The Influence of Framed Messages and Self-Affirmation on Indoor Tanning Behavioral Intentions among 18 to 30 Year Old Women

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Abstract

Objective—To investigate the effects of gain- and loss-framed indoor tanning (IT) prevention messages among young adult women, and examine the potential moderating effect of self-affirmation.

Methods—Young adult women ages 18 to 30 who reported IT at least once in the past year ($n =$ 475) participated in an online experiment. Participants first completed assessments of IT behavior and related constructs and were randomized to either a self-affirmation manipulation or control condition. Then, participants were randomized to either a gain-framed message emphasizing the benefits of avoiding IT or a loss-framed message emphasizing the risks of IT. Participants completed outcome measures of intentions to IT, intentions to quit IT, and emotional and cognitive responses to the framed messages.

Results—Compared with gain-framed messages, loss-framed messages led to weaker intentions to IT and stronger intentions to quit IT. Self-affirmation did not moderate message framing effects, but had a main effect increasing intentions to IT. Mediation analyses indicate that loss-framed messages affect IT behavioral intentions by increasing fear and self-affirmation may have increased intentions to IT by producing defensive reactions to the framed messages.

Conclusions—Loss-framed messages were more effective for reducing intentions to IT and promoting intentions to quit IT among young women after a brief exposure, and emotional response appears to be one pathway through which loss-framed messages affect behavioral outcomes. Messages emphasizing the risks of IT may be optimal as a public health intervention strategy. Unlike other behavioral domains, self-affirmation did not reduce defensive processing of loss-framed messages.

Keywords

indoor tanning; message framing; self-affirmation; skin cancer prevention

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Introduction

Skin cancer is the most common malignancy in the United States, with an estimated 3.5 million cases of non-melanoma skin cancer (NMSC) and more than 75,000 cases of melanoma diagnosed each year, and the incidence is increasing (U.S. Department of Health & Human Services [USDHHS], 2014). Indoor tanning (IT) increases the lifetime risk of NMSC and melanoma (Wehner et al., 2012; Boniol, Autier, Boyle, & Gandini, 2012) and in the U.S. more than 380,000 annual cases of skin cancer are attributable to IT (Wehner et al, 2014). Among U.S. adults the prevalence of IT is highest among young adult, non-Hispanic white women, with nearly 30% tanning in the past year (Guy, Berkowitz, Watson, & Holman, 2013). IT before age 30 and more frequent IT further increase skin cancer risks (Wehner et al., 2012; Boniol, Autier, Boyle, & Gandini, 2012), making IT among young women a major concern for skin cancer prevention.

The U.S. Surgeon General's *Call to Action to Prevent Skin Cancer* highlighted the need for research to understand how to design public health messages to prevent and reduce IT among young women (USDHHS, 2014). In line with this goal, this study investigated the effects of framing IT prevention messages to emphasize either the risks of IT (i.e., loss-framed) or the benefits of avoiding IT (i.e., gain-framed) and the impact of self-affirmation on responses to gain- and loss-framed IT prevention messages. The concept of message framing is an important strategy in health promotion, but research on how to optimally frame IT prevention messages is scarce. Evidence also shows that self-affirmation can reduce defensive responses to threatening health messages and could be used to enhance their impact, but this has not been examined for IT prevention messages. This study also investigated whether self-affirmation moderated indoor tanning message framing effects.

Message Framing

Based on Prospect Theory (Tversky & Kahneman, 1981), some researchers argue that framing health messages around the costs of engaging in a risky behavior (i.e., loss-framed) or the benefits of avoiding a risky behavior (i.e., gain-framed) influences behavioral outcomes (Rothman, Salovey, Antone, Keough, & Martin, 1993). This framing hypothesis has been tested in studies across a range of behavioral contexts and the evidence generally suggests that gain-framed messages are more effective for motivating avoidance of risky behaviors (Gallagher & Updegraff, 2012; O'Keefe & Jensen, 2007, 2009). Although meta-analyses tend to demonstrate message framing effects that are consistent with this hypothesis, the effect sizes are small and framing effects consistent with the hypothesis do not always emerge (Gallagher & Updegraff, 2012; O'Keefe & Jensen, 2007, 2009).

