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Does Affective Valence During and Immediately Following a 10-Min Walk Predict Concurrent and Future Physical Activity?

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Abstract

Background—Affect may be important for understanding physical activity behavior.

Purpose—To examine whether affective valence (i.e., good/ bad feelings) during and immediately following a brief walk predicts concurrent and future physical activity.

Methods—At months 6 and 12 of a 12-month physical activity promotion trial, healthy low-active adults ($N=146$) reported affective valence during and immediately following a 10-min treadmill walk. Dependent variables were self-reported minutes/week of lifestyle physical activity at months 6 and 12.

Results—Affect reported during the treadmill walk was cross-sectionally (month 6: $\beta=28.6$, $p=0.008$; month 12: $\beta=26.6$, $p=0.021$) and longitudinally ($\beta=14.8$, $p=0.030$) associated with minutes/week of physical activity. Affect reported during a 2-min cool down was cross-sectionally (month 6: $\beta=21.1$, $p=0.034$; month 12: $\beta=30.3$, $p<0.001$), but not longitudinally associated with minutes/week of physical activity. Affect reported during a postcool-down seated rest was not associated with physical activity.

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Conclusions—During-behavior affect is predictive of concurrent and future physical activity behavior.

Keywords

Core affect; Feeling scale; Exercise; Physical activity

Introduction

Regular physical activity is associated with numerous health benefits [1]; however, national prevalence rates remain low [2], and sustained compliance with physical activity programs is inconsistent at best [3]. Thus, better understanding of the factors that predict adherence to physical activity programs is a public health priority [4].

Attempts to understand and increase physical activity behavior have traditionally been guided by theories that emphasize cognitive factors [5–9]. However, affect (e.g., mood, emotion) has received increasing attention in newly formulated conceptual models of physical activity motivation. For example, consistent with hedonic theories of behavior [10–12], core affective valence (e.g., good/bad feelings) in response to physical activity has been posited as an important determinant of future physical activity behavior [13–15].

Three recent studies have examined the association between (a) affect reported during and/or immediately following a physical activity stimulus and (b) concurrent or future physical activity behavior. First, Williams and colleagues [16] found that affective valence during a moderate intensity physical activity stimulus (i.e., 64–76 % of age-predicted maximal heart rate) was positively related to future physical activity of at least moderate intensity among previously sedentary adults. A strength of this study was its longitudinal design; however, limitations included a small sample size ($N=37$) and use of a single data point as an indicator of affective valence.

Second, Schneider and colleagues [17] examined cross-sectional associations between affective response to two different physical activity stimuli (moderate and vigorous intensity) and physical activity behavior among moderately active adolescents. Affective valence *during* the *moderate intensity* stimulus (80 % of ventilatory threshold) was positively related to physical activity behavior, whereas affective valence immediately and 10 min *after* the *moderate intensity* stimulus was *not* related to physical activity behavior. Conversely, affective valence *during* the *vigorous intensity* stimulus (halfway between ventilatory threshold and peak oxygen uptake) was *not* related to physical activity, while an association of marginal statistical significance was found between affective valence *after* the *vigorous intensity* stimulus and physical activity behavior. A strength of this study was the multiple assessments of affective valence during and following both moderate and vigorous intensity physical activity stimuli. A weakness of the study was the cross-sectional design.

Finally, Kwan and Bryan [18] examined longitudinal relationships between affective response to physical activity and future physical activity behavior among relatively active young adults. Their measurement approach differed from the two previously discussed studies [16, 17] in two respects. First, core affective response to physical activity was

assessed in a way that is consistent with Watson and Tellegen's rotated circumplex model [19], in which affective valence (i.e., positive versus negative) is conceptualized in conjunction with affective activation (i.e., high versus low) yielding four potential quadrants of core affect: (a) positive activated affect (i.e., positive valence, high activation—e.g., energetic); (b) positive deactivated affect (i.e., positive valence, low activation—e.g., calm); (c) negative deactivated affect (i.e., negative valence, low activation—e.g., fatigued); and (d) negative activated affect (i.e., negative valence, high activation—e.g., anxious). Second, the dependent measure focused on purposeful vigorous intensity exercise [e.g., “running, swimming, bicycling, step aerobics, and basketball” (18, p. 118)] rather than lifestyle physical activity. Despite these differences, findings were generally consistent with the other two studies. Specifically positive activated affect (e.g., energetic) and negative deactivated affect (e.g., fatigued) experienced *during* the moderate intensity physical activity stimulus (i.e., 65 % of maximal oxygen consumption) were positively and inversely (respectively) related to future physical activity. Additionally, positive deactivated affect (e.g., relaxed) and negative deactivated affect (e.g., fatigued) experienced 15 and 30 min *after* the moderate intensity physical activity stimulus were positively and inversely (respectively) related to future physical activity. Strengths of this study were the longitudinal design and multiple assessments of core affect during and following the physical activity stimulus. A potential weakness is that the dependent measure assessed *vigorous intensity* exercise, whereas the independent variable was affective response to a *moderate intensity* physical activity stimulus.

