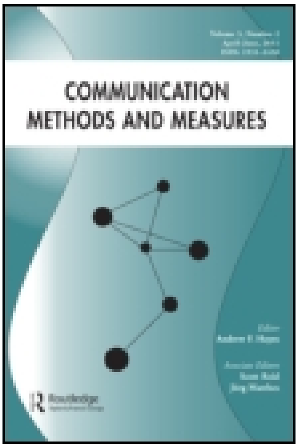

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Measuring Media Exposure to Contradictory Health Information: A Comparative Analysis of Four Potential Measures

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There is increasing concern that the news media present conflicting health information on topics including cancer screening and nutrition, yet little is known about whether people notice such content. This study proposes four potential measures of media exposure to contradictory health information, using nutrition as an example (measures I–IV). The measures varied on two dimensions: (1) content specificity, or whether specific nutrition topics and health consequences were mentioned in the question scripting, and (2) obtrusiveness, or whether "contradictory or conflicting information" was mentioned. Using data from the Annenberg National Health Communication Survey, we evaluated the performance of each measure against a set of validity criteria including nomological, convergent, and face validity. Overall, measure IV, which was moderately content-specific and obtrusive, performed consistently well and may prove most useful to researchers studying media effects of contradictory health information. Future directions and applications are discussed.

Nutrition researchers and clinicians have assumed that contradictory health and nutrition messages exist in the news media (e.g., Angell & Kassirer, 1994; Boyle, Boffetta, & Autier, 2008; Fineberg & Rowe, 1998), and that exposure to these messages negatively influences public understanding and health behavior. Specifically, there is concern that exposure has negative effects, including increased public confusion, less trust in health recommendations, and less engagement in health behaviors (American Dietetic Association, 2007; Department of Health and Human Services, 2008; Drummond, 2006; Goldberg, 1992; Goldberg & Hellwig, 1997; Johnson-Taylor, Yaroch, Krebs-Smith, & Rodgers, 2007). Although there is some evidence that contradictory

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health information exists, there have been few efforts to capture media exposure to such content. Assessing whether people are exposed to and notice conflicting information is critical, as exposure is the central first step in the persuasion process (McGuire, 1999) and thus is fundamental to the study of media effects (Slater, 2004). This study considers four possible approaches to exposure measurement and, using nutrition as an example, evaluates the performance of each measure against a set of validity criteria. Based on this analysis, we suggest which measures may be most useful to researchers studying the effects of contradictory health messages.

CONTRADICTORY HEALTH MESSAGES AND THEIR EFFECTS

Although there are several ways in which we might conceptualize contradictory health messages, this study focuses on a specific definition: messages that offer information about *a single behavior producing two distinct outcomes*. For example, one day someone might see a news article summarizing recent research that found an association between red wine consumption (a single behavior) and improved heart health (outcome #1), but a few weeks later he or she might see another article reporting that new research linked increased consumption of red wine and other alcohol to an increased risk of breast cancer (outcome #2). Someone who notices both messages might wonder if he or she should consume red wine and, if so, how much.

From a nutritional epidemiological standpoint, these messages might not be contradictory per se. For example, in the case of red wine and other alcohol, consumption legitimately could contribute to cardiovascular health, on the one hand, and increased risk of breast cancer on the other. Contradictory findings also might arise for other reasons. For example, distinct study designs can produce seemingly conflicting findings: a rigorous clinical trial of beta carotene might reach different conclusions than earlier observational work. Alternatively, studies may vary in how they measure nutritional intake, and some may be more prone to measurement error than others. Because researchers and clinicians understand these plausible explanations and know that nutrition science is evolutionary (Goldberg & Sliwa, 2011), they are well-equipped to negotiate seemingly conflicting results (Kushi, 1999; Taubes, 2007). In contrast, the public may be less able to reconcile such findings, as many Americans lack a thorough understanding of scientific research (Miller, 2004). In addition, news coverage of science and health often omits methodological and contextual information (e.g., Evans, Krippendorf, Yoon, Posluszny, & Thomas, 1990; Nelkin, 1995; Pellechia, 1997; Tankard & Ryan, 1974). Such omissions may influence people's health cognitions (Jensen et al., 2011), as well as their ability to make sense of conflicting study results. Ultimately, it is important to understand whether the public notices contradictory health information in the media and, if so, how it responds to such content.

There is some evidence that this contradictory information exists, but scholarly attention to these messages has been limited. For example, in a qualitative analysis of media coverage, researchers discerned contradictory information about cancer screening (Smith, Kromm, & Klassen, 2010), and several survey-based studies found that women perceived conflicting guidelines or controversy surrounding mammography recommendations (Meissner et al., 2003; Rimer, Halabi, Strigo, Crawford, & Lipkus, 1999; Squiers et al., 2011; Taplin, Urban, Taylor, & Savarino, 1997). However, none of these studies placed a premium on capturing media exposure to conflicting recommendations. Similarly, although a few studies have identified contradictory nutrition messages in the media, none has attempted to capture exposure to such information. Rather, these studies qualitatively explored perceptions of contradictory messages (Basu & Hogard, 2008; Boyington, Schoster, Martin, Shreffler, & Callahan, 2009; Dorey & McCool, 2009; Dye & Cason, 2005; Vardeman & Aldoory, 2008) or came across messages during content analysis research (Greiner, Smith, & Guallar, 2010; Houn et al., 1995). One study cited public awareness of conflicting information about dietary fat, but did not focus on media exposure (Diekman & Malcolm, 2009), while another explored potential outcomes of contradictory exposure—such as nutrition backlash, or "negative feelings about dietary recommendations"—without assessing exposure itself (Patterson, Satia, Kristal, Neuhouser, & Drewnowski, 2001, p. 38).

