With health care costs continually rising (e.g., Claxton, Rae, Levitt, & Cox, 2018), it is important to understand the psychological factors that promote a healthy lifestyle. Risk perception, or the subjective evaluation of the likelihood and severity of potential risk (Ferrer & Klein, 2015), is a factor that is relevant to a wide variety of health decisions. Risk perception has been found to predict health-related intentions and behaviors in areas such as vaccination (Brewer, Weinstein, Cuite, & Herrington, 2004; Brewer et al., 2007), exercise (e.g., Courneya & Hellsten, 2001), and AIDS prevention (van der Velde, Hooykaas, & van der Joop, 1992). Indeed, Sheeran, Harris, and Epton (2014) conducted a meta-analysis among 208 qualifying studies of the effect of experimentally increasing risk perception on health-related behavioral intentions and behavior, finding overall
effect sizes of $d = .31$ and $d = .23$, respectively. Furthermore, risk perception is often a factor represented in health behavior theories due to its relationship with engagement in health behaviors (for a review see Brewer et al., 2007). For example, the health belief model posits that risk perception plays a major role in decisions about engaging in preventative behaviors (e.g., Rosenstock, 1974), and Witte’s extended parallel process model (1992) utilizes perceived risk as a key element of the effectiveness of fear appeals to influence health behavior. Risk perception appears both theoretically and empirically important in encouraging health behavior change; thus, understanding the factors that influence risk perception can be an important step toward increasing the likelihood of individuals engaging in preventative behaviors rather than seeking treatment after health problems arise.

One factor that has been consistently found to undermine personal perceptions of risk is unrealistic optimism (Kim & Niederdeppe, 2016). Unrealistic optimism is the tendency for people to believe they are more likely to experience positive events and less likely to experience negative events than their peers or an objective standard (Weinstein, 1980). This optimistic bias has been explained as being the result of both motivational and cognitive biases, such that individuals seek to maintain a positive image of themselves in order to reduce anxiety and engage in biased recall of relevant personal experiences to separate themselves from stereotypes associated with negative events (Kim & Niederdeppe, 2016; Weinstein, 1980). Regardless of the specific underlying mechanism, this effect is primarily characterized by an underestimation of personal risk.

Like other biases in reasoning, researchers have looked for ways to overcome unrealistic optimism and increase perceptions of risk in individuals. One mode of information presentation that has been found to be particularly effective is the use of personal narratives (e.g., Kim & Niederdeppe, 2016). Personal narratives conveying health information have been found to be more effective at promoting a sense of personal risk than objective statistics conveying health information, thus resulting in a higher likelihood of engaging in health-protective behaviors (de Wit, Das, & Vet, 2008; Kim & Niederdeppe, 2016). Logically, objective statistics should be more persuasive than narratives because they better represent collective trends; however, the reverse is frequently true (e.g., de Wit et al., 2008; Green & Brock, 2000; Yoo, Kreuter, Lai, & Fu, 2014). One key reason for this discrepancy is simply that narratives are, by nature, stories, and stories have the ability to transport the reader into another world, evoke powerful emotions and motivations, and even change the attitudes of the reader (Green & Brock, 2000). Furthermore, narratives allow for readers to identify with a character within the message, increasing the likelihood that the reader will respond to the message as if the events were actually happening to them (Cohen, 2001).

Following from these lines of research, Dunlop, Wakefield, and Kashima (2008) proposed a model to address the influence of emotions while reading health narratives on perceptions of personal risk and subsequent health-protective behaviors. To summarize the model, these authors propose that exposure to a message can elicit three different classes of emotional responses: message-referential, plot-referential, or self-referential emotions. Message-referential emotions arise in response to the features of the message itself, such as an image contained within or the person presenting the message. Plot-referential emotions arise in response to a character or situation described within the message, proposed to be a result of transportation experienced by the reader. Finally, and most important to their model, the authors describe self-referential emotions as responses to a message that prompt thinking about one’s own life and self. This class of emotional responses is the only one hypothesized to have a direct effect on perceived personal risk (Dunlop et al., 2008). The other two classes indirectly influence perceived personal risk to the extent that they lead to self-referential emotions through character identification (plot-referential) or self-referencing through the message itself (Dunlop et al., 2008).

