Conflicting Health-Related Scientific Evidence in News Reports: Effects of Hedging and Presentation Format on Perceived Issue Uncertainty and Scientists’ and Journalists’ Credibility

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Abstract

Introduction: This study examined effects of two journalistic practices in reporting conflicting scientific evidence, hedging and presentation format, on scientists’ and journalists’ credibility and issue uncertainty. Methods: An online experiment was conducted using students from a western U.S. university. Hedging was manipulated as reporting methodological limitations versus not reporting the limitations in news articles covering the conflict. Presentation format was manipulated as using a single news article to report both sides of the conflict versus using double articles with one side of the conflict in one article and the other side in the other article. Results: The study found that perceived issue uncertainty was higher in hedged news articles than that in non-hedged articles; presentation format did not affect people’s perceived issue uncertainty. For scientists’ credibility (both
competence and trustworthiness), this study found that it was lower in the single-article format than that in the double-article format; for journalists’ credibility, this study found that journalists’ trustworthiness in the two formats did not vary, but their competence was lower in the double-article format than that in the single-article format. **Conclusion:** This study contributes to the field of science and health communication by examining effects of presentation format used in communicating conflicting health-related scientific evidence and by examining effects of communicating scientific limitations in a context where conflicting evidence exists. **Keywords:** conflicting scientific evidence, hedging, presentation format, scientists’ credibility, journalists’ credibility

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**Introduction**

Conflicting or uncertain health-related message exists in news media. A content analysis of UK and Scottish newspapers identified uncertainty as a common theme in reporting e-cigarettes (Rooke & Amos, 2014). Friedman’s (1999) content analysis found that news coverage of dioxin, a potential carcinogen found in many industrialized areas, was highly inconsistent in the 1990s. Meissner and colleagues (2003) documented three controversies in the news about mammography during the 1990s and early 2000s. A content analysis by Smith and colleagues (2010) also identified contradictory information about cancer screening practices. There are concerns that contradictory information has also emerged in other domains such as prostate-specific antigen testing (Hobson, 2009; Dixon,
Scully, Wakefield, & Murphy, 2008), prescription drugs, hormone replacement therapy, and genomics (McBride & Guttmacher, 2009).

Non-experts may not possess the necessary scientific knowledge to make sense of conflicting or uncertain account of a scientific topic. Consequences of exposure to conflicting coverage include confusion about and lower intention to comply with health recommendations (Nagler, 2014) and distrust in scientists (Jensen & Hurley, 2012). Nagler found that people who reported greater exposure to contradictory health messages for topics such as red wine, fish, coffee, and vitamins/supplements experienced greater feelings of confusion and reported lower intention to comply with nutrition recommendations. These beliefs, in turn, were associated with doubt in public health recommendations in general. Jensen and Hurley found that mere news coverage of controversial health-related issues in general might provoke distrust in scientists.

**Hedging**

Past studies have examined how uncertain or conflicting science should be reported in news stories. Corbett and Durfee (2004) examined whether adding contextual information in news reporting conflicting findings could influence people’s perceived issue uncertainty. Dixon and colleagues (2015) examined whether an article can present conflicting views without causing misperceptions by including weight-of-evidence information. Kortenkamp and Basten (2015) examined whether discrediting one expert's viewpoint would minimize false perceptions of controversy. Dixon and Clarke (2013) examined responses to false-balanced news (vs. one-sided). Chang (2015) also examined responses to news stories that cover contradictory (vs.
one-sided) health research findings. Jensen and Hurley (2012) examined responses to news articles that were consistent (vs. contradictory). Binder and colleagues (2015) examined responses to news reporting conflicting and ambiguous expert opinions versus news reporting conflicting but precise expert opinions.

A reporting practice relevant to news coverage of health-related science is hedging. Hedging refers to any linguistic means used to indicate either a lack of complete commitment to the truth value of an accompanying proposition (Hyland, 1998).

There are two key ways that health-related science news stories can be hedged (Hyland, 1996). One occurs when news reports that scientists say X may cause Y or X is likely to cause Y, instead of saying X causes Y. The other occurs when expressing tentative nature of science using sentences to describe caveats or limitations of a study.

