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Association of Enjoyable Leisure Activities With Psychological and Physical Well-Being

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Abstract

Objective—To examine whether engaging in multiple enjoyable activities was associated with better psychological and physiological functioning. Few studies have examined the health benefits of the enjoyable activities that individuals participate in voluntarily in their free time.

Method—Participants from four different studies (*n* = 1399 total, 74% female, age = 19–89 years) completed a self-report measure (Pittsburgh Enjoyable Activities Test (PEAT)) assessing their participation in ten different types of leisure activities as well as measures assessing positive and negative psychosocial states. Resting blood pressure, cortisol (over 2 days), body mass index, waist circumference, and perceived physiological functioning were assessed.

Results—Higher PEAT scores were associated with lower blood pressure, total cortisol, waist circumference, and body mass index, and perceptions of better physical function. These associations withstood controlling for demographic measures. The PEAT was correlated with higher levels of positive psychosocial states and lower levels of depression and negative affect.

Conclusion—Enjoyable leisure activities, taken in the aggregate, are associated with psychosocial and physical measures relevant for health and well-being. Future studies should determine the extent that these behaviors in the aggregate are useful predictors of disease and other health outcomes.

Keywords

leisure; health behaviors; restoration; blood pressure; cortisol; mood

INTRODUCTION

Considerable research has examined the health impact of damaging behaviors, such as smoking, physical inactivity, and medical noncompliance. Similarly, many studies have been devoted to examining the impact of specific healthy behaviors, such as eating a good diet and having proper sleep hygiene. On the other hand, noticeably less emphasis has been devoted toward the health implications of engaging in enjoyable leisure activities that may also have beneficial properties.

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We define enjoyable leisure activities broadly as the pleasurable activities that individuals engage in voluntarily when they are free from the demands of work or other responsibilities. These might include hobbies, sports, socializing, or spending time in nature. Why might these activities be beneficial? From the coping literature perspective, Lazarus and colleagues suggested that enjoyable activities may be salutary, especially during times of stress and in the recovery period post stress (1). Specifically, some leisure activities (e.g., vacations, siestas, coffee breaks) may serve as "breathers" that provide a chance to take a break, engage in a pleasurable diversionary activity, and consequently induce positive emotions and reduce stress. Enjoyable activities may also act as "restorers" that facilitate the individual's recovery from stress by replenishing damaged or depleted resources (1). Restoration may occur as the result of positive social interactions (e.g., feeling protected, cared for) or relaxation that leads to increased positive emotions. As a result, a number of different types of leisure may have health benefits in the context of daily life events or during stressful situations. However, to date, no work has tested whether the overall frequency of engaging in breathers or restorers is beneficial for physical or mental well-being.

A small literature examines specifically restorative activities. These activities typically involve little mental effort, provide a sense of "being away," maintain engagement, and match the person's interests and abilities providing relief from the concerns that normally occupy the mind (2,3). Face-to-face interviews assessing what specific activities individuals find restorative have found several categories including creative, nature-related, social, physical, spiritual, reflective, and travel among others (2). To date, however, research on restorative activities has focused on cognitive outcomes, such as the ability to concentrate and direct attention (4) as opposed to physiological and psychological well-being.

Leisure scientists have long believed that leisure plays a role in benefiting overall well-being and buffering stress (5). This benefit may occur as the result of leisure encouraging positive feelings and promoting a variety of social and physical resources that allow individuals to feel refreshed and better cope with stress (6–8). Although the majority of research in this field focuses on the determinants of leisure and leisure satisfaction, there are a growing number of studies tying leisure to mental and physical health outcomes, although the vast majority focuses on leisure that involves physical activity (9–11).

In the context of health research, the most common approach for those studying enjoyable leisure activities is to focus on a single behavior thought to be beneficial and to look for direct effects on health or psychological outcomes. For example, exercising, engaging in social activities, having hobbies, vacationing, and spending time outdoors have all been independently shown to benefit a variety of well-being outcomes, both psychological (12–14) and biological, ranging from improved physiological function (15–18) to less severe disease outcomes (12–21) and greater longevity (22–24). Although informative, this approach may be limited in terms of our understanding of the true impact of engaging in leisure. What may be most important to health is whether an individual is taking the time to break from daily activities and work. Assessing only one activity may incorrectly assume that individuals are not taking time for a breather. Furthermore, the cumulative occurrence of different enjoyable behaviors is likely a more meaningful predictor of health and physiology as opposed to the occurrence of any one activity. To date, however, the well-being impact of the cumulative frequency of different types of leisure activities thought to be beneficial to health has not been established.

The current paper described the combined results across four studies that assess the associations between a measure of various types of enjoyable activities (Pittsburgh Enjoyable Activities Test (PEAT)) and psychological and physiological measures associated with well-being. We tested five hypotheses. Although we were primarily interested in whether it is valuable to group

different types of enjoyable activities into one scale, we first considered demographic differences in these activities and the role of socioeconomic status (SES). Given the known strong SES-health relationship (25) and the importance of financial resources for some types of leisure activities (26,27), we believed it important to consider leisure as a possible pathway by which SES could influence health. We anticipated that higher SES would be associated with greater frequency of these enjoyable activities, given the need for time and economic resources for some types of leisure. We did not have a priori hypotheses about other measured demographic characteristics, i.e., ethnicity, age, or gender.

For our second hypothesis, we anticipated that, to the extent that the PEAT measures breathers and restoring activities, it should be associated with better mood states. Restoration is thought to be associated with increased vigor, well-being, and calmness, which are all components of positive affect (PA). This indicates that PA and other positive constructs (e.g., life satisfaction) should be strongly associated with the PEAT. We also expected that the PEAT would be associated with lower levels of negative affect (NA) as well as more social support and larger social networks given the social nature of some types of leisure.