Although not explicitly depicted in the model, the authors restricted their discussion to negative emotions only. They reasoned that, because public health messages are designed to reduce risky behavior, associating positive feelings with such actions, as marketing campaigns do with their products, would establish the wrong perception of risky behavior. Focusing on discrete negative emotions, then—which can highlight the consequences of risky behavior—is most appropriate for the health domain (Dunlop et al., 2008). Though much research exists regarding the influence of negatively-valenced public health narratives (e.g., de Wit et al., 2008; Kim & Niederdeppe, 2016; Yoo et al., 2014), the impact of positive emotions remains largely unexplored.
Considering that positive emotions are associated with improved coping ability (Fredrickson & Joiner, 2018), longer and healthier lives (Chida & Steptoe, 2008), reduced chance of contracting certain diseases (e.g., Boehm & Kubzansky, 2012), and better physical and mental health (Mahoney, 2000), their contribution to health behavior is an important topic of inquiry. Fredrickson’s (1998; 2001) broaden-and-build theory gives foundational support for the health benefits of positive emotions. According to this theory, positive emotions serve to broaden attention and thought-action repertoires, unlike negative emotions which tend to narrow an individual’s focus. Through this broadened attention, positive emotions then help build personal resources, such as interpersonal relationships and even physical skills (Fredrickson, 1998; 2001).

Focusing on the broadening property of positive emotions, research shows that individuals who viewed a video clip eliciting joy were better able to distinguish among other-race group faces, thus demonstrating a significantly lower level of the own-race bias than participants who viewed a video clip eliciting negative or neutral emotional responses (Johnson & Fredrickson, 2005). Similarly, Waugh and Fredrickson (2006) found that the experience of positive emotions during the first week of college predicted greater feelings of self-other overlap between new roommates. Taken together, these results suggest that one broadening effect of positive emotions is the expansion of one’s social categories. This ability of positive emotions to allow for more inclusive categorization and self-other overlap may make identification with a character within a message more likely to occur, as perceived similarity with a narrative character is considered an important feature of identification (Slater & Rouner, 2002). This increase in identification then, as hypothesized by Dunlop et al. (2008), could impact people’s personal perceived risk.

In addition, positive moods and outlooks (i.e., optimism) have been found to have beneficial effects on information processing, even when the information is negative (Das, Vonkeman, & Hartmann, 2012). According to the mood-as-a-resource hypothesis, a positive mood increases the likelihood that one will act in the service of long-term, rather than short-term, goals by providing the individual with a psychological buffer for coping with self-relevant negative information (Raghunathan & Tropce, 2002). In an experimental test of this hypothesis, those induced into a positive mood demonstrated greater recall of negative information, as well as greater behavioral intentions of changing in response to the negative information (Raghunathan & Tropce, 2002). Similarly, optimism related to one’s health has been found to increase attention paid to and recall of risk information and decrease defensive responses to such information (Aspinwall & Brunhart, 1996).

Taken together, research on positive emotions, positive moods, and optimism suggest the important role that positive emotions may play in health communication—in particular, risk communication. Given the relative lack of research regarding the role of positive emotions on the interpretation of health-related narratives, the main purpose of this study was to compare the effects of inducing a negative, positive, or neutral emotional state before reading a health narrative on perceptions of personal risk, behavioral intentions, and self-reported behaviors.

We hypothesized that exposure to a positive emotion induction, relative to a negative emotion or neutral emotion induction, prior to reading a health narrative would result in higher levels of perceived personal risk, and a higher likelihood of protective behavioral intentions and health-related behaviors (Hypothesis 1). Furthermore, we hypothesized that these beneficial effects of the positive emotion induction would be mediated by either one or both of the following factors: 1) greater levels of identification with the narrative character (following from Johnson & Fredrickson, 2005 and Dunlop et al., 2008); and/or 2) greater recall of information from the narrative (following from Raghunathan & Tropce, 2002; Das et al., 2012) (Hypothesis 2).

Method

Participants

A total of 124 undergraduate students (29 men, 94 women, 1 did not report) were recruited through emails and campus flyers from the general student body of a small liberal arts college in the Southern United States. Because the study utilized a pedometer app from the Apple App Store, participants were required to own an iPhone or iPod Touch; students without such devices did not qualify to participate in the study. If participants were enrolled in a psychology course, they could receive extra credit for their participation in each part of the study at the discretion of their instructor. All participants who completed the first part of the study received health brochures and a free download of a pedometer app; all participants who...
completed the follow-up portion of the study two weeks later were entered into a drawing for a $25 gift card to a local restaurant. The experimental session took approximately 30 minutes to complete with a 10-minute follow-up survey.

**Materials**

**Emotion-induction videos.** Three different short videos were used to induce positive, negative, and neutral emotions for the study. A clip from the movie *Rudy* (Fried, Woods, & Anspaugh, 1993), which portrayed a character who finally achieved his goal of playing football at his dream school while a crowd cheers for him, was used to induce positive emotions. A clip from the movie *Vertical Limit* (Campbell, King, Nasatir, & Phillips, 2000), used to neutral influence emotions, served as the control and simply provided instructions on how to tile a bathroom or countertop. All videos were similar in length (approximately 5 minutes), contained interpersonal interactions, and were pilot-tested to ensure that they induced the emotions for which they were intended.

