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Keywords

Agricultural Crises, bovine spongiform encephalopathy (BSE), News Story, reporter, impact, Lexis Nexis database, priorities, public, explore

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Introduction and Review of Relevant Literature

In December 2003, the first case of bovine spongiform encephalopathy — known as BSE or "mad cow disease" — in the United States was discovered in a cow in Washington state. That the sick cow had been destined to be processed into hamburger meat to be used by McDonald's franchises added impact to a fascinating and potentially frightening story. U.S. newspaper coverage of this story unfolded over the course of the next year, as reporters consulted various types of sources to help them explain the facts of this scenario to their readers.

In covering such stories, reporters' abilities to identify and successfully use appropriate news sources are paramount to effective, reliable news coverage. Complex stories like the December 2003 BSE event lie outside the everyday experience of most reporters and require knowledge beyond their usual areas of expertise. The identification of knowledgeable sources and the scrupulous attribution of the information they provide are crucial to the accurate telling of such science-intensive stories; reporters must identify and accurately report the "right" sources to explain such matters to their read-

Research

ers (Albaek, Christiansen, & Togeby, 2003; Ashlock, Cartmell & Kelemen, 2006; Borchelt, 2008; Irlbeck, 2009; Lee, 2004).

Several authors have posited that source choice may be driven by agenda-setting competition among issues, including the "news wave" that influences reporters themselves, and/or may reflect effects of framing. It is generally accepted that opinion leaders help define those issues about which the public should think (Dearing & Rogers, 1996; McCombs & Shaw, 1976; McQuail, 1994) and that the media helps communicate such agenda salience (Ashlock, Cartmell & Kelemen, 2006; Holland, 2009; Peters et al., 2008). Reporters' selection of sources plays an important part in agenda setting because story sources can drive issue discussion in particular directions.

Framing, on the other hand, helps guide the public as to how it should think about a particular issue. Framing provides context for opinion formation and discussion (DeFleur & Ball-Rokeach, 1989; McQuail, 1994). A story frame is built around a reporter's concept of newsworthiness, comprising such factors as conflict and proximity, as well as that reporter's sense of the story's contextual salience. Frames developed by reporters help to construct schema to help the public place issues into understood and shared contexts (Ashlock, Cartmell & Kelemen, 2006; Ruth, Eubanks & Telg, 2005). Reporters themselves are susceptible to agenda setting and framing of issues through the coverage of such stories by media they regard as particularly prestigious and credible (Breed, 1955; Dunwoody, 1979; Havick, 1997; Ten Eyck, 2000). Agenda-setting and the news waves of arterial effects (Breed, 1955) it generates may mean reporters are forced to adopt others' frames via consulting the same or similar sources.

Agenda-setting theory accepts the proposition that opinion leaders set public perceptions about which issues are important to consider. Agenda-setting theory further contends that issues of public salience comprise agenda for action, with media input helping to define issue content and relative importance (McQuail, 1994). Agenda-setting may be seen as a process of issues and their proponents competing for reporters' and editors' attention, as well as for the attention of decision-makers and the public (Dearing & Rogers, 1996). In the context of this struggle for control of limited media time and space, source choice becomes paramount (Ashlock, Carmell & Kelemen, 2006; Irlbeck, 2009), as each particular source may drive issue discussion in a particular direction, skewing the agenda presented as important to the public. Editors and reporters themselves may also be influenced by a type of agenda-setting that Ten Eyck (2000) and Havick (1997) called the "news wave," the tendency of media to deem important those stories first covered by prestigious news outlets.

Agenda setting and framing of particular events both may be influenced by reporter/editor and newspaper characteristics. Source selection plays a major role in constructing media agenda and frames, with agenda-setting theorists maintaining that reporters choose their sources based on the agenda their newspapers seek to advance (Dearing & Rogers, 1996) and that sources contribute in major ways to constructing story frames (Ashlock, Cartmell & Kelemen, 2006; Irlbeck, 2009; Zoch & Turk, 1998). Additionally, agenda and frames may evolve over the course of an ongoing story, with sources changing to match that evolution as a story "matures" (Chyi & McCombs, 2004; Sumpter & Braddock, 2002; Martin, 2003). While this article does not explore news selection variables and their relationship to framing and agenda-setting per se, it does use those theoretical ideas to help select variables that should be studied.

Those concerned with the source choices of reporters covering the December 2003 BSE event and with the impact of such sources on the quality of information available to the public may look to an extensive body of research on the factors that influence the sourcing of breaking agricultural news. Those factors include newspaper coverage of agriculture in general and of BSE in particular,

Research

reporters' relationships with their sources, and the relationships between science-specialty-beat reporters and their sources.