Third, based on prior research showing health benefits of individual leisure behaviors, we hypothesized that more frequent overall leisure (assessed by the PEAT) would be associated with better physiological function, including lower blood pressure, body mass index (BMI), and stress hormones, smaller waist circumference (WC), and better self-reported physical functioning. We also anticipated that the cumulative PEAT score would be a stronger correlate of these markers as opposed to any one leisure activity.

Fourth, to the extent that enjoyable leisure activities are a unitary concept, we expected that PEAT activities would be associated with other health behaviors thought to be restorative (i.e., more physical exercise and better sleep). However, we anticipated that these activities would not be entirely responsible for any found connections between the PEAT and well-being.

Finally, leisure has been hypothesized to buffer the damaging effects of stress (6,8). We anticipate that individuals who engage in more frequent enjoyable activities will experience less distress during times of stress as compared with those who infrequently engage in these activities.

METHODS

Participants

Four different studies from the Pittsburgh Mind Body Center were used in this paper and are described in Table 1. Study 1 (data collected 1999–2004) consisted of 193 healthy community-dwelling adults recruited from the general population (via newspaper advertisements) to participate in a study on upper respiratory illness. Study 2 (2000–2003) consisted of 262 patients with osteoarthritis and their spouses plus 19 unmarried female participants in a study of psychosocial factors involved in adjustment to osteoarthritis. Individuals in this sample were recruited from rheumatology clinics. Study 3 (1999–2005) consisted of 379 women participating in an already existing study (Pittsburgh Healthy Women Study) examining changes in cardiovascular risk factors as a function of transitioning through menopause and beyond. The final study (2001–2004) consisted of 284 patients participating in a study of adjustment to breast cancer. Newly diagnosed and recurring patients were identified by nurses in oncologists' offices and contacted by a study recruiter.

Design and Procedure

The research was approved by the Institutional Review Boards at Carnegie Mellon University and the University of Pittsburgh. All four studies administered a common battery of

sociodemographic, psychological, and physiological measures. WC, BMI, and resting systolic (SBP) and diastolic (DBP) blood pressures were measured either at home (Cohorts 2 and 4) or in a laboratory (Cohorts 1 and 3) by study experimenters using a standardized protocol. Salivary cortisol was collected at five preset times after waking up in the morning over 2 days. Because of the additional requirements unique to each study, the timing of each measurement component could not be precisely standardized. However, with only a few exceptions, participants completed their psychosocial batteries within 2 weeks of physiological data collection, typically with questionnaires completed first followed by biological measures in the ensuing weeks. The exception was Study 1, which had participants collect cortisol samples before psychosocial measure completion.

Measures

Sociodemographic Characteristics—Five questions were used to assess demographic information about the participants, including date of birth, sex, race, education, and income. We categorized participants as white/Caucasian or non-white/Caucasian because of the low percentage of minorities in our total sample (<15%). Educational attainment was scored on an 18-point scale ranging from “no formal education” (1 point) to “doctoral degree” (18 points). Yearly household income (before taxes) was assessed on a 13-point categorical scale ranging from “Less than $5,000” (1 point) to “$150,000 or more” (13 points).

PEAT—We considered a broad array of leisure activities, specifically focusing on those that might enhance well-being by acting as breathers, restorers, and stress buffers. After investigating various scales that assess leisure and restorative behaviors, we realized that no single index was available to assess the frequency with which individuals engage in various types of enjoyable leisure activities. Although there were existing scales, they were often too specific (e.g., leisure-time physical activity measures), too detailed (e.g., >50 items) making them implausible due to subject burden, or focused on leisure preferences or satisfaction as opposed to the cumulative frequency across activities, which we reasoned was the most important health determinant. We, therefore, constructed the PEAT as a brief index that would assess the frequency of engagement in a spectrum of enjoyable activities that could be done alone or with others, in an array of locations, and were both active and inactive. To do this, six items were drawn from an existing measure of leisure satisfaction, which had been developed to measure caregiver satisfaction with leisure time activities (28). Four additional items believed to be restorative or offer a breather were generated by the study investigators.[1] The ten total items were: spending quiet time alone; spending time unwinding; visiting others; eating with others; doing fun things with others; club, fellowship, and religious group participation; vacationing; communing with nature; sports; and hobbies. Although this list was not all inclusive, it tapped many different types of leisure (discussed in the above literatures) ensuring that no one demographic group went ignored.

Instructions for the PEAT were: “We are interested in how often in the last month you were able to spend time in activities that you enjoyed. Over the past month, how often have you been able to spend time doing the following?” Response options ranged from “Never” (0 point) to “Every Day” (4 points) and “Not Applicable/Do Not Enjoy” (0 point). The PEAT was scored as the sum of all items (maximum = 40).

Table 1 displays the means, standard deviations, and reliability coefficients of the PEAT across the four cohorts and for the combined sample. We did not anticipate that that these items would

[1]The six items drawn from the Stevens Leisure Satisfaction scale (28) were: spending quiet time by yourself; attending church/fellowship/club meetings; hobbies; going out for meals with friends and/or relatives; visiting family and friends; and doing fun things with others. The remaining four items generated by the authors were: engaging in sports; taking vacations out of town; being in parks and other outdoor settings; and “unwinding” at the end of the day.

be correlated strongly, given that individuals have different leisure preferences; however, the overall reliability coefficient of the index was a 0.67, indicating some overlap. Based on the Scree Plot extraction method (29), one factor emerged in the PEAT (Eigenvalue = 2.70, accounting for approximately 30% of the variance). Eight items loaded >0.40, with two items having a lower loading (quiet time = [0.35] and church/fellowship = [0.25]), again suggesting that the PEAT items are tapping different types of activity preferences not necessarily correlated with one another.