Despite evidence that contradictory messages exist, there is substantially less support for the claim that exposure to such messages has an adverse effect on health cognitions and behaviors. Importantly, the lack of support is due to an absence of empirical evidence—specifically, few efforts to capture media exposure to contradictory information—rather than evidence against the claim of effects. In fact, there is a theoretical rationale for why we would expect effects of contradictory message exposure. Decision theory and, more specifically, the concept of "ambiguity" as described by Ellsberg (1961) provides a foundation for the link between contradictory information exposure and confusion. Ellsberg argued that "[ambiguity] may be high . . . even where there is ample quantity of information, when there are questions of reliability and relevance of information, and particularly where there is *conflicting* opinion and evidence [emphasis in original]" (1961, p. 659). In a set of studies, Han and colleagues explored the influence of perceived ambiguity about cancer prevention recommendations on other cancer-related perceptions and behaviors. Consistent with decision theory research, Han, Moser, and Klein suggested that most people will be averse to ambiguity about cancer prevention recommendations and, importantly, "may manifest this ambiguity aversion through pessimistic interpretations about the preventability of cancer—that is, lower preventability beliefs" (2006, p. 54). As hypothesized, they found that people who reported greater perceived ambiguity reported lower preventability beliefs and fewer screening behaviors (Han, Moser, & Klein, 2007; Han, Kobrin et al., 2007).

Han et al. concluded that their findings "[raise] the possibility that exposure to ambiguous [or conflicting] health information may indeed have negative psychological consequences," as well as behavioral effects (Han, Moser et al., 2007, p. 323). Crucially, however, this research merely raised this possibility, as neither Han et al. nor other researchers have measured exposure to ambiguous or contradictory information. Although two recent studies considered associations between general media exposure and perceived ambiguity about cancer prevention recommendations (Han et al., 2009) and cancer fatalism (Niederdeppe, Fowler, Goldstein, & Pribble, 2010), neither considered whether contradictory exposure, specifically, was associated with such outcomes—even though decision theory suggests that exposure to conflicting information, rather than general media exposure, contributes to perceived ambiguity.

DIMENSIONS OF CONTRADICTORY MESSAGE EXPOSURE

Given the absence of existing contradictory exposure measures and growing concerns about the effects of conflicting health information in the media, this study's central goal was to develop and assess potential approaches to measurement. Using nutrition as an example, we developed four candidate exposure measures (I–IV; see Appendix). Although nutrition is the focus, our aim was to design measures that could be adapted to capture other types of contradictory health information. Ultimately, these measures could be adapted for use in non-health contexts as well, for example, to capture exposure to conflicting information about climate change or genetic modification of food.

The measures varied on two dimensions: content specificity and obtrusiveness. Content specificity has been described in the literature as one dimension on which exposure measures vary, and it falls along a spectrum (Romantan, Hornik, Price, Cappella, & Viswanath, 2008). Some exposure measures are general; for example, they ask about time spent with media and make no mention of content. Other measures are more content-specific, asking about broad health topics or, further along the spectrum, specific health topics. As discussed below, measure I was the most content-specific, III was the least content-specific, and II and IV fell towards the middle of the spectrum.

The second dimension on which the measures varied is obtrusiveness. Although not often discussed in the exposure context, unobtrusive measurement is worth considering given its importance in social science research (Webb, Campbell, Schwartz, & Sechrest, 2000). Unobtrusive measures enable data collection from individuals or groups without their direct knowledge or participation (Schutt, 2004). In the current study, the unobtrusive measures, I and II, asked respondents to recall separately both the positive and negative health consequences of consuming a specific food, which could be characterized in our subsequent analysis as exposure to contradictory information. In contrast, the obtrusive measures, III and IV, directly asked respondents whether they recalled exposure to "contradictory or conflicting information" about a specific food or foods in general. Each approach has its strengths. On the one hand, asking separately about positive and negative consequences has the advantage of demanding recall of specific claims, and may reduce the likelihood of overreporting exposure. On the other hand, respondents genuinely might recall an overarching sense of contradiction about a particular food but not be able to recall the specifics; respondents' summarizing reports of contradictory information, even in the absence of specific recall, might still capture exposure that affects their subsequent beliefs or behavior. We include these considerations in our assessment of the four measures' overall performance.

RESEARCH QUESTIONS AND APPROACH

Romantan and colleagues (2008) provide a useful framework for comparing the performance of exposure measures. The study quantitatively assessed eight cancer information exposure measures, comparing their ability to predict an index of cancer knowledge (i.e., construct validity). However, they also considered three subjectively assessed criteria: face validity as measures of exposure, survey time required for implementation, and cognitive burden on respondents. All four criteria were used in selecting the most useful measures.

