

The Relationship Between Autonomous Motivation for Exercise, Self-Compassion and
Physical Activity

by

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Abstract

This series of studies investigated the relationships between self-compassion, physical activity, and autonomous motivation for exercise. The purpose of Study 1 was to examine if autonomous motivation for exercise moderates the association between self-compassion and physical activity in Carleton University students using a cross-sectional design. The goal of Study 2 was to test the effects of a 5-day self-compassion writing intervention on autonomous motivation and physical activity in first year university students at Carleton University. Autonomous motivation did not moderate the relationship between self-compassion and physical activity in Study 1 ($B = -1.04$, $SE = 1.88$, $t(383) = -0.56$, $p = .57$, 95% CI = [-4.75, 2.65]). The self-compassion intervention in Study 2 did not affect autonomous motivation, self-compassion, or physical activity across time ($p < .05$, $\eta_p^2 = .01 - .24$). Researchers should replicate these findings with larger sample sizes and better measures of self-compassion and physical activity.

Keywords: self-compassion, autonomous motivation, physical activity

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The Relationship Between Autonomous Motivation for Exercise, Self-Compassion and Physical Activity

The decline of regular physical activity has become a universal issue that has researchers establishing awareness of the importance of physical activity for health promotion and prevention (Disseldorp et al., 2012). Physical activity is defined by the World Health Organization (WHO) as “any bodily movement produced by skeletal muscles that requires energy expenditure” (WHO, 2010, p.53). The WHO highlights physical inactivity as the fourth most prevalent cause of mortality (WHO, 2022). With this in mind, the WHO created the global physical activity plan to reduce global physical inactivity by 15% by the year 2030 (WHO, 2018).

Among various reasons for creating a global physical activity plan, one is to improve physical and mental health of individuals. Experimental studies have concluded that increasing daily physical activity can have protective effects on present and future health conditions (Haskell et al., 2009). Increased physical activity can reduce obesity, lower blood pressure, reduce inflammation, and strengthen bone health (Raisanen et al., 2016; Warburton et al., 2006). For example, 150 minutes of moderate intensity physical activity per week is protective against Type 2 diabetes (Knowler et al., 2002). Physical activity is also beneficial for decreasing the rate of aging on memory, learning, and cognitive functioning systems (Andreae, 2015). Individuals who participate in more physical activity tend to have significantly lower levels of fatigue and higher levels of energy (Bray & Born, 2004). Physical activity not only improves physical health, but also mental well-being. Depressive symptoms can be reduced through the biological

and psychosocial benefits of physical activity (Kandola et al., 2019). Well-being factors such as life satisfaction and happiness are also associated physical activity (An et al., 2020).

Despite the physical and mental benefits associated with physical activity, people are not meeting current physical activity guidelines. In Canada, the average self-reported physical activity decreased from 2015 to 2019 in individuals between the ages of 18 and 64 (Statistics Canada, 2021). As well, during the COVID-19 pandemic approximately 20% of those surveyed were found to have decreases in light physical activity engagement, 34% reported decreases in moderate-intensity physical activity, and 42% reported decreases in vigorous physical activity when contrasted with activity levels before COVID-19 (ParticipACTION, 2021). The Canadian Physical Activity Guidelines suggest that adults aged 18 to 64 years old should engage in 150 minutes of moderate to vigorous intensity physical activity per week (Canadian Society for Exercise Physiology, 2021). University students have been identified by researchers to struggle with decreases in physical activity as a result of lifestyle changes and academic commitments (Deliens et al., 2015). Given the low level of physical activity uptake in Canada and specifically among university students, combined with global initiatives to increase physical activity (World Health Organization, 2018), more research is needed to understand the factors related to greater physical activity engagement. One theory that has been used to understand physical activity engagement is Self-Determination Theory.

Self-Determination Theory

Self-determination theory (SDT) is a theory about human motivation and well-being (Ryan & Deci, 2000). Central to SDT, Ryan and Deci (2000) focus on motivational quality rather than quantity. According to Ryan and Deci (2000), good quality motivation occurs when an individual's motivation comes from within one's self and aligns with personal interests and

values versus being externally imposed. One sub-theory within SDT that is particularly relevant to understanding physical activity engagement and motivation is Organismic Integration Theory (Ryan & Deci, 2000).

Organismic Integration Theory

Within Organismic Integration Theory, Ryan and Deci (2000) examine how different types of extrinsic motivation can promote or inhibit certain behaviours. Extrinsic motivation is composed of several levels of behavioural regulation that are underpinned by various degrees of autonomy: external, introjected, identified, and integrated regulation (Ryan & Deci, 2000). External regulation is the least autonomous form of motivation. External regulation is most strongly influenced by external factors such as rewards and external demands (Ryan & Deci, 2000). For example, someone engaging in physical activity due to external regulation may be engaging in physical activity because their friends say they should. Introjected regulation is slightly more autonomous than external regulation and is defined as behaviour that is motivated to avoid unpleasant emotions caused by external pressures (Ryan & Deci, 2000). For example, one may be motivated to engage in physical activity because they would feel ashamed of themselves if they did not. Compared to introjected regulation, identified regulation is more autonomous and is characterized as being influenced by an individual's goals that are valued as important (Ryan & Deci, 2000). For example, individuals with identified regulation would engage in physical activity because they perceive it to be important to their core values. Lastly, the most autonomous form of extrinsic motivation is integrated regulation. Integrated regulation is present when an individual is motivated to behave in a way that reflects their identity (Ryan & Deci, 2000). For example, athletes who engage in physical activity based on integrated regulation do so because it aligns with their identity as an athlete.

Within Organismic Integration Theory, intrinsic motivation and amotivation are at polar ends of the continuum (Ryan & Deci, 2000). Amotivation is underpinned by non-regulation and can be described as behaviour that lacks motivation or intention (Ryan & Deci, 2000). For example, amotivation would be present when individuals do not see any benefit in engaging in physical activity and therefore do not engage in physical activity. Conversely, intrinsic motivation is underpinned by intrinsic regulation (Ryan & Deci, 2000). Intrinsic regulation is characterized by a person engaging in an activity for no separable consequence other than interest and enjoyment and is the most autonomous form of motivation (Ryan & Deci, 2000). For example, a person engaging in physical activity with intrinsic regulation may be doing so because they find it to be enjoyable.

Researchers using SDT have operationalized the motivational continuum in different ways (Wilson et al., 2012). In one approach, researchers use a weighted formula ($\text{amotivation}^* - 3) + (\text{external}^* - 2) + (\text{introjected}^* - 1) + (\text{identified}^* 1) + (\text{integrated}^* 2) + (\text{intrinsic}^* 3)$) to create a relative autonomy index based on the different types of regulation (Wilson et al., 2012). With this relative autonomy index, higher scores reflect greater internalization and autonomous motivation (Vallerand et al., 2008). However, this approach has been criticized because it combines the independent constructs of regulation to create a total score which may bias the results and may not be useful in certain analyses where controlled or autonomous motivation cannot be separate outcomes (Brunet et al., 2015). In another bifurcation approach, researchers create two separate variables to represent controlled motivation (external + introjected regulations) and autonomous motivation (identified + integrated + intrinsic regulations) (Kullman et al., 2021; Wilson et al. 2012). In the bifurcation approach, controlled motivation represents behaviours regulated by external pressures and internal contingencies such as guilt

whereas autonomous motivation represents behaviours that are regulated by identity, value, and enjoyment (Ryan & Deci, 2000; Standage et al., 2008).

Organismic Integration Theory and Physical Activity

Researchers have supported the application of Organismic Integration Theory within physical activity contexts. Williams and Gill (1995) found that adolescents who had greater levels of competence were more likely to have more intrinsic motivation (autonomous motivation), which increased the amount of effort put forth for physical activity (Williams & Gill, 1995). Similarly, Wilson et al. (2003) found that intrinsic and identified motivation (i.e., forms of autonomous motivation) predicted exercise behaviour and physical fitness levels and 62% of the variance in adults' exercise attitudes. Individuals who had intrinsic and identified motivation towards exercise also had higher levels of competence and relatedness throughout the exercise trial (Wilson et al., 2003). External regulation (i.e., a form of controlled motivation) of physical activity is also associated with lower levels of physical activity in female adolescents (Craike et al., 2014).

Results from systematic reviews also support the relationship between quality of motivation and physical activity. For example, identified regulation predicted short-term positive changes in exercise behaviour whereas intrinsic regulation predicted maintaining exercise over the long-term in a systematic review including various samples (e.g., university students, adults, cancer survivors) (Teixeira et al., 2012). Introjected regulation had mixed associations with exercise behaviour such that the majority of the studies found no relationship, but several studies found a positive association with exercise (Teixeira et al., 2012). With this, Teixeira et al.'s (2012) research suggested that the positive associations between exercise and introjected regulation were still considered to be much lower than the associations between the more autonomous

motivations (i.e., intrinsic and identified regulation) and exercise behaviour and were not related to exercise behaviour over the long term. More recently, a meta-analysis concluded that SDT interventions produced small-to-medium favourable changes in SDT constructs (i.e., autonomous motivation, autonomy, and competence) at post-intervention as well as at the follow up (Ntoumanis et al., 2020). For example, the strongest predictor of health behaviours was autonomous motivation (i.e., intrinsic, identified, and integrated regulation combined) (Ntoumanis et al., 2020). This finding is consistent with SDT and the results from Teixeira et al.'s. (2012) review.

Self-Compassion

Along with SDT, self-compassion is another theory that has been used to understand physical activity engagement. Based on Buddhist ideology, self-compassion is defined as the act of being accepting, kind, and non-judgmental towards oneself during difficult times or failures (Neff, 2003b). Self-compassion is composed of three sub-constructs: self-kindness, common humanity, and mindfulness. Self-kindness is defined as being kind to oneself in challenging times rather than being harsh or critical (Neff, 2003b). Common humanity is defined as the perception that one's experiences are part of the bigger picture of human experiences and that they are not the alone in experiencing these difficulties (Neff, 2003b). Lastly, mindfulness allows one to be aware, accepting, and attentive towards negative thoughts or feelings (Neff, 2003b). Although self-kindness, common humanity, and mindfulness are independent concepts of self-compassion, they are interrelated. For example, to have self-kindness, one would also need to be mindful—aware and accepting—of their feelings and thoughts (Neff, 2003b).

Neff (2003b) hypothesized that self-compassion should be a positive psychological trait, which is protective against depression, poor self-esteem, self-judgement, anxiety, neuroticism,

and narcissistic traits. Neff (2003b) argues that we are harder on ourselves than we are on others, but self-compassion reduces this tendency for self-criticism. Researchers have found that a sub-construct of self-compassion—mindfulness—can protect against psychological conditions such as depression (Hayes et al., 1999; Neff, 2003b). It is thought that being aware and accepting of one's thoughts helps one to learn to live with negative experiences and overcome them (Neff, 2003b). Put differently, the role of self-compassion is to reduce the experience of negative feelings (Neff, 2003b). Self-compassion has also been found to have a medium association with well-being in a meta-analysis (Zessin et al., 2015). Therefore, self-compassion could have an active role in reducing feelings of ill-being and promoting well-being outcomes.

Self-Compassion and Health Behaviours

Self-compassion is a health promoting factor because it strongly relates to one's self-regulation (Sirois et al., 2015). In fact, women exercisers with higher self-compassion were more likely to be autonomously motivated towards exercise (Magnus et al., 2010). In a meta-analysis, Sirois et al. (2015) found that self-compassion was significantly related to health promoting behaviours such as physical activity, stress management, healthy sleep regimen, and healthy eating with a small effect ($r = .25$). In addition, the effect of self-compassion on health behaviours was mediated by higher positive affect and lower negative affect (Sirois et al., 2015). These findings suggest that self-compassion may increase positive affect, which, in turn, improves health promoting behaviours. By lessening the effects of physical activity setbacks or failures, individuals may be less likely to disengage from health promoting behaviours.

Various additional mechanisms through which self-compassion can impact health behaviours have been proposed. For example, self-compassion is thought to improve self-regulation for health behaviours by reducing self-criticism, by lowering emotional states, and decreasing

defensiveness (Terry & Leary, 2011). Self-compassion is also hypothesized to improve medical adherence, such as following the doctor's orders for taking medication and making appropriate lifestyle changes, through these processes (Terry & Leary, 2011). Self-compassion is not only thought to help individuals self-regulate health-promoting behaviours, but also to improve their ability to disengage from goals associated with unhealthy behaviours (Terry & Leary, 2011).

Relationships between self-compassion and physical health and health behaviours have also been considered (Dunne et al., 2016; Phillips & Hine, 2019). In a correlational study, Dunne et al. (2016) concluded that self-compassion had an indirect effect on physical health through health-promoting behaviours in adults; those with higher levels of self-compassion were more likely to have better scores of physical health because they engaged in more health-promoting behaviours such as exercising, healthy eating, adequate sleep, and relaxation with a large effect ($R^2 = .26$). (Dunne et al., 2016). Using a meta-analysis of intervention studies, Phillips and Hine's (2019) found small to medium effects such that self-compassion was positively correlated with health behaviours (i.e., physical exercise and diet) and that this relationship was stronger than the relationship between self-compassion and physical health outcomes (e.g., heart rate, metabolism, physical symptoms, and pain). Notably, the self-compassion interventions had a positive medium effect on the relationship between self-compassion and health behaviours (Phillips & Hine, 2019). The results suggest that improving self-compassion may aid in improving health behaviours (Phillips & Hine, 2019).

Bosshard (2020) assessed the effects of a one-week self-compassion journaling intervention on health behaviours (e.g., physical exercise, healthy eating, cigarette smoking) in adult women. In a mediation analysis, self-compassion was associated with lower levels of behavioural resistance and therefore, predicted higher levels of health behaviour. However, both the self-

compassion intervention group and the control group, who practiced general journaling, increased their health behaviours; there were no between group differences in health behaviours. Bosshard (2020) hypothesized that self-compassion interventions with a longer duration might be more effective in improving health behaviours. Additionally, the self-compassion writing prompts were based on everyday negative experiences and did not reflect self-compassion in the context of health behaviours. As can be seen self-compassion may be beneficial for promoting health behaviours.

Self-Compassion and Physical Activity

With previous research suggesting that self-compassion affects positive health behaviours, researchers hypothesized that self-compassion may have a similar effect on engagement and maintenance of physical activity (Hallion et al., 2019). In Thakur and Joshi's (2016) research, higher self-compassion and self-esteem were both present in adolescents who engaged in more exercise. Active individuals who engaged in 30 minutes of exercise 5 days a week had higher self-compassion and self-esteem scores (Thakur & Joshi, 2016). Conversely, Hallion et al.'s (2019) found that self-compassion did not predict any unique variance in physical activity beyond self-regulation in middle aged adults. Results from this study are not consistent with previous research indicating that there may be a relationship between self-compassion and health behaviours such as physical activity (Magnus et al., 2010; Wong et al., 2021).

Despite the inconsistent findings of primary studies, meta-analytic results support a positive association between physical activity and self-compassion ($r = .26$) in studies with participants ranging from 14-75 years old (Wong et al., 2021). For example, a meta-analysis found that self-compassion was positively associated physical activity and that physical activity interventions improve self-compassion scores (Wong et al., 2021). Wong et al. (2021) suggested

for researchers to investigate the association between self-compassion and physical activity further in adolescents as most of the research focused on middle-aged and older adult participants.

Self-Compassion Interventions

Given past findings outlining the favourable role of self-compassion for a variety of outcomes, researchers have begun to develop and test self-compassion interventions aimed at improving self-compassion. A commonly used intervention in the self-compassion literature is self-compassionate letter writing. In one of the first interventions, Leary et al. (2007) induced self-compassion through the implementation of three self-compassion writing prompts targeting common humanity, self-kindness, and mindfulness in a university sample. After the intervention, participants in the self-compassion group had significantly lower negative affect scores compared to those in the writing control group (unprompted writing about negative events), the self-esteem induction group (letter writing based on self-esteem prompts), and the passive control group. Leary et al. (2007) hypothesized that the self-esteem intervention group did not yield the same effect as the self-compassion intervention group because the self-compassion intervention induced the participants to think of others instead of focusing on only themselves. Another weeklong intervention of daily self-compassion letter writing activities yielded similar results in a Canadian adult sample (Shapira & Mongrain, 2010). The participants experienced increased levels of happiness and decreases in depression at post-intervention with small effects (Shapira & Mongrain, 2010).

In an 8-week Mindful Self-Compassion program in an adult sample, participants were asked to write a letter to themselves from the perspective of a compassionate friend after each self-compassion session (Neff & Germer, 2013). After self-compassion workshops, self-

compassion letter writing, and mindful meditation practices, participants had significantly higher scores of self-compassion (large effect), mindfulness and decreases in depression, anxiety, and stress from pre to post-intervention with small to large effects (Neff & Germer, 2013).

Self-compassion interventions have also been applied in specific populations or contexts. For example, a self-compassion letter writing intervention was examined by Kelly and Waring (2018) to increase treatment seeking in individuals diagnosed with anorexia nervosa. The participants were asked to write a self-compassionate letter to themselves once a day for 15 to 20 minutes for a two-week period. Participants reported increased self-compassion, decreased shame, and improved motivation for help seeking as a result of the intervention with small to medium effect sizes. In another study, in male veterans a self-compassion intervention was tested to reduce trauma related guilt through self-compassion letter writing, awareness of present moment experiences, and using their self-compassion as motivation for 5 to 15 minutes a day for a 4-week period (Held & Owens, 2015). The self-compassion activities were effective in reducing trauma related guilt (large effect) (Held & Owens, 2015).

Previous research implementing self-compassion letter writing interventions for a week duration found significant improvements in happiness, physical symptoms, depression, shame, and self-criticism with small to medium effects (Johnson & O'Brien, 2013; & Mosewich et al., 2013; Sharipa & Mongrain, 2010; Wong & Mak, 2016). Within each of these studies, the amount of self-compassion letter writing activities varied. For example, some letter writing interventions occurred daily for the week duration in adult samples (Bosshard 2020; Shapira & Mongrain, 2010). On the other hand, several studies had university students and university athletes write 3 to 5 self-compassion letters in 7-day interventions (Johnson & O'Brien; Mosewich et al., 2013; Wong & Mak, 2016).

Self-Compassion Interventions for Health Behaviours. Self-compassion interventions have also been used in health contexts to improve health behaviours. Specifically, 10 minutes of daily self-compassion journaling for a weeklong period improved within group differences for the overall frequency of the following health behaviours: physical exercise, healthy eating, bedtime procrastination, cigarette smoking, and alcohol drinking in women (Bosshard, 2020). The active control group wrote about positive and negative experiences that day and had a similar effect on health behaviours as the intervention group, indicating that there were no significant differences between the effectiveness of the self-compassion intervention and the active control group. Bosshard (2020) suggested that a self-compassion intervention longer than the one-week duration might have a greater effect on health behaviours. It is also important to note that the self-compassion writing prompts were not tailored to target self-compassion in a health behaviour context. Instead, participants were asked to write self-compassionate letters to themselves based on their day's events (e.g., being late in traffic) (Bosshard, 2020).

Self-compassion letter writing interventions have also been used to reduce cigarette smoking (Kelly et al., 2010). Participants who were seeking help to quit smoking engaged in self-compassion letter writing and self-compassion imagery at two time points throughout a three-week intervention period (Kelly et al., 2010). Smoking behaviour reduced significantly after the self-compassion intervention for participants who were low in readiness to change and high in self-criticism with small effects compared to self-energizing and self-monitoring interventions. Following this research, Kelly and Carter (2015) tested a 3-week daily self-compassion intervention with participants with binge eating disorder. Participants were presented with self-compassion information through a PowerPoint presentation and subsequently engaged in daily self-compassion imagery and self-compassion letter writing. The self-compassion

intervention significantly increased self-compassion and reduced eating and weight concerns with small effects when compared to the other groups. Lastly, a self-compassionate meditation program over a 5-week period increased weight loss more than the control group that was exposed to psycho-educational material about healthy eating in military employees, though the result was not significant (Mantzios & Wilson, 2014).

Self-Compassion Interventions in Physical Activity Contexts. To date, only a few studies have tailored self-compassion interventions to physical activity contexts. Mosewich et al.'s (2013) research modified the self-compassion letter writing activity used in the interventions mentioned above from Leary et al. (2007) to a sport context. Physical activity was not an outcome of this study, though the participants were varsity athletes who were experiencing self-criticism (Mosewich et al., 2013). Through a weeklong self-compassion intervention, participants completed five modules that entailed psychoeducation and self-compassion letter writing (Mosewich, 2013). The active control group completed five writing modules about issues in sport that were unrelated to self-compassion. The participants in the active control group listened to a brief psychoeducation presentation on the importance of writing and journaling for athletes. The participants in the self-compassion group listened to a psychoeducation presentation on self-compassion (i.e., what is self-compassion, how self-compassion is beneficial). Following both presentations, the participants were asked to practice a letter writing module similar to what they would do for the next several days. During the week of the intervention, the self-compassion group wrote self-compassionate letters to themselves about a negative event in sport, whereas the control group wrote about technical skills used in their sport. The self-compassion letter writing intervention reduced the athletes' self-criticism and rumination in sport with medium-to-large effects (Mosewich et al., 2013).

Self-Compassion, Physical Activity, and Motivation

To better understand the relationship between self-compassion and physical activity, researchers have studied each of their relationships with autonomous motivation. Neff (2003b) hypothesized that self-compassion is linked with autonomous motivation given their shared connection with true self-esteem; individuals high in true self-esteem should also display high self-compassion and more autonomous motivation to engage in behaviours. To this end, researchers have found that autonomous motivation for exercise is positively related to self-compassion in adults (Kullman et al., 2021; Semenchuk et al., 2018) and physical activity in adolescents (Duncan et al., 2017).