The amount of coverage afforded agriculture by newspapers, both in numbers of stories and in extent of column inches, has declined over the past several decades, largely because of the increasingly urban nature of American life (Hays, 1993). Other factors contributing to this decline include indications that agricultural producers and scientists may not turn to newspapers as their preferred medium of information exchange (Bouare & Bowen, 1990; Bruening, 1991; Bruening & Martin, 1992; Bruening, Radhakrislma, & Rollings, 1992; Dunwoody, Brossard & Dudo, 2009; Lundy, Ruth, Telg & Irani, 2006; Oskam, 1992; Reisenberg & Gor, 1989, Rollings, Bruening, & Radhakrislma, 1991) and that most newspaper reporters possess low levels of agricultural literacy (Haygood, Hagins, Akers, & Keith, 2005; King, Cartmell & Sitton, 2006). Existing coverage of agricultural topics has concentrated on controversy and risk, with positive stories receiving little play (Beaudoin & Thorson, 2004; Ruth, Eubanks & Telg, 2005; Ten Eyck, 2000). Other researchers note that newsworkers' routines and newsrooms' structures have not been conducive to covering agricultural news (Logan, 2001).

Into this climate of inattention to agricultural news burst BSE, a new and little-understood disease that met the criteria of controversy and risk so prized by journalists. First emerging in the United Kingdom in the early 1990s, BSE generated a large amount of emotionally-charged coverage in Europe (Sturloni, 2003; Washer, 2005), with subsequent outbreaks in Japan and the United States gaining attention from the press because of the potential economic, social, cultural, and geographic impacts of the disease (Ashlock, Cartmell & Kelemen, 2006; King, Cartmell & Sitton, 2006; Ruth & Eubanks, 2005; Ten Eyck, 2000). Researchers have criticized the media for failing to report accurately about BSE and other zoonotic diseases (Peters et al., 2006; Roche & Muskavitch, 2003) and often exaggerating its immediate risks to humans (Raude, Fischler, Lukasiewicz, Setbon, & Flahault, 2004). Such reports caused decreases in beef consumption and, in the short term, hurt the U.S. beef industry (Ashlock, Cartmell & Kelemen, 2006; King, Cartmell & Sitton, 2006; Ruth, Eubanks & Telg, 2005; Schupp, Gillespie, O'Neil, & Prinyawiwatkul, 2004). Although several years have passed and other agricultural crises, such as the 2008 salmonella outbreak in produce imported from Mexico, have usurped BSE's media prominence, it is precisely because of BSE's novelty to both U.S. reporters and media consumers in 2003 and its impact on U.S. agriculture that the country's first BSE event was chosen as the focus of this study.

Even before the 2003 BSE event, however, much research had been devoted to investigating the source selection process, a job function common to all reporters. Studies focused on, among other topics, the role of information subsidies (Borchelt, 2008; Gandy, 1982); the gatekeeping role of newspaper editors (Schmierbach, 2005; Donohue, Olien, & Tichenor, 1989); the part played by reporters' and editors' personal characteristics (Armstrong, 2004; Shoemaker, Eichholz, Kim, & Wrigley, 2001); and the contribution of newsworkers' organizational routines (Clark & Illman, 2003; Dunwoody, 1979, 1980; Kitzinger & Reilly, 1997; Nisbet & Scheufele, 2009). Perhaps chief among the comments that can be made about these studies is that (a) all such studies identify these factors as playing a part in how reporters select sources but (b) they do not often agree on the nature or the degree of influence exerted on source choice by each of them.

Researchers have noted that coverage by science-specialty-beat reporters differs from that by general assignment reporters in quantity, type, and tone (Craft & Wanta, 2004; Long, 1995; Shoemaker, Eichholz, Kim & Wrigley, 2001). Other studies concentrating on relationships between specialty-beat reporters and their sources found that such reporters often use the same sources con-

Research

tinually, building strong bonds with them (Chermak, 1995; Dunwoody, 1979; Gandy, 1982; Holland, 2009; Ten Eyck, 2000) and often focusing almost exclusively on institutional representatives who may be depended upon to furnish information (Ericson, Baranek, & Chan, 1993; Sumpter & Braddock, 2002).   Other researchers have called for media to concentrate to an even greater extent on scientists as sources for complex stories (Dunwoody, Brossard & Dudo, 2009; Holland, 2009; Ramsey, 1999), although they note that a reporter's ability to deal effectively with such expert sources may depend heavily upon that reporter's science training (Grantham & Irani, 2004; Vestal & Briers, 1999; Wingenbach, Rutherford, & Dunsford, 2003).

