Published in final edited form as:
J Commun. 2011 June ; 61(3): 496–513. doi:10.1111/j.1460-2466.2011.01550.x.

Distorting Genetic Research about Cancer: From Bench Science to Press Release to Published News1

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Abstract

This study considered genetic research relating to cancer outcomes and behaviors, specifically investigating the extent to which claims made in press releases (*N*=23) and mainstream print media (*N*=71) were fairly derived from their original presentation in scholarly journals (*N*=20). Central claims expressing gene-outcome relationships were evaluated by a large pool (*N*=40) of genetics graduate students. Raters judged press release claims as significantly more representative of material within the original science journal article compared with news article claims. Claims originating in news articles which demonstrated contact with individuals not directly involved in the research were judged by experts to be more representative of the original science as compared with those that demonstrated contact with individuals directly involved in the research.

Keywords

Genetics; Press Release; Lay Press; Science Communication; Science Journalism

U.S. news media serve a critical health education service in the provision of timely, accurate information (Brown & Walsh-Childers, 2002). Increasingly, in the absence of alternative sources, individuals turn to news sources for developments and/or commentary relating to matters of health (National Science Foundation, 2002; Peterson, 2001; Schlesinger, 2002). News media, and by extension, public information offices, work at the interface between medical researchers and the lay public. Thus, public information officers and journalists play

[1]This study was made possible by Grant Number 5P50CA095856-05, Effects of Public Information in Cancer (EPIC) Center of Excellence in Cancer Communication Research, from the National Cancer Institute. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the National Cancer Institute.

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[1]Based on a content analysis of 20 U.S. major newspapers, 3 U.S. major broadcast news networks, and the Associated Press from the period between 1997 and 2003.

[2]This was done in order to avoid difficulties in attributing claims to particular studies.

[3]In case 12, the dropped rater had an average rating across all claims that was similar to the other seven raters, however scores were consistently in the opposite direction. In this case, reliability increased from .44 to .63 with removal of rater 28.

an important role in the presentation of scientific knowledge, shaping public perceptions and selectively presenting certain pieces of information over others. Their job, as offered by Brody (1999), is to bring perspective and depth to reporting.

Much of the research considering how science is presented in the public press compares content between original science publications and mainstream news media. A significant portion of this literature addresses the conflicting priorities that distinguish scientific and media communities (Friedman, Dunwoody & Rogers, 1986; Nelkin, 1996; Peters, 1995), raising concerns that scientific knowledge may be communicated in ways that are exaggerated or inaccurate (Jensen, 2008; Kua, Reder & Grossel, 2004; Ransonhoff & Ransonhoff, 2001; Schwartz, Woloshin & Baczek, 2002; Stocking, 1999). Some scholars argue this is the case even more so with genetic information (Dillard, Carson, Bernard, Laxova & Farrell, 2004; Vlek, 1987).

In contrast, recent analyses (e.g. Bubela and Caulfield, 2004) have suggested that there may be more homogeneity between original science and its coverage in the lay press than anticipated. Newer lines of inquiry have identified the intermediary press release as an additional source of possible distortion (e.g., Brechman, Lee, Cappella, 2009; Saguy & Almeling, 2008; Woloshin & Schwartz, 2002). The press release, after all, serves as a direct means of communication between science and medical journals and news media, thereby providing “an opportunity for journals [or research institutions] to influence how the research is translated into news” (Woloshin & Schwartz, p. 2858).

A considerable amount of studies have explored the science communication process, comparing the presentation of information between original science publications and mainstream media coverage and between the press release and mainstream media coverage. To the best of our knowledge, however, only a few (e.g., Saguy & Almeling, 2008) have systematically examined the entire process by which scientific knowledge is communicated to the lay public, as it moves from publications in science journals to coverage in the lay press through an intermediary press release.

This study considered the accuracy of science reporting in the context of genetics by examining U.S. newspaper coverage resulting from announcements made within the scientific community between July 2004 and June 2007. By investigating the flow of science information, from its original presentation in a scholarly journal, through an intermediary press release, to its publication in mainstream print media, our study identifies instances of distortion and works toward a more complete picture of how mass media “filter and translate scientific information” (Epstein, 1996, p.22). Characteristics of both the press release and news articles were taken into consideration, in order to determine possible reasons for content mismatch. This task is very important considering that “the practice of public health is likely to become „geneticized’ such that information about genetic risks is widely available” (Dillard, Shen, Laxova, & Farrell, 2008, p. 234).

News reporting, genetics and public health

An area that has received substantial media attention, as well as consumer interest, involves genetics and health (for an overview, see Dillard et al., 2008; Priest, 2006). Within this

domain, topical content analyses have demonstrated exponential growth in reporting (Cappella, Lerman, Romantan & Baruh, 2005; Mountcastle-Shah, Tambor, Geller, Karalisukas, Rodgers & Holtzman, 2003; Parrot, Silk, Weiner, Condit, Harris & Bernhardt, 2004; Ten Eyck & Williment, 2003). Cappella et al., for instance, reported that *each year* approximately 8,000 stories about genetics and health are disseminated to the American public.[1] Many of these print and broadcast stories offer gene-based explanation for a variety of diverse health outcomes (Bernhardt & Cameron, 2003; Cappella et al., 2007; Parrot et al., 2004; Silva, 2005).

