Predicting Weekly Exercise Volume from Arthritis Flares and Self-Regulatory Efficacy to Overcome Flare Barriers

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Abstract

Adults with arthritis struggle to adhere to moderate-vigorous exercise, which is an effective disease self-management strategy. The understanding of theory-based psychosocial factors related to exercise is needed. According to self-efficacy theory, self-regulatory efficacy to overcome challenging barriers may be one such factor. Adults often report that arthritis flares, which involve increases in typical arthritis symptoms (e.g., pain, fatigue), pose a challenge to exercise. However, no research has examined associations between arthritis flares, self-regulatory efficacy to overcome flare barriers, and exercise. The purpose of the study was to examine whether arthritis flares and self-regulatory efficacy to overcome flare barriers predicted weekly moderate-vigorous exercise volume. Ninety adults (M_{age} = 49.36 ± 16.38 years) with self-reported medically diagnosed arthritis responded to an online survey assessing arthritis flares, self-regulatory efficacy, prior moderate-vigorous exercise, and demographics. A hierarchical multiple regression analysis to predict exercise volume from arthritis flares (step 1) and self-regulatory efficacy to overcome flare barriers (step 2) was significant (R^2 adjusted = .14, p < .001). Self-regulatory efficacy was the sole significant predictor in the full model (R^2 change = .11, standardized β = .35, p < .001). These findings are the first to illustrate that individuals' confidence to overcome flare barriers, and not merely the experience of a flare, predict exercise. These findings are important because efficacy beliefs can be changed via theory-based interventions. If future research supports a causal relationship between self-regulatory efficacy to overcome flare barriers and exercise, then an intervention can be designed and tested for improvements in efficacy and, in turn, exercise.

Keywords: self-regulatory efficacy, barriers, arthritis, flare, exercise

Arthritis is a common, chronic disease, characterized by gradual or sudden development of pain or stiffness in and/or around at least one joint (Public Health Agency of Canada [PHAC], 2010). The disease impacts nearly 16% of Canadians aged 15+ years, with as many as 20% expected to be diagnosed by 2031 (PHAC, 2010). Examples of negative health-related consequences include daily activity limitations, increased life stress, decreased abilities for self-

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care, depression, and lower health-related quality of life (PHAC, 2010).

Arthritis self-management is important since there is no known cure for the disease (Bandura, 2005; PHAC, 2010). Exercise participation is a recommended evidence-based self-management strategy (PHAC, 2010). Recommendations are for adults with arthritis, aged 18+ years, to engage in 150+ minutes of moderate-vigorous exercise each week (Centers for Disease Control and Prevention [CDC], 2010; PHAC, 2010). However, 60% of adults with arthritis do not engage in regular exercise (PHAC, 2010). There is a need to identify theory-based factors that may be associated with exercise, so that effective interventions can be designed to target such factors and help individuals better self-manage their arthritis (Alliance for the Canadian Arthritis Program, 2006; Baranowski, Anderson, & Carmack, 1998). According to self-efficacy theory, efficacy to self-regulate may be one such factor (Bandura, 1997, 2004).

Self-regulation and Efficacy

Self-regulation involves efforts that individuals exert over themselves when challenges arise, in order to achieve a desired outcome (Baumeister, Heatherton, & Tice, 1994). In order to achieve the outcome of exercising as planned, individuals may need to self-regulate across various domains of performance, such as the scheduling of exercise, goal setting, preventing relapses, and overcoming barriers (Bandura, 1997; Gyurcsik, Brawley, Spink, & Sessford, 2013; Maddux & Gosselin, 2003). According to contentions in self-efficacy theory (Bandura, 1997, 2004), individuals must be confident in their self-regulatory abilities in order to successfully self-regulate their challenges and engage in exercise. This confidence is termed self-regulatory efficacy (Bandura, 1997, 2004; Maddux & Gosselin, 2003).

When individuals have higher self-regulatory efficacy, they tend to remain task-diagnostic, persisting in their efforts to overcome challenges to their exercise plans (Bandura, 1997, 2004; Maddux & Gosselin, 2003). In contrast, individuals who have lower self-regulatory efficacy tend to become self-diagnostic, focusing more on perceived task-related difficulties, and lack the persistence needed to overcome challenges. Thus, lower efficacy individuals would have difficulties in keeping with their exercise plans. In the arthritis-exercise domain, the experience of an arthritis flare may be one challenge to exercise that could be particularly problematic (Brittain, Gyurcsik, McElroy, & Hillard, 2011; Gyurcsik et al., 2009, 2013; Nes, Roach, & Segerstrom, 2009).