The current study differs in its use of particular criteria. Whereas Romantan et al. expected that greater cancer information exposure would be associated with greater cancer knowledge, the current study did not have a clear hypothesis about the relationship between contradictory exposure and nutrition knowledge. In other words, there was not an obvious expectation that those who were higher on contradictory exposure would have more general nutrition knowledge than those who were lower on contradictory exposure. Rather, we had *a priori* expectations about other variables with which contradictory exposure should be related, and thus included a nomological validity criterion instead. Despite these variations, we used the same overall approach as Romantan et al. Specifically, we asked how well the four candidate measures performed against a comprehensive set of criteria:

1. Nomological validity (a type of construct validity: the extent to which measures are associated with other variables with which they should logically be related; Cronbach & Meehl, 1955)
2. Convergent validity (how well one measure of a construct correlates with other measures of the same construct; Schutt, 2004)
3. Face validity (the extent to which measures obviously pertain to the meaning of the concept being measured; Schutt, 2004)
4. Performance across key demographic variables (whether the measures perform uniformly across subgroups)
5. Survey costs (how much survey time the measures require)
6. Respondent burden (how hard the measures make respondents work)

The first, second, fourth, and fifth criteria were assessed quantitatively, the third criterion was assessed both quantitatively and subjectively, and the last criterion was assessed subjectively. To assess nomological validity, we considered variables that ought to predict who reports greater exposure to contradictory nutrition information (Kelly, Niederdeppe, & Hornik, 2009). Possible predictors were health media use and attention to media information on nutrition topics. Given evidence that contradictory nutrition information exists in the media (e.g., Greiner et al., 2010; Houn et al., 1995), one might expect that those who use health media and pay attention to nutrition stories also might report exposure to contradictory messages. Although we expected associations among these variables, this study suggests that contradictory exposure is a distinct construct—that a contradictory exposure measure captures different information from health media exposure and attention measures. Thus we performed a discriminant analysis, evaluating whether the four contradictory measures were more highly correlated with one another than with health media use or nutrition topic attention.

To assess convergent validity, we examined two types of associations: the internal consistency of responses across items *within* a measure (for measures that required multiple responses) and the associations *among* the candidate measures. Although the measures differed in terms of content specificity and obtrusiveness, they ought to be related to one another if they all capture contradictory exposure.

To evaluate face validity, we subjectively assessed whether what was asked transparently matched the definition of contradictory information we set out. This evaluation was coupled with a quantitative assessment for measures I and II, neither of which mentioned "contradictory or conflicting information" in the question scripting. Specifically, we explored whether respondents were able to differentiate between "true" and "foil" nutrition topics, or topics about which contradictory information exists in the media and topics about which no such information exists, respectively. This differentiation task is similar to the one used by Southwell, Barmada, Hornik, and Maklan (2002), who explored whether people differentially recognized actual and bogus advertisements available in the information environment.

We also evaluated how well the candidate measures performed across key demographic variables, such as age, education, and gender. We calculated the mean score for each measure by demographic subgroup (e.g., under age 50 versus age 50 and older). This analysis enabled us to assess whether some measures performed more uniformly across subgroups.

Lastly, the candidate measures were evaluated for their potential to burden respondents and increase survey costs. Survey costs were assessed by counting the number of words in each measure and its response set, and the number of distinct responses each measure required. Respondent burden, which overlaps with survey costs, involved a subjective judgment of how much thinking was expected from a respondent. In general, measures which demanded more specific recall and provided fewer prompts for recall were considered to have greater respondent burden.

METHOD

Sample

This study used data from the January 2010 Annenberg National Health Communication Survey (ANHCS). ANHCS collects data monthly from a nationally representative sample of U.S. adults over the age of 18 (ANHCS, 2007). Knowledge Networks, a Web-based research company, handles sample recruitment and survey administration. The sample is recruited via random digit dialing; respondents become members of a panel that is surveyed monthly, and those without Internet are provided with access. The January panel recruitment response rate was 20%, and the survey completion rate was 59%.

All respondents completed the health media exposure, attention to nutrition information, and sociodemographic questions ($N = 428$). Respondents were randomly assigned to view either 1) measure I or II first, and then 2) measure III or IV. In other words, each respondent answered one of the unobtrusive measures and then one of the overt measures. This design yielded approximately 100 respondents in each of four cells, but more than 200 cases for each measure (Table 1). Since respondents contributed data to more than one measure, we assessed whether responses to measures III and IV were contingent on whether the respondent received measure I versus II beforehand. We found no evidence of contingent effects; however, because all respondents viewed measure I or II before viewing measure III or IV, we cannot rule out the possibility of order effects. Although viewing measure I or II first might have influenced subsequent responses, this may be less likely since neither measure overtly primed people to think about contradictory information.

Fifty-two percent of respondents were female, and the mean age was 47.75 ($SD = 17.61$). Thirteen percent had less than a high school degree, 26% earned a high school degree or the

TABLE 1
Contradictory Message Exposure Study Design: January 2010 Annenberg National Health Communication Survey

	Measure I	*Measure II*	*Total*
Measure III	$N = 112$	$N = 108$	$N = 220$
Measure IV	$N = 101$	$N = 107$	$N = 208$
Total	$N = 213$	$N = 215$	$N = 428$

Note. The *N*s reported here differ slightly from the *N*s reported in Table 2 due to the number of refused answers on individual items.

equivalent, 29% had some college education, and 31% earned at least a Bachelor's degree. Nearly 80% of respondents were White, Non-Hispanic; 7%, Black, Non-Hispanic; and 7%, Hispanic. Just over half (56%) were married.