Thus, newspaper coverage of agriculture and the impact of various reporter, editor, and newspaper characteristics on source choice have garnered significant attention from researchers.

However, despite the attention given source choice and its implications for and reification of prominent communication theories, an exhaustive search of the relevant literature in journalism, agriculture, and agricultural communications found no studies addressing reporters' work-role identities with regard to their coverage of agricultural news or the part played by reporters' education in their source-choice decisions.

Objectives

This study examined source choices for coverage of the December 2003 bovine spongiform encephalopathy (BSE or mad cow disease) event to discover the sources reporters use when covering breaking agricultural news and the impact of reporters' work role identities, as reflected in beat assignments, on coverage of such issues.

Coverage of the December 2003 BSE event in the United States was selected for examination because this event was novel, timely, newsworthy, and significant to the public and required reporters to explain complex, science-intensive information. This study sought answers as to whether reporters' beat assignments affected the length of their stories about the event and the number and variety of sources used in such stories and to generate data in support of the following hypotheses:

Hypothesis 1: The mean length in words of stories written about the December 2003 BSE event by science specialty-best reporters will differ from the mean length of such stories written by reporters with other beat assignments.

Hypothesis 2: The mean number of sources in stories written about the December 2003 BSE event by science specialty-best reporters will differ from the mean number of sources used in stories written by reporters with other beat assignments.

Hypothesis 3: The mean variety of types of sources used in stories written about the December 2003 BSE event by science-specialty-beat reporters will differ the mean variety of types of sources used in stories written by reporters with other beat assignments.

Data supporting these hypotheses was in turn used to (1) suggest directions for further research into how reporters' work role identities might impact their ability to cover science-intensive crises news as reflected by their source choices for such coverage and (2) suggest implications for the work of agricultural public information officers and media relations professionals as they seek to "pitch" expert sources and their research results to inform news media stories about agricultural crises.

Methods

Study design, population of interest, and sample

To evaluate the study's hypotheses about coverage and source use in U.S. newspaper stories about the December 2003 BSE event, a content analysis of stories in selected major U.S. newspapers was conducted (Macnamara, 2003; Stemler, 2001; Dyer, 1996). Results of content analyses have been used to guide planning for crisis communication (Dyer, Miller, & Boone, 1991), although numerous researchers caution that their results cannot reliably be used to analyze complex newsroom issues or to address issues of audience impact, thus limiting framing constructs based on such analyses (Bartlett, Sterne, & Egger, 2005; Heinrichs & Peters, 2004; Lavie and Lehman-Wilzig, 2005).

The newspapers included in the population of interest were those represented in a census of stories on BSE from Lexis-Nexis for the eleven-month period from December 23, 2003 (when the first BSE event occurred) through October 31, 2004 (the end of the month before occurrence of the second U.S. BSE event). A search of the Lexis-Nexis database was conducted on August 22, 2005 (search terms "General News," "Major Papers," "mad cow" AND "production" AND "agriculture") yielded 296 stories, 190 of them from U.S. newspapers. To minimize potential differences in news-room organization, policies, and practices and in national politics and culture, only newspapers from the United States were included in this study's analysis.

Content analysis was applied to compare a census of all stories in the population written by science-specialty beat reporters (31) with an equal-sized random sample of stories written by non-science-specialty-beat reporters. Reporter work-role identity was established by byline credit or by referencing the reporter in Bacon's Newspaper Directory, 2004 edition.

Data coding and analysis

Each story was reviewed and coded by two trained coders, according to a codebook based initially on the variables of interest and refined through four iterations of coder training. Initial coder training was conducted using content analysis of 10 randomly selected stories from the dataset; these stories were eliminated from the dataset before selection of the stories which form the basis of this study (except for any stories written by science-specialty-beat reporters, which were kept in the census of such stories and recoded for later analysis). During coder training, additional coverage themes were identified for use in analysis of the dataset, and coders were instructed in accurate recognition of all themes/content-analysis categories (Holsti 1969; Riffe, Lacy, & Fico, 1998). Coding variations were identified and addressed, and all differences were resolved. Intercoder reliability at the $p < .01$ level was achieved, as indicated by intercoder correlation coefficients for each pair of variables (Field, 2000).