Psychosocial Measures—Several measures of positive and negative psychological attributes were assessed in the current study. Positive and negative affective states were measured with a reduced (18-item) version of the Profile of Mood States (30) as determined by a factor analysis of the adjectives. The scale consists of three PA subscales assessing vigor, well-being, and calm, and three NA subscales assessing depression, anxiety, and anger in the past week (α values: range = 0.76–0.92) with the factor analysis indicating independent factors for PA and NA. Depressive symptoms were assessed with the 10-item version of the Center for Epidemiological Studies Depression scale (31), a scale that correlates well with other measures of depressive symptoms and is used widely in diverse populations ($\alpha = 0.84$). Global life satisfaction was measured with the Satisfaction with Life Scale (32) ($\alpha = 0.87$) where participants rate how much they agree with self-descriptive sentences about their satisfaction of life. This measure has been shown not to correlate with social desirability and is associated in the expected direction with other measures of subjective well-being. Purpose in life was measured using the Life Engagement Test (33), a scale designed to assess the extent to which a person has a sense of purpose and meaning in life ($\alpha = 0.87$).

Social network size and diversity was assessed with the 12-item Social Network Index (21), a measure of participation in different types of social relationships. It assesses network diversity as well as the number of people in the social network. Social support was assessed by the short form (12-item) Interpersonal Support Evaluation List (34), a well-validated measure assessing the perceived availability of different types of social support (appraisal, belonging, and tangible) ($\alpha = 0.88$).

Recent stressful life events were assessed using 15 items drawn from the “Life Events Scale” (35) and the Elders Life Stress Inventory (36). Participants answered yes/no to whether particular events (e.g., death of a close friend; change in finances) had been experienced in the past 6 months. A sum score of “yes” answers was calculated.

Health Behaviors—Physical activity was assessed via the Paffenbarger Activity Questionnaire (37), an established, brief measure which assesses general level of exercise using kilocalories expended weekly. Sleep behaviors were assessed using a modification of the Pittsburgh Sleep Quality Index (38), an eight-item scale with the ability to distinguish reliably between good and poor sleepers ($\alpha = 0.83$). All scales are described in the high scoring direction.

Physical/Physiological Measurements—Participants completed the physical functioning scale from the Short-Form Health Survey, with higher scores meaning better functioning (39) ($\alpha = 0.80$). BMI was calculated by dividing weight (in kilograms) by the square of height in meters. WC was measured with a nonstretchable measuring tape to the nearest ½ inch (1.27 cm) at the narrowest area in the waist region (above the level of the umbilicus).

SBP and DBP measures were taken at the midpoint of the upper arm on the dominant arm as the participants were in a seated position. Participants rested quietly for 5 minutes with feet flat on the floor before measurement with their arms resting on a flat surface at the level of the

heart. Three blood pressure measures were taken with approximately 2 minutes between readings.

Salivary cortisol levels were determined using a competitive immunoassay procedure. Participants provided cortisol samples via "Salivette" (Sartstedt, Numbrecht, Germany) five times per day (1, 4, 9, 11, and 14 hours after waking up) for 2 consecutive days and were told not to eat or brush their teeth during the hour before the sample, and not to smoke within the half hour before the sample. Samples were excluded if the sample was >60 minutes off the scheduled time or if the cortisol value was an outlier (>3 standard deviations from the sample mean). Area under the curve (AUC) with respect to ground was calculated for each day to assess total cortisol production and averaged for a 2-day mean score (40). AUC was not calculated if any of the five samples were missing. Additionally, we assessed average cortisol slope over the 2 days (using the same exclusionary criteria) as an indicator of cortisol rhythm and calculated by random coefficient model in which the participants were treated as a random factor (41).

Statistical Analysis

To determine if there were any differences in PEAT scores as a function of sociodemographic variables, we conducted univariate linear regression for each variable separately. To test the first hypothesis that higher SES was related to higher PEAT scores, we conducted a multivariate linear regression analysis that included education and income, covarying age, race, and study sample. To test the remaining hypotheses, we first assessed the basic association between the PEAT and the dependent variable of interest (behavior, psychosocial trait, physical measures) using linear regression. This was followed by an assessment of the PEAT minus any items that were assessing a conceptually similar outcome as the dependent measure (e.g., PEAT sports item removed for exercise; social items removed for social measures). Next, we examined the association of the full PEAT with the dependent measures, controlling for basic demographic characteristics (year of birth, sex, race, sample), as well as an additional step controlling for the basic variables and SES variables (income, education). Adjusting for SES may be inadvertently overcontrolling. However, we included these adjustments for those readers who may want to know if the obtained associations remained after full adjustment. Finally, to test whether enjoyable leisure activities buffer the negative impact of stressful life events, we conducted regression analyses with the standard covariates, the PEAT, the life events scale, and the PEAT × Life Events product (all variables centered) as the predictor variables and the psychological and physiological well-being measures discussed above as the dependent variables.

RESULTS

Are Higher PEAT Scores Associated With Higher SES or Other Demographic Differences?

Demographic findings are shown in Table 2. Caucasians and those with higher income and education engaged in more frequent PEAT activities. Age was not associated with the PEAT. Multivariate analyses including all demographic items showed that education and income remained significant predictors of PEAT scores ($\beta = 0.19$ and 0.15, respectively; $p < .001$), independent of age, sample, gender, and ethnicity.

Women had higher PEAT scores than men (Table 2). Examination of sex differences at the item level with *t* tests showed that all of the items were endorsed more frequently by women (all $p < .05$) with the exception of the sports item that was more endorsed by men ($t(1315) = 3.00$, $p < .01$), and the vacation and fun things with others items that were endorsed at a similar frequency by both sexes ($p > .06$). There were no significant PEAT by sex interactions.

Are Higher PEAT Scores Associated With More Positive and Less Negative Psychosocial Characteristics?

Higher PEAT scores were associated with greater PA, life satisfaction and life engagement, and lower levels of NA and depression (Table 3). All three subcomponents of PA were associated with the PEAT (vigor: $\beta = 0.32$; calm: $\beta = 0.18$; well-being: $\beta = 0.29$; all $p < .001$). Social markers and religiosity were also associated positively with the PEAT (Table 3). Specifically, the PEAT was associated with having a larger and more diverse social network in unadjusted and adjusted analyses. The PEAT and the religious coping scale, on the other hand, were not associated once the church item was removed from the PEAT total score.

