April 2018

# Examining the Health Action Process Approach for Predicting Physical Activity Behavior in Adults with Back Pain

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## Recommended Citation

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## Abstract

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## Keywords

Back pain, health action process approach, physical activity, behavior

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**Abstract**

This study investigated the appropriateness of the Health Action Process Approach (HAPA) as it relates to physical activity (PA) behavior in the back pain population. The motivational and volitional constructs of the HAPA, PA, and back pain-related disability variables were assessed in a sample of 350 men and women with back pain. HAPA model fit was satisfactory accounting for 21% of the variance in PA intentions and 28% of PA behavior. All motivational phase constructs relate to PA intention. Action/coping planning and recovery self-efficacy do not relate to PA behavior. PA intentions are the strongest predictor of PA behavior. An expanded model, including disability-specific variables, satisfactorily fit the data, accounting for 32% of PA intentions and 29% of PA participation. These data partially support assumptions of the HAPA for the back pain population. For the back pain population, interventions designed to affect PA behavior must account for disability-specific variables.

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Back pain (BP) is one of the most debilitating musculoskeletal conditions in the United States, affecting approximately 4 out of 5 people at some point throughout their lifespan (Freburger et al., 2009). The disability associated with BP represents a significant burden on our economy, with financial consequences totaling nearly $100 billion in lost productivity and direct health care costs (American College of Physicians, ACOP, 2012). Further, high levels of disability experienced by people with BP often leads to an increasingly sedentary lifestyle which can exacerbate this health care burden by increasing the risk of developing comorbidities in this population (Warburton et al., 2006). This downward health spiral often leads to poor overall well-being and quality of life for people with BP (Montazeri & Mousavi, 2010).

One cost-effective method of improving overall well-being and quality of life is participation in regular physical activity (PA) (Chou, Hwang, & Wu, 2012). Further, regular PA participation is a preventative intervention to combat many of the chronic disease comorbidities associated with sedentary behavior (Haskell et al., 2007). PA participation has additional benefits for those suffering from BP including both speeding the recovery from and preventing recurrence of acute debilitating episodes (Bohman, Alfredsson, Hallqvist, Vingård, & Skillgate, 2013; Macedo, Bostic, & Maher, 2013). Despite these positive benefits, people with BP participate in significantly less PA than their healthy counterparts (Lin et al., 2011).

While encouraging those with BP to participate in regular PA would no doubt benefit this population and potentially reduce this health care burden, convincing people to adopt healthy lifestyle habits is often a challenging task. Eliciting a health behavior change in any individual is a complex, dynamic process, and perhaps even more so for people experiencing disability.

Health behavior change models, such as the Health Belief Model (Rosenstock, 1974), are often used as frameworks for interventions designed to increase a person's intention to adopt a desired health behavior. However, recent evidence suggests that merely increasing a person's intention to adopt a health behavior, by itself, is insufficient in eliciting the desired behavior change (i.e., the so-called "intention-behavior" gap) (Sutton, 2008).
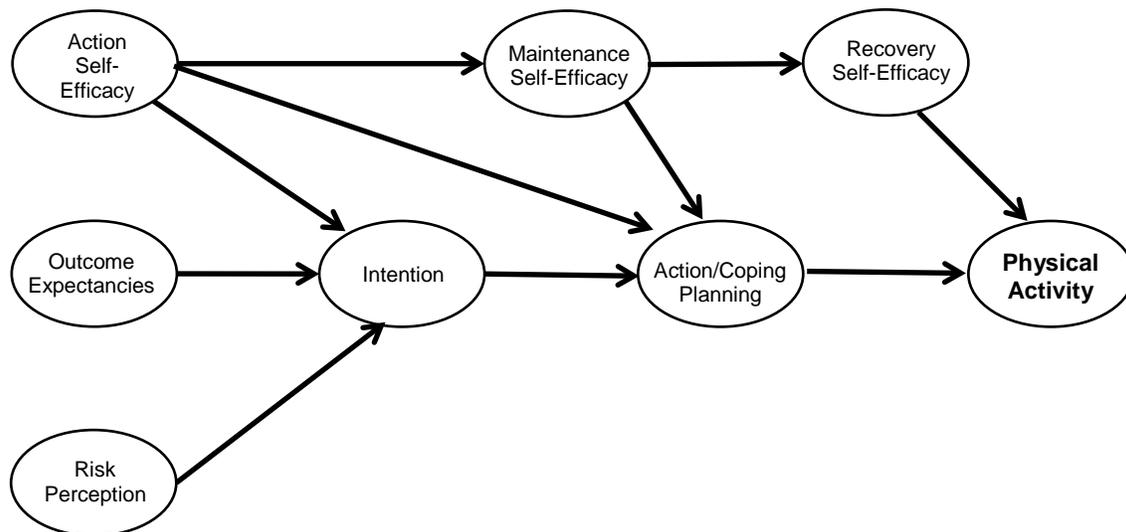


