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Utilizing Framing Theory to Design More Effective Health Messages about Tanning Behavior among College Women

Olivia M. Bullock and Hillary C. Shulman

School of Communication, Ohio State University, Columbus, Ohio, USA

ABSTRACT

Rates of skin cancer among young women are increasing and most cases are associated with tanning behavior. In health communication, scholars and practitioners use framing as a strategy to design persuasive messages. In this experiment, we advance framing research by testing a serial model of framing theory in the context of outdoor tanning behavior among collegiate women. We designed two message frames, language difficulty, and message relevance, to target accessibility and applicability, two mechanisms within framing theory. We deployed these frames in a 2 × 2 experimental design and found that message frames that promoted accessibility and applicability significantly increased perceptions of severity, susceptibility, and reduced behavioral intentions to tan. Our results support framing theory and provide practical implications for message designers who use frames to inform and persuade.

KEYWORDS

Framing effects; persuasion; message design; health campaigns; skin cancer; metacognition

Skin cancer is one of the most common cancers in the United States (American Cancer Society, 2020). Although skin cancer affects all subsets of the population, incidence rates among young adult women are rapidly increasing, making this group particularly at-risk for the disease (Muzic et al., 2017). Previous work has attributed the prevalence of skin cancer among young women to increased exposure to ultraviolet (UV) radiation, indicating that tanning behaviors are largely to blame (Boniol et al., 2012). Tanning is the deliberate exposure of skin to UV radiation from the sun (solar or outdoor tanning) or artificial tanning equipment (nonsolar or indoor tanning; Prior et al., 2014), and is associated with several different types of skin cancer, including melanoma, the deadliest form of the disease (Boniol et al., 2012). At the same time, tanning is a widespread behavior among young adults in the United States and is particularly prevalent among non-Latina, White, college-aged women (Pagoto et al., 2015). As a result, a large body of health communication scholarship has aimed to reduce tanning behavior, including through interventions that employ message tailoring (Reynolds et al., 2008), visual appeals (Occa et al., 2020), or improved media literacy (Cho et al., 2018). However, results of interventions regarding tanning behavior are often nuanced, and scholars have called for a greater understanding of the mediating processes that explain the relationship between message exposure and tanning behaviors (Lovejoy et al., 2015). In response, our study seeks to explicate and test the mechanisms of framing theory (Chong & Druckman, 2007a, 2007b) in the context of outdoor tanning behavior. Specifically, we conducted an experiment ($n= 529$) to examine

CONTACT Olivia M. Bullock  bullock.181@osu.edu  School of Communication, Ohio State University, 3056 Derby Hall, 154 North Oval Mall, Columbus, OH 43210-1339.

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framing theory and the cognitive mechanisms that support framing effects in messages about the risks of outdoor tanning behavior.

It is important to note that outdoor and indoor tannings are distinct behaviors, although both increase exposure to UV radiation, which can lead to skin cancer (Boniol et al., 2012). For example, while both outdoor and indoor tanning are associated with appearance motivations, indoor tanning is linked to skin tone dissatisfaction, while outdoor tanning is motivated by a desire to look healthy (Gambra et al., 2017). Further, reasons for indoor tanning are often emotional, including relaxation, while outdoor tanning can be driven by misleading health reasons, as well as peer and media influences (Rodgers et al., 2015). Because young women may mistakenly believe that outdoor tanning benefits one's health and increases the appearance of being healthy (Randle, 1997), outdoor tanning represents a particularly important context for a health communication intervention. Furthermore, indoor tanning is a generally less common behavior that increases in the winter, while outdoor tanning is a more widespread practice that increases during the summer (Heckman et al., 2016). The study we report here was conducted in Spring 2019 to intervene in potential future outdoor tanning behavior using framing theory to guide strategic message design.

Message Frames and Framing Effects

Framing represents the way that people construct meaning in a world that offers alternative perspectives on the same topic (Goffman, 1974). As a message design strategy, framing refers to the strategic presentation of information in such a way that draws attention *toward* certain aspects of information while simultaneously drawing attention *away* from other aspects. As a consequence of this presentational difference, individuals' attitudes about the topic become more aligned with framed information, leading to more message-consistent effects, referred to as a *framing effect* (Cacciatore et al., 2016).