Certain variables were unambiguous. For example, each story was labeled on its face according to its length (interval level data) and its newspaper of origin (nominal). Whether or not the writer of each story was a science-specialty-beat reporter (nominal) could be ascertained either by a byline containing the reporter's work-role identity (job title) as printed on the story or by consulting Bacon's NewspaperDirectory (2004). The number of sources (interval) included in each story was determined by counting each unique source only once.

Fifteen dichotomous nominal variables (present vs. not present) were established for classifying sources into types, based on extrapolation from the literature (Albaek, Christiansen, & Togeby, 2003; Armstrong, 2004; Ericson, Baranek, & Chan, 1993; Ramsey, 1999; Salwen, 1995; Stempel & Culbertson, 1984; Sumpter & Braddock, 2002; Whitney, Fritzler, Jones, Mazzarella, & Rakow,

1989; Zoch & Turk, 1998). These categories comprised government representatives, government scientists, business representatives, business scientists, agricultural producers (farmers and ranchers), university representatives, university agricultural scientists, all other university scientists, Extension representatives, Extension scientists, trade association representatives, consumer group representatives, media, consumers (general public), and undefined. Each named individual used as a source was placed into the appropriate category based on his or her institutional/organizational affiliation as identified in the story being coded. For example, Secretary of Agriculture Ann Venneman was placed in the government representative category, while the named owner of a meat market was placed in the business representative category. The decision was made to classify veterinarians as scientists rather than merely as representatives of their particular employing organizations.

An "undefined" category was included because many sources were unnamed (Beall & Hayes, 1992). This category was applied to all organizations for which no individual representative was named and to all generic sources, such as "industry experts," "consumers," and similarly cited sources. Such a category varies from those used by some other studies, which entirely excluded "collective anonymous sources like 'voters' or 'government officials'" (Sumpter & Braddock, 2002, p. 543). An exception was made for media outlets for which no individual representative was named; all citations of media outlets were coded as "media" rather than as "undefined" because it was deemed desirable to track all sourcing of other newspapers, books, Web sites, etc.

Three additional interval variables were calculated from those which had been coded. All scientist categories (business scientists, university scientists, university agricultural scientists, Extension scientists) were summed to yield the variable "total scientists," and all agricultural scientist variables (university agricultural scientists, Extension scientists) were summed to yield the variable "total agricultural scientists." Finally, all 15 original source categories were summed to yield the variable "source variety."

All coded data were analyzed to determine statistically significant relationships. At the simplest level, means of the same variable from each of the two reporter groups (science-specialty-beat vs. non-science-specialty-beat) were compared to determine existence of any statistically significant differences (Field, 2001). Both reporter groups were analyzed simultaneously using bivariate correlation (Spearman's rho) and one-way ANOVA.

The data analyzed for this article represent part of a larger study conducted for completion of the first author's doctoral work.

Findings
Overall and role-specific means

Sixty-two stories were studied, 31 written by science-specialty-beat reporters and 31 written by reporters who were not science-specialty-beat reporters. Overall, regardless of reporter work-role identity, the following descriptive statistics were compiled for stories: story length, 220 to 2,749 words (mean=1,086.25); number of sources per story, 1 to 18 (mean=8.20 per story); distinct source types used per story, 1 to 9 (mean source-variety score=4.59); number of scientist sources used per story, 0 to 5 (mean=1.07) and number of agricultural scientists used per story, 0 to 4 (mean=.77).

Stories written by non-science-specialty-beat reporters averaged 1,021.48 words; those written by science-specialty-beat reporters, 1,172.36 words. Non-science-specialty-beat reporters used a mean 8.23 sources; science-specialty-beat reporters used a mean 8.36. Non-science-specialty-beat reporters used a mean 4.52 types of sources in each story; science-specialty-beat reporters used 4.81.

Non-science-specialty-beat reporters used a mean .81 scientist sources and .55 agricultural scientist sources; science-specialty-beat reporters used a mean 1.36 scientists and 1.00 agricultural scientists.

Statistically significant correlations

The number of sources used in stories was positively correlated with both story length and source variety (p < .05), each of which was correlated with the other — that is, the longer the story, the more sources used and the greater the variety of sources used; the more sources, the greater the source variety, as shown in Table 1.

Similarly, the total number of scientists cited as sources and the number of agricultural scientists used are correlated (p < .05), and each is correlated with both source variety and story length (p < .05). Again, the correlation of these two categories of scientist sources is not surprising, since agricultural scientists contribute to total scientist numbers, and both contribute to source variety (Ott & Longnecker, 2001), as shown in Table 1.