*Figure 1*. The Health Action Process Approach and its hypothesized paths

Accounting for this "intention-behavior" gap, the Health Action Process Approach (HAPA; Schwarzer, 2001, Figure 1) shows promise in better predicting PA behavior compared to traditional models (Sniehotta, Scholz, & Schwarzer, 2005a). Making a distinction between the pre-intentional motivational processes and the post-intentional volitional processes, the HAPA allows for both the prediction of cognitive and behavioral outcomes, and the development of tailored behavior change interventions (Schwarzer, 2008). A central tenant of the HAPA that distinguishes it from other health behavior change models is its assumption that planning processes mediate the intention-behavior relationship (Sniehotta, Scholz, & Schwarzer, R, 2005).

Even though the HAPA and its assumptions have proven useful in healthy populations for increasing PA participation, it lacks comprehensive investigation in disabled populations. To date, the HAPA has been tested for people with multiple sclerosis (Chiu, Lynch, Chan, & Berven, 2011), type-2 diabetes (Lippke & Plotnikoff, 2014), and obesity (Parschau et al., 2014), as well as for people in cardiac rehabilitation (Luszczynska & Sutton, 2006), often accounting for less of the variation in PA participation compared to healthy populations. One potential reason for the ineffectiveness of the HAPA in these populations is, as health care professionals now understand, that disability extends beyond the physical domain, including both psychological and contextual factors (Wade & Halligan, 2017). With respect to adopting healthy lifestyle habits, it is possible that behavior change interventions geared toward people currently experiencing disability will need to account for these factors in order to be successful. However,

few studies have looked to integrate physical and contextual factors into traditional health behavior change models.

      With this in mind, the present study looks to test, through both confirmatory and exploratory analysis, the ability of the HAPA to predict PA behavior in people with BP. Confirmatory analyses will include evaluation of the HAPA and its constructs and relationships related to predicting PA behavior. In addition to confirming the efficacy of the HAPA in this population, exploratory analyses will include the addition of constructs specific to barriers to PA participation for individuals with disability. Specifically, environmental and personal barriers to PA participation, social support, and disability severity will be included into this exploratory model. Our initial hypothesis is that the HAPA, and its assumptions, will hold true for PA behavior of individuals with BP. Additionally, we expect that including disability-specific variables affecting PA participation into the HAPA will improve the model's ability to predict this health behavior.

## Methods

### Procedures

Via the use of an online survey created within the Qualtrics<sup>TM</sup> system, 454 adults with BP were recruited over a one-month time period. Potential participants were recruited using email solicitation to university and local communities and respondents were encouraged to forward the survey along to anyone else who might be eligible. Inclusion criteria for study participation were: 1) English-speaking, 2) ages 18-64, and 3) self-reporting with BP. Exclusion criteria were: 1) being under litigation of any kind (e.g., workmen's compensation), 2) inability to give independent consent, 3) use of assistive devices for ambulation, or 4) the presence of severe neuromuscular conditions (e.g., stroke, Parkinson's disease, etc.) that would affect the ability to participate in PA. A university Institutional Review Board approved study procedures and participants provided their written consent prior to answering survey questions.

### Measures

      The survey instrument assessed participant demographics (e.g., age, gender, education, etc.), along with BP-specific information (e.g., pain location and cause). To assess original model variables (i.e., outcome expectancies, risk perceptions, behavior intention, action/coping planning, task, maintenance, and recovery self-efficacy) during confirmatory analysis, items from previous investigations into the HAPA for predicting PA were used (Luszcynska & Sutton, 2006; Renner & Schwarzer, 2005; Sniehotta et al., 2005). In the present sample internal consistency estimates for these scales ranged from moderate to excellent (Cronbach's $\alpha = 0.79$-$0.95$). Self-reported PA participation was measured using the International Physical Activity Questionnaire Short-Form (IPAQ; Booth, 2000). This instrument asked participants to indicate how many days per week and how many hours and minutes they participated in vigorous, moderate, and light PA. Both the test-retest reliability ($r = 0.84$) and validity ($r = 0.57$) of this instrument compared to objective PA monitors is estimated (Craig et al., 2003).

