Science Communication
Volume 30 Number 4
June 2009 453-474

10.1177/1075547009332649
http://scx.sagepub.com
hosted at
http://online.sagepub.com

Lost in Translation?

A Comparison of Cancer-Genetics Reporting in the Press Release and Its Subsequent Coverage in the Press

Jean Brechman
Chul-joo Lee
Joseph N. Cappella
University of Pennsylvania, Philadelphia

Understanding how genetic science is communicated to the lay public is of great import. To address this issue, this study examines the presentation of genetic research relating to cancer outcomes and behaviors (i.e., prostate cancer, breast cancer, colon cancer, smoking and obesity) in both the press release ($n = 23$) and its subsequent news coverage ($n = 71$). Data suggest that genetic discoveries are presented in a biologically deterministic and simplified manner 67.5% of the time. The introduction of deterministic language is attributed equally to both press releases and news coverage. Also, there are substantive differences between content introduced in the press release and content presented in subsequent press coverage; in fact, when two sources report on the same scientific discovery, the information is inconsistent more than 40% of the time. These findings suggest that the intermediary press release may serve as a source of distortion in the dissemination of science to the lay public.

Keywords: *genetics; press release; lay press; science communication; science journalism*

Understanding how science is communicated to the lay public is of great import given its impact on matters of both personal and public health (Friedman, Dunwoody, & Rogers, 1999; Lee & Scheufele, 2006; Logan,

Authors' Note: This study was made possible by Grant 5P50CA095856-05, Effects of Public Information in Cancer, Center of Excellence in Cancer Communication Research, from the National Cancer Institute. Its contents are solely the responsibility of the authors. Correspondence concerning this article should be addressed to Jean Brechman, Annenberg School for Communication, University of Pennsylvania, Philadelphia, PA; e-mail: jbrechman @asc.upenn.edu.

2001). U.S. news media serve a critical health education service in the provision of timely, accurate information. Consumed by a majority of Americans, news media are often cited as a primary source of health information (Geller, Bernhardt, & Holtzman, 2002; National Science Foundation, 2008). Prior research involving representation of science in mainstream print media suggests that coverage is often exaggerated and inaccurate, thus preventing lay audiences from adequately understanding science reporting (Conrad, 1997; Kua, Reder, & Grossel, 2004; Singer, 1990; Stocking, 1999). Science communication scholars have also paid attention to the role of public information personnel as intermediate sources in the dissemination of science news to the general public (for an overview, see Dunwoody, 1999; Weigold, 2001). However, relatively little empirical research has been conducted regarding the press release in terms of its quality and accuracy of representation.

An area of science that has received increasing media attention involves genetics (Cappella, Lerman, Romantan, & Baruh, 2005; Condit, Ofulue, & Sheedy, 1998; Conrad & Weinberg, 1996; Gaskell & Bauer, 2001; Nelkin & Lindee, 1995). Topical content analyses demonstrate exponential growth in incidence of reporting regarding matters of genetics and health (Cappella et al., 2005; Mountcastle-Shah et al., 2003; Parrot et al., 2004; Ten Eyck & Willment, 2003). For example, Cappella et al. (2005) 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 explanations for a variety of diverse health outcomes (Bernhardt & Cameron, 2003; Cappella, Mittermaier, Weiner, Humphreys, & Falcone, 2007; Parrot et al., 2004; Silva, 2005).

News media have been credited with triggering and widening discussion of social issues among citizens (Kim, Wyatt, & Katz, 1999). Increased media coverage of genetic research has, for example, generated safety concerns about genetically modified food (see Priest, 1999) and consideration of the psychological consequences of predictive genetic testing (Broadstock, Michie, & Marteau, 2000). Taking into account the impact that media coverage has on public attitudes toward genetics, Mountcastle-Shah and colleagues (2003, p. 459) noted that observations of press coverage include "an increasing tendency for the press to ascribe a genetic etiology to disease and behavioral traits" (Nelkin & Lindee, 1995), a tendency to "give greater publicity to reports attributing complex traits to genes than to contradictory reports" (Conrad, 1997, 2001), and an exaggeration of the "wide and imminent applicability of genetic discoveries" (Geller et al., 2002; Peterson, 2001). Perhaps the most frequently addressed area of concern involves the

potential for media coverage to contribute toward discriminatory and deterministic attitudes (Cappella et al., 2005; Condit et al., 1999; Conrad & Weinberg, 1996; Hubbard & Wald, 1993; Nelkin, 2001).

Critics express concern that "hyped" reporting on genetics results in a public ideology that is increasingly biologically deterministic. Condit and colleagues (2001) defined this trend, also referred to as *genetic determinism,* 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 multifactorial inputs into a particular characteristic of a biological entity" (p. 380). Nelkin and Lindee (1995) argued that highly deterministic coverage "reduces the self to a molecular entity, equating human beings, in all their social, historical, and moral complexity, with their genes" (p. 2). On the other hand, recent analyses (e.g., Bubela & Caulfield, 2004) have suggested there may be more homogeneity between original science and its coverage in the lay press than anticipated.

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) and health behaviors (Cappella et al., 2005; Frosch, Mello, & Lerman, 2005). 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 (Caulfield, 2000; Geller et al., 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 gene may more actively go through screening tests and engage in more healthy behaviors (Cappella et al., 2005; Parrot et al., 2004).