Although most research supports the relationship between self-compassion and physical activity (Thakur & Joshi, 2016; Wong et al., 2021), a couple of studies have inconsistent findings. For example, Hallion et al. (2019) found that self-compassion did not uniquely predict physical activity behaviour beyond self-regulation. Similarly, in unpublished dissertation work, Gilbertson's (2016) found self-compassion did not contribute significant variance to physical activity beyond self-regulation. Although self-regulation and the SDT sub-types of motivation are not interchangeable constructs, SDT can be used to help understand self-regulated behaviours (Hagger et al., 2014). That is, wanting to engage in a behaviour because you enjoy or value it (i.e., autonomous motivation) can be used to describe how behaviour is self-regulated (Hagger et al., 2014). Being autonomously motivated is a form of self-regulation that can help maintain behaviour (Hagger et al., 2014; Teixeira et al., 2012). Gilbertson's (2016) unpublished dissertation research supports that there was a large overlap between self-regulation and self-compassion which are independent constructs but have some similarities. For this reason, Gilbertson (2016) suggested for future research to test the possible moderating relationship of

intrinsic and extrinsic motivation between self-compassion and physical activity commitment because self-compassion may only predict physical activity with the influence of motivation.

To my knowledge, only one unpublished study (Wong, 2019) has examined the nature of the relationship between self-compassion, autonomous motivation, and physical activity simultaneously. Wong's (2019) dissertation examining a self-compassion intervention with college students found that it was not associated with increases in physical activity or autonomous motivation, but Wong cautioned that the results were underpowered. Based on theory (Neff 2003a; Ryan & Deci, 2000) and past research that showed that (1) autonomous motivation is associated with physical exercise (Teixiera et al., 2012), (2) self-compassion is associated with physical activity (Magnus et al, 2010; Thakur & Joshi, 2016; Wong et al., 2021) and (3) self-compassionate individuals are more likely to engage in autonomously motivated behaviours (Kullman et al., 2021; Neff, 2003b), the association between self-compassion and physical activity may be more pronounced for those who have autonomous motivation towards exercise. For example, having self-compassion might influence physical activity engagement, but having self-compassion while also wanting to engage in physical activity for your values, interest, and enjoyment (i.e., autonomous motivation) might strengthen the relationship. Indeed, Gilbertson (2016) recommended researchers explicitly investigate if motivation moderates the relationship between self-compassion and physical activity. To this end, the overall purpose of this thesis was to examine the nature of the relationship between self-compassion, autonomous motivation, and physical activity using observational and experimental designs. In this study, autonomous motivation for exercise was examined as a moderator (versus controlled motivation or individual types of regulation) because it encompasses three forms of regulation (intrinsic,

identified, and integrated) in SDT that are positively associated with each other (Standage et al., 2008) and related to physical activity (Duncan et al., 2017).

Justification for the Current Study

The justification for this research is three-fold. First, there are inconsistencies in the literature regarding the relationship between self-compassion, physical activity, and exercise motivation. Theory and cross-sectional studies suggest a relationship between self-compassion, autonomous motivation, and physical activity (Kullman et al., 2021; Teixeira et al., 2012; Thakur & Joshi, 2016). In contrast, an experimental study from an unpublished dissertation (Wong, 2019) found that a self-compassion writing intervention had no effect on autonomous motivation and physical activity. It is possible that self-compassion is only related to physical activity for people who are higher in autonomous motivation. More research using both designs (observational and experimental) is needed to further examine these relationships and the moderation hypothesis (Gilberston, 2016). Second, more research is needed to understand the factors that are related to increasing physical activity. As noted above, frequent participation in physical activity has been associated with positive health benefits (Haskell et al., 2009; Warburton et al., 2006), and yet for some Canadians, physical activity levels decreased amid the COVID-19 pandemic (ParticipACTION, 2021). Third, studying the relationship between physical activity and self-compassion in university students is important as Alkhateeb et al. (2019) suggested that exercise and involvement in recreational sports decreased in university students' transition to post-secondary education. As well, the decline in physical activity in university students has been linked to academic activities, and lifestyles changes in a qualitative study (Deliens et al., 2015).

This thesis involved two studies. The overall purpose of this series of studies was to examine the relationship between self-compassion, autonomous motivation for exercise, and

physical activity. These studies were conducted online as they occurred amid COVID-19 restrictions. The first study used an observational design to examine autonomous motivation for exercise as a potential moderator of the relationship between self-compassion and physical activity. Based on the findings of the first study, the second study used an experimental design to examine if self-compassionate writing could increase autonomous motivation for exercise and physical activity.

Study 1 Research Question and Hypothesis

Research question: Does autonomous motivation for exercise moderate the relationship between self-compassion and physical activity?

Hypothesis: The relationship between self-compassion and physical activity would be stronger for individuals with higher autonomous motivation for exercise compared to those with lower autonomous motivation for exercise.

Methods: Study 1

Study Design and Procedures

In Study 1, I used an observational, cross-sectional research design. Perugini et al. (2018) suggests that approximating an effect size for a moderated regression analysis is appropriate when the independent variables are not highly correlated (e.g., around .25 or less). Notably, researchers have found small-to-moderate correlations between (1) autonomous motivation for exercise and self-compassion ($r = 0.20$) (Kullman et al., 2021), (2) self-compassion and physical activity ($r = 0.26$; Wong et al., 2021), and (3) autonomous motivation and physical activity ($r = 0.331$; Duncan et al., 2017). The equation from Perugini et al. (2018), was used to compute a b-coefficient for the interaction term ($b = 0.13$) and then an effect size of ($f^2 = 0.02$). A power

analysis using G*Power determined that the minimum sample size needed to detect a small effect ($f^2 = 0.02$) with 80% power and an alpha of 0.05, was 587 participants.

Data were collected online via Qualtrics from January 2021 to April 2021 through the online Carleton University SONA system. Participants were first- and second-year Carleton University students enrolled in PSYC 1001, 1002, 2001, or 2002. To participate in the study, participants had to be able read and understand English and be 18 years or older. Informed consent was obtained prior to participants beginning the online survey. See Appendix A for ethics materials and Appendix B for eligibility questions.

Measures

Autonomous Motivation

Autonomous motivation for exercise was assessed with the BREQ-3 (Markland & Tobin, 2004; Wilson et al., 2006). The BREQ-3 is composed of 24 items with six sub-scales: external regulation (i.e., “I exercise because people say I should”; 4 items), introjected (i.e., “I feel guilty when I don’t exercise”; 4 items), identified (i.e., “It’s important to me to exercise regularly”; 4 items), integrated (i.e., “I exercise because it is consistent with my life goals”; 4 items), and intrinsic regulation (i.e., “I enjoy my exercise sessions”; 4 items), along with amotivation (i.e., “I don’t see why I should have to exercise”; 4 items). Responses were made on a 4-point scale (0 = *not true for me*, 4 = *very true for me*) (Markland & Tobin, 2004; Wilson et al., 2006). To compute scores for autonomous motivation, the bifurcation scoring method was used (Standage et al., 2008; Wilson et al., 2012). The averages of the intrinsic, identified, and integrated subscales were computed to create a total average score of autonomous motivation (Kullman et al., 2021; Standage et al., 2008; Wilson et al., 2012). The internal consistency estimates for the BREQ-3 subscales computed by Wilson et al. (2006) were as follows: external regulation (α

=.82), introjected regulation ($\alpha = .81$), identified regulation ($\alpha = .78$), integrated regulation ($\alpha = .92$), and intrinsic regulation ($\alpha = .93$). Construct validity of the scale was also supported in Wilson et al. (2006). See Appendix C for full measure.

Self-Compassion

Self-compassion was assessed with the 26-item Self-Compassion Scale (SCS) (Neff, 2003a). The SCS has 6 subscales: (1) common humanity (i.e., “When I am down I remind myself that there are lots of people in the world feeling like I am”; 4 items), (2) self-kindness (i.e., “I try to be loving towards myself when I’m feeling emotional pain”; 5 items), (3) mindfulness (i.e., “When something upsets me I try to keep my emotions in balance”; 4 items), (4) self-judgement (i.e., “I am disapproving and judgemental about my own flaws and inadequacies”; 5 items), (5) isolation (i.e., “When I am feeling down I tend to feel like most other people are probably happier than I am”; 4 items), and (6) overidentification (i.e., “When I am feeling down I tend to obsess and fixate on everything that’s wrong”; 4 items). Self-judgement, isolation, overidentification were reversed scored to reflect the 3 main components of self-compassion (Neff, 2003a). Responses were made on a 5-point scale (1 = *almost never*, 5 = *almost always*). Self-compassion subscale scores were created by averaging items for their respective subscales. An overall self-compassion score was created by averaging all mean subscale scores (Neff, 2003a). Internal consistency for the subscales ranged from .75 to .81 and was considered to have good overall test-retest reliability (.93) (Neff, 2003a). Construct validity of the SCS was supported after its correlation with the Self-Criticisms subscale was significantly negative and its correlation with measures of Social Connectedness and Trait-Meta Mood Scales were significant and positive (Neff, 2003a). See Appendix C for the full measure.

Leisure Time Exercise

The Leisure Time Exercise Questionnaire (LTEQ) was designed to assess self-reported physical activity over a 7-day period (Godin & Shepard, 1985). Total physical activity scores were obtained from weekly frequencies of strenuous (i.e., running), moderate (i.e., fast walking), and mild physical activity (i.e., easy walking). Each occurrence of physical activity was defined by 15 minutes or more of activity. Total weekly physical activity scores were computed by summing the products of the total activity physical scores (i.e., $9 \times \text{Strenuous} + 5 \times \text{Moderate} + 3 \times \text{Mild}$) (Godin & Shepard, 1985). Additionally, by summing weighted moderate and strenuous activity scores, self-reported physical activity can be placed into 3 levels: Active (24 units or more), Moderately Active (14 to 23 units), and Insufficiently Active (less than 14 units) (Godin, 2011). The validity of this scale was deemed satisfactory by Amireault and Godin (2015) from the k coefficients found at 15 days (.65) and at 30 days (.45) for a healthy sample ranging from 18 to 64 years of age. The overall test-retest reliability measured by a kappa coefficient was 0.40. The kappa coefficient for measures within a 15-day period (0.65) was considered satisfactory, whereas retests within 30 days obtained a kappa coefficient of 0.45 (Amireault & Godin, 2015). As well, there was 72% agreement between physical activity scores for test-retest reliability (Amireault & Godin, 2015). See Appendix C for full measure.

Demographics, Weight, and Height

Undergraduate students were asked to indicate their age, ethnicity, parents' marital status, parents' highest level of education, weight, and height (see Appendix B for measures of demographics).

Attention Checks and Honesty Measure

Participants responded to one attention check question that was embedded into each of the questionnaires (SCS and BREQ-3). To pass the attention check participants had to respond accordingly with the following statement: *please select 1 for this response*. Additionally, at the end of the questionnaire participants were asked to complete a measure of whether they answered honestly throughout the survey: *Did you read all of the questions and answer them honestly (yes or no)?*

Analysis Plan

Data Cleaning

Data analysis for Study 1 was conducted in SPSS Version 27 (IBM Corp, 2020). Data cleaning involved removing duplicate cases, inspecting adherence to attention check questions embedded in the SCS and the BREQ-3, and removing participants who self-reported that they did not answer the survey honestly.

Given that item level missing data were expected to be low, (less than 5%; Aminu & Shariff, 2014; Tabachnick & Fidel, 2007), mean imputation was used at the item level on missing items, with the exception of the LTEQ. Mean imputation was not appropriate for missing items on the LTEQ because it is a physical activity measure composed of different activity levels (i.e., strenuous, moderate, and mild). Therefore, listwise deletion was used in the presence of missing data on the LTEQ.

To identify and remove outliers on the LTEQ, BREQ-3, and SCS, *z*-scores were assessed using the *z*-score < +/-3.3 approach (Amireault et al., 2015; Tabachnick & Fidel, 2007). Although it was a possibility that outlier LTEQ scores were valid, they were removed from the analysis as they were considered extreme scores in the dataset.

Validity and Reliability of the BREQ-3 and SCS

Estimates of internal consistency (alpha) were estimated for subscale scores of the SCS and BREQ-3 autonomous motivation subscales. To examine validity evidence based on factor structure for responses to the SCS and the BREQ-3, two higher-order confirmatory factor analyses (CFA) were estimated using the robust maximum likelihood estimator in Mplus 8.0 and default parameterizations (Muthén & Muthén, 2017). For the BREQ-3, one higher-order factor representing autonomous motivation was specified to load onto three lower order latent factors of intrinsic, integrated, and identified regulation. For the SCS, one higher-order factor representing self-compassion was specified to load onto six lower order latent factors of self-kindness, mindfulness, common humanity, self-judgement, isolation, and over-identification. For the analyses, the global model fit was evaluated based on the comparative fit index (*CFI*), and root mean square error of approximation (*RMSEA*), and standardized root mean square residual (*SRMSR*). *CFI* values are considered acceptable when the values fall above the suggested ranges of 0.90 and 0.95 (Hu & Bentler, 1999; Marsh et al., 2004) and *RMSEA* values are acceptable when values fall below 0.05 (Hu & Bentler, 1999). *SRMSR* values below .08 were used to indicate good fit of the model (Hu & Bentler, 1999). Chi-square values are presented but were not interpreted as indicators of fit as they are sensitive to sample size (Hoyle & Panter, 1995; Marsh et al., 2004).

Main Analysis

Frequencies, percentages, means, standard deviations, kurtosis, and skewness values were computed to describe the participants. Bivariate correlations between the variables of interest were estimated. Heteroscedasticity was checked by the Breusch-Pagan test (Daryanto, 2020). If heteroscedasticity was present, the Huber White corrected standard errors were applied using

Process Macro. Normality of the residuals were checked with scatterplots and the Shapiro Wilk test. Multicollinearity was checked by tolerance and VIF values as well as bivariate correlations between independent variables. VIF scores were determined acceptable when the scores were not above 3 (Hair et al., 2019). Linearity was checked visually with scatterplots between the predictor and outcome variables.

The main analysis consisted of two separate models examining moderation using SPSS PROCESS Macro (Hayes, 2013). The first model was unadjusted and included no covariates whereas the second model was adjusted by including age as a covariate. Age was selected as a covariate because age is negatively correlated with physical activity for men (Dowda et al., 2003) and youth (Baldursdottir et al., 2017; Nader et al., 2008), and age is positively associated with self-compassion (Murn & Steele, 2019; Neff & Pommier, 2013; Neff & Vonk, 2009). In both models, self-compassion was entered as the independent variable, autonomous motivation was entered as the moderator and physical activity was entered as the dependent variable.

Results: Study 1

Data Cleaning

A total of 945 survey responses were collected for Study 1. One duplicate case was identified and removed from the dataset. Participants who did not pass the attention check questions ($n = 495$) or indicated that they did not answer the survey questions honestly or did not answer the honesty question ($n = 40$) were removed from the dataset. Listwise deletion was used for missing responses on the LTEQ, resulting in 16 participants being removed from all analyses. Missing data on items from the BREQ-3 and SCS were replaced using mean imputation.

Outliers. No outliers ($z > 3.30$) were identified for autonomous motivation or self-compassion. A total of 6 outliers were identified for LTEQ overall score.¹ Inspection of the outliers indicated that it was possible that these participants misinterpreted the question and reported minutes of physical activity instead of bouts of physical activity. After completing data cleaning, 387 participant cases were retained for the main analysis.

Linear Regression Assumption Tests. The Breusch-Pagan test revealed that the assumption of homoscedasticity was violated in the adjusted model ($LM = 9.02, p = .029$) and the unadjusted model ($LM = 8.81, p = .012$) (Daryanto, 2020). Therefore, the Huber White corrected standard errors were applied to both the adjusted and unadjusted models in PROCESS Macro (Hayes, 2013; Hayes & Cai, 2007). Examining normality of residuals, visual inspection of the scatterplots indicated non-normality and the Shapiro Wilk test ($W = .96, p < .001$) was significant. The model was robust against non-normality due to the large sample size and the Central Limit Theorem (Darlington & Hayes, 2016; Field, 2013). The bivariate correlations between the independent variables showed that multicollinearity was not an issue in both the adjusted and unadjusted model as none were greater than $r = .70$ (Dormann et al., 2013). Tolerance and VIF scores in the adjusted and unadjusted model were acceptable.

The scatterplot of autonomous motivation for exercise scores and physical activity scores supported a linear relationship. The scatterplot of self-compassion scores and physical activity scores did not resemble a linear relationship with the majority of the data were clustered towards the center of the graph though no curvilinearity issues were detected. To increase the

¹ The first z-score analysis for physical activity flagged 3 cases as outliers ($z = 16.53, z = 6.08$, and $z = 5.88$). The bouts of exercise reported in a 7-day period ranged from 30 – 195 (strenuous), 25 - 55 (moderate), 45 - 210 (mild). These outliers were removed and the z-score analysis was ran again. 3 more cases were flagged as outliers ($z = 5.89, z = 3.98$, and $z = 3.35$) and were removed. The bouts of exercise reported in a 7-day period ranged from 0-14 (strenuous), 7-30 (moderate), 5-30 (mild).

interpretability of the regression results for the interaction, the predictor variables were mean-centred (Darlington & Hayes, 2016).

Participant Descriptive Statistics

Participants were 387 undergraduate students who ranged in age from 17 to 48 years old ($M_{age} = 19.69$ years, $SD = 2.69$). Participants' average BMI was 23.29 kg/m², ($SD = 4.76$, $n = 382$). The ethnicity of the sample was predominately White (58.9%) (See Table 1). The majority of the sample had married parents (61.5%). Twenty-four percent of the sample reported having divorced parents, 12% reported that their parents have never been married, and 1.6% of participants reported having a widowed parent. The majority of the participants had a parental guardian with their highest level of education being a bachelor's degree (35.1%), followed by a college degree (26.9%), a graduate or professional degree (26.1%), completed high school education (8.5)%, some high school (2.8%), and less than a high school degree (.5%).

Table 1

Frequencies of Self-Identified Ethnicities

| Ethnicity | Frequency (<i>n</i>) | % |
|----------------------------------------|------------------------|------|
| White | 228 | 58.9 |
| White and Japanese | 3 | 0.8 |
| White and West Indian | 3 | 0.8 |
| White and Chinese | 3 | 0.8 |
| White and Black | 2 | 0.5 |
| White and Filipino | 4 | 1 |
| White, Latin American, and Filipino | 1 | 0.3 |

| Ethnicity | Frequency (<i>n</i>) | % |
|------------------------------------------|------------------------|-----|
| White and Arab | 2 | 0.5 |
| White, Arab and 13 | 1 | 0.3 |
| White and West Asian | 1 | 0.3 |
| Korean | 1 | 0.3 |
| Chinese | 21 | 5.4 |
| Chinese, Latin American, and Japanese | 1 | 0.3 |
| South Asian and Black | 1 | 0.3 |
| Black | 30 | 7.8 |
| Black and further specified | 1 | 0.3 |
| Filipino | 4 | 1 |
| Filipino and South East Asian | 1 | 0.3 |
| Filipino and Arab | 1 | 0.3 |
| Latin American | 6 | 1.6 |
| South East Asian | 7 | 1.8 |
| Arab | 23 | 5.9 |
| Arab and West Indian | 1 | 0.3 |
| West Asian | 2 | 0.5 |
| South Asian | 24 | 6.2 |
| Not Sure | 1 | 0.3 |
| Further Specified | 9 | 2.3 |
| Not sure and further specified | 2 | 0.5 |

Note. Participants were able to self-identify with multiple ethnicities and use an additional text box to provide further information (noted as “further specified” in the table).

Based on Godin’s (2011) activity thresholds using physical activity scores, 20.9% of participants were considered sedentary, 12.4% of participants were considered moderately active, and 66.7% of participants were considered active. See Table 2 for descriptive statistics of the study variables.

Table 2

Descriptive Statistics for Study Variables

| Variable | α | M | SD | Range | Skewness | Kurtosis |
|---------------------------------------|----------|-------|-------|-------------|----------|----------|
| Self-Compassion | .83 | 2.82 | .06 | 1.00 - 4.68 | .10 | .05 |
| Autonomous motivation for exercise | .91 | 2.22 | 1.01 | 0 - 4.00 | -.07 | -.84 |
| Physical Activity (LTEQ) | — | 41.36 | 30.83 | 0 - 142.50 | .75 | .04 |

Note. M = mean; SD = standard deviation; α = internal consistency.

Validity and Reliability of the BREQ-3 and SCS

The internal consistency values were acceptable, with all α values from the main variables (i.e., self-compassion and autonomous motivation for exercise) and their respective sub-scales ranging from .78 to .93 (See Table 2). The higher-order CFA model of the BREQ-3 (i.e., the subscales of intrinsic, integrated, and identified related to autonomous motivation for exercise) revealed an acceptable fit to the data based on CFI and SRMR (CFI = .94, SRMR = .04). The RMSEA was higher and indicated a less than acceptable fit (RMSEA = .01, 90% confidence interval [0.09, 0.11]). The higher-order CFA model of the SCS (i.e., the sub-scales of

self-kindness, common humanity, mindfulness, isolation, over-identification, and self-judgement related to self-compassion) did not indicate an acceptable fit based on the RMSEA (.07, 90% confidence interval [0.06, 0.08]), CFI (.85) and SRMR (.11). The model parameters were acceptable. There were no standardized values over one. The factor loadings on the lower order factors ranged from .55 to .81. The factor loadings from common humanity to self-compassion was somewhat lower (.34) compared to the remaining factor loadings from the subscales to self-compassion (.58 to .95). Modification indices suggested numerous cross-loadings and correlated residuals. Post hoc modification based on modification indices alone was not undertaken as there was no previous theoretical justification to do so. Chi-square values for the BREQ-3 ($\chi^2(51) = 243.52, p < .001$) were and for the SCS were ($\chi^2(325) = 4228.08, p < .001$).

