【 新聞媒體如何建構科學真實：新聞報導的正確性及其影響 】2 年期計畫

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進度說明：

兩年共完成 10 項研究，應用四種不同研究工具：內容分析、深度訪談、電話訪問與實驗。

第一年			
	次主題	方法	發表狀況
研究一	本土科學研究的新聞報導正確性	內容分析	**Paper I- Study 1**
研究二	本土科學家自我新聞正確檢視	內容分析 新聞評比	**Paper I- Study 1**
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第二年			
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研究一	本土科學研究的報導： 科學記者新聞選擇與作業流程	深度訪談	**Paper II- Pilot study**
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研究成果：發表以下兩篇論文

1. Chang, C. (forthcoming). Inaccuracy in Health Research News: A Typology and Predictions of Scientists' Perceptions of the Accuracy of Research News. Paper accepted for publication in *Journal of Health Communication*.
2. Chang, C. (under review). Inform Us or Confuse Us? How People Perceive News Covering Novel or Contradictory Health Research Findings

Inaccuracy in Health Research News:

A Typology and Predictions of Scientists' Perceptions of the Accuracy of Research News

Abstract

This article introduces an integrated inaccuracy typology to explore the prevalence of inaccurate news coverage of health research. According to this typology, errors, omissions, and misinterpretations are three common types of inaccuracy; the former two are objective, whereas the latter is a form of subjective inaccuracy. Objective inaccuracy involves errors and omissions in describing the background or substantive information about the research, such as how, when, where, and on whom research was conducted. Subjective inaccuracy entails misinterpretations due to a lack of expertise among journalists (e.g., misstating facts, errors in inferences, offering speculations as facts) or media's interest in profits (e.g., overemphasis on unique findings, overgeneralizations of findings, shifting emphases). For this study, coders analyzed objective inaccuracy, while scientists rated subjective inaccuracy. In turn, it identifies what can account for the variance in scientists' perceptions of inaccuracy in news articles citing their research. Both objective and subjective inaccuracy offer significant predictors; of the different types of objective inaccuracy, omissions of research methods represent a significant factor, whereas of the types of subjective inaccuracy, errors in inferences, overemphasis on uniqueness, and overgeneralizations of findings are all significant predictors.

Keywords: accuracy, health news, health research, news coverage, misinterpretation

Health and medical research garners substantial media coverage (Pellechia, 1997; Suleski & Ibaraki, 2010). Unlike scientific findings in other domains, such as astronomy or zoology, findings from health and medical research often have direct implications for people's lives. People often cite news media as a primary source for their health information (Brodie, Hamel, Altman, Blendon, & Benson, 2003) and consider taking specific actions after reading health news stories that suggest the benefits from such actions (Voss, 2003). Inaccurate news coverage of health and medical research thus may mislead people to adopt inappropriate behaviors or lifestyles that could harm their health or pose threats to their lives.

Prior research has identified several important causes of such inaccuracies. For example, time constraints lead to news-related inaccuracy (Maille, Saint-Charles, & Lucotte, 2010; McCall, 1988). Journalists' lack of scientific expertise or training also may result in reporting errors (Hartz & Chappell, 1997). Moreover, the purposes of a news story, which differ from those of a scientific report, may lead to interpretive biases. McCall (1988) notes that the audience for news stories is the general public, so these stories offer concrete applications, certain conclusions, and summations, whereas scientific studies, which are read mainly by peers, favor the presentation of abstract principles, tentative conclusions, and comprehensive reporting. Sacrificing accuracy for sensationalism or drama also could be triggered by concerns for profits in news settings (McCall, 1988).

Thus, inaccuracy is a common problem in news coverage of scientific research, and of health research in particular (e.g., Moyer, Greener, Beauvais, & Salovey, 1995; Singer, 1990). In addition to mere errors, news reports often omit relevant information (e.g., Tankard & Ryan, 1974), which represents an inaccuracy in a broad sense. Misinterpreting results also creates a type of inaccuracy (Tankard & Ryan, 1974). This study accordingly explores errors, omissions, and misinterpretations in news coverage of health research and defines inaccuracy as the presentation of erroneous information, omission of relevant information, or misinterpretation of research content. Even while acknowledging that certain types of inaccuracy (e.g., misinterpretations) can do more harm than others (e.g., omissions), this study seeks to present a comprehensive inaccuracy typology that integrates all common types of inaccuracy, regardless of their potential harms. The resulting typology of inaccuracy in news reports thus comprises two general categories: objective and subjective inaccuracy. The former involves errors and omissions; this inaccuracy can be assessed by comparing news content against the original research article. The latter pertains to misinterpretations of the information presented in the original article, whether due to a lack of expertise among the journalists or a media company's interest in profits.

Prior research has explored accuracy in science news, but it has not focused specifically on health news. Furthermore, existing studies explore different types of errors without providing an integrated framework. Therefore, the first objective of this study is to introduce an integrated typology of inaccuracy and examine the prevalence of each specified type, using health research news in Taiwan as an example. Journalists in Taiwan report published research conducted by international and local scholars, using different news development processes. For international research, the coverage mainly relies on wire services, and inaccuracies often get introduced in the process of translating English content into Chinese reports. For local research, journalists' attention may be drawn to a study by press releases from research organizations or conferences, after which they access the original study to construct their news stories. In this case, the inaccuracy arises during the news construction process. The present study addresses this latter case, in which journalists take the initiative in terms of writing the news reports and thus potentially introduce inaccuracy.