This study investigates 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. To this end, we identify slippages and inconsistencies in causal language that occur between the press release and subsequent newspaper coverage, under the assumption that inaccurate or exaggerated coverage found in print media is a byproduct of this translation process.

The conceptual framework that guides the present research stems from classical information theory (Shannon & Weaver, 1949) and assumes a linear, sequential view of science communication. Such an approach allows for consideration of the efficiency with which public information travels from an original source through an intermediate agent (McQuail, 2000). To be sure, a

"transmission" perspective is limited in its utility; more recent paradigms have recognized the social and interactive nature of communication (i.e., interactive science, social construction; 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 is useful in the current context. Without discrediting or replacing the dynamism and complexities inherent in the transfer of public information (Einsiedel & Thorne, 1999), a classic perspective complements our narrow focus on how genetics reporting is transmitted between sources. The model is straightforward and convenient to employ.

Literature Review

The field of science communication has experienced significant theoretical and methodological advances in recent decades. These developments make up a growing literature that contributes to our understanding of how science is transmitted from its point of origin to the public at large. There remain, however, several gaps to be addressed.

Early studies on the accuracy of science reporting in mass media involved scientists' evaluations of press coverage based on their own work (e.g., McCall, 1988; McCall & Stocking, 1982; Tankard & Ryan, 1974; Tichenor, Olien, Harrison, & Donohue, 1970). According to scientists' feedback, the most common errors in science journalism include omission of critical information and context, misquoting, and simplification or sensationalization of headlines (for an overview, see Stocking, 1999; Weigold, 2001). In the meantime, critics have argued that scientists' evaluations may be subjective and biased, in part because of the existence of different standards between science journalists and scientists (Carsten & Illman, 2002; Dunwoody, 1999; McCall, 1988; Nelkin, 1995). In their efforts to identify discrepancies between original science and subsequent press coverage, researchers began to adopt systematic comparative content analysis techniques.

In one of the first studies of its kind, Singer (1990) investigated the accuracy of science reporting by comparing original research reports to their presentation in 15 popular press sources. Newspaper articles, sampled between September 1, 1984, and December 31, 1984, were coded, by Singer herself, according to 11 dimensions (e.g., inaccurate reference to published source, change of emphasis, assimilation of speculation to fact, omission of important results or qualifying details). Singer found that 40% of the assessed stories contained information that was inconsistent with the scientific articles from which they were derived.

Using the standards and procedures set by Singer (1990), and focusing specifically on cancer communication, Moyer, Greener, Beauvais, and Salovey (1995) reviewed a sample of 116 U.S. magazine and newspaper articles published between June 1, 1990, and May 31, 1992. The authors identify 42 inaccuracies between the original science and its coverage in print media. In addition, this study highlighted the difficulty in linking coverage back to the original research; although a majority of articles (97.4%) included references, nearly half (48.3%) were not traceable. In a similar study, MacDonald and Hoffman-Goetz (2002) analyzed cancer coverage in Ontario daily newspapers. In line with previous research, the authors concluded that popular press reporting of cancer news is sometimes inaccurate, positing that such reporting may fail to mobilize people to adopt healthy lifestyle and screening behaviors.

Employing a more qualitative approach, Conrad (1997) used a small case study to illuminate differences between reporting on the relationship between a specific gene and alcoholism. The case study included original research, appearing in the *Journal of the American Medical Association* (*JAMA*), a follow-up article whose findings countered those from the first, also published in *JAMA*, and all resultant coverage in U.S. newspapers. Conrad reported that news media did not afford as much attention to the second study, published 8 months later. More to the point, however, Conrad noted that some coverage of the follow-up study cast the findings as being confirmatory and in line with the original research.

In contrast to studies that call attention to incomplete or exaggerated coverage of genetics in the popular press, the recent work of Bubela and Caulfield (2004) suggested that reporting is more balanced than previously suspected. Having reviewed reporting about gene discoveries in major daily newspapers in Canada, the United States, Great Britain, and Australia, these researchers 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 corroborated concern, however, about the general tendency for science reporting, in both news and science journal articles, to underrepresent risks and overemphasize benefits.

As evidenced in the literature, most content analyses to date have relied on sampling or single case studies and made judgments of comparability using coverage in its entirety (i.e., whole articles). The current study addresses each of these limitations, using a universe of articles that met our selection criteria and focusing on specific claims made within the articles as the units of analysis. In addition, this study contributes to the literature by extending our understanding of the role of press releases.

Public information officers facilitate relationships between scientists and journalists (Dunwoody, 1999; Logan, 2001; Nelkin, 1995; Weigold, 2001). Scientists frequently express fear about communicating with the public directly and report that public information officers aid them in their interactions with journalists (Dunwoody & Ryan, 1983). According to Borchelt (2001), however, the role of public information officers has not been fully explicated within the literature. Research in this area (e.g., Woloshin & Schwartz, 2002) has highlighted the possibility that limitations and conflicts of interest originate with the press release. Given that developments within the science community are often afforded more media attention when accompanied by a press release, it is worth considering the role of the "middle man" (i.e., press conferences and public releases) in the information transfer process more closely.