Taken together, these studies have provided some initial support for the posited relationship between affective response to physical activity and physical activity behavior [13–15]; however, the evidence has thus far been characterized as “preliminary” [20] and based on a “limited body of data” [21]. Moreover, findings regarding the predictive power of during-physical-activity versus postphysical-activity affect have been mixed [17, 18].

Thus, the purpose of the present study was to examine healthy adults' core affective valence in response to acute moderate intensity physical activity stimuli (i.e., 10-min treadmill walks) as predictors of concurrent and future physical activity behavior. Consistent with recent conceptual models of physical activity motivation [13–15], we hypothesized (H1) that participants reporting more positive (or less negative) affective valence *during* the walking stimuli would report higher levels of concurrent and future physical activity. Additionally, we hypothesized (H2) that more positive (or less negative) affective valence *after* the walking stimuli would *not* predict concurrent and future physical activity. The latter hypothesis was based on the operant conditioning principle that more distal consequences of behavior (i.e., affect experienced *after* the physical activity stimulus) are less likely than proximal consequences (i.e., affect experienced *during* the physical activity stimulus) to influence future behavior [22]. In addition to our main hypotheses regarding acute affective response to physical activity as a predictor of physical activity behavior, we examined the inverse relationship: change in physical activity behavior as a predictor of acute affective response to physical activity. Finally, we explored perceived exertion during the walking stimuli as a predictor of concurrent and future physical activity, as previous research has shown relationships between perceived exertion and both affective valence and future physical activity behavior [16, 23].

Methods

Participants

Participants ($N=146$) were healthy, low-active (<90 minutes/ week of at least moderate intensity physical activity) adults (ages 18–65) recruited as part of a randomized controlled physical activity promotion trial via Intranet postings and fliers distributed at local health fairs, churches, and physician's offices (for a report of the main trial see [24]). Participants were excluded for body mass index >40, asthma, emphysema, chronic bronchitis, hypertension, heart disease of any kind or an abnormal electrocardiogram, stroke, chronic infectious disease, any musculoskeletal problem limiting treadmill testing or ability to exercise, or any other serious medical condition that might make exercise unsafe. Other exclusion criteria were a schedule that would make adherence unlikely (such as very frequent travel), plans to move from the area within the next year, current or planned pregnancy, self-report of more than three alcoholic drinks per day on five or more days per week, hospitalization for a psychiatric disorder in the last 6 months or currently suicidal, bipolar, psychotic, or using prescription medication that might impair physical activity tolerance (e.g., beta blockers). Participants read and signed an institutionally approved consent form. Participants were enrolled between September 2006 and April 2008, with final follow-ups conducted in April 2009.

Measures

Feeling Scale—The feeling scale is a single-item measure of the valence dimension of affect [25]. Participants were asked to rate their present feelings on an 11-point good/bad bipolar scale with verbal anchors at +5=very good, +3=good, +1= fairly good, 0=neutral, -1=fairly bad, -3=bad, -5=very bad. The feeling scale has been used as a measure of affective valence in a number of physical activity studies (for a review, see [26]) and has been shown to be related to other measures of affective valence [27], and to be cross-sectionally [23] and longitudinally [16] associated with physical activity participation.

Rating of Perceived Exertion—Perceived exertion was measured using Borg's rating of perceived exertion scale [28]. The scale has numerical ratings ranging from 6 to 20 with verbal anchors of 7="very, very light," 9="very light," 11 = "fairly light," 13 = "somewhat hard," 15="hard," 17="very hard," and 19="very, very hard." The participants were instructed on how to use the rating of perceived exertion scale as described in the American College of Sports Medicine guidelines [29].