Bivariate Correlations

Pearson bivariate correlations were calculated between the main variables (See Table 3). Self-compassion and physical activity were both positively associated with autonomous motivation for exercise. Self-compassion was not significantly associated with physical activity. Age was not significantly associated with self-compassion, autonomous motivation for exercise, or physical activity.

Table 3*Correlations for Study Variables (uncentred variables)*

| Variable | 1 | 2 | 3 |
|------------------------------------------|-------|-------|-----|
| 1. Self-Compassion | – | | |
| 2. Autonomous Motivation for exercise | .28** | – | |
| 3. Physical Activity (LTEQ) | .08 | .50** | – |
| 4. Age | .06 | .08 | .05 |

Note. * $p < .05$. ** $p < 0.01$. Dashes represent data that was not obtained.

Main Analyses

Unadjusted Model. As a whole, the unadjusted model predicted 25.43% variance in physical activity. The main effect of autonomous motivation for exercise was positively associated with physical activity (see Table 4). Neither the main effect of self-compassion nor the interaction between Self-compassion and autonomous motivation for exercise were associated with physical activity (see Table 4).

Adjusted Model. The adjusted model included age as a covariate. As a whole, the adjusted model predicted 25.46% variance in physical activity. The main effect of autonomous motivation for exercise was positively associated with physical activity (see Table 4). Neither the main effect of self-compassion, nor age were associated with physical activity. The interaction term between self-compassion and autonomous motivation for exercise was not associated with physical activity (see Table 4).

Table 4*Results of the Moderation Analyses*

| | Unadjusted Model | | | | | Adjusted Model | | | | |
|--------------------------------------------|------------------|-----------|-----------------------|---------------|----------|----------------|-----------|-----------------------|---------------|----------|
| | <i>B</i> | <i>SE</i> | <i>R</i> ² | 95% <i>CI</i> | <i>p</i> | <i>B</i> | <i>SE</i> | <i>R</i> ² | 95% <i>CI</i> | <i>p</i> |
| Model | | | 0.25 | | < .001 | | | 0.25 | | < .001 |
| Self-Compassion (SC) | -3.20 | 2.26 | | -7.66, 1.25 | .16 | -3.23 | 2.26 | | -7.68, 1.21 | .16 |
| Autonomous Motivation for exercise (AM) | 15.74 | 1.13 | | 13.51, 17.97 | < .001 | 15.70 | 1.13 | | 13.46, 17.94 | < .001 |
| SC x AM | -0.93 | 1.85 | | -4.57, 2.72 | .62 | -1.04 | 1.88 | | -4.75, 2.65 | .57 |
| Age | — | — | | — | — | 0.20 | 0.49 | | -0.75, 1.16 | .68 |

Note. SC = Self-Compassion; AM = Autonomous Motivation for exercise; SC x AM = interaction of self-compassion and autonomous motivation for exercise; *B* = unstandardized coefficient; *SE* = standard error; 95% *CI* = 95% Confidence Interval. Age was not included in the unadjusted model therefore these cells are represented with a dash.

Discussion: Study 1

My goal for Study 1 was to test if autonomous motivation for exercise moderated the relationship between self-compassion and physical activity. The results did not support my hypothesis; autonomous motivation for exercise did not moderate the relationship between self-compassion and physical activity. Moreover, although autonomous motivation for exercise was associated with physical activity, self-compassion was not associated with physical activity in the current study.

The null moderation result is inconsistent with Gilbertson's (2016) contention that intrinsic motivation may moderate the association between self-compassion and physical activity commitment. It is possible the absence of an interaction was caused by the study being underpowered by 200 participants ($N = 387$) when a minimum sample size of 587 participants was needed. Additionally, to calculate the power for this study using Perugini et al.'s (2018) method the association between self-compassion and autonomous motivation for exercise had to be considered mild ($r < .25$) in previous literature. Self-compassion and autonomous motivation for exercise in the current study was slightly higher than that ($r = .28$). Another possibility is that the context of autonomous motivation for exercise and self-compassion measures differed. In particular, autonomous motivation was specific to an exercise context, whereas self-compassion was measured as a general construct and did not assess self-compassion towards exercise specifically. Lastly, there is a possibility that Gilbertson's (2016) suggestion for future research to look at motivation (intrinsic and extrinsic motivation) as a moderator was incorrect for at least autonomous motivation as assessed herein.

Autonomous motivation for exercise was associated with physical activity. Based on previous literature this result is consistent with autonomous motivation being positively

associated with weekly MET minutes (Duncan et al., 2017) and bouts of exercise (Standage et al., 2008). Additionally, autonomous motivation for exercise was found to be a predictor of exercise in a systematic review (Teixeira et al., 2012). Teixeira et al. (2012) suggested that exercise outcomes and maintenance of exercise could be related to valuing exercise. In other words, people who enjoy and value exercise (i.e., autonomous motivation) may be more likely to engage in exercise over time.

I found that physical activity was not associated with self-compassion. Previous research on the relationship between self-compassion and physical activity has been mixed (Gilbertson, 2016; Hallion et al., 2019; Magnus et al., 2010; Thakur & Joshi, 2016; Wong et al., 2021). Wong et al. (2021) stated that the significant relationship between self-compassion and physical activity found in their meta-analysis may be due to the type of physical activity that participants were engaging in. For example, yoga and tai chi were frequent types of physical activity in the meta-analysis which are thought to be related to mindfulness, a sub-component of self-compassion (Wong et al., 2021). In the current study, physical activity was measured as leisure time exercise and the types of activities that participants were engaging in were not collected. Therefore, researchers could measure the type of physical activity participants are engaging in to see if specific types of physical activity are related to self-compassion.

Another possibility for the lack of relationship between physical activity and self-compassion in the present study could be that individuals were not recruited based on their physical activity experiences. Self-compassion is necessary during times of failure and hardship (Neff, 2003b). It is possible that students in this study were active and not experiencing physical activity setbacks (i.e., failing to commit to physical activity goals or not making time for physical activity) and so their self-compassion level did not influence their physical activity because it

was not needed. Another reason for the lack of relationship between physical activity and self-compassion in the present study could be that self-compassion was measured for life in general, not specifically for self-compassion towards physical activity. Individuals may be self-compassionate about other life domains such as family, work, and school, but not towards physical activity. Perhaps, self-compassion in general may not have an influence on physical activity, but self-compassion applied in an exercise specific context, may improve activity levels (i.e., being self-compassionate about exercising or a setback to exercising could enhance commitment to physical activity).

My study had several limitations. First, the study was underpowered decreasing the confidence in the findings. Second, the sample that was recruited may not have been struggling with physical activity and self-compassion, which is when self-compassion is theorized to work best. Third, the autonomous motivation measure was contextualized towards physical activity, but the self-compassion measure was not. Finally, the measure of SCS fell below conventional fit criteria for CFA with no obvious source of misfit. There is currently debate about how best to analyze and represent SCS scores (Halamová et al., 2020; Neff, 2016). Researchers should continue to investigate the factor structure of the SCS.

Study 2: Brief Rationale

Addressing some of the limitations noted in Study 1, the main research goal of Study 2 was to assess if increasing one's self-compassion *towards a physical activity setback* can improve their autonomous motivation towards exercise and increase their participation in physical activity by learning and applying self-compassionate thoughts.

In Study 1, the null results of the interaction effect could have been attributed to participants having average levels of self-compassion and not experiencing hardships in their physical activity pursuits. Self-compassion is theorized to be most useful when one experiences personal failures (Neff, 2003b). Therefore, in Study 2 individuals who were expected to have experienced a physical activity setback were purposively recruited because self-compassion was expected to be most useful to them and they may be lower in self-compassion. Lastly, the interaction effect in Study 1 was not statistically significant, so moderation was not investigated further in Study 2. Instead, autonomous motivation was examined as an outcome of self-compassionate writing.

Research Question: Does a self-compassion writing intervention increase physical activity and autonomous motivation towards exercise?

Hypothesis: The self-compassion intervention would increase physical activity and autonomous motivation for exercise scores for individuals who have experienced a physical activity setback.

Methods: Study 2

Study Design and Procedure

Study 2 used a within and between person experimental design with 3 conditions and 3 time point measures (pre-intervention, post-intervention, and follow-up). In total, the study took 23 days to complete (see Figure 1 for the study timeline). On Day 1, participants completed a baseline survey. After completing the survey, participants were randomly assigned to either a self-compassion writing group (i.e., intervention group), a physical activity writing control group, or an anagram word task control group via Qualtrics. On Day 2, participants were sent a survey link via Qualtrics email distribution system with the instructions for each day's writing or

word activity. They also received one activity per day for the next four days (i.e., Days 3-6). The participants could complete their daily activity at any time (e.g., morning, afternoon, evening) during the 24-hour period. Participants who had not completed the activity by 5 pm, were sent a reminder email. The last daily writing or word activity was sent on Day 6. A post-intervention survey was sent on Day 9, and the follow-up survey was sent 2 weeks after the post-intervention (i.e., Day 23). Participants had 48 hours to complete the post-intervention and follow-up surveys before the survey links expired. A reminder email was sent to participants that had not completed the survey 24 hours after the original email was sent.

In total, the participants could receive up to a total of 2.50% SONA credits. Additionally, participants who completed each time point of the study were entered into e-gift card draws for a chance to win two e-gift cards valued at \$50 and three e-gift cards valued at \$25.

Figure 1

Study Design Overview

| Variables | Baseline Survey (Day 1) | Activity 1 (Day 2) | Activity 2 (Day 3) | Activity 3 (Day 4) | Activity 4 (Day 5) | Activity 5 (Day 6) | Post-Intervention Survey (Day 9) | Follow-up Survey at 2 weeks post-intervention (Day 23) |
|------------------------------|-------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|----------------------------------|--------------------------------------------------------|
| Inclusion/Exclusion Criteria | X | | | | | | | |
| Informed Consent | X | | | | | | | |
| Demographic Variables | X | | | | | | | |
| Self-Compassion | X | | | | | | X | |
| Autonomous Motivation | X | | | | | | X | |
| Physical Activity (LTEQ) | X | | | | | | X | X |
| Physical Activity (IPAQ) | X | | | | | | X | X |
| Group Randomization | X | | | | | | | |
| Daily Email and Reminder | | X | X | X | X | X | X | X |

Note. The columns marked represent measures or procedures that occurred during specific periods of the study.

Participants

Participants were first-year Carleton University students enrolled in PSYC 1001 or 1002 courses. To participate in the study, individuals must have self-reported experiencing a physical activity setback within the past 6 months that they continued to think about and believed was their fault. See Appendix D for ethics materials.

Two power analyses were performed in G*Power to maximize sample size and account for attrition. Power was set at .80, alpha was set at .05, and a medium effect ($f^2 = 0.25$) was hypothesized. The effect size used in the power analysis was based off self-compassion writing

interventions yielding medium to large effects (Mosewich et al., 2013). Results indicated that 42 participants were needed for the pre- and post-intervention analyses and 36 participants were needed for the pre-, post- and follow-up analyses.

Pre-screening Eligibility Criteria

Participants responded to three pre-screening questions to determine whether the participants experienced a physical activity setback within the past 6 months: (1) *Have you experienced a physical activity setback within the past 6 months?* (2) *Do you believe the physical activity setback was your fault?* The criterion of having to believe the physical activity setback was their fault was implemented in research by Semenchuk et al. (2018) as it was theorized to help participants recall a personal exercise activity setback. (3) *How often do you think about this physical activity setback?* Participants responded on a 7-point Likert scale (0 = *never*, 6 = *always*), and were not eligible for the study if they answered 0 = *never*. See Appendix E for eligibility questions.

Experimental Manipulations

Self-Compassion Intervention Group

Participants viewed the psychoeducational component at the end of the baseline survey. The psychoeducation component included information about self-compassion (what is self-compassion and why is it important) and how to write a self-compassionate letter (Mosewich, 2013).

The day after the baseline survey and psychoeducational component (Day 1) participants completed five self-compassion letter writing modules that were adapted from Mosewich et al.'s (2013) study once per day over a consecutive 5-day period. Participants were told that their letters would not be submitted to the researcher and that the letters were for their own reflection

purposes only. The self-compassion letters were not collected for several reasons. Given that this research focuses on the effectiveness of the self-compassion letters rather than the content, the letters were not collected for a qualitative analysis. Further the self-compassion letters were not collected for ethical reasons, as it was seen as unethical to ask participants to submit their letters because the content of the letters would not be analyzed. Additionally, due to the nature of the letter being a personal letter about a physical activity setback, participants may not have felt comfortable sharing their thoughts and feelings about this difficult event or may have responded in a socially desirable way if they knew someone was reading it. See the Appendix F for the self-compassion intervention group protocol and writing prompts.

Control Group 1: Physical Activity Journaling

Participants in the physical activity control journaling control group viewed a psychoeducational component about the benefits of physical activity at the end of the baseline survey (Day 1). To rule out the possibility that writing letters in general could increase autonomous motivation for exercise and physical activity directly, this control group completed a 5-day writing intervention without self-compassion prompts. Having a similar physical activity context for the writing prompts in the experimental and physical activity journaling control groups would provide a stronger attestation to whether self-compassionate writing, rather than writing in general, improves autonomous motivation for exercise and physical activity. Participants randomly assigned to this condition wrote about their experiences with physical activity (e.g., types of activities, motivation for physical activity, and beliefs about the importance of physical activity). The physical activity letters were not collected by the research team. See the Appendix G for the physical activity journaling control group protocol and writing prompts.

Control Group 2: Anagram Word Tasks

Participants in the anagram word task control group were asked to complete three anagram word tasks for five consecutive days. They were given three words each day and were asked to create a new word from each word presented. The word tasks were not collected by the research team. This control group did not have a psychoeducation session or a letter writing component. This control group completed tasks that were unrelated to self-compassion and physical activity. This control group was included to rule out an intervention effect attributable to simply writing or psychoeducation regardless of content. In other words, if the anagram word task group was not included and there was no difference between the self-compassion intervention group and the physical activity journaling control group, it would be impossible to know if it was because writing in general or receiving a psychoeducational had similar effects regardless of the content of the writing and psychoeducation. As such, having this anagram word task group allows for the comparison of writing and psychoeducation against no writing and no psychoeducation. See Appendix H for the anagram word task control group activities.

Measures

The baseline survey included a demographic questionnaire in which participants were asked to identify their gender, age, ethnicity, living arrangements (i.e., on or off-campus), current employment status, and whether they have had an injury within the past 6 months. See Appendix E for full demographic measures. See Figure 1: Study Map for measures at each time point.

Autonomous motivation

The BREQ-3 (Markland & Tobin, 2004; Wilson et al., 2006) was used at the baseline and the post-intervention survey to assess autonomous motivation for exercise and is described in Study 1.

Self-Compassion

The SCS (Neff, 2003a) was used at the baseline and the post-intervention survey to assess self-compassion and is described in Study 1.

Physical Activity

Two physical activity measures were used to capture different aspects of physical activity. The LTEQ (Godin & Shepard, 1985) is described in Study 1 and was used at the baseline, post-intervention, and follow-up surveys. The prompt for the LTEQ was adjusted to address exercise within the past 7 days, instead of a typical week.

The International Physical Activity Questionnaire (IPAQ) is a longer measure of physical activity, in terms of frequency, duration, and domains of activity (Craig et al, 2003). The IPAQ was designed to measure self-reported physical activity in middle aged adults (i.e., ages 15 to 69) with 5 independent activity domains (i.e., job-related physical activity, transportation physical activity, housework, leisure-time physical activity, and time spent sitting) (Craig et al., 2003). Each of these components of physical activity are responded to based on one's frequency and duration (i.e., number of days, hours and minutes) of physical activity. The scale takes into account continuous measures of walking activity (i.e., "during the last 7 days, on how many days did you walk for at least 10 minutes at a time for your work?"), moderate activity (i.e., during the last 7 days, on how many days did you do moderate physical activities like carrying light loads as part of your work?) and vigorous activity (i.e., "during the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, heavy construction, or climbing upstairs as part of your work?").

The IPAQ was measured at the baseline, post-intervention, and follow-up surveys. Hours were converted to minutes on the time variables from the IPAQ and cases that reported less than

10 minutes of activity were removed from the analysis as per the IPAQ scoring guidelines (IPAQ, 2005). Next, outliers on the IPAQ were identified by summing total walking, moderate, and vigorous physical activity minutes from each time question on the survey. Cases that reported more than 960 minutes per day on average were removed from the analysis (IPAQ, 2005). To normalize the data, the scoring protocol for the IPAQ-short suggests for each of the activity categories to be truncated at 180 minutes each per day (IPAQ, 2005). Given that the instructions do not provide information on how the truncation rule should be applied to address the different types of moderate intensity activities for the IPAQ-long, a modified approach was used herein. Mcloughlin et al.'s (2011) research addresses a similar issue with truncating data from the IPAQ-long and described that the truncation rule was applied at item level (i.e., 180 minutes) rather than variable level as suggested by the IPAQ-short guidelines. Lastly, Mcloughlin et al. (2011) truncated total minutes for each activity per week (i.e., total walking, total moderate, and total vigorous minutes) to a maximum of 1260 minutes. MET minutes per week were calculated by multiplying the activity MET value (e.g., walking = 3.3 METS) by the activity duration (i.e., minutes reported) and the activity frequency per week (i.e., days per week reported). Total MET minutes per week were calculated (i.e., total walking MET minutes /week + total moderate MET minutes/week + total vigorous MET minutes/week) (Craig et al., 2003). Weekly physical activity measured using the IPAQ had criterion validity ($r_s = 0.33$) that was similar to other physical activity measures (i.e., accelerometers) (Craig et al., 2003). Craig et al. (2003) assessed the reliability of IPAQ ($r_s = 0.80$) and determined that the IPAQ was as good as other frequently used measures of physical activity. See Appendix C for full measure.

Intervention Adherence

First, the time participants spent on the instruction page for their task was recorded via Qualtrics. When the participants opened the survey link, they were instructed to stay on the screen until they completed the writing prompt, and then were instructed to answer if they completed the writing activity or not. Assessing the average time spent on this screen across activities served as an indicator of whether or not participants were engaging in the task (Couper et al., 2010).

Second, a self-report measure of intervention adherence was collected. At the end of the post-intervention survey (Day 9), participants were asked to self-report the number of days that they completed the writing activities (0 - 5 *days*) (Mosewich et al., 2013). Given that the content of the daily writing activities was not collected, this measure was implemented to describe participants' average days completed and average time spent completing the activities. Participants who did not complete any writing modules as recorded by Qualtrics (i.e., did not access the link) were excluded from the data analysis. See Appendix I for measure.

Intervention Engagement

Participants completed self-report engagement with writing activities (i.e., 1 = *not at all*, 5 = *very much*) at post-intervention (i.e., Day 9; Mosewich et al., 2013). At follow-up (i.e., Day 23) participants self-reported the extent to which they continued to use self-compassion after the intervention period (i.e., 1 = *never*, 5 = *very often*) (Mosewich et al., 2013). Participants were also asked open-ended questions at the follow-up survey similar to Mosewich's (2013) follow-up intervention feedback questions about what participants liked and disliked about the intervention. See Appendix I for measures.

Analysis Plan

Data Cleaning

Analyses were completed using SPSS software (IBM Corp, 2020). Participants were removed if they did not access any of the writing activities and/or did not complete post-intervention and follow-up surveys. Duplicate cases were removed from the dataset.

Missing values on the BREQ-3 and SCS and LTEQ were imputed using Expectation-Maximization at the item level and within intervention groups. Missing data for the IPAQ was removed from the analysis, based on the guidelines for processing the IPAQ described in the measures section. Outliers were identified on the BREQ-3, SCS, and LTEQ based on the z -score cut-off criteria suggested by Tabachnick and Fidel (2007) ($z = \pm 3.3$). Outliers on the IPAQ were identified based on the procedures outlined in the measures section.

Descriptive statistics were computed and reported (i.e., mean, standard deviations, frequencies, and percentages) for all variables. Bivariate correlations were reported between all variables. Before running the repeated measures ANOVA, model assumptions were checked. The Shapiro-Wilk test was used to test normality. Additionally visual inspection of histograms and plots were used to check for normality. Sphericity was assessed to check for homogeneity of variance in groups was using Mauchly's test for sphericity and the equality of variance was checked with the Levene's test. Type 2 sums of squares were used for all of the Repeated Measure ANOVA analyses (Navarro, 2018).

Main Analyses

Prior to running the main analyses, differences in self-compassion scores were assessed as a manipulation check for the writing intervention using a repeated measures ANOVA within-

subjects (baseline survey and post-intervention survey) and between subjects (self-compassion group, physical activity journaling control group, anagram word task control group).

Three separate repeated measure ANOVAs were estimated to test the hypotheses. First, a 2 (time) x 3 (group) repeated measures ANOVA was conducted to assess differences in autonomous motivation for exercise. Next, two separate repeated measures 3 (time) x 3 (group) repeated measures ANOVAs were estimated with factors for physical activity assessed by the (a) LTEQ and (b) IPAQ. If the omnibus test was statistically significant ($p < .05$), Tukey's HSD post-hoc t-tests were evaluated to identify which group significantly differed in autonomous motivation for exercise and physical activity mean scores. In all analyses, estimates of effect size (η_p^2) were interpreted regardless of statistical significance. $\eta^2 = .01$ was considered small, $\eta^2 = .06$ considered medium and $\eta^2 = .14$ considered large (Cohen, 1988).