Scholars have long-stressed the importance of accuracy of news coverage in general (for an overview, see Gibson, 2007; Maier, 2005). News reporting of cancer genetics, in particular, must take care to place scientific developments within an accurate and meaningful context (Brody, 1999; Dillard et al., 2004, 2008) insofar as its presentation in popular press invites certain interpretations of data. Despite a literature that is not yet entirely demarcated, the ways in which genetics research is presented in the news has been shown to have significant effects on an individual's perception of risk (Condit & Parrot, 2004; Jensen, 2008) and health behaviors (Cappella et al., 2005; Frosch, Mello, & Lerman, 2005). One of the more serious and sustained concerns involves the notion that mediated portrayals of genetics can result in a public ideology that is increasingly biologically deterministic. This trend, also referred to as genetic determinism, has been defined as the "attribution of genetic causality in a totalistic and absolute fashion, especially where such a causal account does not accurately represent the probabilistic and multi-factorial inputs into a particular characteristic of a biological entity" (Condit, Ferguson, Kassel, Thadhani, Gooding & Parrott, 1999, p. 380). Highly deterministic coverage, Nelkin & Lindee (1995) have argued, "reduces the self to a molecular entity, equating human beings, in all their social, historical, and moral complexity, with their genes" (p. 2). Media coverage focusing on the negative aspects of genetic discoveries may lead audiences to fear their application and have an adverse impact on utilization of genetic services or involvement in genetic research (Caufield, 2000; Geller, Bernhardt & Holtzman, 2002; Melzer & Zimmern, 2002). Those who have deterministic attitudes about genes may make less effort to engage in disease screening tests and disease preventive behaviors, whereas those who underestimate the role of genes may more actively go through screening tests and engage in more healthy behaviors (Cappella et al., 2005; Parrot et al., 2004).

The work of Condit, Ofulue and Sheedy (1998) has suggested, however, that concerns over the impact of genetics press coverage may be misguided. In a survey of popular U.S. magazines across five pentades, five-year time blocks between 1919-95, the authors found that there has been no significant increase in the level of determinism in public discourse over time. In fact, determinism in more recent coverage has decreased. Newspapers did not exhibit the same decrease in determinism over time and were, generally, more deterministic in tone than magazines. These differences were attributed, in part, to the distinct role each medium plays in public communication.

The (science) communication process

A substantial amount of research relies on a classic transmission model (Shannon & Weaver, 1949; for an overview see McQuail, 2000). While the transmission model can oversimplify the complex negotiation process that occurs among the press, public information offices, and scientific sources, it provides an efficient illustration of how public information travels from source to recipient. Assuming, for the moment, a linear, uni-directional flow of information, the process of communicating science to the public might look something like this: Science experts (i.e. refereed journals, expert physicians, public health officials) provide highly specialized information to public information officers who then produce press releases in an effort to facilitate the transfer of this information to journalists who then popularize it.

Studies relying on a traditional transmission model have generally concluded that news coverage is not comprehensive. Both quantitative content analytic works (e.g., Pelluchia, 1997; Singer, 1990; Singer & Endreny, 1993; Tankard & Ryan, 1974) and qualitative case studies (e.g., Parascandola, 2000; Stocking, 1999) have documented errors in science journalism, including the omission of critical information and context, misquoting, and simplification/sensationalization of headlines (for an overview, see Stocking, 1999; Weigold, 2001). Some scholars worry that these types of errors can impact how a reader interprets a particular set of findings (Jensen, 2008). For example, in studies of focus-groups confronted with stories about a medication for patients with acquired immunodeficiency syndrome (AIDS), Rogers (1999) pointed out that participants wanted to know “where this new information fit into the bigger picture of what came before and what was next. Without such context, they had difficulty making sense of the information and deciding just how important it was in the larger scheme of things” (p. 191).

Additional research considering the presentation of science news in mainstream media reveals that media has often presented data as “scientifically sound evidence rather than as preliminary findings with still uncertain validity” (Schwartz et al., 2002, p. 2863). Angell and Kassirer (1999) noted, for example, that in spite of calls for future research often found in original reports of scientific developments, “neither the public nor the media are inclined to wait for confirmatory studies,” (p. 189). News articles have introduced preliminary data as clear-cut facts, excluding minor details and subtleties of the research. Regardless of whether adequate source information is provided within a news article, few readers seek out the original scientific sources, thereby restricting the public’s interpretation to the one presented in the media (McInerney, Bird & Nucci, 2004).

In contrast to studies that raise concerns about the inaccuracies of coverage of genetics in the popular press, recent analyses (e.g., Bubela & Caulfield, 2004) have demonstrated that there may be more homogeneity between original science and its coverage in the lay press than anticipated. Having reviewed reporting about gene discoveries in major daily newspapers in Canada, the United States, Great Britain, and Australia, Bubela and Caulfield concluded that the majority of newspaper coverage (63%) fairly and accurately represents claims made within the respective science articles. The work of Bubela and Caulfield corroborates

concern, however, about the general tendency for science reporting, in both news and science journal articles, to underrepresent risks and overemphasize benefits.

