Keep Calm and Remain Active: A Feasibility Study to Examine the Effect of Self-Compassion on Exercise Goal Adherence and Related Outcomes

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A Dissertation Presented to

the Faculty of the Department of Psychology

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In Partial Fulfillment

Of the Requirement of the Degree

Doctor of Philosophy

By

Celia Ching Yee Wong

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Keep Calm and Remain Active: A Feasibility Study to Examine the Effect of Self-Compassion on Exercise Goal Adherence and Related Outcomes

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ABSTRACT

The awareness of the health benefits of physical activity has been growing for recent decades. However, existing data indicated that 60% of the U.S. population do not meet the recommendations of physical activity (i.e., at least 150 minutes of moderate-intensity aerobic activity per week or a metabolic equivalent amount of physical activity per week). Much research effort has been put forth to develop physical activity interventions but many resulted in short-term behavioral change only. It is important to develop interventions that motivate sustained physical activity. Self-compassion, a positive self-concept, has been found positively related to health behaviors in recent studies. Research also showed that self-compassion is associated to self-efficacy, autonomous motivation to exercise and weight stigma, known contributing factors of physical activity. Therefore, the present study sought to understand the role of self-compassion in exercise goal adherence and related outcomes. A brief self-compassion exercise intervention was developed based on the results of two feasibility studies. Each examined the feasibility and acceptability of a commonly used brief self-compassion intervention: (1) loving kindness meditation (feasibility study 1), and (2) self-compassion writing (feasibility study 2). In the main study, 109 participants (89 valid cases; 82% female, mean age = 21.51, SD = 4.11; mean BMI = 25.17, *SD* = 6.85) were recruited from the research participation pool of the Department of Psychology at the University of Houston. After completing the baseline assessment and attending the orientation session, participants were randomized into the two conditions (44 participants in the self-compassion group and 45 participants in the control group). Both groups completed 7 daily intervention sessions (each with a brief survey which tracked daily exercise goal progress and mood,

and a brief writing task), and completed follow-up assessments immediately after and 1-month after the daily intervention period. They also used a pedometer application to track their step count for three consecutive weeks. In the brief writing task, participants in both groups were asked to write about (potential) barriers in pursuing their physical activity goals. The self-compassion group received additional prompts which guided them to use an accepting and self-compassionate attitude to process their experience. The hypotheses were partially supported. Results indicated that the self-compassion group reported significantly higher levels of positive self-compassion and higher intention to continue exercise goal(s) pursuit at the post-intervention assessment, compared with their control counterparts. The associations between daily exercise goal progress and daily mood (positive affect and negative affect) was weaker among the self-compassion group, compared with their control counterparts. However, no significant group differences were observed in physical activity (self-reported, step-count), exercise self-efficacy, autonomous motivation to exercise, weight stigma, physical and psychological outcomes. Overall, this study made some significant contributions to the self-compassion and physical activity literatures. It provided preliminary evidence for the feasibility and effectiveness of a self-compassion exercise intervention. Future research should expand on these findings and explore the possibility of integrating self-compassion in a larger-scale physical activity intervention, and investigate potential mechanisms that were not examined in this study.

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Introduction

Physical inactivity (lack of physical activity) has been identified as the fourth leading risk factor for mortality, and accounts for 6% of deaths globally (WHO, 2016). The linkage between physical activity and health has been well-established in both community samples and clinical samples (Kelley, Kelley, Hootman, & Jones, 2009; Mishra et al., 2014). Data indicated that physically active individuals tend to have better health - healthier body mass, better cardiorespiratory and muscular fitness, lower rates of chronic diseases (e.g., coronary heart diseases, high blood pressure, type 2 diabetes, metabolic syndrome), lower chance of having bone fracture and cancer (Bauman, 2004; Blair & Morris, 2009; WHO, 2016).

Per the Physical Activity Guidelines for Americans (United States Department of Health and Human Services, 2008), an adult should have at least 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity aerobic activity (or a metabolic equivalent amount of physical activity) per week to maintain good health condition. Despite increasing awareness of the health benefits of physical activity, more than 60% of the U.S. population do not meet the recommendations of physical activity (Carlson, Fulton, Schoenborn, & Loustalot, 2010; Huffman et al., 2012). While many physical activity interventions have been found successful in promoting short-term changes in physical activity, more research is needed to study factors that motivate sustained physical activity (Arikawa et al., 2012; Findorff, Wyman, & Gross, 2009).

Factors that Affect Physical Activity

Some commonly reported challenges of sustained physical activity include low exercise self-efficacy, low autonomous motivation to exercise, and high weight stigma

(Olaya-Contreras, Bastidas, & Arvidsson, 2015; Schmalz, 2010; Storch et al., 2007). Exercise self-efficacy and autonomous motivation to exercise are the most profound factors that promote physical activity (David et al., 2014; Dunton, Atienza, Castro, & King, 2009; McAuley et al., 2011; Silva et al., 2010). Both factors have been shown to be the major driving forces in the success of existing physical activity interventions (e.g., Burke et al., 2008; Darker, French, Eves, & Sniehotta, 2013; Dutton et al., 2009; Koponen, Simonsen, & Suominen, 2017; Weman-Josefsson, Fröberg, Karlsson, & Lindwall, 2017). Weight stigma is a relatively new, understudied mechanism in existing physical activity intervention studies. However, accumulating evidence has suggested that reducing weight stigma can promote physical activity, especially among overweight individuals (Ball, Crawford, & Owen, 2000; Bauer, Yang, & Austin, 2004; Hayden-Wade et al., 2005; Schmalz, 2010; Storch et al., 2007; Sykes & McPhail, 2008; Vartanian & Shaprow, 2008; Zabinski, Saelens, Stein, Hayden-Wade, & Wilfley, 2003).

Exercise self-efficacy. Self-efficacy refers to the confidence in one's ability to execute the specific actions required to achieve specific outcomes, which in turn determine individuals' subsequent behaviors, sustain or even increase one's effort and perseverance against obstacles and challenges (Bandura, 1997). Self-efficacy is a key construct in major theories of behavior change in health psychology, such as social cognitive theory (Bandura, 1977), the theory of planned behavior (Ajzen, 1991), and protection motivation theory (Prochaska & DiClemente, 1982).

Exercise self-efficacy is the belief that one can successfully engage in physical activity (Bandura, 1997; Bauman et al., 2012). The effect of exercise self-efficacy in promoting physical activity behaviors has been well-documented in the literature. Data

have suggested that increased exercise self-efficacy is the major mechanism that explains the effect of most physical activity interventions (e.g., Burke et al., 2008; Darker, French, Eves, & Sniehotta, 2013; Dutton et al., 2009). A meta-analysis of 20 physical activity intervention studies revealed a significant and large association between the change in exercise self-efficacy and the change in physical activity ($r = 0.69$; William & French, 2011). Experimental studies have also consistently found that interventions targeted at increasing exercise self-efficacy tend to be more successful in promoting lifestyle and recreational physical activity (for a review, please see Ashford, Edmunds, & French, 2010).

Two subtypes of exercise self-efficacy have been identified in the literature: task self-efficacy and barrier self-efficacy (Maddux, 1995; McAuley & Mihalko, 1998). In the context of physical activity, task self-efficacy refers to the confidence in one's ability to engage in physical activity, while barrier self-efficacy refers to the confidence in one's ability to engage in physical activity despite various barriers (Blanchard et al., 2007). Both types of exercise self-efficacy have been found significantly associated with increased physical activity (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998).

It has been suggested that task self-efficacy and barrier self-efficacy may have different functions in maintaining physical activity behaviors (Rogers et al., 2006). Two cross-sectional survey studies consistently showed that task self-efficacy and barrier self-efficacy have independent contributions to physical activity (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998). The strength of task self-efficacy and barrier self-efficacy in predicting physical activity may also vary at different stages of the habit building process (Blanchard et al., 2007). The influence of task self-efficacy on physical activity decreases

when individuals transit from adopting a new habit of physical activity to maintaining this habit (Blanchard et al., 2007). In contrast, the influence of barrier self-efficacy continues to exert a significant impact on physical activity during the maintenance phase, after individuals adopt physical activity as part of their daily routines (Blanchard et al., 2007). Therefore, it is important to examine both task self-efficacy and barrier self-efficacy in physical activity interventions.

Autonomous motivation to exercise. Autonomous motivation to exercise is particularly important in initiating and sustaining physical activity behaviors (Ng et al., 2012; Silva et al., 2010). According to the self-determination theory (Deci & Ryan, 1985, 2000; Ryan & Deci, 2017), motivation falls along a continuum from amotivation to controlled forms of behavioral regulation (i.e., extrinsic regulation, introjected regulation) to autonomous forms of behavioral regulation (i.e., identified regulation, integrated regulation, and intrinsic regulation). The categorization of behavioral regulation along the continuum depends on the degree of self-determination (a.k.a autonomy) for the target behavior. Amotivation is that the lack of intention and reflects behavior for which one does not even know why it occurs. Extrinsic regulation is the most controlled form (the least autonomous) of behavioral regulation, and intrinsic regulation is the most autonomous form of behavioral regulation.

Ng et al. (2012) described the continuum of behavioral regulation for physical activity as the following: Amotivation is present when an individual does not have any intention or reason to engage in physical activity. Extrinsic regulation is present when an individual participates in physical activity either to obtain rewards (e.g., losing weight, gaining social approval), or to avoid punishment (e.g., having illnesses, being warned by

physician). Introjected regulation is present when an individual internalizes regulation of physical activity but does not fully accept it as his/ her own (e.g., I would feel guilty when I do not exercise). Identified regulation is present when an individual participates in physical activity because the outcomes of physical activity are personally significant and important, even though he/ she may not enjoy physical activity itself at all. For instance, an individual may engage in physical activity for its health benefits but he/she does not like physical activity. Integrated regulation is present when an individual engages in physical activity and sees it as congruent with his/ her other central personal goals, values and identities (e.g., I exercise because I consider physical activity to be a fundamental part of who I am). Intrinsic regulation is present when an individual engages in physical activity because of his/ her inherent enjoyment and satisfaction of physical activity (e.g., I do physical activity because I like it, I think physical activity is fun, interesting and challenging).

Self-determination theory has been used as the theoretical framework of many effective physical activity interventions (e.g., Chatzisarantis & Hagger, 2009; Edmund, Ntoumanis, & Duda, 2008; Fortier, Sweet, O'Sullivan, & Williams, 2007; Fortier et al., 2011; Gourlan, Sarrazin, & Trouilloud, 2013; Levy & Cardinal, 2004; Peng, Pfeiffer, Winn, Lin, & Suton, 2015; Silva et al., 2010; Silva et al., 2011; Van Hoecke, Delecluse, Opdenacker, Boen, 2014). A systematic review of 66 empirical studies showed a significant association between autonomous forms of behavioral regulation and physical activity behaviors, with a trend that identified regulation is associated with initial/ short-term adoption of physical activity more strongly than intrinsic regulation, and intrinsic regulation is associated with long-term exercise adherence more strongly than identified

regulation (Teixeira, Carraca, Markland, Silva, & Ryan, 2012). Another meta-analysis of 46 studies indicated that one's relative autonomy index (a weighted score of degree of self-determination, taking account of all forms of behavioral regulation in the motivation continuum) and autonomous motivation (the mean of intrinsic regulation and identified regulation) had a moderate, positive association with leisure time physical activity among children and adolescents (Owen, Smith, Lubans, Ng, & Lonsdale, 2014).

Controlled forms of behavioral regulation (i.e., extrinsic regulation and introjected regulation) may not be sufficient in maintaining a positive behavior change (Silva et al., 2010). As indicated in two recent meta-analyses, autonomous forms of behavioral regulation (i.e., intrinsic regulation, integrated regulation, and identified regulation) are more strongly associated with physical activity than controlled forms of behavioral regulation (i.e., extrinsic regulation and introjected regulation); the association between controlled forms of behavioral regulation and physical activity was either negative or null (Owen, Smith, Lubans, Ng, & Lonsdale, 2014; Teixeira, Carraca, Markland, Silva, & Ryan, 2012). It should be noted that more controlled forms of behavioral regulation at the initial stage of physical activity habit formation does not necessarily deter individuals from sustaining physical activity if supportive conditions are in place (Ryan & Deci, 2000). When individuals experience satisfaction of basic needs for autonomy, competence, and relatedness, controlled forms of behavioral regulation can be internalized and transformed into autonomous forms of behavioral regulation, leading to adaptive behavioral, cognitive and affective outcomes (e.g., commitment to and engagement in consistent physical activity behaviors, joy; Silva et al., 2010).