As discussed briefly above, the current study makes several unique contributions. First, we build on a growing body of literature that suggests that there are slippages and inconsistencies in the transfer of genetic knowledge from scientific sources to the public at large. Moving beyond consideration of the information "end points" (i.e., science articles and news coverage), this study extends a nascent body of work that places emphasis on the intermediary press release. Second, the present research improves on previous work by comparing genetics communication at the level of a source's central claim. Rather than using an entire news or science article as our unit or analysis, we extract core claims from each source in order to more accurately and objectively pinpoint possible discrepancies between different suppliers of genetic information. Last, this study relies on a universe of news coverage from which to identify inconsistencies in reporting.

Based on a traditional transmission model, it is reasonable to assume 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. Therefore, we hypothesize,

Hypothesis 1: The intermediary press release is less likely to report genetic discoveries in a deterministic tone than is the resulting press coverage.

In addition, given the complexities in the literature about the representation of genetics in news media, we put forth the following research questions:

Research Question 1: What types of information supplied by the press release(s) are not present in news coverage?

Research Question 2: What types of information, not presented in the press release(s), are being introduced by journalists?

Method

Sample

In order to identify qualified news stories reporting on gene and 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 nonhealth context (for more information on selection of search terms, see Cappella et al., 2007). 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 and 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 = 1,645).

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, and to stories that contained traceable reference information to published research.[2] 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 composed less than 2% of discarded articles.

All corresponding press releases were then obtained from institution Web sites and EurekAlert! or PR Newswire, 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). In total, 20 cases consisting of a news article(s) and press release(s) were identified (references are available on request).

Coding

The central claim(s) of each article and press release were extracted 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. We also coded verbs for framing language (using a 5-point scale ranging from *probabilistic* to *deterministic*). A sample set of five cases was consensus coded by the authors. Intercoder agreement was quite high, for both claim identification ($\kappa = .91$) and framing language classification ($\kappa = .84$). All points of disagreement were resolved before researchers coded remaining articles.

In addition, a more subjective coding scheme was developed in order to capture important conceptual and contextual differences between information presented in the press release and information presented in related news coverage. Each central claim was compared against all others to determine whether it could be classified as being present in both the press release and news article. Alternatively, (a) claims appearing in the press release but not subsequent news coverage and (b) claims appearing in a news article but not the corresponding press release were coded as being specific to one source. Claims were categorized as being present in only one source if they altered or added information not contained in at least one claim from a corresponding source. More specifically, these additions and alterations were identified using the following four criteria: presence or absence of qualifying information, overinterpretation of partial or preliminary findings, overgeneralization or simplification, and contradiction. These coding criteria were chosen based on a priori categories drawn from the literature (for detailed information, see Moyer et al., 1995; Singer, 1990).

Presence or absence of qualifying information. One way in which a central claim could introduce additional information within a news article or press release was by acknowledging specific qualifications that were *not* acknowledged or discussed in the corresponding press release(s) or news article(s). Qualifying information was operationally defined to include discussion of sample characteristics, methodology, background information, limitations, and/or implications of the research. For example, if a press release claim recognized the limitations of a study's small sample size but there was no mention of this in the accompanying news articles, that claim would be coded as specific to the press release. Alternatively, if a claim within a news article discussed the ways in which a study extended

previous research and these were not included in the corresponding press release(s), the claim was coded as being present in only the news article.

Overinterpretation of partial or preliminary results. A central claim was coded for whether it overinterpreted partial and/or preliminary scientific findings. This criterion recognizes instances wherein a press release or news article claim alters information by drawing conclusions that may be premature based on insufficiencies of the research (e.g., small sample size, not subjected to replication or peer review).

Overgeneralization or simplification. Central claims were coded as appearing in only the press release or news article if they included information that exaggerated or simplified claims made in the corresponding press release(s) or news article(s). For example, if the relationship between genetics and breast cancer was described as an "association" within a press release claim but simplified in the news article claim to "breast cancer gene," the latter claim would be coded as appearing in the news article only.

Contradiction. Central claims containing content contradictory to that appearing in the corresponding press release(s) or news articles(s) from a particular case were coded as being present in only one source.

In order to assess reliability of judgments with regard to the categorization of claims, a random subset of five cases containing 109 claims was coded by two independent coders. Because of the subjective nature of content categorization, reliability was less than desirable ($\kappa = .65$); therefore, coding criteria were revised and uncertain coding decisions were discussed and resolved between two coders. Reliability was reassessed using two additional random cases containing 153 claims; intercoder reliability improved considerably ($\kappa = .76$).

Analysis

All claims within each case that were coded as being present in both the case's press release(s) and its accompanying news articles were matched with all other claims within the case. This resulted in matched pairs, consisting of one central claim from the case's press release(s) and one central claim from the case's news articles. Matched pairs were then reviewed in order to determine whether their claims were comparable on the basis of verb-object agreement between the press release claim and the news article claim. Claims were not considered to be comparable, for

example, if one claim contained an action verb (e.g., *may be involved in*, *trigger*) and the other claim contained an existence verb (e.g., *is*, *are*). Frequencies were run on verb similarity of matched pairs determined to be comparable, thus providing information regarding similarity of framing language used by the press release and the news article.

In order to elucidate subtle, and not so subtle, shifts in meaning between the press release and its subsequent coverage in mainstream print media, an accompanying qualitative textual analysis of claims specific to one source was performed. That is, claims not expressed in *both* the press release and an accompanying news article were examined within the context of the press release or news article in which they appeared. Separate analysis of these claims is valuable because it allows for a more nuanced understanding of (a) what types of information supplied by the press release are not being used by journalists; (b) what types of information, not presented in the press release, are being introduced into the lay press; and (c) how these differences between information presented in the press release and information presented in the general press may contribute to shifts in scientific meaning.

