



2016

The Influence of Running Extreme Obstacle Courses on Positive Affect, Character Strengths, and Well-Being

Ewa Opala
CUNY City College

[How does access to this work benefit you? Let us know!](#)

Follow this and additional works at: http://academicworks.cuny.edu/cc_etds_theses

 Part of the [Applied Behavior Analysis Commons](#), and the [Developmental Psychology Commons](#)

Recommended Citation

Opala, Ewa, "The Influence of Running Extreme Obstacle Courses on Positive Affect, Character Strengths, and Well-Being" (2016).
CUNY Academic Works.
http://academicworks.cuny.edu/cc_etds_theses/590

This Thesis is brought to you for free and open access by the City College of New York at CUNY Academic Works. It has been accepted for inclusion in Master's Theses by an authorized administrator of CUNY Academic Works. For more information, please contact AcademicWorks@cuny.edu.

The Influence of Running Extreme Obstacle Courses on Positive Affect, Character Strengths,
and Well-Being

Ewa Opala

Advisor: Ann Marie Yali, PhD

Submitted to the Department of Psychology

at The City College of New York

Spring 2016

in partial fulfillment of the requirements

for the degree of Master of Arts

EXTREME OBSTACLE COURSES AND POSITIVE EMOTIONS

Acknowledgments

Writing this dissertation has been one of the most exciting and significant challenges that I experienced as a student. The period of the last nine months has been intense but I have learned more than I could have ever hoped for. This thesis owns its existence to several remarkable individuals whom I could never thank enough.

Firstly, I would like to express my deepest appreciation and gratitude to my advisor, Dr. Ann Marie Yali for planting the seed of interest in me in the area of extreme obstacle courses and for guiding me throughout the whole process of writing this thesis. I have been so fortunate to have an advisor who encouraged, supported, listened and believed in me even when I doubted myself. Dr. Yali patiently read and gave me priceless feedback on the countless revisions of my dissertation, and her immense knowledge and expertise provided me with the essential tools to complete this thesis. Dr. Yali taught me how to become a better researcher, she devoted herself to this project, and I have always left our meetings inspired and motivated. I am thankful to have shared this endeavor with her for she made it a beautiful journey.

I would like to thank Dr. Karen Langsam and Dr. Sarah O'Neill for being on my thesis committee, and for being understanding and supportive every step of the way. I have been so honored to be able to share with them this project and I am thankful for their enthusiastic approach, insightful comments and constructive criticism. Their recommendations enriched this thesis and stirred new ideas for future research.

I am also grateful to Stephanie Kronenberg who shared her research data and idea with me and without whom this thesis would not have been possible.

Last but not least, I am thankful to my friends and family for their endless love and support throughout my entire life.

EXTREME OBSTACLE COURSES AND POSITIVE EMOTIONS

Table of Contents

1. Abstract.....	5
2. Introduction.....	6
a. Extreme obstacle courses.....	6
b. Positive outcomes of physical activity.....	7
c. The effects of physical activity on character strengths.....	9
d. The benefits of green exercise.....	12
e. The outcomes of group-based versus individual types of exercise.....	13
f. The importance of studying positive emotions.....	14
g. The current study.....	16
3. Method.....	17
a. Participants.....	17
b. Procedure.....	17
c. Materials.....	18
4. Results.....	22
5. Discussion.....	31
6. References.....	45
7. Tables.....	56

EXTREME OBSTACLE COURSES AND POSITIVE EMOTIONS

a. Table 1 Comparative descriptive statistics between the present sample and samples from other studies	56
b. Table 2 Correlations between all the study variables	57
c. Table 3 Means and standard deviations of the dependent variables (pre-and-post)...	58
d. Table 4 Means and standard deviations for post-race study variables and change scores grouped by team/no team	59
e. Table 5 Summary of hierarchical regression analysis for variables predicting post-race psychological well-being.....	60
f. Table 6 Summary of hierarchical regression analysis for variables predicting post-race zest	61

Abstract

A large body of research demonstrates the positive benefits of numerous types of physical activity. However, the outcomes of running extreme obstacle courses (EOCs) remain unexamined. The aim of the present study was to explore the influence of running EOCs on positive affect, character strengths and well-being. The study utilized a pre-existing sample of 21 participants who filled out an online survey at two time points (pre-and-post race). The findings showed that participating in an EOC was related to increased positive affect (PA) and psychological well-being. Running an EOC with a team was associated with increased post-race teamwork and the number of prior EOCs run was negatively correlated with post-race scores on PA and teamwork. Furthermore, significant relationships were found between post-race pride and psychological well-being and zest. The implications of these findings are discussed.

Keywords: extreme obstacle courses, positive affect, character strengths, well-being.

The Influence of Running Extreme Obstacle Courses on Positive Affect, Character Strengths and Well-Being

Physical activity can be defined as any bodily movement that requires more energy than resting (e.g. walking, cleaning, jogging); exercise is a type of physical activity that is organized and structured, e.g., playing on a sport team or taking a martial arts class (Exercise and Physical Activity, 2011). Research has indicated that physical activity whether general or organized and structured is closely related to one's physical and psychological well-being (e.g. Kim & Kim, 2007; Penedo & Dahn, 2005) and has the ability to enhance positive experiences such as happiness (Khazae-Pool, Sadeghi, Majlessi, & Rashimi Foroushani, 2015) and positive affect (e.g. Barton & Pretty, 2010; Kim & Kim, 2007; Mata, Hogan, Joormann, Waugh, & Gotlib, 2013). There are various forms of physical activity and researchers have explored the positive effects associated with a number of them. Aerobic exercises, yoga, running, bicycling, mountain climbing, weight lifting, swimming, dancing and walking are just a few examples. Nevertheless, there are certain types of physical activities that remain underexplored. For example, up to this point, there has been a scarce amount of research published examining the effects of running extreme obstacle courses (EOCs) although the popularity of such events is increasing at a fast rate. It is estimated that in the year 2015, 4.9 million people worldwide participated in an EOC; this number is expected to grow to 5.3 million in 2016 (Rodriguez, 2016).

Extreme Obstacle Courses

Extreme obstacle courses are a unique type of outdoor physical activity that are modeled in part after military training and include but are not limited to swimming in cold water, crawling through mud, jumping over fire, climbing a wall and/or sprinting through a field of dangling electrical wires (Eichner, 2014; Tough Mudder, 2016). There are various forms and brands of

EOCs, such as Tough Mudder[®], Spartan Race[®] and Superhero Scramble, and they differ from one another in terms of the type and amount of obstacles, difficulty level, and length. All of the EOCs are designed to test one's physical strength and mental toughness and push runners to their limits. The courses are planned and structured; however, due to the nature of the obstacles, runners are unable to prepare before the race for each and every one of them. This fast growing type of competition is often described as high risk sport or extreme sports because it involves a significant risk for accidents and injuries; there is also a potential for permanent disability and death (Eichner, 2014; Lund, Turriss, McDonald, & Lewis, 2015). However, unlike many other sport events where being on top is the goal, for the majority of the EOC runners, doing one's best and finishing the race is what matters most. In addition, different from many high risk and other extreme sports, individuals can sign up to participate in an EOC by themselves or with a team; however, since many obstacles require collaboration between runners, participants tend to help and motivate one another often disregarding the fact that they are competing.

Positive Outcomes of Physical Activity

There is currently no empirical evidence on the benefits, if any, of running EOCs. However, over the years, researchers have identified a number of positive outcomes related to exercising. Recent studies associate physical activity with improved profiles for markers of cellular aging (He et al., 2012) and decreased probability of developing Alzheimer's disease (Laurin, Verreault, Lindsay, MacPherson, & Rockwood, 2001) and dementia (Edmunds, Biggs, & Goldie, 2013). Furthermore, sport participation reduces the incidence of cardiovascular disease, obesity and mortality (Reiner, Niermann, Jekauc, & Woll, 2013), and promotes better cognitive functioning (Tyndall et al., 2013; Zoladz et al., 2009). In addition to the known physiological benefits of physical activity, studies show that exercise decreases tension, anger

(Mead et al., 2009), anxiety (Abu-Omar, Rutten, & Lethenin, 2004) and depressive symptoms (Abu-Omar et al., 2004; Knubben et al., 2007). Furthermore, exercise can increase well-being (Penedo & Dahn, 2005), positive mood (Barton & Petty, 2010; Kim & Kim, 2007; Mata et al., 2013), and self-esteem (Findlay & Coplan, 2010; Kim & McKenzie, 2014; Shmalz, Deane, Birch,) and reduce negative affect (Mata et al., 2013, Mata et al., 2012).

The association between physical activity and a person's mood has been a focus of many studies. For instance, Ekkakikis, Hall and Petruzello (2008) conducted an experiment in which 30 participants were asked to run on a treadmill for 15 minutes at three different intensity levels: below, at or above their ventilatory threshold. The results indicated that exercise increased positive valance from pre- to post-exercise regardless of the intensity; however, exceeding one's ventilatory threshold by as little as 10% during exercise lead to reduced pleasure. These findings are important when studying the effects of physical activity on positive and negative emotions because they indicate factors such as intensity that might contribute to that relationship and should be taken into account.

Another study on the effects of exercise on affective responses conducted by Hogan, Mata and Carstensen (2013) showed similar results. In this experiment, 144 adult participants between the ages of 19 and 93 were assigned to either an exercise (15 minutes of moderate intensity biking) or a control condition (15-22.5 minutes of rating 90 neutral images). Following the manipulation, participants filled out tests on working memory and momentary affect. The findings demonstrated that exercise resulted in augmented levels of high arousal positive affect (HAP) such as feeling excited and proud, and decreased levels of low arousal positive affect (LAP) including feeling calmed and relaxed. Furthermore, age moderated the influence of

exercise on LAP such that younger participants (19-39) reported a greater decrease in LAP post-exercise, while older subjects (65 and older) reported a slight increase.

The Effects of Physical Activity on Character Strengths

Peterson and Seligman (2004) suggest that character is comprised of 24 strengths that may increase one's happiness and well-being. These character strengths fall under six core virtues: wisdom and knowledge (e.g. creativity, curiosity, love of learning), courage (e.g. bravery, perseverance, zest), humanity (love, kindness, social intelligence), justice (teamwork, leadership, fairness), temperance (prudence, forgiveness, self-regulation), and transcendence (hope, gratitude, spirituality). The researchers state that character strengths (listed in parentheses) are the mechanisms by which these six virtues can be achieved. In other words, enhancing specific character strengths is a needed process in order to attain the corresponding virtues. For instance, the virtue of courage can be developed through such strengths as perseverance and zest (Peterson & Seligman, 2004). The importance of character strengths on optimal functioning has been well-supported by research. Studies show that character strengths can decrease stress (Wood, Linley, Maltby, Kashdan, Hurling, 2011), and depression and anxiety (Park & Peterson, 2008). Furthermore, using character strengths leads to increased positive affect and self-esteem (Wood et al., 2011). Although there is a growing body of empirical research focusing on character strengths, only a few of the strengths have been examined in the context of physical exercise or sports.

Researchers indicate that character strengths can be fostered, despite the common definition that character strengths are trait-like and are relatively stable across adulthood (Park, Peterson & Seligman, 2004). McDowell-Larsen, Kearney and Campbell (2002) conducted a study in which 600 senior level executives were asked to rate themselves on various leadership

indices (such as visionary thinking, adaptability, industry knowledge and seasoned judgement). At the same time, participants were also rated by their bosses, subordinates and peers. The results showed that overall executives who exercised regularly were rated more positively as leaders by the observers than those who did not exercise. Moreover, the weighted averages of all the scales for the Executive Success Profile and Campbell Leadership Index were higher for participants who exercised when compared to non-exercisers. These findings suggest that individuals who are physically active are not only self-reporting to have better leadership skills but they are also perceived by others as being superior leaders.