Studies show that newspapers routinely minimize or omit information that would limit the findings or conclusions of a study. A study on trends in coverage of science in three periods (1966-1970, 1976-1980, 1986-1990) found that in all three periods, less than 50% of the articles analyzed contained statements about limitations to the research being reported and the generalizability of the results to the public (Pellechia, 1997). As a result, news coverage of science presents research as more certain than it is (Stocking, 1999). A more recent content analysis suggests that 43% of front-page stories reporting on medical research are based on preliminary findings presented at scientific or press meetings rather than in peer-reviewed journals (Lai & Lane, 2009). Given the amount of preliminary research being
reported in the media, it is necessary to include hedging in news coverage of medical research. Scientists, some journalists, and communication scholars have also advocated for acknowledging limitations in news coverage of science (Hyland, 1998; IFIC, 1998; IFIC & IFT, 2005; Puhan et al., 2012; Stocking, 2010; Schwartz & Woloshin, 2004).

Past studies on hedging have explored hedging’s effects in various contexts. For example, a context where information overload about scientific studies exists (Jensen, 2008; Jensen et al., 2011), a context where interpretation statements of research results are involved (Durik et al., 2008), and a context where data statements of research results are involved (Durik et al., 2008). This study examines hedging’s effects in a context where conflicting scientific evidence exists.

Presentation Format

Two possible ways that an individual might be exposed to conflicting news about a health-related topic are when conflicting information is presented in one document and when conflicting information is presented in two documents. An example of the first way is the reporting of contradictory scientific findings about a health issue within one single news article. A more specific example is a news article reporting a study finding that electronic cigarettes may help tobacco smokers quit smoking and also reporting another study finding that use of electronic cigarettes may lower smokers' chances of abstaining from tobacco. An example of the second way is the reporting of the contradictory information using more than one news articles. A more specific example is one news article reporting a study finding that electronic cigarettes may help tobacco smokers quit smoking and another
news article reporting about another study suggesting that use of electronic cigarettes may lower smokers' chances of abstaining from tobacco.

Past studies have examined how conflicting science should be reported in news stories. Corbett and Durfee (2004) examined whether adding contextual information in news reporting conflicting findings could influence people's perceived issue uncertainty. Dixon and colleagues (2015) examined whether an article can present conflicting views without causing misperceptions by including weight-of-evidence information. Kortenkamp and Basten (2015) examined whether discrediting one expert's viewpoint would minimize false perceptions of controversy. Dixon and Clarke (2013) examined responses to false-balanced news (vs. one-sided). Chang (2015) also examined responses to news stories that cover contradictory (vs. one-sided) health research findings. Jensen and Hurley (2012) examined responses to news articles that were consistent (vs. contradictory). Binder and colleagues (2015) examined responses to news reporting conflicting and ambiguous expert opinions versus news reporting conflicting but precise expert opinions.

**Effects on Scientists’ and Journalists’ Credibility**

Hedging on Scientists’ Credibility and Journalists’ Credibility. Jensen studied effects of discourse-based hedging in news coverage of cancer research on people's credibility perceptions of scientists and journalists (Jensen, 2008). Jensen found that both scientists and journalists were viewed as more trustworthy when news stories included scientific limitations and when the limitations were disclosed by the scientists who conducted the reported research. Jensen argued that hedging increased scientists’ and
journalists’ credibility because it might have helped people navigate through overload of cancer-related information existing in news environment. This study examines hedging’s effects in a context where conflicting scientific evidence exists. Two sets of research questions are asked below:

Research question 1-a: Would hedged articles increase scientists’ competence in a context where conflicting scientific evidence exists?

Research question 1-b: Would hedged articles increase scientists’ trustworthiness in a context where conflicting scientific evidence exists?

Research question 2-a: Would hedged articles increase journalists’ competence in a context where conflicting scientific evidence exists?

Research question 2-b: Would hedged articles increase journalists’ trustworthiness in a context where conflicting scientific evidence exists?

