Research Article

Linking Positive Psychology and the Transtheoretical Model: How Character Strengths and Processes of Change Relate to Each Other and to Exercise

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Abstract

The transtheoretical model promotes exercise and other health behaviors by matching specific processes of change (PoC) to an individual's current stage of change. Similarly, positive psychology confirms that building signature character strengths is associated with greater happiness and less depression. However, past work has not examined how strengths use, PoC, and exercise stage of change are associated or the potential causal direction between constructs. Participants (N = 344) completed an online survey assessing character strengths, PoC, and exercise stage of change. Novel groupings of exercise-specific strengths were found. Use of all fortitude strengths (i.e., self-regulation, perseverance, zest, perspective, appreciation of beauty, hope, leadership, bravery, and gratitude), some of the cognitive strengths (i.e., love of learning, curiosity, creativity, and bravery) and interpersonal strengths (i.e., love and leadership), but none of the self-modulation strengths associated with later stage of change. Multiple structural equation models were compared, showing (a) character strengths and PoC use are linked and (b) strengths are better predictors of PoC than PoC are of strengths. Building fortitude strengths may increase behavioral PoC for physically active people and associate with more regular exercise, and building self-modulation strengths (e.g., prudence, modesty) may increase experiential PoC among non-active individuals.

Keywords

Signature strengths, character strengths, exercise, intervention strategies, and transtheoretical model

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According to the Global Health Observatory data, 23% of adults globally are not sufficiently active (World Health Organization, n.d.). Insufficient levels of physical activity are associated with a host of medical issues, including increased risk for mortality, heart disease, stroke, depression, and several types of cancer, among others (e.g., World Health Organization, n.d.). This is a vexing problem, as many adults are aware of the physical and mental health benefits of physical activity but do not choose to be physically active. Two previously unconnected approaches to enhancing well-being - the transtheoretical model (TTM) and character strengths – are applied in an attempt to better understand if and how these two approaches together can help identify possible interventions to improve physical activity levels.

Transtheoretical model

The TTM is a useful model to explain changes in health behaviors such as stopping smoking, increasing exercise, or stopping overeating (e.g., Prochaska & DiClemente, 2005). The TTM classifies individuals into different stages of change depending upon their current thought and behavior patterns with regards to a specific health behavior, which for this study was exercise. Regarding exercise, *precontemplation* individuals are neither exercising nor intending to start exercising in the future. *Contemplation* individuals are not exercising, but are planning on changing their behavior within the next 6 months. *Preparation* represents people who are beginning to change their exercise behavior, but have not yet met the official criteria. *Action* includes individuals who are currently meeting the guidelines for exercise, but have been meeting the guidelines for less than 6 months. *Maintenance* includes individuals who have been meeting the exercise guidelines for more than 6 months. Progress across the stages is not necessarily linear and may be more cyclical in nature. Most criticisms of the TTM center around the stage of change concept (e.g., Armitage, 2009). However, the stage of change algorithm is strongly related to both self-reported and objectively measured physical activity (see for example Hellsten et al., 2008 report summarizing findings across many studies). Among multiple studies, participants in precontemplation, contemplation, and preparation exercise significantly less than participants in action and maintenance. Thus, in terms of serving as a dependent variable representing physical activity levels, physical activity stage of change will be effective for the purposes of the current study.

The TTM suggests that individuals who are not currently physically active will need different strategies to help them progress to being physically active than will individuals who are already being physically active. The processes of change (PoC) are the specific strategies that are used to help people progress along the stages (e.g., Prochaska & DiClemente, 2005). The PoC are divided into two categories. *Experiential PoC* change the way people think and feel about behavior change and include (a) consciousness raising - increasing knowledge about the benefits of behavior change, (b) dramatic relief - using emotions to understand the potential risks of not changing behavior, (c) environmental reevaluation - caring about the impact of behavior change on significant others, (d) social liberation - noticing public support of behavior change, and (e) self-reevaluation - imagining the possible impact of behavior change on the self. *Behavioral PoC* focus on behavioral changes that help make healthy behaviors easier to implement and include (a) self-liberation-making a commitment to behavior change, (b) counter conditioning - substituting healthier alternatives, (c)

stimulus control-managing your environment to provide reminders of health behavior, (d) reinforcement management - rewarding yourself for behavior change, and (e) helping relationships - enlisting social support from others.

Experiential PoC are hypothesized to be more effective for individuals in the earlier stages of change before they have started exercising regularly, while behavioral PoC are hypothesized to be more effective for individuals in the later stages of change after individuals have already begun exercising regularly (e.g., Prochaska & DiClemente, 2005). The TTM has provided a useful framework for tailoring materials and intervention strategies to the stage of the individual; programs that tailor their strategies to meet individuals at their stage can lead to improvements in physical activity behaviors (e.g., Marcus, Banspach, Lefebvre, Rossi, Carleton, & Abrams, 1992).

Consistently across a variety of studies, implementation of all or most of the PoC is associated with progression to later stages of change or higher levels of attainment or maintenance of physical activity (e.g., Bucksch, Finne, & Kolip, 2008; Dishman, Vandenberg, Motl, & Nigg, 2010; Kirk, MacMillan, & Webster, 2010; Lipschitz et al., 2015; Marshall & Biddle, 2001; Romain, Bernard, Hokayem, Gernigon, & Avignon, 2016; Skaal, 2013; Wadsworth & Hallam, 2007; Woods, Mutrie, & Scott, 2002). Use of PoC, especially behavioral PoC, are effective at enhancing physical activity across all stages, while the hypothesized match between stage and PoC is partially, but not consistently, supported by this research. However, the idea that personalized interventions are more effective than impersonal ones remains supported by research; health behavior-boosting approaches that match specific personality characteristics are more effective than those that do not (e.g., Rothman & Baldwin, 2012). Also, it is well-acknowledged that positive psychology interventions are more effective when there is a good person-activity fit, or greater overlap or match between activity characteristics and personal factors (including personality traits and character strengths) (e.g., Giannopoulos & Vella-Brodrick, 2011; Lyubomirsky & Layous, 2013; Lyubomirsky, Sheldon, & Schkade, 2005). So perhaps matching additional personality traits – such as character strengths – to PoC strategies will also help determine their effectiveness for increasing exercise.