Results

The analysis was based on 20 cases consisting of 23 press releases and 71 news articles. 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 was identified, 113 in press releases and 262 in news articles. Just over half (54.7%) of all central claims were coded as being present in both sources, while the remaining portion (45.3%) were identified as appearing in only the press release or news article. Nearly 80.0% of claims that were coded specific to one source were introduced in the news article ($n = 134$); the remaining claims were present only in the press release ($n = 36$).

In order to evaluate whether the process of language distortion indeed occurs as scientific news is translated from the press release to coverage in public press, claims appearing in both the press release and news articles were assessed for comparability based on verb-object agreement. Those determined to be comparable ($n = 169$) were evaluated for tone. Among these pairs of comparison, 34.4% of the press release claims were found to use language that was more deterministic, whereas 33.1% of the time newspaper claims used more deterministic verb forms than those in the press release. A third of all pairs (32.5%) included press release claims and news claims that used comparable causal language. While there were no

clear trends in the direction of distortion toward deterministic or probabilistic claims, two thirds of the time when there was a clear shared claim there was a change in the deterministic language utilized in one direction or another from the press release to the article.[3]

Turning to Research Questions 1 and 2, all central claims appearing exclusively within either the press release or news article (n = 170) were reviewed qualitatively. While claims within popular press often lacked specificity and overinterpreted preliminary findings, other errors commonly attributed to science journalism, such as lack of qualifying details and use of oversimplified language (e.g., "fat gene"), were observed in press releases. Descriptive examples of claims that illustrate each of these forms of distortion are provided below. Indeed, these examples suggest that various sources in the science communication process, namely, the press release and news coverage, create alternative representations of the original science.

Presence of Qualifications

The most frequent difference between press releases and news articles involved variation in the level of specificity and/or acknowledgment of various qualifications (e.g., background information, methodology, study limitations, and risk-benefit analysis). The omission of qualifications was not limited to coverage in the lay press. In fact, news articles often included information not found in the press release. In the example that follows, news coverage omits facts about relevant past research and methodology. When scientists identified a set of genes that may be involved in breast cancer's spread to the lungs, Memorial Sloan-Kettering Cancer Center (MSKCC) issued a press release that coincided with the publication of study results in the journal *Nature.* Press release material provided information about an earlier study in which the same team of scientists identified a gene pattern in breast cancer cells that spread *to the bone.* This background knowledge provided a frame of reference by acknowledging that "the latest work [showed] that genes that prompt breast tumors to spread to the lungs [were] almost entirely different from [the previously identified set], with only six genes in common" (MSKCC, 2005). Of the press coverage resulting from this press release, only a *Newsday* story, titled "Cancer Cells' Need to Roam; Scientists Track Breast Tumor Genes That Somehow Communicate to Target Other Organs," provided any content that would have allowed readers the perspective to contextualize the presented findings (Ricks, 2005a).[4]

The MSKCC press release also detailed study methodology. Essentially, scientists were able to identify the pattern of cancer cells showing a propensity for migrating to the lung when a cell line from a breast cancer patient was *transplanted into mice.* Again, only the *Newsday* article disclosed that the findings were based on a nonhuman sample.

In a contrasting example, a press release issued by Harvard School of Public Health (2006) promoted its discovery of a gene variation associated with increased risk for obesity, identified "by testing 86,604 single nucleotide polymorphisms (SNPs), or DNA sequence variations, for an association to body mass index (BMI), a surrogate measurement for obesity." Barring an extensive review of the statistical technique used for analysis, the press statement was not forthcoming with contextual information (i.e., study limitations) necessary for accurate interpretation of the study's findings. Five of the seven resulting news articles, on the other hand, cautioned readers about generality (e.g., "Like all scientific findings, [the evidence presented] needs to be confirmed by others"; Wade, 2006, p. 4) and interpretability (e.g., "Scientists still need to pinpoint *how* the genetic variant affects weight"; Smith, 2006, p. B9).

Other examples of omitting qualifying statements include a *USA Today* story that excluded precautions of the National Cancer Institute on the limited generality of findings (e.g., the study is based on a convenience sample; $n = 22$) and the set of articles from *Chicago Tribune*, *Los Angeles Times*, and *Newsday* that did not disclose limitations involved with a progressive admixture mapping technique used by researchers at Dana Farber Cancer Institute.

Overgeneralization and Simplification

There were source-based differences related to the degree of simplification or generalization. An example of this can be found in the following comparison. In a 2005 press release titled "U-M Scientists Say Fused Genes Trigger the Development of Prostate Cancer," the principal investigator of a study run by the University of Michigan's Medical School commented on the significance of their most recent findings: "The data in our study provides tantalizing evidence that gene fusion is the causative agent—the initiating event—in prostate cancer" (University of Michigan Health System, 2005). In the next day's *USA Today,* a story was headlined "Findings Identify Likely Origins of Prostate Cancer," written by Szabo (2005). Its lead sentence stated, "Researchers have found a set of genes that may play a key role in prostate cancer—a discovery that *doctors* are hailing

as a *major breakthrough* that *changes the way they think* about the genetic roots of the disease" (Szabo, 2005, p. 7A).