In addition to considering the relationship between science journals and the coverage of their contents in lay press, researchers have begun attending to the role of public information officers in the diffusion of scientific knowledge (see Borchelt, 2001). Public information officers are responsible for producing and disseminating press releases. The press release is a crucial vehicle for communication to the press about scientific claims (Dunwoody, 1999; Weigold, 2001). Based on a classic transmission model, one might expect that the greater the distortion from the original science to the press release, the greater the distortion from the original science to the public press:

> H_1: Claims made within the press release are more likely to be rated as accurate representations of the original science, relative to claims made within news articles.

Consideration of a "middle-man" has highlighted the possibility that limitations and conflicts of interest originate with the press release (e.g. Woloshin & Schwartz, 2002). Saguy and Almeling (2008) reported, for example, a positive relationship between the number of press releases distributed for a given set of findings and the amount of attention those findings subsequently receive in news media. Their research also indicated that news coverage is reflective of the frames originally adopted in the press release. More recently, Brechman and her colleagues (2009) examined the presentation of genetic research relating to cancer outcomes and behaviors (i.e., prostate cancer, breast cancer, colon cancer, smoking and obesity) in press releases and corresponding news coverage. They reported that genetic discoveries are presented in a biologically deterministic and simplified manner 67.5% of the time. Notably, the introduction of deterministic language is attributed evenly to both press releases and news coverage. Also, using qualitative textual analysis, Brechman et al. found that errors commonly attributed to science journalists, such as lack of qualifying details and use of oversimplified language, originate in press releases.

In contrast to a transmission perspective, recent research has employed an interactive science, or social construction, approach (for an overview see Einsiedel & Thorne, 1999). Critics of the transmission model maintain that it oversimplifies the complex negotiation process that occurs among the press, public information offices and scientific sources. In recognizing the social and interactive nature of communication, recent paradigms (i.e. interactive science, social construction; see McQuail, 2000) allow for the possibility that scientific information makes its way to the public in a circuitous fashion. To be sure, science experts may consult with public information officers in the construction of a press release before disseminating their findings to media outlets. Once received, journalists may solicit additional information in order to supplement material provided in the press release. Indeed, Brody (1999) acknowledges an increasing tendency among news reporters to depress the communication process, allowing themselves the time to put new findings into perspective and substantiate claims.

> H_2: News article claims that suggest interaction with sources beyond the corresponding press release are more likely to be rated as accurate representations of the original science, relative to claims that do not.

H_3: Press release or news article claims that include a direct quote from a science expert are more likely to be rated as accurate representations of the original science, relative to claims that do not include a direct quote.

In the event that inconsistencies do exist between press releases and their corresponding coverage in newspapers, it becomes necessary to consider the characteristics of each source. The literature highlights several factors that may influence the quality of information about cancer genetics in the public press. Sachsman, Simon & Valenti (2006) reported that newspapers with small circulations (less than 14,000) do not have designated science and environmental journalists. Frequent reassignment or responsibilities that extend beyond the coverage of a specific content domain (e.g. health) may prevent reporters from becoming specialized in a certain area (Sachsman et al., 2006). Along these lines, Gibson (2007) reported that mistakes are more likely to occur when reporters change desks. Research has suggested an advantage to sources that hire permanent science staff rather than those who rely on the Associated Press for science coverage (Maier, 2005). Therefore, it is hypothesized:

H_4: Claims within sources produced by staff writers are more likely to be perceived as representative of the original science than claims within sources produced by the Associated Press.

Journalists have also indicated that time constraints as well as financial, travel, and resource concerns are often an impediment to job performance (Gibson, 2007). Based on the assumption that high prestige newspapers may have larger news holes and more resources, we propose:

H_5: Claims from sources determined to be “high prestige” (i.e. New York Times, Washington Post) are more likely to be perceived as representative of the original science than claims presented from sources considered “less prestigious.”

Method

Sample

In order to identify qualified news stories reporting on gene/cancer-outcome discoveries, articles were retrieved through the archives on Nexis.com using the following search terms: (NOCAPS (gene) OR genetic!) AND prostate cancer AND NOT (modified OR corn OR rape OR murder OR Lewinsky OR crime OR crops). Articles sampled were from all major U.S. newspapers published between July 2004 and June 2007. Identical searches were conducted for each of five cancer-outcomes: prostate cancer, breast cancer, colon cancer, obesity, and smoking. Exclusion terms were used to eliminate the high return of articles that discussed technologies relating to genetically modified foods or the use of genetic information in a non-health context (see Cappella, Mittermaier, Weiner, Humphreys, & Falcone, 2007 for more information on selection of search terms). The original search syntax retrieved a list of 5,876 articles. Additional sweeps were made to eliminate irrelevant articles (e.g. obituaries, community calendars, biographies/ individual profiles) as well as those that referenced an association between cancer and genetics without introducing new scientific knowledge. The population of articles was reduced nearly 75% (N=1645).

The article pool was further limited to news stories that received press coverage in more than one news source, to those that did not discuss multiple research efforts within a single article[2] and to stories that contained traceable reference information to published research. The majority of articles (92%) were eliminated as a result of not meeting the first inclusion criterion. Articles discussing more than one study and not containing traceable reference information comprised less than 2% of discarded articles.

All corresponding press releases were then obtained from institution web sites and EurekAlert! or PRNewswire, electronic archives of releases for science writers. If original research findings discussed in news articles did not appear in a traceable press releases, the articles were discarded (*N*=2). The original science articles were obtained from various online databases. In total, twenty cases consisting of news article(s), press release(s) and original science articles were identified (references are available upon request).