Character strengths

Another model that emphasizes the importance of matching behaviors to the person to enhance well-being is the character strengths approach (e.g., Peterson & Seligman, 2004). Character strengths are the universal, morally valued, and stable positive traits that produce positive effects to the self and others when expressed. Individuals will vary with regards to which strengths they are stronger and weaker in. Peterson and Seligman identified 24 character strengths (e.g., creativity, bravery, kindness, teamwork, forgiveness, gratitude). The character strengths approach suggests that using your signature character strengths will promote well-being.

Past research has shown that using character strengths in new ways increases happiness, life satisfaction, positive affect, vitality, and greater well-being and decreases depression and stress (e.g., Gander, Proyer, Ruch, & Wyss, 2012; Mongrain & Anselmo-Mathews, 2012; Peterson & Peterson, 2008; Quinlan, Swain, & Vella-Broderick, 2011; Seligman, Steen, Park, & Peterson, 2005; Wood, Linley, Mattby, Kashdan, & Hurling, 2011). These effects have been shown in both the short-term (e.g., that day, Lavy, Littman-Ovadia, & Bareti, 2014) and in the long-run (e.g., 6 months later,

Wood et al., 2011). Strengths use can also predict higher satisfaction of the psychological needs (i.e., autonomy, competence, relatedness) in self-determination theory and also assist with progress towards goals (e.g., Linley, Nielsen, Gillett, & Biswas-Diener, 2012). A study by Stocker and Hefferon found that personalized exercise programs built around using signature strengths in new ways were effective in boosting exercise adherence and enjoyment (as cited in Hefferon, 2013). In sum, character strengths use is associated with a host of positive, adaptive outcomes.

However, utilizing character strengths is not equally effective for all people or in all situations, suggesting that the effects of character strengths use is more nuanced than the above findings suggest. For example, people who lack a sense of meaning or "calling" in their lives but are higher on strengths level show a stronger positive relationship between strengths use and life satisfaction than do other individuals who are lower in sense of meaning or "calling" (Allan & Duffy, 2013). Practice, effort, and preference influence whether or not strengths use interventions will be effective (Proyer, Wellenzohn, Gander, & Ruch, 2014). Using strengths may need to be contextualized according to goals, interests, and values to be effective (Biswas-Diener, Kashdan, & Minhas, 2011). Also, a person's general strength level across all 24 character strengths may influence how effective working on lesser strengths may be; individuals who score consistently higher across the 24 character strengths in general tended to benefit more from working on lesser strengths than did individuals who scored lower across the 24 character strengths (Proyer, Gander, Wellenzohn, & Ruch, 2015). Thus, character strengths use will not necessarily produce the same outcome across all individuals, suggesting that additional factors also need to be considered.

In addition, measurement of character strengths use may also need to be contextualized further. The common measures of character strengths are general in nature (e.g., Values in Action Inventory of Strengths, Peterson & Seligman, 2004). However, the demands of specific situations and contexts will vary somewhat, changing how applicable certain strengths are in that context (Peterson & Seligman, 2004). Thus, narrowing the measurement focus to apply to the exercise-context specifically, rather than in general, may help identify those specific strengths that may be especially useful for exercise. This approach has been especially fruitful for the study of self-perceptions. For example, drawing on earlier work by Harter (1985), Fox and Corbin (1989) established a multi-dimensional model of self-perceptions that acknowledges that beginning at a young age, people think and judge themselves differently according to the general or specific level of measurement and in terms of which domain of their life is being addressed. This approach has allowed for a more nuanced understanding that global and domain-specific constructs are important to assess separately, and can serve as a reminder that although global and physical domain-specific constructs may be strongly related, there may only be small relationships between the exercise and other domain-level constructs (e.g., Fox & Wilson, 2008). Consistent with the trait-state debate in psychology (e.g., Chaplin, John, & Goldberg, 1988), measurement of constructs at different levels of specificity allows examination of whether global trends are consistent within and across different domains or simply shown at a global level.

While much research has focused on the effects of character strengths use on general psychological well-being, research has rarely studied the effect of strength use on health-specific behaviors. One large study by Proyer, Gander, Wellenzohn, and Ruch (2013) examined the links

between generally-measured character strengths and many aspects of health. Overall, a variety of health-related behaviors were related to self-regulation, curiosity, appreciation of beauty, gratitude, hope, and humor. Regarding exercise specifically, total physical fitness was significantly correlated with the strengths of curiosity, zest, self-regulation, leadership, and hope. Thus, even when measured at a general level, some character strengths are related to health and exercise behaviors. However, as measures of character strengths currently do not focus specifically on exercise behaviors, it is not clear if individuals view those signature strengths as ones they use while preparing for exercise or exercising. One of the main purposes of the present study is to narrow the measurement focus to allow domain-specific examination of character strengths use with regard to planned exercise.