When both PA and NA were entered simultaneously into the regression model predicting the PEAT (including all covariates), only PA remained associated with the PEAT scores (PA: $\beta = 0.35$, $p < .001$; NA: $\beta = 0.029$, $p = .42$). A follow-up analysis examining all positive and negative psychological measures entered simultaneously indicated that PA was the strongest predictor ($\beta = 0.24$, $p < .001$), followed by life engagement ($\beta = 0.11$, $p < .001$) and life satisfaction $\beta = 0.083$, $p < .05$), whereas NA and depression were not significant.

Are Higher PEAT Scores Associated With Better Physiological Function?

Higher PEAT scores were correlated with lower WC, BMI, SBP, DBP, and cortisol AUC and higher self-reported physical function (Table 4). Inclusion of education and income reduced the association of DBP and BMI with the PEAT scores. Given that exercise is likely a strong correlate of many of these outcomes, we redid the analyses of the PEAT with the physiological outcomes after removing the sports item. All physical outcomes remained significantly associated with the PEAT (minus sports item). The PEAT was not associated with cortisol rhythm as assessed by average slope.

Given that many of the activities represented by PEAT items have been tied independently to various physiological outcomes, we also tested whether the relative strength of the association between any one item of the scale was a stronger correlate of the outcomes than the PEAT in its entirety. After accounting for the standard covariates, we found that no item was significantly associated with as many physical or psychological outcomes as the overall PEAT.

Finally, this scale has a number of socially relevant items raising the question of whether the benefits of the PEAT are merely due to that of social support. Similarly, benefits of the PEAT may also arise because of the psychological well-being that engaging in leisure endows. We, therefore, tested whether the associations between the PEAT and the physiological outcomes would persist if we controlled sequentially for PA, NA, social support, and life satisfaction. We found that in only one case was the association of the PEAT with the physiological variables reduced to nonsignificance. When either PA or life satisfaction was included in the analysis of BMI, the initial association between the PEAT and BMI was reduced approximately 30% to marginal levels ($p < .1$).

Are PEAT Scores Associated With Other Types of Health Behaviors?

Greater PEAT scores were associated with better sleep and exercise outcomes (Table 5). To test whether the PEAT is a stronger correlate of psychological and physiological function than these health behaviors, we examined the impact of including them with the PEAT in the regression equation. Most outcomes remained significantly associated ($p < .05$) with the PEAT after including the standard covariates and either sleep efficiency or exercise (KCal per week). The one exception was BMI, which became nonsignificant when exercise was included ($\beta = -0.036$, $p = .28$). None of the health behavior measures correlated with as many well-being outcomes as the PEAT.

Do PEAT Activities Buffer the Negative Impact of Stressful Life Events?

After controlling for the standard covariates, stressful life events were found to be associated with lower PA ($\beta = -0.24$, $p < .001$), life satisfaction ($\beta = -0.20$, $p < .001$), and life engagement ($\beta = -0.15$, $p < .001$), in addition to greater NA ($\beta = 0.25$, $p < .001$) and depression ($\beta = 0.27$, $p < .001$). Stressful life events were also associated with greater WC and BMI ($\beta = 0.11$ and 0.13, respectively, $p < .01$), greater resting SBP ($\beta = 0.085$, $p < .05$), and worst self-reported physical function ($\beta = -0.15$, $p < .05$). DBP and cortisol were not significantly associated with stressful life events ($p > .05$).

Significant (or marginal) interaction terms were found for all of the psychological measures with the strongest association being found for depression ($\beta = -0.35$, $p < .01$) and the weakest for PA ($\beta = 0.22$, $p = .07$). Figure 1 depicts the buffering effect of enjoyable leisure activities on stress for PA and NA ($\beta = -0.31$, $p < .05$) showing that stressful life events have a lesser negative impact on mood when PEAT activities are high. The slopes between high and low stress groups were significantly different for both PA and NA in these analyses (F = 3.78 and 4.44, $p < .05$). There were no significant interactions between the PEAT and stress for the physical outcomes.

Does the PEAT Mediate the Association Between SES and Health?

Given the associations between the PEAT and SES, and the findings that the associations between the PEAT and physiological variables were reduced by the inclusion of SES variables, we explored whether inclusion of PEAT scores reduced the associations between SES variables and physiological health outcomes. First, education was associated significantly with all physiological variables with β values ranging from −0.06 (DBP) to 0.15 (physical function). Income level was associated significantly with all but BP with β values ranging from 0.005 (SBP) to −0.23 (waist). Inclusion of the PEAT in the regression equations resulted in the original associations being reduced up to 50% for the education variable (in this example, WC) and up to 35% for the income variable (with physical function).

DISCUSSION

Consistent with study hypotheses, individuals who engaged in more frequent enjoyable leisure activities had better psychological and physical functioning. They reported greater PA, life satisfaction, life engagement, social support as well as lower depression and NA; they had lower blood pressure, cortisol AUC, BMI, WC, and better perceived physical function, even after adjusting for the standard demographic variables. The PEAT scores were not associated with cortisol slope perhaps because a flatter cortisol slope is found typically in chronically stressed or burned out populations (42,43), whereas AUC varies with psychological function and mood (44). BMI, WC, and blood pressure are tied to increased risk of early mortality and morbidity (43,45–47). The frequent occurrence of enjoyable leisure activities may play some role in accounting for the morbidity and mortality associated with greater weight, fat distribution, and blood pressure. However, because the analyses are cross sectional, we cannot conclude that these activities cause these outcomes as it is also possible that good health encourages engagement in leisure activities.