Weight stigma. Weight stigma is the experience with, and internalization of, weight-related stereotypes (e.g., being lazy, sloppy, stupid; lacking motivation and will power; Durso, & Latner, 2008; Puhl & Brownell, 2001). These weight-related negative stereotypes can have a significant negative impact on physical activity, and contribute to the misconception that overweight people are not physically active (Schmalz, 2010). According to Link and Phelan (2001), internalization of stigma may shape individuals' behaviors in ways that are consistent with the negative stereotypes. Internalization of weight-related negative stereotypes may, thus, create additional barriers for overweight individuals to engage in physical activity (Schmalz, 2010).

While weight stigma has been less widely examined as a contributing factor of physical activity compared to exercise self-efficacy and autonomous motivation to exercise, emerging evidence has been promising. A few cross-sectional survey studies have indicated a significant and negative association between weight stigma and physical activity (Latner, Durso, & Mond, 2013; Pearl, White, & Grilo, 2013; Schmalz, 2010; Vartanian & Shaprow, 2008). Indirect evidence has also been indicated in qualitative studies. Overweight individuals reported being more likely to fall victim to teasing and bullying because of their body size and thus, became less motivated to participate in physical activities (e.g., Ball, Crawford, & Owen, 2000; Bauer, Yang, & Austin, 2004; Storch et al., 2007; Sykes & McPhail, 2008; Zabinski, Saelens, Stein, Hayden-Wade, & Wilfley, 2003).

In fact, weight stigma affects a much wider victim pool than just over-weight individuals (Pearl & Puhl, 2014). Due to the prevalence of the thin ideology in the modern culture and social media, normally-weighted individuals can also develop a

distorted body image, and experience weight stigma (DePierre & Puhl, 2012; Pearl & Puhl, 2014). A few studies have shown that the experience of weight stigma is significantly related to increased desire to avoid physical activity and poorer health functioning, even when body mass index (BMI) has been controlled for (Latner, Durso, & Mond, 2013; Pearl, White, & Grilo, 2013; Vartanian & Shaprow, 2008). This empirical evidence has suggested that weight stigma is not a unique barrier to physical activity for overweight individuals, but rather, weight stigma could be a possible barrier to physical activity for individuals of all body sizes.

Based on the existing evidence in the physical activity literature, it is very possible that individuals' physical activity could be promoted by enhancing their exercise self-efficacy and autonomous motivation to exercise, and reducing their weight stigma. The core and unaddressed question is how to change individuals' exercise self-efficacy, autonomous motivation to exercise and weight stigma. Self-compassion is a positive self-concept, which has been found to be significantly associated with self-efficacy (Iskender, 2009; Manavipour & Saeedian, 2016; Raque-Bogdan, Lent, & Lamphere, 2016; Sirois, Molnar, & Hirsch, 2015), autonomous motivation to exercise (Magnus, Kowalski, & McHugh, 2010; Mosewich, Kowalski, Sabiston, Sedgwick, & Tracy, 2011) and weight stigma (Hilbert et al., 2015). Perhaps, through cultivating self-compassion, individuals would experience increased exercise self-efficacy and autonomous motivation to exercise, and reduced weight stigma, which in turn, lead to sustained physical activity.

Self-Compassion

Self-compassion is the acknowledgement of one's suffering, and the desire to alleviate the suffering and to heal oneself with kindness (Neff, 2003a). Self-

compassionate individuals are open to their suffering; they are less likely to avoid or disconnect from their negative experience (Neff, 2003a). Self-compassion is also an adaptive coping strategy in the face of negative experience such as personal inadequacies and failures (Neff & Tirch, 2013). It provides non-judgmental understanding of one's negative feelings, inadequacies, and failures. It also allows individuals to normalize their negative experience, to see it as part of the larger human experience, and develop a more balanced perspective of their negative experience (Neff, 2003a).

Neff (2003a) operationally defined self-compassion as three components: Self-kindness (versus self-judgment), common humanity (versus isolation), and mindfulness (versus over-identification). *(1) Self-kindness* refers to the tendency to be sympathetic toward the self. It involves tolerance and understanding when relating to one's failings and inadequacies. When confronting negative experience, instead of harsh self-criticism and judgment, people with self-kindness give themselves the warmth, gentleness, and unconditional acceptance that are essential for emotional equanimity and healing (Neff, 2003a, 2003b; Neff & Tirch, 2013). *(2) Common humanity* refers to recognizing that all humans are connected - we all fail, we all make mistakes and engage in dysfunctional behaviors at some points of our lives. People with common humanity tend to have a broader and more inclusive perspective of their negative experiences. They acknowledge life challenges and personal failures as parts of the shared human experience, and that they are not alone in their struggles (Neff, 2003a, 2003b; Neff & Tirch, 2013). *(3) Mindfulness* is a nonjudgmental and receptive mind state that allows awareness of present moment experience. It allows individuals to acknowledge their negative inner experiences without reacting to them (Bishop et al., 2004; Kabat-Zinn, 2003). It has been

suggested that mindfulness is an essential component of self-compassion. It is hardly possible for individuals to treat themselves compassionately without recognizing their own negative inner experiences (Neff, 2003a, 2003b; Neff & Tirch, 2013).

Self-Compassion and Health. The health benefits of self-compassion have been well-established in the literature. Meta-analyses and individuals studies showed that self-compassion is associated with both psychological and physical health (Allen, Goldwasser & Leary, 2012; Hall, Row, Wuensch, & Godley, 2013; MacBeth & Gumley, 2012; Raque-Bodgan et al., 2011; Zessin, Dickhäuser, & Garbade, 2015). Other research also showed that self-compassionate individuals tend to adjust better to chronic illnesses such as chronic pain, diabetes, cancer, and HIV; self-compassionate individuals tend to have higher levels of self-efficacy in illness management and they tend to adopt more adaptive coping strategies (Brion, Leary, & Drabkin, 2014; Costa & Pinto-Gouveia, 2013; Eller et al., 2014; Friis, Consedine, & Johnson, 2015; Przezdziecki et al., 2013; Raque-Bogdan, Lent, & Lamphere, 2016; Sirois, Molnar, & Hirsch, 2015). There is also growing evidence that has suggested that self-compassionate individuals are more likely to engage in health behaviors such as exercising, getting adequate sleep, and having breakfast (Dunne, Sheffield, & Chilcot, 2016; Schoenfeld & Webb, 2013; Sirois, Kitner, & Hirsch, 2015), and they are less likely to engage in health-compromising behaviors such as unhealthy eating and smoking (Adam & Leary, 2007; Kelly, Zuroff, Foa, & Gilbert, 2010).

Self-Compassion and Exercise

The underlying mechanisms through which self-compassion benefits health is not yet known. It has been suggested that self-compassionate individuals may treat themselves with better care and concern, and regulate themselves in ways that promote their long-term well-being (Terry & Leary, 2011). Compared with less self-compassionate others, self-compassionate individuals may select more effective, safer, and more realistic health goals (Terry & Leary, 2011). They may also be more likely to engage in behaviors to reach their health goals, and adjust their behaviors and goals when progress is not sufficiently made (Terry & Leary, 2011). Indeed, two cross-sectional survey studies consistently found that the negative association between self-compassion and physical symptoms was mediated by increased health promoting behaviors (Dunne, Sheffield, & Chilcot, 2016; Sirois, Kitner, & Hirsch, 2015), which provided some evidence that self-compassionate individuals enjoy better health because they engage in more health promoting behaviors. Some intervention studies have been conducted and concluded that enhancing self-compassion could improve health behaviors but most studies focused on eating behaviors (e.g., Adams & Leary, 2007; Gale, Gilbert, Read, Goss, 2014; Kelly & Carter, 2015).

Research on self-compassion and exercise goal regulation has been limited. One recently published cross-sectional survey study indicated that self-compassion is associated with higher levels of exercise goal reengagement among individuals who recalled an exercise failure or setback (e.g., failing to meet an exercise goal, missing one or two exercise sessions, discontinuing gym membership/ classes) that occured within the last six months that they considered to be their fault (Semenchuk, Strachan, & Fortier, 2018). So far, very little is known if a self-compassion intervention may increase

individuals' engagement in physical activity. More research is needed to examine the effect of self-compassion on physical activity and exercise goal regulation, as well as the underlying mechanisms among these associations.

Self-compassion and exercise self-efficacy. Self-compassion may promote physical activity through enhancing individuals' exercise self-efficacy. Some empirical studies have indicated that self-compassionate individuals tend to possess higher levels of coping efficacy and adaptive coping such as active, positive reframing, and acceptance (Sirois, Molnar, & Hirsch, 2015), as well as higher levels of cognitive flexibility (Martin, Staggers, & Anderson, 2011). Consistently, a qualitative study revealed that self-compassionate athletes generally have higher levels of positivity, perseverance, and responsibility, compared to less self-compassionate athletes (Ferguson, Kowalski, Mack, & Sabiston, 2014). These positive qualities may serve as intrapersonal resources that allow self-compassionate individuals remain confident in their ability to engage in physical activity (i.e., exercise self-efficacy) and sustain their effort despite barriers and occasional setbacks.

Several empirical studies have been conducted to examine self-compassion as a resource for women athletes. One cross-sectional survey study showed that women athlete participants with higher levels of self-compassion experienced more emotional and behavioral equanimity (e.g., more positive reaction, perseverance, and responsibility; less rumination, passivity, and self-criticism) when responding to hypothetical, emotionally difficult, sport-specific scenarios such as losing a competition, having an injury and unable to do training (Ferguson, Kowalski, Mack, & Sabiston, 2015). Another experimental study was conducted to test the effect of induced self-compassion on

women athletes' responses to hypothetical, emotionally difficult sport situations (Reis et al., 2015). In this study, participants were randomized into three conditions: self-compassion, self-esteem, and control. All participants were asked to write about a hypothetical, emotionally difficult situations; each participant received condition-specific writing instruction. In the self-compassion condition, participants were asked to write about the situation in a self-compassion manner – express understanding, kindness and concern. In the self-esteem condition, participants were asked to write about the situation in a self-validating matter - interpret the event in ways that made participants feel better about themselves. In the control condition, participants were asked to let go and explore their deepest emotions in the situation. Results showed that participants in the induced self-compassion condition experienced more healthy reactions and thoughts (e.g., equanimity and humor), less unhealthy thoughts (e.g., catastrophizing and personalizing thoughts), and less negative affect, compared with those in the self-esteem condition and the control condition.

Similarly, a separate group of researchers conducted an intervention study to examine the effect of a one-week self-compassion intervention in promoting women athletes' adaptive responses when facing challenges or setbacks in sports (Mosewich, Crocker, Kowalski, & DeLongis, 2013). There were two components in the self-compassion intervention: (1) a 10-minute in-person, group-based psychoeducation session and (2) five self-compassion writing exercises (in form of a booklet, to be completed over the next 7 days after the orientation session). In the in-person session, participants were given a brief overview of basic, stress and coping ideas in sports. They were also introduced to the concept of self-compassion, and how self-compassion might

be helpful for dealing with challenges in sports. After the overview presentation, participants were asked to think about a negative event in sports that occurred over the past week that was personally demanding, and respond to three writing prompts. The writing prompts were decided to help participants to interpret the negative event in a self-compassion manner. Each writing prompt focused on one component of self-compassion: mindfulness, common humanity, and self-kindness. In the week following the psychoeducation session, participants completed five writings, each on the following topics: (1) detailing the most significant setback or failure in sports over the past year that was personally demanding, (2) listing ways in which other people experience similar events – common humanity, (3) expressing understanding, kindness and concern to oneself, write as if you are communicating to a close friend in the same situation – self-kindness, (4) acknowledging the event without over-identification - mindfulness, and (5) integrating all components of self-compassion. Similarly, there were also two components in the attention control condition: (1) a 10-minunte in-person group-based psychoeducation session and (2) five neutral writing exercises (in the form of a booklet). The psychoeducation session discussed the use of writing in sports, where and how writing is often used in sports. After the presentation, participants described a technical skill in their sports explaining why it is important, and what actions one can take to develop the skill. In the week following the psychoeducation session, participants completed five writings, each on a general topic, which were not expected to have any influence on the outcome variables. The topics were: a current event in sports, hazing in sports, favorite varsity sports memory, technical issues in sports, and reflecting on what it means to be a varsity athlete. Results showed that participants in the self-compassion

condition experienced greater increase in self-compassion, and greater reduction in self-criticism, rumination, and concern over mistakes at the post-intervention assessment and the 4-week follow-up assessment, compared with those in the attention control condition. These findings resonate with the previous studies that self-compassion seems to be associated with higher capability to handle setbacks in sports, and possibly higher levels of exercise self-efficacy. However, these findings are limited to athletes, and little is known about whether the effect generalizes to ordinary people who want to improve their exercise habits.