Other research conducted by Kniffin, Wansink and Shimizu (2015) further supports the positive relationship between exercise and leadership skills. The researchers hypothesized that participation in varsity-level high school sports would be positively associated with leadership skills. The findings supported this prediction; former high school athletes demonstrated higher levels of leadership, self-confidence, and self-respect than non-athlete participants. Furthermore, subjects who participated in competitive sports while in high-school (on average 55 years ago) enjoyed higher-status careers and reported more prosocial behavior such as volunteering and donating money compared to non-athletes. These results indicate that sport engagement has long term positive effects that can persist for an extended period of time.

Dewar and Kavussanu (2012) designed another study that examined the relationship between physical activity, character strengths and positive emotions through team sports. In this study, 358 team sport athletes were asked to complete several questionnaires following a competitive match. The researchers indicated that task-involved individuals evaluate their competence using self-referenced criteria and they strive to master a task and attain their goals. In contrast, ego-involved individuals were defined as those who use other-referenced criteria to

evaluate their abilities and who attempt to perform either better than others or as well as the rest but with less effort. The findings demonstrated that task involvement was positively associated with happiness, pride, and hope, but negatively related to dejection and shame. On the other hand, perceived performance (measured by participants' subjective rating of their performance) was positively related to happiness, pride, and hope, and negatively related to dejection and shame. Furthermore, perceived performance moderated the relationship between ego involvement and hope and dejection. In other words, when athletes perceived their performance as high, ego involvement was positively related to hope and unrelated to dejection. However, when the performance was perceived as low, ego involvement was negatively related to hope and positively associated with dejection. Lastly, match outcome moderated the relationships between ego involvement and pride, hope, and dejection such that after losing a match, ego involvement was unrelated to pride but negatively correlated with hope and positively related to dejection; whereas, after winning the match, ego involvement was positively related to pride and hope but it was not significantly associated with dejection.

Another character strength that has been shown to be influenced by physical activity is courage. Brymer and Oades (2009) conducted a study in which unstructured interviews were utilized in order to explore the relationship between extreme sports and courage and humility. The researchers focused on big wave surfing, extreme skiing, solo rope-free climbing, waterfall kayaking, mountaineering and BASE (building, antenna, span, earth) jumping. The findings showed that engaging in extreme sports which involve fear and a real chance of injury or even death allows one to experience the power of nature and realize that nature is much more powerful than humanity. This in turn results in the development of courage and humility.

The Benefits of Green Exercise

The above cited research validates the role of exercise on positive and negative affect as well as various character strengths; however, with so many types of physical activity, one wonders which form might be the most beneficial for increasing positive emotions and character strengths. According to Pretty, Peacock, Sellens and Griffin (2005), “green exercise”, characterized by being exposed to nature during physical activity, has a greater influence on affect than exercise alone. A total of 100 participants (20 per condition), aged 18-60, were exposed to a series of 30 images shown on a screen while running on an indoor treadmill. Four categories of scenes were examined which included: rural pleasant, rural unpleasant, urban pleasant, and urban unpleasant. Participants in the control condition were not exposed to any pictures. Overall, physical activity alone lowered subjects’ blood pressure, increased self-esteem and vigor and reduced confusion and tension. Participants who were exposed to rural or urban pleasant scenes while exercising experienced significantly greater increases in self-esteem relative to the control group. On the other hand, both rural and urban unpleasant images decreased the positive influence of exercise on self-esteem. Tension-anxiety was reduced in all five conditions with the highest changes seen in the pleasant urban and pleasant rural groups. Furthermore, there was also a significant increase in vigor for the urban pleasant, rural pleasant and no exercise conditions with the greatest improvements observed for the control and urban pleasant groups and the lowest for the urban unpleasant condition. These findings suggest that although exercise alone is beneficial, physical activity in pleasant environments might produce greater benefits on self-esteem, mood and blood pressure. This is of particular importance when studying EOCs because most of these events are outdoors. One major weakness of this study

which should be noted here was that the participants were shown images depicting natural scenes while running on a treadmill indoors instead of actually engaging in an outdoor physical activity.

Several other studies have investigated the impact of outdoor exercising on positive emotions. For example, Mackay and Neill (2010) have analyzed the influence of green exercise on state anxiety and the role of exercise duration, type and intensity, as well as the self-perceived level of naturalness. In this study, the self-perceived greenness was assessed using a 10-point Likert scale that asked participants to indicate the degree to which they perceived the environment to be natural versus artificial/urban. The researchers conducted a quasi-experiment by utilizing eight pre-existing outdoor exercising groups which resulted in higher ecological validity of the findings. The results demonstrated that participants' state anxiety levels were lower following a green exercise when compared to the baseline scores obtained at the beginning of the study. Furthermore, the level of greenness and the type of exercise were related to the observed changes in anxiety. More specifically, the largest reductions in anxiety levels were observed for participants in the road cycling, boxercise, and mountain biking groups (compared to mountain running and cross-country running, kayaking, walking and orienteering conditions). Furthermore, the findings indicated that self-perceived environmental greenness was negatively associated with anxiety. In other words, higher self-perceived level of naturalness resulted in greater reductions in anxiety following an exercise. In this study, the state anxiety was not impacted by exercise intensity or duration.

The Outcomes of Group-Based versus Individual Types of Exercise

Apart from exploring indoor versus outdoor physical activity, several studies have examined another factor that might enhance the positive effects of exercise. Researchers suggest that participating in team sports is related to better psychological and social benefits when

compared to individual activities. It is suggested that the social nature of team-based sports mediates the association between sport participation and health-related outcomes (Eime, Young, Harvey, Charity, & Payne, 2013). Furthermore, Cohen, Ejsmond-Frey, Knight, and Dunbar (2009) conducted a study that investigated the impact of team versus individual training on the pain threshold and release of the endogenous opioids (endorphins- a group of hormones that can produce feelings of pleasure and well-being and reduce stress and pain). The sample consisted of 12 male athletes recruited from an Oxford University boat race squad who were tested while training alone and while training in a group (at different days). Each trial involved 45-minutes of continuous rowing on an exercise machine. The pain threshold was measured using blood pressure cuff. The findings demonstrated that after training together, participants experienced higher threshold levels for pain relative to practicing individually. The researchers suggested that the observed results might be due to an increased production of endorphins in the group exercise condition; however, this was not directly assessed in the study.

The findings on the different benefits of group exercise are promising and the results of the few studies published examining the benefits of green exercise all demonstrate that when studying physical activity, it is essential to consider not only the type of exercise but also the amount of “greenness” it involves. However, despite the growing body of literature on green exercise and its numerous positive effects on people’s lives, health, character strengths and mood states, EOCs are an outdoor physical activity that have been under-explored.

The Importance of Studying Positive Emotions

All of the studies described above demonstrate that physical activity can enhance positive emotions; experiencing positive emotions, on the other hand, has numerous benefits including better health, longer life, and increased positive affect and well-being. For instance,

Veenhoven (2008) suggests that happiness may lengthen the lives of healthy individuals by 7.5 to 10 years. Others have shown an inverse relationship between positive emotions and cardiovascular disease (Boehm & Kubzansky, 2012) and the incidence of cold and flu related symptoms (Cohen, Doyle, Turner, Alper, & Skonner, 2003). This might be explained by the positive relationship between subjective well-being and having a stronger immune and endocrine system (Howell, Kern and Lyubomirsky, 2001). In addition, studies have shown support for an inverse relationship between well-being and mortality rates (Howell et al., 2001) and between optimism and cardiovascular death (Giltay, Kamphuis, Kalmijn, Zitman, & Kromhout, 2006). For instance, among an elderly population aged 65-85, optimism was related to lower mortality rates and decreased incidence of cardiovascular disease (Giltay, Geleijnse, Zitman, Hoekstra, & Schouten, 2004). Research also demonstrates that positive emotions are related to increased life satisfaction by promoting the development of resilience against challenges (Cohn et al., 2009).

Apart from physiological and psychological benefits of positive states, studies show that experiencing positive emotions is related to several advantageous work-related outcomes. For instance, Schiopu (2015) found that positive emotions are associated with higher job satisfaction and intention to work for the same company. Furthermore, Wright, Cropanzano and Bonett (2007) showed that psychological well-being moderates the influence of job satisfaction on job performance. The researchers indicated that job satisfaction predicted higher job performance but only when psychological well-being was high. In contrast, there was no relationship between job satisfaction and performance if psychological well-being was low. Lastly, Harzer and Ruch (2014) indicated that there is a positive relationship between character strengths and four dimensions of job performance. The results of the study showed that strengths such as zest, perseverance, creativity, teamwork, leadership, and bravery (among several others) were also

positively associated with self- and supervisor-rated task performance, job dedication, organizational support (defending and following organizational rules), and interpersonal facilitation (cooperating with others, helping and assisting coworkers). This shows the broad scope of the benefits of experiencing positive emotions on people's lives and the need to further explore what might enhance them.

The Current Study

Research demonstrates that physical activity increases positive emotions and well-being, and has the ability to foster the development of character strengths. In turn, these positive traits and emotions can improve physical and mental health, interpersonal relationships, and performance in a workplace. Various types of sports and physical activity have been examined; however, the benefits of running extreme obstacle courses are yet to be explored. Furthermore, past research has focused only on a number of character strengths in the context of exercising. Therefore, the present study aims at examining whether running extreme obstacle courses will have an impact on positive affect, well-being and character strengths including bravery, teamwork, perseverance, leadership, and zest. Moreover, since there is limited research on the impact of team versus individual exercise on positive emotions and traits, the current study will also explore whether being signed up as part of a team versus alone will have an impact on participants' scores. Based on the above cited research, the following hypotheses were formulated: (1) Following the race (Time 2), participants' ratings of positive affect, and psychological and physical well-being will be higher than at Time 1 (pre-race). (2) Participants' scores on the character strength measures will be higher at Time 2 than at Time 1. (3a) Participants who are signed up as part of a team will report higher scores on the post-race measures of positive affect, psychological well-being and physical well-being. (3b) Those who

are signed up as part of a team will also report higher post-race teamwork, leadership, and perseverance. (4) The number of prior EOCs run will be positively related to post-race scores on the study variables. (5a) Pride will be positively associated with post-race scores on positive affect, psychological well-being and physical well-being. (5b) Pride will also be positively related to post-race character strengths.

Method

Participants

The present study is a part of a larger project exploring who runs extreme obstacle races and what motivates them to do so (Kronenberg & Yali, 2014). The data was collected at two time points (Time 1: pre-race, $n= 79$ and Time 2: post-race, $n= 22$). The current study focused on participants with data at both time points. The present sample consisted of 21 participants (data from one male was excluded because he indicated being 17 years old). Eleven participants were male (52.4%) and 10 were female (47.6%) ranging between the ages of 28 to 60 ($M= 40.29$; $SD= 8.95$). Eleven subjects (52%) indicated that they were signed up to participate in the EOC as part of a team and ten were signed up by themselves (48%). At Time 1, 16 participants (76.2%) indicated that they had participated in three or more prior EOCs, three had run two prior courses (14.3%), one had never participated in any EOC before (4.8%) and one did not provide an answer. The majority of participants were married (72.7%), had higher education degrees (86.2%) and an annual household income of over \$70,000 (71.4%). Out of the 17 participants who disclosed their ethnicity, 13 identified themselves as European/European American (61.9% of the total sample).