**Health narratives.** A personal health narrative, titled “Student Voices,” was written for the purposes of this study and presented as a student newspaper publication from another institution. The article was written from the perspective of a college student, Jordan, describing how their diagnosis of prehypertension altered their perspective of engaging in healthier behaviors. The article began with the author reminiscing on their original (lax) view of exercising, then transitioned to them explaining the negative implications of having prehypertension, such as susceptibility to heart problems, type II diabetes, and obesity. The article ended with the author discussing the benefits they received from living a healthier lifestyle and challenging the reader to assume better health habits, as well. The narrative contained a balance of challenging the reader to assume better health and habits, as well. The narrative contained a balance of interpersonal interactions, and was intended to induce negative emotions. The clip depicted a scene in which a group of rock climbers have an emergency that results in them hanging off a cliff, forcing them to decide whether to cut the rope on one of the other characters in order to survive. An instructional tiling video (studyinghealth, 2013), used to neutral influence emotions, served as the control and simply provided instructions on how to tile a bathroom or countertop. All videos were similar in length (approximately 5 minutes), contained interpersonal interactions, and were pilot-tested to ensure that they induced the emotions for which they were intended.

**State emotional experiences.** The Modified Differential Emotions Scale (mDES; Fredrickson, Tugade, Waugh, & Larkin, 2003) was used to assess participants’ moods. This 22-item questionnaire measured the current mood of the participants by requiring them to rate the extent to which different emotions (e.g., “amused, fun-loving, silly;” “sad, downhearted, unhappy”) described their feelings at multiple points in the study. Eleven items each measured for positive emotions (α = .92) and negative emotions (α = .88). Two additional items asked about feelings of boredom and tiredness to assess additional impacts the three videos may have had on feeling states. Items were rated on a 5-point Likert-type scale, ranging from 0 (not at all) to 4 (extremely).

**Manipulation check.** In addition to measuring reactions to the health narrative, the mDES was also used as a manipulation check for the emotion-inducing videos.

**Transportation and identification.** Our measure for transportation and identification was the “Narrative Questionnaire” created by Green & Brock (2000). Thirteen questions (α = .77) measured the participants’ transportation into the health narrative, asking them to rate items such as “I was mentally involved in the article while reading it” on a 7-point Likert-type scale ranging from 1 (not at all) to 7 (very much). Three items (α = .69) measured for identification with the character in the narrative, asking participants to rate statements such as “When good things happened to Jordan, I felt happy, but when negative things happened to Jordan, I felt sad” on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree).

**Information recall.** Six items were used to measure participants’ ability to recall content from the article. These questions were asked in an open-response format and included questions such as “What are two causes of high blood pressure, obesity, and type II diabetes listed in the article?” Answers were scored as 0 (incorrect) or 1 (correct). These questions were included to assess the extent to which the emotion induction videos influenced participants’ ability to accurately recall information from the health narrative as a means of testing the mood-as-a-resource hypothesis (Raghunathan & Trope, 2002).

**Risk perception.** Participants rated their perceived risk for developing heart disease, type II diabetes, and obesity—the three diseases discussed within the narrative. For each disease, participants responded to five questions that were rated on a 7-point Likert-type scale, ranging from 1 (not at all) to 7 (very much). These items were written to tap into the three dimensions of perceived risk: perceived likelihood (two questions; e.g., “How
likely do you think it is that you will be diagnosed with heart disease sometime in the future?"), perceived susceptibility (two questions; e.g., “How susceptible or vulnerable do you think you are to developing heart disease sometime in the near future?"), and perceived severity or seriousness (“How serious a disease do you think heart disease is?”; Brewer et al., 2007). Cronbach’s αs at Contact 1 for the individual heart disease, type II diabetes, and obesity scales were .75, .79, and .80, respectively, with a composite reliability of .86. Cronbach’s αs at Contact 2 for the individual heart disease, type II diabetes, and obesity scales were .74, .83, and .83, respectively, with a composite reliability of .90.