Measures

Measures I and II

The format for measures I and II was identical (see Appendix). Both questions asked respondents "how much have you heard about each of the following issues from the media (including television, radio, newspapers, magazines, and the Internet)" in the past year; the "issues" were specific nutrition topics and associated health consequences. Each question asked about the same six nutrition topics. Four of these—red wine and other alcohol, fish, coffee, and vitamins/supplements—were "true" topics, as content analysis results have shown that there is substantial contradictory information about these topics in the media (Nagler, 2010). Content analysis also informed the selection of the specific health consequences for measure I; a sample of frequently mentioned positive and negative health consequences for each contradictory nutrition topic was included in the measure. The remaining two nutrition topics—mushrooms and poppy seeds—served as "foils." Based on cursory Lexis-Nexis and Google searches, there was no contradictory information about these topics in the media. We included both true and foil topics to assess whether respondents could distinguish between them; evidence of differentiation would provide face validity support for measures I and II.

The main difference between measures I and II was the level of content specificity. Measure I asked about specific health consequences (e.g., "consuming red wine or other alcohol may be good for your heart"), whereas II asked about general health consequences (e.g., "consuming red wine or other alcohol may be good for your health"). For both measures, there were two items per nutrition topic. One asked about a positive health consequence (specific or general, depending on whether it was measure I or II), and the other asked about a negative health consequence. Pairs of items were rotated randomly. In other words, the two red wine and other alcohol items were kept together but randomly ordered vis-à-vis the other pairs of items in the question.

Despite the difference in content specificity, the same coding approach was used to generate measures I and II. The overall logic was that if a respondent recalled hearing both the positive *and* negative health consequence for a given topic, he or she was considered exposed to contradictory information about that topic. Those who reported hearing such information more often were considered more exposed. Using red wine or other alcohol as an example, if a respondent selected "not at all" for either the positive or negative statement, then he or she was considered not exposed to contradictory information about red wine or other alcohol (coded as 0). Respondents had to hear both streams of information to be considered exposed to contradictory messages. If a respondent selected "once or twice in the past year" for both statements, then he or she was coded as 1. By extension, those who selected "once every two or three months" for both were coded as 2, and those who selected "almost every month or more often" for both were coded as 3. We applied an incremental increase approach when respondents reported hearing varying levels of contradictory information. Those who reported hearing one statement "once or twice in the past year" and the other "once every two or three months" were coded as 1.5. Those who reported hearing one statement "once or twice in the past year" and the other "almost every month or more often" were

TABLE 2
Topic-Specific and Combined Distributions for Candidate Exposure Measures

		True topics				Foil topics	
	Level of exposure	*Red wine/other alcohol (%)*	*Fish (%)*	*Coffee (%)*	*Vitamins/ supplements (%)*	*Mushrooms (%)*	*Poppy seeds (%)*
Topic-specific distributions							
Measure I	0.0	76.2	38.5	83.3	78.9	96.2	97.6
	1.0	8.1	19.2	7.7	8.1	2.9	1.4
	1.5	7.6	16.9	6.2	5.7	0.5	0.5
	2.0	5.2	13.6	1.4	2.4	–	0.5
	2.5	1.4	5.6	1.0	2.4	–	–
	3.0	1.4	6.1	0.5	2.4	0.5	–
	Total N	*210*	*213*	*209*	*209*	*208*	*208*
Measure II	0.0	50.9	47.9	52.4	66.2	87.7	94.0
	1.0	21.0	17.8	25.5	7.5	10.0	4.2
	1.5	13.1	16.0	8.0	8.0	1.9	0.5
	2.0	8.9	12.7	11.3	13.6	0.5	1.4
	2.5	3.3	2.8	0.5	2.8	–	–
	3.0	2.8	2.8	2.4	1.9	–	–
	Total N	*214*	*213*	*212*	*213*	*211*	*215*
Measure IV	1.0	24.5	27.5	32.2	31.1		
	2.0	31.3	32.4	22.6	26.7		
	3.0	31.3	32.4	33.2	29.1		
	4.0	13.0	7.7	12.0	13.1		
	Total N	*208*	*207*	*208*	*206*		

		Measure I (%)	*Measure II (%)*	*Measure III (%)*	*Measure IV (%)*
Combined distributions					
No exposure		30.6	23.1	8.6	7.8
Lower exposure		34.0	27.9	21.8	28.8
Medium exposure		25.2	24.5	46.4	37.1
Higher exposure		10.2	24.5	23.2	26.3
Total N		*206*	*208*	*220*	*205*

coded as 2. Thus the latter respondents received the same score as those who reported hearing both statements "once every two or three months" (i.e., both were coded as 2).