      Exploratory analysis of the HAPA in the present study includes constructs relevant to specific physical limitations associated with BP and contextual factors that may limit PA participation. To measure BP-specific physical limitations, the Oswestry Low Back Pain Disability Questionnaire (OWS) was used (Fairbank & Pynsent, 1980). This instrument consists of 10 items, each consisting of a maximum score of 5. Scores range from 0-50 and are then

converted into a percentage with higher percentage scores being associated with greater disability. Test-retest reliability ($r = 0.91$) and internal consistency (Cronbach's α = 0.71-0.87) of this the instrument are considered moderate to strong. Personal and environmental barriers to PA were measured with separate scales used in a previous investigation in individuals with various chronic health conditions (Becker, Stuifberen, & Sands, 1991). In the present sample, internal consistency for these scales was moderate to strong (Cronbach's α = 0.69-0.82). Social support was measured using the Social Provisions Scale (SPS; Cutrona & Russel, 1987). The SPS has been used in participants with chronic health conditions prior to the present investigation demonstrating good reliability and internal consistency. However, in the present sample, the internal consistency of this scale was determined to be relatively weak (Cronbach's α = 0.36). The SPS was still included within the exploratory model due to the potential large impact of social support on PA habits for those with chronic health conditions."

**Data Analysis**

Prior to statistical analysis all data were screened for normality with all but one variable, PA behavior, being normally distributed. Therefore, PA behavior was log transformed in order to create a normally distributed outcome variable for further analysis. Structural path analysis modeling was used to test the hypothesized models with observed variables. The path analysis models include 8 and 12 latent variables, respectively (risk perception, outcome expectancies, action self-efficacy, PA behavioral intentions, action/coping planning, maintenance self-efficacy, recovery self-efficacy, and PA behavior for the confirmatory analysis of the HAPA). We added disability severity, personal and environmental barriers, and social support for the exploratory analysis of the HAPA. The inter-correlation coefficients, means, and standard deviations of all constructs are displayed in Table 1. Full information maximum likelihood estimation provided all model parameter estimates and multiple goodness-of fit indices were used to evaluate model fit. The root mean square error of approximation (RMSEA), with values lower than 0.08 indicating adequate fit, and the comparative fit index (CFI), goodness of fit index (GFI), and normed-fit index (NFI), with values greater than 0.90 indicating good fit were the primary indices to determine model appropriateness (Kline, 2011). If original models did not fit these data, respecification of paths was performed until a significant model was produced. All model estimations were conducted using the T-Calis procedure in Statistical Analysis Software (SAS Version 9.2; Cary, NC, USA).

<div align="center">

**Results**

</div>

**Participants**

After excluding 17 participants who did not meet inclusion criteria and 87 who had more than 10% missing values, the final study sample consisted of 350 participants comprised of 74.2% women and 25.7% men. Participants were 37.4±12.0 years of age and had a mean BMI of 29.4±8.2 kg/m$^2$. Over half (57.5%) of the participants were married, while 30.6% were single, 10.6% divorced, and 1.1% widowed. College graduates comprised 44.2% of the sample, whereas 33.9% attended graduate school, 13.5% had graduated high school, and 8.3% received technical education. Fully 83% of participants were employed full-time, leaving only 10.0% of participants employed part-time and 2.8% unemployed.

The most frequent location of pain symptoms was in the low back (90.5%) with most common causes of those symptoms being either an unknown etiology (48.2%) or trauma (30.7%). Over half of participants reported experiencing more than 11 back pain episodes (51.7%) and the use of pain medication (68.2%) for management of these symptoms was very common. Roughly two-thirds (66.5%) of participants sought treatment from health professionals with conservative care (i.e., physical therapy or chiropractic practices). However, some participants reported receiving more invasive care including steroidal injections (18.1%) or surgery (4.5%).