Results: Study 2

Preliminary Analysis

Data Cleaning

In total, 57 participants were recruited for Study 2. Several participants did not pass the screening questionnaire ($n = 19$). A total of 38 participants completed some aspect of this study. Data were removed for participants who did not complete the post-intervention and follow-up surveys on Days 9 and 23, respectively ($n = 8$). Additionally, 5 participants were removed from the dataset as they did not complete any of the daily activities based on Qualtrics reported data (i.e., 0 out of 5 daily activities). One participant was removed from the analysis because they were manually assigned to a group due to a Qualtrics malfunction. One participant self-reported not engaging with the activities at all, and not completing any of the activities. The time spent on

Qualtrics was cross-referenced and the average time spent on the daily activities (i.e., 5 days) was 19 seconds. Therefore, this participant was removed from the analyses. After data cleaning there were a total of 23 participants included in the analyses ($n_{\text{self-compassion}} = 6$; $n_{\text{physical activity journaling control}} = 8$; $n_{\text{anagram task control}} = 9$).

At the item level, missing data for the BREQ-3 ($n_{\text{baseline}} = 2$, $n_{\text{post-intervention}} = 3$), LTEQ ($n_{\text{baseline}} = 1$, $n_{\text{post-intervention}} = 1$, $n_{\text{follow-up}} = 2$), and SCS ($n_{\text{baseline}} = 1$, $n_{\text{post-intervention}} = 2$), were imputed. For IPAQ scores, after assessing the total activity minutes for each intensity at each time point only 1 case reported a total score greater than 1260 minutes per week for moderate activity at the baseline survey. The MET minutes at baseline were normally distributed, therefore this case was retained for the analysis. In total after removing missing data ($n = 3$) and outliers there were 14 participants retained for the IPAQ physical activity analysis.

Outliers

No outliers were identified for the SCS or the BREQ-3. One outlier was identified and removed from the LTEQ ($z = 4.17$). For the IPAQ, 7 outliers were identified and removed. Therefore, the sample size for both autonomous motivation for exercise and self-compassion were ($N = 23$). The sample size for the physical activity (LTEQ) was 22 and for physical activity (IPAQ) was 14.

ANOVA Assumptions Tests

Self-compassion was not normally distributed at both time points ($W_{\text{Baseline}} = .88$, $p = .01$; $W_{\text{Post-intervention}} = .919$, $p = .06$). Visual inspection of histograms and Q-Q plots confirmed that self-compassion was not normally distributed at baseline. Since self-compassion was only measured at baseline and post-intervention, sphericity was assumed. The Levene's test indicated

that there was equality of variance at baseline ($F(2,20) = .31, p = .73$), but not at post-intervention ($F(2, 20) = 4.68, p = 0.21$).

Autonomous motivation for exercise was normally distributed ($W_{\text{Baseline}} = .93, p = .12$; $W_{\text{Post-intervention}} = .94, p = .22$). Sphericity was assumed due to autonomous motivation only being measured at 2 time points. The Levene's test indicated there was equality of variance at baseline ($F(2,20) = .32, p = .06$) and post-intervention ($F(2,20) = 1.35, p = .28$).

The Shapiro-Wilk test confirmed that physical activity (LTEQ) was normally distributed at all time points ($W_{\text{Baseline}} = .96, p = .60$; $W_{\text{Post-intervention}} = .95, p = .26$; $W_{\text{Follow-up}} = .97, p = .75$). Second, Mauchly's sphericity test confirmed the sphericity assumption ($\chi^2_{(2)} = .94, p = .55$). The Levene's test supported equality of variance at each time point ($F(2, 19) = 2.2, p = .14$; $F(2,19) = .83, p = .45$; $F(2, 19) = 3.0, p = .07$)

Physical activity (IPAQ) was considered to be normally distributed at baseline and post-intervention surveys but not the follow-up survey ($W_{\text{Baseline}} = .89, p = .09$; $KS_{\text{Post-intervention}} = .89, p = .07$; $KS_{\text{Follow-up}} = .81, p = .006$). Visual inspection of the data at time 3 supported a positive skewed distribution. Mauchly's test of sphericity was not significant, indicating that sphericity could be assumed ($\chi^2_{(2)} = .79, p = .30$). The Levene's test revealed equality of variance at each time point ($F(2,11) = .02, p = .98$; $F(2,11) = 1.97, p = .18$; $F(2,11) = 1.30, p = .31$).

Descriptive Statistics

Participants ($N = 23$) were on average 19 years old ($SD = 1.48$). Characteristics of the participants are described in Table 5, 6, and 7.

Table 5*Demographic Characteristics*

| Variables | <i>n</i> |
|---------------------|----------|
| Gender | |
| Woman | 15 |
| Man | 4 |
| Transgender man | 1 |
| Non-binary | 1 |
| Non-conforming | 1 |
| She/They pronouns | 1 |
| Injury in last year | |
| Injury | 8 |
| No Injury | 15 |
| Living Arrangement | |
| On-Campus Living | 9 |
| Off-Campus Living | 14 |
| Employment status | |
| Unemployed | 12 |
| Part-Time Work | 10 |
| Full-Time Work | 1 |
| Ethnicity | |
| White | 13 |
| Black | 4 |

| | |
|----------------------------------------------------------|---|
| South Asian | 2 |
| Arab | 1 |
| Chinese | 1 |
| Other please specify: Jamaican, Swedish, and Matis | 1 |
| White and Latin American | 1 |

Note. Self-reported gender, injury, living arrangement, and ethnicity. Participants were able to specify the gender and ethnicity that they identify with and could identify with more than 1 ethnicity.

Table 6

Descriptive Statistics for Groups

| Variable | Baseline | | Post-intervention | | Follow-up | |
|--------------------|----------|-----------|-------------------|-----------|-----------|-----------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> |
| 1. Age | 19.00 | 1.48 | — | — | — | — |
| 2. Self-Compassion | | | | | — | — |
| Self-Compassion | 3.10 | .77 | 3.19 | .1.00 | — | — |
| Intervention Group | | | | | | |
| Physical Activity | 2.58 | .64 | 2.68 | .71 | — | — |
| Journaling Control | | | | | | |
| Group | | | | | | |
| Anagram Word Task | 2.68 | .63 | 2.44 | .36 | — | — |
| Control Group | | | | | | |

| | | | | | | |
|--------------------------------------------------|---------|---------|---------|---------|---------|---------|
| 3. Autonomous Motivation for exercise | | | | | — | — |
| Self-Compassion Intervention Group | 1.93 | .19 | 2.18 | .32 | — | — |
| Physical Activity Journaling Control Group | 1.76 | .90 | 2.63 | .73 | — | — |
| Anagram Word Task Control Group | 2.54 | .90 | 2.33 | .80 | — | — |
| 4. Physical Activity (LTEQ) | | | | | | |
| Self-Compassion Intervention Group | 23.00 | 8.21 | 26.60 | 20.47 | 28.80 | 16.27 |
| Physical Activity Journaling Control Group | 26.00 | 16.37 | 33.00 | 23.86 | 28.87 | 23.49 |
| Anagram Word Task Control Group | 38.22 | 20.00 | 45.44 | 17.70 | 41.44 | 7.00 |
| 5. Physical Activity (IPAQ) | | | | | | |
| Self-Compassion Intervention Group | 3230.40 | 2674.43 | 1518.90 | 1493.92 | 2706.20 | 1475.95 |
| Physical Activity Journaling Control Group | 2059.60 | 3237.85 | 2952.30 | 2985.19 | 2706.20 | 2792.75 |
| Anagram Word Task | 4686.00 | 2813.84 | 4615.50 | 1729.40 | 4516.75 | 2897.20 |

Control Group

Note. M = mean; SD = standard deviation. Age was measured in years. Dashes represent variables that were not measured at these time points.

Intervention Adherence and Engagement

Adherence and engagement data per group are presented in Table 7. Adherence and engagement across all groups was self-reported above the midpoint of the scales. Approximately 6.5 minutes were spent on average completing the daily self-compassion writing prompts. The average time that the physical activity journaling control group spent on completing the writing tasks was approximately 4 minutes and an average of approximately 2 minutes for the anagram word task control group. All manipulation checks at the end of the daily activities were completed. Only one participant in the self-compassion intervention group reported writing about the same physical activity setback from the first activity.

Table 7*Intervention Adherence and Engagement by Groups*

| Group | Days Completed | Perceived Engagement | Engagement Post-Study | Average Time (across 5 days) |
|--------------------------------------------|----------------|----------------------|-----------------------|------------------------------|
| Self-Compassion Intervention Group | 4.50(.55) | 3.66(.82) | 3.50(.84) | 390.53(161.81) |
| Physical Activity Journaling Control Group | 4.75(.46) | 3.87(1.24) | 2.83(1.32) | 226.90(190.74) |
| Anagram Word Task Control Group | 4.85(.38) | 4.28(.49) | 2.87(1.00) | 108.55(74.65) |

Note. Means are presented in each column followed by the standard deviation in brackets. Days completed = days completed from 0 to 5 days; Perceived engagement = engagement self-reported from 0 = *not at all* to 5 = *very much* measured at post-intervention; engagement post-study = continued engagement with the learned skill measured at follow-up on a scale of 1 = *never* to 5 = *very much*; average time across 5 days = average amount of time spent on the daily activities measured in seconds.

Attention Checks

Attention checks were recorded but were not controlled for in the analyses. Through the baseline and post-intervention surveys there were 13 unique cases of failed attention checks.

Bivariate Correlations and Internal Consistency

Estimates of internal consistency and bivariate correlations are presented in Table 8. Autonomous motivation for exercise was positively correlated with physical activity (LTEQ) at post-intervention.

Table 8

Bivariate Correlations and Reliability Estimates of Study Variables

| Variable | 1 | 2 | 3 | 4 | α | |
|---------------------------------------------|------|-----|------|------|----------|-------------------|
| | | | | | Baseline | Post-intervention |
| 1. Self-Compassion | — | .16 | -.13 | .32 | .92 | .95 |
| 2. Physical Activity (IPAQ) | .06 | — | .32 | .36 | — | — |
| 3. Autonomous Motivation for Exercise | -.07 | .18 | — | .51* | .91 | .89 |

| | | | | | | |
|---------------------|-----|-----|-----|---|---|---|
| 4.Physical Activity | .30 | .12 | .35 | — | — | — |
| (LTEQ) | | | | | | |

Note. Upper diagonal values reflect values at post-intervention. Lower diagonal values reflect values at baseline. Dashes represent measures not obtained. α = internal consistency. * $p < .05$. ** $p < 0.01$

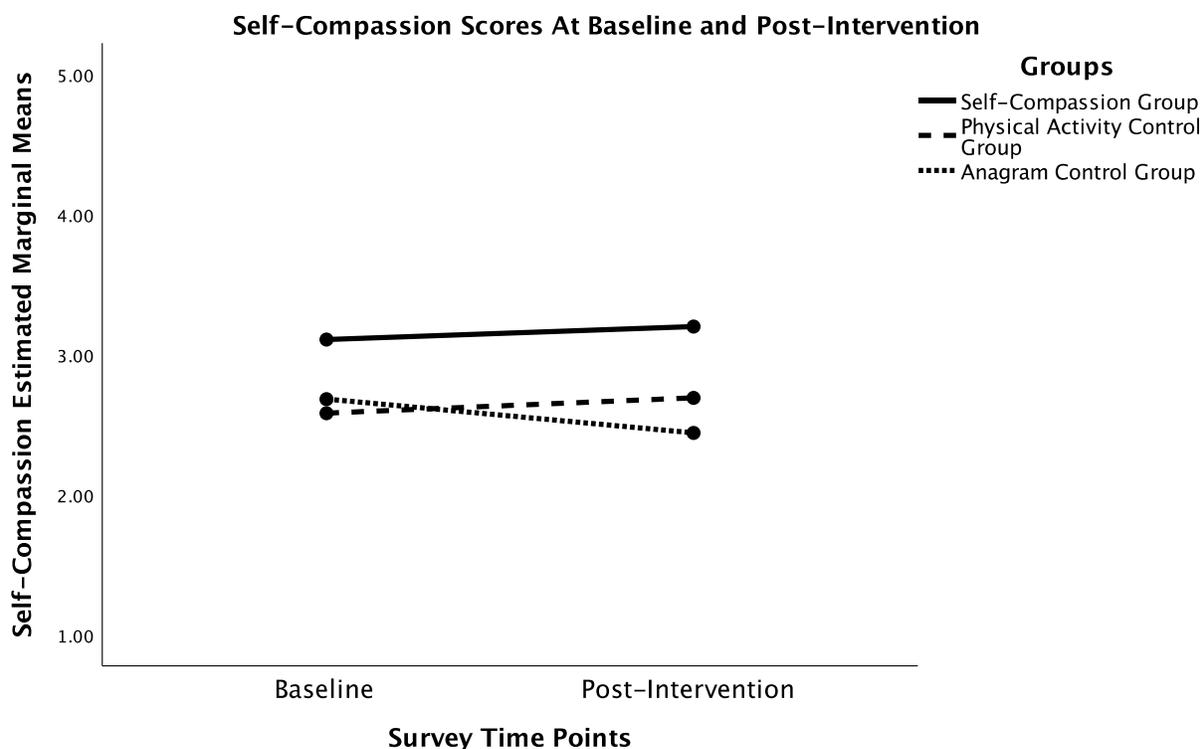
Main Analyses

Self-Compassion

There was no statistically significant interaction (group x time) on self-compassion scores ($F(2, 20) = 1.30, p = .30, \eta_p^2 = .11$). The effect size was medium. There was no statistically significant main effect of time on self-compassion scores $F(1, 21) = .09, p = .76, \eta_p^2 = .005$. The effect size was small. Additionally, there was no statistically significant main effect of condition on self-compassion scores $F(2, 21) = 1.72, p = .20, \eta_p^2 = .15$. The effect size was large. Figure 2 shows that the self-compassion intervention group started off with higher self-compassion scores than both control groups.

Figure 2

Self-Compassion Scores at Baseline and Post-Intervention Surveys



Note. The figure represents the self-compassion scores for each group at the baseline survey and at the post-intervention survey.

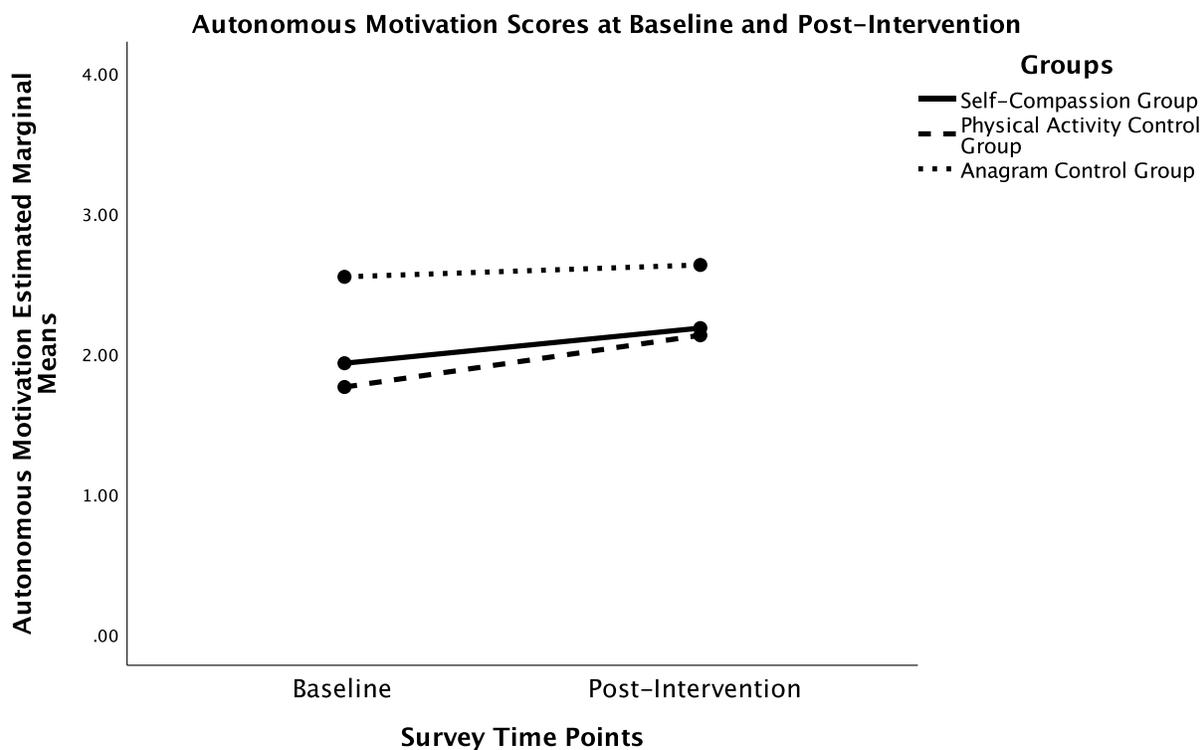
Autonomous Motivation for Exercise

There was no statistically significant interaction (group x time) on autonomous motivation ($F(2, 20) = 1.40, p = .27, \eta_p^2 = .12$). The effect size was medium. The main effect of time on autonomous motivation scores was statistically significant ($F(1, 20) = 9.46, p = .006, \eta_p^2 = .32$). The effect size was large. Visual inspection of the autonomous motivation for exercise scores over time showed that on average autonomous motivation scores increased from baseline to post-intervention (See Figure 3). The main effect of condition on autonomous motivation for

exercise scores was not statistically significant ($F(1, 21) = 1.94, p = .17, \eta_p^2 = .16$). The effect size was large.

Figure 3

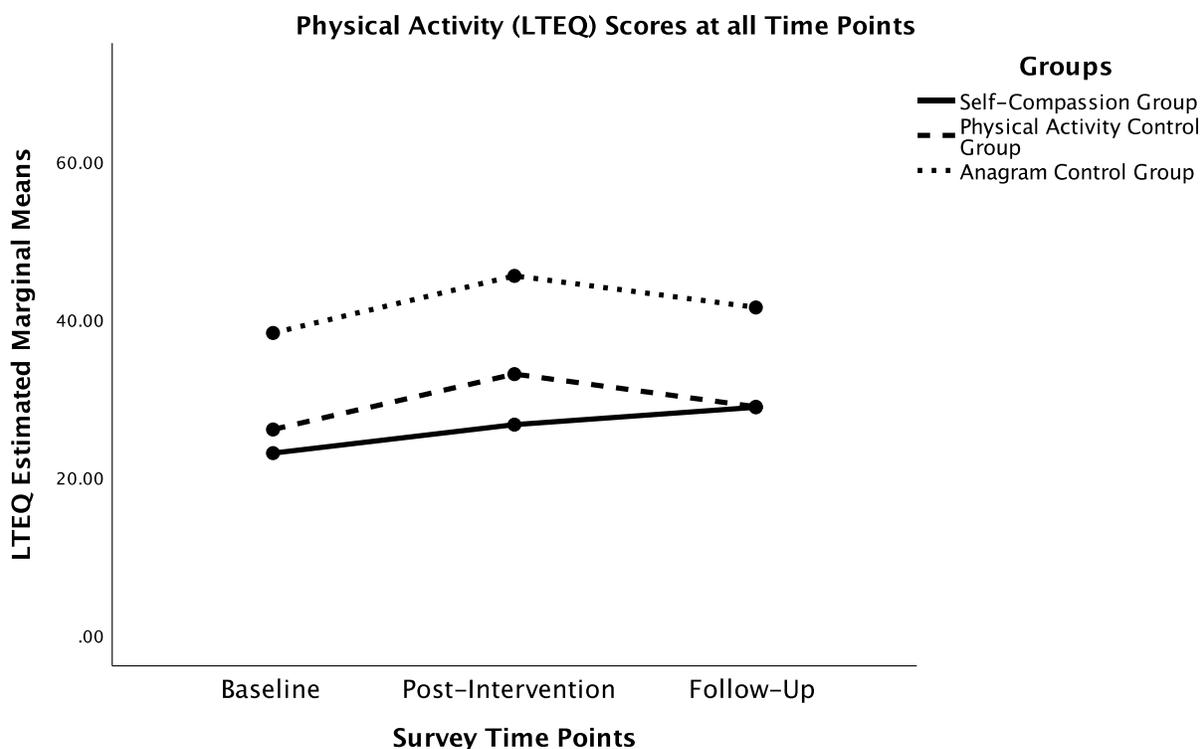
Autonomous Motivation for Exercise Scores at Baseline and Post-Intervention



Note. The figure represents the autonomous motivation for exercise scores for each group at the baseline survey and at the post-intervention survey.