Moreover, unlike prior research that examines scientists' general perceptions of science coverage (Hartz & Chappell, 1997), this article reports on a test of scientists' perceptions of the accuracy of news stories citing their own research. When scientists perceive poor accuracy and develop low trust in the press, it may hinder their willingness to communicate with journalists. Understanding the causes of scientists' negative perceptions thus appears important. On the one hand, scientists may be critical when rating any news, because they have a generally negative attitude toward the popular press (McCall, 1988). On the other hand, scientists may develop their perceptions on the basis of their actual previous experiences. This study explores whether scientists' perceptions of these inaccuracies are well-grounded and caused by the actual presence of subjective or objective inaccuracy. That is, as a second objective, this study examines which factors, representing objective or subjective inaccuracy, contribute significantly to scientists' perceptions of the inaccurate coverage of their research. Understanding these origins of scientists' frustration in turn may help journalists deal with the issue and improve their coverage quality. Furthermore, better news quality may encourage scientists to work more closely with the journalists; close cooperation between scientists and journalists is likely key to better science reporting (Weigold, 2001).

Inaccuracies in Science News Reports

Inaccuracy in science reporting has long been recognized as a serious issue, especially considering the low levels of accuracy generally demonstrated. For example, considering science news contained in 20 newspapers over three months in 1972, Tankard and Ryan (1974) report that only 8.8% of the cited scientists rated the news stories about their research as free of errors. In an exploration of 166 news stories from nine major daily news outlets in Texas, Pulford (1976) asked scientists to rate the news coverage about their research; 29.4% of them rated the articles free of errors. Analyzing hazard-related stories in newspapers and television news that drew on published research, Singer (1990) finds that only 7.1% did not contain any type of errors.

Inaccuracy in coverage of health-related research in particular has drawn research attention. Most studies focus on a specific type of disease or health issues; for example, MacDonald and Hoffman-Goetz (1993) compare news stories about cancer in Ontario daily newspapers with the cited research and find that only 2.5% of the stories were free of errors. News coverage of genetic research offered only 18% without errors (Bubela & Caulified, 2004).

These prior studies feature two common approaches to examining accuracy in science news coverage. In the first, most commonly adopted approach (e.g., MacDonald & Hoffman-Goetz, 1993), news researchers or coders compare the news stories with the original published research (e.g., Pellechia, 1997; Singer, 1990). The second approach instead invites scientists to assess the accuracy of the coverage of their own research by sending them news stories and asking for their evaluations. This approach, as developed by Charnley (1936), initially sought to examine accuracy in general news but also has been employed to explore accuracy in the coverage of scientific research specifically (e.g., Pulford, 1976; Tankard & Ryan, 1974).

The different approaches in turn may be appropriate for analyzing different types of inaccuracy. On the one hand, coders likely can assess errors or omissions in the background or research information—that is, they can make objective accuracy assessments by comparing a news story with the original research article. On the other hand, scientists' evaluations of science news likely are more critical, as a result of their scientific training (McCall, 1988), but they can better assess how news coverage misinterprets their research articles, a form of subjective accuracy. Therefore, for this research, coders assessed objective accuracy, and scientists determined the levels of subjective accuracy.

Objective Inaccuracy

Objective inaccuracy refers to errors in presenting objective details or omissions of objective details, such that it can be readily identified by comparing the original research with the news stories. Such objective details include background information and substantive information about the scientific research (see Table 1).

Table 1 about here

Errors in Presenting Background Information

Basic information about a scientific study includes the names of the authors and their organization, the publication year, and journal titles. Errors in reporting these details are not uncommon; Tankard and Ryan (1974) find incorrect organization names in 10.4% of the science news reports they examine. In Pulford's (1976) study, 14.7% of scientists evaluating science news identified errors in terminology, names, or dates. Moyer et al.'s (1995) coders found that 23.81% of the news about breast cancer research contained various sorts of errors. Yet such information may be important for readers, as heuristic cues about the credibility of the findings. For example, readers may regard findings from a study conducted by Harvard researchers or published in *Science* or *Nature* as more credible. Errors in background information also make it more difficult to find the original source research, such that journalists are less accountable for the accuracy of their reports. Therefore, it is important to explore the prevalence of these errors.

RQ1a: What percentage of health research news contains errors in background information?

Errors in Presenting Substantive Information

In addition to background information, errors can appear when journalists present essential information about the cited study, such as how, when, from whom, and where the data were collected; readers interpret cancer findings derived from experiments with human targets or rats differently, for example, because they differ in their relevancy. Without accurate information, readers may misinterpret the findings' implications for their own lives. The current study defines substantive research information as that pertaining to the four Ws: who (research targets), when (time of data collection), where (countries or places of data collection), and how (methods).

RQ1b: What percentage of health research news contains errors in substantive information?

Omissions in Background Information

Omissions are an even more common problem in science reporting than errors (Tankard & Ryan, 1974). They may be due to editorial constraints (Kua, Reder, & Grossel, 2004), yet the failure to present relevant and essential information that will enable the public to make informed judgments remains problematic. Science coverage that omits important information therefore constitutes an important type of inaccuracy, as scientists widely assert. When asked to judge the frequency of coverage problems, about one-third (32.87%) of scientists indicated "omission of relevant information" as a critical problem (Tichenor, Olien, Harrison, & Donohue, 1970). Moreover, omitting background information again makes it impossible for interested readers to locate the original study or infer its credibility.

RQ2a: What percentage of health research news omits background information?

Omissions of Substantive Information

Omissions of substantive information are common: Tankard and Ryan (1974) report that scientists identifying the types of omission errors in press coverage of their research cited omitting information about the methodology (35.2%), relevant information about the results (33.7%), and definitions of technical terms (13.0%). Similarly, in Pulford's (1976) study, scientists considered omitting information about methods a common problem, present in approximately 21.7% of news coverage. The news stories that Singer (1990) analyzed omitted other important information, such as discussions of the research method, around 47.62% of the time. The omission of essential details is a serious problem when television news reports scientific research (Moore & Singletary, 1985).