Evidence of the effects of gain- and loss-framed messages for skin cancer preventive behaviors is especially mixed. Some studies favor gain-framed messages (e.g., Detweiler, Bedell, Salovey, Pronin, & Rothman, 1993), while some favor loss-framed messages (e.g., Thomas et al., 2011). Other studies show no distinct advantage of either gain- or loss-framed messages, instead demonstrating that message framing effects are moderated by various individual-level factors (e.g., Van't Riet, Ruiter, Werrij, & De Vries, 2010). Meta-analyses generally reflect these mixed results (Gallagher & Updegraff, 2012; O'Keefe & Wu, 2012). However, prior studies have focused primarily on behaviors to reduce sun exposure (e.g.,

seeking shade, using sunscreen) and research investigating the effects of gain- and loss-framed messages for preventing IT is scarce (Mays & Tercyak, In Press). Given these inconsistent findings, and the very limited research on message framing effects for preventing IT, this study examined the effects of gain- and loss-framed IT prevention messages.

Self-Affirmation

A common problem with public health messages about risky behaviors such as IT is defensive responses, or the tendency to reject messages because they are perceived to be threatening (van't Riet & Ruiter, 2013). There is evidence that loss-framed messages produce greater perceived threat than gain-framed messages, eliciting defensive responses (Shen & Dillard, 2007). Self-affirmation is a potential strategy to thwart defensive responses to health messages. According to Self-Affirmation Theory, people need to maintain a favorable sense of self and exercises to affirm the global sense of self can increase tolerance of subsequent threats (Sherman & Cohen, 2006). For health messages, self-affirmation in unrelated domains could reduce defensive responses to messages about a risky behavior such as IT because the global sense of self is reinforced by positive self-related thoughts and feelings prior to message receipt.

Studies have demonstrated positive effects of self-affirmation on responses to messages about risky behaviors (Harris, Mayle, Mabbott, & Napper, 2007; Sherman, Nelson, & Steele, 2000), and a recent meta-analysis confirmed these findings (Epton, Harris, Kane, von Kohingsbruggen, & Sheeren, 2014). However, research on the effect of self-affirmation on skin cancer prevention messages is very limited. One study found self-affirmation to produce less defensive processing of the risk information in a sunscreen promotion message (Jessop, Simmonds, & Sparks, 2009), and another study found that self-affirmation reduced defensive reactions to personalized visual feedback about skin cancer risks among those with high behavioral risk status (Schüz, Schüz, & Eid, 2013). Another study found that self-affirmation increased message acceptance in response to messages about the risks of sun exposure (Good & Abraham, 2011).

Self-affirmation may be an especially important strategy to reduce defensiveness to messages to prevent and reduce IT because IT is closely related to the sense of self that self-affirmation seeks to protect. Improving physical appearance, beliefs in how others perceive physical appearance, and positive psychological rewards are common motives that young women endorse for IT (Heckman, Wilson, & Ingersoll, 2009; Holman & Watson, 2013). Young women who IT, thus, may exhibit defensiveness when encountering loss-framed messages emphasizing the risks associated with IT. Consequently, self-affirmation ought to be particularly useful in the context of IT prevention messaging as a strategy to thwart potential defensive reactions. .

An emerging line of research has examined whether self-affirmation manipulations moderate the effects of gain- and loss-framed messages. For example, in a recent study of anti-smoking messages self-affirmation reduced defensive processing to loss-framed messages and increased defensiveness towards gain-framed messages (Zhao & Nan, 2010). The latter finding raises questions about how self-affirmation may influence the effects of gain-framed

messages. No study has examined the effect of self-affirmation on message framing in IT prevention. Another goal of this study was to extend this line of research by examining the moderating effect of self-affirmation on gain- and loss-framed IT prevention messages.

Methods

Participants

Participants were recruited in December 2014 through Amazon Mechanical Turk (AMT). AMT is a crowdsourcing Internet marketplace designed to efficiently gather data from a large group of respondents at a low cost, and recent studies demonstrate its validity for behavioral science research (Crump, McDonnel, & Gureckis, 2013; Mays & Tercyak, 2015).