Arthritis Flare

An arthritis flare involves an exacerbation of typical arthritis symptoms, such as increases in pain, joint swelling, and fatigue (Bingham et al., 2009). Prior qualitative research has found adults report that their arthritis flares and associated symptoms, such as increases in pain, interfere with their exercise (Der Ananian et al., 2006a; Der Ananian, Wilcox, Watkins, Saunders, & Evans, 2006b; Hewlett et al., 2012; Schoster, Callahan, Meier, Mielenz, & DiMartino, 2005; Wilcox et al., 2006). However, whether arthritis flares actually predict exercise frequency is unknown. Based upon the previously mentioned qualitative findings, the overall experience of an arthritis flare may be associated with exercise. In addition, the specific exacerbated symptoms may serve as barriers that individuals need to self-regulate, in order to exercise as planned (Gyurcsik et al., 2013; Sessford, Brawley, & Gyurcsik, 2015). If this is the case, then self-regulatory efficacy beliefs may predict exercise.

Self-regulatory Efficacy to Overcome Flare Barriers

In order to successfully self-regulate a flare, self-efficacy theory contends that individuals should be confident in their skills and abilities to overcome their flare barriers (Bandura, 1997, 2004; Gyurcsik et al., 2013). Higher self-regulatory efficacy to overcome arthritis flare barriers should be positively associated with exercise participation (Bandura, 1997, 2004). Although this relationship has gone unexamined in the arthritis-exercise domain, prior research has examined the relationship between exercise and self-regulatory efficacy to overcome typical arthritis barriers (e.g., pain, joint stiffness in a non-flare) as well as general barriers (e.g., lack of time).

Gyurcsik and colleagues (2009) found that self-regulatory efficacy to overcome both typical arthritis barriers and general barriers were significant positive predictors of exercise among adults with arthritis. Brittain and colleagues (2011) found that the extent to which typical arthritis and general barriers were perceived to limit adults' planned exercise were stronger predictors of exercise than barrier presence (i.e., whether they experienced the barrier or not). As barrier limitation increased, an associated decrease in moderate exercise participation was found. The researchers suggested that perceived exercise barrier limitation could be explained by participants' lower efficacy to overcome their more limiting barriers.

Only minimal research to date has examined factors associated with exercise when adults experience an arthritis flare. Gyurcsik et al. (2013) first identified adult participants with arthritis who either met or did not meet the exercise recommendations of 150+ minutes/week. Findings, in part, illustrated that the two groups did not differ in their overall

arthritis pain and specific flare-related factors (i.e., flare duration, number of flares, and flare pain) over a two-week period. However, participants who met the exercise recommendation had higher self-regulatory efficacy to overcome typical (non-flare) arthritis barriers. Sessford and colleagues (2015) found that self-regulatory efficacy to overcome typical arthritis barriers was significantly lower when individuals were in a flare compared to when they were not in a flare.

To extend the research, examining efficacy to overcome flare barriers would be ideal. More specifically, whether self-regulatory efficacy beliefs and/or the flare event itself are predictive of exercise is important to delineate. This is because flares are often uncontrollable and arise unexpectedly. Thus, to target a reduction in flare experiences via an intervention may not be realistic or effective. However, if self-regulatory efficacy to overcome flare barriers is found to reliably predict exercise, then a theory-based intervention can be designed to increase efficacy and, in turn, exercise among adults with arthritis.

Summary and Study Purpose

Previous research findings support contentions from self-efficacy theory that higher self-regulatory efficacy beliefs to overcome typical arthritis barriers and general barriers are associated with more exercise (Gyurcsik et al., 2009, 2013). To extend the research, examination of the relationship between exercise and self-regulatory efficacy is needed, to overcome a more challenging situation — when individuals are in an arthritis flare. Thus, the study purpose was to examine whether arthritis flares and self-regulatory efficacy to overcome flare barriers predicted weekly exercise volume among adults with arthritis. Based on self-efficacy theory (Bandura, 1997, 2004; Maddux & Gosselin, 2003) and past research (e.g., Brittain et al., 2011; Gyurcsik et al., 2009, 2013), self-regulatory efficacy was expected to be a significant positive predictor of weekly exercise volume. Based on qualitative reports (Der Ananian et al., 2006a, 2006b; Hewlett et al., 2012; Schoster et al., 2005; Wilcox et al., 2006), arthritis flares were also expected to significantly predict weekly exercise volume.