Physical Activity Recall—The physical activity recall assesses physical activity participation during the past 7 days. This interviewer-administered measure was originally developed for the Stanford Five City Project [30, 31]. The physical activity recall has been sensitive to change in moderate intensity physical activity in intervention trials [32, 33], and numerous studies have demonstrated its reliability and validity (for a review, see [34]). The primary outcome in this study is self-reported minutes/week of at least moderate-intensity physical activity.

Procedures

As part of the parent trial, participants were randomized to receive one of two print-based 12-month lifestyle (i.e., un-supervised) physical activity promotion programs, with materials individually tailored based on either five (*print condition*) or ten (*enhanced print condition*) psychosocial constructs (for a detailed report of the parent study see [24]). The goal for participants in both treatment conditions was to increase their physical activity to a level that met or exceeded national recommendations (150 minutes/week of moderate intensity physical activity [1, 35]). Total minutes/week of physical activity was assessed via the physical activity recall at baseline, month 6, and month 12.

Prior to each physical activity recall administration, participants engaged in a supervised 10-min moderate intensity treadmill walk. The purpose of the treadmill walk was to illustrate (at baseline) or remind (at months 6 and 12) participants of moderate intensity in order to encourage moderate-intensity physical activity during the trial and accurate reporting of physical activity intensity on the physical activity recall. As with the lifestyle physical activity performed during the course of the study, participants were allowed some freedom to choose their intensity during the treadmill walk as long as they were within the moderate intensity range. This allowed for a match between the intensity of the physical activity stimulus and the physical activity that was completed during the course of the lifestyle physical activity promotion program. Moderate intensity was defined as walking at a speed of 2.5–4.0 mph, which corresponds to three to five metabolic equivalents [36]. Participants began the treadmill walk at 2.0 mph and were gradually increased to 3.0 mph. If desired by the participant, the speed was then increased or decreased gradually based on participant comfort level; however, to avoid running, participants were not allowed to exceed 4.0 mph and were excluded from the present analyses if they requested a decrease in speed below the moderate intensity range (i.e., 2.5 mph). At 10 min, the speed was gradually decreased to 2.0 mph, and participants engaged in a 2-min cool-down after which they were seated for administration of the physical activity recall interview.

At months 6 and 12, participants responded to the feeling scale: (a) immediately prior to the treadmill walk (*prewalk*); (b) during the treadmill walk (*during-walk*: at minutes two, five, and eight; intercorrelation=0.95); (c) midway through the 2-min cool-down period (*cool-down*); and (d) following the cool down period [*postwalk*: immediately upon sitting and approximately 10 minutes later (following the physical activity recall); intercorrelation=0.89]. Perceived exertion was reported every minute during each treadmill walk and compiled into *during-walk* (minutes 2, 5, and 8; intercorrelation=0.89) and *cool-down* scores.

The feeling scale was not administered at the baseline treadmill walk because of concerns that it would interfere with the goals of the parent study. Specifically, given that participants were sedentary or low-active at baseline, we were concerned that the feeling scale would draw attention to the potentially aversive nature of the baseline moderate intensity walk [37, 38], thus decreasing their motivation to adhere to the lifestyle physical activity program.

Data Analyses

Analytic Plan—Physical activity data were positively skewed at months 6 (skewness=2.0) and 12 (skewness=5.9). We attempted to use a normalizing transformation, but this did not normalize the data [Kolmogorov-Smirnov $D(146)=0.23$, $p<0.001$ at month 6; $D(127)=0.19$, $p<0.001$ at month 12]. Thus, we adjusted our analyses accordingly. Specifically, in preliminary analyses, we used Spearman's rho, which is less sensitive to outliers compared to Pearson's correlation, to examine bivariate relationships between feeling scale and perceived exertion scores at the month 6 and 12 treadmill walks and physical activity level at months 6 and 12. In the primary analyses, we used quantile regression to model associations between feeling scale scores and the median—instead of mean—minutes/week of physical activity at months 6 and 12, as the median is a more appropriate measure of central tendency when data are skewed [39]. We fit three sets of three regression models. First, in month 6 cross-sectional analyses, we regressed month 6 physical activity (minutes/week) on the during-walk, cool-down, and postwalk feeling scale scores taken at the month 6 treadmill walk, controlling for prewalk feeling scale score and study condition (i.e., print vs. enhanced print). Second, in longitudinal analyses, we regressed month 12 physical activity (minutes/week) on the during-walk, cool-down, and postwalk feeling scale scores taken at the month 6 treadmill walk, controlling for prewalk feeling scale score, study condition, and month 6 physical activity levels. Third, in month 12 cross-sectional analyses, we regressed month 12 physical activity (minutes/week) on the during-walk, cool-down, and postwalk feeling scale scores taken at the month 12 treadmill walk, controlling for prewalk feeling scale score and study condition. For all models, bootstrapped standard errors are reported (corresponding to 1,000 reps). Regression coefficients correspond to estimated difference in median minutes of physical activity per week for each one-unit difference in feeling scale scores controlling for relevant covariates.