After reading a brief description of the study, AMT members residing in the U.S. who were interested in participating reviewed a complete study description, including a link to an online consent form and eligibility screening questions. Eligible participants were women between 18 and 30 years of age who identified as non-Hispanic white race/ethnicity and reported IT at least once in the past year. Due to the low prevalence of IT among men at the population level, men were excluded from participation. AMT members who screened as eligible and provided informed consent proceeded to the online experiment. Participants completing all study procedures were provided with a small monetary credit ($1.00) through AMT. The Georgetown University Institutional Review Board approved the study protocol.

A priori sample size calculations to determine sampling targets indicated 400 participants would provide 80% power to detect small to medium mean differences in the continuous outcome variables (Cohen's $f^2 = .15$) across the experimental conditions. This effect size is consistent with similar studies of self-affirmation and message framing manipulations (e.g., Mays & Tercyak, 2015; Epton et al., 2014).

Procedures

The experiment was a two (self-affirmation or control) by two (gain- or loss-framed message) between-subjects factorial design. After completing measures of IT behaviors and related constructs, participants were randomized to either the self-affirmation or control condition and to view either a gain- or loss-framed IT message. Then, participants completed outcome measures of behavioral intentions and their cognitive and emotional responses to the framed messages. All measures used items that were validated in prior research, including studies examining the effects of self-affirmation and message framing on related cancer risk behaviors (Mays, et al., 2014; Mays & Tercyak, 2015; Zhao & Nan, 2010). Outcome measures of behavioral intentions were similar to assessments of intentions to IT and intentions to quit IT administered before participants viewed the messages but were slightly adapted to avoid habituation that may occur due to the short timeframe of the experiment (Mays et al., 2014). On average, participants took 8.3 minutes ($SD = 7.5$) to complete study procedures.

Self-Affirmation Manipulation—Participants randomized to the self-affirmation condition ranked a list of five values based on their personal importance: kindness, honesty, generosity, independence, and success. Then, participants were asked to think about the

value they ranked as most important and to write down the reasons it was important to them and a personal experience where the value proved important and made them feel good about themselves. This type of self-affirmation manipulation has been shown to be effective in a number of previous studies (McQueen & Klein, 2006). Participants in the control condition were asked to complete a similar exercise by ranking five fruits in order of their preference (Cohen, Aronson, & Steele, 2000). Then, they were asked to think about the fruit they ranked third, to describe what they liked and disliked about the fruit and to describe their last experience eating that fruit.

Framed Messages—The experimental messages were developed and evaluated in a prior study. They were designed to convey well-documented skin cancer risks associated with indoor tanning (USDHHS, 2014) and based on existing skin cancer prevention research (McWhirter & Hoffman-Goetz, 2013) and behavioral theory (Rothman et al., 1993; Tversky & Kahneman, 1981; Witte & Allen, 2000). Draft messages were pre-tested in cognitive interviews with young women from the target population and revised based on their feedback (Mays & Tercyak, 2015). Then, their impact on IT intentions was examined relative to a text-control message in a within-subjects experiment with strong evidence of a successful message framing manipulation (Mays & Tercyak, 2015). Based on the findings, the loss-framed message used for this experiment displayed an image of a young woman's face after surgery to remove a cancerous lesion and included text conveying the risks of IT. The gain-framed message displayed an image of the face of a woman with healthy skin and used text conveying the benefits of avoiding IT. Other message features were consistent across conditions. Messages tested are provided in the online Supplemental Materials.