Physical Activity (LTEQ)

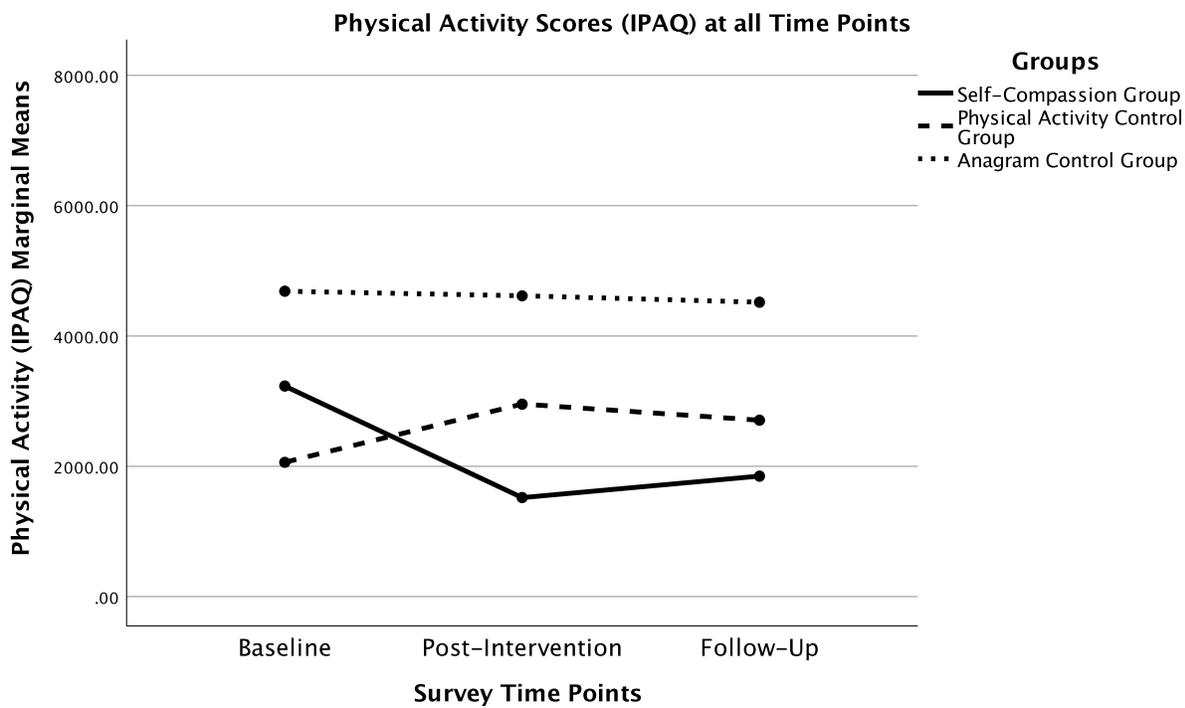
There was no statistically significant interaction (group x time) on physical activity (LTEQ) ($F(2, 38) = .14, p = .97, \eta_p^2 = .01$). The effect size was small. The main effect of time on physical activity (LTEQ) scores was not significant ($F(2, 38) = 1.58, p = .22, \eta_p^2 = .07$). The effect size was medium. The main effect of condition on physical activity (LTEQ) scores was not significant ($F(2, 19) = 2.15, p = .14, \eta_p^2 = .18$). The effect size was large. See Figure 4.

Figure 4*Physical Activity (LTEQ) Scores at all Time Points*

Note. The figure represents the physical activity scores measured by the LTEQ for each group at the baseline survey, the post-intervention survey, and the follow-up survey.

Physical Activity (IPAQ)

There was no statistically significant interaction (group x time) on physical activity (IPAQ) ($F(4, 22) = 1.70, p = .19, \eta_p^2 = .24$). The effect size was large. The main effect of time on physical activity across study time points was not statistically significant ($F(2, 22) = .32, p = .73, \eta_p^2 = .03$). The effect size was small. The main effect of condition on physical activity scores (IPAQ) across time points was also not statistically significant ($F(2, 11) = 1.30, p = .31, \eta_p^2 = .19$). The effect size was large. See Figure 5.

Figure 5*Physical Activity (IPAQ) Scores at all Time Points*

Note. The figure represents the physical activity scores measured by the IPAQ for each group at the baseline survey, the post-intervention survey, and at the follow-up survey.

Discussion: Study 2

There were no statistically significant differences between intervention groups over time in autonomous motivation for exercise or physical activity (LTEQ or IPAQ), although the effect sizes were small to large. These findings were inconsistent with my hypotheses that were based on an effective self-compassion intervention in a sport domain (Mosewich et al., 2013). There are several explanations for the null findings in this study that will be outlined below.

Small Sample Size and Low Statistical Power

First, my study was underpowered. *A priori* power analyses indicated 36 and 42 people were needed for the different ANOVA analyses. Unfortunately, as the study recruitment began so too did a 5th wave of COVID-19. Notably, most classes moved online, gyms had capacity limits and many students were becoming ill while the study was running. Therefore, it is possible that the low sample size and attrition was attributable to the fifth COVID-19 wave. Additionally, attrition over time in the study also indicated that perhaps the study was too demanding (3 surveys, 5 writing activities). Although the open-ended questions seeking feedback from participants were not qualitatively analyzed, reading the responses suggested that some participants felt the writing prompts to be repetitive and difficult to remember to do each day. As such, researchers interested in self-compassion interventions in this population may want to provide a variety of self-compassion writing prompts and have participants complete less frequent and in-person sessions to improve engagement. Given the low sample size, the discussion will be presented herein as suggestions for future research based on this study as a feasibility study.

Second, given the low statistical power, effect sizes and line graphs were interpreted. Visual inspection of the interaction effects shows that the self-compassion intervention group had increasing mean scores for autonomous motivation for exercise, self-compassion, and physical

activity (LTEQ), yet they were not statistically significant. The effect sizes for the group by time interaction analyses were small to large. It is possible that with a larger sample size and more statistical power, the results would have been statistically significant. That said, it is worth noting that Prentice and Miller (1992) suggest that effect sizes should be considered when assessing the intervention effects because conclusions should not be based solely on whether the effect is statistically significant. In fact, small effect sizes can be meaningful when considering variables that are difficult to change (Prentice & Miller, 1992) such as motivation and physical activity. Therefore, I believe researchers should replicate the intervention with larger sample sizes further examine the effect sizes that were found in the context of a statistically powered study.

Baseline Differences in Self-Compassion Between Groups

Third, despite randomization into groups, visual inspection indicated that the self-compassion intervention group began the study with higher average scores of self-compassion compared to the other groups. It is possible that a ceiling effect occurred such that the group on average was relatively self-compassionate before the intervention leaving little room for further increases in self-compassion. With this, researchers in the future may want to use stricter inclusion criteria to ensure participants had low self-compassion at baseline. Additionally, having a larger number of people in each group would likely improve randomization such that the three intervention groups had similar levels of self-compassion at baseline.

Self-Compassion Interventions Online Versus in Person

Fourth, although my study was based on Mosewich et al's. (2013) effective self-compassion intervention in female athletes there are important differences between this intervention and the present study that are worth noting. Previous research using self-compassion writing interventions were largely conducted in person (Mosewich et al., 2013; Wong, 2019), whereas

each component of this study was completed online. Indeed, Bosshard (2020) conducted a self-compassion writing intervention for alternative health behaviours (e.g., physical exercise, substance use, sleep, and eating behaviours) online (Bosshard, 2020) and did not find significant intervention effects. It is possible that the current study was not successful and/or had high attrition online because participants were not able to connect with the researcher or benefit from in person psychoeducational components. More research is needed to examine if self-compassion writing interventions with psychoeducational components are better delivered in person versus online.

Sample and Design Differences Between my Intervention and Published Interventions

Lastly, there were notable methodological differences between my study and a previous self-compassion intervention in sport (Mosewich et al., 2013) that was effective. For example, my study used 2 control groups (i.e., physical activity journaling and anagram word task) whereas the effective sport intervention had one control group that wrote about their experience as an athlete (Mosewich et al., 2013). The use of two control groups increased the internal validity of the current study by being able to investigate any potential writing effects from the physical activity journaling group. This is based on the tenets that journaling can help to reflect on experiences and events (Boud, 2001). Another difference was the population of interest. My study recruited university students in first year psychology courses who had a physical activity setback whereas Mosewich et al. (2013), recruited varsity athletes who were self-critical, and Wong (2019) recruited college students who wanted to improve their physical activity.

Strengths and Limitations

A strength of my study compared to previous self-compassion interventions was the design of the control groups. Previous self-compassion writing interventions had control groups write

about events that were unrelated to their research to control for a writing effect (Bosshard, 2020; Leary et al., 2007; Shapira & Mongrain, 2010; Wong & Mak, 2016). The goal of my study was to investigate if self-compassionate writing can improve physical activity and autonomous motivation towards exercise. To do so, writing effects needed to be ruled out. In other words, it is possible that writing about something in general could improve these behaviours, therefore a third attention group (i.e., anagram word task control group) was used rule out the effect of writing. A benefit of implementing the physical activity journaling control group in the proposed research improved the internal validity of the results (i.e., controlling for confounds and selection effects). Another strength of my study was using two measures of physical activity to capture different aspects of self-reported physical activity (overall leisure activity and specific components of physical activity).

A limitation of my study is that technical errors occurred when delivering the online intervention. The server used to distribute the daily activities and surveys via email to the participants failed. Consequently, the schedule of the participants completing the study at that point ($n = 6$) was delayed by almost 2 days. This meant that participants who were completing their daily activities may have not received the 5 daily activities consecutively in a 5-day time period. Another limitation is that the attention checks, self-reported days completed, engagement (self-reported scale and time spent completing the activities) measures were not controlled for in the analyses due to the small sample size and piloting of the study. Removing the failed attention checks ($n = 13$) or cases that spent less than an average of two minutes on the activities ($n = 8$) would have significantly reduced the sample size. Future research should aim to collect a larger sample size and conduct a sensitivity analysis by removing cases that would be considered “low engagement” from the analysis.

General Discussion

The overall goal of my thesis was to investigate the role of self-compassion and autonomous motivation for exercise in physical activity contexts. The purpose of Study 1 was to examine if autonomous motivation for exercise moderated the relationship between self-compassion and physical activity. The results did not support my hypothesis that self-compassion would be more strongly related to physical activity among individuals with higher autonomous motivation for exercise. The goals of Study 2 were to determine if an online self-compassion writing intervention would improve autonomous motivation for exercise and physical activity. Results indicated that the intervention did not increase physical activity or autonomous motivation for exercise. It should also be noted that while both studies were conducted during the COVID-19 pandemic, the effects of COVID-19 on autonomous motivation for exercise, self-compassion, and physical activity were not assessed.

Before exploring the findings in more depth, it is important to highlight that both studies were statistically underpowered. The null effects in both studies may have been affected by the increased probability of the findings resulting in Type II errors (Perugini et al., 2018). As such, all results should be interpreted with a degree of caution and recognition of low statistical power. In other words, without sufficient statistical power, it is unclear if the null findings indicate there was truly no statistically significant relationships or if the study did not have a high enough sample size to detect an effect if it was there.

Relationship Between Self-Compassion and Autonomous Motivation for Exercise

In Study 1, I found that autonomous motivation for exercise did not moderate the relationship between self-compassion and physical activity. Previous research supports that people who are self-compassionate are more inclined to exercise for intrinsic purposes instead of

extrinsic purposes (Magnus et al., 2010). Therefore, individuals who have high self-compassion and are autonomously motivated to exercise may be more likely to engage in physical activity. Researchers should continue to investigate this relationship with larger sample sizes. It is possible that different moderators (e.g., controlled motivation and self-efficacy) may help to explain the relationship between self-compassion and physical activity. Lastly, researchers should use a measure that is adapted to reflect self-compassion in physical activity contexts.

In Study 2, although the interaction between experimental condition and time was not statistically significant when predicting autonomous motivation for exercise, there was a medium effect size. Previous research has supported the association between self-compassion and autonomous motivation for exercise (Kullman et al., 2021; Magnus et al., 2010; Semenchuk et al., 2018). Additionally, Neff's (2003b) research highlights the similarities between autonomous behaviours and self-compassion. As well, Neff et al.'s (2005) research found that self-compassion and intrinsic motivation for learning (i.e., the most autonomous form of motivation) were associated in university students. Given the support of previous literature for the relationship between self-compassion and autonomous motivation and the theoretical contentions with the null findings of my study, researchers should replicate this study with a larger sample size and with higher power.

The Role of the Self-Compassion in Physical Activity Contexts

Both of my studies did not support the hypothesis that self-compassion is related to physical activity among university students. As discussed above, the literature provides mixed findings on the relationship between self-compassion and physical activity such that some studies find that higher self-compassion is associated with exercise engagement (Magnus et al., 2010; Thakur & Joshi, 2016) and some find that self-compassion is not associated with physical

activity (Hallion et al., 2019; Wong, 2019). These null results in my study may be due to low sample sizes and the self-report nature of the measures used in these studies. For example, participants were asked to self-report their physical activity in the past seven days (i.e., last week) which may have affected the accuracy of the reports because of recall bias and social desirability (Sylvia et al. 2014). Sylvia et al. (2014) stated alternative measures of physical activity such as daily self-reported physical activity, accelerometers, pedometers, and heart rate monitors to reduce bias. Device-based measures of physical activity such as pedometers were not implemented in my studies because of the feasibility of facilitating them for online studies.

Additionally, participants may be self-compassionate to themselves in different areas of their life, but not about physical activity. It may be important for researchers interested in the relationship between self-compassion and physical activity to adapt the SCS to a physical activity context (e.g., When I fail at physical activity that's important to me, I tend to feel alone in my failure). For example, self-compassion may differ across different areas of our lives (i.e., physical activity, work, school, family, etc.) so we may need to contextualize self-compassion measures to physical activity. The Self-Compassion Scale (Neff, 2003a) was previously adapted to measure self-compassion in sport contexts (Fontana et al., 2017; Lizmore et al., 2017).

Lessons from the Self-Compassion Pilot Intervention

There are numerous reasons the intervention failed that serve as lessons for researchers wishing to develop online self-compassion interventions targeting autonomous motivation for exercise and physical activity in the future. First, the small sample size did not offer confidence in the research findings. Second, with self-reported data there is no way of knowing if someone is being honest that they completed the writing activities and how they were intended to be used. Therefore, researchers may want to collect participants' self-compassion letters. Also, with the

differences in reported physical activity between the IPAQ and LTEQ, some participants may not have reported their accurate physical activity duration and frequency in the past week. It is possible that there were environmental effects that impacted the outcomes, such as completing the studies during COVID-19 restrictions (Lesser & Nienhuis, 2020; Stockwell et al., 2021; Hargreaves et al., 2021) and the winter season (Merchant et al., 2007). If participants have a wearable device (i.e., Apple watch, Fitbit, Garmin watch, etc.), their weekly physical activity data could be sent to the research team for an additional device-based measure of physical activity.

Another limitation to Study 2 was that low self-compassion was not directly screened as eligibility criteria prior to the study. Although it was theorized that participants who have experienced a physical activity setback, think about the setback, and believe it was their fault would have lower self-compassion scores, this might not be true for all participants. Future research should aim to use a screening questionnaire and select participants with lower levels of baseline self-compassion.

Lastly, my study may have been too burdensome for students with 3 surveys and 5 days of activities, which may be why many participants did not complete the study. The intervention activities may need to be spread out over a longer period (i.e., 1-2 weeks). Some participants reported that they felt the activities were repetitive. Researchers should aim to provide a variety of self-compassion writing prompts in future interventions. Lastly, researchers may want to implement a reminder application for participants to receive on their cellphones.

Contribution to the Literature

Both of my studies provided unique contributions to the self-compassion and physical activity literature. To my knowledge, despite theoretical justification (Gilbertson, 2016; Neff et

al., 2005; Neff, 2003b), autonomous motivation for exercise has not been investigated as a moderator in the relationship between self-compassion and physical activity. Self-compassion and autonomous motivation have previously been studied in physical activity contexts, but my study looked at the combined association of both variables on physical activity. Although null effects were found, it provides knowledge to the field that being autonomously motivated to exercise does not influence an individual with self-compassion be more likely to exercise.

Few studies have assessed self-compassion writing interventions for increasing physical activity and autonomous motivation for exercise (Bosshard, 2019; Wong, 2019). Both self-reported physical activity measures (LTEQ and IPAQ) have not been used together in similar studies, and my study provides unique information on how both measures had different results. The IPAQ is a comprehensive measure of self-reported physical activity for 4 domains (i.e., physical activity at work, transportation, indoor and outdoor housework, and leisure time) (Craig et al., 2003). As well, this measure considers different intensities of physical activity (i.e., walking, moderate, and vigorous), the frequency (i.e., days per week), and the duration during the last 7 days. Alternatively, the LTEQ is a 3 question self-reported measure specific to intensity and frequency of leisure time exercise in the past 7 days (Godin & Shepard, 1985).

Limitations and Future Directions

In addition to the many limitations of my study listed throughout the discussion sections of Study 1 and 2, it is worth reiterating that the most influential limitation in both studies was the small sample size. Therefore, I cannot conclude whether the null intervention effects were due to the study being underpowered, or if it is due to no effects being present. Similarly, many participants were lost for the Study 1 analysis due to failed attention checks. In Study 2, participants were not removed based on failed attention checks as the sample for the analysis (*N*

= 23) would have substantially decreased to 10 given that 13 participants failed attention checks. There is currently concern about the use of attention check questions and whether or not they should be used in research with people from participant pools. For example, the original intention of attention checks was to ensure that respondents were reading and answering the questions carefully. Nonetheless, recent research suggests that ‘attackers’ in MTurk participant pools have the capability of passing the attention checks (Pei et al., 2020). As well, the use of attention checks was not supported in an online Prolific study for participants in the United States with results suggesting that the attention checks did not increase the external validity of the data (Tang et al., 2022). It is possible that these findings in other participant pools such as MTurk and Prolific do not generalize to university student populations. More research on the use and misuse of attention checks in university student participant pools needs to be conducted.

There were measurement issues across both studies. For example, the higher-order CFA in Study 1 indicated that the SCS fell below acceptable fit criteria with no obvious indicators for post hoc modifications (e.g., adding correlated errors). There is currently a debate in the literature about the best factor structure and analytic technique (e.g., CFA versus exploratory structural equation modeling) for the SCS (Rakhimov et al., 2022). Researchers in the future should investigate these issues with the SCS to determine the best representation of the data. Device-based measures may have reduced biased responding to the self-report physical activity measures used herein. Lastly, researchers should recruit participants who are currently experiencing a physical activity setback, or a more recent physical activity setback (i.e., within the past 2 weeks) instead of a physical activity setback within the past 6 months and who report low levels of self-compassion to rule out ceiling effects.

Practical Implications

Given that I found an association between autonomous motivation for exercise and physical activity, and past research (Duncan et al., 2017; Teixeira et al., 2012; Thøgersen-Ntoumani & Ntoumanis, 2006) has also found that, students should be encouraged to engage in physical activity for autonomous reasons. In other words, individuals need to enjoy the activity or value the activity. For example, someone may be more inclined to run a few times a week if they enjoy running. Conversely, running a few times a week may be more difficult to start and maintain for someone who does not see the value in running, or dislikes it (i.e., controlled motivation).

Although the results were statistically non-significant and underpowered in my study, it is possible that the practice of self-compassion may be important specifically for individuals who have experienced more serious physical activity setbacks. It may help to improve physical activity and to foster autonomous motivation for exercise by reframing thoughts and feelings in a non-judgemental and kind way, but more research is needed to investigate this contention.

Conclusion

Through two studies, my thesis demonstrated that autonomous motivation for exercise is an important factor for both self-compassion and physical activity. In Study 1, my hypothesis of autonomous motivation for exercise increasing the strength of the relationship between self-compassion and physical activity was not supported. In Study 2, results of the underpowered self-compassion intervention showed promising effect sizes for improving physical activity (LTEQ) and autonomous motivation for exercise, but were statistically non-significant. More research with larger sample sizes, recruiting people who have lower self-compassion, and better measures of self-compassion and physical activity is needed to replicate these findings.

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Appendices

Appendix A: Ethics Material for Study 1

SONA Recruitment Notice

Study Name: Mindful Screen Time and Well-Being

Description: This study asks students enrolled in classes (PSYC 1001, 1002, 2001, 2002) at Carleton University to fill out surveys online relating to their demographics, psychological need satisfaction and frustration, mindfulness, self-compassion, motivation to exercise, well-being, and behaviours (e.g., leisure physical activity, sleep, sedentary behaviour). This study will examine the psychometric properties of instruments that will be modified to assess mindfulness and psychological need satisfaction and frustration during screen time in young adults. This will include examining the factor structure of scores and relationships between screen time quality, self-compassion, motivation, well-being, and behaviours.

Eligibility Requirements: We are looking for young adults (N = 500; 18 years or older) taking PSYC 1001 2002, 2001, and 2002 courses at Carleton University. Data collection will end April 14, 2021. The study will close when we have reached 500 participants this may occur before April 14, 2021.

Risks: There will be no more physical risk than is consistent with sitting in front of a computer for 30 minutes. Participants may take breaks if they wish. Participants may feel uncomfortable answering questions on the survey. While these surveys do involve some emotional risks, you have the right to refuse to answer any of the questions without penalty. If participants become upset during or after participation, they can contact someone at the following numbers:

- Mental Health Crisis Line:
 - Within Ottawa (613) 722-6914
 - Outside Ottawa 1-866-996-0991, Web Site: <http://www.crisisline.ca/>
- Ottawa Distress Centre: (613) 238 1089, Web Site: www.dcottawa.on.ca
- Carleton University Health Services 613 520 6674

Duration and Locale: 20-30 minutes online (through SONA and Qualtrics)

Compensation: You will receive 0.25% bonus marks towards your course (PSYC 1001, 1002, 2001, or 2002)

Researchers: Katie Gunnell (Principal Investigator) Email: katie.gunnell@carleton.ca;
Mackenzie Johnston (Student Researcher)
Email: mackenziejohnston@cmail.carleton.ca; Jayson Yung (Student Researcher)
Email: jaysonyung@cmail.carleton.ca

This study has received clearance by the Carleton University Research Ethics Board (B) (Clearance # 114999).