Presentation Format on Scientists’ Credibility. When two scientific studies are reported in one news article, readers might perceive that the conflict between the two studies is more explicit than when the studies are reported in two separated stories. Festinger’s (1957; 1964) theory of cognitive dissonance postulates that people desire consistency among their attitudes, inconsistencies cause cognitive dissonance, therefore, people tend to respond to avoid or reduce cognitive dissonance. Cognitive dissonance refers to a feeling of mental discomfort that occurs when people experience inconsistencies between multiple attitudes they hold. The two scientific studies, one stating e-cigarettes helped smokers quit smoking, whereas the other stating e-cigarettes did not, have the potential to induce inconsistency between readers’ attitudes about e-cigarettes. The present study assumes that more explicit conflict causes more cognitive dissonance.
One possible way news readers use to reduce cognitive dissonance is to discredit one group or both groups of the scientists who are behind the studies (Stadtler, Scharrer, & Bromme, 2013), either of which could lead to lower overall scientists’ credibility.

Hypothesis 1-a: Single-article format would lead to lower scientists’ competence than double-article format would.

Hypothesis 1-b: Single-article format would lead to lower scientists’ trustworthiness than double-article format would.

**Presentation Format on Journalists’ Credibility**

Allen’s discounting hypothesis (Allen, 1991) argues that a source who fails to meet an expectation or exceeds an expectation generates a reevaluation by an audience. For example, suppose an audience knows an issue is controversial and a source is thought to be fair-minded, open, and honest. The source fails to meet audience's expectation by not acknowledging the existence of an opposing side. The audience might react negatively to the source and discount the evidence. A two-sided message acknowledges the controversy and increases the evaluation of the source. For a non-controversial topic, a source that acknowledges the existence of a possible opposing side increases the evaluation of honesty, fair-mindedness, and expertise by the audience.

Hypothesis 2-a: Single-article format would lead to higher journalists’ competence than double-article format would.

Hypothesis 2-b: Single-article format would lead to higher journalists’ trustworthiness than double-article format would.
Effects on Issue Uncertainty

Issue uncertainty is an individual’s perception of how incomplete knowledge about a particular issue, object, or question is (Smithson, 1989). In a conflicting context, hedging can reduce strength of arguments from the two opposing sides. Speech communication scholars studied effects of powerless (e.g., hedging) and powerful (e.g., without hedging) language on strength of claims in a conflicting situation (Bradac, Hemphill, & Tardy, 1981). In Bradac and colleagues’ study, powerless and powerful speech styles were used by a defendant and a plaintiff in a hypothetical courtroom context. Participants read testimony, in high versus low power. The finding suggested that the use of powerful language in a conflicting situation increased strength of claims made by both sides of the conflict. Specially, they found that a person using high-power speech while discussing his participation in a violent interpersonal encounter produced in his audience a judgment that both parties were quite blameworthy. However, the strength of claims decreased when the audience was serially presented with both powerful and powerless styles.

Jensen et al. (2011) found that nutrition backlash, negative feelings about dietary recommendations, was lower in readers of hedged nutrition news articles than in readers of non-hedged articles. Nagler (2014) found that nutrition backlash was positively associated with nutrition confusion. These findings suggest that hedged articles might be able to reduce people’s confusion or uncertainty.
Hypothesis 3: Hedged articles would lead to lower issue uncertainty than non-hedged articles would.

**Presentation Format**

Educational psychology studies compare cognitive performance between reading a single document vs. reading multiple documents (Britt & Aglinskas, 2002; Britt & Rouet, 2012; Stadtler, Scharrer, Brummernhenrich, & Bromme, 2013; Wiley et al., 2009; Wiley & Voss, 1996; Wiley & Voss, 1999). These studies found that multiple documents motivated readers to integrate information. For example, Stadtler and colleagues (2013) found that readers of multiple documents had a more accurate memory of conflicts than those reading a single document. An accurate memory of a conflict implies that readers remember each of the two opposing claims and have established a conflicting relationship between the two claims during their integration process. They also found that participants were more likely to explicitly state the conflicts mentioned in multiple documents than those mentioned in single document.

One explanation is that in the single document, conflict is presented explicitly, whereas in the multiple documents, readers have to integrate information across documents before they will see the conflict. When conflict is explicitly presented, the cognitive efforts readers make in processing information are less than when the conflict is not explicitly presented. More cognitive efforts might lead to better memory of the conflicting claims, thus a higher level of perceived issue uncertainty.