Consistent with our hypothesis, the PEAT scores were correlated positively with better self-reported sleep and more exercise, even after removing the items of the scale most relevant to these behaviors. These findings suggest that the PEAT has convergent validity with other health behaviors. Including these activities with the PEAT did not remove the original associations with well-being, indicating that benefits from these enjoyable leisure activities are not due to associations with other positive health behaviors.

As predicted, the PEAT was correlated positively with SES. This is consistent with the leisure field (26,48) and may be indicative of a pathway by which SES influences health. We found preliminary evidence for this in our data: PEAT scores account for up to 50% of the association between SES and physiological outcomes. In addition, higher PEAT scores were apparent for women and Caucasians. This may be due to women placing greater importance on social and artistic aspects of leisure (represented by at least four items) whereas men place more value on sports and outdoor activities (two items) (49). Interestingly, although men scored higher than women on the single exercise item, there was no difference in reported outdoor activity. Race differences in the PEAT were also consistent with previously found leisure differences in Caucasians/African-Americans (50,51).

As predicted, we also found evidence that engaging in multiple types of leisure activities plays a role in buffering the negative psychological impact of stress. Individuals who had experienced more stressful life events in the past but who also typically engage in more PEAT activities showed lower levels of negative moods and depression, and higher PA, life satisfaction, and engagement than their low PEAT counterparts. This is congruent with the idea that enjoyable leisure activities offer a breather from stress and increase restoration (52). Physiological measures associated with stressful events were not buffered by enjoyable activities. This matches previous work showing stronger buffering effects on psychological outcomes as opposed to physical outcomes (53,54). It may be that the physical benefits of these activities occur directly as opposed to only during times of stress. Future studies should test whether individuals who engage in more of these activities show stress-buffering effects on physiology during times of stress.

Analyses on the relative importance of PA and NA with the PEAT found that, when both were entered simultaneously in the model, NA was no longer significant. Similarly, when all positive and negative measures were entered together, only positive constructs remained significantly associated with the PEAT. This may be due to the presence of PA (but not a lack of NA) encouraging exploration, creativity, and socialization corresponding to the Broaden and Build theory of positive emotions (55). Although we cannot determine the directionality of these associations nor the possibility that there may be a feedback loop of leisure activities and PA, it is clear that positive measures are tied markedly to these activities. Future studies should further explore the possibility that leisure time behaviors are a unique pathway by which PA influences well-being.

There seems to be value in aggregating leisure activities together as opposed to studying any one specific activity. No one activity type was associated with as many outcomes as the total PEAT, and although certain items were logically more tied to certain outcomes (e.g., exercise with WC; data not shown), this does not necessarily argue against the value of having a greater number of health-relevant associations by using a broader array of items. We also have preliminary evidence that the PEAT is associated with physiological outcomes (except for BMI) above and beyond the effects of social support and affect, providing support that these activities are associated independently with physical well-being.

Our study has a number of advantages and disadvantages related to combining the four study samples. Regarding advantages, our combined sample provided an opportunity to assess the PEAT in a large number of individuals who were diverse in SES, gender, ethnicity, and age. It provided a context to test initially the reliability and validity of the PEAT items, with adequate statistical controls, and it allowed us to test the associations of the PEAT with multiple psychological, social, and physical outcomes.

Regarding disadvantages, there were some minor differences in data collection techniques (e.g., completing questionnaires with or without an interviewer). Similarly, because of the

different study-specific requirements, timing of measurement could not be standardized. However, the majority of the variability in timing was between studies as opposed to within, and the vast majority of participants completed the questionnaires and physiological samples within a 2-week period. Thus, minor differences in timing and protocol were statistically adjusted by controlling for cohort in all analyses. We also examined the PEAT by study interactions and no significant patterns emerged. Finally, although the categories of enjoyable activities in the PEAT are rather broad, the PEAT may have missed some activities that are important for specific individuals or cultural groups.

The PEAT was tested as a brief, cumulative scale that is useful for assessing a wide range of enjoyable leisure activities that may serve a health-benefiting function by acting as breathers or restorers. The majority of the items held together in the internal reliability analysis and the PEAT was related to sleep and physical exercise, suggesting that to some extent different types of enjoyable leisure activities go hand in hand. On the other hand, the low α of 0.68 suggests that engaging in one activity is not necessarily indicative of participation in another. This is especially true of the item assessing club/church participation. This was the only item that individuals endorsed a “not applicable or do not enjoy” response (8.4% of the total sample) and it also had the lowest extraction score in the factor analysis.

One remaining open question is whether or not these activities are actually restorative. Restoration is typically marked by greater feelings of well-being, calm, and vigor—a pattern confirmed in this study—indicating that these enjoyable activities may in fact serve as restorers and breathers. However, because these data were not assessed longitudinally after periods of stress or nonstress within person, further studies are necessary to determine whether or not these leisure activities truly restore individuals to baseline functioning after disruption by a stressful event. Future work is also needed to disentangle whether health benefits are due to direct associations with physiological functioning (56), indirect effects by altering emotions, expectations, self-evaluations, and social network qualities (also tied to health) (57–59), or via stress-buffering effects, although in this study they were not found for physiological health outcomes. It is also plausible that being denied the opportunity to engage in usual leisure may serve as an additional source of distress itself, another issue which should be addressed. Longitudinal studies testing these questions would prove invaluable as would research examining whether these enjoyable leisure activities predict better disease outcomes, or whether healthy individuals are able to engage in more leisure. The PEAT may facilitate answering some of these questions.