Missing Data and Sample Size Issues—There were 248 participants enrolled in the parent study [24], with 217 completing the physical activity recall at month 6, and 217 at month 12 (204 participants completed both the months 6 and 12 physical activity recalls). For purposes of this study, we discarded data if (a) the physical activity recall was administered via telephone, and thus, no treadmill walk was attempted ($n=28$ at month 6; $n=33$ at month 12); (b) the treadmill walk was not completed for medical or other reasons (e.g., illness or mild orthopedic injuries at the time of the assessment; $n=10$ at month 6; $n=10$ at month 12); or (c) the participant did not achieve at least 2.5 mph during minutes 2–10 of the treadmill walk ($n=1$ at month 6; $n=2$ at month 12). Thus, the month 6 cross-sectional analyses and the longitudinal analyses were conducted among the 146 participants who completed a valid treadmill walk at month 6, all of whom also completed month 6 and 12 physical activity recalls. The month 12 cross-sectional analyses were conducted among the 127 participants who completed a valid treadmill walk at month 12 and a month 12 physical activity recall.

Results

Preliminary Analyses

Table 1 shows baseline physical activity level and demographic characteristics for participants in the two subsamples analyzed in the present study ($N=146$ and 127). There were no differences on these variables among participants included or excluded from the two subsamples relative to the full sample of participants enrolled in the parent trial ($N=248$; $p>0.05$). Table 2 shows mean feeling scale score and (when relevant) perceived exertion scores at each time point for month 6 and 12 treadmill walks, as well as bivariate correlations between feeling scale and perceived exertion scores and month 6 and 12 physical activity levels.

Month 6 Cross-sectional Analyses

During-walk and cool-down feeling scale scores at the month 6 treadmill walk were associated with month 6 physical activity level ($\beta=28.6$, SE $\beta=10.7$, $p=0.008$; $\beta=21.1$, SE $\beta=9.9$, $p=0.034$) when controlling for prewalk feeling scale score and study condition. Postwalk feeling scale score at the month 6 treadmill walk was not associated with month 6 physical activity level ($\beta=7.4$, SE $\beta=10.8$, $p=0.491$) when controlling for prewalk feeling scale score and study condition.

Longitudinal Analyses

During-walk feeling scale score at the month 6 treadmill walk was predictive of month 12 physical activity level ($\beta=14.8$, SE $\beta=6.8$, $p=0.030$) when controlling for prewalk feeling scale score, study condition, and month 6 physical activity level.¹ Neither cool-down nor postwalk feeling scale scores at the month 6 treadmill walk were predictive of month 12 physical activity level ($\beta=2.5$, SE $\beta=7.0$, $p=0.726$; $\beta=0.0$, SE $\beta=6.6$, $p>0.999$) when controlling for prewalk feeling scale score, study condition, and month 6 physical activity level.

Month 12 Cross-sectional Analyses

During-walk and cool-down feeling scale scores at the month 12 treadmill walk were associated with month 12 physical activity level ($\beta=26.6$, SE $\beta=11.4$, $p=0.021$; $\beta=30.3$, SE $\beta=7.8$, $p<0.001$) when controlling for prewalk feeling scale score and study condition. Postwalk feeling scale score at the month 12 treadmill walk was not associated with month 12 physical activity level ($\beta=10.0$, SE $\beta=10.9$, $p=0.359$) when controlling for prewalk feeling scale score and study condition.