Although the association between self-compassion and exercise self-efficacy has not been examined in existing literature, indirect evidence exists. For example, studies have shown that self-compassionate individuals tend to have higher levels of self-efficacy in learning (Iskender, 2009; Manavipour & Saeedian, 2016), which may be helpful in building new habits of physical activity. In addition, a few recent studies show that self-compassionate individuals tend to have higher levels of self-efficacy in HIV symptoms mangement (Eller et al., 2014), and higher levels of coping self-efficacy among cancer survivors and people living with chronic illnesses (Raque-Bogdan, Lent, & Lamphere, 2016; Sirois, Molnar, & Hirsch, 2015), suggesting that self-compassionate individuals may have higher self-efficacy in regulating health behaviors. Based on the evidence in existing literature, it is likely that a self-compassion intervention could promote individuals' exercise self-efficacy, and hence their intention of continued exericse goal pursuit, and health-related outcomes.

Self-compassion and autonomous motivation to exercise. Self-compassion may also promote physical activity behaviors through enhancing individuals’ autonomous

motivation to exercise. With genuine concern and care about the self, self-compassionate individuals are more likely to have more autonomous motivation to reulgate their behaviors in ways that promote their well-being (Terry & Leary, 2011). A few cross-sectional survey studies have showed that self-compassion is significantly associated with more autonomous form of behavioral regulation (intrinsic behavioral regulation) for physical activity, and less with controlled forms behavioral regulation for physical activity (external behavioral regulation, introjected behavioral regulation; Magnus, Kowalski, & McHugh, 2010; Mosewich, Kowalski, Sabiston, Sedgwick, & Tracy, 2011; Semenchuk, Strachan, & Fortier, 2018). Self-compassion has also been significantly associated with less proneness toward ego goal orientation in exercise (i.e., aiming to demonstrate competence compared to others, or avoiding failure or feelings of incompetence) and less fear of failures (Magnus, Kowalski, & McHugh, 2010; Mosewich, Kowalski, Sabiston, Sedgwick, & Tracy, 2011). Other cross-sectional survey studies have also indicated that self-compassion is associated with less fear of social physique anxiety (i.e., degree of anxiety one experiences when perceiving that one's physique is being evaluated or observed; Hart et al., 1989), less objectified body consciousness (i.e., tendency to view one's body as an object for others to look at and evaluate, including body surveillance, body shame, and appearance control beliefs; McKinley & Hyde, 1996), and less fear of negative evaluation (Magnus, Kowalski, & McHugh, 2010; Mosewich, Kowalski, Sabiston, Sedgwick, & Tracy, 2011). These findings, together, suggested that self-compassionate individuals are less likely to exercise because of controlled forms of behavioral regulation, and they are more self-

determined in their pursuit of physical activity goals. A self-compassion intervention may help promote physical activity behaviors by enhancing autonomous motivation to exercise.

Satisfaction of basic needs for autonomy, competence, and relatedness are supportive conditions that promote internalization and transformation of controlled forms of behavioral regulation into autonomous forms of behavioral regulation (Silva et al., 2010). For individuals who begin exercising with controlled forms of behavioral regulation, a self-compassion intervention may help transform their behavioral regulation into more autonomous by promoting individuals' perceived autonomy, competence and relatedness. Cultivating self-compassion may protect individuals from external influences on their decision to engage in physical activity and allow individuals to experience higher levels of autonomy. Being less prone to social physique anxiety and fear of negative evaluation (Hart et al., 1989; Magnus, Kowalski, & McHugh, 2010; Mosewich, Kowalski, Sabiston, Sedgwick, & Tracy, 2011), individuals trained with self-compassion may feel more autonomous in their exercise behavior. Cultivating self-compassion may also enhance individuals' sense of competence. Self-compassion prevents individuals from fixating on their failures and feeling defeated; it also encourages individuals to take responsibility for their failures and make amends (Breines & Chen, 2012; Leary et al., 2007), and re-engage their failed goal in alternative pathways (Neff & Faso, 2015; Wrosch, Scheier, & Miller, 2013). As such, individuals may feel more competent to continue pursuing their exercise goals despite barriers and occasional setbacks. Furthermore, cultivating self-compassion may allow individuals to experience a stronger sense of relatedness. The common humanity component inherent in self-compassion

trainings helps individuals to become more aware that they are not alone in their journey of pursuing exercise goals, and that everyone experiences setbacks at some points in this journey. As a result, they may feel more related to others in their struggle with failures and setbacks in pursuing exercise goals. Two cross-sectional survey studies showed that self-compassion is significantly associated with more satisfaction of basic needs for autonomy, competence, and relatedness (Ghorbani, Watson, Chen, & Norballa, 2012; Gunnell et al., 2017). Cultivating self-compassion may foster satisfaction of basic psychological needs for autonomy, competence, and relatedness in exercise, and hence, promote autonomous motivation in exercise and increase physical activity behaviors.

Self-compassion and weight stigma. Reduced weight stigma may be another important mechanism through which self-compassion promotes physical activity. Self-compassion provides the emotional safety that is required to clearly observe the self (Allen & Leary, 2010; Neff et al., 2007). Such emotional safety allows individuals to acknowledge both positive and negative parts of themselves, and embrace their body image as it is. Empirical studies have shown that self-compassionate individuals tend to have lower levels of public self-conscioues ness (i.e., being aware of oneself as a social object), less concern about what others think of them, and less desire to please others (Barnard & Curry, 2011; Neff & Vonk, 2009). Self-compassionate individuals also tend to have less social physique anxiety, and less objectified body consciousness (Magnus, Kowalski, & McHugh, 2010; Mosewich, Kowalski, Sabiston, Sedgwick, & Tracy, 2011). These qualities could be helpful in protecting individuals from the thin ideology in the modern society. As such, self-compassionate individuals are less likely to let negative, weight-related stereotypes define the self, and internalize weight stigma (Hilbert et al.,

2015). Similarly, individuals trained with self-compassion should be less likely to agree on weight-related negative stereotypes (e.g., being lazy, sloppy, lacking motivation, will power; Durso, & Latner, 2008; Puhl & Brownell, 2001). They should be less influenced by the misconception that overweight people are not physically active, and more likely to engage in exercise behaviors.

There is limited research on self-compassion and weight stigma. So far, only one cross-sectional survey study has examined and found a significant negative association between self-compassion and weight stigma (Hilbert et al., 2015). Indirect evidence is provided in the literature of other types of stigma. For example, cross-sectional survey studies found a significant and negative association between self-compassion and self-stigma (i.e., internalized stigma) in samples of people living with mental illness or HIV (Touriño et al., 2018; Yang & Mak, 2017), as well as a significant and negative association between self-compassion and affiliate stigma (i.e., internalization of others' negative evaluation and emotions toward themselves and their children with disabilities) in a sample of parents of children with autism spectrum disorders (Wong & Mak, 2016). Other cross-sectional survey studies also found significant negative associations between self-compassion and other internalized stigma-related constructs such as self-criticism, self-blame, and shame (Petrocchi, Ottaviani, & Couyoumdjian, 2014; Reilly, Rochlen, & Awad, 2014; Sirois, Molnar, & Hirsch, 2015; Wong & Mak, 2013). Based on this preliminary evidence, it is likely that enhancing self-compassion may help reduce weight stigma and, in turn, promote physical activity.

Self-compassion and exercise goal regulation. Goal pursuit has a significant impact on mood (Diener, 1984; Klung & Maier, 2015). According to the Control Theory

(Carver & Scheier, 1982), individuals tend to experience more positive emotions when they are making progress toward their goals, and they tend to experience more negative emotions when they fail to achieve their goals. This theory has been empirically proven in many non-exercise goal studies (e.g., Brunstein, 1993; Cantor & Sanderson, 2003; Diener, Suh, Lucas, & Smith, 1999; Emmons, 1986; Freund & Baltes, 2002) and exercise goal studies (e.g., Crocker & Graham, 1995).

People may fail to reach their exercise goals for varied reasons, including lack of motivation, poor time management, bad weather, busy work schedule, and unexpected events, for example. Some of these factors are internal and controllable (e.g., lack of motivation, poor time management), whereas others are external and uncontrollable (e.g., bad weather, unexpected events). It may not be realistic to expect oneself to be able to stick to their exercise goals at all times. There are also days that one's body really needs a break. Imagine that it is Thursday evening. You have been working overtime for the entire week. Today, you start working at 7am and finally get off work at 7:30pm, feeling physically tired and exhausted. You have two choices: (1) stick with your exercise goal - grasp some quick dinner and go to the gym for a 45-minute aerobics class, (2) miss your exercise goal - go home, have a decent dinner, take a hot bath and have a relaxing evening. Perhaps you pick the second choice, considering that the slow-paced evening allows you to feel revitalized and be ready for the work challenges tomorrow. However, people can be surprisingly harsh on themselves, and criticize themselves unfairly (Cohen & Sherman, 2014). When you are having the hot bath, you may start ruminating about not sticking with your exercise goal, blaming yourself for being lazy and unmotivated.

These ruminative thoughts may go on for the entire evening, and you do not feel relaxed at all.

One common challenge of sustained pursuit of exercise goals is that people beat up on themselves when encountering occasional setbacks. Eventually, individuals may feel so defeated that they give up their exercise goals completely (Semenchuk, Strachan, & Fortier, 2018). Negative emotions can thwart individuals' capacity to self-regulate (Baumeister & Heatherton, 1996). Individuals experience negative emotions after a setback may devote their self-regulatory resources to emotion management (Bruyneel, DeWitte, Franses, & DeKimpe, 2009), leaving them few self-regulatory resources for continued exercise goal pursuit (Baumeister, Bratlsavsky, Muraven & Tice, 1998; Semenchuk, Strachan, & Fortier, 2018). A qualitative study suggested that the negative mood (e.g., guilt and sense of inadequacy) resulting from previous goal failures is one common barrier that prevents individuals from continuing to pursue their exercise goals (Bulley, Donaghy, Payne, & Mutrie, 2009). It may be especially true for individuals who have been inactive and just started to build a new habit of physical activity. A few studies have shown that individuals who have little experience, goal failure reduces self-efficacy, which in turn, decreases subsequent behaviors (Bandura, 2015; Bandura & Locke, 2003).

Self-compassion may motivate sustained physical activity by buffering the association between exercise goal pursuit and mood fluctuation, and hence sustain individuals' intention to continue pursuing their exercise goals. A cross-sectional survey study has found that self-compassion is positively associated with mastery oriented goals but negatively associated with performance oriented goals (Neff, Hsieh, & Dejitterat,

2005). These findings suggested that self-compassionate individuals pursue goals for self-determined reasons; they are more motivated by curiosity and the desire to develop skills. They are more likely to make effort attributions for both success and failures, and view failures as a part of the learning process. A few experimental studies have shown that self-compassion could attenuate the threat of failure (e.g., Leary, Tate, Adams, Allen, & Hancock, 2007; Mosewich, Crocker, Kowalski, & DeLongis, 2013; Reis et al., 2015). For instance, in Leary et al. (2007), participants described a negative event that they experienced in high school or college that made them feel badly about themselves – something that involved failure, humiliation, or rejection. After writing about the event, participants were randomly assigned to one of four conditions: (1) self-compassion writing, (2) self-esteem writing, (3) writing control, and (4) no writing control. Results showed that the self-compassion writing group experienced significantly less negative affect after the writing task, compared with participants in the other three conditions. Similar results were reported in Mosewich et al. (2013) and Reis et al. (2015). These findings, together, may suggest that self-compassionate individuals are more likely to view their exercise goal failures as a normal part of the habit building process, and they are less likely to feel defeated by the failures as easily.

Recent research has explored the effect of self-compassion in a goal-pursuing context. For instance, Hope and colleagues (2014) conducted a daily diary study to examine the moderating role of self-compassion on the association between daily goal progress and daily affect among university freshmen. The goals were not in any specific domains; they were personal goals that participants planned on pursuing during the semester. Results indicated that participants with higher levels of self-compassion at

baseline were less vulnerable to the affective consequences of thwarted goal progress compared with their less self-compassionate counterparts. The negative association between daily fluctuations in goal progress and negative affect was significant among participants with low levels of self-compassion but not among those with high levels of self-compassion.

Some may think that self-compassion would hinder exercise goal pursuit by encouraging people to "let themselves off the hook." However, empirical evidence has suggested otherwise. While self-compassion is significantly associated with less self-criticism, it is not significantly associated with the desire to uphold high personal standards (Neff, 2003a). Despite being less self-critical, self-compassionate individuals uphold a similar level of personal standards as those who are less self-compassionate. Self-compassion does not cause self-complacency but rather self-improvement (Breines & Chan, 2012; Leary et al., 2007). Self-compassion allows individuals to let go their self-defense when approaching failures and personal inadequacies, so that individuals can experience equanimity in their failings (Gerner, 2009; Leary et al., 2007). Self-compassionate individuals are less likely to be fixated on their failures and they are more willing to make changes and approach their goal through alternative pathways. A few cross-sectional survey studies have shown that self-compassion is associated with more goal reengagement (i.e., tendency to identify, commit to, and pursue alternative goals when a person confronts an unattainable goal; Neff & Faso, 2015; Miyagawa, Taniguchi, & Niiya, 2018; Semenchuk, Strachan, & Fortier, 2018). Two experimental studies also showed that a brief self-compassion induction (i.e., a 3-minute self-compassion writing exercise) could lead to greater motivation to take responsibility for one's role in a

negative event, changing personal weakness and making amends for mistakes for which one feels guilt, remorse, and regret (Breines & Chen, 2012; Leary et al., 2007).