A form of simplification that was frequently used throughout our sample involved the use of terminological short cuts such as "cancer gene." In the present sample, 10 out of 20 cases contained claims that expressed the relationship between genetics and health outcomes in the form "outcome gene" (e.g., breast cancer gene, cancer-causing gene). The shorthand, which suggests a simplistic Mendelian single gene model, was also applied to more complex outcomes (e.g., the use of "fat gene" or "hunger gene" with regard to obesity). Of the 10 cases using the "outcome gene" term, its usage originated in the press release 70% of the time.

Overinterpretation of Partial and/or Preliminary Findings

Although less common, a third difference between press releases and news coverage involved overinterpreting partial and/or preliminary findings. With reference to the earlier example, involving the discovery of a set of genes linking breast cancer's spread to the lungs, the press release, drafted by the sponsoring institution, posited that the findings "shed new light" on the biology of breast cancer metastasis while also acknowledging the possibilities for advances in treatment and prognostic tools.

In contrast, coverage in the public press declared, "The finding is considered a landmark because *it is proof that specific genetic signature exists for each type of cancer* and the organ it spreads to" (Ricks, 2005a, p. A26). According to the press release, the original science did not provide definitive empirical evidence on any accounts. In fact, it presented data in its infancy. In addition to overextending preliminary findings deserving of corroboration, this example also provides further illustration of overgeneralization. The original research specifically focused on metastases in breast tumors; any claims extending the findings beyond breast cancer and/or its metastases to the lungs are unwarranted and unsupported by the research.

Another example of the overinterpretation of preliminary or partial results includes the *Baltimore Sun* reporting that Johns Hopkins researchers had "deciphered the genetic code of breast and colon tumors" (Bor, 2006, p. 1A). According to the press release, while their research approach "holds great promise for providing an understanding of the genomic contributions to cancer . . . the findings are just the beginning" (National Institutes of Health, 2006).

Contradiction

Finally, information presented in press releases and news articles differed with regard to the introduction of statements that were contradictory to those appearing in other sources. As an example, one press release highlighted the significance of recent findings, noting that "it had been previously assumed that genes that dictate metastases to specific organs did not exist" (MSKCC, 2005). A *Newsday* article, published the next day, told a different story: "We always knew that specific tumors went to certain sites, but we didn't know which genes dictated where they went" (Ricks, 2005a, p. A26).

Presentation of contradictory information was also evident between press releases. In a case involving research on genetic susceptibility to prostate cancer, press releases were issued by both the *Journal of the National Cancer Institute* (*JNCI*, 2004) and the Translational Genomics Research Institute (TGen, 2004). Each presented quite contradictory material about the international study and its findings. According to TGen, release researchers "zeroed in on *three* different regions of the genome containing genes that may make men more vulnerable [to prostate cancer]." Conversely, the *JNCI* release reported the study identified *five* chromosomal regions. In addition to discrepancies of how many genome regions are implicated in study findings, the TGen release included a quote from one of the published study's lead authors, describing how the study "shows that hereditary prostate cancer genes exist" (TGen, 2004). The *JNCI* release did not express the same level of confidence, declaring that while "no genes that confer prostate cancer susceptibility have been found to date," the chromosomal regions identified in the study are "likely to harbor prostate susceptibility genes" (*JNCI*, 2004).

Discussion

The analysis presented here compared central claims made by both press releases and public press coverage of cancer-related genetics research. Earlier studies have contended that news stories often misrepresent genetics by presenting biologically deterministic and simplified portrayals (e.g., Mountcastle-Shah et al., 2003; Ten Eyck & Willment, 2003). In contrast, we find no evidence to support the claim that the process of language distortion occurs as scientific news is translated from the intermediate press release to coverage in the press. Our data show no clear trends in the direction of distortion toward deterministic claims in news articles. Although we find that genetic discoveries are presented in a biologically deterministic

and simplified manner 67.5% of the time, these instances of distortion are not unilaterally attributable to journalistic practices or the nature of public relations writing. In half of the cases, the press release claims were found to use language that was more deterministic; in the other half, newspaper claims used more deterministic verb forms (e.g., *causes*, *triggers*, *is responsible for*).

Essentially, both public information officers and journalists are charged with the task of communicating highly complex material to audiences of nonscientists—public information officers to journalists and journalists to the lay public. Both attempt to "sell" their stories to their respective audiences. In the process of economizing and glamorizing science (Jensen, 2008; Kua et al., 2004; Ransohoff & Ransohoff, 2001; Schwartz, Woloshin, & Baczek, 2002; Stocking, 1999), both employ practices that might distort scientific knowledge.

However, in line with earlier findings (e.g., Kua et al., 2004; Singer, 1990), the present analysis confirmed that, in spite of these commonalities, press releases and news coverage have distinct emphases. In fact, when reporting on the same scientific discovery, press release claims and those contained in subsequent news coverage alter or supply additional information more than 40% of the time. That is, nearly 50% of all central claims were source specific, appearing exclusively in the press release or subsequent news coverage. Nearly 80% of these claims were introduced in the news article, while the remaining claims were only present in the press release.

A variety of reasons for the mismatch were explored. The most common distinction between claims appearing exclusively in the press release and those appearing exclusively in news coverage was the extent to which qualifications were discussed. Claims within the press release often emphasized methodology, history, or the sociological environment of the research. In contrast, claims presented to lay public in news accounts provided little direct contextual information, instead emphasizing how study results apply to the "real world."