Linking PoC and strengths

There may be links between specific exercise-focused PoC and specific exercise-focused character strengths that would make progression to regular exercise more likely. As activities that better fit a person's characteristics are more effective (e.g., Lyubomirsky & Layous, 2013), individuals higher in specific character strengths may be more likely to implement PoC that "match" or involve that character strength. For example, individuals who are higher in the character strength of social intelligence may find it easier to implement the PoC dramatic relief due to high levels of awareness regarding emotions and social factors. Similarly, individuals with high levels of the character strength of perseverance may find the PoC self-liberation which involves committing to behavior change more likely to be effective. Or an individual higher in the more interpersonal strengths may find using PoCs such as social reevaluation or helping relationships more likely to be effective. In other words, individuals with specific character strengths may also find themselves using PoC that complement or implement that strength more often and as a result be more likely to progress to later stages of change. Of course, the possible causal direction could also run in the opposite direction. Practicing PoC repeatedly over time may also build up related character strengths. At issue is whether one of these potential causal directions better represents the relationship between PoC and character strengths. Planning effective interventions to enhance exercise would benefit from knowing whether building certain strengths leads to use of specific PoC and to more exercise, or whether focusing on implementing certain PoC will build specific character strengths and in turn make exercise more likely.

The purposes of this study are to (1) examine whether characters strengths use and PoC use varies across exercise stages of change and (2) to examine the best way to conceptualize the relationship, and most likely direction of influence, between strengths and PoC for the prediction of stage of change (strengths and PoC as unrelated predictors of stage, strengths → PoC → stage, PoC→ strengths → stage; see Figure 1). It is hypothesized that individuals at the later stages will use more behavioral PoC (e.g., Prochaska & DiClemente, 2005) and will use specific character strengths such as curiosity, zest, self-regulation, leadership, and hope more (Proyer et al., 2013). Assessing character strengths use at the domain-specific level may provide more relevant findings for exercise promotion than previous work that assessed character strengths use at a global level.

Method

Participants

Participants included 344 adults (175 male, 166 female, 3 other gender identity) between the ages of 18 and 71 years (M= 34.51 years, SD = 11.18). A majority of participants were White (76.7%), with Asian (10.5%), Black or African American (6.1%), American Indian or Alaska Native (1.5%), and Other (5.2%) also represented. A majority of participants did not have a current gym membership (56.0%) and were not currently enrolled in an exercise class (85.5%). Most participants were not currently participating on a sports team (82.2%), but of those that were, more were participating at the recreational/pick-up level (77.6%) than at competitive (16.3%) and highly competitive (6.1%) levels.

Procedure

Participants were recruited through Amazon Mechanical Turk with a notice about an academic survey about exercise, and participants completed the questionnaire on-line. Participants were paid for their participation. The project was approved by the university Institutional Review Board, and all participants provided informed consent before completing the survey.

Measures

Character strengths. Participants completed a version of the 24-item character strengths measure developed by Ruch, Martinez-Marti, Proyer, and Harzer (2014), modified slightly to apply specifically to the exercise context rather than general use. The instructions preceding the character strength descriptions and response options asked participants to focus on exercise, which could include thoughts and behaviors while planning or preparing for exercise and during exercise sessions. After reading each strength description, participants responded on a Likert-type scale ranging from 1 (*very much unlike me regarding exercise*) to 7 (*very much like me regarding exercise;* See Appendix A).

Initial convergent, divergent, and factorial validity for the measure was demonstrated by Ruch et al. (2014). As the Ruch et al. scale was modified to focus specifically on exercise-related behaviors, an exploratory principal components analysis with varimax rotation was run to examine the emergent factor structure rather than assuming previous factor structures would fit exercise-specific character strengths use. Past work examining the factorial validity of character strengths measures has acknowledged that character strengths and virtues (groupings of character strengths) are correlated (e.g., McGrath, 2015; Brdar & Kashdan, 2009; Peterson & Seligman, 2004; Ruch et al.).

Four factors with eigenvalues greater than 1.00 emerged explaining 57.4% of the variance. With a factor loading cutoff of .40 for inclusion of a factor's interpretation, 7 of the 24 items loaded on more than one factor (see Table 1 for details). The first factor included strengths that focused on effort, perseverance, and bravery in the face of obstacles and big-picture appreciation and perspective for the longer term and was labeled *Fortitude Strengths*. The second factor focused more on control of personal reactions in the shorter term and was labeled *Self-Modulation Strengths.* The third factor focused on interpersonal relationships with other people or with god and was named *Interpersonal*

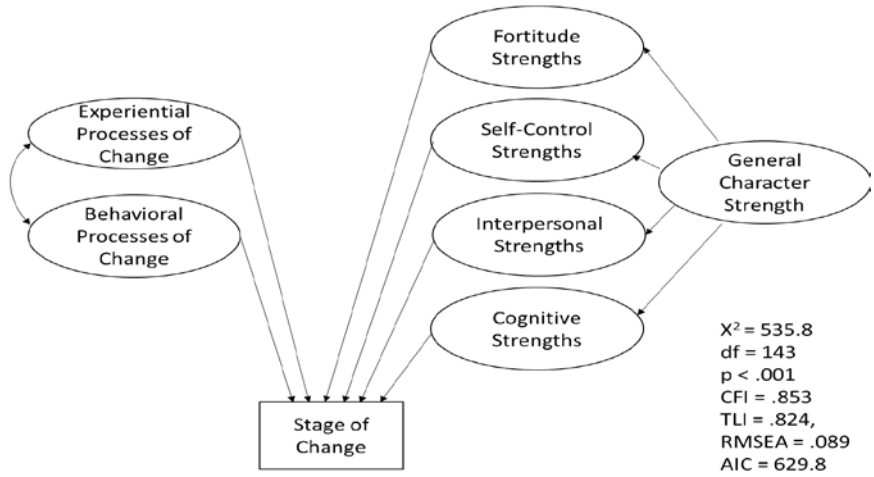
Strengths. The fourth factor focused on factors that would facilitate cognitive growth and aptitude and was labeled *Cognitive Strengths*. Communalities ranged from .37 (honesty) to .69 (zest), with a mean communality of .57 (SD = .08).