This coding strategy was used for the remaining nutrition topics, yielding a total of four topic-specific measures for I and II: exposure to contradictory information about red wine and other alcohol; fish; coffee; and vitamins/supplements (each measure's range = 0–3; Table 2). Although this coding approach also was used to generate foil topic measures, those were set aside for the subsequent face validity assessment. We summed the respective four topic-specific measures to create indices for measures I (range = 0–9.5, as no one reported very high levels of contradictory exposure across topics; $M = 1.98$; $SD = 2.04$) and II (range = 0–12; $M = 2.88$; $SD = 2.58$). For descriptive purposes, both indices were collapsed into four categories ranging from 0 to 3: "No exposure (0)," "Lower exposure (1–2)," "Medium exposure (2.5–4.5)," and "Higher exposure (5–9.5 for I; 5–12 for II)" (Table 2). These categories took into account the fact that there was, across the four individual measures, a substantial number of respondents who reported no exposure to contradictory information, and few people who reported high levels of exposure. All other analyses used the continuous versions of measures I and II.

Measures III and IV

Measures III and IV were the two overt measures, and thus they included "conflicting or contradictory information" in the question scripting. Measure III was the least content-specific of the four measures. Respondents were asked "how much conflicting or contradictory information on food and nutrition" they heard from the media in the past year. Response options were "Not at all," "A little," "Some," and "A lot" (range = 1–4; $M = 2.84$; $SD = 0.88$).

Measure IV was more content-specific than III but less content-specific than I and II. It asked how much conflicting or contradictory information respondents heard from the media in the past year about red wine or other alcohol, fish, coffee, and vitamins/supplements. The four nutrition topics were randomly ordered. For each topic, the response options ranged from "Not at all" to "A lot" (range = 1–4). The four individual measures were summed to create a combined index (range = 4–16; $M = 9.02$; $SD = 3.12$). We collapsed the index to create a categorical version of measure IV: values included "No exposure (4)", "Lower exposure (5–7)," "Medium exposure (8–11)," and "Higher exposure (12–16)" (range = 0–3; Table 2). These categories took into account the fact that, across the individual measures, a majority of respondents reported some contradictory exposure. All other analyses used the continuous version of measure IV.

Health Media Exposure

Respondents were asked, "About how often have you . . . [read health sections of newspapers or general magazines]; [read special health or medical magazines or newsletters]; [watched health segments of local or national television news programs]; [watched television shows that address health issues (e.g., shows that focus on doctors or hospitals)]; [read health information on the Internet when you were not trying to find out about a specific health concern] in the past 30 days?" Response options were "Not at all," "Less than once per week," "Once per week," and "A few times a week" (range = 1–4). An index of health media exposure was created by summing the five items (range = 5–20; $M = 10.05$; $SD = 3.47$). There was good evidence of unidimensionality: one component was extracted with an Eigenvalue greater than 1.0, accounting for 48.3% of the variance.

Attention to Media Information on Nutrition Topics

Respondents were asked, "How much attention do you pay to information about nutrition topics that you hear from the media?" Response options ranged from "Not at all" to "A lot" (range = 1–4; $M = 2.52$; $SD = 0.80$).

RESULTS

Four Candidate Exposure Measures: Descriptive Analyses

Basic frequency analyses were used to calculate the percentage of respondents who reported exposure to contradictory nutrition information. The topic-specific distributions for the more content-specific candidate measures (I, II, and IV) are shown in Table 2. Across true topics, there were fewer reports of contradictory exposure for measure I than II. When the four true topics were combined into a single exposure measure, measure II was more evenly distributed. In other words, respondents who viewed measure I reported hearing less contradictory nutrition information than those who saw measure II. Compared to measures I and II, there were greater reports of topic-specific exposure for measure IV. Across the four combined measures, measure I had the lowest percentage of respondents reporting medium or high exposure, while III and IV had the highest percentage reporting such exposure.

Nomological Validity

To assess nomological validity, zero-order correlations were used to estimate associations between the candidate measures and the variables with which they should logically be related. As shown in Table 3, measures I and IV were positively and significantly associated with health media exposure ($r = 0.37$, $p < .001$; $r = 0.32$, $p < .001$, respectively). Measure II was also significantly associated with health media use, although perhaps less strongly ($r = 0.23$, $p < .01$), while there was no significant association for measure III. In addition, all candidate measures were positively and significantly associated with attention to nutrition-related media stories. Measure I was the most strongly correlated with attention ($r = 0.33$, $p < .001$), and III had the weakest association ($r = 0.15$, $p < .001$).[1] In analyses not shown here, all significant associations remained significant when we adjusted for age, education, gender, and race/ethnicity; only the association between measure III and attention became marginally significant.

Given these associations, we performed a discriminant analysis to assess whether the contradictory exposure measures were conceptually distinct from the health media exposure and attention measures. If the candidate measures are distinct, then they should be more strongly correlated with one another than with the health media exposure or attention measures (Kelly et al., 2009). First, we averaged the zero-order correlations across the set of contradictory measures; these correlations appear in lines 3 and 4 of Table 3. We then averaged the correlations between the contradictory measures and attention (line 5 of Table 3). Lastly, we averaged the correlations between the contradictory measures and health media exposure (line 6 of Table 3). There was some evidence that the contradictory exposure measures capture different information from the health media exposure and attention measures: the contradictory measures were more strongly correlated with one another (mean $r = 0.35$; 95% CI = 0.19–0.51) than they were with

[1]For nomological and convergent validity analyses, we used Fisher's Z transformation to assess whether correlation coefficients were in fact different from one another. Several comparisons did not reach statistical significance due to the study's small sample size. For example, measure I's correlation with attention ($r = 0.33$) was significantly different from III's correlation with attention ($r = 0.15$), whereas measure I's correlation with health media exposure ($r = 0.37$) was not significantly different from II's correlation with health media exposure ($r = 0.23$).