Table 1

*Means, Standard Deviations, and Correlations of Model Variables*

|  | M (SD) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Physical Activity (Log) | 5.96 (3.03) | - | | | | | | | | | | | |
| 2. Intention | 14.50 (4.62) | .52 | - | | | | | | | | | | |
| 3. Risk Perception | 15.54 (7.06) | -.20 | -.21 | - | | | | | | | | | |
| 4. Outcome Expectancies | 37.23 (5.33) | .12 | .35 | -.09 | - | | | | | | | | |
| 5. Action Self-Efficacy | 5.33 (1.60) | .23 | .29 | -.07 | .15 | - | | | | | | | |
| 6. Recovery Self-Efficacy | 8.52 (2.37) | .28 | .36 | -.16 | .24 | .24 | - | | | | | | |
| 7. Maintenance Self-Efficacy | 9.97 (2.91) | .23 | .25 | -.03 | .12 | .26 | .48 | - | | | | | |
| 8. Action/Coping Planning | 22.21 (8.23) | .23 | .68 | -.23 | .36 | .35 | .45 | .30 | - | | | | |
| 9. Personal Barriers | 19.52 (5.61) | -.36 | -.41 | .21 | -.24 | -.17 | -.25 | -.09 | -.42 | - | | | |
| 10. Environmental Barriers | 8.61 (2.48) | -.21 | -.24 | .12 | -.19 | -.09 | -.15 | -.03 | -.33 | .62 | - | | |
| 11. Disability Severity | 17.19 (12.02) | -.29 | -.35 | .06 | -.26 | -.08 | -.11 | -.15 | -.33 | .39 | .23 | - | |
| 12. Social Support | 76.9 (11.0) | .13 | .19 | -.06 | .24 | .14 | .16 | .12 | .21 | -.39 | -.28 | -.23 | - |

*Note*. [a]All scores are related to individual scales, [b]All correlations significant at $p < 0.05$ ($N = 350$)

## Confirmatory Analysis

The first path analysis model tested revealed a significant chi-square yet poor fit indices [$\chi^2$ ($df$=14) = 154.74, $p < .001$; GFI = .90; CFI = .78; NFI = .77; and RMSEA = .16], indicating a less than adequate fit of the model to these data. Using empirical guidance from the statistical output (i.e., the rank order raw residuals), several new paths were identified and included into the path model analyses. New direct paths included in the respecified model are as follows: PA intention and action self-efficacy to recovery self-efficacy; action self-efficacy and recovery self-efficacy to action/coping planning; PA intention and maintenance self-efficacy to PA behavior; and the addition of the endogenous variable maintenance self-efficacy with direct paths from action self-efficacy, recovery self-efficacy, PA intention, and action/coping planning.

Following this respecification, the tested model revealed a significant chi-square and adequate fit indices [$\chi^2$ ($df$=10) = 32.86, $p = .0003$; GFI = .97; CFI = .96; NFI = .95; and RMSEA = .08], indicating an acceptable fit of the model to the data. Table 2 shows the squared multiple correlation coefficients ($R^2$) for all endogenous variables within the respecified model. In this respecified model, variables predicting PA intention account for 21% of the variance; variables predicting action/coping planning account for 53% of the variance; variables predicting

maintenance self-efficacy account for 26% of the variance; variables predicting recovery self-efficacy account for 15% of the variance; and variables predicting PA behavior account for 28% of the variance. Figure 2 shows a schematic depiction of the significant paths with standardized coefficients within the respecified model.
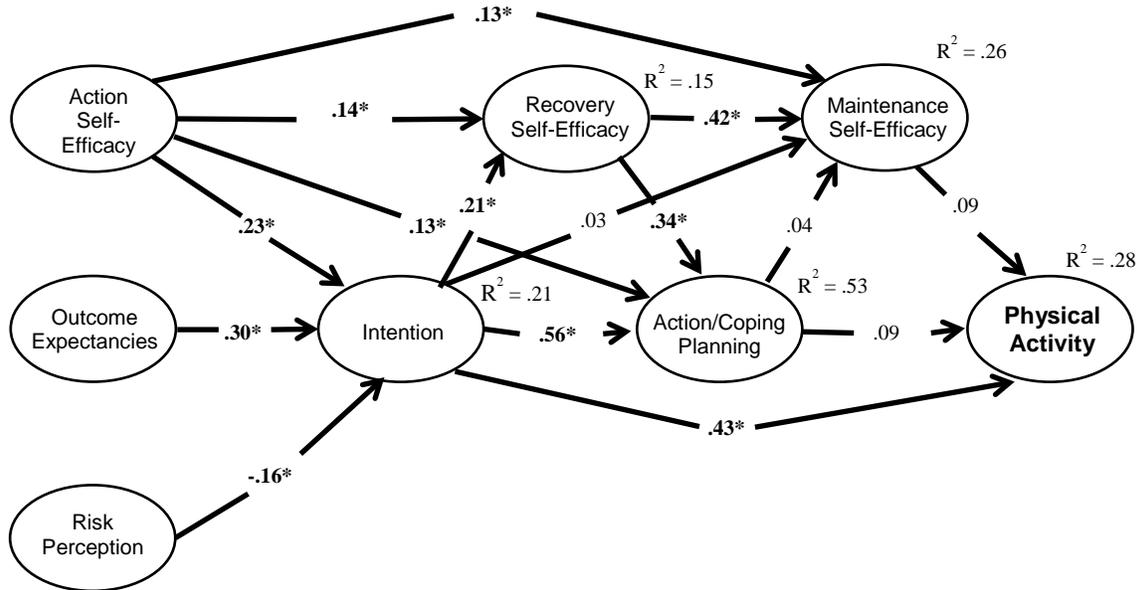