Secondary Analyses

Change in physical activity behavior from month 6 to 12 (as reported on the physical activity recall) was not predictive of month 12 affective response to physical activity (during-walk, cool-down, or postwalk feeling scale scores) when controlling for month 6 affective

¹Addition of perceived exertion scores to each regression equation had virtually no impact on regression coefficients for feeling scale scores. However, in the longitudinal analysis, the coefficient for during-walk feeling scale score ($\beta=14.8$, $p=0.030$) became marginally significant ($\beta=13.8$, $p=0.069$) when month 6 during-walk perceived exertion score was added to the equation.

response to physical activity and study condition. Likewise, there were no significant relationships between perceived exertion scores and month 6 and 12 physical activity levels.

Discussion

Hypothesis 1: Affective Response During a Physical Activity Stimulus Predicts Concurrent and Future Physical Activity Behavior

Consistent with our first hypothesis, affective response (i.e., positive versus negative valence) *during* the acute physical activity stimulus was cross-sectionally and longitudinally associated with physical activity behavior, even when controlling for previous level of physical activity in the longitudinal model. In practical terms, a one-unit difference in during-exercise feeling scale score was cross-sectionally associated with an estimated difference of 27–29 minutes/ week of physical activity and longitudinally associated with an estimated difference of 15 minutes/week of physical activity 6 months later. The use of both cross-sectional and longitudinal analyses helps to offset weaknesses of using either approach alone. That is, the cross-sectional analyses are likely an overestimate of the effects of affective valence on physical activity behavior because of the risk of reverse causality or third variable confounding [40]. On the other hand, the longitudinal analysis—in which previous physical activity behavior is controlled—is the conceptual equivalent of predicting *change* in physical activity behavior from month 6 to 12 and likely underestimates the effects of affective valence on overall physical activity behavior [40]. Thus, 15 and 29 minutes/week of physical activity may be viewed as lower and upper bounds on the effects of affective valence on physical activity behavior in this sample (but see “Limitations” for a discussion on causality).

Previous research has shown similar associations between affective response during an acute moderate intensity physical activity stimulus and concurrent [17] and future [16, 18] physical activity among adolescents and adults. Taken together, present and previous findings support the notion that affective response *during* moderate intensity physical activity is predictive of physical activity behavior [13–15].

Hypothesis 2: Affective Response Following a Physical Activity Stimulus Does Not Predict Concurrent and Future Physical Activity Behavior

Tests of our second hypothesis yielded mixed results. Core affective valence during the 2-min cool down phase (2.0 mph) was cross-sectionally, but not longitudinally related to physical activity. Affective valence reported upon sitting, however, was not related to concurrent or future physical activity. Taken as a whole, findings from the present study showed that affective valence experienced during a physical activity stimulus, during a cool-down period, and during seated rest has diminishing predictive power. These findings are consistent with applications of conditioning theory [22] to physical activity behavior [15] in that more temporally proximal outcomes of behavior (e.g., affect during exercise) are theorized to have a greater influence on future behavior relative to more distal consequences of behavior (e.g., affect *after* exercise).

However, the present findings diverge in this respect from those of Kwan and Bryan [18] who found 15- and 30-min *postphysical activity* affect was predictive of future physical activity behavior. This discrepancy may be explained by the fact that in Kwan and Bryan [18], the dependent variable was purposeful *vigorous intensity* exercise, whereas in the present study, it was *moderate intensity* physical activity. This moderate versus vigorous intensity explanation for the divergent findings is partially corroborated by Schneider and colleagues [17], who found that the relationship between *postphysical activity* affective response and physical activity behavior was present for *vigorous*, but not *moderate* intensity physical activity. Further research is needed to explain the apparent moderation of the relationship between post-physical activity affect and future physical activity behavior by physical activity intensity.

Secondary Analyses

In secondary analyses, we explored the possibility that increases in physical activity are predictive of a more positive or less negative affective response to acute physical activity. In combination with our primary findings, such a relationship would suggest a cyclical pattern in which increases in physical activity behavior lead to more positive affective response to physical activity, which in turn leads to greater increases in physical activity behavior. However, in the present study, changes in physical activity behavior from month 6 to 12 were not predictive of acute affective response to physical activity at month 12. These findings suggest that the relationship between affective response to physical activity and physical activity behavior is uni- rather than bidirectional, at least for participants who have already begun a physical activity program.