TABLE 3
Zero-Order Correlations among Candidate Exposure Measures, Health Media Exposure, and Attention to Media Information about Nutrition Topics

	1.	*2.*	*3.*	*4.*	*5.*	*6.*
1. Measure I	–					
2. Measure II	n/a	–				
3. Measure III	0.20*	0.39***	–			
4. Measure IV	0.25*	0.57***	n/a	–		
5. Attention to nutrition topics	0.33***	0.23**	0.15*	0.24**	–	
6. Health media exposure	0.37***	0.23**	0.11	0.32***	0.30***	–

*$p < .05$; **$p < .01$; ***$p < .001$.
Note. $N = 97$–416.

attention (mean $r = 0.24$; 95% CI = 0.17–0.31) or health media use (mean $r = 0.26$; 95% CI = 0.15–0.37). However, confidence intervals overlapped, so observed differences in correlations could have been chance differences.

Convergent Validity

Inter-item correlations were used to examine the internal consistency of measures I, II, and IV (III was a single item). There was evidence of good internal consistency for measures II (Cronbach's $\alpha = 0.72$; inter-item correlations = 0.31–0.53) and IV (Cronbach's $\alpha = 0.78$; inter-item correlations = 0.38–0.64). Measure I was less internally consistent, although all four items were correlated with one another (Cronbach's $\alpha = 0.60$; inter-item correlations = 0.15–0.38).

Table 3 also allows for a second evaluation of convergent validity: we examined the associations among the four measures. Due to the randomization built into the study design, it was only possible to compare measure I with III and IV and measure II with III and IV. Measure I was positively and significantly associated with both measures ($r = 0.20$, $p < .05$; $r = 0.25$, $p < .05$, respectively). Measure II was also positively and significantly associated with III and IV, but the correlations were substantially stronger ($r = 0.39$, $p < .001$; $r = 0.57$, $p < .001$, respectively). Measure II therefore performed better than measure I on the convergent validity criterion, since it correlated more strongly with other measures of the same construct and was more internally consistent.

Face Validity

Quantitative and subjective assessments were used to evaluate face validity. From a subjective standpoint, measures I and II are not obviously face valid; as unobtrusive measures, neither question clearly pertains to the meaning of the concept being measured (i.e., contradictory health information). However, a quantitative evaluation provides face validity support. Frequency analyses were used to calculate the percentage of respondents who reported exposure to measure I and II's foil topics. These distributions are provided in Table 2. Overall, few respondents reported exposure to contradictory information about mushrooms and poppy seeds. When these distributions were compared to the true topic distributions in Table 2, we found that respondents tended

TABLE 4
Mean Scores on Candidate Exposure Measures by Demographic Subgroups

	Measure I *M (SD)*	*Measure II* *M (SD)*	*Measure III* *M (SD)*	*Measure IV* *M (SD)*
Age				
Less than 50	1.78 (1.90)	2.84 (2.48)	2.82 (0.87)	8.56 (3.05)
50 and above	2.22 (2.19)	2.93 (2.70)	2.87 (0.89)	9.48 (3.12)
Education				
High school and below	1.73 (1.93)	2.28 (2.39)	2.86 (0.92)	8.98 (3.30)
Some college and above	2.17 (2.11)	3.23 (2.63)	2.83 (0.86)	9.05 (2.98)
Gender				
Male	1.59 (1.78)	2.49 (2.32)	2.63 (0.95)	8.65 (3.22)
Female	2.33 (2.20)	3.26 (2.76)	3.00 (0.79)	9.41 (2.97)

Note. $N = 76$–141.

to differentiate between true and foil topics. These findings suggest that measures I and II do not merely capture a general tendency to report contradictions.

A subjective assessment provides support for measure III and IV's face validity. Both explicitly mentioned "contradictory or conflicting information" in the question scripting, and thus pertain to the meaning of the concept being measured. That said, this explicit mention may encourage overreporting of exposure.

Performance across Key Demographic Variables

To assess how the measures performed across key demographic variables (age, education, and gender), we calculated the mean score for each measure by demographic subgroup (Table 4). Across all four measures, older, better educated, and female respondents had higher mean scores than younger, less educated, and male respondents. Although this pattern was somewhat less pronounced for measure III, the overall pattern of mean differences across subgroups was consistent across measures.

Survey Costs

There were 244 and 231 words in measures I and II; III had the fewest (38), and IV had only 65 words. Similarly, measures I and II required 12 distinct responses, III required only one, and IV required four responses.

Respondent Burden

Measure I required respondents to think about very specific foods and consequences. Measure II, because it asked about only general benefits and harms, may have required less thought. Since both measures consumed so much space, they were higher on respondent burden than III and IV. Measure III, although brief, required a fair amount of thinking: respondents had to summarize many different exposures into a single response with little guidance. Since measure IV asked about specific foods, it may have been less difficult for respondents to answer than III.

DISCUSSION

Although exposure is central to the study of media effects, communication researchers have noted that there is, in fact, little systematic research about how best to measure media exposure (Fishbein & Hornik, 2008b). A 2008 special issue of *Communication Methods and Measures* highlighted recent efforts in this area, and although some papers explored how to measure exposure to a specific type of content across multiple sources, none considered contradictory health information (Fishbein & Hornik, 2008a). To our knowledge, the current study is the first to develop and evaluate measures of media exposure to contradictory health messages.