Method

Design and Participants

Study approval was received from the University's Behavioural Research Ethics Board before commencing participant recruitment and data collection. Participants for this cross-sectional study were recruited via various strategies, including study announcements that were: (a) posted on a web-based service that provides announcements to a university community, (b) posted on The Arthritis Society's webpage, (c) posted in arthritis-related web-based chat groups, (d) posted at various locations across a university campus, and (e) emailed to previous research participants. The announcements included the study's purpose, participant inclusion criteria, and a link to the online survey. Participants were offered a $5 coffee shop gift card as a token of appreciation for their participation.

Once interested individuals accessed the link and completed the electronic informed consent, they answered participant inclusion criteria questions. To be eligible, individuals were required to: (a) be an adult (18+ years of age); (b) reside in Canada or in the United States; (c) self-report the diagnosis of arthritis from a medical professional, which is an appropriate assessment procedure within survey-based research (CDC, 2010); (d) have experienced an arthritis flare within the last year; and (e) be currently exercising. The latter two inclusion criteria ensured participants had the experiential basis to relate to the flare barriers and could accurately respond to the self-regulatory efficacy measure. Those who met the criteria proceeded to the remainder of the survey, which took approximately 25 minutes to complete. Those who did not meet the inclusion criteria were automatically directed to an alternate page, where they were thanked for their interest and exited from the survey. No additional data were obtained on those who did not meet the inclusion criteria.

Measures

Demographics. General participant demographic information was collected, including education, race, gender, marital status, and employment status. The number of years that participants were diagnosed with arthritis was also collected. Information on specific types of arthritis was not collected because individuals cannot accurately report such information (CDC, 2011).

Arthritis flares. Before participants completed the flare measure, they read a control definition of a flare, which was defined as "*those 'bad days' of worse/increased symptoms beyond your usual arthritis symptoms.*" The definition corresponds with the consensus in the literature that flares involve an exacerbation of disease symptoms and that individuals serve as their own experts in identifying if their arthritis is flared (Bingham et al., 2009; Brunner, Lovell, Finck, & Giannini, 2002; Hewlett, 2003). After reading the definition, participants reported if they experienced at least one flare in the prior two weeks (yes/no response). The flare measure has been used in previous research (Gyurcsik et al., 2013; Sessford et al., 2015).

Self-regulatory efficacy to overcome arthritis flare barriers. Participants reported their confidence in their skills and abilities to overcome 10 flare barriers. Items were derived from pilot work in which 19 adults with medically

diagnosed arthritis participated in 5 focus groups. Focus group participants were asked a series of open-ended questions about their most challenging barriers to exercise when in a flare. The most frequently mentioned barriers that made exercising difficult were identified and included in the present measure. The barriers included: pain, joint stiffness/soreness, self-consciousness, exercise exclusion (i.e., others assuming individual is disinterested in exercise participation), weather-related aggravation, pain-related sleep loss, non-pain-related sleep loss, stress/frustration, depression, and fatigue.

Participants indicated if they experienced each of the 10 barriers when they were in a flare (yes/no response). If answered affirmatively, participants rated their confidence to overcome the barrier in the next four weeks on a 0 (*not at all confident*) to 10 (*completely confident*) response scale. A mean efficacy score was calculated for each participant, based upon responses to only the barriers they reported experiencing. This mean score was used in the analysis. Including only those barriers that a participant had experienced was in line with barrier measurement recommendations (Brawley, Martin, & Gyurcsik, 1998). Doing so ensured the participants had the experiential basis to form efficacy beliefs and to more accurately report their efficacy.

Exercise. Participants self-reported the average frequency and duration of moderate-vigorous exercise sessions that they participated in during a typical week in the past month. The measure has been used in previous research (e.g., Gyurcsik et al., 2013; Sessford et al., 2015). Instructions emphasized that participants should only report exercise they did for at least 20 minutes at one time, to ensure that their focus was on exercise behaviours requiring self-regulatory skills and confidence. In contrast, light bouts of incidental activity were not reported, which may not require plans and self-regulation (e.g., walking from a car into an exercise facility). Furthermore, light intensity activities are subject to poor recall (Cust et al., 2008).