Hypothesis 4: Double-article format would lead to higher issue uncertainty than single-article format would.
Methods

Design

To examine the effects of hedging and presentation format on source credibility and perceived issue uncertainty, a 2 (two presentation formats: single-article format vs. double-article format) x 2 (hedged vs. not hedged) x 2 (presentation order: pro-first vs. con-first) between-subjects design was used. Participants were randomly assigned to one of the eight experimental conditions. Presentation order did not significantly affect any of the dependent variables. Randomization of participants to experimental conditions was successful as predisposition variables, relevant demographics variables, and behavioral variables (e.g., cigarette and e-cigarette use) did not differ significantly across conditions.

Participants

Participants were recruited through a communication course at a mid-sized, western U.S. university. The communication course was a large undergraduate lecture course that had multiple sections. A total of 491 students completed the study. The sample ($N = 260$) was 38.1% male and 61.9% female. The sample was largely Caucasian. Participants ranged from 19 to 51 years of age, with a mean of 22.43 years ($SD = 4.28$). The majority was 25 years or younger (90.3%). Twenty-nine percent of the sample were science majors, and 0.4% were first-year, 21.1% were second-year, 50.8% were third-year, and 27.7% were fourth-year students. The study was reviewed and approved by an Institutional Review Board at a U.S. university.

Stimulus Materials
Newspaper articles were created by an experienced journalist. The journalist created the articles by following Stocking's (2010) readers' checklist for science stories. The articles were based on two scientific studies published in medical journals in 2014. One study reported that e-cigarettes helped people quit smoking (Brown, Beard, Kotz, Michie, & West, 2014), and the other study reported that e-cigarettes did not help people quit smoking (Grana, Popova, & Ling, 2014). Hedging was manipulated as reporting methodological limitations versus not reporting the limitations. Presentation format was manipulated as single-article format with integration devices versus double-article format without integration devices.

**Study Procedures**

Inviting emails were sent to students. In the emails students were directed to a web-based experiment hosted on Qualtrics. After logging in, participants completed a background questionnaire that measured their predispositions such as prior issue involvement and knowledge. For prior issue involvement and prior issue knowledge, two additional health-related issues, vaccination and genetically modified organisms (GMO), were also included to mask the topic of the study. Participants then were assigned to one of the eight experiment conditions. After reading the stimulus within a condition, participants completed questions that measured issue uncertainty, scientists' credibility, and journalists' credibility. After these dependent variable measures, participants answered questions that measured perception of message features, such as message believability, and manipulation check questions. Participants also answered behavioral and
demographic questions. All participants then read a statement debriefing the purpose of the study.

**Measures**

Scientists’ credibility was measured using McCroskey and Teven’s source credibility scale (1999). Scientists’ credibility is the competence and trustworthiness of scientists as a source of information. Participants were asked to indicate their feelings about the competence ($\alpha = 0.88$, $M = 5.15$, $SD = 0.95$) and trustworthiness ($\alpha = 0.90$, $M = 4.94$, $SD = 1.00$) of scientists who conducted the studies that were mentioned in the news.

Journalists’ credibility was measured using McCroskey and Teven’s source credibility scale (1999). Journalists’ credibility is the competence and trustworthiness of journalists as a source of information. Participants were asked to indicate their feelings about the competence ($\alpha = 0.91$, $M = 4.64$, $SD = 1.16$) and trustworthiness ($\alpha = 0.94$, $M = 4.56$, $SD = 1.16$) of the journalists who wrote the news.

Issue uncertainty was modeled from uncertainty measure by Corbett and Durfee (2004) and Dixon and Clarke (2013). Issue uncertainty ($\alpha = 0.83$, $M = 4.74$, $SD = 1.33$) in this study included perception of a person’s own knowledge, scientists’ knowledge, and public’s knowledge of the issue. Participants rated how they, scientists, and the public feel about the certainty about scientific evidence about e-cigarettes’ association with smoking cessation. Response options were assessed using seven-point scales.