Coding

The central claim(s) of each article and press release were extracted by the first two authors, using criteria developed through an iterative process. A central claim was operationally defined as a sentence that expresses a gene-outcome relationship. The sentence had to be a statement (not a question) and had to express a gene-outcome relationship in humans (not animals or plants). The expression of the gene-outcome relationship in a central claim was also required to include a verbal link between the gene and the outcome. An example of a valid central claim is: “U-M scientists say fused genes trigger the development of prostate cancer,” with *fused genes* as the gene-phrase, *trigger* as the verbal link and *prostate cancer* as the outcome. Inter-coder agreement for claim identification was high ($\kappa = .91$).

An average of ten claims per case were randomly selected to be rated for accuracy. To the extent possible, these claims represented at least one headline and one lead sentence from the press release(s) and news article(s).

In addition to accuracy ratings (described below), claims that represented direct verbal quotations from scientists or other news sources were coded as such (0=no, 1=yes). Source-level variables were created to account for source characteristics. These included source prestige (1=New York Times, Washington Post, Wall Street Journal, 0=all others) and authorship (1=Associated Press, 2=staff writer),

A final source variable, evidence of social construction, was created to account for the extent to which a news article indicated, almost certainly, some outside contact with researchers. This was done under the assumption that the opportunity to discuss the science with an additional source could produce clarifying feedback. Such an exchange might, for example, allow for elaboration on limitations that were not communicated well in the press release. Demonstration of contact with researchers involved in the original study (e.g. quote/paraphrase from principal investigator) was distinguished from demonstration of contact with experts not directly involved in the original research (e.g. quote/paraphrase from researcher involved in similar lines of inquiry).

Participants

Forty expert raters were recruited from genetics graduate programs across the country and compensated for their participation. In comparison with scientists' assessments of their own work, or researchers' evaluations of their own stimuli, third-party student raters provided a level of objectivity. Raters' training in the area of genetic science afforded them the ability to understand highly complex material and technical language appearing in the original science.

Potential expert raters at a large northeastern university were initially contacted through word-of-mouth and program-related list-serves. In order to increase the rater pool, recruitment emails were sent to genetics departments at several other large universities across the country. Raters were male (*N*=20) and female (*N*=20) from various stages of graduate coursework. The majority of raters had completed three or more years of graduate coursework (*N*=30). Areas of rater specialty included Genetics/Development (*N*=12), Genetics & Gene Regulation (*N*=9), Cancer Biology/Genetics (*N*=7) and Genetics of Hypertension (*N*=2).

Procedure

After providing online informed consent, raters received all study materials via mail and were encouraged to complete the study in one sitting. Each rater was assigned a random sequence of original journal articles from four cases. Expert raters were told they were participating in a study investigating the representation of scientific findings. They began by providing basic demographic information, literacy information, and information regarding academic concentration. Raters were then asked to read the four genetic science journal articles assigned to them, one at a time. Immediately following each article, raters were asked to respond to a series of statements relevant to the article they read; they were not aware that these statements were derived from a press release or news article. Rather, the raters were simply informed that the content of their articles had been summarized in other forums and that we were interested in how accurately these statements represented the information contained in the original science article.

Accuracy Ratings As described, raters were asked to review a selection of claims following each original science article and asked to indicate the extent to which they agreed that each could be fairly derived from the original science journal article. How much do you agree or disagree that the following statements can be fairly derived from the article you just read? Responses were on a 7-point visual analog scale with verbal anchors, where "1" indicated complete disagreement and "7" represented complete agreement. The number of claims for each case ranged from 4 to 16; no rater evaluated more than 40 claims total.

Foils An average of 1-2 false claims, extracted from other cases within the study's sample, were included in each set of evaluative statements. These were used to ensure the quality of rater participation (i.e. care with which they read original science; claim assessment).

Rater Characteristics After completing the evaluation task, raters provided information about their familiarity with science journals (e.g. prior exposure, perception of prestige), the assigned reading material and methodology (How familiar are you with the procedures/methodology used by researchers in the article you just read). This information was used to determine whether rater characteristics influenced assessments of claim accuracy.

Upon completion of the study, expert raters were debriefed and compensated for their time.

Results

Analysis was based on 20 cases, each comprised of an original science journal article, all corresponding press releases (*N*=23) and news articles (*N*=71). Three cases contained more than one press release and the average case had between three and four news articles. A total of 375 central claims were identified; 113 in press releases and 262 in news articles. Between four and sixteen claims (*M*=10) were randomly selected from each case, resulting in a sample of 200 claims which were rated for accuracy. There were forty expert raters.

Each case had its claims evaluated by eight raters. Average claim scores ($\mu_{\text{claim x}}$) were calculated, aggregating individual assessments from the raters (*N*=8) assigned to each case and removing foils. Ratings of claims' perceived accuracy ranged from 1.5 to 6.75. When averaged across claims and raters, mean case ratings ($\mu_{\text{case A}}$) ranged from 3.31 to 5.23. Inter-rater reliability was calculated; raters' assessments of accuracy were highly reliable across all cases ($.72 < \alpha < .91$). There was only one isolated instance in which one rater's scores for a single case were dropped because they varied significantly from the other raters' scores.[3] All other ratings for that expert were retained.