Behavioral intentions and self-reported behaviors. Participants rated their intentions to engage in seven different health-protective behaviors (behaviors related to the three health conditions) over the next two weeks on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). An N/A option was also provided. For example, participants rated their agreement with the statements, “I intend to avoid smoking cigarettes” and “I intend to engage in 30 minutes of moderate exercise 5 times per week.” All behavioral intention questions were written for the purposes of this study. Following from seminal work by Davidson and Jaccard (1979) on the measurement of attitudes about performing behaviors, these questions were written to reference intention to perform a specific behavior (e.g., “I intend to engage in 30 minutes of moderate exercise 5 times per week” versus “I intend to exercise”) within a specific time frame (i.e., two weeks). In the follow-up questionnaire, participants self-reported on their actual behaviors for the past two weeks by answering the same questions (e.g., “I avoided smoking cigarettes.”). Because these measures were intended to cover a broad range of protective behaviors across three distinct health conditions, items were analyzed individually; thus, alphas were not calculated.

Health-related behaviors. Participants’ health-related behaviors were measured in two ways: (a) health information-seeking behavior was measured by the number of health brochures (out of six) participants took with them at the conclusion of the first part of the study; and (b) physical activity was measured by participants’ use of a pedometer app over the course of two weeks, which recorded the length of time participants used it, the number of days participants used the app, how many steps they took, and their total distance traveled, in miles, in those two weeks.

Procedure

Contact 1. Experimentation began following approval by the Hendrix College Human Subjects Review Board (Protocol #F1403). Each session was conducted in a private cubicle. After consenting, participants were randomly assigned to watch one of the three emotion-inducing videos. After the video, participants completed the mDES, which was used as a manipulation check. Participants then read the health narrative and completed the mDES for a second time, followed by the measures of transportation, identification, information recall, risk perception, and behavioral intentions (in that order). The final questions inquired about the gender of the participant, their regular exercising habits, whether they had been diagnosed with heart disease, type II diabetes, or obesity, and how they heard about the study. Upon completion, participants received a partial debriefing statement and instructions for downloading a pedometer app offered as incentive for their participation. Participants were asked to use the pedometer app for the next two weeks, then were allowed to leave the study and take health brochures with them. The number of health brochures each participant took (from 0 to 6) was recorded by the researcher.

Contact 2. Two weeks after their participation in the first half of the study, participants were contacted via email and asked to complete a follow-up survey on SurveyMonkey. Participants again completed the measure of risk perception for each health condition before self-reporting on the extent to which they actually engaged in each of the seven health behaviors over the past two weeks. In addition, participants were asked to report how many days they used their pedometer app and exercised, and estimate the number of steps they took and the number of minutes they exercised in total over the past two weeks. Participants were also asked to directly share their pedometer data with the researchers to corroborate these self-report responses. Finally, participants received a complete debriefing on the purpose of the study and were entered into a drawing for a $25 gift card to a local restaurant.

Data Analysis Plan

To test Hypothesis 1, that exposure to a positive emotion induction prior to reading a health narrative would result in higher perceived risk, greater behavioral intentions, and more engagement in health-related behaviors than exposure to a negative or neutral emotion induction, we...
planned to conduct a series of one-way Analyses of Variance (ANOVAs). Because the mechanisms we proposed to test were not intended to be disease-specific, focal tests of Hypothesis 1 were planned on composite measures of perceived risk that averaged across heart disease, type II diabetes, and obesity. Hypothesis 2 proposed two potential mediators of any significant effects found in the analysis of Hypothesis 1: identification with the narrative character and accuracy of information recalled from the narrative. Thus, we planned to conduct and report on two tests of mediation—one for each proposed mediator—for any significant effects the emotion induction had on our focal dependent measures. Any deviations from this a priori analysis plan are reported in the Results section and additional exploratory analyses are labeled as such.

Results

Descriptive Statistics and Sample Characteristics

On average, participants reported exercising around 3.69 days a week for 58.71 minutes per exercise session. Across all emotion induction conditions, no participants were previously diagnosed with diabetes, three participants were diagnosed with heart disease (2.44% of participants), and four participants were diagnosed with obesity (3.25% of participants) prior to their participation in the study. There were no significant differences found between emotion induction conditions on preexisting exercise habits or diagnoses for heart disease, diabetes, or obesity, and no significant gender differences were observed on any primary dependent variable.

Manipulation Checks

A series of one-way ANOVAs were conducted to assess differences in state positive and negative emotions, boredom, and tiredness following the video. A statistically significant difference between groups emerged on reported positive emotions, $F(2, 121) = 55.33$, $p < .001$, $\eta^2 = .48$. A Tukey post-hoc test found that participants in the positive induction condition ($M = 2.38, SD = 0.95$) scored significantly higher than both the neutral ($M = 0.85, SD = 0.68$) and negative ($M = 0.97, SD = 0.54$) induction conditions (both $p < .001$). The negative and neutral induction conditions did not significantly differ from one another on reported state positive emotion ($p = .75$).