To ensure the meaning and understanding of moderate and vigorous exercise were controlled, definitions were provided to the participants before they completed the measure (Haskell et al., 2007; Nelson et al., 2007). The definition for moderate exercise was:

> "*Moderate exercise makes your heart beat faster and makes you breathe a little harder. You can talk easily while doing moderate exercise, but you may not be able to sing comfortably. Intensity can be estimated using a scale of 0 to 10, where sitting is 0 and 10 is the highest level of effort possible, moderate intensity would be a 5 or 6.*"

The definition of vigorous exercise was:

> "*Vigorous exercise makes your heart beat much faster. You may not be able to talk comfortably without stopping to catch your breath. Intensity can be estimated using a scale of 0 to 10, where sitting is a 0 and 10 is the highest level of effort possible, vigorous intensity would be a 7 or 8.*"

After reading the definitions, participants reported the average number of days in a typical week they participated in each type of exercise for more than 20 minutes at a time (frequency) and the average time their exercise sessions took per day (duration). Total weekly exercise volume was calculated by summing the amount of moderate exercise (frequency x duration) with the total amount of vigorous exercise (frequency x duration). For example, a participant may have reported 5 days of moderate activity for 20 minutes/day and 2 days of vigorous activity for 20 minutes/day. This participant's total weekly exercise volume would have been 140 minutes: (5 days x 20 minutes/day) + (2 days x 20 minutes/day).

Data Analyses

Data were examined for missing values, outliers, and normality. Missing scale items were identified and handled in accordance with recommendations from Tabachnick & Fidell (2012). Few self-regulatory efficacy scores were identified as missing from the overall dataset ($n_{participants}$ = 10). Participants with missing self-regulatory efficacy scores were not eliminated from the dataset. Alternatively, in line with recommendations, missing values were replaced using the participant's mean score on the self-regulatory efficacy measure. More specifically, if a participant indicated they had experienced 1 of the 10 exercise barriers, but did not indicate their efficacy to overcome the barrier, then a unique replacement mean was calculated for each participant based on their complete barrier item responses.

Outliers were identified as data points having a z-score of greater than 3.29 (Tabachnick & Fidell, 2012). The exercise data contained three outliers, which were changed to one unit higher than the next highest value based on Tabachnick and Fidell's recommendations. Specifically, the lowest outlier was changed to one value greater than the next highest value in the dataset. Then the next two outliers were given a value of one greater than the previously changed outlier. After correcting for outliers, the exercise data were still non-normally distributed (i.e., positively skewed). In turn, a log transformation was conducted on the exercise data resulting in a normal distribution (Tabachnick & Fidell, 2012).

The results are presented in three sections. The first section describes the study participants. The second section presents descriptive information on the primary study

variables and includes, for ease of interpretation, the raw weekly exercise volume mean and standard deviation. The third section presents a two-step hierarchical multiple regression that was conducted to investigate whether arthritis flares and self-regulatory efficacy significantly predicted weekly exercise volume. Note that the transformed exercise variable was used in this analysis. Additionally, before conducting the analysis, demographics (see Table 1) were examined for significant bivariate associations with exercise. If any were found, the demographic(s) would have been entered as a covariate in the first step of the regression analysis. However, significant associations were not found (e.g., r_s ranged between -.28 and .03; all p's > .05).

Thus, the hierarchical multiple regression analysis included arthritis flares in step 1, followed by self-regulatory efficacy to overcome arthritis flare barriers in step 2. The rationale for controlling for flares in step 1 was based upon previous research findings that adults frequently report arthritis flares as interfering with their exercise adherence (e.g., Brittain et al., 2011; Der Ananian et al., 2006b; Gyurcsik et al., 2009, 2013). Thus, controlling for any association between arthritis flares and exercise allowed for an examination of the unique contribution that self-regulatory efficacy had in predicting weekly exercise volume (step 2).

Results

Participants

Participants were 90 adults (M_{age} = 49.36 ± 16.38 years) from Canada (n = 75) and the United States (n = 15) who were primarily white (n = 84) and female (n = 75). The majority of participants had arthritis for 1 to 5 years (n = 25) or 6 to 10 years (n = 20). Additional general and arthritis-specific demographics are included in Table 1.

Table 1: *General and arthritis-specific demographics of study participants (N = 90)*

Demographic	Category	*n* (%)
Gender	Female	75 (83.33)
	Male	14 (15.56)
Race	White	84 (93.33)
	Latin American	2 (2.22)
	Multiple races	4 (4.44)
Marital status	Married	47 (52.22)
	Single	19 (21.11)
	Not married, but living with partner	10 (11.11)
	Divorced	8 (8.89)
	Widowed	2 (2.22)
	In a relationship, but not married/living with partner	3 (3.33)
Education	None	1 (1.11)
	High school graduate	14 (15.56)
	Trades certificate/diploma	6 (6.67)
	Community college certificate/diploma	21 (23.33)
	University certificate/diploma below bachelor's	7 (7.78)
	Bachelor degree	18 (20.00)
	University certificate/diploma above bachelor's	2 (2.22)
	Medical degree	1 (1.11)
	Master's degree	13 (14.44)
	Earned doctorate	7 (7.78)
Employment status	Employed full-time	24 (26.67)
	Employed part-time	7 (7.78)
	Homemaker	2 (2.22)
	Student	9 (10.00)
	Retired	14 (15.56)
	On disability leave	11 (12.22)

	Self-employed	4 (4.44)
	Unemployed >1 year	1 (1.11)
	Multiple responses	17 (18.89)
Years diagnosed with arthritis	<1 year	6 (6.67)
	1-5 years	25 (27.78)
	6-10 years	20 (22.22)
	11-15 years	12 (13.33)
	16-20 years	9 (10.00)
	>20 years	18 (20.00)

Note. Complete data for the 90 participants are not reported due to missing values for gender (n = 1), marital status (n = 1), and employment status (n = 1).