Demographic variables were included as sample descriptors and explanatory variables. Predisposition variables, which included understanding of scientific process ($\alpha = 0.43$), prior issue involvement ($\alpha =$
prior issue knowledge ($\alpha = 0.90$), tolerance for ambiguity ($\alpha = 0.57$), and epistemic belief ($\alpha = 0.66$), behavior variables, which included news reading frequency, cigarette and e-cigarette use, and message features, which included believability, ease of understanding, and interestingness, were measured as potential covariates.

**Manipulation Check**

The present study has two manipulations. One manipulation was hedging, and the other manipulation was presentation format. A check on the first manipulation is necessary to make sure that participants who were assigned to hedged conditions at least noticed the limitation(s) included in the stories. To determine whether the manipulation on hedging was successful, participants were asked, "In the news coverage you just read, was there an outright mention of a specific limitation of either scientific study? A limitation of a scientific study is defined as a potential flaw in the way scientists carried out their study and it could influence the results of a study." If participants chose "Yes," a follow-up question asked them to describe what the outright mention is, specific limitation(s) was/were; if they chose "No" or "I don't know," a follow-up question asked them to describe why they chose "No" or "I don't know." A definition of limitation was included in the check question to reduce the chance of people reporting other information in the news as limitations. Only the participants who answered the multiple-choice question correctly and accurately described the limitation(s) were included for subsequent analyses. Inter-coder reliability was 0.87 in Cohen's kappa.

Of the 491 participants, 222 were assigned to the hedged conditions; of the
222 assigned to hedged conditions, 101 answered the multiple-choice question correctly and were able to describe at least one limitation.

**Results**

A simple mediation analysis using Hayes’ PROCESS macro for SPSS (2013) was conducted with each journalistic practice (i.e., presentation format and hedging) as the independent variable, each credibility variable or issue uncertainty as the outcome variable, and perceived message believability as the mediator. The mediation analysis was used because it is able to demonstrate how an independent variable’s total effect on a dependent variable can be partitioned into direct effect and indirect effect of a potential covariate. To avoid conflating source credibility with message credibility (Appelman & Sundar, 2016), this study included message believability as a covariate in the analyses for testing hypotheses and research questions.

Research question 1-a asked if hedged articles would increase scientists’ competence in a context where conflicting scientific evidence exists. Mediation analysis found that hedging did not directly predict scientists’ competence.

Research question 1-b asked if hedged articles would increase scientists’ trustworthiness in a context where conflicting scientific evidence exists. Mediation analysis found that hedging did not directly predict scientists’ trustworthiness.

Research question 2-a asked if hedged articles would increase journalists’ competence in a context where conflicting scientific evidence
exists. Mediation analysis found that hedging did not directly predict journalists’ competence.

Research question 2-b asked if hedged articles would increase journalists’ trustworthiness in a context where conflicting scientific evidence exists? Mediation analysis found that hedging did not directly predict journalists’ trustworthiness.

Hypothesis 1-a hypothesized that single-article format would lead to lower scientists’ competence than double-article format would. Mediation analysis found that presentation format directly predicted scientists’ competence, $b = 0.42$, $SE = 0.12$, $t = 3.47$, $p < 0.001$. More specifically, scientists’ competence was lower in single-article format than that in double-article format. Hypothesis 1-a was supported.

Hypothesis 1-b hypothesized that single-article format would lead to lower scientists’ trustworthiness than double-article format would. Mediation analysis found that presentation format directly predicted scientists’ trustworthiness, $b = 0.27$, $SE = 0.13$, $t = 2.04$, $p < 0.05$. More specifically, scientists’ trustworthiness was lower in single-article format than that in double-article format. Hypothesis 1-b was supported.

Hypothesis 2-a hypothesized that single-article format would lead to higher journalists’ competence than double-article format would. Mediation analysis found that presentation format directly predicted journalists’ competence, $b = -0.48$, $SE = 0.16$, $t = -2.26$, $p < 0.05$. More specifically, journalists’ competence was higher in single-article format than that in double-article format. Hypothesis 2-a was supported.
Hypothesis 2-b hypothesized that single-article format would lead to higher journalists’ trustworthiness than double-article format would. Mediation analysis found that presentation format did not directly journalists’ trustworthiness. Hypothesis 2-b was not supported.