It also is common when journalists cover health research. MacDonald and Hoffman-Goetz's (1993) analysis of cancer news revealed that 55% omitted important research information, such as the study population (e.g., elderly) or study target (e.g., cells cultivated in the lab, rats, humans). In a case study, Molitor (1993) points out that news coverage of an aspirin study failed to describe study participants adequately; in another case study of genetics research news coverage, Brechman, Lee, and Cappella (2009) find that many studies omitted the methodological details. In their investigation of breast cancer reports, Moyer et al. (1995) find that 11.9% of news excluded important methodological aspects. Yet information about the four Ws is essential for scientific research, and omitting them may have negative consequences for readers.

RQ2b: What percentage of health research news omits research information?

Subjective Inaccuracy

Subjective inaccuracy instead pertains to inaccurate inferences and interpretations of a study, as a whole or in its particular findings. There are two broad types of subjective accuracy: that caused by a lack of expertise among journalists and that caused by news organizations' focus on profits. Such subjective inaccuracy can appear in body content or headlines; coverage of scientific research often features misleading headlines, according to evaluations by scientists, at frequencies ranging from 26.02% in Tichenor et al.'s (1970) to 30.6% in Tankard and Ryan's (1974) and 30.95% in Pulford's (1976) studies. Coders also have identified 30.95% of science reports (Singer, 1990) and 47.50% of cancer news (e.g., "Cancer vaccine shows promise"; MacDonald & Hoffman-Goetz, 1993) with misleading headlines, along with 9.52% of breast cancer news, which featured misleading headlines such as "Breast Cancer: A Formula for Prevention" (Moyer et al., 1995). However, the specific ways in which headlines can be misleading have not been examined as closely as the inaccuracies in news reports' body content. This study therefore explores subjective accuracy in both body content and headlines.

Inaccuracy Due to Lack of Expertise

Scientists who publish in academic journals often have doctoral degrees and are well-trained in their specialized domains. In contrast, journalists covering scientific research often have bachelor's degrees in journalism and usually lack strong scientific knowledge bases (Hartz & Chappell, 1997; Tichenor et al., 1970). Without a solid basis of scientific training, journalists may have difficulty understanding the scientific methods or reasons for the caveats and linguistic precision contained in scientific publications (Hartz & Chappell, 1997). Trumbo, Dunwoody, and Griffin (1998) also suggest that science reporting demands complex cognitive processes. Without solid science training or background knowledge, errors or biases can emerge during the news construction process. In other words, there exists a gap in expertise between scientists and journalists. Journalists fail to make accurate inferences because they do not have adequate science knowledge to understand the method or solid domain knowledge to comprehend a particular subject. With their deficient expertise and time constraints, journalists may read only the abstract of a scientific publication or just skim through the research article (Maille et al., 2010). Such deficiency in expertise in turn may induce three types of inaccuracy.

Misstatements of facts. Journalists who are not experts in the methodology or domain may misstate information in their efforts to translate complex research content into more accessible language. Scientists who are familiar with their own research can readily perceive whether a news story is accurate in stating the reported findings; 28.0% of the scientists who considered the accuracy of reports in a daily newspaper in Texas in Pulford's (1976) article indicated that those articles had problems in terms of misstating facts.

RQ3a: What percentage of scientists perceive that news articles involving their research are inaccurate in their statements of facts, whether in the headlines or in the body content?

Erroneous causal inference. Inaccurate inferences result when a journalist misinterprets a study's results or findings by making simplified cause-and-effect inferences. Tankard and Ryan (1974) report that 21.8% of scientists believed that the news stories about their research had overstated the causal inferences they actually found. Molitor's (1993) case study of news coverage of an aspirin study revealed that journalists erred in their inference making when interpreting the findings of the study. Simplified causal inferences about health issues (e.g., "drinking milk causes cancer" versus research that suggests drinking milk is associated with a relatively greater risk of cancer among certain targets) may alter people's behaviors and have serious consequences. Thus, erroneous inferences are an important type of subjective inaccuracy, and scientists' perceptions of the extent of this problem in news citing their research deserves research attention.

RQ3b: What percentage of scientists perceive that news articles involving their research contain errors in inferences, whether in the headlines or in the body content?

Speculation as facts. Without adequate knowledge about research methods, journalists may treat speculations reported in scientific research as facts. Tankard and Ryan (1974) report that 20.2% of cited scientists believed that the news stories about their research treated their speculations as facts, whereas Pulford (1976) finds that 11.9% of cited scientists acknowledge this issue. This inaccuracy also appears in Singer's (1990) analysis of hazard-related news, such that 18% of the news treated speculations as facts. Furthermore, 17.50% of cancer news (MacDonald & Hoffman-Goetz, 1993) and 7.14% breast cancer news (Moyer et al., 1995) included speculations treated as facts. Because scientific research is inherently limited to certain aspects or contingent on certain factors, researchers usually make speculations, rather than reaching clear conclusions. Treating speculations in health-related research as facts may be especially problematic, because these speculations often lead to behavioral advice.

RQ3c: What percentage of scientists perceive that news articles involving their research treat speculations as facts, whether in the headlines or in the body content?

Inaccuracy Due to Media's Interest in Profits

Motivations can produce biases and errors in thinking, leading to inaccurate interpretations of scientific research (Trumbo et al., 1998). Whereas scientists seek truth and expect objective reports of findings (Peters, 1995), journalists "sell" information (McCall, 1988) and seek to entertain their audience (Peters, 1995). Sensational approaches to science stories have long been criticized by scientists (Moore & Singletary, 1985), yet for news editors, that which sells best is information that arouses readers' interest or appeals to sensationalism (Glynn, 1988). Singer (1990) thus argues that news inaccuracy may be caused by the media's desire to dramatize research findings, which can lead to overgeneralizations. In addition to overgeneralization, two other types of inaccuracy may be driven by journalists' efforts to enhance readers' interest and thus improve profits: overemphasis on unique findings and changes of emphasis.