Measures

Covariates—Demographics assessed included age, household income, and whether participants were current students. Past year IT was measured using an item from epidemiological surveys, with frequent IT defined using binary variable indicating IT 10 times in the past year (Guy et al., 2013). Five items assessed IT attitudes by capturing participants' agreement that tanning makes them look more attractive, look younger, look thinner, makes other people find them attractive, and hides skin flaws and blemishes based on a five-point scale (1= strongly disagree, 5 = strongly agree) (Hillhouse, Turrisi, Stapelton, & Robinson, 2008). Responses were summed to create a score with higher values indicating more favorable IT attitudes (Cronbach's α = 0.84). Perceived risks of tanning were measured using four items with a five-point response scale (1= strongly disagree, 5 = strongly agree) capturing participants' agreement that IT can lead to premature skin aging, harms the appearance of skin, increases the skin cancer risks, and is harmful to health (Stapelton, Turrisi, Hillhouse, Robinson, & Abar, 2010). Responses were summed to create a score with higher values indicating greater perceived risks (Cronbach's α = 0.93). Intentions to IT and intentions to quit IT in the next year were measured with a single item for each construct (Mays & Tercyak, 2015). Responses were based on a seven-point scale with higher values indicating stronger intentions.

Message Response—We drew from health communication literature to assess emotional and cognitive response to the messages. Fear response was captured using three items from

prior research assessing whether participants felt frightened, anxious, or nervous while reading the message (Dillard & Shen, 2005). Responses were based on a four-point scale (1=not at all, 4=extremely) and were averaged to create a score with higher values indicating stronger fear responses (Cronbach's α = 0.88). Perceived message strength was measured using an adapted seven item scale (Zhao & Nan, 2010). Examples items include "The message was convincing," "The message said something important to me," and "The message gave me a good reason not to tan indoors." Participants rated these statements on a seven-point scale (1= strongly disagree, 7 = strongly agree) and responses were averaged to generate a summary score with higher values indicating greater perceived message strength (Cronbach's α = .92). Participants also indicated the extent to which they thought the message was "exaggerated," "boring," "overblown," and "tried to manipulate my feelings" to assess message derogation (Zhao & Nan, 2010). Responses were based on a seven-point scale (1 = strongly disagree, 7 = strongly agree) and were averaged to create a score with higher values indicating greater message derogation (Cronbach's α = .76).

Primary Outcome Measures—Since behavior change outcomes could not be captured prospectively, cognitive intentions were selected as an indicator of future behavior change (Webb & Sheeran, 2006). After viewing the framed messages, intentions to IT were captured using two items assessing intentions to tan even once and intentions to tan regularly in the next year based on a scale ranging from 1 definitely will not to 7 definitely will. The items were averaged to create a summary score ($r = .70$, $p < .001$). Intentions to quit IT were measured using a single item assessing how much the message made participants want to avoid IT in the next year using a seven-point response scale (1= not at all, 7= a lot).

Statistical Analyses

Associations between covariates measured prior to the experimental exposure and outcome variables were examined using bivariate tests (i.e., *t* tests, Pearson's *r*). Bivariate analyses were also used to test for differences in all variables of interest across the experimental conditions. Analysis of covariance (ANCOVA) was used to test for differences in the behavioral intentions and message response outcome variables based on the experimental conditions. Separate ANCOVAs were created for each outcome variable. Intentions to IT and intentions to quit IT measured prior to the experimental exposure were used as covariates in ANCOVAs examining these outcomes; other variables measured prior to the experimental exposure that were associated with outcomes in bivariate analyses ($p < .05$) were also included as covariates. Pair-wise differences in least square means for each outcome variable were inspected, adjusting for multiple comparisons using Tukey's post-hoc correction where appropriate.

Persuasion research indicates that emotional and cognitive message responses mediate the effect of message manipulations on behavioral outcomes (Dillard, Weber, & Vail, 2007). Ancillary mediation analyses were conducted to estimate the direct and indirect effects of experimental conditions on behavioral intentions through message response variables as mediators, with appropriate adjustment for covariates. Indirect effects were tested using a bias-corrected bootstrapping approach with 1,000 resamples to address non-normality in the product of coefficients (Preacher & Hayes, 2008). Asymmetric 95% confidence intervals

around the estimates that do not include zero indicate statistically significant indirect effects (Preacher & Hayes, 2008). Mediation analyses were conducted using Mplus 7.1 (Los Angeles, CA); all other analyses were conducted using SAS 9.3 (Cary, North Carolina).

Results

Participants

Participant characteristics and descriptive statistics for all measures are shown in Table 1. Participants averaged 24.7 years of age ($SD = 3.2$), 40.8% were college/university students, and 66.1% reported an annual income $50,000. Nearly 40% of participants were frequent indoor tanners. There were no significant differences in participant characteristics by experimental conditions, indicating successful randomization.