Hypothesis 3 hypothesized that hedged articles would lead to lower issue uncertainty than non-hedged articles would. Mediation analysis found that hedging directly predicted issue uncertainty, $b = 0.49$, $SE = 0.18$, $t = 2.78$, $p < 0.05$. More specifically, issue uncertainty was higher in hedged articles than in non-hedged articles. However, this is contradictory to the hypothesis.

Hypothesis 4 hypothesized that double-article format would lead to higher issue uncertainty than single-article format would. Mediation analysis found that presentation format did not directly predict issue uncertainty. Hypothesis 4 was not supported.

**Discussion**

This study examined effects of two journalistic practices in reporting conflicting scientific evidence, hedging and presentation format, on scientists’ and journalists’ credibility and issue uncertainty. Hedging was manipulated as reporting methodological limitations versus not reporting the limitations in news articles covering the conflict. Presentation format was manipulated by using a single news article to report both sides of the conflict versus using two articles with one side of the conflict in one article and the other side in the other article.
Effects on Issue Uncertainty. This study found that presentation format did not affect people's perceived issue uncertainty. This suggests that readers avoid integrating information as not to create an explicit conflict. This is contradictory to the hypothesis of this study. The hypothesis is based on educational psychology studies on readers’ integration of information from multiple documents versus a single document (Britt & Aglinskas, 2002; Britt & Rouet, 2012; Stadtler, Scharrer, Brummernhenrich, & Bromme, 2013; Wiley et al., 2009; Wiley & Voss, 1996; Wiley & Voss, 1999).

There are two potential theoretical explanations. One, integration tend to be avoided when information is conflicting than when it is not. This is because people tend to avoid cognitive dissonance (Festinger, 1957). Cognitive dissonance refers to a feeling of mental discomfort that occurs when people experience inconsistencies between multiple attitudes they hold. The two scientific studies, one stating e-cigarettes helped smokers quit smoking, whereas the other stating e-cigarettes did not, have the potential to induce inconsistency between readers’ attitudes about e-cigarettes. To avoid experience of inconsistency, people might have developed attitude about only one of the two studies or articles and have dismissed or discredited the other (Stadtler, Scharrer, & Bromme, 2013). Prior educational psychology studies did not involve conflicting information. For example, information presented to readers in one of these studies involves causal, not conflicting, relationship among multiple documents (Wiley & Voss, 1996).

Two, integration tend to be avoided when information is explicitly conflicting than when it is implicitly conflicting. One study in educational psychology found people tend to integrate conflicting information from
multiple documents (Stadtler, Scharrer, Brunnmernhenrich, & Bromme, 2013). Participants in their study read one document claiming food contains high amounts of cholesterol and the amount of cholesterol we ingest is an important determinant of our blood cholesterol level, and another document claiming that humans have a regulatory mechanism to keep cholesterol levels constant in healthy individuals. The information in their study is conflicting but implicitly. In this study, information is explicitly conflicting, with one study claiming e-cigarettes helped smokers quit smoking and the other study claiming they did not.

This study also found that perceived issue uncertainty was higher in hedged news articles than that in non-hedged articles. There are two potential explanations. One, hedging might have interacted with the conflicting evidence and the interaction might have caused uncertainty. As discussed in previous paragraphs, when presented with conflicting scientific evidence, readers tend to avoid experience of inconsistency by possibly developing attitude about only one of the studies involved in the conflict and dismissing or discrediting other studies. Jensen and colleagues (2011) postulated that news consumers use scientific uncertainty conveyed by hedging to organize information to help them reduce cancer information overload. Similarly, participants in this study might also have used hedging as a heuristic to organize or process information to help them reduce cognitive dissonance that can be caused by conflicting information. Two, hedging might have directly caused uncertainty. Hedged news articles indicate a lack of complete commitment to the argument (e.g., e-cigarettes help smokers quit smoking) each of the conflicting studies makes,
communicating limitations of scientific studies. Both studies involved in the conflict reported have limitations and the limitations were communicated to the readers. This might have made readers feel knowledge about whether e-cigarettes could help smokers quit smoking more incomplete.

Effects on Scientists’ and Journalists’ Credibility.