Overemphasis on the unique. Science news can seem sensational if it also is unique (Glynn & Tims, 1982). When asked to judge the frequency of coverage problems, scientists in one study rated "overemphasis on the unique" as the most serious problem (Tichenor et al., 1970); in another study, 15.0% of cited scientists believed that news coverage of their own research overemphasized its uniqueness (Tankard & Ryan, 1974). Unique results or findings often draw more media attention. Relatively little previous research has examined this issue in the context of health research reports though.

RQ4a: What percentage of scientists perceive that the news articles involving their research overemphasize the uniqueness of the findings, whether in the headlines or in the body content?

Overgeneralization of findings. Overgeneralization is a common problem in science reporting, motivated by profit concerns (Singer, 1990). For example, 18.1% of scientists who participated in Tankard and Ryan's (1974) study believed that news coverage of their research overgeneralized their reported findings. Coders also identify overgeneralization as a common problem, with frequencies of 36.71% in Singer's (1990) study and 14.29% in Moyer et al.'s (1995) study. Molitor's (1993) case study of the news coverage of an aspirin study also identified journalists who overgeneralized the implications of the findings. Brechman et al. (2009) find overgeneralizations in news coverage, compared with the press releases citing genetics research.

RQ4b: What percentage of scientists perceive that the news articles involving their research overgeneralizes their findings, whether in the headlines or in the body content?

Changes of emphasis. To arouse readers' interest or increase sensationalism, news reports often shift the emphasis of the research. For example, Singer's (1990) analysis of hazard-related news reports on published research calculated a change of emphasis in 45.24% of cases. Moyer et al.'s (1995) analysis of cancer news also indicated that a change of emphasis emerged in 2.38% of the stories. The extent to which scientists perceive that this type of inaccuracy applies to coverage of their research will be examined in RQ4c.

RQ4c: What percentage of scientists perceive that the news articles involving their research change the emphasis, whether in the headlines or in the body content?

Scientists' Inaccuracy Perceptions

Prior research has explored how scientists perceive science coverage in general. For example, when asked to rate science news, 58.9% of scientists considered it accurate (Tichenor et al., 1970), or else 31.3% did (Tankard & Ryan, 1974). Scientists' confidence in the press has remained low (Hartz & Chappell, 1997). Unlike prior research that has examined scientists' perceptions of the accuracy of science coverage in general, this study explores their perceptions of the accuracy of news covering their own research articles. Such perceptions may stem from inaccuracy in news coverage or derive from generally unfavorable attitudes toward journalists or science reporting in the news. This study examines specifically whether forms of inaccuracy in news covering their research prompt scientists' unfavorable accuracy ratings. According to previous findings, the most diagnostic factor, distinguishing a qualified news story from a low quality one, is its accuracy (Salomone, Greenberg, Sandman, & Sachsman, 1990), but between subjective and objective types of inaccuracy, each form might account for more or less of the variance in scientists' accuracy ratings.

RQ5a: What types of inaccuracy, objective or subjective, significantly predict scientists' overall accuracy perceptions of news articles reporting on their research?

Furthermore, objective accuracy comprises specific types, each of which might account for different degrees of variance in scientists' accuracy perceptions. Maille et al. (2010) argue that scientists are particularly frustrated by methodology omissions; Pellechia (1997) speculates that omissions in news coverage alter scientists' accuracy perceptions. This study thus explores which types of errors or omissions are the most significant predictors of scientists' perceptions of the accuracy of news coverage of their research.

RQ5b: Of the four types of objective accuracy (errors in background information, errors in research information, omissions in background information, and omissions in research information), which most significantly predicts scientists' general perceptions of the accuracy of news articles reporting on their research?

With regard to subjective accuracy, caused by either a lack of expertise or interest in profits, it is relevant to determine which type most significantly affects scientists' accuracy perceptions.

RQ5c: Of the six types of subjective accuracy (misstatements of facts, errors in inferences, speculations as facts, overemphases on the unique, overgeneralization, and shifts in emphases), which most significantly predicts scientists' general perceptions of the accuracy of news articles reporting on their research?

Method

Sampling

Most analyses of health news focus on magazine or newspaper articles. This study instead explored news that had been archived in major online databases by leading news conglomerates, for three reasons: (1) The articles are duplicates of those published in newspapers, (2) they can be assessed long after their initial publications, and (3) people often search online for health news, such that news reports included in databases have the potential to generate wide exposure. Analyzing archived news is especially important in the modern era, when more people search online for health information (Cline & Haynes, 2001). More recent health news research similarly has used databases as sources for analyzed news (e.g., Moyer et al., 1995).

The searched online databases represented four newspapers conglomerates: Apple Daily Database (http://tw.nextmedia.com/index/search), the Liberty Times database (http://iservice.libertytimes.com.tw/IService2/search.php), UDNDATA (http://udndata.com/library/), and Knowledge Management Winner (http://kmw.ctgin.com/). The searches sought to identify news coverage of health and medical research appearing in Taiwanese newspapers between November 1, 2010, and December 1, 2011 (366 days). Each conglomerate publishes one of the top four circulated dailies in Taiwan (*Apple Daily, The Liberty Times, United Daily News,* and *China Times*) (Taiwan Communication Survey, 2012), and their databases contain news published in these four dailies.

Because the target of this investigation was news coverage of health research by local scientists, research assistants searched the database using the keyword "research" together with the names of research institutions, as well as "journal" together with the names of the institutions, to identify the target articles. The institution names included 15 universities with medical schools and two research institutions (Academia Sinica and National Health Research Institutes). The use of the institutions' names reflected journalists' common practice of relying on press releases from institutions to identify important research to cover, and the names of the institutions are specified in these press releases. In total, 34 searches conducted on each database generated 7,856 results. After the removal of duplications and news that did not pertain to health research or contain references to a specific study, 437 news reports remained. Research assistants then tried to identify the original articles on which the reports were based. Because some news stories were based on conference proceedings or abstracts, and others did not include sufficient information to trace the original research articles, the research assistants were able to identify only 224 original, full research articles (45 from *China Times*, or 20.09%; 89 from *United Daily News*, 39.73%; 36 from *Apple Daily*, accounting for 16.07%; and 54 from *The Liberty Times*, 24.11%). The coding thus was based on 224 news stories. Most of the research (95.5%) cited in the news reports was published in international journals.