Bivariate Results

In bivariate analyses, the outcome measure of intentions to IT was associated with pre-exposure measures of frequent IT ($M = 5.0$ $SD = 1.5$ frequent tanners, $M = 3.2$ $SD = 1.7$ infrequent tanners, $p < .001$), IT attitudes ($r = 0.36$, $p < .001$), perceived risks ($r = -0.27$, $p < .001$), and intentions to IT ($r = 0.68$, $p < .001$). The outcome measure of intentions to quit IT was associated with pre-exposure measures of frequent IT ($M = 4.0$ $SD = 1.7$ frequent tanners, $M = 4.7$ $SD = 1.9$ infrequent tanners, $p < .001$), IT attitudes ($r = -0.13$, $p = .004$), perceived risks ($r = 0.33$, $p < .001$), and quit intentions ($r = 0.45$, $p < .001$). These variables were used as covariates in subsequent analyses.

Analysis of Covariance (ANCOVA) Results

Results of the ANCOVA adjusting for covariates and examining differences in the outcome measure for intentions to IT by experimental condition are shown in Table 2. There were statistically significant main effects for message framing and self-affirmation, but the interaction was not significant. Intentions to IT were significantly associated with all covariates (Table 2). Pair-wise tests of least-square mean differences in intentions to IT are shown in Table 3. After covariate adjustment, participants randomized to the loss-framed message reported weaker intentions to IT than participants randomized the gain-framed message ($p = .008$). Participants randomized to the self-affirmation condition reported stronger intentions to IT than the control condition ($p = .007$).

Results of the ANCOVA examining differences in the outcome measure for intentions to quit IT by experimental condition are also shown in Table 2. There was a statistically significant main effect for message framing; the main effect for self-affirmation and the interaction were not significant. The intentions to quit outcome was associated with intentions to quit and perceived risks measured before the experimental manipulation (Table 2). Pair-wise tests for mean differences in the outcome measure for intentions to quit IT by the experimental conditions are shown in Table 3. Participants randomized to the loss-framed message reported stronger intentions to quit compared to participants randomized to the gain-framed message ($p < .001$).

ANCOVA results for message response variables are shown in Table 2. There were significant main effects for message framing on emotional response and perceived message strength. Participants randomized to the loss-framed message reported significantly greater emotional response ($p < .001$) and perceived message strength ($p < .001$) than the gain-framed message (Table 3). Participants randomized to the loss-framed messages reported greater perceived message derogation, but this difference only approached statistical significance ($p = .087$) (Table 3). There was a statistically significant main effect of self-affirmation on message derogation (Table 2). Participants randomized to the self-affirmation condition reported stronger message derogation than the control condition ($p = .032$) (Table 3). The participants in the self-affirmation condition also reported greater perceived message strength than the control condition, but this difference only approached conventional statistical significance ($p = .076$) (Table 3).

Mediation Analysis Results

Mediation analysis results are shown in Table 4. In the model for intentions to IT adjusting for covariates, the direct effects of self-affirmation (B = 0.28, 95% CI −0.02, 0.56) and message framing (B = −0.05, 95% CI −0.37, 0.28) were no longer significant. There was a significant indirect effect of message framing via emotional response (B = −0.11, 95% CI −0.23, −0.04), indicating the observed effect of loss-framed messages on intentions to IT was mediated by greater emotional response. There was also a significant indirect effect of self-affirmation via perceived message strength (B = 0.08, 95% CI 0.01, 0.18). These findings indicate that self-affirmation led to lower perceived argument strength, in turn producing greater IT intentions.

In the model examining the outcome variable for intentions to quit adjusting for covariates, the direct effect of message framing on intentions to quit was no longer significant (B = 0.16, 95% CI = −0.16, 0.51), but there was a significant indirect effect of message framing on intentions to quit through emotional response (B = 0.20, 95% CI = 0.10, 0.35). There were no significant direct or indirect effects for self-affirmation (Table 4). This indicates the effect of loss-framed messages on intentions to quit IT was mediated by greater emotional response.

