

Testing the effects of messaging on physical activity motivation in active and non-active adults

Derek J. Hevel^{a,*}, Anthony J. Amorose^b, Kristen M. Lagally^b, Anna Rinaldi-Miles^b, Scott Pierce^b

^a University of North Carolina at Greensboro, Greensboro, NC, 27402, USA

^b Illinois State University, Normal, IL, 61790, USA

ARTICLE INFO

Keywords:

Exercise psychology
Physical activity promotion
Intention

ABSTRACT

Objectives: This study investigated the effects of messaging on physical activity (PA) motivation, and whether the effectiveness of messages aimed to promote either affective benefits, physical health benefits, or a combination of benefits varied based on one's current PA status.

Methods: Adult participants ($N = 188$) completed an online survey assessing demographic information and current stage of change. They then viewed one of four randomly assigned promotional flyers for a campus PA program. The flyers mentioned either the: (a) affective benefits of participation, (b) physical health benefits, (c) a combination of affective and physical health benefits, or (d) a control message. Participants then responded to questions about the flyers, their perceived control for participating, followed by their interest, intention to participate, likelihood of participating, and whether they wanted to sign-up.

Results: A 2 (activity status) x 2 (affective message) x 2 (physical health message) between-subjects ANOVA found that the effectiveness of the promotional messages on overall cognitive motivation (i.e., a combination of interest, intention, and likelihood of participating) varied based on the respondents' PA status. Simple effects showed that messages promoting affective benefits led to greater scores for those who are active. A logistic regression showed that PA status, message condition, and their interactions were non-significant predictors of participants' agreeing to schedule a session in the program.

Conclusion: Using specific messages to sell PA may help increase motivation. However, the type of message that effectively promotes PA appears to vary depending on the message receiver's current PA.

1. Introduction

Physical activity (PA) benefits overall health and well-being for participants, with increasing benefits from continued participation. Unfortunately, data indicates that only 21% of adults in the United States meet the recommended dose of PA, and over 25% of adults engage in no leisure-time PA at all (Center for Disease Control and Prevention, 2014). Due to the current lack of PA, understanding mechanisms that will aid health and fitness professionals in promoting PA effectively is imperative (U.S. Department of Health and Human Services, 2000). One possibility is to explore PA branding; figuring out how to “sell” exercise effectively so people want to buy it. The overall goal of the study is to explore ways in which health care professionals (HCP) can promote PA using effective messaging strategies.

Health care professionals often “sell” PA to consumers based upon the physical health benefits. The American College of Sports Medicine (ACSM) encourages the use of the Exercise Is Medicine[®] (EIM) program,

which provides a pathway for HCPs to talk about their patient's PA levels (Sallis, 2015). EIM calls for HCPs to assess current PA at every visit, similar to other health markers like blood pressure, height, weight, etc. Thus, EIM includes PA as any other common vital sign. When tying PA to this brand, HCPs relate PA as a way to obtain positive physical health outcomes, like lowering blood pressure and losing weight. This is a logical sell for PA by the HCP because increased participation should increase overall physical health by lowering disease risk. However, “selling” exercise as a “vital sign” might not be appealing to the consumer. Recently, Segar, Guérin, Phillips, and Fortier (2016) have argued the answer might be that it is not. A better approach, according to these scholars, would be for HCPs to “sell” exercise as a way for people to get what they want now. For instance, HCPs could communicate to people that PA can lead to increases in positive affect and well-being (e.g., increased energy levels, decreased feelings of stress, enhanced mood, feelings of enjoyment). In other words, Segar and colleagues suggest that framing the value of PA as a

* Corresponding author. 225 Coleman Building, 1408 Walker Avenue, Greensboro, NC, 27402, USA

E-mail address: djhevel@uncg.edu (D.J. Hevel).

<https://doi.org/10.1016/j.psychsport.2019.04.010>

Received 13 October 2018; Received in revised form 9 April 2019; Accepted 12 April 2019

Available online 14 April 2019

1469-0292/ Published by Elsevier Ltd.

way to increase vitality (i.e., affective benefits) instead of as a vital sign (i.e., physical health benefits) may be a better approach. While there is limited research testing this idea, increasing theoretical and empirical work exploring the role affect plays in PA behavior provides some support for the logic of their argument.

Increasingly, scholars have explored the link between affective responses and PA behavior (Brand & Ekkekakis, 2017; Ekkekakis, 2013). According to Ekkekakis and his colleagues (see Brand & Ekkekakis, 2017; Ekkekakis, 2013), affect refers to the generalized feelings of pleasure versus displeasure a person experiences. From this perspective, affective responses include all the emotional states and moods contributing to the way in which a person feels good or bad. Thus, positive affect would include feelings such as enjoyment, pleasure, calmness, energy, and vitality, whereas negative affect would include feeling states such as boredom, anxiety, tension, and listlessness.

A variety of theoretical frameworks highlight the importance of affective responses on future PA behavior (e.g., Brand & Ekkekakis, 2017; Williams, 2008). For example, a model by Williams (2008) links exercise intensity, affective responses, and exercise adherence. Specifically, exercise intensity indirectly influences acute affective responses through cognitive (e.g., perceived autonomy, anticipated affective responses) and interoceptive factors (e.g., ventilatory drive, lactate threshold). These acute affective responses then influence anticipated affective responses for future bouts of PA, and subsequently exercise adherence. Thus, experiencing positive emotions while active is predicted to increase future exercise adherence through cognitively mediated anticipated affect (Ekkekakis, Zenko, Ladwig, & Hartman, 2018).

Support for the importance of affect as a PA predictor has become increasingly clear in recent research as well. For example, Williams et al. (2008) and Kwan and Bryan (2010) found that in an adult population, experiencing positive affect during an acute bout of exercise is predictive of future exercise behavior. Kiviniemi, Voss-Humke, and Seifert (2007) found positive feelings about PA were also predictive of self-reported PA in an adult population. Further, they reported affective responses mediated or partially mediated the effect of various cognitive variables typically used to predict PA (i.e., perceived benefits, barriers, attitudes, social norms, perceived control). Finally, other studies have reported that expecting exercise will make you feel good (i.e., anticipated affect) predicted exercise behavior (Dunton & Vaughan, 2008; Gellert, Ziegelmann, & Schwarzer, 2012) and intention (Helfer, Elhai, & Geers, 2015).

Support for the importance of affect also comes from research exploring the combined and relative effects of affective and instrumental (cognitive) attitudes on PA motivation (see Rhodes, Fiala, & Conner, 2009). For example, Lawton, Conner, and McEachan (2009) showed that affective attitudes for PA (i.e., not enjoyable – enjoyable) were stronger predictors of intention to be active compared to cognitive attitudes (i.e., harmful – beneficial). Similarly, Lowe, Eves, and Carroll (2002) found that affective beliefs were a predictor of self-reported exercise after controlling for prior exercise, whereas instrumental attitudes were not predictive. In sum, theory and research supports that positive affect facilitates increased PA intention and continued participation. Therefore, promoting PA based upon these benefits, as suggested by Segar et al. (2016), might be an effective way for HCPs to sell PA. In particular, messaging strategies might be one way to accomplish this sell.