The provision or omission of qualifications is consequential to how a reader interprets a particular set of findings (Jensen, 2008). In studies of focus groups confronted with stories about a medication for patients with 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)

To a lesser extent, claims appearing in only one source altered information in such a way that partial and/or preliminary findings were overinterpreted. In accordance with the notion that media often present data as "scientifically sound evidence rather than as preliminary findings with still uncertain validity" (Schwartz et al., 2002, p. 2863), our analysis revealed that both news articles and press releases introduced claims as clear-cut facts, excluding minor details and subtleties of the research. Such decisions can have significant consequences. 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).

On occasion, claims appearing exclusively in news coverage differed from those presented in the press release because they supplied additional information (e.g., metaphorical language) to make abstract science phenomenon more lucid (Condit, 2007). To illustrate, a *Newsday* reporter used simile: "There is what [the researcher] calls 'crosstalk' between the cancer and the waiting—and vulnerable—environment of the lung. Think of this devastating communication as a predator sweet-talking its prey into a deadly trap" (Ricks, 2005a, p. A26). While it is sometimes difficult to envisage the ways in which simplification can affect a reader's understanding, there certainly exist instances that illustrate how it can contribute to unintended and misguided interpretation (e.g., "We have discovered the Rosetta Stone of cancer"; McEnery, 2006, p. A1).

Simplification also involved altering information from one source to another. Specifically, 50% of the 20 cases examined in this study expressed the relationship between genetics and health outcomes in the form "outcome gene" (e.g., breast cancer gene, cancer-causing gene). The use of "outcome gene" terminology was introduced in the *press release* 7 out of 10 times. This contradicts earlier findings that suggest that such terminology originates in the public press. For example, Conrad (1997) reviewed widespread press coverage of scientific research, published between 1991 and 1993, implicating genetics in the development of homosexuality. He noted that, in spite of explicit statements of how unlikely it was that a single gene could determine sexuality, the press adopted the term *gay gene*. This type of terminology can yield wider dissemination of images of complex disease as genetically driven phenomena, thus "[privileging] genetics in the public discourse and [reinforcing] ideas of genetic essentialism" (Conrad, 1997, p. 150).

This study has several caveats that should be noted. First, this study is limited in that it considers only news coverage directly related to peer-reviewed articles. As a result, it may underrepresent stories flowing from

other sources such as abstracts from scientific meetings that often go unpublished (Schwartz et al., 2002). Second, the nature of qualitative analysis introduces bias. Our coding scheme, although determined to be reliable, involves perceptions of the researchers that are subject to interpretation, as is any perception of an involved participant (Tankard & Ryan, 1974). A third caveat of the study is its dependence on coverage of cancer genetics within the print media as opposed to broadcast news. Previous studies have reported 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, this study 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.

The dual approach adopted in this study produces a richly detailed picture of changes and continuities in the flow of information between sources. While this study, comparing the press release(s) and ensuing news coverage, is certainly instructive, it also illuminates the need for future research. A necessary next step would involve systematic assessment of the entire process by which scientific knowledge is communicated to the lay public as it moves from publications in science journals to lay press through the intermediary press release. To the best of our knowledge there are few, if any, assessments that do this. The conceptual framework used in the current study may be appropriate for work of this nature. Essentially, the adoption of a transmission perspective, paired with central claims as the units of analysis, will allow for isolation of inconsistencies. Findings can then be contrasted with a more constructivist approach, involving consideration of the negotiation process that occurs among key communicators. In addition, as with all research that implies media effects, reception research can contribute to our understanding of whether and how communication of cancer genetics contributes to shifts in public perceptions of scientific meaning.

The findings in this study present a complicated dilemma for public information officers and science journalists. Public relations writing and science journalism aim to convey important information to the public; however, both are limited in terms of page space and time. Especially in the case of science reporting, this may lead to the omission of qualifying information and/or oversimplification. In addition, both public information officers and journalists are impelled to make the stories readable and

interesting, which may be especially difficult given the technical nature of science. As demonstrated here, press releases contain linguistic overdeterminism just as often as news coverage, thus presenting challenges in the transfer of timely, accurate science information. Distortion may, in part, be attributable to the press release.

Notes

1. This is based on a content analysis of 20 U.S. major newspapers, three U.S. major broadcast news networks, and the Associated Press for the period between 1997 and 2003.

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

3. Because we did not use sampling techniques to extract press releases and newspaper articles, no inferential statistics were conducted for this analysis.

4. This story also ran in the *Orlando Sentinel* (Ricks, 2005b). These are essentially the same article, reprinted under a different headline. Ricks is a reporter for *Newsday*.

References

Bernhardt, J. M., & Cameron, K. A. (2003). Accessing, understanding, and applying health communication messages: The challenge of health literacy. In T. L. Thompson, A. M. Dorsey, K. I. Miller, & R. Parrot (Eds.), *Handbook of health communication* (pp. 583-606). Mahwah, NJ: Lawrence Erlbaum.

Bor, J. (2006, September 8). Genetic code of cancers mapped: Hopkins researchers find new leads on breast, colon tumors. *Baltimore Sun,* p. 1A.

Borchelt, R. E. (2001). Communicating the future: Report of the research roadmap panel for public communication of science and technology in the twenty-first century. *Science Communication, 23*, 194-211.

Broadstock, M., Michie, S., & Marteau, T. (2000). Psychological consequences of predictive genetic testing: A systematic review. *European Journal of Human Genetics, 8,* 731-738.