Discussion

This study is among the first to examine the impact of gain- and loss-framed IT prevention messages among young adult women and to investigate the potential moderating effect of self-affirmation. Compared with gain-framed messages, loss-framed messages produced significantly lower intentions to IT and significantly greater intentions to quit IT, and the effect of loss-framed messages occurred via a stronger emotional response. Self-affirmation did not moderate the message framing effect, but increased young adult women's intentions to tan and may have done so by producing greater message derogation and decreasing perceived strength of IT prevention messages, independent of their framing. These findings have implications for developing persuasive public health communications to prevent indoor tanning and reduce skin cancer risks among young women, and suggest important directions for future research.

Research on framing effects for skin cancer prevention messages has produced inconsistent results, likely because these studies have been conducted among diverse populations (e.g., adolescents, adults) and have targeted behaviors requiring varying levels of effort, motivation, and vigilance to accomplish (e.g., sunscreen use, seeking shade)(Gallagher & Updegraff, 2012; O'Keefe & Wu 2012). Our finding that loss-framed messages produce lower intentions to IT and greater intentions to quit IT compared with gain-framed messages is consistent with evidence indicating that persuasive messages conveying the risks of UV exposure using vivid imagery affect beliefs about skin cancer prevention and promote risk-reducing behavior (Mays & Tercyak, 2015; McWhirter & Hoffman-Goetz, 2013).

This work complements and extends this line of research by adding to the evidence that loss-framed messages conveying the risks associated with indoor tanning may be optimal for preventing and reducing IT. These findings are important in light of recent call for research to determine how to optimally design public health messages to lower skin cancer risks where preventing and reducing IT is a central goal (USDHHS, 2014). Such public health messages are an important intervention strategy targeting young adult women who IT because IT prevention policies often focus exclusively on minors under 18 years of age and do not reach this high-risk group. Public health efforts applying the findings could deploy IT prevention messages in settings where young adult women can be readily reached, such as on college campuses, or by requiring stronger risk communications in IT retail outlets (Mays & Tercyak, 2015).

The findings also indicate that negative emotional response is a potential pathway through which loss-framed IT prevention messages operate. This is consistent with research on other cancer risk behaviors, such as tobacco use. Messages warning about the health risks of tobacco use through text and graphic imagery have been shown to impact behavioral outcomes, due in part to the fact that they elicit a strong emotional reaction (Emery, Romer, Sheerin, Jamieson, & Peters, 2014). Other potential mediating pathways not examined in this study may include perceived risks of IT and perceived benefits of avoiding or quitting IT, which could be examined in future studies. Additionally, message framing effects could be moderated by individual-level factors such as demographics (e.g., age), IT frequency/intensity, and other relevant constructs. Although this study was not sufficiently powered to test such moderation hypotheses, this is another important avenue for future research. In summary, these results provide a foundation of evidence on which to develop high-impact IT prevention messages targeting young adult women and suggest potential avenues for future research to further refine these messages.

The study hypothesized that self-affirmation would reduce message resistance and enhance intentions for positive behavioral change, but these expectations were not confirmed. This pattern of results is inconsistent with other health domains where self-affirmation has been shown to decrease defensive processing, increase message acceptance, and produce favorable behavioral change (Epton et al., 2014). Although speculative, there are potential explanations for this result. It may be the case that different means by which young women are asked to self-affirm may affect their responses to IT prevention messages. For example, Armitage (2012) applied a different approach to self-affirming than was used in this study, finding that self-affirmation reduces body dissatisfaction among adolescent females. The

self-affirmation effects were mediated by changes in young women's self-esteem and body image (Armitage, 2012). In future studies, testing whether different approaches to self-affirming affect young women's responses to IT prevention messaging can help to clarity this issue.