Likewise, a statistically significant difference emerged between groups on reported state negative emotion, $F(2, 121) = 85.33, p < .001, \eta^2 = .59$; a Tukey post-hoc test reported that participants in the negative induction condition ($M = 1.29, SD = 0.64$) scored significantly higher than both the neutral ($M = 0.21, SD = 0.29$) and positive ($M = 0.15, SD = 0.31$) induction conditions (both $p < .001$). The positive and neutral induction conditions did not significantly differ from one another on reported state negative emotions ($p = .82$).

Furthermore, a statistically significant difference emerged between groups on reported boredom, $F(2, 121) = 39.51, \eta^2 = .40$, and tiredness, $F(2, 121) = 15.1, \eta^2 = .20$, after viewing the emotion inducing videos (both $p < .001$). Post-hoc Tukey tests revealed that participants who viewed the neutral video were significantly more bored ($M = 2.1, SD = 1.34$) and tired ($M = 1.96, SD = 1.46$) than participants who viewed the positive (Bored: $M = 0.73, SD = 1.12$; Tired: $M = 0.73, SD = 1.05$) and negative (Bored: $M = 0.12, SD = 0.40$; Tired: $M = 0.68, SD = 1.06$) induction videos (all $p < .001$).

Induction Durability Check

To examine the durability of the emotion induction, repeated measures ANOVAs were conducted using emotion induction condition as the between-participants variable and timing of emotional measurement (immediately after emotion induction versus after reading the health narrative) as the within-participants variable. Regarding positive emotions, a statistically significant interaction emerged, such that the differences in positive emotions found between emotion induction conditions immediately after the emotion induction dissipated after reading the health narrative, $F(2, 120) = 32.52, p < .001, \eta_p^2 = .35$. Significant main effects also emerged for emotion induction condition, $F(2, 120) = 25.30, p < .001, \eta_p^2 = .30$, and time, $F(1, 120) = 160.00, p < .001, \eta_p^2 = .57$. The same pattern of effects emerged for negative emotions, such that the interaction, $F(2, 119) = 57.15, \eta_p^2 = .50$, main effect of emotion induction condition, $F(2, 113) = 33.60, \eta_p^2 = .37$, and main effect of time, $F(1, 113) = 354.65, \eta_p^2 = .76$, were all statistically significant (all $p < .001$). The same was also true for boredom (interaction: $F(2, 120) = 33.64, \eta_p^2 = .36$; main effect of emotion induction condition: $F(2, 120) = 20.66, \eta_p^2 = .26$; main effect of time: $F(1, 120) = 18.30, \eta_p^2 = .13$) and tiredness (interaction: $F(2, 121) = 8.76, \eta_p^2 = .13$; main effect of emotion induction condition: $F(2, 121) = 7.95, \eta_p^2 = .12$; main effect of time: $F(1, 121) = 84.15, \eta_p^2 = .41$), with all $p < .001$. Follow-up tests (one-way ANOVAs) confirmed that, when emotional states were retested after reading the
health narrative, none of the emotion induction conditions differed significantly on any emotion, all $F$s < 1.58, all $p$s > .21, all $\eta^2$s < .03. Descriptive statistics for all emotion induction conditions at each time point can be found in Table 1.

**Hypothesis 1**
Positive emotion induction, relative to negative or neutral emotion induction, will result in higher levels of perceived personal risk for diseases and subsequent protective behavioral intentions and behaviors.

**Risk perception.** A one-way ANOVA was conducted to test the effects of the emotion induction on participants’ perceptions of personal risk at Contact 1. Contrary to Hypothesis 1, emotion induction conditions did not differ significantly on perceived risk at Contact 1 when measures for each disease were analyzed collectively, $F(2, 117) = 1.12, p = .33, \eta^2 = .02$.

For exploratory purposes, we also analyzed the effects of the emotion induction on risk perception for each disease separately and no significant effects emerged, all $F$s < 1.55, all $p$s > .22, all $\eta^2$s < .03 (descriptive statistics are provided in Table 2). When examining perceived risk items from Contact 1 individually for exploratory purposes, a significant effect of emotion induction condition on perceived seriousness of diseases emerged, with the positive induction condition perceiving obesity significantly less seriously ($M = 5.71, SD = 1.49$) than both the negative ($M = 6.37, SD = 0.92$) and neutral ($M = 6.42, SD = 1.05$) induction conditions, $F(2, 120) = 4.63, p = .01, \eta^2 = .07$, and diabetes significantly less seriously ($M = 5.85, SD = 1.15$) than the neutral induction condition ($M = 6.39, SD = 0.89$), $F(2, 120) = 3.43, p = .04, \eta^2 = .05$. No significant differences emerged on any remaining items on perceived risk, all $F$s < 1.41, all $p$s > .25, all $\eta^2$s < .03.