For this study, a research article is defined as a published report of empirical data, obtained and interpreted by researchers in academic and research institutions. Health research, the focus of this investigation, centers on a health topic, disease/treatment, or food safety, as defined in prior research (e.g., Borra, Earl, & Hogan, 1998; Logan, Peng, & Wilson, 2000). Subcategories in the health topic include research on nutrition (e.g., dietary choices, nutrition and health, human nutrition needs, food sensitivities or allergies, and functional foods, the relationship between food and health), addictions (e.g., alcohol, smoking), and so on. Within the disease/treatments topic, subcategories include research on diseases or medical treatment. Finally, food safety research comprises subcategories such as food-borne illnesses, food ingredients (e.g., normal ingredients, chemical additives, pesticides) and health, food–disease links, and food additive safety.

Coding by the Coders

Procedures. Two coders, one with a doctoral degree and one with a master's degree in related domains, who worked at Academia Sinica analyzed the objective accuracy of the 224 news stories. The coding followed the procedures suggested by Krippendorff (2004) and Neuendorf (2002): (1) define each variable (see Table 1); (2) identify levels and subcategories of each variable that are mutually exclusive; (3) develop coding schemes and coding forms; (4) train coders; (5) establish pilot reliability using news articles not from the sampled articles; (6) have coders code one-fifth of the sample and calculate intercoder reliability (it was satisfactory, with Holsti's [1969] agreement formula ranging from .96 to 1); and (7) have coders split up and each code two-fifths of the remaining sample.

Coding categories for objective inaccuracy. Coders read the original journal article from which the news story derived and then rated the presence of errors or omissions in the news story. In terms of background information, coders noted the presence of errors in or omissions of information regarding the (1) names of authors, (2) names of institutions, (3) publication year, or (4) publication journal. For errors in substantive information, they coded for the presence of errors in or omissions of information regarding the (1) time the data were collected, (2) places the data were collected, (3) research method adopted, or (4) research targets (e.g., humans, cells, animals).

Ratings by Scientists

Procedures. A packet containing a cover letter, the news story or stories (depending how many stories their research prompted), a questionnaire for each news story, a sheet with detailed explanations and definitions for each coding category presented in the questionnaire, a real example of the application of the coding categories (for illustration), and a stamped envelope were sent to relevant scientists, by mail on August 6–8, 2012. The cover letter noted the importance of understanding accuracy in health news reports and guaranteed the anonymity of their responses. The questionnaire asked these scientists to rate whether the six types of inaccuracies appeared in the body content or headlines of news reports about their own research. One week (August 13–15) after the packets were sent, a follow-up e-mail sent to these same scientists mentioned the mailed packet and provided another, electronic version, in case they preferred electronic files. On August 28, 2012, a first reminder was sent. One month later, a second reminder was sent. From the 224 mailed packets, 127 questionnaires were completed and returned; 2 incomplete responses came from scientists who stated that they knew the journalists who wrote the news reports and would not feel comfortable rating them. The response rate thus was 57.59% (129/224), but usable responses accounted for 56.70% (127/224) of the mailings.

Coding categories for subjective inaccuracy. Scientists checked for the following subjective accuracy problems in the news story or stories that reported on their research: (1) misstating facts, (2) committing errors in causal inferences, (3) treating speculations as facts, (4) overemphasizing the unique findings, (5) overgeneralizing the findings, or (6) changing emphases, using binary yes (presence) or no (absence) indicators. They first checked for the six problems in the headlines, then checked for the same six problems in body content (i.e., other than the headline). Finally, the scientists rated the degree of overall accuracy in the news coverage with one item (1 = very low to 5 = very high).

Results

Objective Accuracy

The focus in RQ1a is on the percentage of health research news that contains errors in background information. As summarized in Table 2, 14 (6.25%) of the news stories contained errors in the author names, publication years, or journal titles. However, because some of the articles initially identified (N = 437) were not included in the final sample as a result of their failure to provide sufficient or accurate information that could identify the original research, these results likely underestimated the prevalence of such errors. This article seeks to present an integrated inaccuracy typology, so the errors of background information were tested, and they appeared in 6.25% of coverage. But these findings can be interpreted only in reference to news reports that at least provided sufficient accurate information to trace the cited journal articles.

Table 2 about here

With RQ1b, the investigation centered on the percentage of health research news that contains errors of substantive information. It revealed that 31 articles (14.29%) committed errors in information about the time of data collection, adopted methods, or research targets. When considering only news articles that presented such research information, the error percentage reached 10.62% with regard to research targets, 17.50% for the time of data collection, and 8.19% for the methods of data collection.

Omissions were more common than errors, so RQ2a sought to explore the percentage of health research news that omitted background information that was readily available in all research articles. The results of the coding indicated that 72.77% of the news coverage omitted at least one of these four types of basic information (see Table 2). The most commonly omitted information was the publication year, as occurred in 69.20% of the news reports. Furthermore, the omission of information about the reporting institutions likely was underestimated in this analysis, because this study used the institutions to identify the sample.

The focus of RQ2b was the percentage of health research news that omitted substantive data collection information: how, who, when, and where. The findings suggested that 93.30% of the news coverage omitted at least one of these four types of information. For example, indications of how the data were collected were missing from 18.30% of the news reports. All the original research articles specified their targets (e.g., animals vs. human beings) or target characteristics (e.g., demographics, frequent exercisers), yet only 50.45% of the news reports covered such information. This omission is problematic, because readers may misinterpret or make incorrect inferences about the results when they lack such information.