Table 1

Intercorreclations Between Number of Sources, Story Length, Source Variety, Number of Scientist Sources and Number of Agricultural Scientist Sources

	No. Sources	Story Length	Source Variety	No. Scientists	No. Ag Scientists
No. Sources	–	.653*	.640*	.090	.076
Story Length	–	–	.644*	.302*	.279*
Source Variety	–	–	–	.461*	.386*
No. Scientists	–	–	–	–	.849*
No. Ag Scientists	–	–	–	–	–

Note. Spearman rho used as test statistic. *p < .05

Work-role identity summary statistics

Only two of the science-specialty-beat reporters in the population were identified simply as "science writer." Thirteen different areas of expertise were designated for the 20 other science-specialty-beat reporters producing the stories studied, including agribusiness, biotechnology, environment, medicine, or health. Most non-science-specialty-beat reporters were known either as staff reporters (6) or staff writers (9) or had no title (12). Bacon's was used to verify that these untitled reporters were not science-specialty-beat reporters. Three reporters were designated as business reporters, and one, as a business writer.

Only two non-science-specialty-beat reporters produced more than one story about BSE (Jonathan Martin, Seattle Times, two stories, and Sue Kirchhoff, USA Today, two stories), but seven science-specialty-beat reporters wrote or co-wrote multiple stories: Sandra Blakeslee, Pittsburg Post-Gazette, 2; Chris Clayton, Omaha World Herald, 2; Mark Kawar, Omaha World Herald, 4; Michelle Cole, Oregonian, 2; Andy Dworkin, Oregonian, 7; Richard Hill, Oregonian, 3; and Joe Rojas-Burke, Oregonian, 2. Almost one-half of the BSE stories written by science-specialty-beat reporters (14/31) were published in just one newspaper, the Portland Oregonian.

Science specialty-beat ropers great use of scientist/agricultural scientist sources

Analysis of data from this sample showed that stories written by science-specialty-beat reporters did not differ significantly in length, number of sources, or source variety from stories written by non-science-specialty-beat reporters, although one-way ANOVA was significant at the $p < .05$ level for differences in numbers of agricultural scientists used as sources. Science-specialty-beat reporters used more scientists and agricultural scientists as sources than did other types of reporters.

Table 2

One-Way ANOVA for Differences in Story Characteristics Based on Reporter Work-Role

Source of variation		Df	F	P
Story length	Between groups	1		
	Within groups	60	1.306	.258
Number of Sources	Between groups	1		
	Within groups	60	.015	.903
Source variety	Between groups	1		
	Within groups	60	.488	.487
Number of scientist sources	Between groups	1		
	Within groups	60	3.413	.070
Number of ag scientist sources	Between groups	1		
	Within groups	60	3.978	.051*

*$p < .05$

As shown in Table 3, reporter work-role identity was found to be correlated with use of certain types of sources, specifically with both the numbers of scientists and the numbers of agricultural scientists used as sources in each story ($p < .05$), that is, designation as a science-specialty-beat reporter was associated with using more scientists and agricultural scientists as sources than was designation as a non-specialty reporter.

Table 3

Correlations Among Reporter Work-Role Identity and Story Characteristics

	Story Length	Number of Sources	Source Variety	No. Scientist	No. Ag Scientists
Work-Role ID	.118	.046	.062	.290*	.272*

Note: Spearman rho used as test statistic. *$p < .05$

Source choice patterns

Although none of the differences in individual source-type relationships proved statistically significant, regardless of reporter work-role identity patterns of source choice emerged, with the largest number of named sources being selected from among industry representatives (140). Government (46) and educational (46) sources were used in equal numbers, while consumers (44) were a close second to these two groups. Reporters of both types chose a total of 27 media sources. Undefined (unnamed) sources were included in the 62 stories 175 times. These results are summarized in Table 4.