Table 1. Emergent character strengths in exercise factors from the principal components analysis

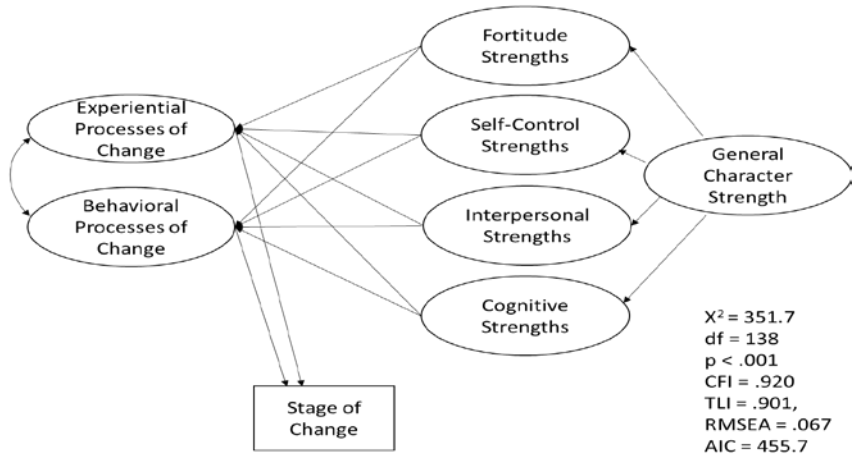
	Factor Loadings			
	1.	2.	3.	4.
1. Fortitude Strengths				
Self-regulation	**.80**	.20	.02	.04
Perseverance	**.79**	.12	.08	.14
Zest	**.76**	.03	.25	.23
Perspective	**.56**	.18	.29	.27
Appreciation of beauty	**.51**	.28	.25	.25
Hope	**.50**	**.48**	.18	.28
Bravery	**.47**	.13	.33	**.40**
Gratitude	**.44**	.38	.33	.23
2. Self-Modulation Strengths				
Modesty	.11	**.75**	-.06	.14
Prudence	.25	**.70**	.07	-.12
Forgiveness	.01	**.65**	**.46**	.04
Fairness	.05	**.60**	.38	.30
Kindness	.03	**.53**	**.53**	.32
Judgment	.28	**.50**	.12	**.47**
Honesty	.29	**.46**	.11	.26
Humor	.06	**.45**	.38	**.42**
3. Interpersonal Strengths				
Teamwork	.14	.10	**.70**	.27
Love	.18	.30	**.66**	.25
Religiousness	.26	.10	**.60**	-.33
Leadership	**.47**	-.08	**.57**	.24
Social intelligence	.27	.31	**.56**	.31
4. Cognitive Strengths				
Love of learning	.32	.22	.14	**.68**
Curiosity	.38	.18	.12	**.64**
Creativity	.22	.05	.37	**.52**

Note. Bold loadings (≥.40) indicate loadings that contributed to the interpretation of that factor.

Model 1



Model 2



Model 3

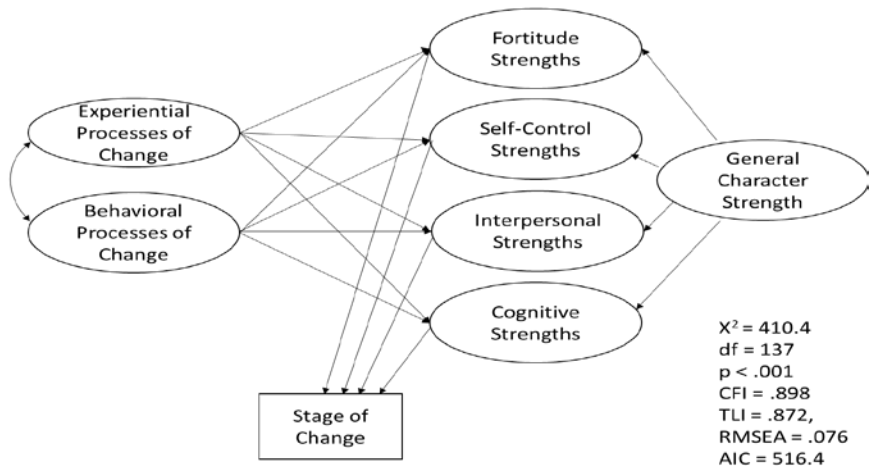


Figure 1. The three structural equation models compared for best fit

For use in the structural equation models, Hayduk and Litvay (2012) recommend using up to three best individual indicators for each latent variable to reduce model complexity and enhance model precision. As such, three individual items were selected for each of the four strengths categories that emerged in the principal components analysis. Individual items were chosen to represent each latent variable rather than creating parcels, as parceling requires items that are unidimensional for each parcel and there were a large number of cross-loading items in the factor analysis (Little, Rhemtulla, Gibson, & Schoeman, 2013). The selected items were chosen so that (1) the loading on the primary component was as large as possible, (2) the loading on the next-highest component was as small as possible and in all cases below .39, and (3) higher communalities were preferable.

Exercise stage of change. Stage of change was assessed with a measure developed from Marcus, Selby, Niaura, and Rossi (1992) and modified by Norman, Benisovich, Nigg and Rossi (1998). First, participants were provided with a detailed description of exercise as planned moderate-to-vigorous physical activity. Then, participants were asked, "do you exercise regularly according to that definition?" and responded with "Yes, I have been for *MORE than 6 months"* (maintenance), "Yes, I have been for *Less than 6 months"* (action), "No, but I intend to in the *next 30 days*" (preparation), "No, but I intend to in the *next 6 months*" (contemplation), or "No, and I do *NOT* intend to in the *next 6 months.*" (precontemplation). In the current study, 49% of participants indicated being in the maintenance stage, 20% in the action stage, 16% in the preparation stage, 12% in the contemplation stage, and 3% in the pre-contemplation stage. Consistent with past research (e.g., Marcus & Simkin, 1993; Wyse, Mercer, Ashford, Buxton, & Gleeson, 1995), membership in the precontemplation and contemplation stages were collapsed to ensure large enough group sizes for analyses.