Subjective Accuracy

Scientists' own ratings of the news articles that cited their research provided insights into RQ3 and RQ4. First, regarding the presence of three types of inaccuracies likely driven by a lack of expertise, the scientists identified inaccuracies in stating facts (RQ3a), errors of inferences (RQ3b), and speculations as facts (RQ3c), in the headlines and body content. As Table 3 shows, scientists believed that about one-third of the stories covering their research contained mistakes in stating the facts, in the body content (33.07%) or headlines (33.07%). Regarding errors of inferences, they indicated that 35.43% of the headlines and body content committed such errors. Finally, 29.13% of the headlines and 27.56% of the content treated their speculations as facts.

Table 3 about here

Second, regarding the inaccuracies likely driven by the news agencies' interests in profits, the scientists noted overemphases on the unique (RQ4a), overgeneralization of findings (RQ4b), and changes of emphasis (RQ4c) in the headlines and body content. As summarized in Table 3, their ratings revealed that more headlines tended to overemphasize the unique findings (35.43%) than did body content (26.77%). About one-third of the headlines (37.80%) and body content (36.22%) overgeneralized their findings. Regarding changes of emphases, they found that 33.86% of headlines and 31.50% of content had such problems.

Predicting Scientists' Accuracy Perceptions

In RQ5a, the focus was on which types of inaccuracy predict scientists' general perceptions of the accuracy of news articles reporting on their research. Therefore, the current research regressed scientists' accuracy perceptions, in turn, on (1) objective accuracy, (2) subjective accuracy in headlines, and (3) subjective accuracy in content (see Table 4). With only the first block of variables included, the R-square value was significant. When including the second block of variables, the increase in R-square was significant. Finally, with the third block of the variables, the increase in R-square again was significant. That is, each set of variables contributed to the variance in scientists' accuracy perceptions.

Table 4 about here

To test RQ5b, pertaining to the four types of objective accuracy, the accuracy ratings were regressed on the total number (from 0 to 4) of errors in presenting the four types of background information, the total number (0–4) of errors in presenting the four types of substantive information, the total number (0–4) of omissions of the four types of background information, and the total number (0–4) of omissions of the four types of substantive information. A score of 0 indicated the absence of all four problems; a score of 4 indicated the presence of all four problems for each category. The findings suggested that the most significant predictor of scientists' accuracy perceptions was omissions in substantive information (Table 4). When regressing the accuracy ratings on the four types of these omissions, the results specified that scientists' accuracy ratings decreased significantly when the reports omitted information about the time of the data collection, $\beta = -.15$, $p = .05$, and the research methods, $\beta = -.14$, $p = .04$.

Finally, the answers to RQ5c, regarding which of the six types of subjective accuracy (perceived accuracy in stating facts, errors in inferences, speculations as facts, overemphasis on the unique, overgeneralizations, and shift in emphasis) significantly predict scientists' general accuracy perceptions, appear in Table 4. Headlines that committed errors in inferences significantly reduced accuracy perceptions. The third block in the model also revealed notable influences of subjective accuracy in the body content, such that errors in inferences, overemphasis on the unique results, and overgeneralizations of the findings significantly accounted for the variance in scientists' perceptions of the accuracy of news reports.

Conclusions

This study has proposed an integrated inaccuracy typology, as summarized in Table 2, of the different types of objective and subjective inaccuracy, then analyzed the prevalence of these different types of inaccuracy according to analyses by both coders and involved scientists. With regard to objective accuracy, as analyzed by the coders, omissions were more common than errors. Errors in presenting background information appeared in 6.25% of the news reports; errors in substantive information about how, where, when, and from whom the data were collected appeared in 14.29% of them. When examining only news that mentioned the research targets, 10.62% committed errors. For example, a report might present findings from studies on animals as if they were about humans. Omissions were even more prevalent: Approximately 70% of news reports omitted at least one type of background information, and 93.30% of them omitted at least one type of substantive information. In particular, 18.30% of the news reports ignored information about research methods, which is crucial for readers' interpretations.

The ratings by the scientists suggested the prevalence of subjective inaccuracy too, with about one-third of headlines and body content featuring some of the six types of subjective inaccuracy. In general, the prevalence of each type of subjective inaccuracy appeared similar for the headlines and body content, though the overemphasis on uniqueness was a more serious problem for the headlines.

The regression analyses suggested that when each subcategory of subjective and objective inaccuracy was included in the model, objective accuracy, subjective accuracy in headlines, and subjective accuracy in body content all significantly predicted scientists' perceptions of the overall accuracy of the news articles that cited their research. Specifically, omissions in substantive information represented a significant predictor, as did errors of inferences in headlines and body content, an overemphasis on uniqueness in the body, and overgeneralizations in the body content.

Overall, subjective inaccuracy explained more variance in scientists' accuracy perceptions than objective inaccuracy. As reviewed previously, scientists and journalists vary in their expertise and training and differ in the degree to which they are motivated to appeal to sensationalism to arouse readers' interests (McCall, 1988; Peters, 1995). They also develop different conceptions of what constitutes good scientific news. Errors in inferences in the body content, which likely were caused by the journalists' lack of expertise and errors in their cognitive processes, led to reduced accuracy perceptions among the scientists. An overemphasis on uniqueness and overgeneralization of the findings in the body content, which probably were driven by the journalists' interests in readership and profits, was associated with lower scientists' accuracy ratings. However, it is important to note that causes of these misinterpretations may differ across journalists. For example, errors in inferences may be driven by a lack of expertise by one journalist but an interest in profits by another.