These findings, together, have revealed that self-compassionate individuals may be more capable of accepting failures, focusing on the overall exercise progress in goal pursuit instead of occasional setbacks (e.g., Neff, Hsieh, & Dejitterat, 2005); they are less likely to feel defeated (e.g., Leary et al., 2007; Mosewich, Crocker, Kowalski, & DeLongis, 2013; Reis et al., 2015). Therefore, it is likely that self-compassion can moderate the association between daily exercise goal pursuit and daily mood fluctuation, and sustain individuals' effort in goal pursuit despite setbacks or failures.

Aims of The Present Study

To sum up, promoting self-compassion may facilitate individuals' physical activity by increasing their levels of exercise self-efficacy, autonomous motivation to exercise, and reducing their levels of weight stigma. Most of the existing studies on self-compassion and physical activity are cross-sectional, and the levels of physical activity have not been examined as an outcome in experimental studies that involved a self-compassion manipulation. To bridge the gap in existing literature, the present study aimed to test the feasibility and effectiveness of a brief self-compassion intervention in promoting (1) physical activity (i.e., minutes of physical activity per week, intention of continued exercise goals pursuit), (2) exercise self-efficacy, autonomous motivation to exercise, weight stigma, and (3) health-related outcomes, as well as to (4) examine the potential buffering role of self-compassion in the association between daily exercise goal progress and daily mood. It was expected that participants in the self-compassion group

would have higher levels of physical activity, higher levels of exercise self-efficacy, higher levels of autonomous motivation to exercise, lower levels of weight stigma, better physical and psychological health, compared to those in the control group. It was also expected that condition assignment (i.e., self-compassion vs. control) would moderate the association between daily exercise goal progress and daily mood (i.e., positive and negative affect) such that the self-compassion intervention group would experience a weaker association between daily exercise goal progress and daily mood compared with the control group.

This research is novel. There are limited self-compassion intervention studies on self-compassion and physical activity in existing literature. To better understand the effect of a brief self-compassion intervention on physical activity and related outcomes, and participants' acceptability of a brief self-compassion intervention in promoting physical activity, two feasibility studies were conducted before launching the main study. Each examined the feasibility and acceptability of a commonly used self-compassion manipulation: (1) loving kindness meditation (feasibility study 1), and (2) self-compassion writing (feasibility study 2).

Feasibility Study 1

This study aimed at exploring the feasibility and acceptability of loving kindness meditation in promoting self-compassion, exercise goal adherence and related outcomes.

Methods

Participants

A total of 217 college students completed the brief screening survey. Among them, 94 met the study criteria and indicated initial interest; 35 signed up for the

orientation session and continued their participation in the study. Eligibility criteria included: (1) age (18 – 69 years old) and (2) physical inactivity. Physical inactivity was operationalized as less than (a) 150 minutes per week of recreational moderate-intensity of physical activity or (b) less than 75 minutes per week of recreational vigorous-intensity physical activity or (c) a metabolic equivalent amount of physical activity. Participants self-reported how many minutes of moderate to vigorous physical activity performed in an average week. Participants who did not meet the listed eligibility criteria, and women who were pregnant or nursing currently or within the past six months were excluded from the study.

Procedures

Institutional review board approval was obtained before the launching of this study. Participants were recruited from the research participation pool of the Department of Psychology at the University of Houston in the spring semester of 2017. Recruitment flyers were posted around the campus, and distributed among potential participants during in-class study annoucements. Interested students signed up for the study via the online SONA system and completed an eligibility screening survey (please see the eligibility criteria in the participants section above). Eligible participants proceeded to provide informed consent and sign up for a 30-minute in-person orientation session. Participants were then randomly assigned to one of two conditions: self-compassion condition (i.e., experimental condition), or control condition. Except for the in-person orientation session, all study procedures were completed online (i.e., baseline assessment, two-week daily intervention and daily survey, post-intervention assessment, two-week follow-up assessment).

During the in-lab orientation session, an experimenter provided details about the study procedures, including study components and the timeline. Recommendation of weekly physical activity levels (i.e., 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity aerobic activity a metabolic equivalent amount of physical activity per week) and information about the categorization of different intensity levels of physical activity were also provided to participants. Immediately after the orientation, a baseline assessment was sent to participants. Participants were required to complete the baseline assessment before the following Monday, when the two-week daily intervention period began. Participants had 2 to 6 days to complete the baseline assessment, depending on their scheduled orientation session. In the baseline assessment, participants were also asked to set personal physical activity goal(s) that they would like to work on throughout this study. Participants were recommended to set goal(s) that adhere to the recommendation (i.e., at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or at least 75-minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity), or goals that best fit their needs and interests. Some example goals were 30-minute walking, every day; 30-minute running, 3 times a week, etc.

During the two-week daily intervention period, participants were required to complete two online tasks every day, including (1) an online intervention session (an audio task, approximately 10 minutes, please see the experimental manipulation section below), and (2) a brief online survey (approximately 5 minutes) which assessed participants' daily physical activity, perceived goal progress, positive affect ad negative affect. No time restriction was imposed on the intervention session. Participants were

asked to complete the audio task at least once a day; it could be anytime throughout the day. To better capture participants' physical activity that occured throughout the day, time restriction was imposed on the daily survey. Participants were asked to complete the daily survey anytime between 8pm and 5am. They were also told to not go back to complete the daily survey if they had forgotten. Any daily surveys that were completed after the time limit were excluded from analyses. Immediately after and two weeks after the daily intervention period, participants received and completed the post-intervention assessment and the follow-up assessment. Course credits (i.e., 8 SONA credit hours) were provided as compensation for participants' time and effort. Participants were advised to stop their physical activity and consult doctors if physical activity caused any injury or health conditions.

Experimental Manipulations

Across the two-week daily intervention period, participants in both conditions were asked listen to a 10-minute audio clip every day. A link to the condition-specific audio clip was sent to participants on the first day of the two-week daily intervention period. Participants were asked to open the link and listen to the audio clip at least once every day, and anytime throughout the day.

Loving kindness meditation is a commonly used brief self-compassion intervention, which has been proven to be effective in promoting self-compassion, physical and psychological health outcomes (e.g., Galante, Galante, Bekkers, & Gallacher, 2014; Przezdziecki & Sherman, 2016). In the self-compassion condition, participants listened to the instruction of loving kindness meditation (meditation transcript please see Appendix A, provided by UCLA Semel Institute Mindful Awareness

Research Center). In the control condition, participants listened to pure music that is typically used as background music for meditation practice.

Measures

Except for questions about demographic and medical information (which were only included in the baseline assessment) and exercise goal(s) setting, all measures were included in assessments at baseline, post-intervention, and 2-week follow-up.

Physical activity variables.

***Recalled physical activity*.** Habit of physical activity was self-reported. Participants indicated the type(s) and minutes of exercise that they completed in the previous week.

Exercise goal setting. Participants were asked to choose an exercise goal that they would like to work on throughout this study. Participants were recommended to set goals that adhere to the recommendation (i.e., at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or at least 75-minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity), or goals that best fit their needs and interests. Some example goals were provided to participants, including 30-minutes walking, every day; 30-minute running, 3 times a week.

Exercise goal adherence. At the two-follow-up assessment, participants were asked if they attempted to keep up with their exercise goal after the daily intervention period, and if yes, how many minutes per week they exercised.

Mechanism-related variables.

Exercise Self-efficacy. Exercise self-efficacy was assessed by the 17-item Exercise Efficacy Scale (Haworth et al., 2009). Participants rated on a 7-point scale (1 = cannot do at all; 7 = absolutely certain I can do this). A sample item is "How confident are you that you can carry out exercise/ activities correctly?" The Exercise Efficacy Scale has been used in adult clinical samples (Driver, Irwin, & Woolsey, & Warren, 2013), demonstrating adequate reliability and validity. In the present study, the Cronbach's alphas at baseline, post-intervention, and 2-week follow-up ranged from .90 to .94.

Autonomous motivation to exercise. Autonomous motivation to exercise was assessed by the 15-item Behavioral Regulation in Exercise Questionnaire (BREQ; Mullen, Markland, & Ingledew, 1997) and the 30-item Exercises Motivations Inventory (EMI; Markland & Ingledew, 1997). BREQ assesses self-determined motivation to exercise on a 5-point scale (0 = not true for me; 4 = very true for me). Sample items include "I exercise because other people say I should (external regulation)," "I feel guilty when I don't exercise (introjected regulation)," "I value the benefits of exercise (identified regulation)," and "I exercise because it's fun (intrinsic regulation)." The subscales were weighted to calculate a relative autonomy index (RAI) using the following formula (Ryan & Connell, 1989): (-2*external regulation) + (-1*introjected regulation) + (1*identified regulation) + (2*intrinsic regulation). EMI assesses different dimensions of exercise motives (e.g., stress management, revitalization, enjoyment, challenge, social recognition, affiliation, competition, health pressure, ill-health avoidance, positive health, weight management, and appearance) on a 4-point scale (1 = strongly disagree; 4 = strongly agree). BREQ has been validated in samples of college students and community adults (e.g., Wilson, Rodgers, & Fraser, 2002). EMI has been

used in samples of college students (e.g., Maltby & Day, 2001; Wilson, Rogers, Rodgers, & Wild, 2006). Both BREQ and EMI demonstrated evidence of reliability and validity. In the present study, the Cronbach's alphas at baseline, post-intervention, and 2-week follow-up ranged from .75 to .95 (BREQ), and .66 to .96 (EMI), respectively.

Psychological need satisfaction in exercise. Satisfaction of basic psychological needs for autonomy, competence, and relatedness was assessed by the 18-item Psychological Need Satisfaction in Exercise Scale (Wilson, Rogers, Rodgers, & Wild, 2006). Participants rated on a 7-point scale (1 = I do not agree at all; 7 = I very strongly agree). Sample items are "I feel free to exercise in my own way" (autonomy), "I feel that I am able to complete exercises that are personally challenging" (competence), and "I feel attached to my exercise companions because they accept me for who I am" (relatedness). The scale has been used in samples of college students (e.g., Quartiroli & Maeda, 2014; Sweet, Fortier, & Strachan, 2012), demonstrating evidence of reliability and validity. In the present study, the Cronbach's alphas of the subscales at baseline, post-intervention, and 2-week follow-up ranged from .79 to .93.

Weight stigma. Weight stigma was assessed by the 11-item Modified Weight Bias Internalization Scale (Pearl & Puhl, 2014) and the 12-item Weight Self-Stigma Questionnaire (Lillis, Luoma, Levin, & Hayes, 2010). The Modified Weight Bias Internalization Scale was rated on a 7-point scale (1 = strongly disagree; 7 = strongly agree), whereas the Weight Self-Stigma Questionnaire was rated on rated on a 5-point scale (1 = completely disagree; 5 = completely agree). Sample items are "I feel anxious about my weight because of what people might think of me" (Modified Weight Bias Internalization Scale), and "I feel guilty because of my weight problems" (Weight Self-

Stigma Questionnaire). The Modified Weight Bias Internalization has been used in samples of overweight or obese women and normal-weight women (e.g., Essayli, Murakami, Wilson, & Latner, 2016; Pearl, Puhl, & Dovidio, 2015), and the Weight Self-Stigma Questionnaire has been used in a sample of overweight women (e.g., Palmeira, Pinto-Gouveia, Cunha, & Carvalho, 2017), both demonstrating reliability and validity. In the present study, the Cronbach's alphas at baseline, post-intervention, and 2-week follow-up ranged from .94 to .97 (Modified Weight Bias Internalization Scale), and .93 to .96 (Weight Self-Stigma Scale), respectively.

Health-related outcomes variables.

Psychological health. Subjective well-being and perceived stress were assessed by the 38-item Mental Health Inventory (MHI-38; Veit & Ware, 1983), the 5-item WHO (Five) Well-Being Index (Bech, 1999; Bech, Gudex, & Johansen, 1996) and the 10-item Perceived Stress Scale (PSS; Cohen, Kamark, & Mermelstern, 1983). MHI adopts a 6-point scale with different anchors for individual items. The WHO (Five) Well-Being Index was rated on a 6-point scale (0 = at no time; 5 = all the time) and the Perceived Stress Scale was rated on a 5-point scale (0 = never; 4 = very often). Sample items include "How happy, satisfied, or pleased have you been with your personal life during the past two weeks?" (MHI-38), and "I have felt cheerful and in good spirits" (WHO (Five) Well-Being Index), and "In the past two weeks, how often have you been upset because of something that happened unexpectedly?" (PSS). MHI-38 has been used and validated in samples of community adults and cardiac patients (e.g., Cumming, Smith, Grossbard, Smoll, & Malina, 2012; Elizur & Hirsh, 1999), WHO (Five) Well-Being Index has been used and validated in community and clinical samples (Allgaier et al.,

2012; Heun, Bonsignore, Barkow, Jessen, 2001; Topp, Ostergaard, & Sondergaard, & Bech, 2015), and PSS has been used and validated in samples of college students and community adults (e.g., Hubbs, Doyle, & Bowden, 2012; Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2004), all demonstrating reliability and validity. In the present study, Cronbach's alphas at baseline, post-intervention, and 2-week follow-up ranged from 93 to .98 (MHI subscales), .85 to .93 (WHO), and .87 to .94 (PSS), respectively.