Quality of rater judgments

There were no significant associations between (a) raters' prior familiarity with the science article; (b) raters' familiarity with the journal and (c) raters' familiarity with the methodology and their assessments of perceived accuracy. Nor was there any significant correlation between a rater's area of specialty and their assessments of perceived accuracy. With regard to raters' perceptions of journal prestige, there was only one significant correlation (r=.859, p<.01) across 20 cases. Here, raters assigned the journal *Chest* as being a 2 or 3 on prestige, and those with higher perceptions of prestige were significantly more likely to rate claims as being accurate representations of the original science.

Comparisons of claim accuracy

Paired samples t-tests were carried out, comparing various combinations of claim types on assessments of claim accuracy (see Table 1). As was expected, the tests revealed that there was a highly significant statistical difference between each of the three claim types, claims that appeared in both the press release and the news article ($t(17)$=11.8, p<.001), claims unique to the press release ($t(12)$=10.01, p<.001) and claims unique to the news article ($t(18)$=7.55, p<.001), and foil claims. The mean ratings for claims appearing in both the press release and the news article (*M*=4.4, *SD*=.78), the press release only (*M*=5.34, *SD*=.8)

and news article only (*M*=3.86, *SD*=.83) were consistently higher than the ratings of claims included as foils (*M*=1.88, *SD*=.72), suggesting raters were successful at identifying foils.

The tests also revealed that there was a highly significant statistical difference between press-release claims and news article claims ($t(10)=6.2$, $p<.001$). The mean ratings for claims appearing, exclusively, within the press release (*M*=5.5, *SD*=.78) were consistently higher than the ratings of claims appearing, exclusively, within the news article (*M*=3.5, *SD*=.83). Raters judged claims within the press release as being more representative of the material within the original science journal article. There were no significant differences between claims that appeared in both the press release and the news article and claims that appeared in only one of the two sources.

Impact of source characteristics on claim accuracy

Independent and paired samples t-tests were conducted at the level of independent claims, in order to compare various source characteristics with assessments of claim accuracy (see Table 2). Consistent with previous analyses, the tests revealed that there was a highly significant statistical difference between claims that originated from a press release and those that originated from a news article ($t(176)=4.27$, $p<.001$). There were also significant differences among mean ratings of claims, depending on evidence of constructivist approaches to science communication ($t(114)=20.3$, $p<.001$). Specifically, mean ratings for claims introducing information from individuals *other than* those directly involved in the research being discussed were (*M*=4.2, *SD*=1.2) consistently higher in accuracy than the ratings of claims that contained information from study staff (i.e. authors) (*M*=3.3, *SD*=1.2). There were no significant differences between claims with no clear attribution to sources other than the journalist and those derived from either study staff ($t(30)=1.6$, *ns*) or non-related experts ($t(88)=-.56$, *ns*).

Discussion

Scientific developments often debut in peer-reviewed academic journals. Readers of these journals are often scientists and medical professionals. Key findings are then disseminated by public information officers, in the form of a press release. Ultimately, scientific knowledge becomes public knowledge as journalists publish research findings in news media. This study examined the communication process, following developments within the domain of caner genetics as they traveled from their original scientific source, through public information offices, to eventual publication in major U.S. newspapers. The findings presented here suggest that as scientific knowledge is filtered and translated for mass consumption, there are slippages and inconsistencies that result in coverage that does not fairly represent the original science.

Points of distortion

We find evidence to suggest that the primary source of distortion in the communication of cancer genetics occurs between the press release and news article. When asked to rate how accurately claims made within both the press release(s) and news article(s) represented the information from the corresponding science journal article, expert raters perceived press

release claims to be more accurate than those contained within newspaper articles even though they had no idea about the source of the claim. From a traditional transmission perspective, such findings are not unexpected. The more people a message must go through before reaching its intended recipient, the more likely it is that the final message will suffer distortion in comparison with the original one.

Perceived inaccuracies in news coverage may be the result of restrictions imposed on journalists. Charged with communicating highly complex information to lay audiences, journalists must simplify scientific information and package it in such a way that will appeal to readers and be understood. However, while economizing and glamorizing science often falls on journalists' shoulders, our findings do not dismiss the role of public information officers, and the press releases they produce, in contributing toward distorted communication. On a scale ranging from 1 to 7, with 7 representing the highest level of accuracy, claims appearing in press releases received scores that ranged from 1.5 to 6.62. Despite an average rating of 4.8, nearly 16% of press release claims were rated below 3.5, the scale's mid-point. As Woloshin & Schwartz (2002) pointed out, press releases serve as a direct means of communication between science and medical journals and news media, thereby providing "an opportunity for journals [or research institutions] to influence how the research is translated into news" (p. 2858). Although claims made within press releases were rated as being more representative of the original science than claims made within news articles, a substantial proportion of PR claims' ratings (15.9%) suggest there was still a degree of mismatch between the press release and the original science. In other words, statements made within press releases were simply rated as (mis)representing original science to a lesser extent than news articles.

Constructive reporting may minimize distortion

In hopes of determining the reasons for varying levels of perceived accuracy among various source types, characteristics of both claims themselves and the sources in which they appeared were analyzed. We find no evidence that news articles written by permanent science staff reporters are more accurate than those produced by the Associated Press. Similarly, our findings do not support the hypothesis that high prestige sources produce more accurate news coverage.