Procedure

In the original study, participants were recruited via snowball sampling (chain referral

process). Anyone who was known by the researchers to be interested in EOCs was invited via email or phone to participate in the study. Next, the potential participants were asked to recommend others they knew that might also be interested in participating in the research on who runs EOCs and why. A link to the survey was posted on Facebook, Twitter, various EOC-related group sites and to general EOC interest groups. The survey was created and administered online via Qualtrics, a web-based software program for designing and distributing surveys (Qualtrics, 2016). In order to be eligible for the study, participants had to be at least 18 years old and be interested in EOCs. In order to verify that, participants were asked at the very beginning of the survey the following questions: “I understand that in order to participate in this study, I must be at least 18 years of age“ and “Are you interested in participating in extreme obstacle courses?” If a participant answered “no” to either of these questions, the survey would end. Those who met these criteria filled out several validated questionnaires. Only those who had completed a race during the study period were invited to fill out the survey at Time 2 (post-race) (Kronenberg & Yali, 2014). Participants filled out the post-race scales within 72 hours of the race that they participated in, which was approximately one to six months following the pre-race survey. The analyses reported for the present study are based on participants who had complete data for both Time 1 and Time 2.

Materials

Demographic questionnaire. The demographic questionnaire assessed information such as gender, ethnicity, age, education level, and the number of prior EOCs run. At Time 1, participants were also asked whether or not they were signed up to participate in an upcoming extreme obstacle course. If they responded “yes”, they were asked several questions regarding that race (e.g. “What is the race?”; “What is the date of the race?”).

Positive affect. The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item scale which consists of two mood subscales, one assessing positive affect (PA) and one measuring negative affect (NA). Each subscale is comprised of ten adjectives. In the present study, only the PA subscale was analyzed. The PA subscale includes emotions such as “proud”, “excited”, “interested”, and “inspired”. Participants were asked to rate on a scale from 1 (very slightly or not at all) to 5 (extremely) how often in the past two days they have felt these emotions. Crawford and Henry (2004) report an internal reliability coefficient (Cronbach’s α) of .89 for the PA scale. In the present study the internal reliability for the PA subscale was relatively high to moderate at both time points (Time 1 $\alpha = .88$; Time 2 $\alpha = .82$).

Well-being. The modified BBC Subjective Well-Being scale (BBC-SWB; Pontin, Schwannauer, Tai, & Kinderman, 2013) consists of 24 items designed to assess three dimensions of well-being (WB): psychological (12 items), physical (7 items), and relationship (5 items). Respondents are asked to rate each question on a Likert scale from 1 (never, not at all) to 5 (almost always, extremely). In the present study, only the ‘psychological well-being’ and ‘physical well-being’ subscales were utilized because the ‘relationship well-being’ subscale had low internal consistency (Time 1 $\alpha = .43$; Time 2 $\alpha = .57$). Sample items measuring psychological well-being include: “Do you feel depressed or anxious?” (reversed scored), “Are you happy with yourself and your achievements?” In contrast, the physical well-being subscale contains questions such as “Are you happy with your physical health?” and “Are you happy with your ability to work?” Pontin et al. (2013) report good internal consistency for the psychological well-being (Cronbach’s $\alpha = .93$) and physical well-being subscales ($\alpha = .80$). In the present study, the reliability for psychological well-being was .87 at Time 1 and .85 at Time 2,

while for physical health and well-being subscale, the internal consistency was .81 at Time 1 and .83 at Time 2.

Pride. In order to assess pride, the Authentic Pride Scale (Tracy & Robins, 2007) was administered at Time 2. The questionnaire consists of seven items reflecting authentic pride such as “fulfilled”, “achieving” and “accomplished”. Participants rated on a 5-point scale (1= not at all, 5= extremely) how each of the adjectives or phrases represented the way they felt following the race. The scale has a good internal consistency with one study reporting an *alpha* of .88 (Tracy & Robins, 2007) while another indicating a reliability of .84 (Carver, Sinclair, & Johnson, 2010). The internal consistency of the measure in the current study was .95.

Character strengths. A slightly modified version of the Values in Action Inventory of Strengths (VIA-120; Peterson & Park, 2009; Peterson & Seligman, 2004) was utilized in the present study to assess character strengths. The VIA-120 is a self-report questionnaire that uses a 5-point Likert scale ranging from 1 (very much unlike me) to 5 (very much like me). Each of the character strengths has five corresponding statements and respondents are asked to rate the extent to which each statement applies to them. The original scale consists of 24 character strengths; however, for the purpose of the current research only the six values in action that were expected to be relevant for those running EOCs were assessed and are described below.

Creativity. This subscale measures one’s ability to think of new ways of doing things and includes items such as “I like to think of new ways to do things” and “I am an original thinker” (Peterson & Park, 2009; Peterson & Seligman, 2004). McGrath (2013) reported reliability of .90 for this subscale; however, the *alpha* in the present study was .87 at Time 1 and .88 at Time 2.

Bravery. This subscale assesses courage. According to VIA Institute on Character (2016), a brave person is someone who speaks up when facing opposition and does not fear challenge,

pain or threat. The subscale includes items like “I always stand up for my beliefs” and “I am a brave person” (Peterson & Park, 2009; Peterson & Seligman, 2004). In a previous research the internal consistency of the subscale was .80 (McGrath, 2013). Reliability was relatively high in the current study (Time 1 $\alpha = .85$; Time 2 $\alpha = .88$).

Teamwork. This subscale measures ability to excel as a member of a group and consists of sentences such as “I work at my very best when I am a group member” and “It is important to me to respect decisions made by my group” (Peterson & Park, 2009; Peterson & Seligman, 2004). According to McGrath (2013), the subscale has a reliability of .68. The *alpha* in the present study was .77 at Time 1 and .85 at Time 2.

Leadership. The leadership subscale assesses the degree to which a respondent encourages a group to get things done. The scale also measures the ability to maintain harmony in the group and make all of the team members feel included. Leadership is measured with items such as “To be an effective leader, I treat everyone the same” and “My friends always tell me I am a strong but fair leader” (Peterson & Park, 2009; Peterson & Seligman, 2004). The reported internal consistency for the scale is .69 (McGrath, 2013), and in the current research it was .77 at Time 1 and .49 at Time 2.

Perseverance. This subscale is intended to measure whether or not one works hard to finish what one started. Someone who scores high on the perseverance scale takes satisfaction from completing things and does not get distracted when working. Some sample items on the subscale include: “I never quit a task before it is done” and “I finish things despite obstacles in the way” (Peterson & Park, 2009; Peterson & Seligman, 2004). McGrath (2013) indicated Cronbach’s *alpha* of .87. The reliability for this subscale in the present study was .70 at Time 1 and .84 at Time 2.

Zest. Zest is characterized by approaching life full of energy and excitement. The subscale consists of items such as “I think my life is extremely interesting” and “I have lots of energy” (Peterson & Park, 2009; Peterson & Seligman, 2004). Prior study reported internal consistency of .83 (McGrath, 2013) and in the current study the reliabilities were as follows: Time 1 $\alpha = .70$, Time 2 $\alpha = .74$.

Results

In order to test the study’s hypotheses, the data was analyzed using SPSS V22.0 (IBM, 2013) and GraphPad Quick Calcs (GraphPad Software, 2016). First, descriptive statistics were obtained for the study’s variables. Next, all the continuous variables were analyzed for normality using the Shapiro-Wilk test. The test was significant for two measures, pride ($S-W = .86, p < .01$) and post-race positive affect ($S-W = .90, p < .05$), indicating that these variables were not normally distributed. Logarithmic (to base 10), square root, and reciprocal transformations were not successful in correcting for non-normality for these variables. The two-step transformation (Templeton, 2011), which requires first transforming the data to percentile ranks and then performing an inverse-normal transformation on the results of the first step, corrected the non-normality for pride and post-race PA. Therefore, the transformed variables were used in all parametric analyses.

Descriptives

Since the scales do not have predetermined cutoff points to categorize the scores (e.g. high, moderate, low), the means and standard deviations calculated for the present sample were compared with other studies utilizing the same scales. This was done using GraphPad Quick Calcs for unpaired t-test (GraphPad Software, 2016). All study variable means for pre and post-race, along with the comparisons to other studies, appear in Table 1.

Positive affect. Positive affect was measured on a scale from 1 to 5 (1: very slightly to not at all; 5: very much). In the present study, the item average on the pre-race PA scale was 3.86 which is between “moderately” and “quite a bit”. The item average for the post-race PA was 4.30 which is just slightly higher than “quite a bit” on the scale. Using GraphPad QuickCalcs (GraphPad Software, 2016) for unpaired t-test, and using the non-transformed variable, it was demonstrated that participants’ scores on the PA scale were significantly higher at both times for the current sample when compared to the Watson et al. (1988) normative sample of 1002 participants; Pre-race: $t(1019) = 3.30, p < .001$; Post-race: $t(1021) = 6.11, p < .001$.

Well-being. Psychological and physical WB were assessed using a scale from 1 (never, not at all) to 5 (almost always, extremely). For the psychological WB, the item average was 3.91 on the pre-race scale, and 4.09 for the post-race measure. For the physical WB, the item mean was equal to 3.87 at Time 1 and 3.99 at Time 2. All of these four item averages correspond to “often, very much” on the scale. Pontin et al. (2013) validated the well-being scale on 23,341 adult participants. Using the GraphPad Quick Calcs (GraphPad Software, 2016) unpaired samples t-tests were conducted and showed that the pre-and-post race total score means for the psychological WB were significantly higher in the present sample compared to Pontin et al. (2013) (Pre-race: $t(23360) = 4.77, p < .0001$; Post-race: $t(23360) = 5.80, p < .0001$). The same was true for physical WB (Pre-race: $t(23360) = 4.61, p < .0001$; Post-race, $t(23360) = 5.38, p < .0001$).

Character strengths. Character strengths were measured on a scale from 1 to 5 (1: very much unlike me; 5: very much like me). For the present sample, item averages ranged from 3.66 to 4.13 which corresponds to greater than “neutral” to slightly above “like me” on the scale. These averages suggest that participants believed that all six of the characteristics described them at least to some degree and were more like them than unlike them. Utilizing GraphPad Quick

Calcs (Graphpad Software, 2016), independent samples t-tests were conducted in order to compare the present sample to the sample of 123 undergraduate students in the age range of 18 to 24 (Singh & Choubisa, 2010). Results showed that there were no significant differences on the pre-race scores of creativity ($t(142)= 1.55, p= .12$), bravery ($t(142)= .46, p= .65$), teamwork ($t(142)= .30, p= .77$), and leadership ($t(142)= .47, p= .64$) relative to the means reported by Singh and Choubisa (2010). Pre-race perseverance was significantly higher in the present sample, $t(142)= 3.49, p< .0001$, and so was pre-race zest ($t(141)= 2.57, p< .05$).

For the post-race scores, there were no statistically significant differences on bravery ($t(142)= .90, p= .37$), teamwork ($t(142)= .00, p= 1.00$), and leadership ($t(142)= .66, p= .51$). However, participants in the present sample had significantly higher post-race creativity ($t(141)= 2.38, p< .05$), perseverance ($t(142)= 3.28, p< .01$) and zest scores ($t(142)= 3.91, p< .001$) than those reported by Singh and Choubisa (2010).

Correlations

In order to determine the relationships among demographics and study variables, bivariate correlations and nonparametric Mann-Whitney U tests were conducted. Although most research tends to use Pearson's r for all the variables, in the present study Pearson correlations were used when both variables were continuous, point-biserial (r_{pb}) when one variable was continuous and the other one was dichotomous, and Spearman's rho (r_s) for not normally distributed ordinal variables. All correlations appear in Table 2.

Age. Bivariate correlations revealed significant associations between age and post-race bravery scores ($r= -.45, p< .05$), and being signed up as part of a team¹ ($r_{pb}= -.44, p< .05$).

Younger participants had higher post-race bravery scores than older subjects. An independent

¹ No team/team was coded in SPSS as 0 and 1, respectively.

samples t-test corroborated that subjects who participated as part of a team were generally younger ($M = 36.64$, $SD = 7.93$) than those who were not signed up with a team ($M = 44.30$, $SD = 8.59$), $t(19) = -2.13$, $p < .05$.