Physical health. Perceived energy level was assessed by the 7-item Vitality Scale (Ryan, & Frederick, 1997) and the 10-item Fatigue Assessment Scale (Michielsen, De Vries, & Van Heck, 2003). Participants rated on a 7-point scale (1 = not at all true; 7 = very true) for the Vitality Scale and rated on a 5-point scale (1 = never; 5 = always) for the Fatigue Assessment Scale. Sample items include "I feel alive and vital (vitality)" and "I get tired very quickly (fatigue)." Physical symptoms were assessed by the 12-item somatization subscale of the Hopkins Symptoms Checklist (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). Participants rated their level of symptoms on a 4-point scale (1 = not at all; 4 = extreme). Sample items include "headache," "chest pain" and "stiff/sore muscles." The Vitality Scale has been validated and used in samples of college students and community adults (Molina-García, Castillo, & Queralt, 2011; Salama-Younes, Montazeri, Ismaïl, & Roncin, 2009), the Fatigue Assessment Scale has been used in samples of working adults and breast cancer survivors (Michielsen, De Vries, & Van Heck, 2003; Michielsen, Van der Steeg, Roukema, & De Vries, 2007), and the Hopkins Symptoms Checklist has been validated and used in samples of community adults and older adults (Connell, 1994; Gurung, Taylor, & Seeman, 2003), all demonstrating reliability and validity. In the present study, the Cronbach's alphas at

baseline, post-intervention, and 2-week follow-up ranged from .93 to .95 (Vitality Scale), .92 to .93 (Fatigue Assessment Scale), and .79 to .82 (somatization subscale), respectively.

Manipulation check.

Self-compassion. Self-compassionate attitude was assessed by the 26-item Self-Compassion Scale (SCS; Neff, 2003a). Participants rated on a 5-point scale (1 = almost never, 5 = almost always). Previous studies suggested that self-compassion could be constituted of positive self-compassion and negative self-compassion; the two components are not mutually exclusive and they tend to predict different types of outcomes (Costa, Marôco, Pinto-Gouveia, Ferreira, & Castilho, 2015; Gilbert, McEwan, Matos, & Rivis, 2011; López et al., 2015; Muris & Petrocchi, 2016). Sample items are "I try to be loving toward myself when I'm feeling emotional pain (positive self-compassion)" and "When I'm feeling down I tend to obsess and fixate on everything that's wrong (negative self-compassion)". In the present study, the Cronbach's alphas of the SCS subscales (i.e., positive self-compassion, negative self-compassion) at baseline, post-intervention, and 2-week follow-up ranged from .92 to .93 (positive self-compassion) and .93 to .97 (negative self-compassion), respectively.

Demographic and medical information. Participants self-reported their demographic information (i.e., age, education, annual household income, and marital status), body weight and height (for calculating BMI, weight (kg)/ height^2 (m^2)), as well as existing medical conditions (e.g., asthma, arthritis, diabetes etc.).

Daily measures. To enhance the accuracy of the physical activity and mood reports, throughout the two-week intervention period, participants completed a brief online questionnaire every day. The measures included:

***Recalled physical activity and perceived progress*.** Participants reported their recreational physical activity (i.e., type(s) and minutes of physical activity) that occurred in the past 24 hours. They also reported their perceived progress toward their exercise goal(s) on a 7-point Likert scale (1 = not at all; 7 = completely), and whether they experienced an injury that prevent them from exercise behaviors on a given day.

Mood. The 20-items Positive and Negative Affective Schedule (Watson, Clark, & Tellegen, 1988) was used. Participants rated their levels of daily positive affect and negative affect on a 5-point scale (1 = very slightly or not at all; 5 = extremely). Sample items of positive affect are interested, excited and alert; sample items of negative items are distressed, upset, and guilty. In the present study, the Cronbach's alphas across the two-week daily intervention period were .94 and .90 for positive and negative affect, respectively.

Results

Participant Demographics, Enrollment, Completion and Attrition

Among the 35 eligible participants who attended the orientation session, 30 completed the baseline assessment, and continued to participate in the two-week daily intervention (i.e., 15 participants in the self-compassion group and 15 participants in the control group). Among them, 23 were female with mean age = 23.50, *SD* = 7.29, and mean BMI = 27.02, *SD* = 7.46. The ethnic/ racial background of participants was very diverse; 40% reported being of Hispanic/ Latino origin; 40.0% Caucasian, 26.7% Asian,

16.7% Black/ African-American, 6.7% multi-race, 10.0% others). Participants who did not complete the baseline assessment within two weeks were dropped from the study, and they would not receive any content of the daily intervention.

On average, the completion rate for the daily survey was 78.4% (mean = 10.97 days out of 14 days; 83% in the self-compassion group and 69% in the control group). The completion rate for the daily intervention session (i.e., daily access to the audio clip of loving kindness meditation or pure music) was only 48.8% (mean = 6.83 days out of 14 days; 53.0% in the self-compassion group and 44.8% in the control group). However, 6 out of 30 (20%) participants have never accessed the condition-specific audio clip during the two-week intervention period, and 6 out of 30 (20%) participants only accessed the condition-specific audio clip once or twice over the two-week daily intervention period.

Descriptive Statistics

Daily measures. Across the two-week daily intervention period, the self-compassion group and the control group reported similar levels of positive affect (self-compassion group: mean = 2.19, *SD* = 0.66; control group: mean = 2.28, *SD* = 0.62) and negative affect (self-compassion group: mean = 2.05, *SD* = 0.62; control group: mean = 2.02, *SD* = 0.48). The control group tended to report more perceived progress toward their weekly exercise goal (self-compassion group: mean = 3.09, *SD* = 2.12; control group: mean = 3.71, *SD* = 2.43).

Periodic assessments. The sample means and standard deviations of outcome variables and mechanism-related variables in the self-compassion group and the control

group at the baseline, post-intervention, and 2-week follow-up assessments are presented in Table 1.

Manipulation check

ANCOVA results indicated that there were no significant differences in the self-compassion components at the post-intervention assessment and the two-week follow-up assessment, when baseline self-compassion components were controlled for (see Table 1).

Physical activity and mechanism-related outcomes

ANCOVAs were conducted to examine the effect of self-compassion intervention at the post-intervention assessment and the 2-week follow-up assessment, with the baseline variables controlled for. Effect size (i.e., partial eta squared, η_p^2) are presented in Table 1. According to Cohen (1969), the benchmarks of small, medium, and large effects reflected in the values of η_p^2 are .0099, .0588, and .1379.

Results indicated that there were no significant group differences in physical activity and related outcome variables at post-intervention and two-week follow-up assessment, when baseline variables were controlled for. Chi-square test of independence indicated that there was no significant group difference in the portion of participants indicating intention to keep up with the exercise goal that the two-week follow-up assessment, $\chi^2(1) = 0.08$, $p = .78$. Similarly, independent sample t-test result indicated that there was no significant group difference in the reported minutes of exercise at the two-week follow-up assessment, $t(10) = 1.26$, $p = .24$.

While not being statistically significant, the effect sizes suggested that there might be mixed group differences at the post-intervention assessment and the two-week follow-

up that were underpowered to be detected. At the post-intervention assessment, the self-compassion group tended to report higher level of ill health avoidance (medium effect). Unexpectedly, the self-compassion group also tended to report lower levels of autonomous motivation to exercise (large effect), psychological need satisfaction of competence (large effect), and mental well-being (MHI; large effect). At the two-week follow-up assessment, the self-compassion tended to report higher levels of motivation to exercise because of stress management (large effect), challenges (medium effect), affiliation (large effect), competition (large effect), health prevention (medium to large effect), ill health avoidance (large effect), weight management (large effect) and appearance (large effect), and lower levels of weight stigma (medium effect). The self-compassion group also tended to report lower levels of psychological need satisfaction of autonomy (large effect), competence (large effect), positive self-compassion (medium effect), vitality (large effect), and mental well-being (WHO; medium to large effect).

It should be noted that the completion rate of the intervention was slightly short of 50%, and thus some participants might not have received sufficient intervention dosage to experience changes in the outcome variables or mechanism-related variables. Also, the findings in this study may not be generalizable because of the small sample size. Caution is warranted when interpreting these findings.

Discussion

Based on the preliminary findings of feasibility study 1, the effects of loving kindness meditation on promoting physical activity and related outcomes were mixed and inconclusive. The mixed findings might be attributed to small sample size and low

completion rate of daily interventions sessions. Some study limitations were noted, and changes were made for feasibility study 2, accordingly.

Gap between daily survey and daily intervention session completion rate

The completion rate of daily intervention sessions was relatively low (48.8%; 53% in the self-compassion group vs. 44.8% in the control group). In addition, there was a substantial gap between the completion rate of the daily survey (78.4%) and the completion rate of the daily intervention session (48.8%). Based on the data, a significant proportion of participants (approximately 30%) completed the daily surveys without completing the daily intervention session (listening to a 10-minute audio clip). Data also indicated that 20% of the participants had never accessed the audio clips during the two-week intervention period, and an additional 20% participants had only accessed the condition-specific audio clip once or twice over the two-week daily intervention period. Minimal exposure to the experimental manipulation could severely influence the findings in this study. Indeed, results indicated that the experimental manipulation was not successful – there were no significant group differences in self-compassion components at the post-intervention assessment and the two-week follow-up assessment. There were also mixed findings across physical activity and related outcome variables, which contrasted with the findings in existing literature.

Three factors may have contributed to the low completion rate of the daily intervention sessions: (1) The intervention content might not be engaging enough. Listening is a passive task that requires minimal input from the participants. Repeated listening to the same audio clip over two weeks could be quite boring, especially when

the content of the audio clips has little relevance to the purpose of this study – promoting physical activity. (2) Participants might not be very well-aware that their activity in the daily intervention session could be tracked (participants need to input their study ID before they accessed the audio clips). They might, thus, feel less obligated to complete the intervention session every day. (3) The daily survey and the daily intervention session (i.e., the audio task) were sent to participants in two separate links, and different time restrictions were imposed on the two tasks. Participants were required to complete the daily survey within a set number of hours (between 8pm and 5am) every day. However, this time restriction did not apply to the daily intervention sessions. Participants were allowed to complete the daily intervention session anytime throughout the day. While an instruction sheet was distributed during the orientation session to remind participants about their schedule of different tasks in this study, no additional daily reminders were sent to participants during the two-week intervention period. Because of the relatively loose time restriction on the daily intervention sessions compared with that imposed on the daily surveys, it might take participants more self-discipline to complete the daily intervention sessions on their own schedule than completing the daily surveys at a restricted time period.

To improve the completion rate of the daily intervention sessions, several changes were considered. First, a more active, engaging task should be used as the experimental manipulation. Instead of a passive audio task, an active task that requires cognitive input from participants (e.g., writing task) should be used in future study. Second, it is important to increase accountability of participants. In the future study, it should be made obvious to participants that their completion rate could be tracked and assessed. In this

study, it was difficult for researchers to evaluate participants' degree of task engagement. While participants' access to the audio clips could be tracked, it was almost impossible to know whether participants pay attention when they were listening to the audio files. Future study should consider a task that allows objective evaluation of task engagement. Last but not least, the future study should consider streamlining the daily tasks - combining the daily survey and the daily intervention session, such that participants only need to respond to a single link every day, at the same schedule. This change may increase convenience and reduce burden to participants, and hence increase the completion rate of daily intervention sessions.

Measure sensitivity

Some measures in this study were not sensitive enough to assess variables of interest, and they should be dropped from the future study. For instance, some items of the Weight Self-Stigma Questionnaire might not be relevant to participants who may be inactive but not over-weight (e.g., *I'll always go back to being overweight*, *I became overweight because I'm a weak person*). The Exercise Motivations Inventory is relatively lengthy (48 items) and it does not directly assess autonomous motivation to exercise. In addition, to capture the concepts of exercise self-efficacy and identified motivation to exercise, the Barriers Self-Efficacy Scale (Rogers et al., 2006), a newer version of the Behavioral Regulation in Exercise Questionnaire (BREQ-3; Markland & Tobin, 2004; Wilson, Rodgers, Loitz, & Scime, 2006) and the Exercise Identity Scale (Anderson & Cychosz, 1994) should be used. Lastly, to increase accuracy of physical activity assessment, the combination of a well-established physical activity measure (e.g.,

International Physical Activity Questionnaire; Craig et al., 2003) and accelerometers should be used to replace the self-report measure of physical activity.