PoC. The PoC were assessed using a 28-item measure assessing 10 behaviors to enhance exercise adherence developed by Nigg, Norman, Rossi, and Benisovich (1998). Sample items read, "I believe that regular exercise will make me a healthier, happier person." (self-reevaluation) and "I make commitments to exercise" (self-liberation). Participants used a Likert-type scale ranging from 1 (*never*) to 5 (*repeatedly*). Three PoC were randomly selected as indicators of the experiential and behavioral PoC latent variables, respectively (e.g., Little et al., 2013).

Data analyses

ANOVAs identified differences in mean scores of each strength and PoC across the stages of change. Structural equation modeling examined the possible directional relationships among groups of PoC and character strengths and exercise stage of change.

Results

Preliminary analyses–examining differences in strengths and PoC across stages

Data was examined for skewness and kurtosis, and univariate and multivariate outliers were removed. To examine whether individuals in different stages of change vary on character strengths and PoC, a series of ANOVAs were performed. A Bonferroni correction was employed to reduce the family-wise error rate ($\alpha = .05/34 = .0015$). Seven of the 10 PoC (consciousness raising, self-

reevaluation, counter conditioning, helping relationships, self-liberation, stimulus control, reinforcement management) and 13 of the 24 character strengths (self-regulation, perseverance, zest, perspective, appreciation of beauty and excellence, hope, bravery, gratitude, love, leadership, love of learning, curiosity, creativity) displayed differences between stages. In the majority of the strengths and PoC with significant differences across the exercise stages of change, scores were lower among those participants not exercising regularly and higher among those exercising regularly. Please see Table 2 for detailed comparisons.

Structural equation modeling of character strengths, PoC, and stage of change

Structural equation modeling allowed for comparison of different modeled relationships among variables. First, three models were compared to examine which directional relationship best described the links among character strengths, PoC, and stage of change. All models included the same three indicators for each latent variable. The models were Model 1 with strengths and PoC as unrelated predictors of stage, Model 2 with strengths predicting PoC and PoC predicting stage, and Model 3 with PoC predicting strengths and strengths predicting stage (see Figure 1). Model 1 with character strengths and PoC as unrelated predictors of stage of change showed only a moderate fit to the data (χ^2 = 535.8, df = 143, χ^2 /df = 3.75, $p < .001$, CFI = .853, TLI = .824, RMSEA = .089, RMSEA 90% CI = .081 to .098, AIC = 629.8). Model 3 with the PoC predicting strengths, which in turn predicted stage of change showed slightly better model fit (χ^2 = 410.4, df = 137, χ^2 /df = 3.00, $p < .001$, CFI = .898, TLI = .272, RMSEA = .076, RMSEA 90% CI = .068 to .085, AIC = 516.4). However, Model 2 with strengths predicting PoC, which in turn predicted stage of change showed the best fit to the data (χ^2 = 351.7, df = 138, χ^2 /df = 2.55, $p < .001$, CFI = .920, TLI = .901, RMSEA = .067, RMSEA 90% CI = .059 to .076, AIC = 455.7) and was selected as the final model.

Modification indices for the final Model 2 were examined to look for potential changes to the model; however, no theoretically or conceptually justified changes were suggested. General character strengths were not suggested as a direct predictor of stage of change or of the PoCs in the modification indices. Although the fit of the final model to the data was acceptable but not excellent, the final model was retained as is.

Regarding the measurement aspects of the final model, all observed indicators loaded significantly on their respective constructs ($p < .001$) and all factor loadings were acceptable and .88 or larger. All strengths loaded on the general strengths latent factor, and general strengths explained 48%, 62%, 74%, and 69% of the variance in fortitude, self-modulation, interpersonal, and cognitive strengths, respectively. In addition, the covariance between the residuals of behavioral and experiential PoC was significant (.128, SE = .022, $p < .001$).

Table 2. Means of PoC and strengths by exercise stage of change

	1-Maintenance	2- Action	3-Preparation	4-Contemplation/ Precontemplation	Overall ANOVA *p* value	Group differences
Processes of Change						
Consciousness raising	3.30	3.11	2.56	2.21	<.001	1,2>3,4
Dramatic relief	3.11	3.18	3.16	2.82	.039	
Environmental reevaluation	3.49	3.57	3.41	2.95	.003	
Self-reevaluation	4.28	4.18	4.22	3.66	<.001	1,2,3>4
Social liberation	3.52	3.44	3.52	3.49	.904	
Counter conditioning	3.42	3.02	2.36	1.98	<.001	1>2>3,4
Helping relationships	2.88	2.74	2.23	1.96	<.001	1>3,4; 2>4
Self-liberation	3.70	3.42	2.83	2.33	<.001	1,2>3>4
Stimulus control	3.31	2.78	2.27	1.86	<.001	1>2>3,4
Reinforcement management	4.04	3.94	3.62	2.99	<.001	1>3>4; 2>4
Character Strengths						
Self-regulation	5.62	5.21	4.05	3.94	<.001	1,2>3,4
Perseverance	5.82	5.29	4.60	3.76	<.001	1>3,4; 2>4
Zest	5.41	4.97	4.18	3.42	<.001	1>3,4; 2>4
Perspective	5.20	4.81	4.44	3.62	<.001	1>3,4; 2>4
Appreciation of beauty and excellence	5.50	5.09	4.55	4.20	<.001	1,2>3; 1, 2>4
Hope	5.72	5.57	5.25	4.60	<.001	1,2>4
Bravery	5.00	4.04	4.16	3.10	<.001	1>2,3>4
Gratitude	5.58	4.91	4.56	4.06	<.001	1>2, 3, 4; 2>4
Modesty	5.66	5.59	5.87	5.14	.061	
Prudence	5.37	5.13	5.16	4.86	.263	
Forgiveness	5.05	4.99	5.05	4.22	.029	
Fairness	5.31	5.21	5.33	4.86	.384	
Kindness	5.17	5.19	4.91	4.28	.005	
Judgment	5.52	5.30	5.27	4.56	.002	
Honesty	5.65	5.57	5.38	5.16	.180	
Humor	5.36	5.20	5.45	4.64	.042	
Teamwork	4.63	4.77	4.55	3.98	.159	
Love	4.75	4.64	4.38	3.66	.001	1,2>4
Religiousness	3.35	3.07	3.31	2.76	.367	
Leadership	4.40	3.79	3.58	2.68	<.001	1,2>4
Social intelligence	5.04	4.74	4.51	4.10	.005	
Love of learning	5.45	5.19	5.04	3.88	<.001	1,2,3>4
Curiosity	5.27	5.10	4.89	4.28	.001	1,2>4
Creativity	4.73	4.36	4.22	3.22	<.001	1,2,3>4