Table 4

Actual Number of Named Sources in Each Category, Grouped by Work-Role Identity of Reporter

Source Category	No. of Unique Citations in Stories Written by Science Specialty-Beat Reporters	No. of Unique Citations in Stories Written by All Other Reporters
Government representatives	4	12
Government scientists	12	18
Total government sources		**46**
Business representatives	50	19
Business scientists	2	1
Agricultural producers	12	8
Trade association reps	24	24
Total industry sources		**140**
University representatives	4	0
University agricultural scientists	7	13
University scientists (not ag)	7	8
Extension representatives	3	1
Extension scientists	1	1
Total university sources		**46**
Consumer association reps	14	17
Consumers	8	5
Total consumer sources		**44**
Media	16	11
Total media sources		**27**
Undefined	83	92
Total undefined sources		**175**

Conclusions, Implications and Recommendations
Discussion of results

Few differences found between science-specialty-beat reporters and other reporters. Analysis of data in this sample showed that reporters designated as science-specialty-beat reporters did not (a) write longer stories, (b) use more sources, or (c) use a greater variety of sources than did reporters having other work-role identities. Although these particular issues regarding "science writers" have not been thoroughly explored in the literature, based on long-standing journalistic practice, it stands to reason that more "in-depth" stories might be longer, might contain more sources, and that the more sources used, the greater the chance for including more different kinds of sources in the mix (MacDougall, 1987). However, that was not shown to be the case here. The fact that stories written by science-specialty-beat reporters, including agricultural reporters, were no different from those written by other types of reporters might be extrapolated to mean that, at least based on this sample, specialty-reporter coverage of agriculturally relevant events may not prove to be more comprehensive nor of greater interest and utility to readers.

The nulls of the three hypotheses posited in this study cannot be rejected. Comparison of means using one-way ANOVA between stories written by science-specialty-beat reporters and those written by other types of reporters showed no statistically significant differences with regard to mean story length, mean number of sources used, and mean overall variety of sources used, although a statistically significant difference ($p < .05$) was found between the two groups in the mean number of agricultural scientists used as sources.

Research

Use of expert sources. It has long been recognized that the media play an important role in disseminating science information to the public (Borchelt, 2008; Holland, 2009; Nisbet & Scheufele, 2009; Peters et al., 2008; Wilson, Code, Dornan, Ahmad, Hebert, & Graham, 2004), much of which is associated in newspaper stories with risks (Ruth, Eubanks & Telg, 2005; Ten Eyck, 2000). Previous research has called upon the media to provide more in-depth information for the public, especially about topics involving science, through encouraging reporters to attain increased levels of scientific literacy in order to provide more such in-depth coverage (King, Cartmell, & Sitton, 2006). Researchers recommend accessing experts as sources of science information as one way to counteract reporters' lack of expertise about such matters (Heinrichs & Peters, 2004; Ramsey, 1999; Whaley & Tucker, 2004), but increased scientific and agricultural literacy on the part of reporters is almost surely needed to choose expert sources wisely (Vestal & Briers, 1999; Whitaker & Dyer, 2000; Wingenbach, Rutherford, & Dunsford, 2003).

Source choice is a job function common to all reporters. Reporters try to choose the best sources for a given story based on the source's institutional position, knowledge, accessibility, or cooperativeness, or some combination of these characteristics. However, previous research has documented that a source's political power or social influence often unduly influences such choices, causing government officials and corporate spokespersons to be overrepresented in the source pool (Whitney, Fritzler, Jones, Mazzarella, & Rakow, 1989). For example, Ashlock, Cartmell and Kelemen (2006) reported that 34.88 percent of the sources for information about BSE cited by stories in their sample were government officials and 23 percent were industry representatives, but only 4.49 percent were university scientists. Surprisingly, sources representing business, agricultural producers, and trade associations (industry, 140) overwhelmingly dominated the stories in our sample; the governmental (46), educational (46), and consumer (44) sources found to predominate in other studies were in a decided minority here, a result that doubtless deserves further scrutiny. Such factors in source-choice also may reflect media agenda-setting or framing effects (Ashlock, Cartmell & Kelemen, 2006; Irlbeck, 2009; Lee, 2004; Kitzinger & Reilly, 1997; Salwen, 1995), considerations outside the framework of this study.

Impact of reporters' institutional work roles. This study did address the impact of reporters' institutional work roles on source choice, which other researchers have found to be more important than reporters' personal characteristics in making such selections. This study's findings did not support the idea that work-roles influence the ways in which reporters fulfill their job duties, including their choice of information sources (Clark & Illman, 2003; Craft & Wanta, 2004; Dunwoody, 1978, 1979; 1980; Holland, 2009; Kitzinger & Reilly, 1997; Logan, 2001; Shoemaker, Eichholz, Kim, & Wrigley, 2001), although such impact may be derived from sources' influence on reporters' agendas and frames. According to the research cited, source choices of science-specialty-beat reporters (reporters specializing in coverage of stories with significant science components) may reflect not just normal newsroom routines and practices or individual reporter characteristics, but may be influenced by such reporters' special position within the news organization, by their special training, and by the narrative and expositional demands of the subject matter covered. However, this study found no evidence to support such a conclusion.