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Glossary

PEAT	Pittsburgh Enjoyable Activities Index
SBP	systolic blood pressure
DBP	diastolic blood pressure
BMI	body mass index
WC	waist circumference
SES	socioeconomic status

References

1. Lazarus, RS.; Kanner, AD.; Folkman, S. Emotions: A cognitive-phenomenological analysis. In: Plutchik, R.; Kellerman, H., editors. Theories of Emotion. New York: Academic Press; 1980.
2. Jansen DA, von Sadovszky V. Restorative activities of community-dwelling elders. West J Nurs Res 2004;26:381–99. discussion 400–4. [PubMed: 15155023]
3. Kaplan S. The restorative benefits of nature: toward an integrative framework. J Environ Psychol 1995;15:169–82.
4. Cimprich B. Development of an intervention to restore attention in cancer patients. Cancer Nurs 1993;16:83–92. [PubMed: 8477404]
5. Iwasaki Y, Mackay KJ, Mactavish JB, Ristock J, Bartlett J. Voices from the margins: stress, active living, and leisure as a contributor to coping with stress. Leisure Sci 2006;28:163–80.
6. Iwasaki Y, Schneider IE. Leisure, stress and coping: an evolving area of inquiry. Leisure Sci 2003;25:107–13.
7. Iwasaki Y, Mannell RC. Hierarchical dimensions of leisure stress coping. Leisure Sci 2000;22:163–81.
8. Coleman D, Iso Ahola S. Leisure and health: the role of social support and self determination. J Leisure Res 1993;25:11–28.
9. Wong CH, Wong SF, Shen L. Correlates of habitual walking and sports/leisure-time physical activity in older persons in Singapore: interaction effects between educational attainment and gender. Ann Acad Med Singapore 2003;32:801–6. [PubMed: 14716950]
10. Szabo A, Meskó A, Caputo A, Gill ET. Examination of exercise induced feeling states in four modes of exercise. Int J Sport Psychol 1998;29:376–90.
11. Batty GD, Shipley MJ, Marmot M, Davey Smith G. Leisure time physical activity and coronary heart disease mortality in men symptomatic or asymptomatic for ischemia: evidence from the Whitehall study. J Public Health Med 2003;25:190–6. [PubMed: 14575192]
12. Diener, E.; Lucas, RE.; Oishi, S. Subjective well-being: the science of happiness and life satisfaction. In: Snyder, CR.; Lopez, SJ., editors. Handbook of Positive Psychology. New York: Oxford University Press; 2002.
13. Ryff CD, Singer BH, Dienberg Love G. Positive health: connecting well-being with biology. Philos Trans R Soc Lond B Biol Sci 2004;359:1383–94. [PubMed: 15347530]
14. Watson D. Intraindividual and interindividual analyses of positive and negative affect: their relation to health complaints, perceived stress, and daily activities. J Pers Soc Psychol 1988;54:1020–30. [PubMed: 3397861]
15. Benca RM, Quintas J. Sleep and host defenses: a review. Sleep 1997;20:1027–37. [PubMed: 9456469]
16. Simon, HB. Exercise and human immune function. In: Ader, R., editor. Psychoneuroimmunology. San Diego, CA: Academic Press; 1991.
17. Staats H, Gatersleben B, Hartig T. Change in mood as a function of environmental design: arousal and pleasure on a simulated forest hike. J Environ Psychol 1997;17:283–300.
18. Ulrich RS, Simons RF, Losito BD, Fiorito E, Miles MA, Zelson M. Stress recovery during exposure to natural and urban environments. J Environ Psychol 1991;11:201–30.
19. Ayas NT, White DP, Al-Delaimy WK, Manson JE, Stampfer MJ, Speizer FE, Patel S, Hu FB. A prospective study of self-reported sleep duration and incident diabetes in women. Diabetes Care 2003;26:380–4. [PubMed: 12547866]
20. Ayas NT, White DP, Manson JE, Stampfer MJ, Speizer FE, Malhotra A, Hu FB. A prospective study of sleep duration and coronary heart disease in women. Arch Intern Med 2003;163:205–9. [PubMed: 12546611]
21. Cohen S, Doyle WJ, Skoner DP, Rabin BS, Gwaltney JM Jr. Social ties and susceptibility to the common cold. JAMA 1997;277:1940–4. [PubMed: 9200634]
22. Gump BB, Matthews KA. Are vacations good for your health? The 9-year mortality experience after the multiple risk factor intervention trial. Psychosom Med 2000;62:608–12. [PubMed: 11020089]
23. House JS, Landis KR, Umberson D. Social relationships and health. Science 1988;241:540–5. [PubMed: 3399889]