Bubela, T. A., & Caulfield, T. A. (2004). Do the print media "hype" genetic research? A comparison of newspaper stories and peer-reviewed research papers. *Canadian Medical Association Journal, 170*(9), 1399-1407.

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

Cappella, J. N., Mittermaier, D. J., Weiner, J., Humphreys, L., & Falcone, T. (2007, November). *Framing genetic risk in print and broadcast news: A content analysis.* Paper presented at the annual conference of the National Communication Association, Chicago.

Carsten, L. D., & Illman, D. L. (2002). Perceptions of accuracy in science writing. *IEEE Transactions of Professional Communication, 45*(3), 153-156.

Caulfield, T. (2000). Underwhelmed: Hyperbole, regulatory policy and the genetic revolution. *McGill Law Journal, 45,* 437-460.

Condit, C. (2007). How geneticists can help reporters to get their story right. *Nature Reviews, 8,* 815-820.

Condit, C., Ferguson, A., Kassel, R., Thadhani, C., Gooding, H. C., & Parrott, R. (1999). A exploratory study of the impact of news headlines on genetic determinism. *Science Communication, 22*, 379-395.

Condit, C. M., Ofulue, N., & Sheedy, K. M. (1998). Determinism and mass-media portrayals of genetics. *American Journal of Human Genetics, 62,* 979-984.

Condit, C. M., & Parrot, R. (2004). Perceived levels of health risk associated with linguistic descriptors and type of disease. *Science Communication, 26*, 152-161.

Conrad, P. (1997). Public eyes and private genes: Historical frames, news constructions, and social problems. *Social Problems, 44*(2), 139-154.

Conrad, P. (2001). Media images, genetics and culture: Potential impacts of reporting scientific findings on bioethics. In C. B. Hoffmaster (Ed.), *Bioethics in social context* (pp. 90-111). Philadelphia: Temple University Press.

Conrad, P., & Weinberg, D. (1996). Has the gene for alcoholism been discovered three times since 1980? A news media analysis. *Perspectives on Social Problems, 8*, 3-25.

Dunwoody, S. (1999). Scientists, journalists, and the meaning of uncertainty. In S. M. Friedman, S. Dunwoody, & C. L. Rogers (Eds.), *Communication uncertainty: Media coverage of new and controversial science* (pp. 59-79). Mahwah, NJ: Lawrence Erlbaum.

Dunwoody, S., & Ryan, M. (1983). Public information persons as mediators between scientists and journalists. *Journalism Quarterly, 60,* 647-656.

Einsiedel, E. F., & Thorne, B. (1999). Public responses to uncertainty. In S. M. Friedman, S. Dunwoody, & C. L. Rogers (Eds.), *Communication uncertainty: Media coverage of new and controversial science* (pp. 43-57). Mahwah, NJ: Lawrence Erlbaum.

Friedman, S. M., Dunwoody, S., & Rogers, C. L. (Eds.). (1999). *Communicating uncertainty: Media coverage of new and controversial science.* Mahwah, NJ: Lawrence Erlbaum.

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

Gaskell, G., & Bauer, M. W. (Eds.). (2001). *Biotechnology 1996-2000: The years of controversy.* London: Science Museum.

Geller, G., Bernhardt, B. A., & Holtzman, N. A. (2002). The media and public reaction to genetic research. *Journal of the American Medical Association, 287,* 773.

Harvard School of Public Health. (April, 2006). *Gene variant associated with obesity risk found with new statistical technique* (Press release). Boston: Author.

Hubbard R., & Wald, E. (1993). *Exploding the gene myth.* Boston: Beacon.

Jensen, J. D. (2008). Scientific uncertainty in news coverage in cancer research: Effects of hedging on scientists and journalists' credibility. *Human Communication Research, 34*, 347-369.

Journal of the National Cancer Institute. (2004, August 17). *Other highlights in the August 18 JNCI* (Press release). Bethesda, MD: Author.

Kim, J., Wyatt, R. O., & Katz, E. (1999). News, talk, opinion, participation: The part played by conversation in deliberative democracy. *Political Communication, 16,* 361-385.

Kua, E., Reder, M., & Grossel, M. J. (2004). Science in the news: A study of reporting genomics. *Public Understanding of Science, 13,* 309-322.

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

Logan, R. A. (2001). Science mass communication: Its conceptual history. *Science Communication, 23*, 135-163.

MacDonald, M. M., & Hoffman-Goetz, L. (2002). A retrospective study of the accuracy of cancer information in Ontario daily newspapers. *Canadian Journal of Public Health, 93*(2), 142-145.

McCall, R. B. (1988). Science and the press: Like oil and water? *American Psychologist, 43*(2), 87-94.

McCall, R. B., & Stocking, S. H. (1982). Between scientists and public: Communicating psychological research through the mass media. *American Psychologist, 37*(9), 985-995.

McEnery, R. (2006, September 8). Case team helps crack genetic code of tumors. *Cleveland Plain Dealer,* p. A1.

McInerney, C., Bird, N., & Nucci, M. (2004). The flow of scientific knowledge from lab to the lay public. *Science Communication, 26*, 44-74.

McQuail, D. (2000). *McQuail's mass communication theory* (4th ed.). Thousand Oaks, CA: Sage.

Melzer, D., & Zimmern, R. (2002). Genetics and medicalisation. *British Medical Journal, 324,* 863-864.