Feasibility Study 2

This study aimed at exploring the feasibility and acceptability of self-compassion writing in promoting self-compassion, exercise goal adherence and related outcomes.

Methods

Participants

A total of 92 college students completed the screening and baseline survey. Among them, 58 indicated interest to continue participating in the remaining parts of the study and 20 met the study inclusion criteria. Eligibility criteria included: (1) age (18 – 69 years old), (2) physical inactivity, and ; assessed by the International Physical Activity Questionnaire; Craig et al., 2003), and (3) safety and feasibility of participation (assessed by the Physical Activity Questionnaire for Everyone (PAR-Q+; Warburton, Jamnik, Bredin, Gledhill, 2014). Physical inactivity was operationalized as less than (a) 150 minutes per week of recreational moderate-intensity of physical activity or (b) less than 75 minutes per week of recreational vigorous-intensity physical activity or (c) a metabolic equivalent amount of physical activity. Participants' levels of physical activity were assessed by the International Physical Activity Questionnaire (Craig et al., 2003).

Procedures

Study procedures were similar to those adopted in feasibility study 1, with some changes in experimental manipulations (please see the "experimental manipulation" section for details), measures (please see the "measure" section for details), and the schedule of assessments. Participants were recruited from the research participation pool

of the Department of Psychology at the University of Houston in the fall semester of 2017. In this study, for easier implementation, the screening survey and the baseline assessment were combined. The goal setting items were separated from the baseline assessment, and participants set their exercise goals(s) on the morning of first day of the daily intervention period, before they received any daily survey and daily internvention sessions that were sent in the evening. Repeating the study design of previous self-compassion writing intervention studies (e.g., Mosewich, Crocker, Kowalski, & DeLongis, 2013; Wong & Mak, 2016), the duration of daily intervention lasted one week instead of two weeks. The daily survey and the writing task were sent to participants through email and text message every evening, during the one-week daily intervention period. Participants only needed to complete the daily tasks once a day, either via email or text message. To capture a longer duration of behavioral change, follow-up assessment took place one month, instead of two weeks, after the daily intervention period. With the addition of physical activity assessments (and the associated tasks, please see "measure" for details), one additional course credit hour was offered to participants in this study compared with those in feasibility study 1. A total of 9 SONA credit hours were provided as compensation for participants' time and effort.

Experimental Manipulation

Self-compassion writing is another commonly adopted brief self-compassion intervention, which has been proven to be effective in promoting self-compassion, physical and psychological health outcomes (e.g., Johnson & O'Brien, 2013; Odou & Brinker, 2014; Wong & Mak, 2016).

The self-compassion writing prompt used in this study was developed by Wong and Mak (2016). The writing instruction was initially created based on the self-compassion journal exercise developed by Neff (2009) and the self-compassion induction exercise developed by Leary et al. (2007). These writing prompts were developed with the purpose of promoting well-being; participants were asked to write about their negative experiences (e.g., painful events, personal failures etc.) in a self-compassion manner. Similar writing prompts have been used among female athletes, and found to be successful in promote adaptive responses when facing challenges or setback in sports (e.g., less self-criticism and rumination; Mosewich, Crocker, Kowalski, & DeLongis, 2013; Reis et al, 2015). The purpose of this study was to promote physical activity among inactive college students. Therefore, the writing instruction was slightly modified. Participants were asked to write about (potential) barrier(s) in pursuing their physical activity goals, and use an accepting and self-compassionate attitude to process their experience. Three prompts, each centered on the concept of mindfulness, common humanity and self-kindness, were given to participants (see Appendix B). Additional descriptions about the three self-compassion components were provided in the content of daily emails/ text messages (see Appendix C). In the control condition, participants wrote about (potential) barriers in pursuing their physical activity goals, in a factual and non-emotional manner (see Appendix D). Participants responded to the same, condition-specific writing instruction every day, over the one-week daily intervention period.

In both conditions, the writing session was presented immediately after the daily survey. The writing session was timed so that participants could not submit their response until 5 minutes had passed. Also, it was emphasized in the consent form and the

orientation materials that participants would not receive their research credits if they failed to complete a minimum amount of four writings throughout the one-week intervention period. These changes were implemented with the intention to increase participants' accountability, and hence the completion rate of the daily intervention session. Feedback about the writing instructions was also sought from participants. This information would be helpful to determine the acceptabilility of the self-compassion writing. Any concern or clarity problems would be addressed in the writing instruction to be used in the main study.

Measures

Except for questions about demographic and medical information (which were only included in the baseline assessment) and exercise goal(s) setting, all measures were included in assessments at baseline, post-intervention, and1-month follow-up.

Physical activity variables.

***Recalled recreational physical activity*.** Habit of physical activity was assessed by the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003). It assesses physical activity in multiple dimensions: (1) job-related physical activity, (2) transportation, (3) housework, house maintenance, and caring for family, (4) recreational, sport, and leisure-time physical activity, and (5) time spent sitting. Two items assessed physical activity on the dimensions of recreational, sport, and leisure-time physical activity. Items were “during the last 7 days, on how many days per week did you do vigorous physical activities like aerobics, running, fast bicycling, or fast swimming in your leisure time? 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)” and

"during the last 7 days, on how many days per week did you do moderate physical activities like bicycling at a regular pace, swimming at a regular pace, and double tennis in your leisure time? 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)?" The IPAQ was developed with samples from 12 countries (Craig et al., 2003), and it has been validated and used in samples of college students (Hagströmer, Oja, & Sjöström, 2006; Quartiroli & Maeda, 2014), demonstrating good validity.

Accelerometer. To have an objective measure of daily physical activity, accelerometers were used to assess participants' daily physical activity during the assessment period. The assessment of physical activity lasted three weeks: one week prior to the daily intervention period, one week during the daily intervention period, and one week after the daily intervention period.

An accelerometer is a motion-sensitive monitor that count the number of movements and steps taken per pre-specified time interval (1-minute epochs). In this study, ActiGraph GT3XE-Plus triaxial activity monitor was used, and participants were asked to wear the device on their hip, which allows best capture of their ambulatory activities. Based on the recommendations by Layne et al. (2015) and Ward et al. (2005), participants were instructed to wear the device at all times and to remove it only during water-based activities (e.g., swimming, showering, bathing). Participants were also asked to keep a log to record any periods during which they did not wear the device (e.g., water-based activities), nap times, sleep times, and days for any illness or injury. The data of all times when the device was not worn (i.e., 60 minutes or more of consecutive zeros activity counts) were removed from analysis. Remaining data were coded to determine

the total number of hours of wear time. A valid day was defined as 10 hours or more of wear time, and a valid week was defined as 4 valid days or more of wear time including at least 1 weekend day of wear time. Based on the common practice reported by Tudor-Locke, Camhi, and Troiano (2012), in this study, moderate to vigorous activity was defined by 2,020 or above activity counts per minute or more. Assessment of physical activity is expressed in form of physical activity energy expenditure - metabolic equivalent (MET). Typical MRT categories include: sedentary (1-1.5 METs), light (1.5-3 METs), moderate (3-6 METs), and intense/ vigorous (>6 METs) physical activity (American College of Sports Medicine, 2013).

Exercise goal setting. Participants were asked to choose exercise goal(s) that they would like to work on throughout this study. Participants were recommended to set goals that adhere to the recommendation (i.e., at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or at least 75-minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity), or goals that best fit their needs and interests. Definitions and examples of moderate-intensity physical activity (i.e., requires a moderate amount of effort and noticeably accelerates the heart rate, e.g., brisk walking, dancing, gardening, active involvement in games and walking domestic animals) and vigorous-intensity physical activity (i.e., requires a large amount of effort and causes rapid breathing and a substantial increase in heart rate, e.g., running, walking/ climbing briskly up a hill, fast cycling, aerobics, fast swimming, competitive sports and games) were provided. Some example goals were also provided to participants, such as 30-minute walking, 5 times a

week; 25-minute running, 3 times a week, etc. Participants could also set goals with a combination of multiple types of physical activity.

In addition to setting exercise goals, participants completed the 9-item Barriers Self-Efficacy Scale (Rogers et al., 2006; please see below for details) and the one-item task self-efficacy scale (please see below for details). Participants also rated their perception of their exercise goals on a 6-point scale (1 = strongly disagree; 6 = strongly agree), including (1) to what extent do you feel that the exercise goals are important to you, (2) how much you feel in control of the exercise goals, and (3) how likely it is that you can accomplish the exercise goals.

Mechanism-related variables.

Exercise self-efficacy. Perception of barrier self-efficacy over exercise was assessed by the 9-item Barriers Self-Efficacy Scale (Rogers et al., 2006). Participants rated on a 0-100-point scale (0 = not at all confident; 100 = extremely confident). Sample items include "I believe that I could adhere to my exercise goal when I lack discipline to exercise" and "I believe that I could adhere to my exercise goal if I felt pain or discomfort when exercising." This measure has been used in samples of breast cancer survivors, head and neck cancer patients and people with multiple sclerosis (e.g., McAuley, White, Rogers, Motl, & Courneya, 2010; Rogers, McAuley, Courneya, & Verhulst, 2008; Rogers et al., 2008), and has demonstrated good reliability and validity. Perception of task self-efficacy was assessed by a single item, "I feel confident in adhering to my physical activity goals." Participants indicated their levels of task self-efficacy on a 0-100 point scale (0 = not at all confident; 100 = extremely confident) . Because the perception of exercise self-efficacy was tied to the exercise goal(s) that

participants set, participants completed the baseline measure of exercise self-efficacy in the goal-setting survey instead of the baseline assessment. In the present study, the Cronbach's alphas of the Barriers Self-Efficacy Scale at baseline, post-intervention and 1-month follow-up ranged from .90 to .93.

Autonomous motivation. Autonomous motivation to exercise was assessed by the 24-item Behavioral Regulation in Exercise Questionnaire (BREQ-3; Markland & Tobin, 2004; Wilson, Rodgers, Loitz, & Scime, 2006). The BREQ-3 assesses different behavioral regulation in exercise on a 5-point scale (0 = not true for me; 4 = very true for me). Sample items are "I don't see why I should have to exercise (amotivation)," "I exercise because other people say I should (external regulation)," "I feel guilty when I don't exercise (introjected regulation)," "It's important to me to exercise regularly (identified regulation)," "I exercise because it is consistent with my life goals (integrated regulation)," and "I exercise because it's fun (intrinsic regulation)." The subscales were weighted to calculate a relative autonomy index (RAI) using the following formula (Ryan & Connell, 1989; Vallerand, Pelletier, & Koestner, 2008): (-3*amotivation) + (-2*external regulation) + (-1*introjected regulation) + (1*identified regulation) + (2*integrated regulation) + (3*intrinsic regulation). BREQ-3 has been used in samples of adolescents and college students (e.g., Kostick, 2016' Sicilia, Sáenz-Alvarez, González-Cutre, & Ferriz, 2014), and demonstrated reliability and validity. In the present study, the amotivation subscale of BREQ-3 was lower than expected (Cronbach's alphas ranged from .17 to .78). The Cronbach's alphas of BREQ-3 subscales at baseline, post-intervention and 1-month follow-up ranged from .64 to .95.

Exercise identity. Identification with exercise as an integral part of the concept of the self was assessed by the 9-item Exercise Identity Scale (Anderson & Cychosz, 1994). It consists of subscales for role-identity and exercise beliefs which are rated on a 7-point scale (1 = strongly disagree; 7 = strongly agree). Sample items are "Others see me as someone who exercises regularly (role-identity)" and "Physical exercise is a central factor to my self-concept (exercise beliefs)." The Exercise Identity Scale has been validated in samples of college students and community adults (Lorentzen, Ommundsen, & Holme, 2007; Wilson & Muon, 2008), demonstrating reliability and validity. In this study, the Cronbach's alphas at baseline, post-intervention and 1-month follow-up ranged from .85 to .98 for role identity and .85 to .90 for exercise beliefs, respectively.

Psychological need satisfaction in exercise. As in feasibility study 1, satisfaction of basic needs for autonomy, competence, and relatedness were assessed by the Psychological Need Satisfaction in Exercise Scale (Wilson, Rogers, Rodgers, & Wild, 2006). In the present study, the Cronbach's alphas of the subscales at baseline, post-intervention, and 1-month follow-up ranged from .90 to .99.

Weight stigma. As in feasibility study 1, The Modified Weight Bias Internalization Scale (Pearl & Puhl, 2014) was used to assess weight stigma. In this study, the Cronbach's alphas at baseline, post-intervention and 1-month follow-up ranged from .76 to .93.

Health-related outcomes variables.