Gender. Spearman's rho correlation corroborated a significant association between gender² and the number of prior EOCs run ($r_s = -.55$, $p < .05$). Prior EOCs was not normally distributed among males and females ($S-W = .71$, $p < .01$); therefore, Mann Whitney U-test was conducted and showed that males participated in more prior EOCs than females, $U = 27.50$, $p < .05$.

For the pre-race scores, a point-biserial correlation revealed a significant correlation between gender and teamwork ($r_{pb} = .48$, $p < .05$). On average, women had significantly higher pre-race teamwork scores than men, $t(19) = -2.37$, $p < .05$ ($M_{males} = 3.36$, $SD_{males} = .67$; $M_{females} = 3.98$, $SD_{females} = .49$). Cohen's d indicated large effect size (Cohen's $d = 1.07$). Gender was also significantly correlated with post-race teamwork ($r_{pb} = -.56$, $p < .01$); Independent samples t-test corroborated that females had significantly higher post-race teamwork scores than males, $t(19) = -2.95$, $p < .01$ ($M_{males} = 3.35$, $SD_{males} = .66$; $M_{females} = 4.08$, $SD_{females} = .45$). The effect size for this difference was also quite large (Cohen's $d = 1.29$).

A significant relationship was also found for gender and pride ($r_{pb} = .46$, $p < .05$). Shapiro-Wilk indicated that pride was normally distributed among males ($S-W = .99$, $p > .05$) but not among females ($S-W = .81$, $p < .05$); therefore, the non-parametric Mann-Whitney U test was performed to determine whether there were significant gender differences for pride. The test indicated that women scored significantly higher on the pride scale ($median = 4.93$) compared to

² Gender was coded as 1= males, 2= females.

men (*median*= 4.00); $U= 25.50, p < .05$. No other correlations and differences between gender and study variables were significant.

Socioeconomic status. Spearman's rho correlation showed that income was negatively related to pre-race creativity ($r_s = -.46, p < .05$), post-race teamwork ($r_s = -.45, p < .05$) and post-race leadership scores ($r_s = -.57, p < .01$). The results of Spearman's rho correlational analysis also showed that education was negatively related to pre-race PA ($r_s = -.46, p < .05$), and post-race teamwork ($r_s = -.48, p < .05$). Moreover, a negative significant relationship was also found between education and being signed up as part of a team ($r_s = -.56, p \leq .01$), indicating that individuals with higher education levels were signed up by themselves. Mann Whitney U-test corroborated that those who were signed up as part of a team had significantly lower education level (*median*= 4) than participants who were signed up with a team (*median*= 7), $U= 23.00, p < .05$.

Inferential Analyses

Hypothesis 1. Participants' scores on positive affect, psychological well-being and physical well-being will be higher at Time 2 (Post-Race) than at Time 1 (Pre-Race).

In order to use parametric test to examine whether or not there were significant differences on PA, psychological well-being and physical well-being scores pre- versus post-race, the distributions of within pair differences are required to be approximately normal (McCrum-Gardner, 2007). Shapiro-Wilk test for normality indicated that the differences (T2-T1) in the matched pairs for PA ($S-W = .98, p > .05$), psychological WB ($S-W = .97, p > .05$), and physical WB ($S-W = .95, p > .05$) were normally distributed; therefore, paired samples t-tests were performed and corroborated that participants' scores on the PA scale were significantly higher following the race when compared to their scores at Time 1, $t(18) = -3.89, p < .01$. Cohen's

d was computed and showed a large effect size (Cohen's $d = .91$). Psychological WB scores were also significantly higher at Time 2 relative to Time 1, $t(20) = -2.37, p < .05$. Cohen's d indicated medium effect size for this analysis ($d = .52$). Physical WB was not statistically different pre- to post-race, $t(20) = -1.27, p > .05$, and yielded a correspondingly small effect size (Cohen's $d = .28$). The descriptive statistics for these analyses are presented in Table 3.

Hypothesis 2. Participants' scores on character strength measures will be higher at Time 2 than at Time 1.

Shapiro-Wilk test of normality was computed and indicated that the within-pair differences for all of the character strengths followed a normal distribution ($S-W_{\text{ChangeCreativity}} = .94, p = .23$; $S-W_{\text{ChangeBravery}} = .98, p = .92$; $S-W_{\text{ChangeTeamwork}} = .96, p = .56$; $S-W_{\text{ChangeLeadership}} = .96, p = .56$; $S-W_{\text{ChangePerseverance}} = .94, p = .22$; $S-W_{\text{ChangeZest}} = .95, p = .36$). Therefore, in order to test the second hypothesis, paired-sample t-tests were conducted and showed that although all the character strength scores except perseverance were larger at Time 2, none of those changes were significant ($p > .05$). Calculated effect sizes corroborated that the differences were small. See Table 3.

Hypothesis 3: Participants who are signed up as part of a team will report higher scores on the study variables compared to those who were signed up to participate by themselves. Specifically,

3a. Participants who are signed up as part of a team will report higher scores on the post-race measures of PA, psychological WB and physical WB compared to those who were signed up to participate by themselves.

Shapiro-Wilk indicated that PA and psychological and physical WB were normally distributed among both levels of the independent variable (team/alone). Independent samples

t-test was conducted and showed that there were no statistically significant differences on PA and well-being outcomes between the team/no team conditions (see Table 4). While the effect size for physical well-being was small (Cohen's $d = .25$), Cohen's d indicated medium effect sizes for PA ($d = .67$) and psychological WB ($d = .52$). It is interesting to note that the difference in change scores on psychological WB and physical WB from Time 1 to Time 2, while not statistically significant, yielded medium effect sizes. See bottom half of Table 4.

3b. Participants who are signed up as part of a team will report higher scores on the post-race character strengths of teamwork, leadership, and perseverance compared to those who were signed up to participate by themselves.

The Shapiro-Wilk test of normality indicated that teamwork and leadership followed a normal distribution for those who were signed up as part of a team and those who participated alone ($p > .05$) but perseverance was not normally distributed for those who participated by themselves ($S-W = .83, p < .05$). Logarithmic (to base 10) and square root transformations were not successful in correcting the non-normality. However, the two step transformation corrected the non-normality for this variable (Templeton, 2011). Therefore, independent-samples t-tests were conducted to examine any differences between teams on teamwork, leadership and transformed perseverance scores. The t-test revealed that participants who were signed up as part of a team had significantly higher scores on the teamwork scale post-race compared to those who indicated that they participated alone, $t(19) = -2.13, p < .05$. Cohen's d indicated a large effect size ($d = 1.14$). Subjects who were signed up as part of a team also scored higher on the post-race measures of leadership relative to those who participated alone but this difference was not statistically significant, $t(19) = -1.03, p = .32$, although Cohen's d was .45 (approximately a medium effect size). The results showed no pre to-post race differences on perseverance for

those who were signed up with a team versus those who participated alone, $t(19) = .30, p = .77$, Cohen's $d = .13$. See Table 4.

Hypothesis 4. The number of prior extreme obstacle courses run will be positively related to post-race scores on PA, psychological and physical WB and character strengths measures.

Spearman's rho correlation revealed that, contrary to the prediction there were significant negative associations between prior number of EOCs and post-race PA ($r_s = -.50, p < .05$) and teamwork ($r_s = -.50, p < .05$). There were not significant correlations between EOC and either of the WB measures.

Hypothesis 5. Scores on the post-race pride scale will be positively correlated with study variables. Specifically,

5a. Scores on the post-race pride will be positively associated with scores on PA, psychological WB and physical WB.

Correlational analysis indicated a significant positive relationship between pride and post-race psychological WB ($r = .55, p < .05$). The association between pride and physical WB T2 was positive but not significant ($r = .34, p = .13$). Similar was true for the correlation between pride and PA T2 ($r = .24, p = .31$).

Next, in order to examine the unique contribution of pride on post-race psychological WB, a hierarchical linear regression analysis was conducted. The variables were entered into the blocks in temporal order. The order within each step was based on the strength of the association between the predictors and DV (the variables with a stronger relationship were entered first). To control for time one, pre-race psychological WB was entered in step one. In step two, pre-race

PA, physical WB, and zest were entered. Post-race physical WB, zest, and PA were entered in step three. Pride was entered on the last step.

The data for all the predictors met the assumption of collinearity and results showed that multicollinearity was not a concern (*tolerance* > .1; *VIF* < 10). The results of step 1 indicated that pre-race psychological WB accounted for a significant 69.1% of variance in post-race psychological WB ($F(1,16) = 35.84, p < .0001$). Variables entered in step 2 contributed to a nonsignificant 3.5% increase in variance in the DV ($\Delta F(3,13) = .55, p = .66$). Model 3 indicated that Time 2 variables explained a significant 16.5% ($\Delta F(3,10) = 5.05, p < .05$) of the variance in psychological WB. Pride, on the last step, accounted for a nonsignificant 1.3% of variance ($\Delta F(1,9) = 1.17, p = .31$). See Table 5.

5b. Scores on the post-race pride scale will be positively correlated with post-race scores on the character strengths.

Bivariate correlation indicated a significant strong positive relationship between pride and post-race zest ($r = .48, p < .05$). No other correlations between pride and character strengths were significant.

Next, a hierarchical linear regression was conducted in order to analyze the unique contribution of pride on post-race zest. The variables were entered into the blocks in temporal order with the variables with stronger correlations with the DV entered first. To account for the pre-race score, zest T1 was entered in step 1. All the pre-race variables that were significantly correlated with post-race zest were entered as predictors in block 2 which included psychological WB and PA. In step 3, post-race psychological WB, PA, physical WB and creativity were entered. Finally, pride was entered into the last block.

Tests to see if the data met the assumption of collinearity indicated that multicollinearity was a concern for several of the controlled variables especially in model 4 (*tolerance* < .1; *VIF* > 10); however, it was not a concern for pride which was the predicting variable of interest (*tolerance* = 1.13, *VIF* = 8.88). The results of step 1 indicated that pre-race zest accounted for a significant 57.8% of variance in the DV ($F(1,15) = 20.54, p < .0001$). Variables entered in step 2 contributed an additional non-significant 11.6% increase in variance in zest T2 ($\Delta F(2,13) = 2.47, p = .12$). Post-race variables entered in block 3 accounted for a significant 20.5% of variance in the DV ($\Delta F(4,9) = 4.58, p < .05$). Pride, on the last step, explained an additional nonsignificant 1.7% of change in the DV ($F(1,8) = 1.62, p = .24$). See Table 6.

Discussion

Prior research has demonstrated that physical activity can enhance positive emotions and well-being. However, the benefits of running EOCs have been underexplored. The present study was conducted in order to examine the positive effects of participating in EOCs.

The current study's first hypothesis predicted that after running an extreme obstacle course, ratings of positive affect and well-being scales would be higher relative to ratings before the race. This hypothesis was partially supported. Consistent with previous findings on the benefits of physical activity, the results of the current study indicated that participating in an extreme obstacle course race was significantly associated with higher levels of positive affect and psychological well-being post-race compared to pre-race. This finding suggests that despite the difficulty and high risk that running EOCs involves, this unique type of exercise has the ability to increase one's positive affect and psychological well-being which might help to explain, to some degree, the growing popularity of such events.

Running an EOC was not associated with a statistically significant increase in physical well-being as predicted. One potential reason why could be that people interested in and who actually run EOCs might be in peak physical condition and perceive themselves to have very high subjective physical well-being to begin with. Indeed, participants' reported physical well-being scores were quite high at the beginning of the study suggesting a possible ceiling effect. This is of particular importance because if the initial scores on a scale are toward the top of the distribution, there is a little room for improvement and detection of a change over time (Koedel & Betts, 2009). Perhaps the largest increases would be observed for those who participated in an EOC for the first time compared to those who have run multiple races in the past. The current research could not assess this possibility because there was only one participant who indicated that this would be his/her first race. Future research should take that into account and aim at recruiting participants with various numbers of prior races run, including those who have never run an EOC before but have interest in doing so.

