to cancer treatment.

There are limitations to our study. We included only articles published in the past decade (2012-2022). We also limited inclusion to English-language reports. Articles included in this review reported on published media from newspapers, magazines, and news websites; more contemporary and fluid forms of information distribution including social media were not included. Finally, no peer-reviewed articles on media coverage of new radiotherapy techniques and technologies. However, this does not mean that the media do not report on radiotherapy techniques and technologies.

Media and lay news reporting is needed in disseminating cancer research findings to the general public, it is therefore critical to improve how cancer research findings are reported. To improve cancer reporting, we suggest several steps that should be taken by researchers, journalists and general public, which are summarized in Table 3; 1) researchers should be cognizant that research articles will be read by non-scientists and therefore remove any potential source misinterpretation; 2) many journalists receive scientific information from institutional press releases – as such, researchers and institutions should be mindful that they are not contributing to these problems and avoid overstating the implications of their work and avoid using hype and spin; 3) although cancer treatments have varying potential benefits and side effects, journalists should make an effort to present both sides of the treatment story and not just the potential benefits; 4) journalists should ensure the readership understands both the level of evidence (RCT vs observational) and the potential limitations of the relevant studies; and 5) because the incremental benefits of many new cancer treatments are modest (i.e. increase survival by only few months), journalists should include information to this extent so that

patients and families have realistic expectations of the slow and incremental pace of cancer advances. A pragmatic intervention that might help advance these changes is for the scientific community to host a series of short workshops for health journalists to educate them about the pitfalls of scientific studies and how to better understand the implications of published studies.

In summary, problems exist with current media reporting of new cancer advances – especially with undue use of superlatives and hype. This has potential harm to patients and society. The oncology community has an obligation to ensure that we are not contributing to these problems by overstating the relevance and validity of our own work. Journalists have an obligation to understand the limitations of what they are reporting and to be more cautious with their use of superlative language. Further study is needed to better understand how social media can influence patients' understanding of cancer care. The oncology community and journalists should work together to create a series of educational workshops that would allow health journalists to develop basic skill sets in critical appraisal and to better understand the nuances of emerging cancer research. Finally, studies included in this review were done in high income countries, there is a need to examine how media outlets in low and middle income countries report cancer breakthroughs.

DISCLOSURES

The authors have no conflicts of interest to report.

Supplemental eTable 1A. Search strategy to identify studies of how media describes cancer treatment from EMBASE.

Search Flow	Keyword/ subject headings	Number of articles/records
1	*mass medium/ or television/	(24852)
2	(news or newspaper* or television* or broadcast*).ti,ab,kw,kf.	(58671)
3	(media adj5 (cover* or content* or report* or campaign* or influenc*)).ti,ab,kw,kf.	22797
4	(mass media or journalism).ti,ab,kw.	7900
5	1 or 2 or 4	76842
6	exp *malignant neoplasm/dm, dt, rt, su, th [Disease Management, Drug Therapy, Radiotherapy, Surgery, Therapy]	973411
7	exp *antineoplastic agent/ae, dt, to, th [Adverse Drug Reaction, Drug Therapy, Drug Toxicity, Therapy]	510445
8	exp *chemotherapy/	249790
9	6 or 7 or 8	1401633
10	5 and 9	730
11	limit 10 to (conference abstract or "review")	175
12	10 not 11	555
13	limit 12 to yr="2012 -Current"	202

Supplemental eTable 1B. Search strategy to identify studies of how media describes cancer treatment from OVID.

Search Flow	Keyword/ subject headings	Number of articles/records
1	Journalism, Medical/	(2437)
2	Mass Media/	(11907)
3	(newspaper* or news article*).ti,ab.	8051