Framing, as a strategic device, can be further divided into two different framing strategies: Emphasis frames and equivalency frames. Emphasis framing refers to differences in *what* information is being presented, while equivalency framing focuses on differences in *how* information is presented (Cacciatore et al., 2016). More specifically, emphasis framing occurs when a communicator includes certain pieces of information and omits other information in order to define an issue (Entman, 1993). As a result, the emphasized dimensions become more salient, and individuals are more likely to form judgments that are consistent with the frame emphasis (Sun et al., 2016). Equivalency framing, on the other hand, examines when information that is logically identical varies along some presentational dimension, such as the information's valence (Levin & Gaeth, 1988), language complexity (Shulman & Sweitzer, 2018b), or presence of risk (Kahneman & Tversky, 1979).

In health communication, both emphasis and equivalency framing have been used to manipulate health information to determine effective presentation strategies. For example, a commonly studied emphasis frame portrays a public health crisis as either an individual or social problem, and then examines the effect of this emphasis on attributions of responsibility (i.e., Sun et al., 2016). In this way, framing effects can also occur on a collective level, as framed messages influence public opinion, which, in turn, affects health policy outcomes (Niederdeppe et al., 2014). On the other hand, a common equivalency frame in health communication is gain-loss framing, where scholars manipulate the valence with which

equivalent information is presented to determine how frames alter risk perceptions (see O’Keefe & Jensen, 2009, for a review). Though framing is a common strategy in health message design, there is room for greater understanding of how specific frames impact the cognitive processes that lead to framing effects (cf. Anspach & Draguljić, 2019).

Here, we examine how design elements that are consistent with an *equivalency frame* influence mechanisms of framing effects. We approach this question through the lens of framing theory (Chong & Druckman, 2007a, 2007b), which offers specific predictions for how framing effects occur. As detailed below, framing theory suggests that the relationship between exposure to a frame and its influence on outcomes is mediated by a series of cognitive processes. According to this approach, each of these mechanisms must be sequentially triggered for frames to exert a discernable influence. However, the serial model of framing theory has not been widely empirically verified. In this work, we present, to our knowledge, one of the first experimental studies to investigate framing theory as a serial model. Our intent is that if the process that underlies framing effects is better understood, it becomes possible for researchers and practitioners to design and deploy more reliably persuasive framed messages.

Framing Theory

To provide a framework for understanding how to build messages that target the mechanisms that support framing effects, we turn to framing theory (Chong & Druckman, 2007a, 2007b). Framing theory proposes that individuals’ attitudes are composed of a set of evaluative beliefs about a particular subject, topic, or object, and that these evaluative beliefs can vary in their valence and intensity. The sum of evaluative beliefs, accounting for valence and intensity, composes an attitude (Chong & Druckman, 2007a). For example, an individual’s attitude about outdoor tanning might be composed of weak, negative beliefs about negative health effects, and strong, positive beliefs about one’s tanned appearance. Framing theory is a useful lens for understanding framing effects because it considers how differently framed messages may target different evaluative beliefs. Building on this idea, framing theory suggests that three cognitive mechanisms – availability, accessibility, and applicability – determine whether a frame is likely to influence judgments (see Figure 1). These mechanisms are described below.

Mechanisms of Framing Effects

Availability

The first mechanism within framing theory proposes that for framing effects to occur, one must have a belief about the subject, topic, or object available. *Availability* means that

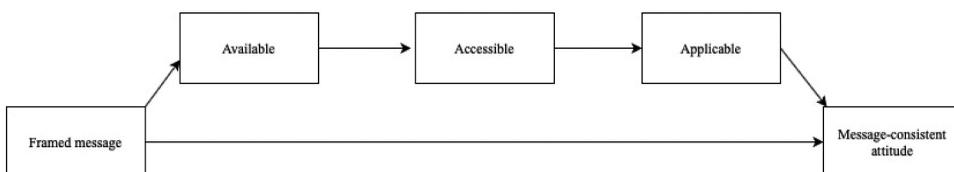


Figure 1. Illustration of framing theory.

a belief is stored in one's memory and is able to be retrieved (Chong & Druckman, 2007a). If an individual does not have a belief *available*, then he or she will not be affected by message frames. In the context of outdoor tanning behavior, research has shown that more than 90% of college-aged females know that exposure to excess UV radiation is dangerous and can lead to cancer (Dennis et al., 2009). This demonstrates the availability of information among the population most at risk for the adverse consequences of this behavior (college females), which makes this group a promising target for a framing intervention. Given that the prerequisite of available information is satisfied, the next step toward successfully inducing framing effects is to design frames that target the next two mechanisms: accessibility and applicability.