The second hypothesis predicted that participants' scores on the character strengths measures would be higher at Time 2 than at Time 1. The results showed no evidence to support this hypothesis. A possible explanation as to why running extreme obstacle courses was able to considerably increase positive affect and psychological well-being but not the character strengths might be because affect and well-being are constructs that can be defined as "states" or "feelings" that can fluctuate within a short amount of time and thereby might be more easily influenced and altered by physical activity. Character strengths, on the other hand, might be more comparable to personality traits that are relatively stable over time, and therefore may not be as easily impacted by one episode of physical activity. Although prior research suggests that character strengths can in fact be altered by physical activity (Dewar & Kavussanu, 2012;

Kniffin et al., 2015; McDowell et al., 2002), perhaps a longer period of time is required in order to see such changes. For instance, the study conducted by Kniffin et al. (2015) examined how participation in high-school sports influenced individuals 60 years later. In the study of McDowell et al. (2002), the researchers focused on “regular exercisers” who were defined by exercising for longer than six months and only if they exercised at a high intensity level. Furthermore, it is important to note that similarly to physical well-being, participants’ scores on the character strengths were already high at the beginning of the study; this might have resulted in a restricted variance, leaving little room to detect significant development of character strengths.

Prior research demonstrated that participating in team sports is associated with larger psychological and social benefits relative to partaking in individual activities (Eime et al., 2013). Therefore, the third hypothesis predicted that following the race, participants who were signed up as part of a team would report higher scores on teamwork, leadership, perseverance, positive affect and well-being compared to those who were signed up by themselves. The results partially supported this hypothesis and showed that those who were signed up to run the EOC with a team had significantly higher scores on post-race teamwork than those who were signed up to participate by themselves and the effect size indicated that this difference was large. In other words, those who run the EOCs as part of a team indicated that they felt like they worked at their best when in a group, and that they supported their teammates and respected their leaders even when they disagreed with them. Furthermore, higher teamwork scores indicate that participants are more likely to respect decisions made by the group and sacrifice their self-interest for the benefit of their team. The relationship between running as a team and teamwork might be due to the social nature of team-based activities that promotes communication, cooperation and

motivation amongst the members of the team which in turn may lead to increased teamwork skills. Future research might be able to assess these potential variables as mediators of the relationship between running as a team and the character strength of teamwork.

Participants who were part of a team also had higher positive affect, psychological well-being and leadership scores post-race, but these differences did not reach the traditional cut-off for statistical significance. One potential reason for not obtaining statistically significant results between the above listed variables could be the fact that although individuals can sign up to participate in an EOC by themselves or with a team, many obstacles in these races require collaboration between runners and everyone tends to help and motivate each other. In other words, although participants might not have signed up with a team, they probably did not run the race completely alone, thereby minimizing the potential differences between the groups. Interestingly, the effect sizes for the difference in PA, psychological WB and leadership between team/no team were medium suggesting that running an EOC with a team might be able to influence these constructs and future studies should attempt to replicate these findings using larger samples.

Next, it was hypothesized that the number of prior extreme obstacle courses run would be positively related to post-race scores on affect, well-being and character strengths measures. Based on previous research that demonstrated that physical activity enhances positive emotions, one might expect that the number of prior EOCs run would be positively associated with the scores on the study variables; however, this hypothesis was not supported. On the contrary, the results showed that there were negative associations between the number of prior EOCs and post-race affect and teamwork. One reason for this is that perhaps the positive effects of running EOCs are not long-lasting; hence, it could be that it is the activity itself in the present moment

that produces temporary benefits not the number of prior EOCs that one participates in. This is supported by the finding that PA and psychological well-being increased from Time 1 to Time 2 overall, regardless of number of prior races run. Secondly, it is important to note that in the present study, the number of prior extreme obstacle courses run was measured using a categorical scale (0, 1, 2, 3+); hence, nonparametric correlational analyses were performed. When the parametric analyses were run on this variable (e.g. Pearson's correlation) and post-race scores, the only significant relationship was found between the number of prior EOCs and post-race creativity, and in the positive direction. Furthermore, the majority of participants indicated that they participated in three or more EOCs and given the study's small sample size, this resulted in a very small number of subjects in the other three categories, effectively truncating the range of this variable. Goodwin and Leech (2006) indicate that this issue is often present in the research that recruits potential participants based on certain characteristic (e.g. having an interest in and/or having run an EOC in the past). A restricted range affects the analysis of the relationship between the variables by reducing the variability which decreases the strength of a correlation (Goodwin & Leech, 2006); therefore, these findings should be interpreted with caution and future studies should account for this limitation.

It was also predicted that pride would be related to participants' post-race scores on affect, well-being and character strengths. The results partially supported this hypothesis. The findings demonstrated that there were significant positive relationships between pride and post-race zest and psychological well-being. In other words, as subjects' scores on the post-race pride increased, so did their scores on zest and psychological well-being. EOC participants who reported feeling fulfilled, productive, successful, confident, and accomplished and who felt like they were achieving something reported higher levels of energy, thought that their life was

interesting, loved what they were doing, described themselves as full of zest and were as excited about the good fortune of others as they were about their own. Furthermore, compared to those who scored low on pride, participants with higher scores were less anxious, felt more like they had a purpose in life and were able to do the things they chose to, felt like they were able to grow as a person and were optimistic about the future, were happy with themselves, their appearance and their achievements, felt like they were in control of their lives, and were confident in their own opinions and beliefs. These results are consistent with prior research showing that participants' subjective rating of feeling proud about their performance on a match is positively related to happiness (e.g. whether subjects felt "pleased" or "joyful" when thinking about their performance), hope, perceived performance and subjective outcome of the match and negatively correlated with shame and dejection pride (Dewar & Kavussanu, 2012). The findings also indicated a positive relationship between pride and positive affect and physical well-being but these associations did not reach the standard significance level, although pride was associated with approximately 6% of the variance in post-race positive affect and about 12% of variability in post-race physical well-being. This suggests that pride might have an impact on these variables and future studies should attempt to replicate these findings in a larger sample.

Lastly, it is important to talk about some interesting findings on gender differences and running EOCs. The results showed that, on average, men participated in more prior EOCs than women. However, females experienced significantly more pride and had higher teamwork scores after running the race than males. One possible explanation for this might be that those who run fewer races are more easily affected by them than those who have participated in several races in the past. In other words, the benefits of running EOCs might be the greatest and more easily observed for those with fewer past EOCs because after running many races, the benefits remain

relatively constant or may even decrease. Another possible explanation is that generally women might prefer to work with others while men might be more individualistic.

Study Limitations

Sample. Despite the limitations already mentioned above, there are others that should be noted here and taken into account in future research. The present study utilized pre-existing data obtained from a small sample of participants ($n= 21$). This is the main limitation of the study because smaller samples might not have enough power to detect differences between groups leading to a potential Type II error (false negative finding) (e.g. Biau, Kernéis, & Porcher, 2008; Nayak, 2010). Thus, future research should employ a larger sample in order to increase the power of the study to show significant differences between conditions if true changes do exist. In addition, a larger sample size would allow researchers to conduct more sophisticated analyses (e.g. structural equation modeling including path analysis) which we were unable to run because they usually require a minimum of 10 subjects per variable (e.g. Kline, 2011). Another limitation concerning the study sample is that the sample consisted of mostly White participants with higher education degrees limiting the generalizability of the findings to the general population. However, the present study targeted a specific population of persons who were interested- and/or who participated in EOCs. Therefore, the demographics of the present sample might actually be representative of the population of individuals who run or are interested in running EOCs, particularly since participants were recruited via snowball technique (anyone who was known by the researchers to be interested in EOCs was invited and asked to recommend others with the same interest) and through a link posted on social media and EOC-related group sites. Thus the results may generalize to those who take part in these races. Unfortunately, the leading EOC companies such as Tough Mudder[®], Spartan Race[®] and Warrior Dash generally do not publish

their demographic data. For instance, the only information disclosed by Tough Mudder (2016) is that 65% of the runners are males with an average age of 29-35. However, according to Will Dean, the founder of Tough Mudder[®], many participants “come from Wall Street”, and “white-collar urban professionals” were identified as the demographic trend when the Tough Mudder[®] was first started back in 2010 (Stein, 2012). Future studies involving those who run or who are interested in running EOCs should compare the demographics of the present sample to the background characteristics of their participants.

Measurement of variables. As it has been briefly addressed above, the number of prior EOCs run was assessed only at Time 1 using a categorical scale (0, 1, 2, 3+) and the majority of participants indicated that they have run three or more EOCs in the past. Using this scale prevented us from knowing the exact number of prior races that the subjects participated in and examining whether there were any differences between those who have run three races versus those who participated in more EOCs in the past.

The second measurement limitation concerns the VIA-120 (Peterson & Park, 2009; Peterson & Seligman, 2004) leadership subscale which was the only scale in the present study with poor internal consistency at Time 2. Subsequent studies should use a more reliable scale to assess leadership.

In addition, although the survey utilized in the present study assessed post-race pride, the survey did not ask participants to report the outcome (e.g. the time, whether or not they have finished the race, their position) and perceived performance of the race. Prior research shows that these two variables might influence the effects of participating in sports; therefore, future studies should assess them.

Furthermore, the present study failed to measure the length of the course and participants' subjective rating of the intensity of the race they participated in. Extreme obstacle courses are designed to test one's physical and mental strength but the type and amount of obstacles, the difficulty level and the length of the races differ. Moreover, participants' experience and fitness level might also affect their perceived intensity of the course. Past research on exercise intensity and psychological benefits of physical activity are contradictory. For instance, Reed & Ones (2006) state that moderate and high intensity physical exercise results in smaller increases in positive affect compared to low intensity exercise. In contrast, Ekkakikis et al. (2008) show that intensity does not influence positive changes from pre- to post-exercise but intensity above ventilatory threshold decreases pleasure during the exercise. Both of these studies illustrate the effect that intensity level might have on the variables under investigation, so had the intensity level been assessed in the current research, it might have helped to explain some of the findings. When it comes to the length of the race, Reed and Ones (2006) suggest that physical activity that lasts 30-35 minutes produce the largest positive effects on mood and that exercises longer than 75 minutes decrease positive affect. The findings of the current study contradicted the results reported by Reed and Ones (2006). EOCs are events that usually take several hours to complete (Tough Mudder, 2016), yet, after running the course, positive affect and psychological well-being scores were significantly higher relative to the scores before the race. In order to determine whether the length and intensity of an EOC influences the positive outcomes, future studies should also record participants' ratings of these variables.

Another limitation is that in the present study, the post-race survey was to be completed within 72 hours after the day of the race; however, the study failed to precisely assess how many hours and minutes after completing the race, participants filled out the post-race questionnaire.

Several past studies showed that there is a main effect of time when it comes to the influence of physical activity on valance. For instance, one study indicated that the benefits of exercise on positive affect lasts only up to 30 minutes post exercise (Reed and Ones, 2006). This would suggest that the positive effects of running EOCs might be present after the race but only within a limited timeframe; however, the present study shows that the positive changes in positive affect and psychological well-being might be present even up to 72 hours after a race. It is possible that an even larger effect size would be obtained had all the participants took the survey directly after participating in an EOC. Perhaps the findings would be different if we were able to investigate the effects of time on the impact of running EOCs on affect, well-being and character strengths; therefore, future studies should ask participants to answer several scales directly following the course and then again to complete the same measures a few hours later and perhaps even within a few days. Furthermore, as noted earlier, perhaps a longer timeframe is needed to be able to detect changes in character strengths. Thus, future research should also employ a longitudinal design in order to examine the development, if any, of character strengths over time (and even after running a number of EOCs).