Descriptive Statistics

Sixty-one participants reported experiencing an arthritis flare within the previous two weeks. On average, participants reported that they had experienced 6 (± 1.82) of the 10 flare barriers. Recall that self-regulatory efficacy to overcome the barriers was measured on a scale from 0 (*not at all confident*) to 10 (*completely confident*). Accordingly, on average, participants reported moderate self-regulatory efficacy to overcome their flare barriers ($M_{efficacy}$ = 5.88 ± 1.98). In addition, participants' mean total exercise volume was above the recommended weekly amount (i.e., 150 minutes) at 164.20 minutes (± 141.70 minutes).

Hierarchical Multiple Regression Analysis to Predict Exercise

Table 2 presents the results from the hierarchical multiple regression analysis. Step 1 included arthritis flares, which was not significant in predicting weekly exercise volume; $F(1, 88) = 3.86$, $p = .05$. Adding self-regulatory efficacy to overcome flare barriers in step 2 resulted in an overall model that was significant, $F(2, 87) = 8.00$, $p < .001$. In the overall model, arthritis flares did not significantly contribute to predicting weekly exercise volume; $t(87) = 1.23$, $p = .22$. However, self-regulatory efficacy significantly contributed to the model ($t[87] = 3.42$, $p < .001$) and demonstrated a medium effect size (shown as Beta [β] values in Table 2; Cohen, 1988). Self-regulatory efficacy accounted for an additional and significant 11% of the variance in exercise and was the sole significant predictor.

Discussion

The present study was the first to examine the relationships between arthritis flares, self-regulatory efficacy to overcome flare barriers, and exercise. Results of the hierarchical multiple regression analysis supported the hypothesis that self-regulatory efficacy significantly predicts weekly exercise volume. Findings also supported theoretical contentions from self-efficacy theory (Bandura, 1997, 2004). Specifically, individuals with higher self-regulatory efficacy are expected to be persistent in overcoming challenges and continue performing motivated behaviours such as exercise (Bandura, 1997, 2004; Maddux & Gosselin, 2003).

Although prior qualitative research indicated that adults with arthritis report that their flares interfere with their exercise (e.g., Der Ananian et al., 2006a, 2006b; Hewlett et al., 2012; Schoster et al., 2005; Wilcox et al., 2006), the study finding that arthritis flares did not predict exercise was not supportive of the hypothesis. A quantitative study by Gyurcsik and colleagues (2013) found that individuals meeting and not meeting the exercise recommendations did not differ relative to pain and flare-related factors. However, their work did find that those meeting the recommendation had higher self-regulatory efficacy. One possible reason for these findings may be that flare-related cognitions (e.g., efficacy to overcome flare

Table 2: *Prediction of moderate-vigorous exercise (N = 90)*

Predictor	$R^2_{adjusted}$	ΔR^2	ΔF	β
Step 1	.03	.04	3.86	
Arthritis flares				.21
Step 2	.14	.11	11.67	
Arthritis flares				.12
Self-regulatory efficacy to overcome flare barriers				.35*

*$p < .001$

barriers), rather than a flare itself, may be the overriding predictors of exercise.

Evidence for this suggestion comes from prior research showing that one particular aspect of arthritis — perceived pain — is not predictive of exercise. Similar to flares, adults have often reported that their pain is a barrier to their exercise (e.g., Brittain et al., 2011; Der Ananian et al., 2006b; Gyurcsik et al., 2009), but when examined quantitatively, pain does not seem to differ between those exercising more or less (e.g., Brittain et al., 2011; Focht, Ewing, Gauvin, & Rejeski, 2002; Gyurcsik et al., 2009, 2013). Suggestions are that pain-related cognitions, not pain itself, are what predict whether people will engage in motivated behaviours, such as exercise (McCracken & Gutierrez-Martinez, 2011; White et al., 2013). Given findings from the present study, a similar contention may be made. More specifically, whether individuals perceive that they could manage a flare and associated exercise barriers (i.e., have flare-related cognitions) may be more salient to predicting exercise than the flare experience alone. Thus, self-regulatory efficacy to overcome flare-related barriers may be a key psychosocial factor that helps to explain why some adults who experience a flare continue to exercise at higher levels while other adults do not.