Memorial Sloan-Kettering Cancer Center. (2005, July 27). *Researchers identify gene set linked to breast cancer's spread to lungs* (Press release). New York: Author.

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

Moyer, A., Greener, S., Beauvais, J., & Salovey, P. (1995). Accuracy of health research reported in the popular press: Breast cancer and mammography. *Health Communication, 7*(2), 147-161.

National Institutes of Health. (2006, September 7). *Statement from the NIH on cancer genetics findings at Johns Hopkins University*. Bethesda, MD: Author.

National Science Foundation, Division of Science Resources Statistics. (2008). S*cience and engineering indicators 2008.* Arlington, VA: National Science Foundation.

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

Nelkin, D. (2001). Molecular metaphors: The gene in popular discourse. *Nature Reviews. Genetics, 2*(7), 555-559.

Nelkin, D., & Lindee, S. (1995). *The DNA mystique: The gene as cultural icon.* New York: Freeman.

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

Peterson, A. (2001). Biofantasies: Genetics and medicine in the print news media. *Social Science and Medicine, 52*, 1255-1268.

Priest, S. H. (1999). Popular beliefs, media, and biotechnology. In S. M. Friedman, S. Dunwoody, & C. L. Rogers (Eds.), *Communication uncertainty: Media coverage of new and controversial science* (pp. 95-112). Mahwah, NJ: Lawrence Erlbaum.

Ransohoff, D., & Ransohoff, R. (2001). Sensationalism in the media: When scientists and journalists may be complicit collaborators. *Effective Clinical Practice, 4*, 185-188.

Ricks, D. (2005a, July 28). Cancer cells' need to roam; Scientists track breast tumor genes that somehow communicate to target other organs. *Newsday,* p. A26.

Ricks, D. (2005b, July 28). Scientists tag genes that stir breast cancer's spread. *Orlando Sentinel,* p. A18.

Rogers, C. L. (1999). The importance of understanding audiences. In S. M. Friedman, S. Dunwoody, & C. L. Rogers (Eds.), *Communicating uncertainty: Media coverage of new and controversial science* (p. 191). Mahwah, NJ: Lawrence Erlbaum.

Schwartz, L., Woloshin, S., & Baczek, L. (2002). Media coverage of scientific meetings. *Journal of the American Medical Association, 287,* 2859-2863.

Shannon, C.E. & Weaver, W. (1949). The Mathematical Theory of Communication. Urbana, Illinoise: University if Illinois Press.

Silva, V. T. (2005). In the beginning was the gene: The hegemony of genetic thinking in contemporary culture. *Communication Theory, 15*(1), 100-123.

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

Smith, S. (2006, April 17). Genetic discovery one day could lead to weight loss. *Boston Globe,* p. B9.

Stocking, S. H. (1999). How journalists deal with scientific uncertainty. In S. M. Friedman, S. Dunwoody, & C. L. Rogers (Eds.), *Communication uncertainty: Media coverage of new and controversial science* (pp. 23-41). Mahwah, NJ: Lawrence Erlbaum.

Szabo, L. (2005, October 28). Findings identify likely origin of prostate cancer. *USA Today*, p. 7A.

Tankard, J. W., & Ryan, M. (1974). News source perceptions of accuracy of science coverage. *Journalism Quarterly, 51*(2), 219-225, 334.

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

Tichenor, P. J., Olien, C. N., Harrison, A., & Donohue, G. (1970). Mass communication systems and communication accuracy in science news reporting. *Journalism Quarterly, 47,* 673-683.

Translational Genomics Research Institute. (2004, August 17). *Study narrows search for genes putting men at increased risk for prostate cancer* (Press release). Phoenix, AZ: Author.

University of Michigan Health System. (2005, October 27). *U-M scientists say fused genes trigger the development of prostate cancer* (Press release). Ann Arbor: Author.

Wade, N. (2006, April 18). Common genetic link to obesity is discovered. *New York Times*, p. F2, F4.

Weigold, M. F. (2001). Communicating science: A review of the literature. *Science Communication, 23*, 164-193.

Woloshin, S., & Schwartz, L. (2002). Press releases: Translating research into news. *Journal of the American Medical Association, 287*(21), 2856-2858.

Jean Brechman, is a PhD candidate at the Annenberg School for Communication at the University of Pennsylvania. Her work centers on media and social influences on public health, particularly within adolescent populations. Her current research interests include narrative processing of entertainment media as well as campaign and media product evaluation techniques.

Chul-joo Lee is an assistant professor in the School of Communication at Ohio State University, having received his PhD from the Annenberg School for Communication at the

University of Pennsylvania in 2009. His research interests include science communication and health communication, specifically focusing on the effects of the Internet and social capital. His works have been published in *Journalism & Mass Communication Quarterly, Journal of Health Communication, Journal of Broadcasting & Electronic Media, Communication Methods and Measures, Science Communication,* and *Mass Communication & Society.*

Joseph N. Cappella (PhD, 1974, Michigan State University) is a professor of communication and holds the Gerald R. Miller Chair at the Annenberg School for Communication at the University of Pennsylvania. His research has focused on the effects of media on health and political issues as well as social interaction, nonverbal behavior, and statistical methods. He is a fellow of the International Communication Association, a distinguished scholar of the National Communication Association, and a recipient of the B. Aubrey Fisher Mentorship Award.