Such inaccurate reports about health and medical research may have serious consequences. Studies have indicated that people often take specific actions after reading a health news story that touts the benefits of those actions (Voss, 2003). If these behavioral suggestions are based on journalists' speculations or misinterpretations of research findings, they could cause direct harm to the public. Imagine a patient who reads a news story that reports that a scientific study has concluded that a particular type of treatment increases the risk of heart disease. In truth, the study might only speculate that this treatment may be associated with higher risks of health disease among patients who have other medical conditions. Yet the reader still may ask his or her physician to halt the focal treatment, which may be detrimental rather than beneficial to his or her health. Finding ways to improve accuracy in news reports thus represents an important issue. Weigold (2001) suggests some important directions for improving science reporting, such as offering more training for journalists, focusing on audience needs, and working more closely with sources. These recommendations also likely apply to health research reporting.

Limitations

The findings of this study must be interpreted in relation to its limitations. First, for reasons discussed previously, the coders assessed objective accuracy, whereas scientists coded for subjective accuracy. Using these different sources of information in the same model to predict scientists' perceptions may be problematic, because the former introduced between-subject errors but the latter did not. Second, the prevalence of objective accuracy may be underestimated, in that 213 of the articles initially identified (N = 437) did not provide sufficiently accurate information to enable the identification of the original research, so coding such stories became impossible.

Further Research Directions

This study involved both coders and scientists who analyzed the same news stories. Additional research might invite journalists to rate their own news stories and then compare the journalists' accuracy ratings against the scientists', to explore the schism in their perceptions. Journalists also might comment on why these different types of inaccuracy emerge. For example, omissions of certain information could be attributed to reasons other than mere mistakes, such as space constraints, readers' anticipated lack of interest, their own difficulty comprehending the journal articles, or the exclusion of this information from the press releases the journalist used to develop the story.

The coders were limited to analyzing objective inaccuracy, because despite their graduate training in relevant areas, these coders still may not be qualified to judge accurately whether the journalists misinterpreted a specific study. Yet involving the original authors of the research article to assess the subjective inaccuracy of related news reports may induce bias concerns, especially if the scientists make blanket condemnations of news reports as generally inaccurate. Although objective inaccuracy can be assessed more easily by coders, and scientists may balk at spending their time reviewing these extensive details, it might be insightful to gather both coders' and scientists' ratings of both objective and subjective accuracy to explore their correspondence.

In developing medical news reports, even if journalists access and read the original articles (Entwistle, 1995), they likely rely on press releases to identify newsworthy information. For example, de Semir, Ribas, and Revuelta (1998) show that among 142 news stories reporting on articles in medical journals, 119 (84%) initiated with press releases by medical journals. In their analysis of press releases by medical journals, Woloshin and Schwartz (2002) find that a high percentage of them omit the research limitations and exaggerate the findings. Thus, if a journalist faces time constraints and develops a news story merely on the basis of its press release, it may contain errors or omissions that were introduced in the press releases, as well as errors or omissions due to the news construction. Moreover, press releases can be issued by researchers' affiliated institutions, leading medical journals, scientific societies, or private institutions (e.g., pharmaceutical, medical device, or biotechnology companies). Press releases issued by private institutions may contain embedded interests, such that news coverage derived from these types of news releases may introduce inaccuracy. To identify who should be held accountable for objective or subjective inaccuracy and how it occurs, additional research might differentiate news stories that rely on press releases and those derived from original research, then specify the types of inaccuracy that are more representative of each news development processes. Further research also might differentiate news stories that rely on press releases from different sources, then compare the types of inaccuracy in the news stories that derive from them.

This study only focuses on news coverage of published research, which is available for assessment and thereby enables researchers to perform an accurate comparison. Yet some journalists also cover research presented in scientific meetings or other informal channels. Some research presented at scientific conferences may not have come under the critical scrutiny of the scientific community or is based on preliminary results, such that it may not ultimately be published (Schwartz, Woloshin & Baczek, 2002). Further research should explore whether omissions are more likely in reports on research presented at conferences rather than in academic journals.

Dunwoody and Scott (1982) demonstrate that scientists evaluate news coverage of their own specialty more critically than news coverage of science outside their own specialty areas. In parallel, the high subjective inaccuracy reported in this study may reflect scientists' adoption of more critical standards when evaluating news reporting on their own research. Therefore, further research should compare scientists' subjective inaccuracy ratings of news citing their own research with their ratings of news that cites peer scholars' research. This step may help discern the potential for negative biases in ratings of news coverage that cites one's own research.

This study identifies two general reasons for the six types of subjective inaccuracies, namely, journalists' lack of expertise and media's interests in profits. But health news also can affect the profits of certain pharmaceutical companies or the stock performance of some biotechnology or food companies, in which case journalists in close relationships with the potentially affected companies could downplay certain results or highlight others. Research sponsored by different entities could be covered with different degrees of accuracy. Additional research should explore the potential effects of competing profit motives on the development of medical research news.

This study has sought to integrate prior research pertaining to different types of inaccuracy within one framework, yet the typology only distinguishes misinterpretations in headlines or body content, without specifying the different types of information in the body, such as source quotes, behavioral advice developed from the findings, and so forth. Researchers might explore what types of objective or subjective inaccuracy emerge in these different types of content. For example, omissions of context information may be particularly common when quoting scientists.

Sacrificing accuracy to arouse readers' interests can never be justified in reporting on health and medical research, which has direct implications and impacts on people's health. Presenting all these different types of inaccuracy represents an attempt to raise journalists' and readers' awareness of such problems and motivate them to avoid or watch for such errors, biases, and misinterpretations before embracing any new developments or findings from health research.

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Table 1.