Limitations and Strengths

The present study had several limitations. First, the cross-sectional study design, although appropriate for the stage of research, did not allow cause and effect conclusions. Second, the sample included primarily white, female, educated individuals, who met the exercise recommendations and had computer access to the online survey. As a result, the findings cannot be generalized to the broader adult population with arthritis. Third, self-reported exercise data may be considered a study limitation. However, in the present study, self-reporting ensured the reported exercise bouts corresponded with the self-regulatory efficacy variable. Specifically, the exercise bouts were ≥ 20 minutes, planned, and self-regulated, in comparison to reporting incidental or light exercise bouts, which are often susceptible to participant recall error (Cust et al., 2008). Furthermore, self-reporting moderate-vigorous intensity exercise has been found to correlate with objective measures (Cust et al., 2008; Matthews et al., 2005). Since data collection involved completion of an online survey, the use of an objective measure was not feasible in the present study. Finally, the present study did not include appropriate measures to allow assessment of the extent to which arthritis type and severity may predict exercise. However, given the stage of the research, this may be a direction for future research and will be discussed further below.

Despite limitations, the present study had several strengths. It provided novel information on the relationship between arthritis flares, self-regulatory efficacy to overcome flare barriers, and exercise. The research was the first to show that the experience of a flare was not predictive of exercise. However, an alterable cognition — self-regulatory efficacy — was predictive. Another strength was the theory-based nature of the study, which followed recommendations to include theory in health-related research, particularly among individuals with arthritis (Alliance for the Canadian Arthritis Program, 2006; Baranowski et al., 1998; Painter, Borba, Hynes, Mays, & Glanz, 2008). The advantage of conducting a theory-based study is that once causal relationships are established, the theory can be used to design an intervention to alter problematic factors in order to enhance exercise participation.

Future Directions

Future research should employ broader recruitment strategies for inclusion of a more diverse sample, to enhance generalizability. For example, community-based organizations and lower socioeconomic status neighborhoods could be approached, to increase inclusion of racial minorities and less educated individuals. Research should also examine whether those who meet or do not meet the exercise recommendation of 150+ minutes per week differ in their self-regulatory efficacy to overcome flare barriers. Based on theory, those who do not meet the recommendation should have lower self-regulatory efficacy than those who do meet the recommendation (Bandura, 1997; Maddux & Gosselin, 2003).

In addition, future research could use an experimental design to examine the theoretical contention that people with higher self-regulatory efficacy should persist longer when trying to overcome an exercise challenge (Bandura, 1997; Maddux & Gosselin, 2003). For example, an experiment could manipulate the level of perceived challenge during a flare by presenting more or less challenging written stories to higher or lower efficacy individuals. Then, their persistence to deal with the presented story could be assessed. Theoretical contentions would be supported if individuals with higher efficacy persist longer in response to the higher challenge scenario than those with lower efficacy.

Finally, investigation of the extent to which arthritis severity may predict exercise was beyond the scope of the current study. However, recall theoretical contentions suggest that cognitions (e.g., self-regulatory efficacy) may be important predictors of behaviour when individuals experience behavioural challenges (Bandura, 1997, 2004). The current study examined only one type of arthritis challenge — the experience of an arthritis flare in general.

Given arthritis symptoms and flares may differ in severity, the potential corresponding level of challenge to exercise may vary between individuals (PHAC, 2010). Thus, a direction for future research may be to examine whether measures of arthritis severity, including fluctuations in the severity of flare experiences, predict exercise participation. Based on theory, those who experience less severe arthritis and flares, and have greater self-regulatory efficacy, would be expected to exercise more (Bandura, 1997, 2004).

Conclusion and Practical Application

The Public Health Agency of Canada (2010) recommends that individuals with arthritis engage in regular exercise in order to help with disease self-management. The present study provided novel information that having high self-regulatory efficacy may be important when individuals try to overcome flare barriers to exercise. In contrast, the overall experience of an arthritis flare did not predict exercise. If future research finds a causal relationship between efficacy to overcome flare barriers and exercise, then theory-based interventions can be designed that target self-regulatory efficacy enhancement (e.g., through verbal persuasion and modelling of appropriate coping strategies; Bandura, 1997). This type of intervention could help individuals persist in overcoming challenges and adhering to their exercise plans, to better self-manage their arthritis.