Lastly, prior studies show the benefits associated with green exercise (Mackay & Neill, 2010; Pretty et al., 2005) but unfortunately, there is limited research in that area. The vast majority of EOCs take place outdoors; however, in order to be able to compare whether there are any differences in the effects of participating in indoor versus outdoor EOCs, future studies should employ two separate samples of individuals who run an EOC that takes places inside a building and out in the open air.

Study Strengths and Implications

Despite the aforementioned limitations which can easily be addressed in future research

designs, the current study demonstrated several important and promising findings and added essential knowledge to understanding the effects of running EOCs on positive emotions. The present research served as a preliminary study on an otherwise unexplored type of physical activity. This is of particular significance considering the rapidly growing number of individuals who participate in EOCs. The results of the current study indicated that after participating in an EOC, scores on positive affect, psychological well-being and various character strengths increased. Although only the differences on positive affect and psychological well-being were significant, the present study could serve as a pilot study for a larger investigation.

There are several practical implications of the research findings. Previous studies suggest that physical activity increases positive emotions (Barton & Pretty, 2010; Khazae-Pool et al., 2015; Kim & Kim, 2007; Mata et al., 2013). Consistent with this research, the present study showed that running an EOC has a positive influence on PA and psychological WB. This could explain, to a certain degree, the growing popularity of EOCs as it suggests that individuals are generally in a better mood and evaluate themselves and their lives in a more positive way (based on how PA and psychological WB were assessed in the present study) after running an EOC. The positive effects of running EOCs might motivate people to participate more frequently in such events which supports the broaden-and-build theory that suggests that experiencing positive emotions expands one's scope of attention and awareness and encourages novel thoughts and actions (Fredrickson & Joiner, 2002). These increased positive emotions, on the other hand, might trigger an "upward spiral" toward enhanced social resources such as interpersonal trust (Burns et al., 2008) and emotional well-being (Fredrickson & Joiner, 2002). Indeed, the majority of the participants were repeat runners, having participated in three or more prior events. The positive outcomes experienced by participating may lead individuals to identify themselves with

being a part of a “movement” and thereby increase continued participation (Allman, Mittelstaedt, Martin, & Goldenberg, 2009).

Prior research shows that character strengths are the mechanisms by which the six core virtues (wisdom and knowledge, courage, humanity, justice, temperance, and transcendence) are developed. Character strengths can decrease depression, anxiety (Park & Peterson, 2008), and stress and increase positive affect and well-being (Wood et al., 2011); therefore, clinicians should consider the benefits of running EOCs when developing interventions for patients with anxiety and depression because EOCs might be able to not only increase positive affect and general mental health but also enhance the development of character strengths which leads to even more positive outcomes. Indeed exercise and physical activity has been shown to have positive therapeutic effects in both healthy and clinical samples (e.g. Brosse, Sheets, Lett, & Blumenthal, 2002). However, due to the limited research on the benefits of running EOCs and the high intensity of these events, future studies should explore the effects of participating in EOCs on clinical samples because it is plausible that we would observe different patterns for different clinically issues like anxiety.

The extreme obstacle course might be recommended as a form of physical activity in school settings as well as the workplace to promote better physical and mental health and enhance character strengths. The current study showed that being signed up to run an EOC with a team was associated with significantly higher teamwork ratings than being signed up to participate alone and teamwork skills are essential in school and work environments. This suggests that school directors, employers and managers could increase employee health and work-related skills by promoting group or team physical activities. Indeed, evidence suggests that physical activity improves mental and physical health of students and employees and leads

to better interactions among colleagues (Ben-Ner, Hamann, Koepp, Manohar, & Levine, 2014), reduced sickness absenteeism (Van Amelsvoort, Spigt, Swaen, & Kant, 2006), increased work performance (Coulson, McKenna, Field, 2008) and better quality and quantity of the work (Ben-Ner et al., 2014). When developing and implementing physical activity into a school or a workplace, rather than incorporating solely individual type of exercises, directors and employers should consider team-based activities that enhance the development of teamwork. Moreover, due to the fact that obstacles in the EOCs often require collaboration among the participants, running an EOC may strengthen the between and within groups relationships and improve communication. Employees may have a lot of fun while working together on completing the race as well as while working with their employers and vice versa in a completely different environment than a workplace. As a result of the enhanced subjective workplace relationships, the feelings of self-efficacy might also increase and managers might perceive themselves as better leaders and be more efficient in their job-related activities (Trépanier, Fernet, & Austin, 2012). It is likely no accident that companies like Goldman Sachs and Morgan Stanley bring large teams to run EOCs (Stein, 2012).

Conclusion

Prior research has demonstrated that exercise has the ability to increase positive emotions and well-being and foster the development of character strengths. Researchers have explored the benefits of several types of physical activity; however, participation in extreme obstacle courses remains unexplored. Moreover, since character strengths are commonly described as stable traits, only a number of them have been examined in the context of exercising. The present study differed in that it was conducted in order to explore the impact of running extreme obstacle courses on positive affect, well-being and character strengths including creativity, bravery,

teamwork, perseverance, leadership and zest. The results of the present study showed that running extreme obstacle courses enhances positive affect and well-being, and that running as part of a team can increase the character strength of teamwork. These findings indicate that there are positive outcomes associated with participating in extreme obstacle courses and suggest that more efforts should be undertaken to conduct further research on the effects of running extreme obstacle courses.

References

- Abu-Omar, K., Rütten, A., & Lehtinen, V. (2004). Mental health and physical activity in the European Union. *Sozial-und Präventivmedizin*, 49(5), 301-309. Retrieved from http://www.ocerint.org/intcess15_e-publication/papers/580.pdf
- Allman, T. L., Mittelstaedt, R. D., Martin, B., & Goldenberg, M. (2009). Exploring the motivations of BASE jumpers: Extreme sport enthusiasts. *Journal of Sport & Tourism*, 14(4), 229-247. doi: 10.1080/14775080903453740
- Barton, J., & Pretty, J. (2010). What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environmental Science & Technology*, 44(10), 3947-3955. doi: 10.1021/es903183r
- Ben-Ner, A., Hamann, D. J., Koepp, G., Manohar, C. U., & Levine, J. (2014). Treadmill workstations: the effects of walking while working on physical activity and work performance. *PloS One*, 9(2), e88620. doi: 10.1371/journal.pone.0088620
- Biau, D. J., Kernéis, S., & Porcher, R. (2008). Statistics in brief: the importance of sample size in the planning and interpretation of medical research. *Clinical Orthopaedics and Related Research*, 466(9), 2282-2288. doi: 10.1007/s11999-008-0346-9
- Boehm, J. K., & Kubzansky, L. D. (2012). The heart's content: the association between positive psychological well-being and cardiovascular health. *Psychological Bulletin*, 138(4), 655. doi: 10.1037/a0027448
- Brosse, A. L., Sheets, E. S., Lett, H. S., & Blumenthal, J. A. (2002). Exercise and the treatment of clinical depression in adults. *Sports Medicine*, 32(12), 741-760. doi: 10.2165/00007256-200232120-00001

- Brymer, E., & Oades, L. G. (2008). Extreme sports: A positive transformation in courage and humility. *Journal of Humanistic Psychology*, *49*(1), 114-123.
doi: 10.1177/0022167808326199
- Burns, A. B., Brown, J. S., Sachs-Ericsson, N., Plant, E. A., Curtis, J. T., Fredrickson, B. L., & Joiner, T. E. (2008). Upward spirals of positive emotion and coping: Replication, extension, and initial exploration of neurochemical substrates. *Personality and Individual Differences*, *44*(2), 360-370. doi: 10.1016/j.paid.2007.08.015
- Carver, C. S., Sinclair, S., & Johnson, S. L. (2010). Authentic and hubristic pride: Differential relations to aspects of goal regulation, affect, and self-control. *Journal of Research in Personality*, *44*(6), 698-703. doi: 10.1016/j.jrp.2010.09.004
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd edition). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Cohen, S., Doyle, W. J., Turner, R. B., Alper, C. M., & Skoner, D. P. (2003). Emotional style and susceptibility to the common cold. *Psychosomatic Medicine*, *65*(4), 652-657.
doi: 10.1097/01.PSY.0000077508.57784.DA
- Cohen, E. E., Ejsmond-Frey, R., Knight, N., & Dunbar, R. I. (2010). Rowers' high: behavioural synchrony is correlated with elevated pain thresholds. *Biology Letters*, *6*(1), 106-108.
doi: 10.1098/rsbl.2009.0670
- Cohn, M. A., Fredrickson, B. L., Brown, S. L., Mikels, J. A., & Conway, A. M. (2009). Happiness unpacked: positive emotions increase life satisfaction by building resilience. *Emotion*, *9*(3), 361-368. doi: 10.1037/a0015952

Coulson, J. C., McKenna, J., & Field, M. (2008). Exercising at work and self-reported work performance. *International Journal of Workplace Health Management, 1*(3), 176-197.

doi: 10.1108/17538350810926534

Crawford, J. R., & Henry, J. D. (2004). The Positive and Negative Affect Schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 43*(3), 245-265.

doi: 10.1348/014466503175293

Dewar, A. J., & Kavussanu, M. (2012). Achievement goals and emotions in team sport athletes. *Sport, Exercise, and Performance Psychology, 1*(4), 254-267.

doi: 10.1037/a0028692

Edmunds, S., Biggs, H., & Goldie, I. (2013). Let's get physical- the impact of physical activity on wellbeing. *Mental Health Awareness Week*. Retrieved from

<http://www.bhfactive.org.uk/userfiles/Documents/lets-get-physical-report.pdf>

Eichner, E. R. (2014). Tough Mudder injuries, triathlon drownings, and team rhabdomyolysis in the navy. *Current Sports Medicine Reports, 13*(2), 66-67.

doi: 10.1249/JSR.0000000000000044

Eime, R. M., Young, J. A., Harvey, J. T., Charity, M. J., & Payne, W. R. (2013). A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through

sport. *International Journal of Behavioral Nutrition and Physical Activity, 10*(98), 1.

doi: 10.1186/1479-5868-10-98

Ekkekakis, P., Hall, E. E., & Petruzzello, S. J. (2008). The relationship between exercise intensity and affective responses demystified: to crack the 40-year-old nut, replace the

- 40-year-old nutcracker! *Annals of Behavioral Medicine*, 35(2), 136-149.
doi: 10.1007/s12160-008-9025-z
- Everitt, A. V., Couteus, L., & David, G. (2007). Life extension by calorie restriction in humans. *Annals of the New York Academy of Sciences*, 1114(1), 428-433.
doi: 10.1196/annals.1396.005
- Exercise and physical activity. (2011, May). Retrieved from
https://d2cauhfh6h4x0p.cloudfront.net/s3fs-public/exercise-guide_1.pdf?4T0eeP86C0SKhrN3E93ALt_Z5BiCR9.R
- Findlay, L. C., & Coplan, R. J. (2008). Come out and play: Shyness in childhood and the benefits of organized sports participation. *Canadian Journal of Behavioural Science*, 40(3), 153.
doi: 10.1037/0008-400X.40.3.153
- Fredrickson, B. L., & Joiner, T. (2002). Positive emotions trigger upward spirals toward emotional well-being. *Psychological science*, 13(2), 172-175.
doi: 10.1111/14679280.00431
- Giltay, E. J., Geleijnse, J. M., Zitman, F. G., Hoekstra, T., & Schouten, E. G. (2004). Dispositional Optimism and All-Cause and Cardiovascular Mortality in a Prospective Cohort of Elderly Dutch Men and Women. *Archives of general psychiatry*, 61(11), 1126-1135. doi:10.1001/archpsyc.61.11.1126
- Giltay, E. J., Kamphuis, M. H., Kalmijn, S., Zitman, F. G., & Kromhout, D. (2006). Dispositional optimism and the risk of cardiovascular death: the Zutphen Elderly Study. *Archives of Internal Medicine*, 166(4), 431-436. doi:10.1001/archinte.166.4.431
- Goodwin, L. D., & Leech, N. L. (2006). Understanding correlation: Factors that affect the size of r . *The Journal of Experimental Education*, 74(3), 249-266. doi: 10.3200/jexe.74.3.249266