Evidence also suggests IT may be unlike other health behaviors where self-affirmation has been investigated in that it is directly tied into one's self-concept. The need to feel good about oneself by improving self-perceived physical appearance and improving how others perceive oneself are strong IT motivations (Heckman, Wilson, & Ingersoll, 2009; Holman & Watson 2013). For many IT is in itself a self-affirmation experience. When people are made aware of their need to protect and maintain a positive sense of self through other self-affirmation methods, the utility and importance of IT could become even more salient. Consequently, IT intentions may intensify and messages confronting the risks associated with this behavior could be considered a significant threat that needs to be warded off using defensive strategies. The close ties between IT and one's self-concept also means that the usual self-affirmation exercises such as reflecting on generic positive personal attributes may lack the necessary potency to compensate for the threat to the self when IT behavior is attacked. The challenge to one's self-image induced by the messages may be too intense for the typical self-affirmation manipulation to neutralize. This, coupled with the heightened need to self-maintain, may lead to more extreme message resistance and stronger IT intentions.

Although previous studies have generally supported the ability of self-affirmation to reduce defensive processing and message resistance, some boundary conditions have also been noted. Positive effects of self-affirmation have been shown to dissipate or become iatrogenic among low risk individuals (Harris, Mayle, Mabbott, & Napper, 2007) and those high in trait reactance (Nan & Zhao, 2012). Self-affirmation may also decrease information processing, inflate confidence in prior beliefs, and potentially produce more biased evaluations of messages that are nonthreatening (Brinol, Petty, Gallardo, & DeMarree, 2007). Taken together with the findings of the current study, this suggests that the relevance of the target preventive behavior to people's self-concept is another important dimension that produces variability in the effects of self-affirmation on responses to health-promoting messages. These findings urge careful attention to the boundaries and conditions of self-affirmation effects in future research.

The study has notable limitations. Data were collected through AMT, an online crowdsourcing platform in a convenience sample of young adult women. Compared with prior IT research focusing on female college student samples (Heckman Wilson, & Ingersoll, 2012; Hillhouse, Turrisi, Stapleton, & Robinson, 2008), participants in this study tended to be older age, most were non-students, and they reported higher household income. The representativeness of the sample is not clear, and generalizability of the findings may be limited. All measures are based on self-report and are subject to potential reporting biases. Outcome measures were administered after a single, brief exposure to framed IT prevention messages and focused on indoor tanning behavioral intentions, which are not consistently strongly related to behavior change. Online procedures also prevent close monitoring of protocol adherence, although all participants completed the study procedures.

Despite these limitations, the results indicate that loss-framed messages about the health risks of IT are more effective than gain-framed messages about the benefits of avoiding indoor IT for influencing IT behavioral intentions. Although the findings suggest a stronger emotional response to loss-framed messages as a potential mediating mechanism, other pathways of message effects should be examined in future studies. The self-affirmation manipulation produced unexpected effects, generating stronger IT intentions and doing so through increased defensive message response. This result points to important avenues for future research on self-affirmation in the context of IT, including potentially deploying stronger self-affirmation manipulations and assessing individual-level factors that may affect self-affirmation response.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1

Sample characteristics

	N= 475	
	N or Mean	**% or Std Dev.**
Demographics		
Age (*M, SD*)	24.7	3.2
Current Student	194	40.8
Non-Student	281	59.2
Household Income		
< $20,000	85	17.9
$20,001–$35,000	112	25.7
$35,001–$50,000	107	22.5
$50,001–$75,000	73	15.4
>$75,000	66	13.9
Prefer Not to Say	22	4.6
Past Year Frequent Indoor Tanning Behavior		
Tanned 10 Times	188	39.6
Tanned < 10 Times	287	60.4
Tanning Attitudes *M, SD* (range 5–25)	20.5	3.7
Perceived Risks of Tanning *M, SD* (range 4–20)	16.7	3.2
Intentions to Tan *M, SD* (range 1 to 7)	5.4	1.8
Intentions to Quit Tanning *M, SD* (range 1 to 7)	3.3	2.1
Outcome Measures		
Intentions to Tan *M, SD* (range 1 to 7)	3.9	1.8
Intentions to Quit Tanning *M, SD* (range 1 to 7)	4.4	1.8
Fear Response *M, SD* (range 1 to 4)	2.0	0.9
Message Strength *M, SD* (range 1 to 7)	4.9	1.4
Message Derogation *M, SD* (range 1 to 7)	3.8	1.4