Accessibility

According to framing theory, an available belief only affects judgments, or produces message-consistent effects, when the belief is made *accessible*. Information that is accessible is said to have a higher activation potential, meaning that it is more likely to be retrieved from memory compared to other beliefs (Fazio & Roskos-Ewoldsen, 2005). Accessibility is theorized to increase through frequency and recency of use, meaning that regular and repeated exposure to a belief (e.g., outdoor tanning has negative health effects) increases the likelihood of that belief being used to evaluate an issue (e.g., outdoor tanning is unhealthy). Framing can be persuasive because exposure to a framed message can increase the likelihood that a belief is made accessible, meaning that this particular cognition is more likely to be used to inform judgments (Chong & Druckman, 2007a).

Recent extensions of framing theory (Shulman & Sweitzer, 2018b) suggest that the probability of drawing on framed beliefs through accessibility can be amplified by *processing fluency*, or the ease with which something is processed (Shulman & Bullock, 2019). When something is processed fluently, the retrieved information *feels* more accessible because it is called to mind quickly and with feelings of ease. On the other hand, when something is processed disfluently, the information *feels* less accessible. As a result, previous research (Bullock et al., 2019; Shulman et al., 2020) suggests that a framed message that feels easy to process (e.g., an easily understandable message about health risks) is more likely to be effective in informing attitudes than a framed message that feels difficult to process (e.g., a message that is difficult to understand about health risks).

To examine whether feelings of accessibility influence framing effects, we designed an equivalency frame that operationalizes accessibility through self-reported processing fluency. To manipulate processing fluency, we created messages that contained the same information, but varied along the presentational dimension of language difficulty. In the difficult language condition, participants were presented with more challenging terms, and in the easy language condition, difficult terms were replaced with easier synonyms. Because participants were exposed to substantively identical information but the presentation of this information varied along this attribute, this manipulation is consistent with the definition of equivalency framing (Levin & Gaeth, 1988). Previous research (Shulman & Sweitzer, 2018a, 2018b) suggests that difficult language is more effortful to process than easy language and reduces processing fluency. Thus, we expect that participants who are exposed to information with easier language will report higher levels of processing fluency, and that, as predicted by framing theory, processing fluency

will mediate the relationship between language frame and message-consistent outcomes. The message-consistent outcomes used here are from the health belief model and theory of planned behavior, which have each been previously used in tanning interventions (e.g., McWhirter & Hoffman-Goetz, 2016).

H1: Easy language condition will increase processing fluency, and processing fluency will mediate the relationship between language frame and outcomes of beliefs about (a) severity, (b) susceptibility, and (c) behavioral intentions.

Applicability

After availability and accessibility, the final mechanism within framing theory (Shulman & Sweitzer, 2018a, 2018b) is applicability. According to framing theory (Chong & Druckman, 2007a), among a set of accessible beliefs that are targeted with a framed message, only some are judged to be relevant, or *applicable*, to the evaluation at hand. Framing theory suggests that individuals determine what information is applicable through a deliberative process of weighing competing beliefs (e.g., outdoor tanning is unhealthy, but it improves appearance) and deciding which are best suited to the current context. Some factors that increase the probability of information being deemed applicable include quality or logic of argumentation, source credibility, and message relevance. According to framing research, when information is deemed applicable or relevant, framing effects become more likely (Benford & Snow, 2000; Chong & Druckman, 2007b).