GraphPad Software, Inc.: GraphPad Quick Cals [Computer software], (2016). Retrieved from <http://www.graphpad.com/quickcalcs/>

Guszkowska, M., & Sionek, S. (2009). Changes in mood states and selected personality traits in women participating in a 12-week exercise program. *Human Movement, 10*(2), 163-169. doi: 10.2478/v10038-009-0014-2

Harzer, C., & Ruch, W. (2015). The relationships of character strengths with coping, work-related stress, and job satisfaction. *Frontiers in Psychology, 6*. doi: 10.3389/fpsyg.2015.00165

He, C., Bassik, M. C., Moresi, V., Sun, K., Wei, Y., Zou, Z., ... & Korsmeyer, S. (2012). Exercise-induced BCL2-regulated autophagy is required for muscle glucose homeostasis. *Nature, 481*(7382), 511-515. doi: 10.1038/nature10758

Hogan, C. L., Mata, J., & Carstensen, L. L. (2013). Exercise holds immediate benefits for affect and cognition in younger and older adults. *Psychology and Aging, 28*(2), 587-594. doi: 10.1037/a0032634

Howell, R. T., Kern, M. L., & Lyubomirsky, S. (2007). Health benefits: Meta-analytically determining the impact of well-being on objective health outcomes. *Health Psychology Review, 1*(1), 83-136. doi: 10.1080/17437190701492486

IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

Khazaei-Pool, M., Sadeghi, R., Majlessi, F. and Rahimi Foroushani, A. (2015), Effects of physical exercise programme on happiness among older people. *Journal of Psychiatric and Mental Health Nursing, 22*: 47–57. doi: 10.1111/jpm.12168

- Kim, S., & Kim, J. (2007). Mood after various brief exercise and sport modes: aerobics, hip-hop dancing, ice skating, and body conditioning. *Perceptual & Motor Skills*, 104(3), 1265-1270. doi: 10.2466/pms.104.4.1265-1270
- Kim, J. H., & McKenzie, L. A. (2014). The impacts of physical exercise on stress coping and well-being in university students in the context of leisure. *Health*, 6(19), 2570-2580. doi: 10.4236/health.2014.619296
- Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). New York, NY, US: Guilford Press.
- Kniffin, K. M., Wansink, B., & Shimizu, M. (2015). Sports at work anticipated and persistent correlates of participation in high school athletics. *Journal of Leadership & Organizational Studies*, 22(2), 217-230. doi: 10.1177/1548051814538099
- Knubben, K., Reischies, F. M., Adli, M., Schlattmann, P., Bauer, M., & Dimeo, F. (2007). A randomised, controlled study on the effects of a short-term endurance training programme in patients with major depression. *British Journal of Sports Medicine*, 41(1), 29–33. doi: 10.1136/bjism.2006.030130
- Koedel, C., & Betts, J. (2010). Value added to what? How a ceiling in the testing instrument influences value-added estimation. *Education*, 5(1), 54-81. doi: 10.1162/edfp.2009.5.1.5104
- Kronenberg, S., S., & Yali, A., M. (2014). Who participates in extreme obstacle courses and why. Unpublished master's thesis, The City College of New York.
- Laurin, D., Verreault, R., Lindsay, J., MacPherson, K., & Rockwood, K. (2001). Physical activity and risk of cognitive impairment and dementia in elderly persons. *Archives of Neurology*, 58(3), 498-504. doi: 10.1001/archneur.58.3.498

- Lund, A., Turriss, S. A., McDonald, R., & Lewis, K. (2015). On-site management of medical encounters during obstacle adventure course participation. *Current Sports Medicine Reports, 14*(3), 182-190. doi: 10.1249/JSR.0000000000000161
- Mackay, G. J., & Neill, J. T. (2010). The effect of “green exercise” on state anxiety and the role of exercise duration, intensity, and greenness: A quasi-experimental study. *Psychology of Sport and Exercise, 11*(3), 238-245. doi: 10.1016/j.psychsport.2010.01.002
- Maslow, A. H. (1968). *Toward a psychology of being* (2nd ed.). Oxford, England: D. Van Nostrand.
- Mata, J., Hogan, C. L., Joormann, J., Waugh, C. E., & Gotlib, I. H. (2013). Acute exercise attenuates negative affect following repeated sad mood inductions in persons who have recovered from depression. *Journal of Abnormal Psychology, 122*(1), 45-50.
doi: 10.1037/a0029881
- Mata, J., Thompson, R. J., Jaeggi, S. M., Buschkuhl, M., Jonides, J., & Gotlib, I. H. (2012). Walk on the bright side: physical activity and affect in major depressive disorder. *Journal of Abnormal Psychology, 121*(2), 297-308. doi: 10.1037/a0023533
- McCrum-Gardner, E. (2010). Sample size and power calculations made simple. *International Journal of Therapy and Rehabilitation, 17*(1), 10. doi: 10.1016/j.bjoms.2007.09.002
- McDowell-Larsen, S. L., Kearney, L., & Campbell, D. (2002). Fitness and leadership: is there a relationship? Regular exercise correlates with higher leadership ratings in senior-level executives. *Journal of Managerial Psychology, 17*(4), 316-324.
doi: 10.1108/02683940210428119
- McGrath, R. E. (2014). Scale-and item-level factor analyses of the VIA Inventory of Strengths. *Assessment, 21*(1), 4-14. doi: 10.1177/1073191112450612

- Mead, G. E., Morley, W., Campbell, P., Greig, C. A., McMurdo, M., & Lawlor, D. A. (2009). Exercise for depression. *Cochrane Database of Systematic Reviews*, 3. doi: cd004366 10.1002/14651858.cd004366.pub4
- Nayak, B. K. (2010). Understanding the relevance of sample size calculation. *Indian Journal of Ophthalmology*, 58(6), 469-470. doi: 10.4103/0301-4738.71673
- Park, N., & Peterson, C. (2006). Methodological issues in positive psychology and the assessment of character strengths. In A. D. Ong & M. van Dulmen (Eds.), *Handbook of methods in positive psychology* (pp. 292-305). New York, NY, US: Oxford University Press.
- Park, N., Peterson, C., & Seligman, M. E. (2004). Strengths of character and well-being. *Journal of social and Clinical Psychology*, 23(5), 603-619. doi: 10.1521/jscp.23.5.603.50748
- Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*, 18(2), 189-193. doi: 10.1097/00001504-200503000-00013
- Peterson, C., & Park, N. (2009). Classifying and measuring strengths of character. In S. J. Lopez & C. R. Snyder (Eds.), *Oxford handbook of positive psychology (2nd ed.)* (pp. 25-33). New York: Oxford University Press. www.viame.org
- Peterson, C., & Seligman, M. E. P. (2004). *Character strengths and virtues: A handbook and classification*. New York, NY, US: Oxford University Press.
- Pontin, E., Schwannauer, M., Tai, S., & Kinderman, P. (2013). A UK validation of a general measure of subjective well-being: the modified BBC subjective well-being scale (BBC-SWB). *Health and Quality of Life Outcomes*, 11(1), 1-9. doi: 10.1186/1477-7525-11-150

- Pretty, J., Peacock, J., Sellens, M., & Griffin, M. (2005). The mental and physical health outcomes of green exercise. *International Journal of Environmental Health Research, 15*(5), 319-337. doi: 10.1080/09603120500155963
- Qualtrics Survey Software (2014) [Computer software]. Provo, UT: Qualtrics
- Reiner, M., Niermann, C., Jekauc, D., & Woll, A. (2013). Long-term health benefits of physical activity— a systematic review of longitudinal studies. *BMC Public Health, 13*(1), 813. doi: 10.1186/1471-2458-13-813
- Rodriguez, M. (2016). *Obstacle race world: the state of the mud run business* (2nd. ed). Retrieved from <http://www.obstacleraceworld.com/>
- Rogers, C. R. (1951). *Client-centered therapy*. Boston: Houghton Mifflin.
- Schiopu, A. F. (2015). Workplace Emotions and Job Satisfaction. *International Journal of Economic Practices and Theories, 5*(3), 277-282. Retrieved from http://www.ijept.org/index.php/ijept/article/view/Workplace_Emotions_and_Job_Satisfaction/pdf_116
- Schmalz, D.L., Deane, G.D., Birch, L.L., Davison K.K., (2007). A longitudinal assessment of the links between physical activity and self-esteem in early adolescent non-hispanic females. *The Journal of Adolescent Health, 41*(6), 559-565. doi: 10.1016/j.jadohealth.2007.07.001
- Seligman, M. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*(1), 5-14. doi: 10.1037/0003-066X.55.1.5
- Singh, K., & Choubisa, R. (2010). Empirical validation of values in action-inventory of strengths (VIA-IS) in Indian context. *Psychological Studies, 55*(2), 151-158. doi: 10.1007/s12646-010-0015-4

Spartan Race (2016). Retrieved from <http://www.spartan.com/en>

Stein, J.D. (2012, December 7). Forging a bond in mud and guts. *The New York Times*. Retrieved from <http://www.nytimes.com/2012/12/09/fashion/extreme-obstacle-course-races-forge-a-bond-in-mud-and-guts.html?pagewanted=all>

Templeton, G. F. (2011). A two-step approach for transforming continuous variables to normal: implications and recommendations for IS research. *Communications of the Association for Information Systems: Mississippi State, MS, USA*. doi: 10.3390/jmse3020276

Tough Mudder: Probably the toughest event on the planet (2016). Retrieved from <https://toughmudder.com/events/what-is-tough-mudder>

Tracy, J. L., & Robins, R. W. (2007). The psychological structure of pride: a tale of two facets. *Journal of Personality and Social Psychology*, 92(3), 506.
doi: 10.1037/0022-3514.92.3.506

Trépanier, S. G., Fernet, C., & Austin, S. (2012). Social and motivational antecedents of perceptions of transformational leadership: A self-determination theory perspective. *Canadian Journal of Behavioural Science*, 44(4), 272.
doi: 10.1037/a0028699

Tyndall, A. V., Davenport, M. H., Wilson, B. J., Burek, G. M., Arsenault-Lapierre, G., Haley, E., ... & Longman, R. S. (2013). The brain-in-motion study: effect of a 6-month aerobic exercise intervention on cerebrovascular regulation and cognitive function in older adults. *BMC Geriatrics*, 13(1), 21. doi: 10.1186/1471-2318-13-21

Van Amelsvoort, L. G., Spigt, M. G., Swaen, G. M., & Kant, I. (2006). Leisure time physical activity and sickness absenteeism; a prospective study. *Occupational Medicine*, 56(3), 210-212. doi: 10.1093/occmed/kqj026

VIA Institute on Character: Bravery (2016). Retrieved from

<https://www.viacharacter.org/www/Character-Strengths/Bravery>

Warrior Dash (2016). Retrieved from <https://www.warriordash.com/>

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063. doi: 10.1037/0022-3514.54.6.1063

Wood, A. M., Linley, P. A., Maltby, J., Kashdan, T. B., & Hurling, R. (2011). Using personal and psychological strengths leads to increases in well-being over time: A longitudinal study and the development of the strengths use questionnaire. *Personality and Individual Differences*, 50(1), 15-19. doi: 10.1016/j.paid.2010.08.004

Wright, T. A., Cropanzano, R., & Bonett, D. G. (2007). The moderating role of employee positive well-being on the relation between job satisfaction and job performance. *Journal of Occupational Health Psychology*, 12(2), 93. doi: 10.1037/1076-8998.12.2.93

Zoladz, J. A., Majerczak, J., Duda, K., & Chlopicki, S. (2009). Exercise-induced prostacyclin release positively correlates with vo(2max) in young healthy men. *Physiological Research*, 58(2), 229-238. Retrieved from http://www.biomed.cas.cz/physiolres/pdf/58/58_229.pdf

Note. ^aPA scale was compared to the sample of Watson et al. (1988) of mostly undergraduate US

Table 1

Comparative Descriptive Statistics between the Present Sample (Time 1: pre-race and Time 2: post-race) and Samples from Other Studies.