24. Tominaga K, Andow J, Koyama Y, Numao S, Kurokawa E, Ojima M, Nagai M. Family environment, hobbies and habits as psychosocial predictors of survival for surgically treated patients with breast cancer. Jpn J Clin Oncol 1998;28:36–41. [PubMed: 9491140]
25. Adler NE, Ostrove JM. Socioeconomic status and health: what we know and what we don't. Ann N Y Acad Sci 1999;896:3–15. [PubMed: 10681884]
26. Lindstrom M, Hanson BS, Ostergren PO. Socioeconomic differences in leisure-time physical activity: the role of social participation and social capital in shaping health related behaviour. Soc Sci Med 2001;52:441–51. [PubMed: 11330778]
27. He XZ, Baker DW. Differences in leisure-time, household, and work-related physical activity by race, ethnicity, and education. J Gen Intern Med 2005;20:259–66. [PubMed: 15836530]
28. Stevens AB, Coon D, Wisniewski S, Vance D, Arguelles S, Belle S, Mendelsohn A, Ory M, Haley W. Measurement of leisure time satisfaction in family caregivers. Aging Ment Health 2004;8:450–9. [PubMed: 15511743]
29. Cattell RB. The scree test for the number of factors. Multivariate Behav Res 1966;1:245–76.
30. Usala PD, Hertzog C. Measurement of affective states in adults: Evaluation of an adjective rating scale instrument. Res Aging 1989;11:403–26. [PubMed: 2623354]
31. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. Appl Psychol Meas 1977;1:385–401.
32. Diener E, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. J Pers Assess 1985;49:71–5. [PubMed: 16367493]
33. Scheier MF, Wrosch C, Baum A, Cohen S, Martire LM, Matthews KA, Schulz R, Zdaniuk B. The life engagement test: assessing purpose in life. J Behav Med 2006;29:291–8. [PubMed: 16565785]
34. Cohen, S.; Mermelstein, R.; Kamarck, T.; Hoberman, H. Measuring the functional components of social support. In: Sarason, IG.; Sarason, BR., editors. Social Support: Theory, Research and Applications. The Hague, Holland: Martinus Nijhoff; 1985.
35. Fried LP, Borhani NO, Enright P, Furberg CD, Gardin JM, Kronmal RA, Kuller LH, Manolio TA, Mittelmark MB, Newman A. The cardiovascular health study: design and rationale. Ann Epidemiol 1991;1:263–76. [PubMed: 1669507]
36. Aldwin, CM. The Elders Life Stress Inventory (ELSI): research and clinical applications. In: Keller, PA.; Hyman, SR., editors. Innovations in Clinical Practice: A Source Book. Sarasota, FL: Professional Resource Press/Exchange; 1991.
37. Paffenbarger RS Jr, Blair SN, Lee IM, Hyde RT. Measurement of physical activity to assess health effects in free-living populations. Med Sci Sports Exerc 1993;25:60–70. [PubMed: 8423758]
38. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res 1989;28:193–213. [PubMed: 2748771]
39. Ware, JE.; Snow, KK.; Kosisnki, M.; Gandek, B. Manual and Interpretation Guide. Boston, MA: Nimrod Press; 1993. SF-36 Health Survey.
40. Pruessner JC, Kirschbaum C, Meinlschmid G, Hellhammer DH. Two formulas for computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. Psychoneuroendocrinology 2003;28:916–31. [PubMed: 12892658]
41. Stone AA, Schwartz JE, Smyth J, Kirschbaum C, Cohen S, Hellhammer D, Grossman S. Individual differences in the diurnal cycle of salivary free cortisol: a replication of flattened cycles for some individuals. Psychoneuroendocrinology 2001;26:295–306. [PubMed: 11166492]
42. Pruessner JC, Hellhammer DH, Kirschbaum C. Burnout, perceived stress, and cortisol responses to awakening. Psychosom Med 1999;61:197–204. [PubMed: 10204973]
43. Sephton SE, Sapolsky RM, Kraemer HC, Spiegel D. Diurnal cortisol rhythm as a predictor of breast cancer survival. J Nat Canc Inst 2000;92:994–1000.
44. Smyth J, Ockenfels MC, Porter L, Kirschbaum C, Hellhammer DH, Stone AA. Stressors and mood measured on a momentary basis are associated with salivary cortisol secretion. Psychoneuroendocrinology 1998;23:353–370. [PubMed: 9695136]
45. Folsom AR, Kaye SA, Sellers TA, Hong CP, Cerhan JR, Potter JD, Prineas RJ. Body fat distribution and 5-year risk of death in older women [Erratum appears in JAMA 1993 Mar 10;269:1254]. JAMA 1993;269:483–7. [PubMed: 8419667]

46. Kaplan GA, Camacho T. Perceived health and mortality: a nine-year follow-up of the human population laboratory cohort. Am J Epidemiol 1983;117:292–304. [PubMed: 6829557]
47. Vasan RS, Larson MG, Leip EP, Evans JC, O'Donnell CJ, Kannel WB, Levy D. Impact of high-normal blood pressure on the risk of cardiovascular disease. N Engl J Med 2001;345:1291–7. [PubMed: 11794147]
48. White RC. Social class differences in the uses of leisure. AJS 1955;61:145–150.
49. Cutler, SJ.; Hendricks, J. Leisure and time use across the life course. In: Binstock, RH.; George, LK., editors. Handbook of Aging and the Social Sciences. San Diego, CA: Academic Press; 1990.
50. Crespo CJ, Smit E, Andersen RE, Carter-Pokras O, Ainsworth BE. Race/ethnicity, social class and their relation to physical inactivity during leisure time: results from the Third National Health and Nutrition Examination Survey, 1988–1994. Am J Prev Med 2000;18:46–53. [PubMed: 10808982]
51. Washburn RA, Kline G, Lackland DT, Wheeler FC. Leisure time physical activity: are there black/white differences? Prev Med 1992;21:127–35. [PubMed: 1738764]
52. Folkman S, Moskowitz JT. Positive affect and the other side of coping. Am Psychol 2000;55:647–54. [PubMed: 10892207]
53. Cohen, S.; Edwards, JR. Personality characteristics as moderators of the relationship between stress and disorder. In: Neufeld, RWJ., editor. Advances in the Investigation of Psychological Stress. New York: Wiley; 1989.
54. Cohen S, Hoberman HM. Positive events and social supports as buffers of life change stress. J Appl Soc Psychol 1983;13:99–125.
55. Fredrickson BL. What good are positive emotions? Rev Gen Psychol 1998;2:300–19.
56. Steptoe A, Gibson EL, Hamer M, Wardle J. Neuroendocrine and cardiovascular correlates of positive affect measured by ecological momentary assessment and by questionnaire. Psychoneuroendocrinology 2007;32:56–64. [PubMed: 17157442]
57. Antonucci TC, Jackson JS. Physical health and self-esteem. Fam Community Health 1983;6:1–9. [PubMed: 10261557]
58. Pressman SD, Cohen S. Does positive affect influence health? Psychol Bull 2005;131:925–71. [PubMed: 16351329]
59. Cohen S. Social relationships and health. Am Psychol 2004;59:676–84. [PubMed: 15554821]