Furthermore, repeated measures ANOVAs were conducted to test the effect of the emotion induction condition on perceived risk over time, with emotion induction condition as the between-participants variable and timing of the measure (Contact 1 versus Contact 2) as the within-participants variable. These analyses were also exploratory in nature. When risk perception for the three diseases was analyzed collectively, no significant interaction or main effects emerged; however, the main effect of emotion induction condition approached significance, $F(2, 51) = 2.67, p = .08, \eta^2 = .10$. Tukey tests revealed that overall risk perception across both time points was marginally lower in the positive induction condition ($M = 3.61, SD = 0.97$) than the neutral induction condition ($M = 4.32, SD = 0.90$), $p = .07$. Neither the positive induction condition nor the neutral induction condition significantly differed from the negative induction condition ($M = 4.03, SD = 0.96$; both

**TABLE 1**
Descriptive Statistics for Manipulation Checks in Contact 1 and Contact 2

<table>
<thead>
<tr>
<th></th>
<th>Control Condition</th>
<th>Positive Condition</th>
<th>Negative Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emotion Scores After Video</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>0.85</td>
<td>0.68</td>
<td>0.93</td>
</tr>
<tr>
<td>Negative</td>
<td>0.21</td>
<td>0.29</td>
<td>0.15</td>
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<tr>
<td>Bored</td>
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<td>0.73</td>
</tr>
<tr>
<td>Tired</td>
<td>1.96</td>
<td>1.46</td>
<td>0.73</td>
</tr>
<tr>
<td><strong>Emotion Scores After Narrative</strong></td>
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<td></td>
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<tr>
<td>Positive</td>
<td>2.19</td>
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<td>Negative</td>
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</tr>
<tr>
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<td>0.63</td>
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</tr>
<tr>
<td>Tired</td>
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<td>1.31</td>
<td>1.95</td>
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**TABLE 2**
Descriptive Statistics for Focal Dependent Measures at Contact 1 and Contact 2

<table>
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<th></th>
<th>Control Condition</th>
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<tbody>
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<td></td>
</tr>
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<td>Composite</td>
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<tr>
<td>Heart Disease</td>
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<td>3.91</td>
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<tr>
<td>Diabetes</td>
<td>3.53</td>
<td>1.35</td>
<td>2.89</td>
</tr>
<tr>
<td>Obesity</td>
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<td>1.63</td>
<td>2.75</td>
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<tr>
<td><strong>Perceived Risk Contact 2</strong></td>
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<td></td>
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<tr>
<td>Composite</td>
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<td>0.88</td>
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<td>Heart Disease</td>
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<td>Diabetes</td>
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<tr>
<td>Total Distance</td>
<td>17.27</td>
<td>7.58</td>
<td>31.98</td>
</tr>
</tbody>
</table>

Note: Composite Perceived Risk represents the average of all risk items across all diseases. Total Distance was calculated in miles.
Emotions, Narratives, and Risk Perception | Udochi, Kennedy, and Sestir

When risk perception for each disease was analyzed separately, there were no significant emotion induction condition x time interactions, all Fs < 2.11, all ps > .13, all η²s < .07, or significant main effects of emotion induction condition, all Fs < 2.26, all ps > .11, all η²s < .08. However, for all three diseases, a significant main effect of time emerged, all Fs > 14.62, all ps < .001, all η²s > .21, such that risk perception increased over time, regardless of emotion induction condition. Descriptive statistics for these effects are presented in Table 2.

Behavioral intentions and self-reported behaviors. One-way ANOVAs were conducted to test the effects of the emotion induction videos on participants’ intentions at Contact 1 to engage in a variety of health-protective behaviors over the next two weeks and their self-reported engagement in these same behaviors at Contact 2. Contrary to Hypothesis 1, emotion induction condition did not have significant effects on intentions to engage in any of the provided health behaviors in the following two weeks, all Fs < 0.84, all ps > .40, all η²s < .02. Emotion induction condition also did not have any significant effects on participants’ self-reported engagement in health behaviors, including self-reported pedometer steps, all Fs < 2.63, all ps > .08, all η²s < .09.