By extension, work by Shoemaker, Eichholz, Kim, and Wrigley (2001) and by Craft and Wanta (2004) suggests that (a) a newspaper's employing a science-specialty-beat reporter may go a long way toward determining the nature of its coverage of science-based news and (b) the unique position of a science-specialty-beat reporter in a newsroom could impact the quantity, type, and tone of science coverage provided. However, this study found no differences in source selection based on reporter

work-role, perhaps reflecting that newspaper beat assignments may be made arbitrarily, with little regard to reporter education or expertise, detracting from any positional uniqueness as posited by these researchers.

Special reporter-source relationships. Science stories about complex issues often demand sources beyond the usual institutional spokepersons, requiring explanation by experts in science and technology. Science-specialty-beat reporters often use the same expert sources continually, laying a foundation for the development of special reporter-source relationships. Previous research has noted reporters' focus on educational and governmental sources, which may in fact control reporter access to meet their own agendas (Ashlock, Cartmell & Kelemen, 2006; Ericson, Baranek, & Chan, 1993; Miller, 1999); such focus was not supported by the results of this study. In fact, regardless of work-role identity, reporters in this study chose industry sources by a greater than 3-to-1 margin over other source types.

Gandy (1982) has noted a special affinity between science-specialty-beat reporters and their sources, evidenced by such writers' repeated use of the same sources, which can be compared to the practices of police-beat reporters as documented by Chermak (1995). Gandy cautions that such close relationships and repeated contacts may result in sources using reporters for agenda-setting or framing purposes of their own. Examination of the lists of sources used by science-specialty-beat reporters in this sample supports Gandy's contentions that science-specialty-beat reporters often use the same source types (albeit, here, industry sources), but his conclusions about the impact of these practices on agenda-setting and framing fall outside the scope of this study.

Current study limitations and recommendations for further research

This study focused on the dichotomy in source choice between reporters with one organizational role — that of science-specialty-beat reporter — and those with any other work-role identity. Although science-specialty-beat reporters were not found to use different types of sources than other reporters, they did use more scientists and agricultural scientists as sources. The nature of this relationship over time was not explored; for example, particular reporters were not followed over the eleven-month lifespan of the sampled event to discover whether their patterns of source use remained constant or changed due to story maturation or to source winnowing (Sumpter & Braddock, 2002). Such investigation could be fruitful. Additionally, the extensive use of "undefined" sources, for example, experts, advocates, critics, for which no representative was named, has not been explored in the literature, although some research exists dealing with sources termed part of the general public (Sumpter & Braddock, 2002). The impact of sourcing of unnamed individuals upon public understanding of complex stories and upon media credibility should be explored.

Only source identity was tracked across the sampled stories. Further investigation might focus on the dominance and prominence (Stempel & Culbertson, 1984) of each source in the sampled stories, determining whether these characteristics varied with reporter work-role identity. Additionally, the reliance of reporters on industry sources in covering the first U.S. BSE event is surprising and should be investigated further.

Frames employed in coverage of BSE in the United States should be compared with Ruth and Eubanks' (2005) findings that four frames were used in coverage of such outbreaks in Canada, identified as industry crisis, economic calamity, blame/responsibility, and health risk and to findings by Irlbeck (2009) and Ashlock, Cartmell and Kelemen (2006). The relationship of such frames with sources used should be explored, as well as frame shifting that may occur as a story matures (Chyi & McCombs, 2004).

This study examined source choice but did not investigate the role of information subsidies in initial source identification and selection. Previous research has indicated that subsidies such as news releases and press conferences may play an important part in source choice and in agenda-setting and framing (Borchelt, 2008; Day, 2003; Dunwoody, 1980; Dunwoody, Brossard, & Dudo, 2009; Kelley, 2000; Melgares, Rutherford, & Alexander, 2003; Nisbet, Brossard, & Kreopsch, 2003; Nisbet & Scheufele, 2009; Rost, Savonen, & Duncan, 1993; Skillman & Miller, 2003; Thompson, Able, & Maretzki, 2001); thus the role of such subsidies in coverage of BSE events should be investigated.

This study examined only reporters' work-role identity and ignored reporters' personal and educational characteristics (Grantham & Irani, 2004); given that previous research has emphasized the possible role of such characteristics in reporters' agenda-setting, framing, and source choice decisions, reporter characteristics should be examined in future studies, in conjunction with work-role identity. Such investigation seems particularly important given the fact that science-specialty-beat reporters may exhibit personal and educational characteristics different from those of other reporters.