Psychological health. As in feasibility study 1, subjective well-being and perceived stress were assessed by the Mental Health Inventory (MHI-38; Veit & Ware, 1983), the WHO (Five) Well-Being Index (Bech, 1999; Bech, Gudex, & Johansen, 1996)

and the Perceived Stress Scale (PSS; Cohen, Kamark, & Mermelstern, 1983). In the present study, the Cronbach's alphas at baseline, post-intervention and 1-month follow-up ranged from .93 to .98 (MHI subscales), .88 to .98 (WHO), and .69 to .92 (PSS), respectively.

Physical health. As in feasibility study 1, perceived energy level was assessed by the Vitality Scale (Ryan, & Frederick, 1997) and the Fatigue Assessment Scale (Michielsen, De Vries, & Van Heck, 2003). Physical symptoms were assessed by the somatization subscale of the Hopkins Symptoms Checklist (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). In the present study, the Cronbach's alphas at baseline, post-intervention and 1-month follow-up ranged from .90 to .96 (Vitality Scale), .78 to .87 (Fatigue Assessment Scale), and .70 to .84 (somatization subscale), respectively.

Manipulation check.

Self-compassion. As in feasibility study 1, self-compassionate attitude was assessed by the Self-Compassion Scale (SCS; Neff, 2003a). In the present study, the Cronbach's alphas of the SCS subscales (i.e., positive self-compassion, negative self-compassion) at baseline, post-intervention and 1-month follow-up ranged from .84 to .97 (positive self-compassion) and .93 to .94 (negative self-compassion), respectively.

Demographic and medical information. Participants self-reported their demographic information (i.e., age, education, annual household income, and marital status), body weight and height (for calculating BMI), as well as existing medical conditions (e.g., asthma, arthritis, diabetes etc.).

Daily measures. Similar to feasibility study 1, throughout the one-week intervention period, participants completed a brief online questionnaire every day. The measures included:

***Recalled physical activity and perceived progress*.** Participants reported their recreational physical activity (i.e., type(s) and minutes of physical activity) that occurred in the past 24 hours. Participants were also asked if they missed the daily measure in the past two days. If so, they would report their daily recreational physical activity in the missed days. They also reported their perceived progress toward their exercise goal(s) on a 7-point Likert scale, and whether they experienced an injury that prevented them from exercise behaviors on a given day.

Mood. The 20-item Positive and Negative Affective Schedule (Watson, Clark, & Tellegen, 1988) was included as before. In the present study, the Cronbach's alphas across the one-week daily intervention period were .95 (positive affect) and .88 (negative affect), respectively.

Results

Participant Demographics, Enrollment, Completion and Attrition

A total of 20 eligible participants attended the orientation session, and were randomized into the two conditions (11 participants in the self-compassion group and 9 participants in the control group). Two participants dropped out in the first two days of the intervention period, resulting in 18 participants in analysis (9 participants in the self-compassion group and 9 participants in the control group). Among the participants, 16 were female with mean age = 20.48, SD = 3.60; mean BMI = 24.04, *SD* = 8.72. The ethnic/racial background of participants was very diverse; 33.3% being of Hispanic/

Latino origin; 22.2% Caucasian, 33.3% Asian, 16.7% Black/ African-American, 11.1% multi-race, 5.6% Native American/ American Indian, and 11.1% others. On average, participants perceived the exercise goals as important to them (mean = 4.59, *SD* = 1.23; self-compassion: mean = 4.60, *SD* = 0.84; control: mean = 4.57, *SD* = 1.72), they felt they were in control of the exercise goals (mean = 4.65, SD = 1.41; self-compassion: mean = 5.10, *SD* = 0.57; control: mean = 4.00, *SD* = 2.00), and they were likely to accomplish the exercise goals (mean = 4.71, SD = 1.21; self-compassion: mean = 5.00, *SD* = 0.67; control: mean = 4.29, *SD* = 1.71).

The completion rate for the daily survey was 82.5% (mean = 5.78 days out of 7 days; 66.23% in the self-compassion group and 84.13% in the control group). The completion rate for the daily intervention session was 74.60% (mean = 5.22 writing out of 7 days; 61.04% in the self-compassion group and 74.60% in the control group). All participants completed at least four writings over the one-week daily intervention period.

Throughout the 21-day physical activity assessment period, an average participant wore the accelerometer for 13.56 valid days (i.e., more than 10 hours a day; 13.56 wear days in the self-compassion and 13.56 wear days in the control group). Among the 18 participants, only 4 participants provided valid weekly data of physical activity (i.e., 4 valid days or more of wear time including at least 1 weekend day of wear time) across the three-week assessment period. For the remaining participants, 4 participants did not provide any valid weekly data of physical activity, and 10 participants reported partial valid data, with one or two weekly data being invalid.

Descriptive Statistics

Daily measures. Across the one-week daily intervention period, the self-compassion group and the control group reported similar levels of positive affect (self-compassion group: mean = 2.66, *SD* = 1.10; control group: mean = 2.87, *SD* = 1.11) and negative affect (self-compassion group: mean = 1.61, *SD* = 0.67; control group: mean = 1.55, *SD* = 0.69). The self-compassion group and the control group reported similar levels of perceived progress toward their exercise goal (self-compassion group: mean = 3.27, *SD* = 2.43; control group: mean = 4.25, *SD* = 1.70).

Periodic assessments. The sample means and standard deviations of outcome variables and mechanism-related variables in the self-compassion group and the control group at the baseline, post-intervention, and 1-month follow-up assessments are presented in Table 2.

Manipulation check

ANCOVA results indicated that there were no significant differences in the self-compassion components at the post-intervention assessment and the one-month follow-up assessment, when baseline self-compassion components were controlled for. Effect sizes are presented in Table 2. While not being statistically significant, the effect sizes suggested that there might be small group differences in positive self-compassion at the one-month follow-up assessment that were underpowered to be detected. The self-compassion group tended to report higher levels of positive self-compassion at the one-month follow-up assessment, compared with their control counterparts.

Physical activity and related outcomes

ANCOVA results indicated that there were no significant differences in physical activity and related outcome variables at the post-intervention assessment and the 1-

month follow-up assessment, with the baseline variables controlled. Effect sizes are presented in Table 2.

There were mixed findings on the group differences across different outcome variables. At the post-intervention assessment, the self-compassion group tended to report higher level of autonomous motivation to exercise (large effect), exercise beliefs (medium to large effect), mental well-being (medium effect), self-reported moderate and total physical activity (medium effect). Unexpectedly, the self-compassion group also tended to report lower levels of task self-efficacy (small to medium effect), exercise role-identity (medium to large effect), self-reported vigorous physical activity (large effect) and objective physical activity (MET; medium effect), and higher levels of weight stigma (medium to large effect).

At the one-month follow-up assessment, the self-compassion group tended to report higher levels of psychological need satisfaction in exercise (competence and relatedness; large effect), mental well-being (large effect), self-reported moderate physical activity (medium effect), as well as lower levels of weight stigma (medium to large effect) and physical symptoms (large effect). Unexpectedly, the self-compassion group also tended to report lower levels of barrier self-efficacy (medium effect), autonomous motivation to exercise (large effect), exercise role-identity (large effect), exercise beliefs (medium to large effect). It should be noted that the findings in this study may not be generalizable because of the small sample size. Caution should be warranted when interpreting these findings.

Discussion

Improved daily intervention completion rate

Compared with feasibility study 1, the completion rate of daily intervention session in this study has been improved by more than 50% (from 48.8% to 74.6%). The gap between the completion rate of the daily survey and the completion rate of the daily intervention session was reduced considerably, from 29.6% to 7.9%. This improvement in the completion of the daily intervention session might suggest that the new task experimental manipulation (i.e., self-compassion writing) has been effective in engaging participants. The writing task required participants to actively reflect on their day and review the (potential) barrier(s) that prevent them from pursuing their physical activity goal(s). It is also more personally-relevant than the passive, audio task used in the feasibility study 1.

In addition, the daily survey and the daily intervention session were presented in a combined session in this study. It might increase convenience for the participants by reducing the demand of participants' self-discipline to complete the daily intervention session at a flexible schedule. In feasibility study 1, participants were allowed to complete the intervention session anytime throughout the day. While this design gave participants greater degree of freedom to complete the intervention session at their convenience, it also required participants to exert more self-discipline to initiate the intervention session at a non-specific time every day. Also, the same time restriction (i.e., 8am – 5pm) was imposed on completing the daily survey and completing the daily intervention session. This design might allow participants to experience a routine of completing survey and intervention session every evening, throughout the one-week daily intervention period.

Furthermore, participants in this study might be more aware that their effort in the daily tasks was evaluated by the experimenter compared with their counterparts in feasibility study 1. Due to the passive nature of the audio task, it was relatively difficult to have an objective evaluation on participants' effort in the daily intervention session in feasibility study 1. Also, participants might not be very mindful that their activities were tracked and time-stamped. However, in feasibility study 2, participants' effort in the daily intervention session was clearly indicated by the content of the writing task. With the increased accountability, participants might be less likely to slack off from the daily intervention session.

Overall, the acceptability of the writing intervention seemed satisfactory. All participants completed at least four writing throughout the one-week daily intervention period, which allowed them to have adequate exposure to the experimental manipulation. Also, participants did not have any specific comments and feedback on improving the writing instruction. Participants could engage in the writing task without further clarification or assistance from the research team, which make it a more feasible brief self-compassion intervention than other self-compassion interventions that require professional assistance and guidelines to implement (e.g., Gilbert & Procter, 2006; Kelly et al., 2009; Neff & Germer, 2013).

Low compliance rate of accelerometer wear

A potential burden of wearing the accelerometer was indicated by the low compliance rate of accelerometer wear. In feasibility study 2, participants were expected to wear the accelerometer for 21 consecutive days, and were recommended not to take off

the device unless they participated in water-related activities (e.g., taking a shower, swimming) or they went to bed. Unexpectedly, less than one-fourth of the participants (4 out of 18 participants) wore the accelerometer sufficiently for meaningful data interpretation (i.e., less than 10 hours per day, 4 days per week). This might be attributed to the discomfort and inconvenience resulting from wearing the device for a long period of time. Participants might thus consider wearing an accelerometer as burdensome, and possibly chose not to wear the accelerometer during the three-week of physical activity assessment. Indeed, 6 out of 18 participants provided feedback at the 1-month follow-up assessment complaining about the inconvenience of wearing the accelerometer and wishing that the device could be smaller and easier to carry around.

Considering the burden that the accelerometer may impose on participants, a change in physical activity assessment was necessary for the next study. Perhaps a smartphone pedometer application could be used in replacement of the accelerometer. While a smartphone pedometer application may not provide the most accurate estimation of physical activity, it costs a minimum inconvenience to participants. Many people carry their smartphones everywhere, during almost every daily activity (Hermanis, Nesenbergs, Cacurs, & Greitans, 2013; Nuzhat, Shaikh, & Ismail, 2018). The pedometer application allows assessment of objective physical activity without carrying a separate device. Indeed, using smartphone pedometer applications to assess physical activity is not a new practice, and it has been reported in multiple studies in the past (e.g., Bort-Roig, Gilson Puig-Ribera, Contreras, & Trost, 2014; Paul et al., 2016).

Main Study

Based on the preliminary findings in feasibility studies 1 and 2, the main study adopted the self-compassion writing task as the experimental manipulation, other limitations identified in feasibility studies 1 and 2 were also addressed in this study.

Methods

Participants

Similar eligibility criteria were imposed except for the removal of restriction of physical inactivity (individuals who have less than 150 minutes physical activity per week). With the difficulty in recruiting only inactive participants, the main study relaxed the inclusion criteria and allowed both inactive and active participants to participate. The new eligibility criteria included: (1) age (18 – 69 years old), (2) interest in promoting physical activity habit, and (3) safety and feasibility of participation (assessed by the Physical Activity Questionnaire for Everyone (PAR-Q+); Warburton, Jamnik, Bredin, Gledhill, 2014). Before participant recruitment, power analysis was conducted using GPower 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) to estimate an adequate sample size for this study. Results indicated around 80 people were needed to detect a medium to large effect (η_p^2 = .09) for ANCOVA analysis, with a p value of .05 and power of .80.

A total of 321 college students completed the screening and baseline survey. Among them, 218 indicated interest to continue participating in the study, 1 participant was excluded because of pregnancy, and 44 participants were excluded because they did not meet the criteria of safety and feasibility of participation. Those who met the study inclusion crtieria (n = 173) were invited to attend an in-person orientation session. Eventually, 109 attended the orientation session and took part in the remaining parts of the study.

Procedures

Study procedures were the similar as those adopted in feasibility studies 1 and 2. In the spring and fall semesters of 2018, participants were recruited from the research participation pool of the Department of Psychology at the University of Houston. Recruitment flyers were posted around the campus, and distributed among potential participants during in-class study announcements. Interested students signed up for the study and completed the screening and baseline survey via the online SONA system. Eligible participants were invited to attend a 30-minute in-person orientation session, and then randomly assigned to one of two conditions: self-compassion condition (i.e., experimental condition), or control condition. Except for the in-person orientation session, all study procedures were completed online (i.e., baseline assessment, two-week daily intervention and daily survey, post-intervention assessment, two-week follow-up assessment).