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References

Alliance for the Canadian Arthritis Program. (2006). *Report from the summit on standards for arthritis prevention and care.* http://www.arthritisalliance.ca/docs/SAPC%20Full%20Report%20200603 31%20en.pdf

Bandura, A. (1997). *Self-efficacy theory: The exercise of control*. New York: Freeman.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education and Behaviour, 31*(2), 143-164. http://dx.doi.org/10.1177/1090198104263660

Bandura, A. (2005). The primacy of self-regulation in health promotion. *Applied Psychology*, *54*(2), 245-254.

Baranowski, T., Anderson, C., & Carmack, C. (1998). Mediating variable framework in physical activity interventions: How are we doing? How might we do better? *American Journal of Preventive Medicine, 15*(4), 266-297. http://dx.doi.org/10.1016/S0749-3797(98)00080-4

Baumeister, R., Heatherton, T.F., & Tice, D.M. (1994). *Losing control: How and why people fail at self-regulation.* San Diego: Academic Press.

Bingham, C. O., III, Pohl, C., Woodworth, T. G., Hewlett, S. E., May, J. E., Rahman, M. U., & Alten, R. E. (2009). Developing a standard definition for disease "flare" in rheumatoid arthritis (OMERACT 9 Special Interest Group). *The Journal of Rheumatology, 36*(1), 2335-2341. http://dx.doi.org/10.3899/jrheum.090369

Brawley, L. R., Martin, K. A., & Gyurcsik, N. C. (1998). Problems in assessing perceived barriers to exercise: Confusing obstacles with attributions and excuses. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp. 337-350). Morgantown, WV: Fitness Information Technology.

Brittain, D. R., Gyurcsik, N. C., McElroy, M., & Hillard, S. A. (2011). General and arthritis-specific barriers to moderate physical activity in women with arthritis. *Women's Health Issues, 21*(1), 57-63. http://dx.doi.org/10.1016/j.whi.2010.07.010

Brunner, H. I., Lovell, D. J., Finck, B. K., & Giannini, E. H. (2002). Preliminary definition of disease flare in juvenile rheumatoid arthritis. *The Journal of Rheumatology, 29*(5), 1058-1064.

Centers for Disease Control and Prevention (CDC). (2010). Prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation – United States, 2007-2009. *Morbidity and Mortality Weekly Report, 59*(39), 1261-1265. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5939a1.htm?s_cid=mm5939a1_w

Centers for Disease Control and Prevention (CDC). (2011). *Data & statistics. FAQs (data related) case definition: Is self-reported information on the type of arthritis valid?* http://www.cdc.gov/arthritis/data_statistics/case_definition/faqs.htm

Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences* (2nd ed.). New York, NY: Lawrence Erlbaum Associates.

Cust, A. E., Smith, B. J., Chau, J., van der Ploeg, H. P., Friedenreich, C. M., Armstrong, B. K., & Bauman, A. (2008). Validity and repeatability of the EPIC physical activity questionnaire: a validation study using accelerometers as an objective measure. *International Journal of Behavioural Nutrition and Physical Activity, 5*(1), 33-45. http://dx.doi.org/10.1186/1479-5868-5-33

Der Ananian, C., Wilcox, S., Abbott, J., Vrazel, J., Ramsey, C., Sharpe, P., & Brady, T. (2006a). The exercise experience in adults with arthritis: A qualitative approach. *American Journal of Health Behaviour, 30*(6), 731-744. http://dx.doi.org/10.5993/AJHB.30.6.18

Der Ananian, C., Wilcox, S., Watkins, K., Saunders, R. P., & Evans, A. E. (2006b). Factors that influence exercise among adults with arthritis in three activity levels. *Preventing Chronic Disease, 3*(3), A81. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1636716/

Focht, B. C., Ewing, V., Gauvin, L., & Rejeski, W. J. (2002). The unique and transient impact of acute exercise on pain perception in older, overweight, or obese adults with knee osteoarthritis. *Annals of Behavioural Medicine, 24*(3), 201-210. http://dx.doi.org/10.1207/S15324796ABM2403_05

Gyurcsik, N. C., Brawley, L. R., Spink, K. S., Brittain, D. R., Fuller, D. L., & Chad, K. C. (2009). Physical activity in women with arthritis: Examining perceived barriers and self-regulatory efficacy to cope. *Arthritis & Rheumatism, 61*(8), 1087-1094. http://dx.doi.org/10.1002/art.24697

Gyurcsik, N. C., Brawley, L. R., Spink, K. S., & Sessford, J. D. (2013). Meeting physical activity recommendations: Self-regulatory efficacy characterizes differential adherence during arthritis flares. *Rehabilitation Psychology, 58*(1), 43-50. http://dx.doi.org/10.1037/a0031293

Haskell, W. L., Lee, I., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., Macera, C. A., Heath, G. W., Thompson, P. D., & Bauman, A. (2007). Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise, 39*(8), 1423-1434. http://dx.doi.org/10.1249/mss.0b013e3180616b27

Hewlett, S. A. (2003). Patients and clinicians have different perspectives on outcomes in arthritis. *The journal of Rheumatology, 30*(4), 877-879.