As shown in Table 3, in this final model, greater use of fortitude strengths (i.e., self-regulation, zest, perseverance) predicted greater use of the behavioral PoC (i.e., counter-conditioning, self-liberation, stimulus control). In contrast, greater use of self-modulation strengths (i.e., prudence, fairness, modesty) and interpersonal strengths (i.e., love, teamwork, social intelligence) predicted greater use of the experiential PoC (i.e., dramatic relief, self-re-evaluation, social liberation). In turn, using more behavioral PoC predicted later stage of change (i.e., towards maintenance), while using more experiential PoC predicted earlier stage of change (i.e. towards precontemplation/contemplation).

Table 3. Structural model paths from the final structural equation Model #2.

	Estimate	S.E.	*p*
General character strength -> fortitude strengths	0.93	0.09	<.001
General character strength -> self-modulation strengths	0.67	0.09	<.001
General character strength -> interpersonal strengths	1.20	0.11	<.001
General character strength -> cognitive strengths	1.05	0.09	<.001
Fortitude strengths -> experiential PoC	-0.02	0.03	0.58
Fortitude strengths -> behavioral PoC	0.30	0.05	<.001
Self-modulation strengths -> experiential PoC	0.17	0.07	0.02
Self-modulation strengths -> behavioral PoC	-0.12	0.09	0.17
Interpersonal strengths -> experiential PoC	0.10	0.04	0.03
Interpersonal strengths -> behavioral PoC	0.07	0.06	0.23
Cognitive strengths -> experiential PoC	0.00	0.05	0.94
Cognitive strengths -> behavioral PoC	0.08	0.06	0.15
Behavioral PoC -> Stage of change	-1.24	0.12	<.001
Experiential PoC -> Stage of change	0.88	0.22	<.001

Note: Stage of change coded as maintenance = 1, action = 2, preparation = 3, precontemplation/contemplation = 4.

In addition, several significant indirect effects were found; scoring higher across character strengths in general was a significant predictor of later stage of change (-.28, p = .005), more behavioral PoC (.37, p = .005), and more experiential PoC (.20, p = .003). Self-modulation strengths (.29, p = .006) and fortitude strengths (-.39, p = .01) both had significant indirect effects on stage, with greater self-modulation strengths associated with earlier stage of change and greater fortitude strengths associated with later stage of change. However, the indirect effects of cognitive strengths on stage (-.11, p = .079) and interpersonal strengths on stage (.001, p = .997) did not reach statistical significance. Overall, the model explained 44%, 29%, and 43% of the variance in behavioral PoC, cognitive PoC, and stage of change, respectively.

Discussion

Both the TTM and the character strengths approach emphasize the need to consider the individual and tailor interventions to enhance efficacy. This study examined both whether characters strengths use and PoC use varied across exercise stage of change and the most likely direction of influence

between strengths and PoC for the prediction of stage of change. In turn, these findings provide ideas for interventions that consider the most likely causal direction and mechanisms to enhance exercise.

To accomplish this goal, the relationships were analyzed in two ways: (1) using ANOVAs to examine differences in use of PoC and character strengths across the stages of change and (2) using structural equation modeling to determine which directional relationship among character strengths and PoC predicting exercise stage of change best fit the data. While measurement of character strengths is typically done across all aspects of life, the character strengths questionnaire in this study focused participants' responses on when they were preparing to or were engaging in exercise. Thus, this study enabled examination of which exercise-focused character strengths are most relevant to incorporate into exercise-focused interventions.

Structure of character strengths in exercise

Past analyses examining the factor structure of generally-worded character strengths measures has not yielded consistent findings (e.g., McGrath, 2015; Brdar & Kashdan, 2009, Peterson & Seligman, 2004; Ruch et al., 2014). The emergent factor structure of the exploratory principal components analysis of the current exercise-focused measure also yielded a different set of character strength groups. Interpersonal strengths involving knowing how to work well with others and cognitive strengths promoting new knowledge, skills, and ways of being are more closely aligned with the common groupings of strengths (e.g., Peterson & Seligman, 2004). Some strengths may be more relevant or useful for certain domains or behaviors than others, which could affect the pattern of loadings across strengths when comparing general applicability to application to a specific domain. The emergence of fortitude strengths related to longer-term perseverance and bigger-picture perspective may have occurred because these strengths are more relevant to exercise behaviors which must be consciously enacted each and every exercise session. In contrast, the self-modulation strengths that focus more on control within a specific situation may be less important for continued exercise behavior and more important for other behaviors that require less thought to enact on each occasion. Of course, in addition to differences emerging as a function of the focus on exercise, differences could also emerge from using of the short 24-item measure modified from Ruch et al. (2014) as opposed to the 120- or 240-item versions of the Values in Action Inventory (Peterson & Seligman, 2004) more typically examined in the literature. Therefore, character strengths may form different meaningful groupings with regard to exercise than in other contexts. Future research should examine the context-specific nature of patterns among character strengths.