However, our findings partially support a social constructivist approach to science reporting. That is, claims originating in news articles which demonstrated contact with individuals not directly involved in the research were perceived to be more representative of the original science as compared with those that demonstrated contact with individuals directly involved in the research. There were no differences, however, between claims that originated within articles exhibiting no evidence of story construction and claims that originated within articles that did.

Limitations

There are several caveats that should be noted. First, by using central claims as our units of analysis, information was necessarily isolated from surrounding text and, as a result, required that scientific information be evaluated out of context. Consumers do not read

isolated claims (Condit, 1999; Condit et al., 2001). Rather, they bring pre-existing attitudes and beliefs, as well as varying levels of familiarity with the topic, to bear - all of which influence how content is interpreted. Assessment of single extracted claims against entire articles, then, may have contributed toward more definitive and deterministic judgments.

Second, our sample only included news coverage that could be traced to peer- reviewed articles. As a result, the sample may under-represent stories flowing from other sources such as abstracts from scientific meetings which often go unpublished (Schwartz et al., 2002). Also, we limit our sample to coverage of cancer genetics within print media. Previous studies report that print media tend to provide more in-depth information about science issues than do broadcast media (Lee & Scheufele, 2006; Weigold, 2001), thereby highlighting an opportunity for future research to contrast representation of cancer genetics between multiple media. Finally, the current research is limited to a specific field of science, involving communication of genetics research relating to cancer outcomes and behaviors. It is possible that, given the nature of our topic, patterns in reporting are not generalizable to other specific issues or to science reporting in general.

Conclusions

In spite of these limitations, the findings presented here deserve further investigation as they raise interesting questions about the utility of secondary sources in science journalism. Although efforts to consult with additional sources beyond the press release do not appear to be particularly advantageous, in terms of how accurately the news article will represent the original science, when efforts *are* made, the quality of coverage does, indeed, appear to benefit from perspectives of experts not-directly involved with the study. As Brody (1999) noted, “Whereas medical researchers were once reluctant to speak beyond the direct implications of new findings…they often extrapolate freely and speculate wildly about far-reaching consequences” (p. 170). It may very well be the case that researchers’ personal investments in a project impede their ability to speak objectively about their findings, therein explaining the comparative differences between study staff and experts not directly involved.

The task of assessing how accurately scientific knowledge is communicated to lay audiences is a difficult one. The process involves familiarizing oneself with the original findings of genetics research published in a peer-reviewed journal in order to rate its translation into other forms of communication. Highly complex material and technical language make it nearly impossible for individuals without science training to do so. In contrast to previous studies which rely on scientists’ assessments of their own work (e.g. McCall, 1988; McCall & Stocking, 1982; Tankard & Ryan, 1974) or researchers’ own evaluations (e.g. MacDonald & Hoffman-Goetz, 2002; Singer, 1990), the researchpresented here relies on judgments made by third-party, expert raters. This approach illustrates that expert raters, despite background differences and having conducted assessments on their own time and in uncontrolled environments, exhibit substantial degrees of agreement with one another about what constitutes a fair inference. Our data strongly suggest that expert raters can be employed as “parallel instruments” in evaluating complex science and subsequent claims.

When considering ratings assigned to each of three claim types (claims from both the PR and NA, PR only claims and NA only claims) and claims inserted as foils, there were significant differences. More to the point, expert raters' consistently identified foils as such, evidenced by low ratings (*M*=1.9). These sharp differences are testimony to the validity of the judgments made by the raters. There were no significant associations between ratings of accuracy and any individualized rater or journal characteristic. Taken together, these findings reflect the high quality in rater judgments and serve as evidence for the validity of procedures used. Future research, then can benefit from this methodological innovation, as it provides an objective method of assessment without requiring researchers to have advanced scientific knowledge on topics of interest.

The data presented here illustrate the importance of considering the whole process by which scientific information is diffused. In line with a growing body of research, we reliably demonstrate that a pivotal point in conveying genetic information from the laboratory to the general public occurs between the press release and the news article. More research should take advantage of the unique methodologies presented here, extending work in this area to other media outlets and to different scientific topics.

References

Angell M, Kassirer J. Clinical research: What should the public believe? New England Journal of Medicine. 1999; 331:189–190. [PubMed: 8008033]

Bernhardt, JM.; Cameron, KA. Accessing, understanding, and applying health communication messages: The challenge of health literacy. In: Thompson, TL.; Dorsey, AM.; Miller, KI.; Parrot, R., editors. Handbook of health communication. Lawrence Erlbaum Associates; Mahwah, NJ: 2003. p. 583-606.

Borchelt RE. Communicating the future: Report of the research roadmap panel for public communication of science and technology in the twenty-first century. Science Communication. 2001; 23(2):194–211.

Brechman J, Lee -J, Cappella JN. Lost in translation? A comparison of cancer-genetics reporting in the press release and its subsequent coverage in lay press. Science Communication. 2009; (4):30, 475–505.