1.1. Effects of messaging

The effects of message framing have received attention in health communication literature (Rothman & Salovey, 1997; Updegraff & Rothman, 2013). Message framing is a communication strategy used to promote the potential effects of a behavior in the hopes that the message will encourage the recipient to adopt the desired behavior. Research in health communication has typically focused on the relative

effectiveness of gain-versus loss-framed messaging. A gain-framed message highlights the benefits of adopting the behavior, whereas a loss-framed message emphasizes the cost of not adopting the behavior (Updegraff & Rothman, 2013). Rothman and Salovey (1997) propose in their prospect theory that gain-framed messages persuade individuals to engage in preventative behaviors (e.g., using sunscreen), while loss-framed messages effectively urge people to engage in detection behaviors (e.g., performing a skin cancer self-examination). PA behavior is considered a preventative behavior because the action helps to mitigate the negative consequences of sedentary lifestyles, much like sunscreen prevents skin cancer, and research consistently supports the relative value of gain-framed messages in this context (see Latimer, Brawley, & Bassett, 2010). Therefore, an effective behavior change strategy might consider emphasizing the benefits associated with adopting PA.

The majority of research on message framing and PA has focused on comparing gain-versus loss-framed messages; however, scholars have begun to examine other aspects of messaging such as the effectiveness of affective versus instrumental messages. Affective messaging highlights emotional benefits like better mood or increased energy levels, while instrumental messaging promotes PA as a way to gain benefits like increasing cardiovascular fitness or losing weight. Conner, Rhodes, Morris, McEachan, and Lawton (2011) sought to examine the impact of messaging (e.g., university students received written statements, which in some conditions were also accompanied by pictures) on self-reported exercise within two studies. Study 1 compared affective messages (e.g., regular PA has been shown to reduce anxiety) to instrumental (e.g., regular PA has been shown to reduce the risks of developing colon and breast cancer) and a no-message control. The greatest change in exercise behavior over a three-week period occurred for those receiving affective messages. Similar results were found in Study 2. However, they also found that the significant increase in PA resulting from receiving an affective message was only consistent for those low in need for cognition and for those high in need for affect. Overall, these studies suggest that affective (i.e., vitality) messaging, more so than instrumental (i.e., vital sign) messaging, can positively change affective attitudes and exercise behavior.

Sirriyeh, Lawton, and Ward (2015) examined the influence of message framing effects on adolescents' PA levels. Participants were divided into four experimental conditions. The conditions manipulated affective benefits (i.e., enjoyable/unenjoyable), instrumental benefits (i.e., beneficial/harmful), a combination of affective and instrumental benefits, and a control condition using text messages. The participants received one SMS text message consistent with their group assignment each day for 14 days. Results revealed a significant interaction between the text message conditions and self-reported level of PA at the beginning of the study. Specifically, they found that inactive participants who received affective messages increased their PA levels significantly more than the instrumental group and the combined group.

The results of the studies by Conner et al. (2011) and Sirriyeh et al. (2015) provide some support for the call by Segar et al. (2016) to “sell” PA as a way to promote “vitality” (i.e., promoting the affective benefits) versus the conventional “vital sign” (i.e., promoting the physical health or instrumental benefits). Nevertheless, there are questions that still need to be addressed. For instance, what about the effectiveness of simultaneously promoting both affective benefits and physical health benefits? Current research supports affective messaging as a new way to “sell” PA and HCPs are currently using physical health messaging to “sell” PA, so combining both might be more effective. However, current research suggests that this might not be as effective as one might think. Zhang, Fishbach, and Kruglanski (2007) introduced the dilution model of goal pursuit focusing on this topic. This model proposes that when more than one goal is added to a single mean, the strength of the association and perceived efficacy of the goals to the mean is diminished. For example, an individual might exercise (i.e., the mean) as a way to lose weight (i.e., one goal) and/or lower blood pressure (i.e., a second goal). However, the value of exercise as a way to attain either goal is

diminished when used to attain both goals, relative to the value of the exercise as a means to obtain either one of the goals individually. Zhang et al. (2007) provided some support for the dilution effect in a series of studies. For example, participants in one study read short essays about a how a single mean (e.g., aerobic exercise) might satisfy either one goal (e.g., protection from heart disease) or two distinct goals (e.g., protection from heart disease and maintain healthy bones). When more than one goal was added to a single mean (e.g., aerobic exercise), it weakened the overall instrumentality of the single mean.

Based on the dilution effect demonstrated by Zhang et al. (2007), adding both affective and instrumental content to a message as a way to promote PA might not be as effective as just promoting one benefit (or type of benefit). Some support for this idea can also be seen in the results of Sirriyeh et al. (2015). Analysis of the results indicated the combined condition (where messages included a combination of affective and instrumental benefits) was not as effective at promoting PA compared to the affective alone message condition. Further, there were no differences between the instrumental, combined, and control conditions in their effect on adolescents' PA. These results and the dilution model suggest that there might be diminishing returns from adding more goals, yet the relative lack of research on the issue within the PA domain makes this question worth exploring further.

1.2. Activity status

Another question is whether affective and/or physical health messages will be more or less effective depending upon certain characteristics of the recipient. Message framing research has explored a host of variables that moderate the message's function on various health behaviors (see Covey, 2014; Rothman, Wlaschin, Bartels, Latimer, & Salovey, 2008; Updegraff & Rothman, 2013). Age (e.g., Berry & Carson, 2010; Kin-Kit, Sheung-Tak, & Fung, 2014), gender (e.g., Kin-Kit et al., 2014; van 't Riet, Ruiter, Werrij, & de Vries, 2010), dispositional needs for affect and cognition (Conner et al., 2011), source credibility (e.g., Jones, Sinclair, & Courneya, 2003), temporal salience (e.g., Morris, Lawton, McEachan, Hurling, & Conner, 2016), and regulatory fit (e.g., Latimer et al., 2008; Pfeffer, 2013) are examples of moderating variables that have been explored in the research on messaging and PA. Of particular interest in this study is current PA behavior as a potential moderating variable. A few studies (e.g., Berry & Carson, 2010; de Bruijn, Out, & Rhodes, 2014; Sirriyeh et al., 2015; van 't Riet et al., 2010) have specifically tested whether PA status moderates the effect of different messages, and the results are somewhat inconsistent. For example, van 't Riet et al. (2010) found no differences in the effect of gain- vs loss-framed messages on intention and PA behavior 3 months later between those who were or were not already meeting recommended PA guidelines. Berry and Carson (2010), de Bruijn et al. (2014) and Sirriyeh et al. (2015), on the other hand, found PA status moderated the effectiveness of messages. While the specific effects of the moderation varied, the results point to the possibility that active and non-active people may respond differently to messages.