Hewlett, S., Sanderson, T., May, J., Alten, R., Bingham III, C. O., Cross, M., March, L., Pohl, C., Woodworth, T., & Bartlett, S. J. (2012). 'I'm hurting, I want to kill myself': Rheumatoid arthritis flare is more than a high joint count – an international patient perspective on flare where medical help is sought. *Rheumatology, 51*(1), 69-76. http://dx.doi.org/10.1093/rheumatology/keq455

Maddux, J. E., & Gosselin, J. T. (2003). Self-Efficacy. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 218-238). New York: Guilford Press.

Matthews, C. E., Ainsworth, B. E., Hanby, C., Pate, R. R., Addy, C., ... & Macera, C. A. (2005). Development and testing of a short physical activity recall questionnaire. *Medicine and Science in Sports and Exercise, 37*(6), 986-994. http://dx.doi.org/10.1249/01.mss.0000171615.76521.69

McCracken, L. M., & Gutierrez-Martinez, O. (2011). Processes of change in psychological flexibility in an interdisciplinary group-based treatment of chronic pain based on acceptance and commitment therapy. *Behaviour Research and Therapy, 49*(4), 267-274. http://dx.doi.org/10.1016/j.brat.2011.02.004

Nelson, M. E., Rejeski, W. J., Blair, S. N., Duncan, P. W., Judge, J. O., King, A. C., Macera, C. A., & Castaneda-Sceppa, C. (2007). Physical activity and public health in older adults: Recommendation from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise, 39*(8), 1435-1445. http://dx.doi.org/10.1249/mss.0b013e318061aa2

Nes, L. S., Roach, A. R., & Segerstrom, S. C. (2009). Executive functions, self-regulation, and chronic pain: A review. *Annals of Behavioural Medicine, 37*(2), 173-183. http://dx.doi.org/10.1007/s12160-009-9096-5

Painter, J. E., Borba, C. P. C., Hynes, M., Mays, D., & Glanz, K. (2008). The use of theory in health behaviour research from 2000 to 2005: A systematic review. *Annals of Behavioural Medicine, 35*(3), 358-362. http://dx.doi.org/10.1007/s12160-008-9042-y

Public Health Agency of Canada, Centre for Chronic Disease Prevention and Control, & Chronic Disease Surveillance Decision. (2010). *Life with arthritis in Canada: A personal and public health challenge.* http://www.phac-aspc.gc.ca/cd-mc/arthritis-arthrite/lwaic-vaaac-10/pdf/arthritis-2010-eng.pdf

Schoster, B., Callahan, L. F., Meier, A., Mielenz, T., & DiMartino, L. (2005). The people with arthritis can exercise (PACE) program: A qualitative evaluation of participant satisfaction. *Preventing Chronic Disease: Public Health Research, Practice, and Policy, 2*(3), A11. http://www.cdc.gov/pcd/issues/2005/jul/05_0009.htm

Sessford, J. D., Brawley, L. R., & Gyurcsik, N. C. (2015). Examination of self-regulatory efficacy and pain among individuals challenged by arthritis flares. *Rehabilitation Psychology, 60*(1), 43-50. http://dx.doi.org/10.1037/rep0000020

Tabachnick, B. G., & Fidell, L. S. (2012). *Using multivariate statistics* (6th ed.). Boston, MA: Allyn & Bacon.

White, D. K., Tudor-Locke, C., Felson, D. T., Gross, K. D., Niu, J., ... & Neogi, T. (2013). Do radiographic disease and pain account for why people with or at high risk of knee osteoarthritis do not meet physical activity guidelines? *Arthritis & Rheumatism, 65*(1), 139-147. http://dx.doi.org/10.1002/art.37748

Wilcox, S. Der Ananian, C., Abbott, J., Vrazel, J., Ramsey, C., Sharpe, P. A., & Brady, T. (2006). Perceived exercise barriers, enablers, and benefits among exercising and nonexercising adults with arthritis: Results from a qualitative study. *Arthritis Care & Research, 55*(4), 616-627. http://dx.doi.org/10.1002/art.22098