Our goal was to compare candidate measures of exposure, evaluating their performance against a set of validity criteria: nomological, convergent, and face validity; performance across key demographic variables; survey costs; and respondent burden. Since this analysis yielded a substantial amount of information about each measure, we used a summary table—similar to the one developed by Romantan et al. (2008)—to synthesize results (Table 5). For each validity criterion, measures were rated on a scale of 1 through 4, with 1 equaling the worst performance and 4 the best performance.

Overall, measure IV performed consistently well on both quantitatively and qualitatively assessed criteria. It performed strongly in the nomological assessment, as it correlated in the expected direction with health media exposure and nutrition topic attention. It was internally consistent and significantly associated with the other contradictory exposure measures. It was also face valid, as the question scripting transparently matched the definition of contradictory information we set out, and it performed uniformly across demographic subgroups. Lastly, it demanded little survey real estate and likely placed minimal cognitive burden on respondents.

Despite Measure IV's comparatively strong performance, it has some shortcomings. Perhaps most notably, it is an overt measure, explicitly asking respondents whether they noticed "contradictory or conflicting information." As previously noted, this explicit mention might suggest to respondents that such information exists in the media, and thus might encourage overreporting of exposure—particularly since respondents could indicate that they heard contradictory information about a particular topic without having to recall specific health consequences. Indeed, Table 2 shows that measures III and IV had the highest percentage of respondents reporting medium or

TABLE 5
Summary Analysis across Validity Criteria

Exposure question	*Nomological validity*	*Convergent validity*	*Face validity*	*Performance across key demographic variables*	*Survey costs*	*Respondent burden*
Measure I	4	2	4	4	1	1
Measure II	2	3	4	4	1	2
Measure III	1	1	4	4	4	3
Measure IV	3	4	4	4	4	4

Note. 1 = worst performance; 4 = best performance.

high levels of exposure to contradictory information. Future content analytic efforts might be able to allay overreporting concerns—for example, if they find that reported exposure levels are consistent with the amount of contradictory information in the media about red wine and other alcohol, fish, coffee, and vitamins/supplements.

It is also worth noting that underperforming measures could have utility in some contexts. Although the measures varied in performance, all four are viable options: results showed that all were face valid, a discriminant analysis provided at least some support for the claim that the contradictory measures are distinct from health media exposure and attention measures, and all four measures performed relatively uniformly across demographic subgroups. Consider measure I as an example. It performed the strongest on the nomological criterion but was less internally consistent, consumed considerable survey space, and likely required respondents to think hard due to its high content specificity. If a researcher was concerned about overreporting risks and had sufficient survey space, then measure I could be a reasonable option, particularly if it were modified to include fewer topics and thus reduce respondent burden. If, on the other hand, a researcher was less concerned about overreporting, was interested in several nutrition or health topics, and space was at a premium, then measure IV would remain the most parsimonious option.

However, although all four measures performed strongly in the face validity assessment, and although there was evidence for convergent validity across measures, whether all four should be labeled as measures that capture the same underlying construct deserves additional consideration. Ultimately, measuring exposure is not as straightforward as it appears (Hornik, 2002; Slater, 2004). As research on self-report exposure measures accumulates, it has become increasingly clear that we need to take a nuanced approach in labeling and describing these measures. For example, Southwell and colleagues (Southwell, 2005; Southwell et al., 2010) have argued that self-reported exposure really captures memory for exposure rather than true past exposure, and they have looked for external indicators (e.g., media market-level exposure) to use in place of self-report measures (Hwang & Southwell, 2009). The implication for the current study is that while the face validity for the four contradictory measures might be generally high, it could vary considerably if we home in on the specific variable of interest, that is, contradictory message exposure. For instance, perhaps measure IV actually captures perceived conflict about nutrition in the public information environment, whereas measure I, with its high degree of content specificity, actually assesses something else (e.g., understanding of or interest in nutrition research). As previously noted, both measures are viable, and selection may depend on survey space constraints or desired level of content specificity. Yet what might these substantive differences mean for subsequent effects analyses? If measure IV captures a subjective perception of conflict or confusion in the information environment—rather than actual exposure to conflicting information—then an observed association with confusion might be explained, at least in part, by variables associated with greater confusion (e.g., lower levels of health literacy, less tolerance for complexity). In other words, analyses that use measure IV might need to adjust for such potential confounders of an exposure–confusion relationship. In contrast, measure I might assess understanding of nutrition research rather than true exposure; thus effects analyses should adjust for understanding of scientific research. Ultimately, each measure's association with outcomes may be subject to distinct threats to inference, and these should be considered in future effects studies.

This study has some additional limitations. First, although we used data from a nationally representative survey of U.S. adults, the low response rates may undermine true representativeness of the sample. Nonetheless, the ANHCS response rates are similar to those of other large-scale surveys. Second, we considered some potential moderators of measure validity (age, education, and gender), but due to the small sample size the estimates for subgroups are substantially less stable than for the entire sample. Measure performance across demographic variables should be explored in future research. Third, we did not include true and foil topics for measures III and IV. We included both for measures I and II because evidence of differentiation would provide face validity support for these unobtrusive (and thus not obviously face valid) measures. However, including foil topics for measures III and IV would have provided additional evidence of accuracy of recall. Fourth, due to survey space constraints, nomological validity analyses involved a limited number of variables (health media use and attention); the use of different variables might have yielded different outcomes. Fifth, the candidate measures were developed for the purposes of this research, and other question wording or formats might have produced different results. Lastly, we relied on indirect indicators of survey costs and respondent burden because measure response times were not available.