Health-related behaviors. One-way ANOVAs were conducted to test the effects of the emotion induction videos on participants’ taking of health brochures at Contact 1 (health information-seeking behavior) and their actual pedometer use in the two weeks between Contact 1 and Contact 2. In regard to the health information-seeking behavior of brochure taking, the positive induction condition (M = 0.54, SD = 1.47) did not significantly differ from the negative (M = 0.23, SD = 1.00) and neutral (M = 0.38, SD = 0.79) induction conditions, F(2, 120) = 0.78, p = .46, η² = .01. Due to a low rate of providing direct pedometer access in Contact 2, inferential tests were not conducted on these data. Descriptive statistics can be found in Table 2.

Hypothesis 2
The beneficial effects of positive emotion induction would be mediated by either one or both of the following factors: (a) greater levels of identification with the narrative character; and/or (b) greater recall of information from the narrative.

Because emotion induction condition did not affect the main outcome variables, we did not conduct tests of mediation. However, exploratory one-way ANOVAs were conducted to test for differences between emotion induction conditions on identification with the narrative character and accuracy of narrative information recall.

Regarding identification with the narrative character, we discovered that separating one of the identification items (i.e., “When you read this article, how often did you feel or react as if the experiences of Jordan were happening to you?”) raised the remaining two items’ Cronbach’s α from .69 to .81. The average of these two items was analyzed separately from the third identification item. One-way ANOVAs determined there were no statistically significant differences between groups on levels of transportation or identification (1- or 2-item measure), all Fs < .65, all ps > .52, all η²s < .02.

Regarding recall of information from the health narrative, a significant difference in accuracy was found when participants were asked to recall two causes for the diseases included in the narrative, F(2, 121) = 4.00, p = .02, η² = .06, and a marginally significant difference was found between groups when asked to recall two negative thoughts the narrative character expressed about exercising, F(2, 121) = 2.67, p = .07, η² = .04. In both cases, the neutral induction condition demonstrated better recall of information (M = 1.00, SD = 0.22; M = 0.86, SD = 0.57, respectively) than both the positive (M = .83, SD = 0.38; M = 0.56, SD = 0.63, respectively) and negative (M = .80, SD = 0.40; M = 0.78, SD = 0.61, respectively) induction conditions. There were no additional statistically significant differences between groups for accurately recalling information from the health narrative, all Fs < 1.91, all ps > .15, all η²s < .04.

Discussion
Prior research on risk perception has shown that personal perceived risk for diseases is linked to better health habits (Brewer et al., 2004; van der Velde et al., 1992), and that increasing risk perception can increase both health-related behavioral intentions and behaviors (Sheeran et al., 2014). In the present study, we attempted to increase risk perception and, thus, health behaviors, indirectly by inducing an emotional state—positive, negative, or neutral—before exposing our participants to a health-related narrative. To maximize the personal relevance of the health information provided and avoid the defensive information processing that often results from purely statistical information dissemination (de Wit et al., 2008), we utilized narratives to provide participants with both a
story to be transported into and a character with whom to identify (Green & Brock, 2000). Further, by manipulating emotional state prior to health information exposure, we attempted to contribute to preexisting literature on the role mood plays in information processing and health behavior intentions. In Contact 2, we hoped to assess the long-term effects of Contact 1’s emotion induction, health information processing, and behavioral intentions by measuring actual engagement in healthy behaviors two weeks after Contact 1.

In this study, we did not find a significant relationship between emotion induction condition and risk perception, health intentions, or health behaviors. In short, our hypotheses were largely not supported. Instead, our findings suggested positive emotions may, indeed, decrease people’s perceived seriousness of diseases, such as diabetes and obesity. Thus, our data partially reinforced the relevance of negative emotions in health communication.

Our findings also did not support the mood-as-a-resource hypothesis (Raghunathan & Trope, 2002), which states that, when confronted with negative health information, positive emotions provide a buffer that allows people to focus more on processing the content of the information, relative to negative or neutral emotions. In contrast to the mood-as-a-resource hypothesis, the only significant or marginally significant differences related to information processing were products of the neutral induction condition exemplifying the best memory recall, suggesting that positive emotions might not lead to improved narrative content interpretation as suggested in the model. Furthermore, our results were not consistent with the broadening effect of positive emotions on social categories (Johnson & Fredrickson, 2005), such that participants in the positive induction condition did not show higher identification with the narrative character than participants in the negative or neutral induction conditions.

These results should be interpreted with several limitations in mind. Importantly, we did not acquire baseline measurements of the participants’ emotional states prior to administering any procedure, constricting our ability to assess the impact that the video and narrative had on their moods and the efficacy of our random assignment procedures. The lack of baseline measurements for risk perception impeded exploration of possible pre-existing group differences in those measures as well. In addition, our data suggested that participants’ induced state emotions did not persist after reading the health narrative (see Table 1), leaving little possibility for the emotion induction to impact participants’ perceptions of risk for diseases and health intentions and behaviors. Thus, future research should measure participants’ emotional states before any manipulations, use a longer-lasting or stronger manipulation, and further explore the relationship between emotions and health behaviors proposed in the mood-as-a-resource hypothesis.