*Figure 2*. The respecified Health Action Process Approach with social-cognitive determinants of physical activity in individuals with back pain. *Boldfaced coefficients are statistically significant at least at the p = .05 level.

**Exploratory Analysis**

The new disability-specific constructs of the exploratory model were added with the following direct paths: disability severity, personal barriers, and social support to PA intention; environmental barriers to action/coping planning; and disability severity and social support to PA behavior. The model tested revealed a significant chi-square and adequate fit indices [$\chi2$ (*df*=24) = 57.50, *p* < .0001; GFI = .97; CFI = .96; NFI = .94; and RMSEA = .06], indicating an adequate fit of the model to the data. Table 2 shows the squared multiple correlation coefficients ($R^2$) for all endogenous variables within the respecified model. Figure 3 shows a schematic depiction of the significant paths with standardized coefficients for the disability-specific constructs within the exploratory model.

**Changes in model assumptions.** The addition of disability-specific constructs resulted in changes to the path coefficients of the exploratory model with respect to both PA intentions and behavior. The magnitude of the direct effects of action self-efficacy ($\beta$ = 0.23 to 0.20), outcome expectancies ($\beta$ = 0.30 to 0.21), and risk perception ($\beta$ = -0.16 to -0.11) on PA intention are reduced. Further, the effects of both action/coping planning ($\beta$ = 0.09 to 0.07) and maintenance self-efficacy ($\beta$ = 0.09 to 0.08) on physical activity behavior are reduced as well. Additionally,

the magnitude of the direct effects of PA intentions on recovery self-efficacy are strengthened (β = 0.21 to 0.32), while its effects on action/coping planning are reduced (β = 0.56 to 0.53).