CUREB-B:

This research has been cleared by Carleton University Research Ethics Board-B (CUREB-B Clearance #114999). If you have any ethical concerns with the study, please contact Dr. Bernadette Campbell, Chair, Carleton University Research Ethics Board-B (via email at ethics@carleton.ca).

Informed Consent

Name and Contact Information of Researchers:

Katie Gunnell, Carleton University, Department of Psychology

Email: katie.gunnell@carleton.ca

Mackenzie Johnston, Carleton University, Department of Psychology

Email: mackenziejohnston@cmail.carleton.ca

Jayson Yung, Carleton University, Department of Psychology

Email: jaysonyung@cmail.carleton.ca

Project Title: Mindful Screen Time and Well-Being

Project Sponsor and Funder (if any)

Social Sciences and Humanities Research Council (SSHRC)

Faculty of Arts and Social Sciences, Carleton University

Carleton University Project Clearance

Clearance #: #114999

Date of Clearance: January 15th, 2021

Invitation

You are invited to take part in a research project because you are a young adult (18 years or older) taking PSYC 1001, 1002, 2001 or 2002. The information in this form is intended to help you understand what we are asking of you so that you can decide whether you agree to participate in this study. Your participation in this study is voluntary, and a decision not to participate will not be used against you in any way. As you read this form, and decide whether to participate, please ask all the questions you might have, take whatever time you need, and consult with others as you wish.

Objectives and Summary:

The aim of this study is to examine the psychometric properties of instruments that will be modified to assess mindfulness during screen time. This will include examining the factor structure of scores from modified instruments and examining the relationships between different indicators of screen time quality (mindful, psychological needs), well-being, and behaviours (e.g., sleep, sedentary behaviour, physical activity). We will also examine the relationships between self-compassion, behaviours and psychological variables (e.g., well-being and

motivation). We estimate that the survey will take about 20 to 30 minutes to complete. Your participation in this survey is voluntary, and you may choose not to take part, or not to answer any of the questions. If you decide to withdraw after you submit the survey, we will remove your responses from survey data if you notify the researcher before April 14, 2021. If you would like to withdraw from the study, you must contact Dr. Gunnell to let her know your wish to withdraw and have your data removed. Your data will be withdrawn without penalty. We hope to survey a total of 500 people. Data collection will end April 14, 2021.

Risks and Benefits:

There will be no more physical risk than is consistent with sitting in front of a computer for a thirty-minute period. Participants may take breaks if they wish. Participants may feel uncomfortable answering questions on the survey. While these surveys do involve some emotional risks, you have the right to refuse to answer any of the questions without penalty. If participants become upset during or after participation, they can contact someone at the following numbers:

- Mental Health Crisis Line:
 - Within Ottawa (613) 722-6914
 - Outside Ottawa 1-866-996-0991, Web Site: <http://www.crisisline.ca/>
- Ottawa Distress Centre: (613) 238 1089, Web Site: www.dcottawa.on.ca
- Carleton University Health Services 613 520 6674

We do not anticipate that participants will experience any direct benefits by participating in this study. However, your participation may allow researchers to better understand how to measure different experiences during screen time and how they relate to behaviours and well-being.

Compensation

You will receive 0.25% bonus marks towards your course (PSYC 1001, 1002, 2001, or 2002).

Confidentiality and Data Storage:

We will remove all identifying information from the downloaded study data as soon as possible, which will be after April 14, 2021. We will treat your personal information as confidential, although absolute privacy cannot be guaranteed. No information that discloses your identity will be released or published without your specific consent. However, research records identifying you may be accessed by the Carleton University Research Ethics Board to monitor the research.

The coded data will be stored on Carleton based computers that are password-protected or Carleton's One Drive which uses your MyCarletonOne (MC1) account name & password and files are encrypted in transit and at rest. The computers will be located in Dr. Gunnell's office and Dr. Gunnell's Lab, both of which have locked doors. The files will be encrypted, and the data will be de-identified. Data will not be sent over email. Data will be shared between members of the research team via a shared folder on Carleton's One Drive. To transfer data between computers, an encrypted USB key will be used. Once the data are transferred, the encrypted USB key will be wiped clean. The encrypted USB key will be stored in a locked filing cabinet in Dr. Gunnell's office or lab.

De-identified (i.e., no personal information or IP address) data will be stored indefinitely for possible future use on the same or related topics. Data may be used by other researchers or students. Anonymized data will be shared publicly. The anonymized data set will be uploaded onto the Open Science Framework, where it will be available for public access. The data placed on Open Science Framework will be completely anonymous (i.e., only the data from the study variables and demographic information will be made available; unique participant codes, names, email addresses, student numbers, SONA ids, IP addresses will be removed).

All data could be used in presentations and/or for future research. For presentations and future research, participants will not be identifiable and aggregate data will be presented.

Because you may be granted course credit for taking part in the study, identifying information will be retained. Identifying information will be removed from the data when it is downloaded and replaced with a unique code. A master file linking the unique codes and identifying information will be password protected and stored on a password protected computer or Carleton's One Drive cloud server. All research data will be encrypted. Your data will be stored and protected by Qualtrics. Qualtrics servers are based in Toronto Canada but may be disclosed via a court order or data breach. Qualtrics data will not collect IP addresses. Research data will be accessible by the researcher, the research supervisor, and the survey company.

REB Review and Contact Information:

This research has been cleared by Carleton University Research Ethics Board-B (CUREB-B Clearance #114999). If you have any ethical concerns with the study, please contact Dr. Bernadette Campbell, Chair by email at ethics@carleton.ca.

Implied consent:

By completing the online survey, you are agreeing to participate in the study.

Debriefing Letter

Name and Contact Information of Researchers:

Katie Gunnell, Carleton University, Department of Psychology

Email: katie.gunnell@carleton.ca

Mackenzie Johnston, Carleton University, Department of Psychology

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Jayson Yung, Carleton University, Department of Psychology

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Project Title: Mindful Screen Time and Well-Being

Project Sponsor and Funder

Social Sciences and Humanities Research Council (SSHRC)

Faculty of Arts and Social Sciences, Carleton University

Carleton University Project Clearance

Clearance # 11499

Date of Clearance: January 15th, 2021

What are we trying to learn in this research?

The questionnaires you completed assessed mindfulness and psychological need satisfaction during screen time, self-compassion, motivation, well-being, and behaviours such as physical activity, sleep, and sedentary behaviours. We were interested in determining if we can accurately measure mindfulness and psychological needs during screen time in a valid and reliable way. To do this, we will use statistical analyses to determine if the questionnaires are valid and reliable. We will examine the relationships between mindfulness and psychological needs during screen time and other important variables such as self-compassion, your overall well-being and behaviours such as physical activity, sleep, and sedentary behaviours. As well, we will measure motivation to exercise and its relationships between mindfulness, self-compassion, overall well-being, and important behaviours (physical activity, sleep, and sedentary behaviours).

Why is this important to scientists or the general public?

This research will benefit both the research community and society in general. This study will help us determine if we can measure screen time quality through self-report questionnaires. This research may provide information about the psychological processes that occur during digital screen use that differentiate the quality of the experiences into adaptive or maladaptive in relation to well-being and the regulation of behaviour. With continued research, this could provide information on how to leverage technology for the well-being, self-regulation of other behaviours, and digital literacy of young Canadians. This study will also contribute to advancing theory, measurement, and informing future research.

What are our hypotheses and predictions?

We predict that scores from the modified instruments will retain the same factor structure evidenced in the original questionnaire from other contexts outside of screen time. We also believe that psychological need satisfaction and mindfulness during screen time will be positively correlated with well-being, sleep, and physical activity. It is also predicted that psychological need frustration will be negatively correlated with well-being, sleep, and physical activity. Lastly we believe self-compassion will be positively related to well-being, exercise motivation and health behaviours.

Where can I learn more?

If participants became upset during or after participation, they can contact someone at the following numbers:

- Mental Health Crisis Line:
 - Within Ottawa (613) 722-6914
 - Outside Ottawa 1-866-996-0991, Web Site: <http://www.crisisline.ca/>
- Ottawa Distress Centre: (613) 238 1089, Web Site: www.dcottawa.on.ca
- Carleton University Health Services 613 520 6674

For more information on the relationships between health behaviours and psychological health, see the following resources:

Saunders, T. J., & Vallance, J. K. (2016). Screen time and health indicators among children and youth: Current evidence, limitations and future directions. *Applied health economics and health policy*, 1-9. doi:10.1007/s40258-016-0289-3

Cain, N., & Gradisar, M. (2010). Electronic media use and sleep in school-aged children and adolescents: A review. *Sleep Medicine*, 11(8), 735-742.
doi:10.1016/j.sleep.2010.02.006

Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current opinion in psychiatry*, 18(2), 189-193.

LeBlanc, A. G., Gunnell, K. E., Prince, S. A., Saunders, T. J., Barnes, J. D., & Chaput, J. P. (2017). The Ubiquity of the Screen: An Overview of the Risks and Benefits of Screen Time in Our Modern World. *Translational Journal of the American College of Sports Medicine*, 2(17), 104-113. doi:10.1249/TJX.0000000000000039

What if I have questions later?

If you have any remaining concerns, questions, or comments about this study, please feel free to contact Dr. Katie Gunnell (principal investigator) at katie.gunnell@carleton.ca, Mackenzie Johnston (student researcher) at mackenziejohnston@cmail.carleton.ca, or Jayson Yung (student researcher) at jaysonyung@cmail.carleton.ca.

CUREB-B:

This research has been cleared by Carleton University Research Ethics Board-B (CUREB-B Clearance #114999). If you have any ethical concerns with the study, please contact Dr. Bernadette Campbell, Chair, Carleton University Research Ethics Board-B (via email at ethics@carleton.ca).

Thank you for participating in this research!

Appendix B: Study 1 Eligibility and Demographic Questionnaire

We would like to find out a little bit about you. Please answer the questions below so we can learn more about you. There are no right or wrong answers to these questions and you can skip any question you feel uncomfortable answering!

1. Are you a student at Carleton University?

- Yes
- No

2. Are you able to read and understand English?

- Yes
- No

3. Are you 18 years or older

- Yes
- No

4. How old are you? _____ years old

5. What is the year of your birth? (YYYY) _____

6. What is your gender?

- Man
- Woman
- Other (please specify) _____
- Prefer not to answer

7. Do you belong to any of the population groups listed below?

- White
- Chinese
- South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)
- Black

- Filipino
- Latin American
- Southeast Asian (e.g., Vietnamese, Cambodian, Laotian, Thai, etc.)
- Arab
- West Asian (e.g., Iranian, Afghan, etc.)
- Korean
- Japanese
- Not sure
- Other (please specify) _____

8. What is your parents' marital status?

- Married
- Divorced or separated
- Never Married
- Widowed parent

9. What is the **MOTHER'S** highest level of education completed?

- Less than high school
- Some high school
- High school diploma/GED
- Diploma or 1-3 years of college
- Bachelor's degree
- Graduate (Master's or PHD)/professional degree

10. What is the **FATHER'S** highest level of education completed?

- Less than high school
- Some high school
- High school diploma/GED
- Diploma or 1-3 years of college
- Bachelor's degree
- Graduate (Master's or PHD)/professional degree

11. How tall are you _____ (feet and inches) **or** _____ (centimeters)

12. How much do you weigh _____ (pounds) **or** _____ (kilograms)

Appendix C: Study 1 and Study 2 Measures

Self-Compassion Scale (SCS)

HOW I TYPICALLY ACT TOWARDS MYSELF IN DIFFICULT TIMES

Please read each statement carefully before answering. For each item, indicate how often you behave in the stated manner, using the following 1-5 scale. Please answer according to what really reflects your experience rather than what you think your experience should be. (almost

never= 1, almost always =5)

1. I'm disapproving and judgmental about my own flaws and inadequacies.
2. When I'm feeling down, I tend to obsess and fixate on everything that's wrong.
3. When things are going badly for me, I see the difficulties as part of life that everyone goes through.
4. When I think about my inadequacies, it tends to make me feel more separate and cut off from the rest of the world.
5. I try to be loving towards myself when I'm feeling emotional pain.
6. When I fail at something important to me I become consumed by feelings of inadequacy.
7. When I'm down, I remind myself that there are lots of other people in the world feeling like I am.
8. When times are really difficult, I tend to be tough on myself.
9. When something upsets me, I try to keep my emotions in balance.
10. When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.
11. I'm intolerant and impatient towards those aspects of my personality I don't like.
12. When I'm going through a very hard time, I give myself the caring and tenderness I need.

13. When I'm feeling down, I tend to feel like most other people are probably happier than I am.
14. When something painful happens I try to take a balanced view of the situation.
15. I try to see my failings as part of the human condition
16. When I see aspects of myself that I don't like, I get down on myself.
17. When I fail at something important to me, I try to keep things in perspective.
18. When I'm really struggling, I tend to feel like other people must be having an easier time of it.
19. I'm kind to myself when I'm experiencing suffering.
20. When something upsets me I get carried away with my feelings.
21. I can be a bit cold-hearted towards myself when I'm experiencing suffering.
22. When I'm feeling down, I try to approach my feelings with curiosity and openness.
23. I'm tolerant of my own flaws and inadequacies.
24. When something painful happens I tend to blow the incident out of proportion.
25. When I fail at something that's important to me, I tend to feel alone in my failure.
26. I try to be understanding and patient towards those aspects of my personality I don't like.

BREQ-3**WHY DO YOU ENGAGE IN EXERCISE?**

We are interested in the reasons underlying peoples' decisions to engage or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes. Please answer the following statements on a scale of (0= not true for me, 1, 2 = sometimes true for me, 3, and 4= very true for me).

1. It's important to me to exercise regularly
2. I don't see why I should have to exercise
3. I exercise because it's fun
4. I feel guilty when I don't exercise
5. I exercise because it is consistent with my life goals
6. I exercise because other people say I should
7. I value the benefits of exercise
8. I can't see why I should bother exercising
9. I enjoy my exercise sessions
10. I feel ashamed when I miss an exercise session
11. I consider exercise part of my identity
12. I take part in exercise because my friends/family/partner say I should
13. I think it is important to make the effort to exercise regularly
14. I don't see the point in exercising
15. I find exercise a pleasurable activity

16. I feel like a failure when I haven't exercised in a while
17. I consider exercise a fundamental part of who I am
18. I exercise because others will not be pleased with me if I don't
19. I get restless if I don't exercise regularly
20. I think exercising is a waste of time
21. I get pleasure and satisfaction from participating in exercise
22. I would feel bad about myself if I was not making time to exercise
23. I consider exercise consistent with my values
24. I feel under pressure from my friends/family to exercise

International Physical Activity Questionnaire

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous and moderate activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. Do you currently have a job or do any unpaid work outside your home?

Yes

No → Skip to PART 2: TRANSPORTATION

The next questions are about all the physical activity you did in the last 7 days as part of your paid or unpaid work. This does not include traveling to and from work.

- 1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, heavy construction, or climbing up stairs as part of your**

work? Think about only those physical activities that you did for at least 10 minutes at a time.

_____ days per week

No vigorous job-related physical activity → Skip to question 4

2. **How much time did you usually spend on one of those days doing vigorous physical activities as part of your work?**

_____ hours per day _____ minutes per day

3. **Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads as part of your work? Please do not include walking.**

_____ days per week

No moderate job-related physical activity → Skip to question 6

4. **How much time did you usually spend on one of those days doing moderate physical activities as part of your work?**

_____ hours per day _____ minutes per day

5. **During the last 7 days, on how many days did you walk for at least 10 minutes at a time as part of your work? Please do not count any walking you did to travel to or from work.**

_____ days per week

No job-related walking → Skip to PART 2: TRANSPORTATION

6. **How much time did you usually spend on one of those days walking as part of your work?**

_____ hours per day _____ minutes per day

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you traveled from place to place, including to places like work, stores, movies, and so on.

7. **During the last 7 days, on how many days did you travel in a motor vehicle like a train, bus, car, or tram?**

_____ days per week

No traveling in a motor vehicle → Skip to question 10

8. **How much time did you usually spend on one of those days traveling in a train, bus, car, tram, or other kind of motor vehicle?**

_____ hours per day _____ minutes per day

Now think only about the **bicycling** and **walking** you might have done to travel to and from work, to do errands, or to go from place to place.

9. **During the last 7 days, on how many days did you bicycle for at least 10 minutes at a time to go from place to place?**

_____ days per week

No bicycling from place to place → Skip to question 12

10. **How much time did you usually spend on one of those days to bicycle from place to place?**

_____ hours per day _____ minutes per day

11. **During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?**

_____ days per week

No walking from place to place → Skip to PART 3: HOUSEWORK, HOUSE
MAINTENANCE, AND CARING FOR FAMILY

12. **How much time did you usually spend on one of those days walking from place to place?**

_____ hours per day _____ minutes per day

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the last 7 days in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

13. **Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, chopping wood, shoveling snow, or digging in the garden or yard?**

_____ days per week

No vigorous activity in garden or yard → Skip to question 16

14. **How much time did you usually spend on one of those days doing vigorous physical activities in the garden or yard?**

_____ hours per day _____ minutes per day

15. **Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate activities like carrying light loads, sweeping, washing windows, and raking in the garden or yard?**

_____ days per week

No moderate activity in garden or yard → Skip to question 18

16. **How much time did you usually spend on one of those days doing moderate physical activities in the garden or yard?**

_____ hours per day _____ minutes per day

17. **Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate activities like carrying light loads, washing windows, scrubbing floors and sweeping inside your home?**

_____ days per week

No moderate activity inside home → Skip to PART 4: RECREATION, SPORT AND

LEISURE-TIME PHYSICAL ACTIVITY

18. **How much time did you usually spend on one of those days doing moderate physical activities inside your home?**

_____ hours per day _____ minutes per day

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

19. **Not counting any walking you have already mentioned, during the last 7 days, on how many days did you walk for at least 10 minutes at a time in your leisure time?**

_____ days per week

No walking in leisure time → Skip to question 22

20. **How much time did you usually spend on one of those days walking in your leisure time?**

_____ hours per day _____ minutes per day

21. **Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do vigorous physical activities like aerobics, running, fast bicycling, or fast swimming in your leisure time?**

_____ days per week

No vigorous activity in leisure time → Skip to question 24

22. **How much time did you usually spend on one of those days doing vigorous physical activities in your leisure time?**

_____ hours per day _____ minutes per day

23. **Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis in your leisure time?**

_____ days per week

No moderate activity in leisure time → Skip to PART 5: TIME SPENT

SITTING

24. **How much time did you usually spend on one of those days doing moderate physical activities in your leisure time?**

_____ hours per day _____ minutes per day

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

25. During the last 7 days, how much time did you usually spend sitting on a weekday?

_____ hours per day

_____ minutes per day

26. During the last 7 days, how much time did you usually spend sitting on a weekend day?

_____ hours per day

_____ minutes per day

Leisure Time Exercise Questionnaire

During a typical 7-Day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time (write on each line the appropriate number).

- a. STRENUOUS EXERCISE (HEART BEATS RAPIDLY)** (e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling).

Times per week: _____

- b. MODERATE EXERCISE (NOT EXHAUSTING)** (e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing).

Times per week: _____

- c. MILD/LIGHT EXERCISE (MINIMAL EFFORT)** (e.g., yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking).

Times per week: _____

- d.** During the last 7 days (week), in your leisure time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

OFTEN

SOMETIMES

NEVER/RARELY

1.

2.

3.

Appendix D: Ethics Materials for Study 2

SONA Recruitment Notice

Study Name: Writing and exercise study

Description: The overall goal of this study is to examine the relationships between self-compassion, physical activity, well-being, and exercise motivation. This study asks first year students enrolled in classes (PSYC 1001 & PSYC 1002) at Carleton University to fill out 3 online surveys. Participants will also be asked to complete a writing or word task activity every day for 5 days.

Eligibility Requirements: We are looking for young adults, who are (a) first-year Carleton University students, (b) who have experienced a physical activity setback within the past 6 months (e.g., not enough time to be physically active), who believe the physical activity setback was their fault (*i.e., you signed up for a sports team or fitness class and never went or you chose to do other activities besides physical activity such as hanging out with friends or watching TV*), think about the physical activity setback, and (c) taking PSYC 1001 or 1002. Participants who signed up to complete the study in the fall term will be unable to sign up to complete the study in the winter term. Only individuals meeting these criteria will be eligible to participate.

Participants should begin the study as soon as possible once they have signed up in SONA because signing up on SONA does not guarantee a spot in the study. Only participants who complete the study (*i.e., who sign up in SONA and begin the questionnaire*) while it is open will be eligible for compensation (see below). The study will close when we have enough participants, which could occur before the data collection end date listed in SONA and on the informed consent (April 10, 2022).

Risks: There are no foreseeable risks in participating in this study. The surveys and activities will be completed online therefore there are no physical risks. Each survey should take 30 - 40 minutes to complete. Some survey questions related to self-compassion and personal physical activity setbacks may elicit slight feeling of discomfort. If there are any questions that participants do not feel comfortable answering they may skip the question or opt to end the questionnaire at any point during the study. If participants become upset during or after participation, they can contact someone at the following numbers:

- Mental Health Crisis Line:
 - Within Ottawa (613)-722-6914
 - Outside Ottawa 1-866-996-0991, Web Site: <http://www.crisisline.ca/>
- Ottawa Distress Centre: (613)-238-1089, Web Site: www.dcottawa.on.ca
- Carleton University Health Services 613-520-6674

Duration and Locale: This is a multi-phase study and will take approximately **175 minutes** (2.9 hours) to complete online (through SONA and Qualtrics). Specifically, the study involves: an online survey (Day 1) followed by a daily writing or word activity to be completed for 5 consecutive days (Day 2 – Day 6), an online survey at Day 9, and a follow-up online survey in 2 weeks.