Likewise, perceived exertion during the exercise stimulus was not associated with concurrent or future physical activity, although bivariate correlations were in the expected direction (i.e., negative). In Williams and colleagues [16], perceived exertion recorded during an exercise stimulus at baseline of a physical activity promotion program was predictive of physical activity level at month 6, but not at month 12. Taken together, the findings suggest that perceived exertion predicts initial compliance with a physical activity promotion program, but does not predict continuation of physical activity once the program is underway. One possible explanation for this is that perceived exertion is more influential in determining future exercise when people are unfit and thus unaccustomed to the physiological strain of exercise, whereas such physiological responses become normalized and thus less significant once a physical activity program has been initiated.

Limitations

The above interpretations of the present findings should be considered in light of its limitations. First, the study design was observational; thus, while the findings may suggest potential causal pathways, causation should not be assumed. Even in the longitudinal analyses in which previous physical activity was controlled, it is possible that some unmeasured third variable may have influenced both positive affective response to acute physical activity and changes in physical activity between the month 6 and 12 time points. Future research should use experimental approaches to determine the causal impact of acute affective responses to physical activity on physical activity participation. Second, physical

activity behavior was assessed via self-report. Third, there is ongoing debate regarding the measurement of affective response to physical activity [18, 41, 42]. While the feeling scale has been recommended by some researchers as a measure of affective valence [43], one limitation is that it is only a single-item measure and thus may be less reliable than multi-item measures. This concern is somewhat circumvented in the present study as during-walk and postwalk assessments of affect included highly intercorrelated multiple administrations of the feeling scale. However, assessment of prewalk and cool-down affect included only a single feeling scale data point making it impossible to assess its reliability at those time points. Fourth, the participant sample consisted of primarily non-Hispanic Caucasian women; thus, the findings may not generalize to more diverse populations. Likewise, generalizability may be limited by the presence of the physical activity intervention. While intervention condition was controlled in the analyses, all participants received a physical activity intervention. The presence of the intervention likely provided optimal conditions for studying the relationship between affective response to acute physical activity and future physical activity behavior, as participants not exposed to an intervention would be less likely to change, thus resulting in less variability in the dependent variable. The observed relationships might not exist when physical activity behavior is self-motivated.

Finally, the feeling scale was not administered at the baseline treadmill walk because of concerns that it would draw attention to the potentially aversive nature of the baseline moderate intensity walk among the previously sedentary or low-active participants [37, 38] and thus interfere with the parent physical activity promotion study [24]. As a result, we were unable to examine acute affective response to physical activity *at initiation of a physical activity promotion program* as a predictor of physical activity behavior. However, in the context of a prior physical activity promotion trial among previously sedentary or low-active participants [33], Williams and colleagues [16] found that acute affective response at baseline was predictive of physical activity behavior at months 6 and 12. Taken together, the previous [16] and present findings suggest that acute affective response to physical activity is predictive of both initiation and continuation of physical activity promotion programs. Nonetheless, the lack of feeling scale data at baseline of the present physical activity promotion study inhibits our ability to fully examine the bidirectional relationship between acute affective response to physical activity and physical activity behavior among people who are previously sedentary or low active. Further research is needed to fully explicate this relationship, preferably at multiple time points over an extended period of time.

Implications

With these limitations in mind, the findings raise several theoretical and applied questions. From a theoretical perspective, it is important to identify the mechanism through which acute affective response to physical activity impacts future physical activity behavior. Consistent with decision affect theory [44] and response expectancy theory [45], Williams [15] has posited anticipated affective response to acute physical activity as a putative mediator. A second potential pathway is illustrated in Kivimäki's [46] concept of affective association, which is defined as how people feel when considering physical activity behavior. Finally, previous affective response to acute bouts of physical activity may influence affective attitudes about physical activity [47, 48] as posited in the Theory of

Planned Behavior [5]. Each of these putative mechanisms (i.e., anticipated affect, affective associations, and affective attitudes) may operate through deliberate conscious processing to influence the direction and strength of intention to engage in regular physical activity [49] and/or through more automated non-conscious processing routes occurring temporally proximal to each behavioral opportunity [50, 51].