Note: Data display *N* and % of the sample unless otherwise indicated

Table 2

Analysis of covariance (ANCOVA) test statistics for follow up intentions to tan and intentions to quit tanning

| | Behavioral Outcomes | | | | | | Mediating Variables | | | |
| | Intentions to Tan | | Intentions to Quit Tanning | | Fear Response | | Perceived Message Strength | | Message Derogation | |
	F	P value	F	P value	F	P value	F	P value	F	P value
Main Effects										
Self Affirmation	10.9	.007	.39	.692	.40	.444	4.2	.076	6.6	.032
Message Framing	11.7	.006	33.3	<.001	20.2	<.001	16.4	.001	4.2	.087
Interaction Effects										
Self Affirmation x Message Framing	.56	.540	.00	.997	.03	.835	1.5	.292	.21	.700
Baseline Covariates										
Intentions	295.1	<.001	176.4	<.001	--	--	--	--	--	--
Frequent Tanning	66.1	<.001	6.14	.115	.09	.721	1.9	.228	6.7	.030
Attitudes	14.6	.002	.50	.653	6.9	.002	4.5	.068	7.2	.025
Perceived Risks	44.2	<.00	94.8	<.001	9.3	<.001	240.1	<.001	178.9	<.001

Table 3

Least square mean differences in follow-up intentions to tan and intentions to quit tanning by self-affirmation and message framing

| | Behavioral Outcomes | | | | Mediating Variables | | | | | |
| | Intentions to Tan | | Intentions to Quit Tanning | | Fear Response | | Perceived Message Strength | | Message Derogation | |
	M	SE	M	SE	M	SE	M	SE	M	SE
Self-Affirmation (A)	4.1[B]	.08	4.4	.10	2.0	.05	4.8	.08	3.9[B]	.08
Control (B)	3.8[A]	.08	4.5	.10	1.9	.05	5.0	.07	3.7[A]	.08
Loss-Framed (C)	3.8[D]	.08	4.7[D]	.10	2.2[D]	.05	5.1[D]	.08	3.9	.08
Gain-Framed (D)	4.1[C]	.08	4.2[C]	.10	1.8[C]	.05	4.7[C]	.07	3.7	.08

M = mean, SE = standard error. Intentions to tan and intentions to quit were measured using a 4-point scale with higher values indicating stronger intentions. Emotional response was measured using a 7-point scale with higher values indicating stronger intentions. Message strength and Message derogation were measured using a 7-point scale with higher values indicating stronger perceived message strength/derogation. Different superscript letters adjacent to means within a column indicate statistically significant differences between conditions at p <.05. Analysis of covariance adjusted for baseline measures of relevant behavioral intentions, frequent indoor tanning, attitudes towards indoor tanning, and perceived risks.

Table 4

Mediation analysis of emotional response, perceived message strength, and message derogation on the effects of message framing and self-affirmation on indoor tanning intentions

	Independent Variable	Mediating Variable	Intentions to Tan	Intentions to Quit Tanning
Direct Effect	Framing	--	−.05 (−.37, .28)	.16 (−.16, .51)
Indirect Effect	Framing	Fear Response	−.11 (−.23, −.04)	.20 (.10, .35)
	Framing	Perceived Message Strength	−.07 (−.15, .001)	.15 (−.03, .34)
	Framing	Message Derogation	.03 (−.01, .08)	−.03 (−.09, .001)
Direct Effect	Self-Affirmation	--	.28 (−.02, .56)	.09 (−.23, .39)
Indirect Effect	Self-Affirmation	Fear Response	−.02 (−.08, .03)	.04 (−.06, .13)
	Self-Affirmation	Perceived Message Strength	.08 (.01, .18)	−.18 (−.39, −.01)
	Self-Affirmation	Message Derogation	.03 (.00, .09)	.04 (−.06, .13)

Regression coefficients and bias-corrected 95% confidence intervals are displayed. Confidence intervals that do not include 1 are statistically significant at $p < .05$. Models adjusted for baseline covariates including relevant intentions measures, attitudes towards tanning, perceived risks of tanning, and indoor tanning behavior.