Table 2

*Squared Multiple Correlations for Variables in the Respecified HAPA Models*

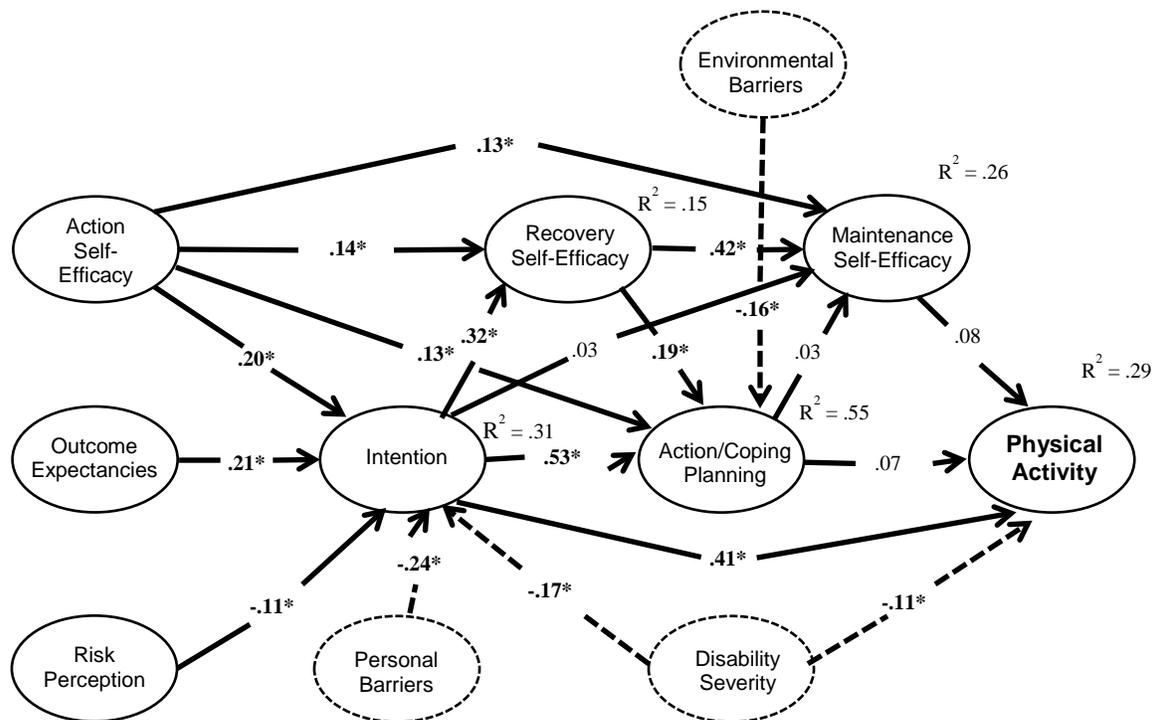| Model Variable | Confirmatory Model | Exploratory Model |
|---|---|---|
| PA Intention | .21 | .32 |
| Action/Coping Planning | .53 | .55 |
| Maintenance Self-Efficacy | .26 | .26 |
| Recovery Self-Efficacy | .15 | .15 |
| PA Behavior | .28 | .29 |

*Note*. (*N*=350)



*Figure 3.* The respecified Health Action Process Approach with social-cognitive determinants of physical activity in individuals with back pain. Added constructs represented by dashed lines. *Boldfaced coefficients are statistically significant at least at the p = .05 level.

**Discussion**

The results of the present study support the HAPA assumptions regarding the relationships between the constructs of the motivational phase. Action self-efficacy, outcome expectancies, and risk perceptions all have direct effects on PA intentions for this sample from the BP population, which supports findings from other clinical populations (Chiu et al., 2011; Lippke & Plotnikoff, 2014; Luszczynska & Sutton, 2006; Parschau et al., 2014). Interestingly, while the present data show a direct relationship between risk perceptions and PA intentions, most previous investigations in clinical populations fail to support this finding (Chiu et al., 2011; Lippke & Plotnikoff, 2014; Parschau et al., 2014). Further, a study in the orthopedic rehabilitation population, which presumably would include BP patient, shows risk perceptions and outcome expectancies have no direct effect on PA intensions (Schwarzer, 2008). These data show individuals with BP conform to the motivational assumptions of the HAPA, which contrasts with previous investigations in other clinical populations.

While these findings support the motivational assumptions of the HAPA, they fail to provide support for the assumptions of the volitional phase. While these data show that PA intentions directly affect action/coping planning just as previous studies report (Chiu et al., 2011; Lippke & Plotnikoff, 2014; Luszczynska & Sutton, 2006; Parschau et al., 2014; Schwarzer, 2008), they do not show that action/coping planning mediates the relationship between PA intentions and PA behavior. These findings are not novel, as a study investigating the HAPA in an obese population had similar results (Parschau et al., 2014). Additionally, another HAPA assumption is that recovery self-efficacy directly effects PA behavior. Even though previous work in clinical populations verifies this assumption (Chiu et al., 2011; Lippke & Plotnikoff, 2014; Luszczynska & Sutton, 2006; Parschau et al., 2014; Schwarzer, 2008), the present data do not support this assumption. One possible explanation is that these data indicate making a differentiation between different types of self-efficacy (i.e., action self-efficacy versus recovery self-efficacy) may not be necessary for this population. For example, because these data show direct effects reciprocating from all modes of self-efficacy found in the HAPA model, these constructs could represent one underlying construct of overall self-efficacy that affects PA behavior (Bandura, 2004). Further, the current findings challenge the contention that action/coping planning mediates the intention to behavior relationship. These data show a direct effect of PA intentions on PA behavior. In fact, PA intentions are a stronger predictor of PA behavior than action/coping planning in these data. However, despite these shortcomings, the overall predictive capability (i.e., $R^2 = 0.28$) of the HAPA in people with BP remains comparable to findings from other clinical populations ($R^2 = 0.07 - 0.38$; Chiu et al., 2011; Lippke & Plotnikoff, 2014; Luszczynska & Sutton, 2006; Parschau et al., 2014). Combining confirmation of motivational assumptions and limitations in the volitional phase of the HAPA observed in the present data, the authors contend that the factors affecting PA behavior in the BP population may more closely align with those of prior health behavior change models (i.e., Social Cognitive Theory; Bandura, 2004).