The goal of the current study sought to examine the effects of messaging on adults' PA motivation. Specifically, the purpose was to test the relative effectiveness of messages aimed to promote either affective (i.e., vitality), physical health benefits (i.e., vital signs), or a combination on PA motivation. The study also investigated whether the effectiveness of the different messages varied based on one's current PA status. We hypothesized that affective messages will be more effective at promoting interest, intention, and likelihood to participate in a PA program compared to physical health messages, a combination of affective and physical health, or a control message. Additionally, based on the dilution model (Zhang et al., 2007), it was hypothesized that the combination condition will be no more effective than either the affective or physical health condition. Active and non-active participants might differ in their motivational outcomes. However, given the lack of consistency in the research involving activity status and the effects of

messages on motivational outcomes (e.g., Berry & Carson, 2010; de Bruijn et al., 2014; Sirriyeh et al., 2015), no specific hypothesis was made.

2. Methods

2.1. Participants

Participants ($N = 188$) completed an online survey sent via email to the community of a Midwestern University. Of this group, 18 were eliminated based on their response to the manipulation check questions, leaving 170 people in the final sample. These were predominantly female (70.60%) with a mean age of 46.07 years ($SD = 14.01$) and a range of 21–74 years. Most participants identified themselves as Caucasian/White (90.60%), with the remaining identifying as black or African American (2.90%), Asian (1.80%), Hispanic/Latino (4.10%), or Other (0.60%). Finally, most participants (65.30%) considered themselves regularly active (maintenance or action stage).

2.2. Procedure

An Institutional Review Board approved all study procedures. An anonymous online survey was sent via email to university community members who had agreed previously to receive solicitations for research projects. The survey began by explaining the general purpose of the study, that participating was voluntary, and completing the survey constituted informed consent.

The survey was broken into sections. First, participants responded to basic demographic questions, current PA status, and their attitudes toward PA in general. Next, the survey included a promotional flyer for a PA program offered on campus. The content of the promotional flyer served as the experimental manipulation. After viewing the randomly assigned promotional flyer, the participants responded to a series of manipulation checks. These were followed by assessments of their attitudes about the program described in the promotional flyer, their perceived control for participating, and their motivation to participate in the program.

2.3. Experimental conditions

Participants were randomly assigned to receive one of four flyers promoting a PA program on campus. Although the program was fictitious, the respondents were led to believe the program was real. All flyers indicated that the PA program had been designed by faculty within exercise science using the latest knowledge and research on exercise programming. However, the flyers varied in the reported benefits of participating in the program; highlighting either affective (e.g., better mood), physical health (e.g., improved cardiovascular fitness), a combination of the two messages (e.g., better mood and improved cardiovascular fitness), or a control message (e.g., nice facilities). Across all four conditions, the order in which the specific benefits were presented was counterbalanced to minimize the potential of any order effects.

Affective Condition. This condition ($n = 48$) highlighted the affective benefits of the PA program (see Figure 1 – Panel A). The flyer cited previous participants of the program stating it helped increase their mood or increased their energy level. The program staff shared research indicating that PA can increase overall feelings of well-being.

Physical Health Condition. This condition ($n = 42$) highlighted the physical health benefits received from the PA program (see Figure 1 – Panel B). Previous participants cited the program helped increase their cardiovascular fitness and helped control their weight. The program staff provided a quote citing research showing PA increases overall physical health.

Combination Condition. The combination condition ($n = 43$) promoted both affective and physical health benefits of the fictitious PA



Fig. 1. Flyer message by condition.

program (see Figure 1 – Panel C). Previous program participants highlighted an affective benefit (e.g., increased their energy) and a physical health benefit (e.g., helped control weight). The program staff shared that research indicates physical activity helps improve overall physical health and increase overall feelings of well-being.

Control Condition. The control condition ($n = 37$) highlighted parts of the program unrelated to the physical health or affective benefits obtained from the PA program (see Figure 1 – Panel D). A previous participant of the program said the program had clean facilities while the other program participant said the program ran smoothly. The program staff cited that having the program on campus was great.

2.4. Measures

Pre-Manipulation Measures. The following measures used in this study were presented before the flyers describing the PA program were introduced.

Demographics. Participants were asked to report their age, gender,

and race/ethnicity.

Stage of Change. The short-form of the Exercise: Stages of Change questionnaire was used to determine current PA status (Marcus, Selby, Niaura, & Rossi, 1992). Participants indicated their current stage of change (i.e., maintenance, action, preparation, contemplation, pre-contemplation) by selecting the appropriate descriptor of their current level of activity and/or intention to be active. The instruction set used being active 3 to 5 times per week for 20–60 min per session as the criterion for defining regular exercise participation. Participants in the maintenance and action stages were grouped and labeled as active, whereas those in the preparation, contemplation, and precontemplation stages were labeled as non-active.

Attitudes – General PA. Exercise attitudes were measured with a 7-point bipolar adjective scale created by Rhodes and Courneya (2005). Three items assessed affective attitudes (enjoyable – unenjoyable, interesting – boring, relaxing – stressful) and 3 items assessed instrumental attitudes (e.g., useful – useless, wise – foolish, beneficial – harmful). Higher scores indicated the respondent endorsed the more

positive adjective. Cronbach's alpha coefficients indicated that these scales all had acceptable internal consistency in the final sample ($\alpha = 0.86$ for affective attitude, $\alpha = 0.92$ for instrumental attitude, $\alpha = 0.87$ for general attitude).

Post-Manipulation Measures. The following measures used in this study were included in the survey after the participants were provided with the randomly assigned promotional flyer.

Manipulation Check Questions. Participants were asked to respond to a series of questions about the promotional flyer they viewed. These questions were used to ensure the participants retained the relevant information about the PA program, and thus served as manipulation checks. Using a 5-point scale (1 = definitely false, 5 = definitely true), participants indicated whether the PA program led to: (a) psychological/emotional benefits (e.g., better mood, increased energy), (b) physical health benefits (e.g., controlled weight, increased cardiovascular fitness), (c) a combination of both psychological/emotional and health benefits, and (d) occurs in a newly updated facility. If a participant responded, "probably false", "definitely false" or "unsure/do not know" to the manipulation check corresponding to their flyer message condition, they were removed from the study. For example, if a participant in the affective condition responded "probably false" to whether or not the program "led to psychological/emotional benefits for former participants" they were removed from the study because the affective condition stated the PA program led to those listed benefits.

Perceived Control. A three-item measure assessed behavioral control specific to the PA program. The measure of perceived behavioral control was adapted from Rhodes and Courneya (2005) and Parrott, Tennant, Olejnik, and Poudevigne (2008). First, participants responded to "How confident are you that you could participate in the physical activity program if you wanted to do so?"; measured on a 7-point scale ranging from 1 (very unconfident) to 7 (very confident). Second, participants responded to "How much personal control do you feel you have over participating in the physical activity program?"; measured on a 7-point scale from 1 (very little control) to 7 (complete control). The third question asked: "Participating in the physical activity program is completely up to me."; measured on a 7-point scale from 1 (strongly disagree) to 7 (strongly agree). An average of the responses to these questions were used to reflect the respondents' perception of control to participate in the PA program, with higher score reflecting greater control. Cronbach's alpha coefficient indicated the scale had acceptable internal consistency in the final sample ($\alpha = 0.77$).