Measurement limitations also could have impacted our attempts to explore the distal effects emotions have on behavioral intentions and actual engagement in healthy behaviors. Although each behavior was assessed individually, all were intended to represent behaviors that could protect against all diseases presented in the narrative; however, the items did not intercorrelate well (intentions $\alpha = .56$, behaviors $\alpha = .34$), indicating inconsistency within participants’ responses. Upon reviewing the questions asked on behavioral intentions, it is possible participants did not associate all of the health behaviors provided with diabetes, obesity, or heart disease because we did not explicitly define the relationship between the behaviors and diseases for participants. This lack of context may have led them to answer the questions in ways inconsistent with the health information we provided, contributing to the low reliability of the measures. Future tests of these relationships should explicitly establish the connections between health problems and their associated preventative health behaviors before presenting participants with a questionnaire on behavioral intentions. Reliability was also low for the 3-item measure of identification with the narrative character ($\alpha = .69$), suggesting a more general need for stronger measures in follow-up research.

Our study also utilized a small convenience sample of college students in the southern United States, which could have been additionally restricted in representativeness by the requirement for participants to own an iPhone and iPod Touch. While smartphone ownership is nearly universal among college-aged individuals (99%) and common among the general population (81%; Pew Research Center, 2019), users of Apple products could have differed substantively from those that used other products or none at all. Our study also did not involve the collection of the age nor race of the participants, which is another limitation, as these factors could have influenced our findings. Further, our sample was comprised of an uneven distribution of gender. Thus, our findings may not be generalizable to broader populations. Future research
should utilize materials that work across all major manufacturer devices and types and, if possible, include a broader range of ages and backgrounds to best ensure generalizable findings. Additional methodological adjustments for future research include counterbalancing measures to eliminate any potential order effects, reducing reliance on self-report measures to increase accuracy of data, utilizing a larger sample with more generalizable characteristics, and testing complex hypotheses across multiple smaller studies.

The pedometer app we gifted to the participants also provided its own limitations because the data we received from the participants was highly variable and incomplete. Contact 2 requested participants email the researchers their pedometer data, but only 15 participants (12.1% of the participant population) opted to do so, thus restricting our ability to use these data. Providing our participants with a specific incentive to share their pedometer data with us at the end of the study may have improved response rates. Future research on participants’ actual engagement in health behaviors should use more reliable measurement and consider research designs that may improve follow-up response rates.

In addition to methodological improvements, future research should consider the effects of emotional inductions on other factors included in theories of behavior change. For example, Ajzen’s theory of planned behavior (1985) has been linked to the effectiveness of health programming at improving health behaviors and outcomes (Wright, Broadbent, Graves, & Gibson, 2016). Assessing factors such as perceived behavioral control or subjective normative environment, in conjunction with emotional inductions, could provide a clearer picture of the relationship between state emotions, health narratives, and subsequent health behaviors. This would allow for the possibility that different predictors of behaviors may benefit from different emotional states (e.g., risk perception may be enhanced by negative moods whereas perceived behavioral control may be enhanced by positive moods). In a similar vein, future research should explore the potential importance of alignment between the valence of emotion induced (i.e., positive or negative) and the valence of the targeted behavior change (e.g., promoting positive versus preventing negative health behavior).

### Conclusion

In summary, our results did not match our initial predictions and, instead, suggest positive emotions may reduce personal risk perception and motivation to engage in health behaviors. However, more research—with stronger and longer-lasting emotional inductions—should be conducted to better understand the role positive emotions may play in health communication. Our findings suggest that health communicators hoping to increase the perceived seriousness of their health information might consider the role of emotional tone in their messages, specifically avoiding eliciting positive emotions, as our findings suggest positive mood may reduce perceived seriousness. Health communicators should also consider the longevity of mood induction from their messages, as our study shows that short-lived emotional inductions do not significantly affect health behaviors. Future studies should explore the effects of longer-term emotional differences on health habits and continue to assess optimal emotion induction strategies for increasing perceived seriousness of diseases, inspiring healthy behavioral intentions and actions, and producing better health outcomes.

### References


studyinghealth. (2013). Tiling (Neutral Induction - 5 and a half minutes) [Video file]. Retrieved from https://www.youtube.com/watch?v=0z8vDzQlPlA&feature=youtu.be


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