From a practical perspective, the data suggest that if the affect experienced *during* physical activity could be made more positive (corresponding to a one-unit increase in the feeling scale, controlling for prewalk affect) this would—considering the caveats associated with causal interpretations—result in an increase of 15–29 minutes/week of physical activity participation. Such a change in affective valence *during* physical activity is reasonable, as it represents less than one standard deviation in during-walk feeling scale responses at months 6 and 12. Moreover, on a population level, an increase in physical activity of 15–29 minutes/week could result in substantial public health benefits. Indeed, in light of the accumulating evidence that increases in physical activity are likely to lead to health benefits even if such increases do not result in exceeding some threshold (e.g., 150 minutes/week of moderate intensity physical activity) [52, 53], recent national physical activity guidelines now clearly state that more physical activity is better [1,21,35].

Given the potential link between affective response to physical activity and adherence to physical activity programs, it is important to understand how to promote more positive or less negative affective valence *during* acute bouts of physical activity. Ekkekakis [54] has posited a dual-mode model in which both cognitive and interoceptive factors influence acute affective response to physical activity, with cognitive factors (e.g., expected outcomes of physical activity) having greater influence when the physical activity stimulus is below the ventilatory threshold and interoceptive factors (e.g., increased muscle pH) having greater influence when the physical activity stimulus exceeds the ventilatory threshold. Consistent with the dual mode model, Williams [15] has hypothesized that self-paced physical activity may lead to more positive (or less negative) affective valence relative to prescribed intensity physical activity because of (a) reduced likelihood of exceeding the ventilatory threshold and (b) increases in perceived autonomy (see also [55]). There is some preliminary indication that self-paced physical activity leads to a more favorable affective response and may be preferred to imposed-intensity physical activity, even when the absolute intensity is controlled [56–58].

In addition to physical activity intensity, other physical activity characteristics, such as physical activity modality and physical and social setting, have been shown to impact affective response to acute physical activity [59–61]. Finally, distraction and mindfulness strategies that have previously been examined in the context of sport performance enhancement are relevant to physical activity promotion to the extent that they can alleviate negative shifts in affective valence associated with acute physical activity [62]. Further research is needed to support these potential strategies for impacting affective response to acute physical activity, and, in turn, sustained physical activity behavior.

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Table 1

Baseline physical activity levels and sociodemographic factors

Variable	Sample 1 (N=146)	Sample 2 (N=127)
Mean (SD) age in years	47.6(10.1)	47.2(9.8)
Gender (% female)	87.0	86.6
Race/ethnicity (% non-Hispanic white)	81.5	81.9
Marital status (% married)	64.8	65.1
Employment (% employed)	80.0	81.8
College graduate (%)	64.8	61.9
Household income >\$50,000 (%)	58.6	57.9
Cigarette use (% current smokers)	5.5	6.4
Mean (SD) body mass index	28.1(4.6)	28.2(4.8)
Mean (SD) physical activity (minutes/week)	13.7(23.3)	13.0(22.2)
Completely sedentary (%)	67.8	67.7

Sample 1 includes participants included in the month 6 cross-sectional and longitudinal analyses. Sample 2 includes participants included in the month 12 cross-sectional analyses. Sample 2 is a subset of sample 1

Table 2

Mean/median and bivariate relationships (Spearman rho) among affect, perceived exertion, and physical activity level at months 6 ($N=146$) and 12 ($N=127$)

Variable	Mean (SD)	Correlation with month 6 PA Level	Correlation with month 12 PA Level
Month 6			
Prewalk FS	2.7(1.8)	0.14	0.10
During-walk FS	2.6(1.5)	0.25 **	0.24 **
Cool-down FS	3.1(1.6)	0.20 *	0.16 *
Postwalk FS	3.3(1.4)	0.15	0.13
During-Walk RPE	11.7(1.6)	-0.07	-0.04
Cool-down RPE	8.7(1.7)	-0.07	-0.01
Month 6 PA Level (median)	125.0	-	0.57 ***
Month 12			
Prewalk FS	2.5(1.9)	-	0.18 *
During-walk FS	2.6(1.6)	-	0.31 ***
Cool-down FS	2.8(1.7)	-	0.36 ***
Postwalk FS	3.3(1.6)	-	0.21 *
During-walk RPE	11.4(1.2)	-	-0.03
Cool-down RPE	10.0(2.7)	-	-0.14
Month 12 PA level (median)	95.0	-	-

FS feeling scale, RPE rating of perceived exertion, PA physical activity

*
 $p < 0.05$

**
 $p < 0.01$

 $p < 0.001$