Motivation to Participate. Four single-item questions assessed motivation to participate in the PA program. The first three indicators of motivation explored the participants' interest, intention, and likelihood of participation. First, participants responded to: "How interested are you in learning more about the physical activity program?"; answering on a 7-point scale ranging from 1 (not at all interested) to 7 (very interested). Intention was assessed by "Do you intend on signing up for the physical activity program this school year?"; using a 7-point scale ranging from 1 (do not intend to sign up at all) to 7 (strongly intend to sign up). "How likely is it that you will participate in the physical activity program this school year?" measured likelihood of participation and was assessed by a 7-point scale ranging from 1 (extremely unlikely) to 7 (extremely likely). The fourth question served as a more behavioral indicator of motivation. This question asked the participants to indicate if they wanted to sign up for the program at that time by answering the follow question: "If you would like to go ahead and schedule an initial session in the physical activity program, click the option labeled 'Yes'. If not, please click 'No'". The response options for this question were: "Yes – I would like to sign up for an initial session (Clicking this link will allow you to access the physical activity program scheduling calendar at the conclusion of the survey)." or "No – I am not interested in scheduling a session."

2.5. Data analysis

A series of preliminary analyses were conducted to establish that the manipulation of the PA program benefits reported in the different flyers and that the randomization of participants to condition were effective. First, one-way ANOVAs were used to test for differences across the flyer conditions in the manipulation check questions. Next, ANOVAs and Chi-Square analyses were used to determine if there were any differences in general attitudes about PA, age, gender, and activity status across the flyer conditions.

The main analysis testing differences on the continuous motivation indicators (interest, intention, likelihood of participation) involved a 2 x 2 x 2 (activity status: active vs. non-active x affective message: yes vs. no x physical health message: yes vs. no) between-subjects ANOVA. Simple effect post-hoc analyses were used to probe significant interactions, and effect sizes for any significant effects were reported as η^2 . A logistic regression analysis was used to predict the probability that a participant agreed to sign up for an initial session of the PA program. The predictor variables included activity status (active vs. non-active), affective message (yes vs. no) and physical health message (yes vs. no), as well as their interactions. An alpha level of 0.05 was used for all analyses to evaluate significance.

3. Results

3.1. Preliminary analysis

Manipulation Checks. Participants completed manipulation checks after viewing the flyer message. Eighteen people were removed from the original sample size because they indicated either "probably false", "definitely false", or "unsure/do not know" to the statement listed on their flyer. No participants were removed from the affective condition, six participants were removed from the physical health condition, one participant was removed from the combination condition, and eleven participants were removed from the control condition. Figure 2 displays the flow diagram of the participant enrollment, allocation, and analysis.

Table 1 identifies means and standard deviation scores for the manipulation check questions by condition for the final sample ($N = 170$). A separate ANOVA was conducted for each manipulation check question to determine if the responses varied by flyer condition. Results showed that there were significant differences on the question about affective benefits, $F(3, 157) = 9.27, p < .01, \eta^2 = 0.15$. Student-Newman-Keuls (SNK) post hoc tests revealed significant differences between the affective and combination conditions compared to the control and physical health conditions. Participants who were exposed to a flyer where at least one person mentioned an affective-based benefit of the program were more likely to agree that increased vitality was a benefit of the program. Significant differences by flyer condition were also found for the physical health benefits question, $F(3, 156) = 40.82, p < .01, \eta^2 = 0.44$. A SNK post hoc test found differences between the physical health flyer and combination flyer conditions compared to the control and affective conditions. Participants who were exposed to a flyer where at least one person mentioned a vital sign (i.e., physical health) benefit of the program were more likely to agree that increased physical health was a benefit of the program. The differences across flyer condition on the combination of benefits were also significant $F(3, 156) = 2.64, p < .01, \eta^2 = 0.10$. A SNK post hoc analysis indicated that those in the control flyer condition reported significantly lower scores on physical health benefit relative to the other flyer conditions which were not significantly different from each other. Thus, those participants in three experimental groups who were exposed to at least one mention of an affective or physical health benefit were more likely to agree that these types of benefits would exist compared to the control group participants who were told nothing about these types of benefits. Finally, no significant differences across

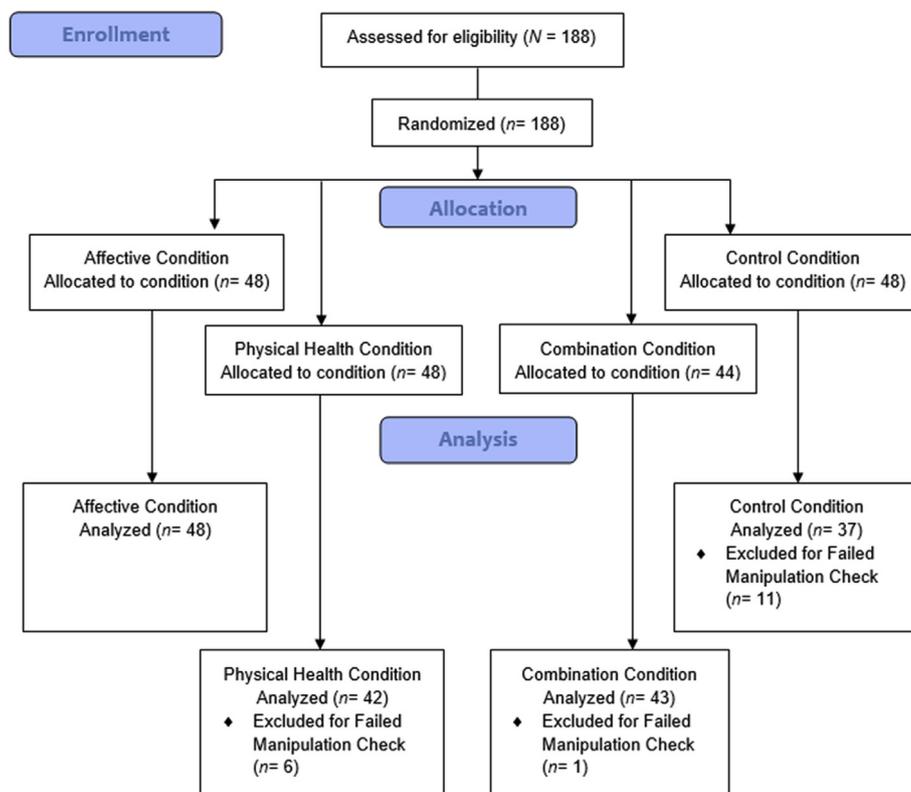


Fig. 2. Participant flow diagram.

the flyer conditions were found for the question asking about the program occurring in a new facility, which was one of the main comments made on the control flyer condition, $F(3, 113) = 1.88, p = .05, \eta^2 = 0.07$.

Randomization Success. Descriptive statistics on general attitude, age, activity status and gender by flyer condition are also included in Table 1. Separate ANOVAs were conducted for attitude and age to determine if there were any differences in these variables across the flyer conditions. Results indicated non-significant differences in general attitude, $F(3, 166) = 0.47, p = .70, \eta^2 = 0.01$, affective attitude, $F(3, 166) = 0.59, p = .62, \eta^2 = 0.01$, instrumental attitude, $F(3,$

$166) = 0.258, p = .86, \eta^2 = 0.01$, and age, $F(3, 166) = 0.73, p = .53, \eta^2 = 0.01$.