Message relevance is also an important feature of health communication messaging. According to Kreuter and Wray (2003), a message is “more likely to be perceived as relevant by an individual if it is seen as corresponding to his or her particular circumstance, life experience, or predisposition” (p. S228). When a message is judged as relevant, it is more likely to lead to message-consistent attitudes and behavior change (Kreuter & Wray, 2003). As a result, health communication campaigns aim to increase the relevance of their messages by employing strategies such as targeting, which uses dimensions of a population’s identity to generate messages specific to their group. Here, we manipulated relevance as a message feature that should produce variance in applicability. This operationalization allowed us to test Chong and Druckman’s (2007b) expectation about factors that influence applicability (relevance), while also dovetailing the framing literature with health campaigns literature (e.g., Kreuter & Wray, 2003). To our knowledge, this experiment is the first to conceive of and test framing theory in this way. It is expected that information that is relevant to an individual’s geographic and demographic group will be judged as more applicable than information that is about a less relevant group.

In this study, we offer a novel test of the serial mediation model postulated by framing theory (Figure 1) by examining the mediators of accessibility and applicability. Moreover, we strive to evoke these mechanisms using novel, but conceptually consistent, instantiations of message frames to establish a rigorous test of framing theory. We propose that the effects of our framed messages (easy vs. difficult language and high vs. low message relevance) will be associated with message-consistent outcomes through the serial mediators of processing fluency and applicability.

H2: The effects of frame condition on outcomes of beliefs about (a) severity, (b) susceptibility, and (c) behavioral intentions will be through linked multiple mediators of processing fluency and applicability.

Method

Participants

Participants were 529 female undergraduate students from a large Midwestern university. Only female participants were recruited for this study because tanning behavior is particularly prevalent among women (Sontag & Noar, 2017). The sample ranged in age from 18 to 46 ($M = 20.39$, $SD = 3.29$), and participants reported their race as 68.1% White, 21.2% Asian, 10% Black, 0.4% Native American, and 0.4% Pacific Islander. Although tanning is less prevalent for nonwhite women, the behavior is still common (Daniel et al., 2018). Further, recent evidence suggests that rates of skin cancer are also increasing among minority groups, especially among Asian women (Loh et al., 2016), making this an important population to consider in tanning interventions. We defined tanning as “Going outdoors to tan your skin using the sun for more than two hours at a time.” We also asked participants “How many times in the last year have you gone outdoor tanning,” with options ranging from one time to 20 or more times. 55.2% of respondents ($n = 292$) reported tanning in the previous year. Among these, 17.2% reported tanning more than 20 times, 18% reported tanning 10–19 times, 14.6% reported tanning 3–9 times, and 5.5% reported tanning 1–2 times.

Procedure

Participants were randomly assigned to experimental condition in a 2 (easy vs. difficult language) \times 2 (high vs. low message relevance) between-subjects design. All participants read three paragraphs about sun exposure and skin cancer. Across all three paragraphs, presentation order and condition assignment were held constant. Each piece of information was held on-screen for a minimum of ten seconds, based on average reading time of this word count, to encourage participants to read the full text. After exposure to all three paragraphs, participants answered questions about processing fluency, applicability, and dependent variables. The study took an average of 10.41 minutes to complete ($SD = 3.78$).

Stimulus Materials

Before creating the stimulus materials (see full messages in Appendix A at <https://osf.io/t4ahf>), we obtained information about the risks of sun exposure and skin cancer from sources such as the Centers for Disease Control and Prevention, American Cancer Society, and Surgeon General. The information was modified according to the manipulations described below and sources of information were removed to avoid potential bias.

Language Difficulty

To target the mechanism of accessibility, we designed an equivalency frame that manipulated language difficulty. Participants were randomly assigned to view the information

about sun exposure and skin cancer in either an easy language ($n = 264$) or difficult language ($n = 265$) condition. In the difficult language conditions, the information included jargon (e.g., “Radiation from tanning”), whereas in the easy language conditions, jargon was replaced with easier synonyms (e.g., “Light from tanning”).

Message Relevance

We manipulated message relevance to target the mechanism of applicability. Participants were randomly assigned to low ($n = 266$) or high ($n = 263$) relevance. Message relevance was manipulated by changing the message’s referent group. In the low message relevance conditions, the message’s referent group was older adults in the South (i.e. “Older adults who live in the South are especially likely to tan”). In the high message relevance conditions, the message’s referent group was female college students in the Midwest (i.e., “Female college students at Ohio State are especially likely to tan”).