Brody JE. Communicating cancer risk in print journalism. Journal of the National Cancer Institute Monographs. 1999; 25:170–2. [PubMed: 10854474]

Bubela TA, Caulfield TA. Do the print media "hype" genetic research? A comparison of newspaper stories and peer-reviewed research papers. Canadian Medical Association Journal. 2004; 170(9): 1399–1407. [PubMed: 15111473]

Cappella JN, Lerman C, Romantan A, Baruh L. News about genetics and smoking: Priming, family smoking history, and news story believability on inferences of genetic susceptibility to tobacco addiction. Communication Research. 2005; 32(4):478–502.

Cappella, JN.; Mittermaier, DJ.; Weiner, J.; Humphreys, L.; Falcone, T. Framing genetic risk in print and broadcast news: A content analysis. the annual conference of the National Communication Association; Chicago, IL. Nov. 2007 Paper presented at

Caulfield T. Underwhelmed: Hyperbole, regulatory policy and the genetic revolution. McGill Law Journal. 2000; 45:437–60. [PubMed: 12688281]

Condit CM. How the public understands genetics: non-deterministic and non-discriminatory interpretations of the "blueprint" metaphor. Public Understanding of Science. 1999; 8:169–180.

Condit CM, Ofulue N, Sheedy KM. Determinism and mass-media portrayals of genetics. American Journal of Human Genetics. 1998; 62:979–984. [PubMed: 9529342]

Condit C, Ferguson A, Kassel R, Thadhani C, Gooding HC, Parrott R. An exploratory study of the impact of news headlines on genetic determinism. Science Communication. 2001; 22(4):379–95.

Condit CM, Parrot R. Perceived levels of health risk associated with linguistic descriptors and type of disease. Science Communication. 2004; 26(2):152–161.

Dillard JP, Carson CL, Bernard CJ, Laxova A, Farrell PM. An analysis of communication following newborn screening for cystic fibrosis. Health Communication. 2004; 16(2):195–205.

Dillard JP, Shen L, Laxova A, Farrell P. Potential Threats to the Effective Communication of Genetic Risk Information: The Case of Cystic Fibrosis. Health Communication. 2008; 23(3):234–44. [PubMed: 18569052]

Dunwoody, S. Scientists, journalists, and the meaning of uncertainty. In: Friedman, SM.; Dunwoody, S.; Rogers, CL., editors. Communicating uncertainty: Media coverage of new and controversial science. Lawrence Erlbaum; Mahwah, NJ: 1999. p. 59-79.

Einsiedel, EF.; Thorne, B. Public responses to uncertainty. In: Friedman, SM.; Dunwoody, S.; Rogers, CL., editors. Communicating uncertainty: Media coverage of new and controversial science. Lawrence Erlbaum; Mahwah, NJ: 1999. p. 43-57.

Friedman, SM.; Dunwoody, S.; Rogers, CL. Science and Journalists: Reporting Science as News. American Association for the Advancement of Science; Washington, DC: 1986.

Frosch D, Mello P, Lerman C. Behavioral consequences of testing for obesity risk. Cancer Epidemiology, Biomarkers, & Prevention. 2005; 14(6):1485–1489.

Geller G, Bernhardt BA, Holtzman NA. The media and public reaction to genetic research. Journal of the American Medical Association. 2002; 287:773. [PubMed: 11851549]

Gibson, DR. All the news that's fit to fix: Error and Misjudgment in the *New York Times*. the annual meeting of the American Sociological Association; New York. Aug. 2007 presented at

Jensen JD. Scientific uncertainty in news coverage of cancer research: Effects of hedging on scientists' and journalists' credibility. Human Communication Research. 2008; 34:347–369.

Kua E, Reder M, Grossel MJ. Science in the news: A study of reporting genomics. Public Understanding of Science. 2004; 13:309–322.

Lee C-J, Scheufele DA. The influences of knowledge and deference toward scientific authority: A media effects model for public attitudes toward nanotechnology. Journalism & Mass Communication Quarterly. 2006; 83(4):819–834.

MacDonald MM, Hoffman-Goetz L. A retrospective study of the accuracy of cancer information in Ontario daily newspapers. Canadian Journal of Public Health. 2002; 93(2):142–145. [PubMed: 11963520]

Maier SR. Accuracy matters: A cross-market assessment of newspaper error and credibility. Journalism and Mass Communication Quarterly. 2005; 82(3):533–551.

McCall RB. Science and the press: Like oil and water? American Psychologist. 1988; 43(2):87–94.

McCall RB, Stocking SH. Between scientists and public: Communicating psychological research through the mass media. American Psychologist. 1982; 37(9):985–995.

McInerney C, Bird N, Nucci M. The flow of scientific knowledge from lab to the lay public. Science Communication. 2004; 26(1):44–74.

McQuail, D. McQuail's mass communication theory. 4th. Sage; Thousand Oaks, CA: 2000.

Melzer D, Zimmern R. Genetics and medicalisation. British Medical Journal. 2002; 324:863–864. [PubMed: 11950719]

Mountcastle-Shah E, Tambor E, Geller G, Karalisukas R, Rodgers J, Holtzman NA. Assessing mass media reporting of disease-related genetic discoveries: Development of an instrument and initial findings. Science Communication. 2003; 24(4):458–478.

National Science Foundation, Division of Science Resources Statistics. S*cience and Engineering Indicators 2002*. National Science Foundation; Arlington,VA: 2002.