Correlates of exercise stage of change

Past work has examined the links between use of the PoC and physical activity stage of change, and, consistent with this past work, the majority of the PoC were significantly related to exercise stage of change in the current study. As hypothesized, all of the behavioral PoC associated with exercise stage of change, and in general, showed increases from precontemplation/contemplation through to maintenance. This finding is both consistent with hypothesizing by Prochaska and DiClemente (2005) and research showing that PoC use generally increases with stage of change (e.g., Dishman

et al., 2010; Woods et al., 2002) In contrast, the experiential PoC showed a different pattern in the current study, with either no differences found across the stages of change (social liberation, dramatic relief, and environmental reevaluation) or significant differences between precontemplation/contemplation and others (self-reevaluation) or individuals who were exercising regularly versus those who were not (consciousness raising). Thus, the trends are more similar to those hypothesized by Prochaska and DiClemente (2005) in that the experiential PoC are more likely to help individuals in the earlier stages, when changing the way someone thinks about the health behavior is vital to stage progression.

Examining relationships between character strengths use and exercise stage of change was more exploratory, as previous work has not focused much on strengths as correlates of physical activity. One study by Proyer et al. (2013), utilizing a global measure of character strengths use, found correlations between the strengths of curiosity, zest, self-regulation, leadership, and hope and physical activity. Consistent with those findings, in the current study use of each of these specific strengths measured at a domain-specific level differed by stage of change, with those exercising regularly generally scoring higher than those who were not exercising regularly**.** In addition, several other strengths also varied by stage of change. With regards to the emergent factor structure in this study, all nine of the character strengths that loaded on the fortitude strengths factor differed by stage (self-regulation, perseverance, zest, perspective, appreciation of beauty, hope, leadership, bravery, and gratitude), suggesting that this set of character strengths may be especially salient for exercise behaviors. In contrast, none of the nine character strengths that loaded onto the self-modulation strengths factor differed by stage of change (modesty, prudence, forgiveness, fairness, kindness, judgment, hope, honesty, and humor). Thus, while both fortitude and self-modulation strengths both focus on control and self-regulation of responses and behavior, the set of strengths most related to success in exercise behavior is the big-picture, longer-term focus exemplified by the fortitude strengths. In-the-moment modulation of responses represented by the set of self-modulation strengths was not related to stage of change in the ANOVAs. In addition, four of the six cognitive strengths (love of learning, curiosity, creativity, and bravery but not judgment or humor) and two of the seven interpersonal strengths (love and leadership but not teamwork, religiousness, social intelligence, kindness, or forgiveness) were significantly related to exercise stage of change, suggesting that the individual strengths rather than these groups of strengths are important to consider.

As groups, both behavioral PoC and fortitude strengths showed the most consistent, positive relationships with exercise stage of change progression. However, examining ANOVAs cannot help us understand the most likely possible causal direction among these variables. The following section describes findings that can begin to examine the possible causal direction. However, future research is still needed to experimentally or longitudinally examine whether use of behavioral PoC and fortitude strengths promotes movement to a later exercise stage of change, or if movement to a later exercise stage of change promotes use of these different strategies.

Potential order of the relationships between strengths and PoC

In order to examine the possible directional relationships between PoC and character strengths as

predictors of exercise stage of change, a series of structural equation models were examined. Both models with PoC and character strengths related showed better fit than a model in which PoC and character strengths were independent predictors of exercise stage of change. However, the best-fitting model was the one in which character strengths predicted PoC use, which in turn predicted exercise stage of change. Encouraging individuals to build up and use specific strengths may make follow-through of specific PoC and more exercise more likely.

Closer examination of the details of the best-fitting model showed that greater use of fortitude strengths (i.e., self-regulation, zest, perseverance) predicted greater use of the behavioral PoC (i.e., counter-conditioning, self-liberation, stimulus control) which in turn predicted later stage of change. Also, greater use of self-modulation strengths (i.e., prudence, fairness, modesty) predicted greater use of the experiential PoC (i.e., dramatic relief, self-reevaluation, social liberation), which in turn predicted earlier exercise stage of change. Thus, different PoC are used by individuals in earlier stages of change than those in later stages of change, with the experiential PoC used more by people in the earlier stages of change as hypothesized by the TTM (but not always shown across studies). Greater use of the character strengths that focus on moderating behavior in the moment or focus on interpersonal relationships predicted greater use of the experiential PoC; while encouraging these behaviors may be more effective for individuals in the earlier stages of change, they do not seem to be as effective for individuals in later stages of change. Thus, certain strengths – mainly the fortitude strengths – may help all participants to be more active and should be emphasized in intervention programs. While in general having strength across character strengths is related to more exercise behavior, all strengths may not be equally effective in boosting exercise behaviors.

Study Limitations and Future Research

While this study was the first of its kind to alter a character strengths measure to be focused specifically on exercise behaviors, the measure used a single item to assess each strength. Also, the data was cross-sectional and correlational in nature, precluding any true causal conclusions. The population who answered the posted study description were more active than the general population. Also, the fit of the final structural equation model in the current study was acceptable, but not very strong. This may in part be due to the non-linear, real life nature of stage progression. Future research could examine non-linear trends in use of strengths and PoC across the stages of change.