4	exp Antineoplastic Agents/ae, de, re, tu, to [Adverse Effects, Drug Effects, Radiation Effects, Therapeutic Use, Toxicity]	499460
5	exp Neoplasms/dt, rt, su, tr [Drug Therapy, Radiotherapy, Surgery, Transplantation]	1258853
6	exp Neoplasms/dt, rt, su, tr [Drug Therapy, Radiotherapy, Surgery, Transplantation]	1258853
7	4 or 5 or 6	1505709
8	1 or 2 or 3	20972
9	7 and 8	125
10	limit 9 to yr="2012 -Current"	38
11	(news or newspaper* or television* or broadcast* or journalism).ti,ab,kw,kf.	52484
12	(media adj5 (cover* or content* or report* or campaign* or mass or influenc*)).ti,ab,kw.	22634
13	(mass media or journalism).ti,ab,kw,kf.	7749
14	11 or 12 or 13	71904
15	(cancer* or chemotherap* or carcinoma* or melanoma* or sarcoma* or tumor or tumour or tumours or tumors).ti,ab,kw,kf.	3758603
16	14 and 15	4161
17	limit 16 to medline	3621
18	16 not 17	540

Table 1. Characteristics of studies which describe media reporting of specific cancer treatments

Author (year)[reference]	Media (years)	Research question	Key findings
Abola (2016)[8]	Google News (2015)	What are the true results and benefits of new cancer medicines that are described using superlatives in media reports?	94 media reports about 36 cancer drugs were identified that used 10 superlatives (e.g., "breakthrough", "cure", "revolutionary", "game-changer". 50% of the drugs (18/36) were not approved by FDA; 5/36 (14%) had no human data. The use of superlatives to describe the benefits of new cancer medicines is discordant with more modest benefits observed in RCTs.
Tayapongsak (2017)[15]	Google News, Medscape (2016)	Are media reports of "unprecedented" cancer medicines based on legitimate scientific data?	96 media reports about 48 drugs were identified that used the word "unprecedented". Nearly half (48%, 23/48) were not FDA-approved and only 54% (26/48) were supported by RCT data. The use of the term "unprecedented" does not align with the findings of clinical trials.
Booth (2007)[19]	Canadian media reports (2000-2005)	Does the media give different levels of coverage to different cancers?	This study reviewed the degree of media interest in 18 cancer drugs and the time to funding. Trastuzumab for breast cancer was reported in the media 17 times/month; the next most commonly reported medicines were 1.2/month. Trastuzumab funding approval was made within 3 months of reporting of the pivotal RCT; the mean time to funding approval for the other drugs was 31 months. There were large differences in media attention and time to funding decisions for breast cancer compared to other cancers.
Fralick (2013)[20]	North American newspapers (2002-2013)	How was Bevacizumab for advanced breast cancer reported in the media before/during FDA approval and after FDA revocation?	There were 359 media reports during the study period. Over the three phases (pre-approval, during approval, and post-revocation) media reporting evolved with a decrease in "positive" tone, and greater emphasis on side effects and costs. Media reports did reflect evolving changes in drug policy.
Ficko (2017)[23]	US Newspapers (2010-2015)	How is robotic surgery reported in the media?	The study reviewed 83 media reports covering robotic surgery in the US. Most reports related to (54%) and

			gynecologic (57%) procedures. Most reporting highlighted downsides of robotic surgery without reporting its benefits.
Haneef (2017)[21]	Altmetric Explorer	What factors are associated with online media attention of cancer treatment articles?	Altmetric scores were reviewed for 729 research studies reported in the media. 44 % were observational studies and 31% were randomized controlled trials High Altmetric scores were associated with the presence of a press release, open access to the article, and a high journal impact factor. There was no significant difference in Altmetric scores between randomized trials and observational studies.
Vitry (2015)[22]	FDA documents, medical journals and media reports	What are the clinicians, patients and cancer survivors reactions on drug approval withdrawal?	There were a variety of perspectives regarding the therapeutic value of bevacizumab, with strong beliefs among cancer survivors that the drug was effective and the risk of adverse effects was manageable. The public's high expectations may have been fueled by overly optimistic media coverage and a limited understanding of the complexity of the scientific evaluation of new medications and the regulatory processes

Table 3. Characteristics of studies which describe media reporting of cancer in general.