Nelkin, D. Selling science: How the press covers science and technology. New York: Freeman: 1995. (Rev. ed.)

Nelkin, D.; Lindee, S. The DNA mystique: The gene as cultural icon. WH Freeman; New York: 1995.

Parasandola M. Health in the news: What happens when researchers and journalists collide. Research Practitioner. 2000; 1:1–29.

Parrot R, Silk K, Weiner J, Condit C, Harris T, Bernhardt J. Deriving lay models of uncertainty about genes' role in illness causation to guide communication about human genetics. Journal of Communication. 2004; 54(1):105–122.

Pellechia MG. Trends in science coverage: A content analysis of three U.S. newspapers. Public Understanding of Science. 1997; 6:49–68.

Peters HP. The interaction of journalists and scientific experts. Media, Culture and Society. 1995; 17:31–48.

Peterson A. Biofantasies: Genetics and medicine in the print news media. Social Science and Medicine. 2001; 52:1255–68. [PubMed: 11281408]

Priest SH. The public opinion climate for gene technologies in Canada and the United States: Competing voices, contrasting frames. Public Understanding of Science. 2006; 15:55–71.

Ransohoff D, Ransohoff R. Sensationalism in the media: When scientists and journalists may be complicit collaborators. Effective Clinical Practice. 2001; 4:185–188. [PubMed: 11525108]

Reynolds T. News headlines feed on fear of cancer risk, experts say. Journal of the National Cancer Institute. 2001; 93:9–11. [PubMed: 11136832]

Rogers, CL. The importance of understanding audiences. In: Friedman, SM.; Dunwoody, S.; Rogers, CL., editors. Communicating uncertainty: Media coverage of new and controversial science. Lawrence Erlbaum; Mahwah, NJ: 1999. p. 191

Russell C. Living can be hazardous to your health: How the news media cover cancer risks. Journal of the National Cancer. 1999

Sachsman DB, Simon J, Valenti JM. Regional issues, national norms: A four-region analysis of U.S. environment reporters. Science Communication. 2006; 28(1):93–121.

Saguy AC, Almeling R. Fat in the fire? Science, the news media, and the “obesity epidemic. Sociological Forum. 2008; 23(1):53–83.

Schlesinger M. A loss of faith: The sources of reduced political legitimacy for the American medical profession. Millbank Quarterly. 2002; 80(2):185–235.

Schudson, M. The sociology of the news. W.W. Norton & Company; New York: 2003.

Schwartz L, Woloshin S, Baczek L. Media coverage of scientific meetings. Journal of the American Medical Association. 2002; 287:2859–2863. [PubMed: 12038934]

Shannon, CE.; Weaver, W. The Mathematical Theory of Communication. University if Illinois Press; Urbana, Illinoise: 1949.

Silva VT. In the beginning was the gene: The hegemony of genetic thinking in contemporary culture. Communication Theory. 2005; 15(1):100–123.

Singer E. A question of accuracy: How journalists and scientists report research on hazards. Journal of Communication. 1990; 40(4):102–116.

Singer, E.; Endreny, PM. Reporting on risk. Russell Sage Foundation; New York: 1993.

Stocking, SH. How journalists deal with scientific uncertainty. In: Friedman, SM.; Dunwoody, S.; Rogers, CL., editors. Communication uncertainty: Media coverage of new and controversial science. Lawrence Erlbaum; Mahwah, NJ: 1999. p. 23-41.

Tankard JW, Ryan M. News source perceptions of accuracy of science coverage. Journalism Quarterly. 1974; 51(2):219–225. 334.

Ten Eyck TA, Willment M. The national media and things genetic: Coverage in the New York Times (1971-2001) and the Washington Post (1977-2001). Science Communication. 2003; 25(2):129–152.

Walsh-Childers, K.; Brown, J. Effects of media on personal and public health. In: Bryant, J.; Zillman, D., editors. Media effects: Advances in theory and research. Lawrence Erlbaum; Hilldale, NJ: 2002. p. 453-488.

Weigold MF. Communicating science: A review of the literature. Science Communication. 2001; 23(2):164–193.

Woloshin S, Schwartz L. Press releases: Translating research into news. Journal of the American Medical Association. 2002; 287(21):2856–2858. [PubMed: 12038933]

Table 1

Mean claim accuracy in three categories of claims: Paired t-test for genetic claims versus foils

Type of Claim (Mean Rating)	Both PR & NA (4.4)	Press Release (5.3)	News Article (3.9)	Foil (1.9)
Claim in both PR & NA	-	−1.9	1.6	11.8*
Press Release Claim		–	6.2*	10.0*
News Article Claim			–	7.6*

* significant at $p<.001$

Table 2

Paired t-test of select source/claim characteristics

Source/Claim Characteristic	Mean Rating (scale of 1 to 7)	Standard Deviation
Source Prestige		
High Prestige Source	4.3	1.3
Low Prestige Source	4.3	.98
Article Byline		
Staff Writer	4.0	1.23
Associated Press	4.0	1.18
Original Source		
Press release	4.78*	1.17
News Article	4.0*	1.20
Evidence of constructivist journalism		
Information from *non-related* expert	4.20*	1.17
Information from *related* expert/study staff	3.28	1.16
No additional information introduced	3.96	.97

**significant at $p<.001$, as compared against information from *related* expert

*significant at $p<.001$;