For scientists’ credibility, this study found that it (both competence and trustworthiness) was lower in the single-article format than that in the double-article format. This finding is consistent with the hypothesis which is based on cognitive dissonance theory (Festinger, 1957). More explicit conflict tends to cause more cognitive dissonance. To reduce the discomfort caused by the explicit conflict presented to them, readers of the single-article format might have engaged in more active cognitive efforts than readers of the double-article format. One possible effort is to discredit scientists who were behind one of the two studies or scientists behind both studies. (Stadtler, Scharrer, & Bromme, 2013). In the discrediting process, readers used both competence and trustworthiness.

Competence is conveniently accessible in the single-article format to be discredited, because the two studies asked the same research question about the same item, whether e-cigarettes could help smokers quit smoking, but ended with contradictory findings. Future research can examine if readers also discredit competence to reduce discomfort when conflicting evidence involves scientific studies asking different research questions about the same item. For example, one study finds association between coffee consumption and increased lung cancer risk, and the other study finds association between coffee consumption and decreased breast cancer risk.
Scientists’ trustworthiness is also discredited, and this might have to do with conflict of interest in medical or life-science research. Over one-third of publications reporting studies on e-cigarettes had no conflict of interest disclosure statement, and this proportion was even higher in news articles, editorials and other types of publications (Martínez, et al., 2018). Information about the scientists’ funding source or partnership was not included in the news articles used in this study. Martínez and colleagues (2018) also found that conflict of interest was more likely to exist in publications with conclusions favorable to e-cigarette use. Future research can examine if disclosure of conflict of interest increases or decreases scientists’ trustworthiness when scientific evidence is conflicting.

For journalists’ credibility, this study found that journalists’ trustworthiness in the two formats did not vary, but their competence was lower in the double-article format than that in the single-article format. This finding is consistent with discounting hypothesis which argues that a source who fails to meet an expectation generates a reevaluation by an audience (Allen, 1991). This finding suggests that readers expect journalists to be competent in curating and aggregating scientific studies in their reports. Reporting a single study without reviewing or providing what other studies say about the topic hurt journalists’ competence.

This finding also suggests that trustworthiness is not a relevant expectation for journalists who report this topic. It is probably because e-cigarette is not a highly politicized issue. E-cigarette restricting policies can be ideological as it involves belief in government role in individual choices (Sanders-Jackson, Tan, Bigman, Mello, & Niederdeppe, 2016), but it has not
yet become a partisan fight like other science topics such as climate change (Funk & Kennedy, 2016). For a science topic or issue that is not politicized, journalists, the messenger of scientists, only get their competence hurt if they fail to curate and aggregate other relevant scientific studies but not their trustworthiness.

**Limitations**

This study has a few limitations. One, the manipulation of presentation format included the number of articles and use of integration devices. Integration devices, such as lede and transitional sentences, were used in the single-article format but not in the double-article format. They were used in the single-article format to make the news more realistic. As a consequence, variance in source credibility between the two formats are difficult to interpret. Variance may be the result of the number of news articles, use of integration devices, or both. To distinguish the effects of the two, perceived message credibility was measured and included as a covariate in analyses. Two, message credibility is a one-item measure which only measured believability of the news. In the context of news, a more reliable scale should include accuracy, authenticity, and believability (Appelman & Sundar, 2016). There existed no scale that exclusively measures message credibility when this study was in progress in 2016. Three, this study did not distinguish credibility of the sources for one study from that for the other study in the conflict. Instead, participants were asked to rate source credibility of the two conflicting studies in an overall manner. This could be problematic if participants’ perceptions of scientists’ credibility in one study were different from their perceptions of scientists in the other
study or in the double-article format condition, their perceptions of journalists’ credibility in one article were different from those in the other article. Therefore, source credibility in this study should be interpreted as people’s overall perceptions not as their perception for each study or article individually. Four, this study used a convenience sample of college students. College student participants have more education in science and this may lead to greater understanding of scientific uncertainty and trust in science (Sturgis & Allum, 2004).

Despite these limitations, this study preliminarily examines effects of communicating scientific limitations, a form of hedging, and presentation format in a context where conflicting scientific evidence is involved. It offers practical implications for journalists and scientists in how to communicate conflicting scientific evidence. It also offers theoretical explanations on how individuals integrate conflicting scientific information.
References