Future research could examine more specifically whether character strengths use varies across domains or behaviors. Additional work to validate the brief 24-item measure of character strengths including whether the emergent factor structure is consistent over time would also be helpful. In addition, more information about the possible mechanisms behind why character strengths enhance specific behaviors would be ideal. Perhaps using strengths enhances outcomes through such mechanisms as greater expectancies for success and task value as Eccles' (e.g., 1983) expectancy value model might suggest, or through greater psychological need satisfaction and intrinsic motivation as Deci and Ryan's (e.g., 2000) self-determination theory may suggest. With regards to promoting exercise, what is it about the fortitude strengths that promotes more exercise behaviors? Clearly, understanding more about the mechanisms and influence of specific contexts will be aspects of future investigations.

The results of this study suggest that building up fortitude strengths should promote use of the behavioral PoC and enhance the likelihood of exercise behavior change. As such, perhaps an intervention program should focus on building character strengths that help people see the bigger picture, increase their gratitude, and prepare to put energy and effort into making long-term changes – and to see these strengths as traits that persist over time.

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Appendix A

Exercise-Specific Version of the Character Strengths Measure

The following 24 statements reflect characteristics that many people would find desirable, but we want you to answer only in terms of whether the statement describes what you are like. **As you answer these questions, please focus on how you think and act while exercising. This can include any time you are planning or preparing to be physically active as well as how you think and act during physical activity sessions.** Please be honest and accurate! Please do not describe yourself as someone you aspire to be but as you actually are with regards to exercise.

Please use the following rating scheme: 1 = *very much unlike me regarding exercise*, 2 = *rather unlike me regarding exercise*, 3 = *somewhat unlike me regarding exercise*, 4 = *neither nor*, 5 = somewhat *like me regarding exercise*, 6 = *rather like me regarding exercise*, and 7 = *very much like me regarding exercise.*

Creativity (originality, ingenuity): Creative people have a highly developed thinking about novel and productive ways to solve problems and often have creative and original ideas. They do not content themselves with conventional solutions if there are better solutions for exercising.
Curiosity (interest, novelty-seeking, openness to experience): Curious people take an interest in all ongoing experience in daily life for its own sake and they are very interested in and fascinated by various topics and subjects. They like to explore and discover the world, they are seldom bored, and it's easy for them to keep themselves busy while exercising.
Judgment & Open-Mindedness (critical thinking): People with a highly developed judgment think things through, like to question thoughts and beliefs, and examine them from all sides. They do not jump to conclusions and build on facts while making decisions. They are able to change their mind in light of evidence regarding exercise.
Love of Learning: Curious people and those who are willing to learn like to master new skills, topics, and bodies of knowledge and are excited about learning. They add new skills and abilities or expand existing knowledge about exercising.
Perspective (wisdom): People with this strength are considered to be wise and are asked for advice by others. They see the big picture and have a mature view on life regarding exercise.
Bravery (valor): Brave and courageous people do not shrink from threat, challenge, difficulty or pain. They speak up for their opinions and convictions even if there is opposition while exercising.
Perseverance (persistence, industriousness): Persistent and industrious people finish what they start, even in spite of obstacles. They do not allow themselves to be distracted by inner or outer factors and take pleasure in completing exercise tasks.
Honesty (authenticity, integrity): Honest people speak the truth, present themselves in a genuine way, and act in a sincere way about exercise.

Zest (vitality, enthusiasm, vigor, energy): Zestful people pursue their goals with a lot of energy and enthusiasm. They do not do things halfway or halfheartedly, they love what they do, and they look forward to every new day. They see exercise as an adventure.

Capacity to Love and Be Loved: People with a highly developed capacity to love and secure attachment to others value close relationships, in particular those in which sharing and caring are reciprocated regarding exercise.

Kindness (generosity, nurturance, care, compassion, altruistic love, niceness): Kind and generous people like doing favors and good deeds for others. They appreciate being generous and nice to others in exercise settings.

Social Intelligence (emotional intelligence, personal intelligence): Socially competent people are aware of the motives and feelings of other people as well as themselves, and they know what to do to fit into different social situations regarding exercise.

Teamwork (citizenship, social responsibility, loyalty): People with highly developed teamwork skills work well as a member of a group or team. They are loyal to the group and consider being a team member as a central factor when exercising.

Fairness: Treating all people the same according to notions of fairness and justice is a central principle of fair people. They do not let personal feelings bias decisions about others, and they give everyone a fair chance regarding exercise.

Leadership: People with highly developed leadership encourage a group (of which one is a member) to get things done, while at the same time they maintain good relations within the group and treat everyone equally. They are able to organize group activities and see that they happen in exercise.

Forgiveness & Mercy: People with this strength have an easier time forgiving those who have done wrong. They give people a second chance. Being merciful and not being vengeful is their principle in exercise settings.

Modesty & Humility: Modest people do not seek the spotlight and do not regard themselves as more special than they are. They let their accomplishments speak for themselves. Others would describe them as modest and humble during exercise.

Prudence: Prudent people think carefully about the consequences of their choices before acting. They do not say or do things that might later be regretted during exercise.

Self-Regulation (self-control): People with a highly developed self-regulation are able to regulate what they feel and do. They are very disciplined regarding exercise.

Appreciation of Beauty and Excellence (awe, wonder, elevation): People with this strength notice and appreciate things. They are highly interested in beauty, excellence, and/or skilled performance regarding physical activity.

Gratitude: Grateful people are aware of and thankful for the good things that happen to them. Others describe them as being grateful, because they always take time to express thanks regarding exercise.

Hope (optimism, future-mindedness, future orientation): Optimistic people expect the best in the future; they believe that a good future is something that can be brought about. They hope for the best and work to achieve their goals regarding exercise.

Humor (playfulness): People with this strength like to laugh, tease, and bring smiles to other people. They try to see the light side in various exercise situations.

Religiousness & Spirituality (faith, purpose): Religious or spiritual people have coherent beliefs about the higher purpose and meaning of the universe. Their religious beliefs about the meaning of life shape their conduct and provide comfort and strength regarding exercise.