Measures

All measures were Likert scales from 1 to 7, where higher scores reflect stronger agreement with the concept being measured.

Mediating Variables

After exposure to the message, participants responded to five questions assessing their *processing fluency* (Shulman & Sweitzer, 2018b), which were averaged to form a single scale ($M = 5.62$, $SD = 1.07$, $\alpha = .83$). Sample items included “It was easy for me to understand the information presented.” Next, participants responded to four questions to judge the *perceived relevance* of the message, which were averaged to form a single scale ($M = 4.90$, $SD = 1.38$, $\alpha = .88$). Sample items included “The message I read was meant for someone like me.”

Outcome Variables

Beliefs about *severity* were measured by averaging four items ($M = 5.48$, $SD = 0.95$, $\alpha = .79$), including “The health risks of tanning are severe” (Greene et al., 2010). Beliefs about *susceptibility* were measured with five items ($M = 4.55$, $SD = 1.11$, $\alpha = .72$), including “I am worried about developing skin cancer because of my tanning behavior” (Mays et al., 2017). *Behavioral intentions* were measured with three items ($M = 4.25$, $SD = 2.11$, $\alpha = .97$) such as “I will tan in the next twelve months” (Sontag & Noar, 2017).

Analysis Plan

Our analysis plan was first to conduct a manipulation check to ensure that our language difficulty and message relevance conditions successfully induced variance in processing fluency and perceived relevance. In the manipulation check, we also included potentially relevant covariates of race and previous tanning behavior, as prior studies suggest that both can exert significant influences on tanning attitudes and behaviors (Daniel et al., 2018). Race was binarily coded (White; non-white) and the number of times that an individual had tanned in the previous year was included as a continuous variable. Following the results of the manipulation check, we then tested our hypotheses. The first hypothesis was tested

using Model 4 of the PROCESS macro for SPSS, and the second was tested using Model 6 (Hayes, 2013). Separate models were run for each of our dependent variables. Consistent results across our three related outcome measures serve as a demonstration of the robustness of our findings.

Results

Manipulation Check

To ensure our message manipulations had the intended effects on accessibility and applicability, we conducted a two-way MANCOVA, where language difficulty (easy, difficult) and message relevance (low, high) were fixed factors, self-reported processing fluency and perceived relevance were dependent variables, and race and previous tanning behavior were covariates. Race did not meaningfully affect the mediating variables of processing fluency ($F(1, 290) = 0.19, p = .66$) and perceived relevance ($F(1, 290) = 1.62, p = .20$), nor did previous tanning behavior affect processing fluency ($F(1, 290) = 0.98, p = .32$) or perceived relevance ($F(1, 290) = 3.21, p = .07$). Because the covariates did not significantly impact the results of our manipulation check, they were not included in subsequent analyses. Language difficulty significantly affected processing fluency, $F(1,525) = 72.15, p < .001, \eta^2 = .14$, such that those in the easy language condition reported higher processing fluency ($M = 6.00, SE = 0.06$) than those in the difficult condition ($M = 5.25, SE = 0.06$). Similarly, message relevance significantly affected perceived relevance, $F(1,525) = 54.10, p < .001, \eta^2 = .05$, such that those in the high message relevance condition reported greater perceived relevance ($M = 5.32, SE = 0.08$) than those in the low relevance condition ($M = 4.48, SE = 0.08$). There was one significant interaction effect observed between language condition and message relevance on self-reported processing fluency, $F(1,525) = 4.43, p = .04, \eta^2 = .007$. Under conditions of difficult language, high message relevance *increased* processing fluency ($M = 5.36, SE = 0.09$) relative to low message relevance ($M = 5.15, SE = 0.09$), and under conditions of easy language, high message relevance *decreased* processing fluency ($M = 5.92, SE = 0.09$) relative to low message relevance ($M = 6.08, SE = 0.09$). We interpret this finding further in the Discussion section and report descriptive statistics by condition in Table 1.