Inaccuracy Typology and Definitions of Coding Categories

Coding Categories	Definitions
Objective accuracy	By coders
Errors in background information	Journalists commit errors when referring to the following background information: (1) names of authors (2) names of institutions (3) publication year (4) publication journal
Errors in substantive information	Journalists commit errors when referring to the following research information: (1) time when the data were collected (2) places where the data were collected (3) research method adopted (4) research targets (e.g., human beings, cells, or animals)
Omissions in background information	Journalists omit the following background information: (1) names of authors (2) names of institutions (3) publication year (4) publication journal
Omissions in substantive information	Journalists omit the following research information: (1) time when the data were collected (2) places where the data were collected (3) research method adopted (4) research targets (e.g., human beings, cells, or animals)
Subjective accuracy	By scientists
Misstatements of facts	Journalists make mistakes when describing the findings and the research content. For example, when an original study concludes that people in negative affective states drink more coffee, the news story might assert that depressed people drink more coffee.
Errors of inferences	Journalists make causal inferences that do not derive from the findings reported in the study or make incorrect causal inferences. Thus a researcher might state that migraines appear associated with depression and the available evidence cannot establish a causal relationship, yet journalists might state that migraines cause depression, or vice versa.
Speculation as facts	Journalists report speculations by the authors as facts. For example, a researcher states that "trauma in childhood may be a possible trigger of depression, even though their relationship cannot be established by their data," but the journalists report that "trauma causes depression."
Overemphasis on the unique	Among the different findings, journalists focus only the most dramatic results or figures but not the results or figures that the researchers believe most appropriate. For example, in some research,

	scientists would report different results with or without considering demographics or adjusting for existing differences. Journalists report only the most dramatic results.
Overgeneralization of findings	When reporting the findings, journalists ignore the conditional contexts in which the study is conducted or the special criteria or characteristics of research participants. For example, the study reports lower risks of a disease after adopting a special diet, when compared with risks among general populations, but the news report does not mention that only healthy participants who routinely exercised were recruited in this experiment.
Changes of emphasis	The focus of the original research is different from the focus of the news story. For example, the research article found that muscle strength is important for health, but the news coverage focuses on what exercises can more effectively build muscle strength.

Table 2

Prevalence of Each Type of Objective Inaccuracy

Coding variables	Number[a]	Percentage[b] by total (224)	Number of news stories that present information	Percentage of news stories that present information
Errors in background information	**14**[c]	**6.25**		
(1) names of authors	2	.89	188	1.06
(2) names of institutions	0	0	224	0
(3) publication year	8	3.57	69	11.59
(4) publication journal	7	3.13	170	4.12
Errors in substantive information	**31**[c]	**14.29**		
(1) time when the data were collected	7	3.13	40	17.50
(2) places the data were collected	0	0	76	0
(3) research method adopted	15	6.70	183	8.19
(4) research targets	12	5.36	102	10.62
Omissions in background information	**163**[c]	**72.77**		
(1) names of authors	36	16.07	224	16.07
(2) names of institutions	0	0	224	0
(3) publication year	155	69.20	224	69.20
(4) publication journal	54	24.11	224	24.11
Omissions in substantive information	**209**[c]	**93.30**		
(1) time when the data were collected	73	32.59	113	64.60
(2) places the data were collected	26	11.61	102	25.49
(3) research method adopted	41	18.30	224	18.30
(4) research targets	113	50.45	224	50.45

[a]The number of news stories that included the designated problem.

[b]The number of news stories that included the designated problem, divided by the total number of news stories in the sample (224).

[c]Some news stories commit more than one error, so this total is not equivalent to sum of the four rows.

Table 3.

Prevalence of Different Types of Subjective Inaccuracy, Rated by Scientists

Subjective accuracy	Headlines		Body Coverage	
	Cases	Percentage	Cases	Percentage
Driven by lack of expertise				
Perceived accuracy in stating facts	42	33.07	42	33.07
Errors of inferences	45	35.43	45	35.43
Speculation as facts	37	29.13	35	27.56
Driven by interest in profits				
Overemphasis on the unique	45	35.43	34	26.77
Overgeneralization of findings	48	37.80	46	36.22
Changes of emphasis	43	33.86	40	31.50

Notes: N = 127.

Table 4.

Hierarchical Multiple Regression Analyses Predicting Scientists' Accuracy Perceptions

Predictor	Accuracy	
	△R^2	β
Step 1	.09***	
Errors in background information (0-4)		.02
Errors in substantive information (0-4)		-.16
Omission in background information (0-4)		.16
Omission in substantive information (0-4)		-.23*
Step 2–Subjective inaccuracy in headlines	.38***	
Perceived accuracy in stating facts (0-1)		-.12
Errors of inferences (0-1)		-.27*
Speculation as facts (0-1)		-.15
Overemphasis on the unique (0-1)		-.09
Overgeneralization of findings (0-1)		-.07
Changes of emphasis (0-1)		-.07
Step 3–Subjective inaccuracy in body content	.16***	
Perceived accuracy in stating facts (0-1)		-.11
Errors of inferences (0-1)		-.34*
Speculation as facts (0-1)		.14
Overemphasis on the unique (0-1)		-.34**
Overgeneralization of findings (0-1)		-.30*
Changes of emphasis (0-1)		-.11
Total R^2	.64***	

Notes: N = 121. Responses with missing values were not included in the analyses.

* $p < .05$. ** $p < .01$.

Inform Us or Confuse Us?

How People Perceive News Covering Novel or Contradictory Health Research Findings

Abstract

This article explores how people perceive news that covers novel or contradictory health findings. In-depth interviews of journalists revealed they were more likely to cover health research that reported novel (versus familiar) and contradictory (versus one-sided) research findings, because such findings appeared newsworthy and attention drawing. A nationwide telephone survey of the general public (N = 603) also showed that people rated news headlines that featured novel and contradictory findings as less credible, such that they were less willing to adopt the advocated behaviours. Two experiments further indicated that exposure to such news boomeranged, causing negative responses to not only the news but also health research overall. In particular, exposure to news featuring novel and contradictory findings reduced the credibility ratings of the news, which further decreased intentions to comply with the advocated behaviours. Moreover, exposures to such news aroused greater uncertainty about health research, which further reduced attitudes toward health research in general.