Scale	Time 1			Time 2			Comparison Sample ^a		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M^b</i>	<i>SD</i>
Positive Affect	19	38.79 ^{***}	7.20	21	42.92 ^{***}	5.12	1,002	33.3	7.2
Psychological WB	21	46.90 ^{***}	6.96	21	49.05 ^{***}	6.86	23,341	36.99	9.52
Physical WB	21	27.10 ^{***}	4.33	21	27.95 ^{***}	4.84	23,341	22.03	5.04
Creativity	21	3.82	.77	20	3.94 [*]	.72	123	3.6	.57
Bravery	21	3.66	.77	21	3.72	.82	123	3.6	.51
Teamwork	21	3.66	.66	21	3.7	.67	123	3.7	.53
Leadership	21	3.76	.57	21	3.78	.43	123	3.7	.55
Perseverance	21	4.13 ^{***}	.44	21	4.11 ^{**}	.59	123	3.6	.67
Zest	20	3.86 [*]	.64	21	4.02 ^{***}	.52	123	3.5	.57

students. Psychological and physical WB scales were compared to the study of Pontin et al.

(2013) of adult UK residents. All six of the character strengths were compared to the sample of

Singh and Choubisa (2010) of undergraduate Indian students.

^bThe means reported by Singh and Choubisa were rounded to one decimal place. No other information was available in the original article.

* $p < .05$. ** $p < .01$. *** $p < .001$

Table 2
Correlations between all the Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
1. Age	-																									
2 Gender ^a	-.01	-																								
3. Education ^b	.21	-.24	-																							
4. Annual income ^b	.24	-.42	.37	-																						
5. # of prior EOCs ^b	.04	-.55	.56	.34	-																					
6. No team/team ^a	-.44	.15	-.56	-.22	-.45	-																				
7. PA T1	.03	.08	-.46	-.27	-.61	.08	-																			
8. PA T2 ¹	.22	.20	-.39	-.32	-.50	.31	.53	-																		
9. Psych WB T1	-.01	-.13	-.26	-.01	-.37	.07	.78	.37	-																	
10. Psych WB T2	.15	-.02	-.39	-.02	-.46	.26	.64	.56	.82	-																
11. Physical WB T1	.34	.05	.01	.30	-.11	-.38	.57	.05	.72	.57	-															
12. Physical WB T2	.36	-.01	-.22	.11	-.37	-.13	.64	.45	.73	.81	.78	-														
13. Creativity T1	-.09	-.05	-.01	-.46	.11	.15	.22	-.03	.14	.04	-.06	-.06	-													
14. Creativity T2	.29	-.12	.05	-.44	.08	-.13	.05	.14	.20	.23	.04	.11	.64	-												
15. Bravery T1	-.29	.08	.18	-.36	.15	.07	-.04	-.23	-.23	-.20	-.37	-.32	.62	.45	-											
16. Bravery T2	-.45	.16	.14	-.34	.10	.08	-.06	-.03	-.04	-.02	-.25	-.14	.55	.43	.76	-										
17. Teamwork T1	.07	.48	-.41	-.41	-.39	.44	.08	.16	-.10	.02	-.24	-.26	-.05	.02	.11	-.14	-									
18. Teamwork T2	-.08	.56	-.48	-.45	-.50	.52	.09	.35	.06	.18	-.14	-.14	-.17	-.02	-.10	-.03	.83	-								
19. Leadership T1	.19	.24	-.24	-.23	-.12	.11	.03	.00	-.34	-.29	-.25	-.34	-.08	-.20	.14	-.31	.68	.35	-							
20. Leadership T2	.02	.32	-.34	-.57	-.09	.23	.16	.16	-.18	-.07	-.23	-.23	.15	-.14	.04	-.08	.49	.38	.62	-						
21. Persev. T1	-.05	.19	.31	-.36	.11	-.33	.09	.01	.04	-.07	.10	-.10	.29	.31	.26	.33	-.10	-.07	.13	.45	-					
22. Persev. T2	.08	.11	.16	-.23	.18	-.24	.14	.18	.23	.20	.18	-.01	.11	.30	.02	.17	-.03	.12	.03	.38	.78	-				
23. Zest T1	.20	.35	-.14	-.25	-.15	.10	.65	.56	.57	.57	.42	.48	.33	.52	.13	.12	.26	.30	.01	.12	.42	.33	-			
24. Zest T2	.28	.26	-.35	-.31	-.36	.11	.62	.69	.70	.78	.43	.63	.14	.45	-.02	.14	.17	.36	-.18	.03	.17	.41	.72	-		
25. Pride ¹	.08	.46	-.34	-.13	-.52	.27	.42	.23	.42	.55	.40	.34	.02	-.02	-.09	-.23	.34	.36	.08	.22	.09	.18	.60	.48	-	

Note. Red, $p < .01$; blue, $p < .05$; green, $p < .10$.

¹Transformed variables. ^aCorrelations with these variables are point biserial correlations. ^bCorrelations with these variables are Spearman's rho coefficients.

Gender was coded as 1= males, 2= females. Education was coded as 1= some high school; 2= high school diploma or GED; 3= some college; 4= college graduate; 5= some graduate school; 6= graduate degree; 7= post-graduate school. Income: 1= under \$14,999; 2= \$15K-34,999; 3= \$35K-69,999; 4= \$70K-100K; 5= over 100k. Number (#) of prior EOCs was coded as 1= 0; 2= 1; 3= 2; 4= 3 or more. No team/team was coded as 0 and 1, respectively.

T1= pre-race. T2= post-race. PA= Positive affect. Psych WB= Psychological well-being. Persev.= Perseverance.

Table 3

Means and Standard Deviations of all the Dependent Variables (Pre-and-Post Race)

	Time 1		Time 2		<i>p-value</i>	<i>Cohen's d</i>
	(pre-race)		(post-race)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Positive Affect	38.79	5.90	42.95	5.12	.001**	-.91
Psychological WB	46.90	6.96	49.05	6.86	.03*	-.52
Physical WB	27.10	4.33	27.95	4.84	.22	-.28
Creativity	3.82	.77	3.94	.72	.63	-.11
Bravery	3.66	.77	3.72	.82	.59	-.12
Teamwork	3.66	.66	3.70	.67	.66	-.10
Leadership	3.76	.57	3.78	.43	.85	-.04
Perseverance	4.13	.44	4.11	.59	.82	.06
Zest	3.86	.64	4.02	.52	.11	-.39

Note. Effect size thresholds: small, Cohen's $d = .2$; medium, $d = .5$; large, $d = .8$ (Cohen, 1988)

Significant differences between pre-and-post race scores are marked as follows:

* $p < .05$

** $p < .001$

Table 4

Means and Standard Deviations for Post-Race Study Variables and Change Scores Grouped by Team/No Team

	Team			No Team			<i>p</i> -value	Cohen's <i>d</i>
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>		
Time 2 Scores								
Positive Affect	11	44.55	4.08	10	41.20	5.77	.14	.67
Psychological WB	11	50.73	6.72	10	47.20	6.86	.25	.52
Physical WB	11	27.36	5.05	10	28.60	4.79	.57	.25
Teamwork	11	4.02	.51	10	3.34	.67	.02*	1.14
Leadership	11	3.87	.48	10	3.68	.37	.32	.45
Perseverance ^a	11	.09	1.46	10	.24	.78	.77	.13
Change Scores (T2-T1)								
Positive Affect	10	5.10	5.20	9	3.67	4.87	.55	.28
Psychological WB	11	3.36	4.84	10	.80	2.86	.16	.64
Physical WB	11	1.82	3.54	10	-.20	2.20	.14	.68
Teamwork	11	.09	.35	10	-.02	.45	.53	.28
Leadership	11	.05	.47	10	-.02	.45	.72	.28
Perseverance	11	-.02	.47	10	-.02	.24	.99	.28

Note. Effect size thresholds: small, Cohen's *d*= .2; medium, *d*= .5; large, *d*= .8 (Cohen, 1988)

Change scores were calculated by subtracting pre-race scores from post-race scores.

^aTransformed variable.

**p*< .05

Table 5

Summary of Hierarchical Regression Analysis for Variables Predicting Post-Race Psychological WB

Predictor	Post-Race Psychological WB					
	<i>B</i>	<i>SE B</i>	β	R^2	ΔR^2	95% CI
						Lower Upper
Step 1				.69***	.69***	
Psych WB T1	.84	.14	.83			.54 1.14
Step 2				.73**	.04	
Psych WB T1	1.14	.38	1.13			.33 1.95
PA T1	-.18	.32	-.15			-.87 .51
Physical WB T1	-.50	.44	-.30			-1.46 .45
Zest T1	1.23	2.17	.11			-3.45 5.91
Step 3				.89***	.17*	
Psych WB T1	.67	.32	.67			-.04 1.38
PA T1	-.07	.26	-.06			-.64 .50
Physical WB T1	-.61	.37	-.36			-1.44 .23
Zest T1	-2.15	2.24	-.20			-7.14 2.84
Physical WB T2	.38	.41	.26			-.53 1.28
Zest T2	7.58	3.58	.57			-.39 15.55
PA T2 ^a	-.04	1.15	-.01			-2.61 2.53
Step 4				.90**	.01	
Psych WB T1	.65	.32	.64			-.07 1.36
PA T1	-.14	.26	-.12			-.72 .45
Physical WB T1	-.65	.37	-.39			-1.49 .20
Zest T1	-1.84	2.24	-.17			-6.90 3.22
Physical WB T2	.62	.46	.43			-.42 1.66
Zest T2	4.48	4.56	.34			-5.84 14.81
PA T2 ^a	.25	1.17	.04			-2.41 2.91
Pride ^a	1.47	1.36	.18			-1.16 4.55

Note. ^aIndicates transformed variables. CI stands for confidence interval.

*** $p < .0001$; ** $p \leq .001$; * $p < .05$

Table 6

Summary of Hierarchical Regression Analysis for Variables Predicting Post-Race Zest

Predictor	Post-Race Zest						
	<i>B</i>	<i>SE B</i>	β	R^2	ΔR^2	95% CI	
						Lower	Upper
Step 1				.58***	.58***		
Zest T1	.63	.14	.76			.33	.93
Step 2				.69	.12		
Zest T1	.45	.17	.54			.09	.81
Psych WB T1	.04	.02	.48			-.00	.09
PA T1	-.01	.02	-.11			-.06	.04
Step 3				.90**	.21*		
Zest T1 ^b	.51	.25	.61			-.06	1.08
Psych WB T1	-.02	.03	-.20			-.09	.05
PA T1	-.01	.02	-.12			-.06	.03
Psych WB T2	.04	.02	.51			.00	.09
PA T2 ^a	.01	.10	.03			-.21	.23
Physical WB T2	.04	.03	.33			-.04	.11
Creativity T2	-.11	.16	-.15			-.48	.26
Step 4				.92**	.02		
Zest T1 ^b	.01	.46	.01			-1.06	1.07
Psych WB T1 ^b	.02	.04	.21			-.08	.11
PA T1	-.02	.02	-.16			-.06	.03
Psych WB T2 ^b	.00	.04	.04			-.08	.09
PA T2 ^{a,b}	.17	.15	.38			-.19	.52
Physical WB T2	.03	.03	.28			-.04	.11
Creativity T2 ^b	.18	.27	.24			-.45	.81
Pride ^a	.23	.18	.39			-.18	.64

Note. ^aIndicates transformed variables. *** $p < .0001$; ** $p \leq .001$; * $p < .05$

^b $Tolerance < .1$; $VIF > 10$