Hypothesis Tests

The first hypothesis predicted that the easy language condition would increase processing fluency, which would mediate the relationship between language condition and beliefs about severity, susceptibility, and behavioral intentions. This hypothesis was tested using Model 4 of the PROCESS macro for SPSS (Hayes, 2013, 95% bias-corrected bootstrap CIs based on 5,000 resamples). Three separate models were tested, one for each of the

Table 1. Descriptive statistics for all dependent variables by language difficulty and relevance condition.

	High Relevance			Low relevance			Language difficulty totals		
	Sev. <i>M</i> (<i>SE</i>)	Susc. <i>M</i> (<i>SE</i>)	Behave. <i>M</i> (<i>SE</i>)	Sev. <i>M</i> (<i>SE</i>)	Susc. <i>M</i> (<i>SE</i>)	Behave. <i>M</i> (<i>SE</i>)	Sev. <i>M</i> (<i>SE</i>)	Susc. <i>M</i> (<i>SE</i>)	Behave. <i>M</i> (<i>SE</i>)
Easy language	5.56 (.08)	4.72 (.10)	4.54 (.19)	5.56 (.08)	4.54 (.10)	4.14 (.18)	5.55 (.06)	4.63 (.07)	4.33 (.13)
Difficult language	5.47 (.08)	4.63 (.10)	4.10 (.18)	5.37 (.08)	4.32 (.10)	4.22 (.18)	5.42 (.06)	4.48 (.07)	4.17 (.13)
Relevance totals	5.51 (.06)	4.67 (.07)	4.32 (.13)	5.46 (.06)	4.43 (.07)	4.19 (.13)	5.49 (.04)	4.55 (.05)	4.23 (.09)

dependent variables. For each test, significant indirect effects were obtained such that the easy language condition significantly increased processing fluency (Path 1: $B = 0.73$, $SE = 0.09$, $p < .001$, 95% CI [.56, .91], $R^2 = .12$), which, in turn, increased beliefs about severity (Path 2: $B = 0.35$, $SE = 0.04$, $p < .001$, 95% CI [.28, .43], $R^2 = .15$) susceptibility (Path 2: $B = 0.15$, $SE = 0.05$, $p = .002$, 95% CI [.05, .24], $R^2 = .02$), and behavioral intentions (Path 2: $B = 0.51$, $SE = 0.09$, $p < .001$, 95% CI [.33, .68], $R^2 = .06$). Thus, the easy language condition increased processing fluency, which led to greater frame-consistent attitudes, consistent with H1. Together, all three analyses offered support for the mechanism of accessibility within framing effects.

The second hypothesis predicted that the effects of frame condition on outcomes would be through linked through the mediators of accessibility and applicability. This hypothesis was tested using Model 6 of the PROCESS macro for SPSS (Hayes, 2013, 95% bias-corrected bootstrap CIs based on 5,000 resamples, see Figure 2). In this test, frame condition was included as a categorical predictor (with four levels) and processing fluency and applicability were included as serial mediators. A separate model was run for beliefs about severity, susceptibility, and behavioral intentions. Figure 2 represents these models and includes labels that correspond to each of the paths estimated in Table 2. For beliefs about severity, susceptibility, and behavioral intentions, significant indirect effects in the predicted direction were obtained, such that the frame produced more message-consistent effects through the serial mediators of processing fluency and applicability. This support for H2 suggests that the framing effects we observed occurred through processing fluency and applicability, both of which led to greater frame-consistent perceptions. This finding was the strongest for the easy language, high relevance condition relative to the other three conditions. This finding provides empirical support for the serial roles of accessibility and applicability in generating framing effects.

Discussion

The purpose of this experiment was to test the serial mediation model of framing theory within a context of practical importance, outdoor tanning. Before a discussion of the theoretical contributions, this pursuit is practically important because rates of skin cancer are increasing among young women, such as the participants in our sample, and most cases are linked to excess exposure to UV radiation (Muzic et al., 2017). Theoretically, this study advances framing theory by offering new ways to think about frames (as language complexity and message relevance), and testing these frames using measures of the cognitive mechanisms proposed by framing theory. More specifically, framing theory suggests that