A chi-squared analysis was performed and revealed no relationship between message conditions and activity status, $X^2(3, N = 170) = 1.58, p = 0.67$. Additionally, another chi-squared analysis was performed and revealed no relationship between message conditions and gender, $X^2(3, N = 170) = 5.88, p = 0.12$. Since no significant differences between the groups emerged in general attitude, affective attitude, instrumental attitude, or age, the randomization between conditions was deemed successful.

Descriptive Statistics for the Motivational Outcomes. Bivariate

Table 1
Descriptive statistics for preliminary analysis.

	Affective Condition	Physical Health Condition	Combination Condition	Control Condition	Total
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Manipulation Checks					
Affective	4.29 (0.65)	3.78 (1.18)	4.45 (0.55)	3.67 (0.63)	4.07 (0.84)
Physical Health	3.17 (0.90)	4.62 (0.49)	4.42 (0.60)	3.68 (0.64)	3.96 (0.91)
Combination	4.11 (0.60)	4.11 (0.81)	4.35 (0.61)	3.71 (0.63)	4.09 (0.69)
Control	3.38 (0.83)	3.70 (0.88)	3.42 (0.95)	3.89 (0.75)	3.61 (0.86)
General Attitude					
Affective	5.05 (1.53)	5.06 (1.41)	5.42 (1.48)	5.12 (1.55)	5.16 (1.49)
Instrumental	6.45 (0.96)	6.38 (1.07)	6.53 (0.85)	6.54 (0.81)	6.47 (0.93)
Overall	5.75 (1.07)	5.72 (1.12)	5.97 (1.05)	5.83 (1.06)	5.82 (1.07)
Descriptives					
Age ^a	43.90 (15.81)	46.95 (12.64)	45.79 (13.14)	48.22 (14.12)	46.07 (14.01)
Female ^a	77.08%	78.57%	67.44%	56.76%	70.60%
Male ^a	22.92%	21.43%	32.56%	43.24%	29.40%
Physically Active ^a	60.40%	66.70%	72.10%	62.20%	65.30%

Note. Affective Manipulation Check: "Led to psychological/emotional benefits for former participants (e.g., better mood, increased energy)."; Physical Health Manipulation Check: "Led to physical health benefits for former participants (e.g., controlled weight, increased cardiovascular fitness)."; Combination Manipulation Check: "Led to psychological and physical health benefits for former participants."; Control Manipulation Check: "Occurs in a newly updated facility."; Possible scores for manipulation checks ranged from 1 to 5; Possible scores for general attitude ranged from 1 to 7.

^a Evaluated as the percentage of people within the category.

correlations for among the motivational outcomes were computed to better understand their relationship. Intention and likelihood of participation showed a strong positive correlation $r(168) = 0.91, p < .01$. Interest and intention $r(168) = 0.67, p < .01$ and interest and likelihood of participation $r(168) = 0.65, p < .01$ showed moderate positive correlations between the variables. Sign-up (“yes” = 1 and “no” = 0) and interest $r(168) = 0.48, p < .01$, sign-up and intention $r(168) = 0.48, p < .01$, and sign-up and likelihood of participation $r(168) = 0.49, p < .01$ revealed moderate positive correlations.

Initially we planned to consider each of these outcomes as separate indicators for motivation; however, the strength of the correlations, particularly among the continuous indicators (interest, intention, likelihood of participation), suggest these variables might lack sufficient discriminant validity. Thus, we conducted a principal axis factor analysis to determine if these indicators were better represented by an overall motivation factor.¹ In support of this, results showed that 83.0% of the variance in the three items were accounted for by a single factor. Further, the factor loadings were all high (i.e., interest = 0.69, intention = 0.97, likelihood of participation = .94). As a result, we combined these three indicators into a single motivation variable for use in the main analyses. The descriptive statistics for this variable, labeled cognitive motivation, are presented in Table 2. Cronbach’s alpha coefficient indicated acceptable internal consistency for the three-item scale ($\alpha = 0.90$).

The descriptive statistics on the motivational outcomes are presented in Table 2. When considering the total sample of participants, the sample reported moderate to high motivation for the PA program. The percentage of people interested in signing up for the program, however, was relatively low with only 35.90% saying yes. The descriptive data also indicated that those who were currently active reported higher motivation across all four measures than those who were non-active. The data (see Table 2) also suggests that those in the affective condition reported higher mean scores for PA motivation. For the sign-up motivational outcome, however, those in the physical health condition indicated a higher percentage of participants who wanted to sign up for the program. The control group consistently indicated the lowest motivation.

3.2. Main analysis

Figure 3 illustrates the variations in cognitive motivation by activity status and message condition. A 2 x 2 x 2 (activity status: active vs. non-active x affective message: yes vs. no x physical health message: yes vs. no) between-subjects ANOVA was conducted to test for significant differences across groups and conditions. Results showed most of the effects were non-significant. Specifically, the main effects for activity status, $F(1,162) = 1.00, p = .32, \eta^2 < 0.01$, affective message, $F(3, 162) = 1.00, p = .32, \eta^2 = 0.03$, and physical health message, $F(1,162) = 0.25, p = .62, \eta^2 < 0.00$, were non-significant. The two-way interaction between activity status and the physical health message, $F(1,162) = 2.58, p = .11, \eta^2 < 0.02$, and the three-way interaction between activity status, affective message, and physical health message, $F(1,162) = 0.66, p = .42, \eta^4 < 0.00$, were also non-significant. While non-significant at the $p < .05$ level, the two-way interaction between the affective message and the physical health message approached significance, $F(1,162) = 3.21, p = .08, \eta^2 < 0.02$. The simple effects follow-up showed those who received the affective message reported higher motivation ($M = 4.62$) compared to the control message condition (i.e., those who receive neither the affective or physical health message) ($M = 4.02$).

The one effect that did emerge as significant was the two-way

¹ We would like to thank those involved in the review process for highlighting the potential lack of discriminant validity in these motivation indicators and suggesting this as an alternative approach.

interaction between activity status and the affective message, $F(1,162) = 5.50, p = .02, \eta^2 < 0.03$. The test of simple effects showed that the significant difference in cognitive motivation was between the active and non-active groups who received the affective message. Specifically, the active group reported higher motivation in response to the affective message ($M = 4.82$) compared to the non-active group ($M = 4.18$).

The pattern of results exploring differences in the probability of participants agreeing to sign up for an initial session of the PA program are illustrated in Figure 4. The logistical regression analysis predicting sign-up behavior showed a non-significant effect. Specifically, a test of the full model versus a model with the intercept only was non-significant, $\chi^2(4, N = 170) = 2.93, p = .57$. In other words, wanting to sign up for the program was not significantly different across groups or combination of groups.^{2, 3}

4. Discussion

The purpose of the study was to understand the effects of messages aimed at increasing PA motivation, and to test whether the effectiveness of different messages was dependent on PA status. The main hypothesis proposed that affective messaging (compared to physical health benefits, combined benefits, or the control message) would be a better predictor of motivation in terms of interest, intention, likelihood of participation, and whether or not the message recipient would like to sign up for a program. Further, PA status was expected to potentially alter the way the messages influenced motivation; however, no specific pattern was predicted given the limited and mixed results of previous research (e.g., Berry and Carson (2010); de Bruijn et al., 2014; Sirriyeh et al., 2015).