Along with looking to confirm original HAPA assumptions, the present study also aimed to explore relationships of disability-related factors (e.g., disability severity), which might have an effect on PA behavior in the BP population. To date, only two studies of the HAPA have investigated the effects of such constructs on predicting PA behavior in clinical populations (Chiu et al., 2011; Parschau et al., 2014). While these investigations explored the constructs of

disease severity, personal and environmental barriers to PA, and social support, neither study examined these constructs together in the same population.

Chiu et al. (2011) included both disease severity and perceived barriers (i.e., combined personal and environmental barriers to PA) when testing the HAPA in patients with multiple sclerosis. While the present study includes these same constructs, it also makes the distinction between personal and environmental barriers to PA, as we hypothesized these constructs would have separate effects within the model. In the multiple sclerosis population, disease severity correlated with outcome expectancies and action self-efficacy and directly affected individuals' perceived barriers, while perceived barriers to PA directly affected both PA intentions and recovery self-efficacy (Chiu et al., 2011). In the present sample, disease severity directly affects both PA intentions and PA behavior. Further, through making the distinguishing between the two, we show personal barriers directly affect PA intentions while environmental barriers directly affect action/coping planning. These results are logical as personal barriers center on individual motivation (i.e., individuals' attitudes and beliefs toward PA) while environmental barriers relate to the tenants of action/coping planning (i.e., the how, when, and where of PA behavior). In the obese population, social support has direct effects on both PA intention and PA behavior, making it vital to those individuals (Parschau et al., 2014). In contrast, our data indicate social support has no direct effects on any construct within the HAPA. It is possible that the obese population is more dependent on social support due to the negative body image often associated with obesity (Friedman, Reichmann, Costanzo, & Musante, 2002). In the present sample, the average BMI for participants falls into the "overweight" category, potentially leading to these participants not having developed negative attitudes toward their body image in their current state (American College of Sports Medicine, ACSM, 2013). Overall, the addition of disability-specific constructs has only trivial effects on the predictive capability of the HAPA in this population. However, given the important direct effects of these constructs (i.e., disability severity on both PA intention and behavior; environmental barriers on action/coping planning) we suggest that any HAPA-based interventions to increase PA behavior in the BP population must consider them during intervention development.

The present study is not without its limitations. One such limitation is that the existence of other models fitting the present data may exist. However, the structural model paths tested in the present study examines the assumptions of the HAPA and satisfactorily fits the data. Another limitation is, due to the use of survey methods, a possible sampling bias could exist as it limits inclusion to only those participants with access to a working computer and current email address. Further, the sample distribution skews toward female participants, which could make the model described not valid for the male population. Despite these limitations and given the results of the present study (i.e., only partial support of the HAPA), future research needs to replicate the present study with a larger, more balanced sample to either support these findings or corroborate the original HAPA assumptions. Further, future studies should develop alternative models that include both social-cognitions (i.e., risk perceptions, perceived benefits, etc.) and disability-specific constructs for predicting PA behavior in the BP population; as described in a recent investigation (Quinn et al., 2012).

## Implications for Health Behavior Research

This is the first study to test HAPA assumptions and explore the addition of disability-related constructs in the BP population. The results of the present study only provide support for the motivational assumptions of the HAPA. In fact, the direct effect of PA intentions on PA

behavior suggests that a core premise of the HAPA (i.e., that action/coping planning mediates the intention to behavior relationship) may not hold true for this clinical population. Despite this, the inclusion of disability-related constructs (e.g., environmental barriers) may be vitally important to the success of health promotion interventions for increasing PA behavior for people with BP. Another model or adaptation of this model, perhaps based on the SCT of another similarly focused health behavior change model that integrates disability-specific constructs needs to be explored.

## Acknowledgements

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