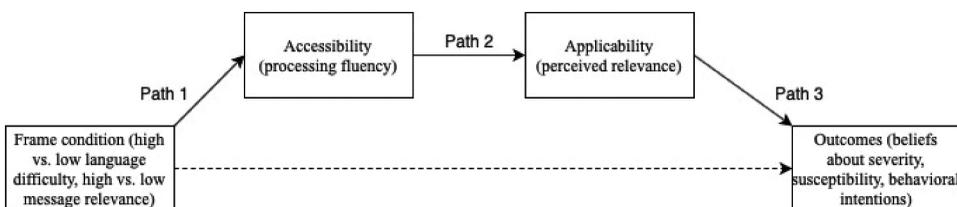


Figure 2. Model 6 from PROCESS to test hypothesis 2. *Note:* Indirect effects are calculated as the product of paths 1, 2, and 3.

Table 2. Results from the serial mediation analyses for hypothesis 2.

Outcomes	Frame condition	Path 1 <i>B</i> (<i>SE</i>)	Path 2 <i>B</i> (<i>SE</i>)	Path 3 <i>B</i> (<i>SE</i>)	<i>R</i> ²	Indirect Effect <i>B</i> (<i>SE</i>)	95% CI LL, UL
Severity	High processing fluency, high applicability	.77 (.12) ***	.37 (.05) ***	.13 (.03) ***	.18	.04 (.01)	.02–.07
	Low processing fluency, high applicability	.21 (.12)	.37 (.05) ***	.13 (.03) ***		.01 (.01)	–.003–.03
	High processing fluency, low applicability	.93 (.12) ***	.37 (.05) ***	.13 (.03) ***		.05 (.02)	.02–.08
Susceptibility	High processing fluency, high applicability	.80 (.12) ***	.37 (.05) ***	.34 (.03) ***	.19	.10 (.02)	.06–.15
	Low processing fluency, high applicability	.22 (.12)	.37 (.05) ***	.34 (.03) ***		.03 (.02)	–.007–.06
	High processing fluency, low applicability	.93 (.12) ***	.37 (.05) ***	.34 (.03) ***		.12 (.03)	.07–.18
Behavioral Intentions	High processing fluency, high applicability	.77 (.12) ***	.37 (.05) ***	.63 (.06) ***	.20	.18 (.04)	.11–.27
	Low processing fluency, high applicability	.21 (.12)	.37 (.05) ***	.63 (.06) ***		.05 (.03)	–.02–.32
	High processing fluency, low applicability	.93 (.12) ***	.37 (.05) ***	.63 (.06) ***		.22 (.05)	.13–.32

Path 1 denotes the path coefficient between the frame condition and processing fluency. As this is a multicategorical predictor, the low processing fluency, low applicability frame condition was used as the indicator variable. Guided by Hayes (2013), this condition was used as the reference group because it resulted in the lowest values for each variable; thus, each other condition represents an increase relative to the reference group. Path 2 denotes the relationship between processing fluency (higher scores = easier experience) and applicability, and is the same for all models. Path 3 indicates the relationship between applicability and outcomes (Figure 2). All models were run using Model 6 (Hayes, 2013), 95% bias-corrected bootstrap CIs based on 5,000 resamples. Non-zero indirect effects indicate support for the serial mediation model hypothesized.

****p* < .001.

the relationship between exposure to a frame and its influence on attitudes and behaviors is mediated by a series of cognitive processes that must be sequentially triggered for a framing effect to occur. In this article, we examined these relationships to test the underlying processes that lead to framing effects. Notably, testing framing theory in this way follows recommendations (see Cacciatore et al., 2016) to offer theoretical improvement in framing research. Thus, by answering this call, this work hopes to improve our understanding and usage of framing theory, and, in doing so, offers the opportunity to design and deploy more reliably persuasive messages.

The results obtained for the mediation models offer support for framing theory and represent the first, to our knowledge, empirical test of the theory's serial model. Specifically, we found that accessibility and applicability serially mediated the relationship between frame exposure and persuasive outcomes. Indeed, our results for H1 and H2 provide robust message-consistent support across three persuasive outcomes including beliefs about severity, susceptibility, and behavioral intentions. Moreover, all three models predicted between 18% and 20% of the variance, which are illustrative of large effects in general (Cohen, 1992), but are also much larger than typical framing work within health communication (e.g., O'Keefe, 2009). Taken together, this evidence suggests that designing frames that improve accessibility and applicability is a promising direction for future campaigns. Importantly, while the present study operationalized accessibility and applicability through language difficulty and message relevance, respectively, our focus on psychological states implies that any message design strategy that invokes these processes will produce similar results.