Results of the study provided partial support for the hypothesis in that the type of messages led to variations in cognitive motivation (i.e., the combination of interest, intention, and likelihood of participation). Further, activity status influenced which messages were more or less effective. Consistent with the hypotheses, the affective messages yielded higher motivation scores when participants were active. The positive responses to the affective messaging for this group are consistent with Segar et al. (2016) who purports selling PA through vitality messaging.

Results for the non-active participants, on the other hand, were unexpected. No significant differences emerged in the cognitive or behavioral indicators of motivation (although there was a tendency for this group to see the physical health messaging as more motivating based on the cognitive indicators). These findings diverge from previous research where non-active participants rated affective messaging as more motivating (Sirriyeh et al., 2015), and the source of this difference is unclear. One possibility could be differences in methods used across studies. For example, Sirriyeh et al. (2015) utilized text messaging once a day for fourteen days consecutively. The current study presented a promotional flyer containing the message on one occasion and then called for participants to indicate their motivation for participating in the program. Perhaps non-active individuals are less affected by a single presentation of potential benefits given differences in desire/and or ability to process different messages. Also, Berry and Carson (2010) found non-exercisers might not find PA messages as personally relevant, and therefore they may not process the messages in

² We also conducted both of the main analyses using perceptions of control as a covariate given that feelings of control over participation can effect intention and motivation (see Ajzen & Fishbein, 2005; Conner & Sparks, 2005). Results of the ANOVA and the logistic regression showed that the inclusion of perceived control did not alter the overall pattern of results in either analysis.

³ To assure that our decision to remove participants for failing the manipulation checks did not impact the results, we conducted both main analyses again with the full sample ($N = 188$). The pattern of results for both analyses was essentially identical. Thus, we felt justified in removing these participants.

Table 2
Mean scores for motivational outcomes by activity status and message condition.

Motivational Outcome	Affective	Physical Health	Combination	Control	Total by Activity Status
	(n = 48)	(n = 42)	(n = 43)	(n = 37)	
	M (SD)	M (SD)	M (SD)	M (SD)	
Cognitive Motivation ^{a, b}					
Active (n = 111)	4.89 (1.04)	3.82 (1.37)	4.00 (1.72)	3.46 (1.84)	4.08 (1.58)
Non-Active (n = 59)	3.51 (1.29)	4.33 (1.38)	3.78 (1.40)	3.60 (1.49)	3.78 (1.39)
Total By Condition	4.34 (1.32)	3.99 (1.38)	3.94 (1.62)	3.51 (1.69)	3.97 (1.52)
Yes Sign-up ^c					
Active (n = 111)	37.90%	39.30%	41.90%	39.10%	39.60%
Non-Active (n = 59)	31.60%	42.90%	25.00%	14.30%	28.80%
Total By Condition	35.40%	40.50%	37.20%	29.70%	35.90%

Note.
^a Possible scores ranged from 1 to 7
^b Measure computed as the average of interest, intention, and likelihood of participation.
^c Evaluated as the percentage of participants that indicated "Yes" to scheduling a session.

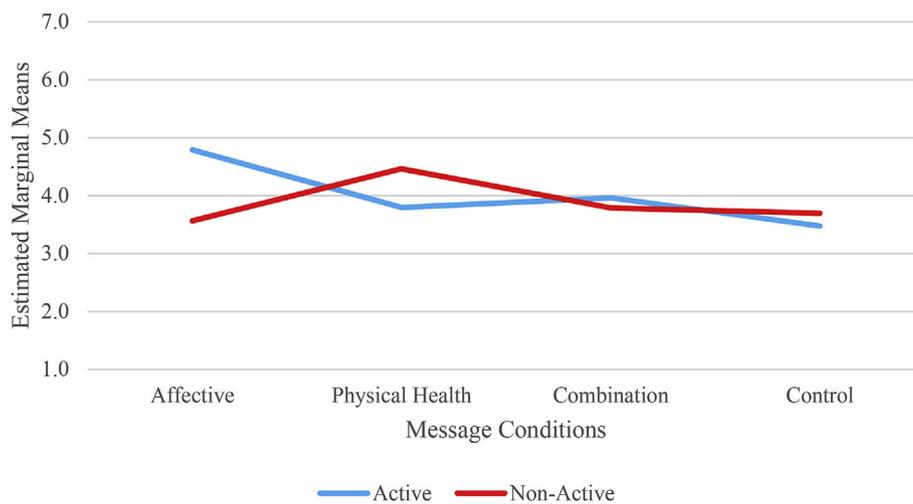


Fig. 3. Results using cognitive motivation.

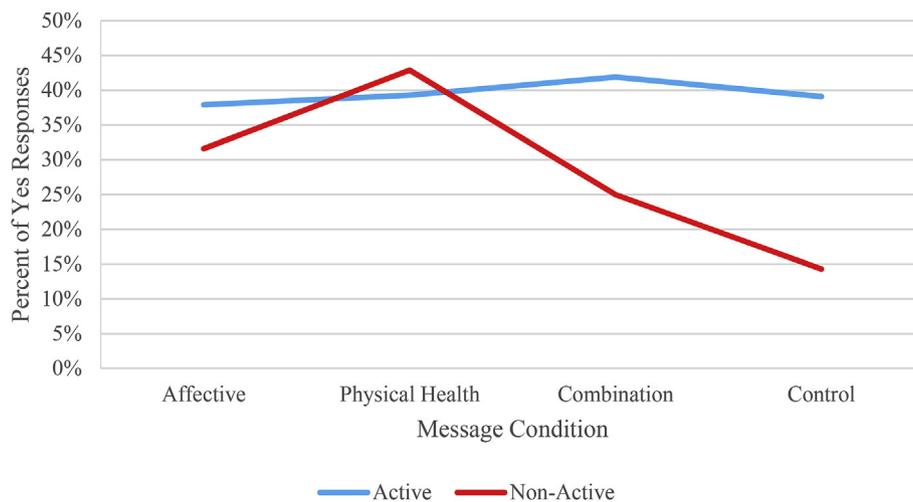


Fig. 4. Results using motivated behavior (i.e., attempting to sign-up).

the same way. Future research should explore the extent to which repeated messages selling the positive affective benefits (i.e., vitality benefits) of PA are required to entice non-active participants to become more active like was found in Sirriyeh et al. (2015).