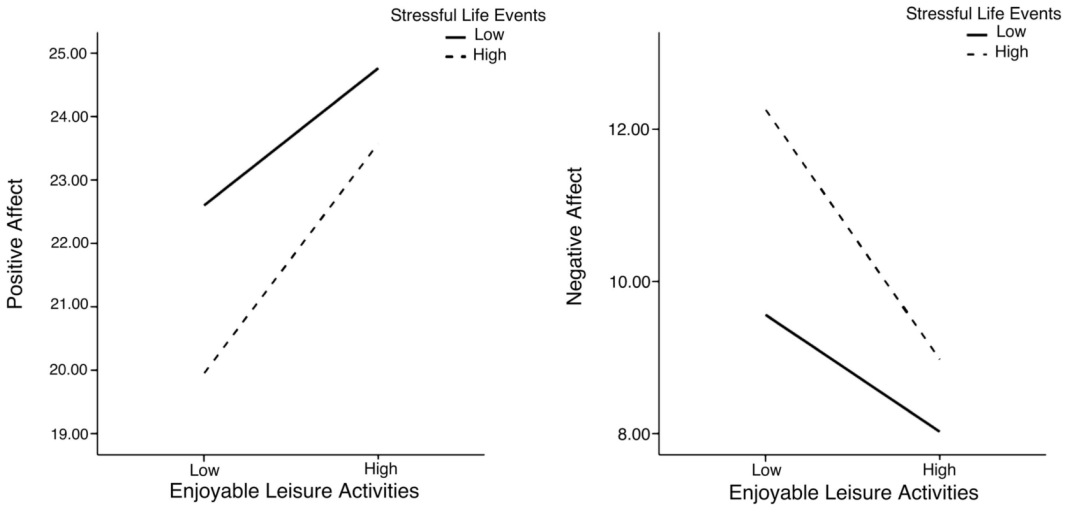

Figure 1.
Buffering effects of enjoyable leisure activities on stressful life events. Variables are assessed continuously and are depicted as a dichotomous split for figure purposes only.

TABLE 1

Characteristics of Each Study Participant Sample and the Combined Sample

	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Combined Samples
n	193	543	379	284	1399
% female (*n*)	50.8 (98)	51.6 (280)	100 (379)	100 (284)	74.4 (1041)
% non-white (*n*)	44 (85)	13.1 (71)	6.9 (26)	12.3 (35)	15.5 (217)
Median education category	Some college or associates degree	Some college or associates degree	College graduate	Some college or associates degree	Some college or associates degree
Median income category	$15,000–19,000	$30,000–39,999	$50,000–59,999	$50,000–59,999	$40,000–49,999
Median birth Year	1964	1932	1937	1950	1937
PEAT score (SD)	22.20 (5.85)	21.15 (5.68)	23.47 (5.35)	21.87 (5.40)	22.11 (5.63)
Cronbach's α	0.72	0.68	0.65	0.66	0.68

PEAT = Pittsburgh Enjoyable Activities Index; SD = standard deviation.

Sample 1 = community-based sample of adults; 2 = osteoarthritis patients and their spouses; 3 = community-based sample of middle-aged women; 4 = women with breast cancer.

TABLE 2

Standardized β Values From Linear Regression Analyses Examining the Association Between the PEAT and Sociodemographic Variables, Adjusted for Cohort

	PEAT
Sex (female = 2; male = 1)	0.096**
Birth year	0.020
Race (white = 1; non-white = 2)	–0.14**
Education	0.23***
Income	0.25***

** $p < .01$;

*** $p < .001$.

PEAT = Pittsburgh Enjoyable Activities Index.

TABLE 3

Standardized β Values From Linear Regression Analyses Examining the Association Between the PEAT and Psychosocial Measures

Covariates Psychosocial Measures	None	Overlapping Item(s) Removed	Age, Sex, Race, and Cohort	Age, Sex, Race, Cohort, Education, and Income
Positive affect	0.33***	N/A	0.34***	0.33***
Negative affect	−0.22***	N/A	−0.24***	−0.22***
Depression (CES-D)	−0.32***	N/A	−0.33***	−0.29***
Life satisfaction	0.31***	N/A	0.32***	0.26***
Life engagement	0.28***	N/A	0.28***	0.25***
Religiosity	0.15***	0.021	0.15***	0.18***
Perceived social support	0.33***	0.24***	0.33***	0.30***
Social network diversity	0.30***	0.26***	0.29***	0.25***
Social network size	0.34***	0.28***	0.33***	0.29***

The three social items were removed from the PEAT for the social outcome variables and church attendance was removed for the religiosity analyses.

*** $p < .001$.

PEAT = Pittsburgh Enjoyable Activities Index; CES-D = Center for Epidemiological Studies Depression scale.

TABLE 4

Standardized β Values From Linear Regression Analyses Examining the Association Between the PEAT and Physical Measures

Covariates	None	Age, Sex, Race, and Cohort	Age, Sex, Race, Cohort, Education, and Income
Cortisol: AUC	−0.088*	−0.074*	−0.065*
Cortisol: slope	0.017	0.022	0.025
Systolic blood pressure	−0.13***	−0.11***	−0.096**
Diastolic blood pressure	−0.069*	−0.060*	−0.044
Waist circumference	−0.15***	−0.12***	−0.076*
Body mass index	−0.088**	−0.089*	−0.046
Perceived physical function (SF-36)	0.27***	0.24***	0.22***

* $p < .05$;

** $p < .01$;

*** $p < .001$.

PEAT = Pittsburgh Enjoyable Activities Index; AUC = area under the curve; SF-36 = Short-Form Health Survey.

TABLE 5

Standardized β Values From Linear Regression Analyses Examining the Association Between the PEAT and Health Behavior Measures

Covariates	None	Overlapping Item(s) Removed	Age, Sex, Race, and Cohort	Age, Sex, Race, Cohort, Education, and Income
Kilocalories burned in a week	0.34***	0.26**	0.35***	0.32***
Exercised at least once per week	0.34***	0.26***	0.34***	0.30***
Sleep efficiency	0.12***	N/A	0.11***	0.081**
Sleep quality	0.15***	N/A	0.17***	0.25***

Sports item removed for exercise regression analyses.

** $p < .01$;

*** $p < .001$.

PEAT = Pittsburgh Enjoyable Activities Index; N/A = not applicable.