Taken together, results suggest that measure IV, a moderately content-specific and obtrusive exposure measure, may prove most useful to researchers studying the effects of contradictory health information in the media. Subsequent studies might adapt measure IV to health contexts such as cancer screening, particularly in light of recent media coverage of mammography and prostate-specific antigen (PSA) testing. The measure also could be adapted to non-health contexts in which seemingly contradictory or conflicting information exists, such as climate science. Yet though this study provides guidance for how to construct such measures, substantial adaptation will be required. We focused on a single domain (nutrition), and modifying questions for use in other health- and non-health contexts may prove challenging, particularly in the case of highly content-specific measures (e.g., measure I). Thus the current study provides a model for measure construction, but adaptation should be followed by cognitive testing and at least some validity assessment prior to use. Future studies could separate out media sources, allowing researchers to drill down on specific sources that might be important vehicles of contradictory information (e.g., women's magazines, national news magazines, blogs). Researchers also could adapt the measures to study contradictory message exposure from medical and interpersonal sources, exploring the relative contribution of media, medical, and interpersonal exposure on potential outcomes. Ultimately, additional measure refinement and development efforts may prove central to media effects research—as contradictory health messages remain an underexplored, but increasingly important, research arena.

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APPENDIX

Four Candidate Measures of Exposure to Contradictory Nutrition Information

Measure I. Thinking about the *past 12 months*, how much have you heard about each of the following issues from the **media** (including television, radio, newspapers, magazines and the Internet)?

*How often did you hear from the **media** in the past 12 months . . .*	*Not at all*	*Once or twice in the past year*	*Once every two or three months*	*Almost every month or more often*
. . . that consuming red wine or other alcohol may be good for your heart.	☐	☐	☐	☐
. . . that consuming red wine or other alcohol may increase the risk of breast cancer.	☐	☐	☐	☐
. . . that consuming mushrooms may promote brain function.	☐	☐	☐	☐
. . . that consuming mushrooms may raise blood cholesterol levels.	☐	☐	☐	☐
. . . that consuming fish may be good for your heart.	☐	☐	☐	☐
. . . that consuming fish may increase the risk of mercury poisoning.	☐	☐	☐	☐
. . . that consuming poppy seeds may promote eye health.	☐	☐	☐	☐
. . . that consuming poppy seeds may increase the risk of bleeding.	☐	☐	☐	☐
. . . that consuming coffee may reduce the risk of Type 2 diabetes.	☐	☐	☐	☐
. . . that consuming coffee while pregnant may increase the risk of miscarriage.	☐	☐	☐	☐
. . . that consuming vitamins/supplements (such as Vitamin D) may protect against heart disease.	☐	☐	☐	☐
. . . that consuming vitamins/supplements (such as Vitamins E) may increase the risk of cancer when taken in high doses.	☐	☐	☐	☐

Measure II. Thinking about the *past 12 months*, how much have you heard about each of the following issues from the **media** (including television, radio, newspapers, magazines and the Internet)?

*How often did you hear from the **media** in the past 12 months . . .*	*Not at all*	*Once or twice in the past year*	*Once every two or three months*	*Almost every month or more often*
. . . that consuming red wine or other alcohol may be good for your health.	☐	☐	☐	☐
. . . that consuming red wine or other alcohol may be harmful to your health.	☐	☐	☐	☐
. . . that consuming mushrooms may be good for your health.	☐	☐	☐	☐
. . . that consuming mushrooms may be harmful to your health.	☐	☐	☐	☐
. . . that consuming fish may be good for your health.	☐	☐	☐	☐
. . . that consuming fish may be harmful to your health.	☐	☐	☐	☐
. . . that consuming poppy seeds may be good for your health.	☐	☐	☐	☐
. . . that consuming poppy seeds may be harmful to your health.	☐	☐	☐	☐
. . . that consuming coffee may be good for your health.	☐	☐	☐	☐
. . . that consuming coffee may be harmful to your health.	☐	☐	☐	☐
. . . that consuming vitamins/supplements may be good for your health.	☐	☐	☐	☐
. . . that consuming vitamins/supplements may be harmful to your health.	☐	☐	☐	☐

Measure III

	A lot	*Some*	*A little*	*Not at all*
Thinking about the *past 12 months*, how much conflicting or contradictory information on food and nutrition have you heard from the **media** (including television, radio, newspapers, magazines and the Internet)?	☐	☐	☐	☐

Measure IV. Thinking about the *past 12 months*, how much conflicting or contradictory information have you heard from the **media** (including television, radio, newspapers, magazines and the Internet) about each of the following nutrition topics?

	A lot	*Some*	*A little*	*Not at all*
Red wine or other alcohol	☐	☐	☐	☐
Fish	☐	☐	☐	☐
Coffee	☐	☐	☐	☐
Vitamins/supplements	☐	☐	☐	☐