It is also noteworthy that the current study included adult participants (*M* age = 46.07 years), whereas previous studies used adolescent

(Sirriyeh et al., 2015) or college-aged students (Conner et al., 2011). Exploring the effects of messages in an older age group is one way in which this study extended the literature, as it would be ill advised to assume that younger and older people are similarly motivated. Studies have reported, for instance, that there are age differences in perceived benefits and motives for engaging in physical activity, with older adults

more likely to note health-related factors as motivation (Allender, Cowburn, & Foster, 2006; Zunft et al., 1999). Combined with other message framing research demonstrating that age can potentially moderate a message's function on various health behaviors (e.g., Berry & Carson, 2010; Kin-Kit et al., 2014), it is possible that any differences in the pattern of results found between the current study and previous research are a function of sample differences.

Another interesting finding that emerged from the study involved the combination condition (i.e., the messages including both affective and physical health benefits together). Consistent with previous research (Sirriyeh et al., 2015; Zhang et al., 2007), the current study hypothesized that combining the two message types together would offer no motivational advantage. In the current study, the combined messages was not significantly better in terms of motivation relative to the other messaging conditions. It seems that adding both messages together is not the messaging solution to increased PA participation.

While the results indicated that different messages affected PA motivation, it is important to note that this was only true for cognitive motivation, which was a combination of self-reported interest, intention, and likelihood of participation. No effect emerged when considering whether the participants attempted to sign up for the PA program. The reason for the lack of effect found with this more behavioral indicator of motivation remains unclear, as it was expected to differ based on previous research (e.g., Conner et al., 2011; Sirriyeh et al., 2015). One possibility, however, is the nature of the measure. The previous studies on the effectiveness of affective and instrumental messaging have focused on self-reported PA behavior as the main motivational variable (e.g., Conner et al., 2011; Sirriyeh et al., 2015). These methods make sense given the purpose was to track behavior change over time. The question about wanting to sign up to schedule an initial session in the PA program being promoted in this study was included as a behavioral indicator of motivation inasmuch as this question referred to a specific action the participants were willing to take at that moment. This was consistent with the design of the current study, where the focus was on recruiting participants into a specific, albeit hypothetical, PA program. While both approaches are reasonable given the stated goals, the nature of the indicators are clearly different, and thus may account for the lack of consistencies in findings across studies. Future studies wanting to explore the effect of messaging on recruitment into a program should consider other indicators of motivated behavior, for instance, requesting participants' contact information if they agree to sign up. Alternatively, if a program were actually being offered, recording whether people actually showed up.

A number of limitations of the current study are noteworthy. First, the study was not pre-registered nor was an a priori power analysis calculated. Using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) with power ($1 - \beta$) set at 0.80 and $\alpha = .05$, our overall estimated sample size requirement to uncover large ($f = 0.40$), medium ($f = 0.25$), or small ($f = 0.10$) effects in our main analysis would have been $N = 73$, 179, and 1095, respectively. Thus, one could argue that our study was underpowered to detect smaller effects. Second, the representation of the sample was limited by the fact that the participants included predominantly active, female, and Caucasian/White participants, and clearly messaging effects on PA might differ with other populations (e.g., populations outside of a university setting).

Another limitation of the study was the hypothetical and vague nature of the flyer message. The flyers were purposefully vague and offered as little information as possible to minimize the risk of a particular PA modality to be more or less unsavory or desirable. However, this vague and hypothetical program could have had an undesired effect and left participants with uncertainties about the program and subsequently altered the results. Additionally, as a reviewer pointed out, the control message (e.g., the program occurred in a clean facility) could have elicited an emotional response. Future research should carefully consider the control message. The single presentation of the message is also a limitation, as this limited exposure might not elicit a

great deal of information processing on the part of those who viewed the flyers. Finally, it is possible that the use of previous participants and program staff to "sell" the benefits of the PA program in the flyers was not sufficiently persuasive.

In summary, the findings of the study indicate that message framing can alter aspects of PA motivation, although the effects vary by PA status and the indicator of motivation in question. HCP's should consider their patient's PA status when selling PA. Results from the current study suggest that, for those who are active, HCP's should sell PA based upon the affective benefits (i.e., vitality benefits). Programs that sell PA based upon the physical health benefits (e.g., EIM) may be effective for non-active individuals, but be less effective for active individuals. HCP's and intervention programs should carefully consider their target population when choosing their PA sell and subsequent message.

5. Declarations of interest

None.

References

- van 't Riet, J., Ruiter, R. A., Werrij, M. Q., & de Vries, H. (2010). Investigating message-framing effects in the context of a tailored intervention promoting physical activity. *Health Education Research*, *25*(2), 343–354.
- Ajzen, I., & Fishbein, M. (2005). The influence of attitudes on behavior. In D. Albarracín, B. T. Johnson, & M. P. Zanna (Eds.), *Handbook of attitudes and attitude change: Basic principles* (pp. 173–221). Mahwah, NJ: Erlbaum.
- Allender, S., Cowburn, G., & Foster, C. (2006). Understanding participation in sport and physical activity among children and adults: A review of qualitative studies. *Health Education Research*, *21*(6), 826–835.
- Berry, T. R., & Carson, V. (2010). Ease of imagination, message framing, and physical activity messages. *British Journal of Health Psychology*, *15*(1), 197–211. <https://doi.org/10.1348/135910709X447811>.
- Brand, R., & Ekkekakis, P. (2017). Affective-reflective theory of physical inactivity and exercise: Foundations and preliminary evidence. *German Journal of Exercise & Sport Research*, *48*(1), 48–58. <https://doi.org/10.1007/s12662-017-0477-9>.
- de Bruijn, G., Out, K., & Rhodes, R. E. (2014). Testing the effects of message framing, kernel state, and exercise guideline adherence on exercise intentions and resolve. *British Journal of Health Psychology*, *19*(4), 871–885. <https://doi.org/10.1111/bjhp.12086>.
- Centers for Disease Control and Prevention (2014). *Facts about physical activity*. May 23. Retrieved from <https://www.cdc.gov/physicalactivity/data/facts.htm>.
- Conner, M., Rhodes, R. E., Morris, B., McEachan, R., & Lawton, R. (2011). Changing exercise through targeting affective or cognitive attitudes. *Psychology and Health*, *26*(2), 133–149. <https://doi.org/10.1080/08870446.2011.531570>.
- Conner, M., & Sparks, P. (2005). The theory of planned behaviour and health behaviours. In M. Conner, & P. Norman (Eds.), *Predicting health behaviour: Research and practice with social cognition models* (pp. 170–222). (2nd ed.). Maidenhead: Open University Press.
- Covey, J. (2014). The role of dispositional factors in moderating message framing effects. *Health Psychology*, *33*(1), 52–65.
- Dunton, G. F., & Vaughan, E. (2008). Anticipated affective consequences of physical activity adoption and maintenance. *Health Psychology*, *27*(6), 703–710. <https://doi.org/10.1037/0278-6133.27.6.703>.
- Ekkekakis, P. (2013). *The measurement of affect, mood, and emotion*. New York: Cambridge University Press.
- Ekkekakis, P., Zenko, Z., Ladwig, M., & Hartman, M. (2018). Affective determinants of health behavior. *Affect as a potential determinant of physical activity and exercise: Critical appraisal of an emerging research field* Oxford University Press <https://doi.org/10.1093/oso/9780190499037.003.0011>.
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*, 175–191.
- Gellert, P., Ziegelmann, J. P., & Schwarzer, R. (2012). Affective and health-related outcome expectancies for physical activity in older adults. *Psychology and Health*, *27*(7), 816–828. <https://doi.org/10.1080/08870446.2011.607236>.
- Helfer, S. G., Elhaj, J. D., & Geers, A. L. (2015). Affect and exercise: Positive affective expectations can increase post-exercise mood and exercise intentions. *Annals of Behavioral Medicine*, *49*(2), 269–279.
- Jones, L. W., Sinclair, R. C., & Courneya, K. S. (2003). The effects of source credibility and message framing on exercise intentions, behaviors, and attitudes: An integration of the elaboration likelihood model and prospect theory. *Journal of Applied Social Psychology*, *33*(1), 179–196.
- Kin-Kit, L., Sheung-Tak, C., & Fung, H. H. (2014). Effects of message framing on self-report and accelerometer-assessed physical activity across age and gender groups. *Journal of Sport & Exercise Psychology*, *36*(1), 40–51. <https://doi.org/10.1123/jsep.2012-0278>.
- Kiviniemi, M. T., Voss-Humke, A. M., & Seifert, A. L. (2007). How do I feel about the behavior? The interplay of affective associations with behaviors and cognitive beliefs