Finally, population parameters for this study dictated the comparison of a census of science-specialty-beat reporters (time and place sample) (Glass, Peckham, & Sanders, 1972; Hinkle, Wiersma, & Jurs, 1979; Oliver & Hinkle, 1982) with a random sample of other types of reporters. Thus, this study violated several methodological guidelines for performing a content analysis. In the strictest sense, the results presented here are not generalizable to longer time periods or to larger groups of reporters. They generally do, however, match what we would anticipate the outcome to be in an environment where specialty reporters influence one another (Dunwoody, 1979, 1980; Dunwoody & Shields, 1984; Shoemaker & Reese, 1991; Weigold, 2001) and where institutional-level decisions are affected by agenda-setting, framing, and the news wave. Future research could benefit from sampling populations including larger numbers and wider varieties of newspapers, as well as other types of media, and including media with large enough numbers of science-specialty-beat reporters to allow randomization.

Contributions to the field

Although the research consensus is that factors such as the news wave, reporter/editor individual characteristics, newsroom organization, newsworker routines, and use of information subsidies may impact reporters' source choices, few guideposts exist by which to gauge the relative importance of the influence of these different factors on selection of sources. Further, most source-choice research has focused on coverage of political or crime news or on reporter/editor gender, ethnicity, or work routines. Few published studies were found applying agenda-setting or framing theory to explanations of source-choice in coverage of agricultural breaking news or showing how reporter, editor, newsroom, or newspaper characteristics impact such coverage. Thus, the current study sought to illuminate to what extent reporters' designation as science-specialty-beat reporters influenced their use of experts in their coverage of the December 2003 BSE event in the United States.

This study is of course limited by its sample, newspapers included in the LexisNexis database, and by its design, focused only on source-choice relative to reporter work-role identity. However, its contribution to the literature of the field transcends these limitations in that it questions previous studies' findings concerning coverage of science-intensive stories. The fact that in this study no differences in coverage were found between science-specialty-beat reporters and other types of reporters should provoke trenchant questions from both scholars and journalists. Such questions might include whether science-specialty-beat reporters indeed can provide more comprehensive and

informative coverage of science-intensive stories and, if not, whether their failure lies in low-levels of science literacy (King, Cartmell & Sitton, 2006) rooted in inadequate training (Vestal & Briers, 1999; Whitaker & Dyer, 2000; Wingenbach, Rutherford, & Dunsford, 2003) or in newsroom institutions that do not accommodate the exercise of their talents and skills (Chermak, 1995; Dunwoody, 1980; Gandy, 1982). In addition, relationships explored in the current study may be extrapolated and tested with regard to breaking news coverage of other agricultural crises, for example, Avian flu outbreaks or the 2008 salmonella outbreaks in the U.S.

Implications for the National Research Agenda in Agricultural Communications and for agricultural public information officers and media relations practitioners

This study addresses priorities stated in RPA2 - the desire of agricultural communicators to "aid the public in effectively participating in decisions making related to agriculture," through providing information on which such decisions can be based (National Research Agenda, 2007-2010, p. 4).

In particular, implications of this study and the support it does or does not offer previous research may help agricultural public information officers (PIOs) and media relations practitioners in their efforts to "disseminate . . . relevant information that facilitates public decision making about high priority agricultural issues" and to "improve the effectiveness of mass media coverage of agricultural issues" (National Research Agenda, 2007-2010, p. 4). Improving such professionals' understanding of the ways in which reporters' work-role identities may influence coverage could help them more effectively craft their information subsidies and determine better how to target their subsidies and pitch them to particular reporters. For example, if science-specialty-beat reporters are more likely to use scientists or agricultural scientists as sources with regard to agricultural crisis news, agricultural communicators should target these reporters with their information.

Concentrating on the reporters most likely to provide coverage will facilitate effective use of time and other resources by practitioners and improve their chances for placement of important agricultural information. In this instance (2003 BSE event), the knowledge that proximity and urban-location influence coverage might have determined on which newspapers agricultural media relations practitioners would concentrate their attention. It is to be hoped that studies such as this one will contribute to enhancing the effectiveness of practitioners through increasing their ability to identify and target receptive journalists.

Overall, the authors believe that the reach and impact of this study could be increased by its replication for other similar populations and other types of crisis events, allowing the application of a grounded theory approach to the additional data to develop stronger conclusions and more effective applications for agricultural PIOs and media relations practitioners.

Keywords

mad cow, BSE, reporters, sources, science reports

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