In addition to testing framing theory as a whole, our experimental design also uniquely allowed for an in-depth look at the distinct contributions of accessibility and applicability. Recall that accessibility, operationalized through processing fluency, was manipulated using a language difficulty equivalency frame, and applicability was operationalized through message relevance. When comparing these message manipulations, our findings reveal that processing fluency was a stronger predictor of frame-consistent outcomes than applicability. For example, when applicability was high, but processing fluency was low, framing effects became non-significant. These initial findings suggest that message designers should prioritize making a message feel easier to process, and language difficulty offers one promising strategy for doing so, although there are many others (see Shulman & Bullock, 2019, for an overview). These findings also lend support to framing theory's proposition that accessibility must be accomplished before individuals consider applicability.

Interestingly, we identified an unanticipated interaction effect between language difficulty and message relevance such that the effect of language difficulty on processing fluency was conditional on the perceived relevance of the message. When the language was difficult, perceived relevance increased processing fluency, but when language was easy, perceived relevance decreased processing fluency. One possible explanation for this result is defensive processing: When a message is easy to understand and threatening to one's health, individuals are more likely to engage in reactance and counterarguing (Richards & Banas, 2015). Although our results support this explanation, it would be interesting to see if this finding replicates.

Limitations and Recommendations for Future Research

These results are qualified by some limitations. Theoretically, we tested framing theory in the context of individual persuasive effects, but it would be interesting to see if the serial model holds for collective attitudes and public opinion as well. Methodologically, we limited our messages to addressing outdoor tanning behavior due to the time of year in which we collected our data (summer in the Midwest), but there is a wealth of literature suggesting that indoor tanning represents a significant threat to young women's risk for skin cancer as well. Future research should examine if our findings generalize to indoor tanning health messages. Another limitation is that our study exposed participants to only one message. Future studies should consider using multiple messages or multiple iterations of messages to ensure more broad applicability of this work.

There are also limitations to our measures. First, our outcomes of severity, susceptibility, and behavioral intentions asked generally about tanning, rather than specifically about outdoor tanning. Due to the differences between indoor and outdoor tanning behavior, this is an important limitation to acknowledge. Additionally, our study measured behavioral intentions rather than observing or conducting follow-up studies related to overt behaviors, limiting our ability to make predictions about actual tanning behavior following message exposure. Future research should consider including behavioral measures or multiple waves of data collection to better understand the effects of message frames on tanning behaviors.

Additionally, as is true of most experimental work, the benefits of isolating the mechanisms of interest come at the cost of any claims about broad generalizability. As a result, questions about whether these processes are moderated by specific individual differences or would replicate with a different population admittedly cannot be addressed with this design

but should be the focus of future research. However, despite these shortcomings, the fact that the target audience for tanning interventions in the real-world is White, college-aged females, our study findings do offer more ecological evidence than is typical of many experimental designs with college samples. Finally, we acknowledge that although we opted to use the PROCESS macro for SPSS to run our analyses of moderated mediation, an SEM approach may have been better suited to address the intercorrelations between our endogenous variables.

Despite these limitations, the results from this experiment pose interesting implications for communication scholars and practitioners. Communicators using framing theory should consider the following questions as they design messages: Is the information being framed *available* among the target population? How can the designed message make the desired information *easily accessible* in memory? How can messages be crafted to produce an easier processing experience? And lastly, how can this message maximize *applicability*? Considering these psychological factors and incorporating them into message design can facilitate persuasion both at the individual-level and perhaps at the collective-level as well. Taken together, our study finds that linking message design to psychological states illuminates understanding of why a message is persuasive and, in doing so, can inform how to design more effective messages.

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Disclosure Statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Olivia M. Bullock is a Ph.D. candidate in the School of Communication at The Ohio State University.

Hillary C. Shulman is an Assistant Professor in the School of Communication at The Ohio State University.

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