- as influences on physical activity behavior. *Health Psychology*, 26(2), 152–158. <https://doi.org/10.1037/0278-6133.26.2.152>.
- Kwan, B. M., & Bryan, A. (2010). In-task and post-task affective response to exercise: Translating exercise intentions into behaviour. *British Journal of Health Psychology*, 15, 115–131. <https://doi.org/10.1348/135910709X433267>.
- Latimer, A. E., Brawley, L. R., & Bassett, R. L. (2010). A systematic review of three approaches for constructing physical activity messages: What messages work and what improvements are needed? *International Journal of Behavioral Nutrition and Physical Activity*, 7(36), 1–17. <https://doi.org/10.1186/1479-5868-7-36>.
- Latimer, A. E., Rench, T. A., Rivers, S. E., Katulak, N. A., Materese, S. A., Cadmus, L., ... Salovey, P. (2008). Promoting participation in physical activity using framed messages: An application of prospect theory. *British Journal of Health Psychology*, 13(4), 659–681. <https://doi.org/10.1348/135910707X246186>.
- Lawton, R., Conner, M., & McEachan, R. (2009). Desire or reason: Predicting health behaviors from affective and cognitive attitudes. *Health Psychology*, 28(1), 56–65.
- Lowe, R., Eves, F., & Carroll, D. (2002). The influence of affective and instrumental beliefs on exercise intentions and behavior: A longitudinal analysis. *Journal of Applied Social Psychology*, 32(6), 1241–1252.
- Marcus, B., Selby, V., Niaura, R., & Rossi, J. (1992). Self-efficacy and the stages of exercise behavior change. *Research Quarterly for Exercise & Sport*, 63(1), 60–66. <https://doi.org/10.1080/02701367.1992.10607557>.
- Morris, B., Lawton, R., McEachan, R., Hurling, R., & Conner, M. (2016). Changing self-reported physical activity using different types of affectively and cognitively framed health messages, in a student population. *Psychology Health & Medicine*, 21(2), 198–207. <https://doi.org/10.1080/13548506.2014.997762>.
- Parrott, M. W., Tennant, L. K., Olejnik, S., & Poudevigne, M. S. (2008). Theory of planned behavior: Implications for an email-based physical activity intervention. *Psychology of Sport and Exercise*, 9, 511–526. <https://doi.org/10.1016/j.psychsport.2007.07.002>.
- Pfeffer, I. (2013). Regulatory fit messages and physical activity motivation. *Journal of Sport & Exercise Psychology*, 35(2), 119–131.
- Rhodes, R. E., & Courneya, K. S. (2005). Threshold assessment of attitude, subjective norm, and perceived behavioral control for predicting exercise intention and behavior. *Psychology of Sport and Exercise*, 6, 349–361. <https://doi.org/10.1016/j.psychsport.2004.04.002>.
- Rhodes, R., Fiala, B., & Conner, M. (2009). A review and meta-analysis of affective judgments and physical activity in adult populations. *Annals of Behavioral Medicine*, 38(3), 180–204. <https://doi.org/10.1007/s12160-009-9147-y>.
- Rothman, A. J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: The role of message framing. *Psychological Bulletin*, 121(1), 3–19.
- Rothman, A. J., Wlaschin, J. T., Bartels, R. D., Latimer, A., & Salovey, P. (2008). How persons and situations regulate message framing effects: The study of health behavior. In A. J. Elliot (Ed.), *Handbook of approach and avoidance motivation* (pp. 475–486). New York, NY: Psychology Press.
- Sallis, R. (2015). Exercise is medicine: A call to action for physicians to assess and prescribe exercise. *The Physician and Sportsmedicine*, 43(1), 22–26. <https://doi.org/10.1080/00913847.2015.1001938>.
- Segar, M. L., Guérin, E., Phillips, E., & Fortier, M. (2016). *From a vital sign to vitality: Selling exercise so patients want to buy it*. *Current Sports medicine reports*, 15, Lippincott Williams & Wilkins 276–281. <https://doi.org/10.1249/JSR.0000000000000284>.
- Sirriyeh, R., Lawton, R., & Ward, J. (2015). Physical activity and adolescents: An exploratory randomized controlled trial investigating the influence of affective and instrumental text messages: Erratum. *British Journal of Health Psychology*, 20(2), 447–448. <https://doi.org/10.1111/bjhp.12140>.
- Updegraff, J. A., & Rothman, A. J. (2013). Health message framing: Moderators, mediators, and mysteries. *Social & Personality Psychology Compass*, 7(9), 668–679. <https://doi.org/10.1111/spc3.12056>.
- U.S. Department of Health and Human Services (2000). *Healthy people 2020: Understanding and improving health* (2nd ed.). Washington, DC: U.S. Government Printing Office.
- Williams, D. M. (2008). Exercise, affect, and adherence: An integrated model and a case for self-paced exercise. *Journal of Sport & Exercise Psychology*, 30(5), 471–496.
- Williams, D. M., Dunsiger, S., Ciccolo, J. T., Lewis, B. A., Albrecht, A. E., & Marcus, B. H. (2008). Acute affective response to a moderate-intensity exercise stimulus predicts physical activity participation 6 and 12 months later. *Psychology of Sport and Exercise*, 9, 231–245. <https://doi.org/10.1016/j.psychsport.2007.04.002>.
- Zhang, Y., Fishbach, A., & Kruglanski, A. W. (2007). The dilution model: How additional goals undermine the perceived instrumentality of a shared path. *Journal of Personality and Social Psychology*, 92(3), 389–401. <https://doi.org/10.1037/0022-3514.92.3.389>.
- Zunft, H. F., Friebe, D., Seppelt, B., Widhalm, K., de Winter, A. R., Vaz del Almeida, M. D., Kearney, J. M., & Gibney, M. (1999). Perceived benefits and barriers to physical activity in a nationally representative sample in the European Union. *Public Health Nutrition*, 2, 153–160.