Compensation: Participants can receive up to 2.50% bonus course credit and a chance to win one of 2 e-gift cards valued at \$50 CAD or one of three e-gift cards valued at \$25 CAD. Eligible participants will be entered into 5 draws for a chance to win an e-gift card. Please note **ONLY** participants who complete all parts of the study, that is the first questionnaire, the 5 days of assigned activities, the second questionnaire and the final questionnaire, will be entered into the draw for the e-gift card. Missed surveys cannot be taken at a later date or time and therefore

cannot be compensated. Participants will have 24 hours to complete each daily activity before the link expires. For Time 2 and Time 3 surveys, participants will have 48 hours to complete before the survey links expire.

Participants who miss any part of the study after the first survey will still be able to continue with the rest of the study, but will only be compensated for the parts of the study completed and will not be entered into the gift card draw. For example, if a participant misses 2 days of the writing activities, they will not be compensated for these missed days, but will be able to complete the next parts of the study and receive course credit. If the participant chooses to end their participation in this study at any point, they will still receive compensation of their SONA credit(s) for parts of the study they have completed up until that point, but will not be entered in the draw for the gift cards. For example, suppose a participant has completed each component of the study except the second survey. In that case, they will receive course credit for each component they have completed. Participants will not receive course credit for the missed component(s). If a participant misses a component, they may continue with the study and receive course credit only for the components completed.

Bonus course credit will be granted within 1 week of the participant completing the study. The draws will take place April 12th, 2022, and winners will be notified via email. Participants who win the e-gift card must respond to the prize email within seven days to claim it, or the prize will be re-drawn. Winners of the draw may choose gift cards from Amazon.ca, Starbuck Canada, Walmart Canada, or Best Buy.ca. *Please note that gift cards will be in Canadian dollars (CAD) and eligible for Canadian locations **only** (e.g., Amazon.ca, Best Buy Canada, etc.). Winners of the e-gift cards will be compensated at the end of the study and contacted via email.

*Participants withdrawing from the study will be eligible to receive the compensation (SONA credit) for what they have completed up to that date and based on the guidelines outlined above.

* Participants who win the e-gift card must respond to the prize email within 7 days to claim it.

One reminder email will be sent to participants who win the e-gift card within the seven day response period. If no response from the participant is received within 7 days from when the initial email was sent, the prize will be re-drawn, and they will no longer be eligible to receive the prize.

Compensation and Participation Schedule:

Time 1: 45 minutes total: completion of consent and first online questionnaire = 0.50 % bonus course credit.

Day 1 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Day 2 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Day 3 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Day 4 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Day 5 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Time 2 Survey (2 days after completing the final activity): 35 minutes total: completion of second online questionnaire = 0.50% bonus course credit.

Time 3 Survey: 15 minutes (at 2-week follow-up): completion of final online questionnaire = 0.25% bonus course credit.

Lead Researcher and Faculty Supervisors:

Dr. Rachel Burns, PhD

Assistant Professor, Department of Psychology

Carleton University

Phone: 613-520-2600 ext. 2680; Email: rachel.burns@carleton.ca

Dr. Katie Gunnell, PhD

Associate Professor, Department of Psychology

Carleton University

Phone: 613-520-2600 ext. 2419; Email: katie.gunnell@carleton.ca

Mackenzie Johnston

M.A. Candidate, Department of Psychology

Carleton University

Email: mackenziejohnston@cmail.carleton.ca

This research has been cleared by Carleton University Research Ethics Board-B (Clearance # 116442).

If you have any ethical concerns with the study, please contact the Carleton University Research Ethics Board- B (by phone at 613-520-2600 ext. 4058 or via email at ethics@carleton.ca).

During Covid, the Research Ethics Staff are working from home without access to their Carleton phone extensions. Accordingly, until staff return to campus, please contact them by email.

Informed Consent

Supervisor:

Dr. Rachel Burns, PhD

Assistant Professor, Department of Psychology

Carleton University

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Dr. Katie Gunnell, PhD

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Student Researcher:

Mackenzie Johnston

M.A. Candidate, Department of Psychology

Carleton University

Email: mackenziejohnston@cmail.carleton.ca

Project title: Writing and exercise study.

Carleton University Project Clearance:

CUREB-B Clearance #: 116442

Date of Clearance: January 31, 2022

Invitation: You are invited to take part in a research project because you are a first-year Carleton University student taking PSYC 1001 or PSYC 1002. To be eligible to participate you must also have experienced a physical activity setback (e.g., not enough time to be physically active) within the past 6 months, believe the physical activity setback was your fault (*i.e.*, you

signed up for a sports team or fitness class and never went, or you chose to do other activities besides physical activity such as hanging out with friends or watching TV), and think about the physical activity setback. The study will involve 3 online surveys and 5 activities that you will complete on 5 consecutive days. The information in this form is intended to help you understand what we are asking of you so that you can decide whether you agree to participate in this study. Your participation in this study is voluntary, and a decision not to participate will not be used against you in any way. Take your time to read this form and decide whether you would be interested in participating. If you have any questions, please reach out to the research team via the contact information listed above.

Study Objectives: The overall goal of this study is to examine the relationships between self-compassion, physical activity, well-being, and exercise motivation. If you decide to participate there will be multiple steps that all occur online over 6 consecutive days, with a second survey on Day 9, and a follow up survey after 2 weeks.

First, on Day 1 you will be asked to complete an online survey with questions relating to your demographic information, motivation, well-being, self-compassion, and physical activity (leisure time exercise and physical activity). You will also complete a short activity at the end of the survey. This will take approximately 45 minutes to complete. The survey will be administered online through SONA.

Second, you will be emailed instructions for your writing or word activity the following day (Day 2) this should take you 15 minutes to complete. For 5 consecutive days you will receive an email with instructions for your writing or word activity (Day 2 – Day 6). Please do not discuss what you have been asked to do for this study with other students. You will have 24 hours to complete the activity for the day before the link expires.

Third, on Day 9 you will receive an online survey via email to complete with questions pertaining to motivation, self-compassion, well-being, and physical activity (leisure time exercise and physical activity). This will take approximately 35 minutes to complete. You will have 48 hours to complete the survey before the link expires.

Fourth, you will complete a follow-up survey that will be sent to you through email (approximately 15 minutes). Questions on this survey will relate to well-being, physical activity, feedback from the daily activities, and your experience with the daily activities. You will have 48 hours to complete the survey before the link expires.

Your participation in this study is voluntary, and you may choose not to take part, or not to answer any of the questions. If you decide to withdraw after you submit the survey, we will remove your responses from the survey data if you notify the researcher (Mackenzie Johnston) before April 10, 2022. Your data will be withdrawn without penalty. We hope to survey a total of 250 people. The study will close when we have enough participants, which could occur before the data collection end date listed in SONA and on the informed consent (April 10, 2021).

Eligibility: We are looking for young adults, who are (a) first-year Carleton University students, (b) who have experienced a physical activity setback within the past 6 months, who believe the physical activity setback was their fault (*i.e., you signed up for a sports team or fitness class and never went or you chose to do other activities besides physical activity such as hanging out with friends or watching TV*), think about the physical activity setback, and (c) taking PSYC 1001 or 1002. Only individuals meeting these criteria will be eligible to participate. Participants can only participate in this study once therefore those who participated in the fall term will not be able to sign up again for the winter term.

Potential Risks and Benefits: There are no foreseeable risks associated with participating in this study. There is no more of a physical risk associated with participating in this study than is consistent with sitting in front of a computer to complete a survey for approximately 30-40 minutes at multiple time points. Some survey questions related to self-compassion and personal physical activity setbacks may elicit slight feelings of discomfort. If there are any questions that participants do not feel comfortable answering they may skip the question or opt to end the questionnaire at any point during the study. If you choose to end your participation in this study at any point you will still receive compensation of your SONA credit(s) that you have completed up until that point. If you become upset during or after your time participating in the study, you can contact someone at the following numbers or web sites:

- Mental Health Crisis Line:
 - o Within Ottawa: (613) 722-6914
 - o Outside of Ottawa 1-866-996-0991, Web Site: www.crisisline.ca
- Ottawa Distress Centre: (613) 238-1089, Web Site: www.dcottawa.on.ca
- Carleton University Health Services: 613-520-6674

Duration and Compensation: This is a multi-phase study and will take approximately **175 minutes** (2.9 hours) to complete online (through SONA and Qualtrics). Specifically, the study involves: an online survey (Day 1) followed by a daily writing or word activity to be completed for 5 consecutive days (Day 2 – Day 6), an online survey at Day 9, and a follow-up online survey in 2 weeks.

Participants enrolled in the courses PSYC 1001 and PSYC 1002 can receive up to 2.5% SONA credit and a chance to win one of 2 e-gift cards valued at \$50 CAD or one of three e-gift cards valued at = \$25. CAD. NOT ALL participants will be entered into the e-gift card draws; only participants who complete the last survey.

Missed surveys cannot be taken at a later date or time and therefore cannot be compensated.

Participants will have 24 hours to complete each daily activity before the link expires. For Time 2 and Time 3 surveys, participants will have 48 hours to complete before the survey links expire. Please note **ONLY** participants who complete all parts of the study, that is the first questionnaire, the 5 days of assigned activities, the second questionnaire and the final questionnaire, will be entered into the draw for the e-gift card.

The draws will take place April 12th, 2022, and winners will be notified via email. Participants who win the e-gift card must respond to the prize email within seven days to claim it, or the prize will be re-drawn. Winners of the draw may choose gift cards from Amazon.ca, Starbucks Canada, Walmart Canada, or Best Buy.ca.

*Please note that gift cards will be in Canadian dollars (CAD) and eligible for Canadian locations **only** (e.g., Amazon.ca, Best Buy Canada, etc.). Winners of the e-gift cards will be compensated at the end of the study and contacted via email.

Participants who miss any part of the study after the first survey will still be able to continue with the rest of the study, but will only be compensated for the parts of the study completed and will not be entered into the gift card draw. For example, if a participant misses 2 days of the writing activities, they will not be compensated for these missed days, but will be able to complete the next parts of the study and receive course credit. If the participant chooses to end their participation in this study at any point, they will still receive compensation of their SONA credit(s) for parts of the study they have completed up until that point, but will not be entered in the draw for the gift cards. For example, suppose a participant has completed each component of the study except the second survey. In that case, they will receive course credit for each component they have completed. Participants will not receive course credit for the missed

component(s). If a participant misses a component, they may continue with the study and receive course credit only for the components completed.

*Participants withdrawing from the study will be eligible to receive the compensation (SONA credit) for what they have completed up to that date and based on the guidelines outlined above.

* Participants who win the e-gift card must respond to the prize email within 7 days to claim it.

One reminder email will be sent to participants who win the e-gift card within the seven day response period. If no response from the participant is received within 7 days from when the initial email was sent, the prize will be re-drawn, and they will no longer be eligible to receive the prize.

Bonus course credit will be granted within 1 week of the participant completing the study.

Compensation and Participation Schedule:

Time 1: 45 minutes total: completion of consent and first online questionnaire = 0.50 % bonus course credit.

Day 1 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Day 2 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Day 3 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Day 4 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Day 5 Writing Activity: 15 minutes total: completion of daily activity = 0.25% bonus course credit.

Time 2: 35 minutes total: completion of second online questionnaire = 0.50% bonus course credit.

Time 3: 15 minutes (at 2-week follow-up): completion of final online questionnaire = 0.25% bonus course credit.

If you choose to end your participation in this study at any point you will still receive compensation of your SONA credit(s) that you have completed up until that point

Confidentiality and Data Retention: We collect data through Qualtrics, which uses servers with multiple layers of security to protect the privacy of the data (e.g., encrypted websites and password protected storage). We ensure that your Internet IP address will not be collected in Qualtrics. Any identifying information (i.e., your Carleton University email address and student number provided to ensure you receive compensation and to link data time points) will be deleted from the data set by April 28th, 2022, and participants will be rendered anonymous at that time. Identifying information will not be associated with survey answers. Furthermore, data that is rendered anonymous will be retained indefinitely. Qualtrics servers are based in Toronto, Canada but may be disclosed via a court order or data breach. Any publications using the data from this study will use the data of the group together, ensuring that no information about a single individual is given.

Because you may be granted course credit for taking part in the study, identifying information will be retained (e.g., emails and student numbers). Identifying information will be removed from the data when it is downloaded and replaced with a unique code. A master file linking the unique codes and identifying information will be password protected and stored on a password

protected computer or Carleton's One Drive cloud server. Data will be shared with members of the research team through the One Drive Carleton cloud.

Data Security: Data stored directly in Qualtrics (i.e., on Qualtrics servers) will be deleted after 1 year. The data files will be retained on the researcher's secure, password-protected computer indefinitely, and the anonymized data may be shared with other researchers, academic journals, or on online platforms such as Open Science Framework. All published data will be anonymous and presented in aggregate form.

Right to Withdraw: Your participation in this study is completely voluntary. At any point during the study, you have the right to leave any response blank or withdraw from the study without forfeiting your compensation for the component(s) of the study you have completed thus far. For example, if you have completed all components of the study and wish to withdraw after completion, you will be compensated fully for each component of the study you completed. If you choose to withdraw during the study and have only completed the first survey, you will receive course credit for the first survey only. Therefore, how your compensation will be impacted depends on how much of the study you have completed before withdrawing.

Participants who withdraw from the study will not be entered in the draw for the e-gift cards. If you would like to withdraw from the study, please click through the remaining survey pages, leaving the responses blank, until you reach the debriefing on the last page. After the data has been submitted, you can withdraw from the study (by emailing Mackenzie Johnston at mackenziejohnston@cmail.carlton.ca) until April 10, 2022. Incomplete responses will be considered in the data analysis unless you withdraw.

Publication of Results: Results of this study will be written in a graduate thesis and will be presented to committee members. The results may be published in scientific journals and

presented at conferences. Any publications using the data from this study will be anonymous and presented in aggregate form; ensuring no information about specific participants will be given.

Contact Information: If you have any questions about this study or require further information, please contact Mackenzie Johnston, Dr. Rachel Burns, or Dr. Katie Gunnell using the contact information provided at the top of this consent form.

Ethics Review: This research has been cleared by Carleton University Research Ethics Board-B (Clearance # 116442). If you have any ethical concerns with the study, please contact the Carleton University Research Ethics Board-B (by phone at 613-520-2600 ext. 4085 or via email at ethics@carleton.ca). During Covid, the Research Ethics Staff are working from home without access to their Carleton phone extensions. Accordingly, until staff return to campus, please contact them by email. Please print and keep a copy of this for your records.

Consent: *I agree to be part of the study described above based on the information I have read. I have had the chance to ask questions about the study, and I know that I may ask questions in the future. I understand that I may change my mind and stop being in the study at any time. If I choose to do this, I understand that there is the option to exit the survey, and I can withdraw without penalty. I acknowledge that in the case that I do withdraw, my data will be deleted directly from the server.*

Click on **“I consent”** if you agree to participate. This will direct you to the survey.

Click on **“I do not consent”** if you have read the above information and DO NOT agree to participate and wish to exit the survey.

I consent ____ I do not consent ____

Debriefing Letter

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Project title: Writing and Exercise Study.

Carleton University Project Clearance:

CUREB-B Clearance #: 116442

Date of Clearance: January 31, 2022

What are we trying to learn in this research?

Thank you for completing this study. Your responses will help us understand the relationships between self-compassion, exercise motivation, physical activity and well-being after a physical activity setback.

In this study, there were three groups that each completed a different set of activities. Group 1 was the self-compassion group; they wrote self-compassionate letters based on their physical activity setback. We hypothesized that Group 1 would have an effect. Group 2 was an active control group; they wrote letters about physical activity (e.g., what they enjoy doing, their motivation, possible physical activity setbacks, overcoming setbacks, perceived importance of physical activity). Group 3 was the inactive control group; they completed anagram puzzles tasks. Once data collection is complete (April 10, 2022), participants in Group 2 and Group 3 will receive the self-compassion intervention that Group 1 received to complete if they wish to do so. This will be sent via email and is only to complete for your own interest.

Why is this important to scientists or the general public?

Most Canadians report low levels of physical activity. Additionally, we know that a physical activity setback can further affect one's physical activity. This research will be used to determine if autonomous motivation is a factor that may be related to increasing the relationship between self-compassion and physical activity after a physical activity setback. It is possible that individuals who have had a physical activity setback and were in a self-compassion intervention are only influenced to engage in physical activity to a certain extent, but autonomous motivation further strengthens this relationship. For example, having self-compassion might influence physical activity engagement, but having self-compassion while also wanting to engage in physical activity for your interest and enjoyment (i.e., autonomous motivation), might strengthen

the relationship. It is also important to look at if self-compassion interventions can be used to improve individuals' well-being after a physical activity setback. These results could inform future research to test interventions that could be used to improve individuals' physical activity level and well-being and to inform future self-compassion interventions in the exercise domain.

What are our hypotheses and predictions?

We predicted that the self-compassion group would improve physical activity. We also predicted that individuals' autonomous motivation for exercise (self-determined exercise motivation) would moderate the relationship between individuals who received the self-compassion writing intervention and their physical activity levels after the intervention.

Where can I learn more?

If I found this study to be emotionally distressful, where can I get support?

In the event that you are feeling emotionally distressed, please feel welcome to contact:

- Mental Health Crisis Line:
Within Ottawa (613) 722-6914

Outside Ottawa 1-866-996-0991, Web Site: <http://www.crisisline.ca/>
- Carleton University Health Services: 613-520-6674
- Ottawa Distress Centre: (613) 238-1089, Web Site: www.dcottawa.on.ca

If you would like to learn more about the research conducted in the Health Psych Lab, please visit <https://carleton.ca/healthpsychlab/>.

Thank you for your time and for participating in this study! If you would like to receive information relating to the study outcome after data analysis, please contact Mackenzie Johnston (mackenziejohnston@cmail.carleton.ca), Dr. Rachel Burns (rachel.burns@carleton.ca), or Dr. Katie Gunnell (katie.gunnell@carleton.ca).

What if I have Questions?

If you have any questions, concerns, or comments about the study, please do not hesitate to contact us by sending a message to Mackenzie Johnston (Student Researcher; mackenziejohnston@cmail.carleton.ca), Dr. Rachel Burns (Supervisor; Rachel.burns@carleton.ca), or Dr. Katie Gunnell (Supervisor; katie.gunnell@carleton.ca).

This research has been cleared by Carleton University Research Ethics Board-B (Clearance # 116442). If you have any ethical concerns with the study, please contact the Carleton University Research Ethics Board-B (by phone at 613-520-2600 ext. 4085 or via email at ethics@carleton.ca). During Covid, the Research Ethics Staff are working from home without access to their Carleton phone extensions. Accordingly, until staff return to campus, please contact them by email.

Participants who win the e-gift card must respond to the prize email within 7 days to claim it. One reminder email will be sent to participants who win the e-gift card within the seven day response period. If no response from the participant is received within 7 days from when the initial email was sent, the prize will be re-drawn, and they will no longer be eligible to receive the prize.

Thank you for participating in this research study!

Appendix E: Eligibility and Demographic Material for Study 2

Physical activity includes ANY activity that increases your heart rate above resting, it is more than just your goal-directed structured exercise (e.g., running on a treadmill or lifting weights). For example, physical activity can also include activities such as household chores, outdoor work (e.g., raking leaves), walking outdoors, swimming, and taking the stairs.

1. Are you a first-year Carleton University student enrolled in a PSYC 1001 or PSYC 1002 course?
 - a. Yes
 - b. No
2. Physical activity includes ANY activity that increases your heart rate above resting, it is more than just your goal-directed structured exercise (e.g., running on a treadmill or lifting weights). For example, physical activity can also include activities such as household chores, outdoor work (e.g., raking leaves), walking outdoors, swimming, and taking the stairs.

Physical activity setbacks are events that slow you down when trying to achieve a personal physical activity goal. As well, physical activity setbacks can be other obstacles that get in your way when you are trying to engage in physical activity. Here are some possible examples of a physical activity setback but are not limited to these:

- set a goal to be more active, but life got in the way
- signed up for a sports team or fitness class and never went
- chose to do other activities besides physical activity such as hanging out with friends or watching TV
- didn't sign up for any extracurricular activities that could have helped you be more active
- didn't transition from working out at the gym to being physically active at home during COVID
- don't feel like you have enough time
- do not make time for exercise

Have you experienced a physical activity setback within the past 6 months?

Answer Options:

- **Yes**, I have experienced a physical activity setback.
- **No**, I have not experienced any physical activity setbacks.

Those who did not experience a physical activity setback will not be eligible to participate in the study and will be automatically directed to the end of the survey message.

3. **Do you believe that this physical activity setback was your fault?** (*i.e., you signed up for a sports team or fitness class and never went, you don't make time for physical activity, you chose to do other activities besides physical activity such as hanging out with friends or watching TV*).

Answer Options:

- **Yes, I believe this physical activity setback was my fault.** (*describe your setback in 1-2 sentences*)
- **No, I do not believe this physical activity setback was my fault.**

Those who do believe that their physical activity setback was their fault will not be eligible to participate in the study and will be automatically directed to the end of the survey message.

4. **How often do you think about this physical activity setback?**

Participants who answer "yes" to experiencing a physical setback that they believe was their fault will be asked how often they think about this setback on a 7-point Likert scale (0 = never, 6 = always).