Author (year)[reference]	Media (years)	Research question	Key findings
Fishman (2010)[16]	US newspapers and magazines (2005-2007)	How does the media report cancer treatment and outcomes?	Of the 436 reviewed news articles, 32% (143/436) focused on survival and only 8% (33/436) focused on death and dying. Only 13% (57/436) reported that treatment can fail and 30% (131/436) reported that aggressive treatment can cause toxicities. Thus, the media portrays and overly optimistic view of cancer treatment, outcomes, and prognosis.
Amberg (2020)[24]	Newspapers in UK, USA, Australia (2017)	What is the quality of cancer reporting in the media?	80 articles about cancer were included describing primarily epidemiologic and basic sciences (39% and 24% respectively); 29% of articles related to clinical cancer research. The authors identified concerns with the quality of reporting and also a striking gender imbalance whereby new reports disproportionately feature male physicians and scientists.
Lewison (2008)[25]	BBC news database (1998-2006)	How is cancer research portrayed in the media?	170 articles were identified. Relative to disease burden (13%), breast cancer was over-represented (33%); lung cancer was under-represented (10% articles, 20% disease burden). New cancer medicines were featured in 20% of articles followed by lifestyle choices and cancer (12%), genetic s (9%), and nutrition (8%).
Lewison (2018)[26]	UK newspapers (2010-2015)	How did the media portray creation of the UK Cancer Drug Fund	1692 media reports described the Cancer Drug Fund. The articles were generally very favorable with calls to extend the program to Wales and Scotland and to increase the overall budget. There was rarely any critical comment on the lack of survival benefit, cost, or severe side effects of the included medicines.
Hicks-Courant (2021)[29]	US newspapers, magazines, news outlets (1998-2011)	Does the media sensationalize personalized medicine?	This article reviewed 396 news reports related to cancer and personalized medicine (PM). The term PM was clearly defined in only 27% (107/296) of articles, 96% (2/75/396) of stories reported benefits of PM; 48% (137/396) described the challenges of PM. Commonly reported benefits included improved treatment (89%), prediction of side effects (30%), disease risk prediction (33%), and lower cost (19%). Confusion about personalized medicine may be exacerbated by

			media reports. Most reports over-state the benefit of PM which may lead to unrealistic expectations for cancer genomic care
Sabel (2016)[27]	US newspapers and magazines (Up to 2014)	How does media report breast cancer treatment decisions of celebrities?	727 media reports were reviewed. Reports increased over time corresponding to celebrities going public about their breast cancer treatment. Among those celebrities who underwent prophylactic bilateral mastectomy, in 60% (27/45) of articles there was no mention of genetics, family history or risk. Media reports of celebrity breast cancer disproportionately describe decisions of bilateral prophylactic mastectomy; this could influence decision-making of women in the general population.
Macaulay (2014)[28]	National and regional newspaper websites, UK broadcasters (April 2014)	How does media report NICE decision-making?	Macaulay evaluated how the media report the decision-making of the National Institute for Health and Care Excellence (NICE), with a particular focus on the NICE document that did not recommend Trastuzumab Emantansine for breast cancer. Seven out of nineteen articles centered on the reaction of a patient or physician, all of whom were especially critical of the NICE decision. Three out of nineteen articles focused on the proposed high price of the new drug, with two of those articles criticizing the pharmaceutical company. The media continues to be hostile toward NICE's decisions not to fund oncology drugs, focusing more on patient reactions than the challenges of allocating scarce health care resources to optimize care.

Table 3. Recommendations to improve media reporting of cancer treatment

1. Researchers should be cognizant that research articles will be read by non-scientists and remove any potential source misinterpretation.
2. Researchers, academic institutions and pharmaceutical companies should be mindful that they are not contributing to overstating the implications research findings and should avoid using hype and spin.
3. Journalists should present both sides of the treatment story (benefits and side effects) and not just the potential benefits.
4. Journalists should ensure the readership understands both the level of evidence (RCT vs observational) and the potential limitations of the relevant studies.
5. Journalists should include information about the incremental benefits of many new cancer treatments are modest (i.e., increase survival by few months), so that patients and families have realistic expectations of the slow and incremental pace of cancer advances.
6. Researchers and academic institutions should hold short-course workshops for health journalists to teach principles of critical appraisal and to increase awareness of the risks of hype and spin in scientific studies and media reports.

Declaration of Interest statement

None declared

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