Demographic Questionnaire: Study 2

We would like to find out a little bit about you. Please answer the questions below so we can learn more about you. There are no right or wrong answers to these questions and you can skip any question if you feel uncomfortable answering!

1. What is your Carleton University email? _____
2. What is your Carleton University student ID number? _____
3. Which gender do you identify with?
 - Man
 - Woman
 - Transgender man
 - Transgender woman
 - Non-conforming
 - Prefer to self-describe (please specify) _____
 - Prefer not to say
4. How old are you? (please indicate your age in years) _____
5. Do you belong to any of the groups below?
 - White
 - Chinese
 - South Asian (e.g., East Indian, Pakistan, Sri Lankan, etc.)
 - Black
 - Filipino
 - Latin American
 - Southeast Asian (e.g., Vietnamese, Cambodian, Laotian, Thai, etc.)
 - Arab
 - West Asian (e.g., Iranian, Afghan, etc.)
 - Korean
 - Japanese
 - Not sure
 - Other (please specify)
6. Have you experienced an injury within the past year?
 - Yes
 - No
7. What is your current living arrangement?
 - on-campus living
 - off-campus living

8. Are you currently employed?

- employed full-time
- employed part-time
- unemployed

Appendix F: Self-Compassion Intervention Protocol and Writing Prompts

Psychoeducation Component (presented at the end of Survey 1)

Most Canadians do not get enough physical activity to benefit their health. Physical activity can be difficult and often requires commitment, motivation, and confidence. Often, people engaging in physical activity experience setbacks. People may respond to physical activity challenges differently; some individuals may stop engaging in physical activity altogether. Self-compassion may help people overcome physical activity challenges or setbacks.

Have you ever heard of self-compassion? People who are high in self-compassion are kind and understanding to themselves during difficult times or personal failures. Self-compassion has three components: self-kindness, mindfulness, and common humanity.

Self-kindness involves acting kind towards yourself instead of being self-critical.

Mindfulness is when you can be aware of your thoughts and feelings without judging them or changing them.

Lastly, common humanity is when you understand and accept that your negative experience is not unique to you. Many other people are likely to have experienced this or are experiencing it at the same time you are, indicating that you are not alone in your experience or struggle.

Self-compassion promotion key ideas:

- Self-compassion shows promise in helping individuals overcome personal struggles such as a physical activity setback (Semenchuk et al., 2018).
- Self-compassion can help people deal with negative emotions. It may help to reduce negative emotions and increase more positive feelings such as kindness (Neff et al., 2005).
- Researchers have changed people's self-compassion through interventions. That research shows that self-compassion interventions can help people change their negative thoughts, and to learn skills to cope with many issues (Allen & Leary, 2010).

Benefits of Self-Compassion:

- Self-compassion may be a coping strategy for dealing with difficulties. People may use self-compassion to deal with their physical activity challenges to help them get back into regular physical activity after experiencing a setback (Semenchuk et al., 2018).
 - Self-compassion can help protect people from self-judgement (Neff, 2005).
 - Self-compassion is thought to help people engage in healthy behaviours (e.g., healthy eating or staying physically active) (Bosshard, 2020; Sirois et al., 2015).
- Self-compassionate letter writing has been used to help people improve their self-

compassion. It can also reduce self-criticism about a negative event. For example, self-compassion has been used to reduce smoking. Researchers have found that people who are self-compassionate are more likely to have good physical health (Dunne et al., 2016). As well, researchers have found that people who are self-compassionate are more likely to take care of their health (sleep, healthy eating, etc.) (Phillips & Hine, 2019).

Self-compassion is thought to improve people's motivation for health behaviours by reducing self-criticism, and how they respond to emotional events (Terry & Leary, 2011). Self-compassion can also help people deal with negative emotions when they experience a challenge in life. It can also improve positive emotions (Terry & Leary, 2011).

Lastly, research shows that self-compassionate people are more likely to participate in physical activity.

A self-compassion letter allows people to think and write about a negative experience, setback, or failure in a kind, unemotional, and understanding way. In this study, you will write about a personal physical activity setback.

The anatomy of a self-compassion letter (a brief sample letter):

- *Briefly describe what happened and what factors might have contributed to your physical activity setback.*

Example response: My physical activity setback is that I do not make time for physical activity anymore. I used to be very active a few years ago when I did not seem as busy as I am now. Sometimes, it bothers me to know that I do not make time for physical activity when I

know I should. If I allocated my time differently, I know I could make time to be more active. Sometimes these are just excuses that I tell myself. I think that even just taking my dog Dax on a short walk could help. I find having an exercise regimen a bit overwhelming.

- **Common Humanity:** *How might others have experienced the same physical activity setback as you? Who might have experienced the same setback as you, and why?*

Example response: I know that I am not the only one who struggles with making time to be active. Other students are likely in the same position as me. I am trying to balance my time between school, a part-time job, friends, and family; other students also have to do the same.

Other students might also experience this physical activity setback because they have a lot going on in their lives. I need to be kinder to myself and less critical.

- **Self-Kindness:** *Write to yourself about your physical activity setback using self-kindness. Write to yourself about your setback in a way that you would talk to your friend in the same situation.*

Example response: Sometimes I beat myself up over the fact that I don't make time to be active.

I know that it won't always be like this. I can balance all my other responsibilities, so I shouldn't beat myself up about it. I am trying my best.

- **Mindfulness:** Describe your setback in an unemotional way. What is your physical activity setback, and why is it happening? Try to detach from the event personally and describe it objectively (consider the facts).

Example response: I am aware that I could be more active. I am likely just tired by the end of the day or am in a rush to get to class, so I drive across campus instead of walking. If my friends were also active, that might help as well. If I think about my schedule and the amount of time I spend scrolling through my social media feeds, I am sure I could make more time for exercise if I wanted to.

You will now get a chance to practice writing a self-compassion letter to yourself using the prompts below. This is similar to the writing activity you will complete for the next 5 days.

This activity is for your reflection only. You will not be submitting this letter to the researchers. You will need a writing utensil and paper, or you can write your letter using a word-type document on your computer. Please do not discuss what you have been asked to do for this study with other students.

It is important to note that physical activity includes ANY activity that increases your heart rate above resting; it is more than just your goal-directed structured exercise (e.g., running on a treadmill or lifting weights). For example, physical activity can also include activities such as household chores, outdoor work (e.g., raking leaves), walking outdoors, swimming, and taking the stairs. **This activity should take 10 - 15 minutes of your time.** Here are a few examples of physical activity setbacks.

- **Goal-Oriented Issues**
 - Failure to reach goals
 - (i.e., set a goal to be active and weren't)
 - (i.e., set a goal to be more active, but life got in the way)
 - (i.e., signed up for a sports team or fitness class and never went)
 - (i.e., chose to do other activities besides physical activity such as hanging out with friends or watching TV)
- **Physical Setbacks**
 - Injury
 - (i.e., found it difficult to be active after an injury)
 - Access
 - (i.e., didn't buy a gym membership)
 - (i.e., didn't sign up for any extracurricular activities that could have helped to be more active.)
 - (i.e., didn't transition physical activity from extracurricular sports to physical activity at home during COVID)
 - (i.e., didn't transition physical activity from working out at the gym to working out at home during COVID)
- **Mental Setbacks**
 - Time
 - (i.e., don't feel like I have enough time)
 - (i.e., don't make time for exercise)
 - Competence
 - (i.e., not knowing how to be active)
 - (i.e., don't think I can be physically active)
 - Self-judgement
 - (i.e., not as strong as I would like to be)
 - (i.e., can't keep up with my friends at the gym)
 - do not find physical activity enjoyable

When you are ready, please begin!

1. **Write about a physical activity setback that you experienced in the past 6 months. This should be one that you believe was due to your fault. As well, this setback should be one that you have thought about on several different occasions. Explain how you were feeling during and immediately after this setback.**
2. **With this setback in mind, give some examples of how you think others might have experienced this as well.**
3. **Next, write to yourself about the setback in an understanding and kind way.**
4. **Lastly, write about your experience in an unemotional and mindful way.**

This activity is for your reflection only. You will not be submitting this letter to the researchers.

Did you complete the writing activity?

- Yes**
- No**

Activity 1 – sent via email through Qualtrics

Here are your instructions for your first activity. This should take you 15 minutes to complete.

Have a piece of paper and a writing utensil or a computer with a blank word-type document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted. Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

Consider physical activity setbacks...

- *Think about a challenging physical activity setback that you experienced over the past year.*
- *Briefly describe what happened and what factors might have contributed to this setback.*
- This setback should be one that you believe was due to your fault.
- As well, this event should be one that you have thought about on several different occasions.
- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

Here are a few examples of physical activity setbacks that could be due to your own fault:

- **Goal-Oriented Issues**
 - Failure to reach goals
 - (i.e., set a goal to be active and weren't)
 - (i.e., set a goal to be more active, but life got in the way)
 - (i.e., signed up for a sports team or fitness class and never went)
 - (i.e., chose to do other activities besides physical activity such as hanging out with friends or watching TV)
- **Physical Setbacks**
 - Injury
 - (i.e., found it difficult to be active after an injury)
 - Access
 - (i.e., didn't buy a gym membership)
 - (i.e., didn't sign up for any extracurricular activities that could have helped to be more active.)
 - (i.e., didn't transition physical activity from extracurricular sports to at physical activity at home during COVID)
 - (i.e., didn't transition physical activity from working out at the gym to working out at home during COVID)
- **Mental Setbacks**
 - Time
 - (i.e., don't feel like I have enough time)
 - (i.e., don't make time for exercise)
 - Competence
 - (i.e., not knowing how to be active)
 - (i.e., don't think I can be physically active)
 - Self-judgement
 - (i.e., not as strong as I would like to be)
 - (i.e., can't keep up with my friends at the gym)

- do not find physical activity enjoyable

Did you complete the writing activity?

- Yes
- No

Please press the next arrow when you are finished.

Activity 2 - sent via email through Qualtrics

Here are your instructions for your writing activity today. This should take you 15 minutes to complete. Have a piece of paper and a writing utensil or a computer with a blank word-type document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted.

Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

- *In regard to the physical activity setback that you described in the previous exercise, explain how others might have had similar setbacks.*
- *Who might have had a similar setback as you and why do you think this?*
- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

Did you complete the writing activity?

- Yes
- No

Please press the next arrow when you are finished.

Activity 3 - sent via email through Qualtrics

Here are your instructions for your writing activity today. This should take you 15 minutes to complete. Have a piece of paper and a writing utensil or a computer with a blank word-type document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted.

Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

- *In regard to the physical activity setback that you previously described, write about it to yourself in a kind and understanding way.*
- *Kindly write to yourself about the negative setback as you would to a close friend or family member.*
- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

Did you complete the writing activity?

- Yes
- No

Please press the next arrow when you are finished.

Activity 4 – sent via email through Qualtrics

Here are your instructions for your writing activity today. This should take you 15 minutes to complete. Have a piece of paper and a writing utensil or a computer with a blank word-type document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted. Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

- *Continue to reflect on your physical activity setback that you described in Activity 1. Write about it in an objective and unemotional manner (consider the facts).*
- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

Did you complete the writing activity?

- Yes
- No

Please press the next arrow when you are finished.

Activity 5 - sent via email through Qualtrics

Here are your instructions for your writing activity today. This should take you 15 minutes to complete. Have a piece of paper and a writing utensil or a computer with a blank word document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted.

Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do

not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

Consider putting your new skills into practice...

- *Use the skills that you have practiced over the last week and apply them to a recent physical activity setback.*
- *Reflect on a physical activity setback that you experienced more recently in the past week.*
- *If you have not experienced a recent setback, you are welcome to write about your first setback in Activity 1.*
- *This event should be one that you believe was due to your fault.*
- *As well, this setback should be one that you have thought about on several different occasions.*
- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

- Write a small paragraph for each prompt.

1. *Think about commonalities...*

- a. *Regarding the recent physical activity setback that you experienced in the past week, explain how others might have had similar setback.*
- b. *Who might have had a similar setback as you and why do you think this?*

2. *Think about support...*

- a. *Write about the recent physical activity setback that you experienced in the past week in a kind and understanding manner.*
- b. *Kindly write to yourself about your setback as you would to a close friend or family member.*

3. *Think about neutrality...*

- a. *Lastly, write about your recent physical activity setback in an unemotional and objective way.*

Did you complete the writing activity?

- Yes
- No

Did you write about a recent physical activity setback or the same setback from Activity 1?

- a recent physical activity setback
- the same setback from Activity 1

Please press the next arrow when you are finished.

Appendix G: Physical Activity Control Group Protocol and Writing Prompts

Psycho-Education Component (presented at the end of Survey 1)

Step 1: Participants will complete a practice letter writing task to prepare them for the writing activities they will complete in the upcoming week. They will be asked to write briefly about their experience with physical activity.

What is physical activity?

Physical activity includes ANY activity that increases your heart rate above resting. Physical activity can be structured and goal-oriented such as going to the gym and running on a treadmill or lifting weights. Physical activity can also include activities that increase your heart rate such as household chores (e.g., vacuuming), outdoor work (e.g., raking leaves), commuting to work or school (e.g., walking and cycling), work activity (e.g., lifting heavy objects while at work), sports (e.g., hockey, volleyball, cheerleading) or during your leisure time (e.g., swimming, skiing, dancing)

Benefits of Physical Activity

- Physical activity is related to good physical health. For example, it can reduce the risk of hypertension and chronic illnesses (e.g., diabetes and cancer) (Kim et al., 2012; Warburton et al., 2010)
- Physical activity is related to good mental health. For example, it can improve symptoms of depression and anxiety and enhance happiness and positive emotions (Kim et al., 2012; Wang et al., 2020).
- Engaging in physical activity can also help people feel more energized and improve cognitive functioning (Andreae, 2015; Bray & Born, 2004).
- Physical activity can improve people's self-perception and self-esteem (Zamani Sani et al., 2016)
- People who feel confident in their ability to do physical activity tend to be more active than others (Ryan & Deci, 2017).

Physical Activity Promotion

- Research has found that when people feel that they are good at physical activity it can help them continue engaging in it (Ryan & Deci, 2017). Try to pick physical activities that make you feel capable and competent.
- Research has shown that when people choose their own physical activity it will help them stay motivated to engage in it (Ryan & Deci, 2017). Try picking physical activities yourself rather than feeling pressured to do certain types of activity.
- Research has found that when people engage in physical activity with other people who are important to them, it will help them stick with it (Ryan & Deci, 2017). Try to recruit a friend, partner, or family member to engage in physical activity with you.
- When people engage in physical activity that they find personally enjoyable, that is in line with their identity and their values is related to more favourable outcomes such as more physical activity and well-being (Ryan & Deci, 2017).

One way that could help you increase your physical activity is through writing. Writing about personal experiences or thoughts can help you reflect and make meaning of them (Boud, 2001). Writing also has the potential to impact what you do and how you do it.

You will now get a chance to practice writing using the prompts below. This is similar to the writing activity you will complete for the next 5 days.

Please spend the next 10 - 15 minutes writing a letter to yourself using the prompts below. You will need a writing utensil and paper, or you can write your letter using a word-type document on your computer. Please do not discuss what you have been asked to do for this study with other students. **This activity is for your reflection only. You will not be submitting this letter to the researchers.**

When you are ready, please begin!

Write about how you engage in physical activity.

- **What activities do you do the most?**
- **How often do you do these and for long?**

- **What do you enjoy the most about these activities?**
- **What factors do you think might influence you to want to engage in physical activity?**
- **How often do you engage in physical activity with others?**

Did you complete the writing activity?

- **Yes**
- **No**

Please press the next arrow when you are finished.

Activity 1 - sent via email through Qualtrics

Here are your instructions for your writing activity today. This should take you 15 minutes to complete. Have a piece of paper and a writing utensil or a computer with a blank word-type document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted. Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

Consider the importance of physical activity...

- Write a brief paragraph by answering the questions below.
- *Why do you think physical activity is important?*
- *What strategies would you suggest to a friend who wants to be more physically active?*

- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

Did you complete the writing activity?

- Yes
- No

Please press the next arrow when you are finished.

Activity 2 – sent via email through Qualtrics

Here are your instructions for your writing activity today. This should take you 15 minutes to complete. Have a piece of paper and a writing utensil or a computer with a blank word-type document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted. Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

Consider a physical activity you enjoy...

- Write a brief paragraph by answering the questions below.
- *Why do you enjoy it?*
- *How did you start this activity?*
- *Do you complete it alone or with others?*
- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

Did you complete the writing activity?

- Yes
- No

Please press the next arrow when you are finished.

Activity 3 - sent via email through Qualtrics

Here are your instructions for your writing activity today. This should take you 15 minutes to complete. Have a piece of paper and a writing utensil or a computer with a blank word-type document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted. Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

Consider motivation for physical activity...

- Write a brief paragraph by answering the questions below.
- *Write about what motivates you to engage in physical activity?*
- *What do you think motivates others to engage in physical activity?*
- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

Did you complete the writing activity?

- Yes
- No

Please press the next arrow when you are finished.

Activity 4 - sent via email through Qualtrics

Here are your instructions for your writing activity today. This should take you 15 minutes to complete. Have a piece of paper and a writing utensil or a computer with a blank word-type document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted. Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

Consider physical activity setbacks...

- Write a brief paragraph by answering the questions below.
- *What physical activity setback have you experienced?*
- *Describe how you overcame that setback or how you plan to overcome it in the future.*
- *What are some strategies you would suggest a friend implement to overcome a similar physical activity setback?*
- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

Did you complete the writing activity?

- Yes
- No

Please press the next arrow when you are finished.

Activity 5 – sent via email through Qualtrics

Here are your instructions for your writing activity today. This should take you 15 minutes to complete. Have a piece of paper and a writing utensil or a computer with a blank word-type document available to you.

What is your Carleton University email? _____

What is your Carleton University student ID ? _____

- Before beginning this activity, please go to a quiet space where you are unlikely to be disrupted. Turn off or put away any possible distractions such as your cell phone, TV, or tablet. Please do not discuss what you have been asked to do for this study with other students. You are going to write a letter to yourself based on the instructions provided to you.

Consider others' physical activity setbacks...

- Write a brief paragraph by answering the questions below.
- *What physical activity setbacks do you think other people might have?*
- *Why do you think other people have physical activity setbacks?*
- **This activity is for your own reflection only. You will not be submitting this letter to the researchers.**
- **Please stay on this page until you have completed writing your letter.**

Did you complete the writing activity?

- Yes
- No

Please press the next arrow when you are finished.

Appendix H: Anagram Control Group Word Tasks

Activity 1 – sent via email through Qualtrics

- Here is your activity for today. Please do not discuss what you have been asked to do for this study with other students.
- What is your Carleton University email? _____
- What is your Carleton University student ID ? _____
- Please use the letters from each word to form a new word. Use a writing utensil or a word document. Your writing task will not be collected by the research team.
- - span
 - act
 - dad

Did you complete the activity?

- Yes
- No

Activity 2 – sent via email through Qualtrics

- Here is your activity for today. Please do not discuss what you have been asked to do for this study with other students.
- What is your Carleton University email? _____
- What is your Carleton University student ID ? _____
- Please use the letters from each word to form a new word. Use a writing utensil or a word document. Your writing task will not be collected by the research team.
- - part
 - loop
 - alps

Did you complete the activity?

- Yes
- No

Activity 3 – sent via email through Qualtrics

- Here is your activity for today. Please do not discuss what you have been asked to do for this study with other students.
- What is your Carleton University email? _____
- What is your Carleton University student ID ? _____
- Please use the letters from each word to form a new word. Use a writing utensil or a word document. Your writing task will not be collected by the research team.
- - care

- keen
- heart

Did you complete the activity?

- Yes
- No

Activity 4 – sent via email through Qualtrics

- Here is your activity for today. Please do not discuss what you have been asked to do for this study with other students.
- What is your Carleton University email? _____
- What is your Carleton University student ID ? ____
- Please use the letters from each word to form a new word. Use a writing utensil or a word document. Your writing task will not be collected by the research team.

- reed
- bare
- toga

Did you complete the activity?

- Yes
- No

Activity 5 – sent via email through Qualtrics

- Here is your activity for today. Please do not discuss what you have been asked to do for this study with other students.
- What is your Carleton University email? _____
- What is your Carleton University student ID ? _____
- Please use the letters from each word to form a new word. Use a writing utensil or a word document. Your writing task will not be collected by the research team.

- - tops
 - hops
 - stew

Did you complete the activity?

- Yes
- No

Appendix I: Adherence Questions for Study 2
Intervention Adherence Questionnaires at Post-Intervention_(Mosewich,
2013)

1. Out of the 5 writing activities, how many days did you complete the writing task assigned?
 - a. 0 days
 - b. 1 day
 - c. 2 days
 - d. 3 days
 - e. 4 days
 - f. 5 days

2. To what extent on a scale of 1 (not at all) to 5 (very much) did you engage in and make use of the daily writing activities?
 - a. 1 (not at all)
 - b. 2
 - c. 3 (somewhat)
 - d. 4
 - e. 5 (very much)

Intervention Adherence Questions at Follow-Up from Mosewich, 2013

Thank you for participating in this study. In order to understand your overall experience during and after the intervention we would like to ask you a few questions. The feedback that you provide will be used to inform future interventions to make improvements where necessary.

1. Since your participation in the 5-day writing activities, to what extent would you say that you have continued to use the skill that you learned?
 - a. 1 = Never
 - b. 2 = Rarely
 - c. 3 = Sometimes
 - d. 4 = Often
 - e. 5 = Very Often
2. What did you enjoy about these activities? _____
3. What did you dislike about these activities? _____
4. Do you have any suggestions for future studies using this writing activity? _____