During the in-lab orientation session, an experimenter provided details about the study procedures, including study components and the timeline. Recommendation of weekly physical activity levels and information about the categorization of different intensity levels of physical activity were also provided to participants. Participants set their exercise goals(s) on the morning of first day of the daily intervention period, before they received any internvention content. During the one-week daily intervention period, participants were required to complete two online tasks every day, including (1) an online intervention session (a writing task, approximately 10 minutes, please see the experimental manipulation section below), and (2) a brief online survey (approximately 5 minutes) which assessed participants' daily physical activity, perceived goal progress,

positive affect ad negative affect. Participants were asked to complete the daily survey and the daily intervention session anytime between 8pm and 5am. They were also told to not go back to complete the daily survey if they had forgotten. Any daily surveys that were completed after the time limit were excluded from analyses. The daily survey and the writing task were sent to participants through email and text message. Participants only needed to complete the daily tasks once a day, either via email or text message. Immediately after and one month after the daily intervention period, participants completed the post-intervention assessment and the follow-up assessment. Similar to feasibility study 2, participants tracked their physical activity for three consecutive weeks (one week prior to the daily intervention period, one week during the daily intervention period, and one week after the daily intervention period). A total of 9 SONA credit hours were provided as compensation for participants' time and effort.

Experimental Manipulation

The experimental manipulation used in feasibility study 2 was adopted. Participants were asked to write about (potential) barrier(s) in pursuing their physical activity goals, and use an accepting and self-compassionate attitude to process their experience. Three prompts, each centered on the concept of mindfulness, common humanity and self-kindness, were given to participants (see Appendix B). Additional descriptions about the three self-compassion components were provided in the content of daily emails/ text messages (see Appendix C). In the control condition, participants wrote about (potential) barriers in pursuing their physical activity goals, in a factual and non-emotional manner (see Appendix D). Participants responded to the same, condition-specific writing instruction every day, over the one-week daily intervention period. In

both conditions, the writing session was presented immediately after the daily survey. The writing session was timed so that participants could not submit their response until 5 minutes had passed. Also, it was emphasized in the consent form and the orientation materials that participants would not receive their research credits if they failed to complete a minimum amount of four writings throughout the one-week intervention period.

Measures

Except for questions about demographic and medical information (which were only included in the baseline assessment) and exercise goal(s) setting, all measures were included in assessments at baseline, post-intervention, and 1-month follow-up.

Physical activity variables.

***Recalled recreational physical activity*.** Similar to feasibility study 2, habit of physical activity and inactivity was assessed by the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003).

Pedometer. The StepUp smartphone application (available at www. http://www.thestepupapp.com/) was used to measure participants' number of daily steps. The assessment lasted three weeks: one week prior to the daily intervention period, one week during the daily intervention period, and one week after the daily intervention period. Participants were asked to always carry their smartphones during the assessment period. They were also asked to send us a screenshot of the step count summary by the end of each week of assessment (i.e., the Monday following each assessment period). The StepUp smartphone application was chosen because it is one of the most highly rated free pedometer applications (4.4 out of 5) that is available for both Android and IPhone

systems. Also, the application runs automatically; participants did not need to turn on/ off the application once they finished the initial set-up (which occurred during the orientation session). The purpose of using this pedometer application in the present study was to objectively assess participants' physical activity (walking and running, specifically) instead of using it as an intervention tool by providing feedback on participants' step count (e.g., Glynn et al, 2014; Kirwan, Duncan, Vandelanotte, & Mummery, 2012). While the application allows participants to set their personalized daily step goal and notification during the initial set-up, we asked all participants to keep the default setting (i.e., 5000 steps per day, no notification of goal progress). This restriction was set to standardize and minimize the amount of feedback of step count that each participant received, and hence the potential impact of the pedometer application on outcomes of interest.

Exercise goal setting. As in feasibility study 2, participants were asked to choose exercise goal(s) that they would like to work on throughout this study. Participants were recommended to set goal(s) that adhere to the recommendation (i.e., at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or at least 75-minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity), or goals that best fit their needs and interests. Definitions and examples of moderate-intensity physical activity and vigorous-intensity physical activity were provided. Some example goals were also provided, e.g., 30-minute walking, 5 times a week; 25-minute running, 3 times a week, etc. Participants could also set goals with a combination of multiple types of physical activity.

Intention of continued exercise goal(s) pursuit. At the post-intervention assessment and the 1-month follow-up assessment, participants were asked to use a 0 to 100-point scale to indicate the likelihood that they would continue to pursue the exercise goals in the coming two weeks.

Mechanism-related variables.

Exercise self-efficacy. As in feasibility study 2, the Barriers Self-Efficacy Scale (Rogers et al., 2006) assessed barrier self-efficacy. A single-item perception of task self-efficacy was also used. In the present study, the Cronbach's alphas of the Barriers Self-Efficacy Scale at baseline, post-intervention and 1-month follow-up ranged from .70 to .91.

Autonomous motivation. As in feasibility study 2, the BREQ-3 (Markland & Tobin, 2004; Wilson, Rodgers, Loitz, & Scime, 2006) assessed autonomous motivation to exercise. In the present study, the Cronbach's alphas of BREQ subscales at baseline, post-intervention and 1-month follow-up ranged from .76 to .92.

Psychological need satisfaction in exercise. As in feasibility studies 1 and 2, satisfaction of basic needs for autonomy, competence, and relatedness was assessed by the Psychological Need Satisfaction in Exercise Scale (Wilson, Rogers, Rodgers, & Wild, 2006). In the present study, the Cronbach's alphas of the subscales at baseline, post-intervention, and 1-month follow-up ranged from .91 to .96.

Exercise identity. As in feasibility study 2, the Exercise Identity Scale (Anderson & Cychosz, 1994) assessed role-identity and exercise beliefs. In this study, the Cronbach's alphas at baseline, post-intervention and 1-month follow-up were .90 to .92 (exercise identity) and .85 to .91 (exercise belief), respectively.

Weight stigma. As in feasibility studies 1 and 2, the Modified Weight Bias Internalization Scale (Pearl & Puhl, 2014) assessed weight stigma. In this study, the Cronbach's alphas at baseline, post-intervention and 1-month follow-up ranged from .91 to .94.

Health-related outcomes variables.

Psychological health. As in feasibility studies 1 and 2, subjective well-being and perceived stress were assessed by the Mental Health Inventory (MHI-38; Veit & Ware, 1983), the WHO (Five) Well-Being Index (Bech, 1999; Bech, Gudex, & Johansen, 1996) and the Perceived Stress Scale (PSS; Cohen, Kamark, & Mermelstern, 1983). In the present study, the Cronbach's alphas at baseline, post-intervention and 1-month follow-up ranged from .95 to .97 (MHI), .85 to .92 (WHO), and .90 to .92 (PSS), respectively.

Physical health. As in feasibility studies 1 and 2, perceived energy level was assessed by the Vitality Scale (Ryan, & Frederick, 1997) and the Fatigue Assessment Scale (Michielsen, De Vries, & Van Heck, 2003). Physical symptoms were assessed by the somatization subscale of the Hopkins Symptoms Checklist (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). In the present study, the Cronbach's alphas at baseline, post-intervention and 1-month follow-up ranged from .90 to .94 (Vitality Scale), .82 to .90 (Fatigue Assessment Scale), and .63 to .80 (somatization subscale), respectively.

Manipulation check.

Self-compassion. As in feasibility studies 1 and 2, self-compassionate attitude was assessed by the Self-Compassion Scale (SCS; Neff, 2003a). In the present study, the Cronbach's alphas of the SCS subscales (i.e., positive self-compassion, negative self-

compassion) at baseline, post-intervention and 1-month follow-up ranged from .87 to .92 (positive self-compassion) and .90 to .94 (negative self-compassion), respectively.

Demographic and medical information. Participants self-reported their demographic information (i.e., age, education, annual household income, and marital status), body weight and height (for calculating BMI), as well as existing medical conditions (e.g., asthma, arthritis, diabetes etc.).

Daily measures. As in feasibility study 2, throughout the one-week intervention period, participants completed a brief online questionnaire every day. The measures included:

***Recalled physical activity and perceived progress*.** Participants reported their recreational physical activity (i.e., type(s) and minutes of physical activity) that occurred in the past 24 hours. Participants were also asked if they missed the daily measure in the past two days. If so, they would report their daily recreational physical activity in the missed days. They also reported their perceived progress toward their exercise goal(s) on a 7-point Likert scale and whether they experienced an injury that prevented them from exercise behaviors on a given day.

Mood. Mood was measured with the 20-item Positive and Negative Affective Schedule (Watson, Clark, & Tellegen, 1988). In the present study, the Cronbach's alphas across the two-week daily intervention period were .94 and .88 for positive and negative affect, respectively.

Data analytic plan

Descriptive statistics, tests of baseline equivalence and tests of manipulation check were performed before testing the main hypotheses.

Aim 1 was to compare the levels of physical activity and intention of continued exercise goal(s) pursuit in the self-compassion intervention group with the control group. Analyses of covariance (ANCOVA) were conducted to test the between-group differences in the levels physical activity at the post-intervention and the 1-month follow-up assessment, with the baseline level of physical activity controlled for. Independent sample t-tests were conducted to test the between-group differences in the levels of intention of continued exercise goal(s) pursuit at the post-intervention assessment and the 1-month follow-up assessment.

Aim 2 was to compare the levels of exercise self-efficacy, autonomous motivation to exercise, and weight stigma in the self-compassion intervention group with the control group. Analyses of covariance (ANCOVA) were conducted to test the between-group differences at the post-intervention assessment and the 1-month follow-up assessment; the initial levels of the outcome variables of interest were controlled in all ANCOVA models.

Aim 3 was to compare psychological and physical impacts in the self-compassion intervention group as compared with the control group. Analyses of covariance (ANCOVA) were conducted to test the between-group differences in psychological well-being (i.e., subjective well-being and perceived stress) and physical well-being (i.e., vitality, fatigue, and physical symptoms) at the post-intervention assessment and the 1-month follow-up assessment; the initial levels of the outcome variables of interest were controlled in all ANCOVA models.

Aim 4 was to examine the moderating role of self-compassion (i.e., condition assignment) in the relationship between daily exercise goal progress and daily affect (i.e.,

positive and negative affect). Hierarchical linear modeling was used to analyze a data structure where within-person data (level-1) were nested within between-person data (level-2). Of specific interest was the association between daily exercise goal progress (level-1 predictor variable) and daily affect (level-1 criterion variables), and experimental manipulation (level-2 predictor variable). Model testing proceeded in 4 phases: unconditional model, means-as-outcome model, random-regression coefficients model, and the intercepts- and slopes-as-outcomes model. The equations of each model are provided below:

Unconditional model

- Level 1: daily affect$_{ij}$ = b_{0j} + r_{ij}
- Level 2: daily affect$_{ij}$ = b_{0j} = g_{00}+ u_{0j}

Means-as-outcome model

- Level 1: daily affect$_{ij}$ = b_{0j} + r_{ij}
- Level 2: daily affect$_{ij}$ = b_{0j} = g_{00}+ g_{01}(condition assignment) + u_{0j}

Random-regression coefficients model

- Level 1: daily affect$_{ij}$ = b_{0j} + b_{1j} (time) + b_{2j} (daily exercise goal progress) + r_{ij}
- Level 2: daily affect$_{ij}$ = b_{0j}= g_{00}+ u_{0j}

Intercepts- and slopes-as-outcomes model

- Level 1: daily affect$_{ij}$ = b_{0j} + b_{1j} (time) + b_{2j} (daily exercise goal progress) + r_{ij}
- Level 2: daily affect$_{ij}$ = b_{0j}= g_{00}+ g_{01} (condition assignment) + u_{0j}

b_{1j}= g_{10}+ u_{1j}

b_{2j}= g_{20}+ g_{21}(self-compassion) + u_{2j}

In the level 1 model, daily affect$_{ij}$ was a daily measure of affect (positive affect and negative affect) for person *j* on day *i*. The intercept (b_{0j}) represented the mean of daily affect for person *j* across *i* days of observations. r_{ij} represented level 1 day and person-specific random variance. In multilevel modeling, the level 1 coefficients were modeled at level 2 such that b_{0j} was modeled as a function of the grand mean at the person-level (g_{00}) and person-specific error (u_{0j}). u_{0j} represents the level 2 random variance. Daily exercise goal progress was assessed by (1) perceived exercise goal progress and (2) hour(s) of physical activity. Condition assignment was a dummy variable with 1 representing the self-compassion group and -1 representing the control group.

Results

Participant Demographics, Enrollment, Completion and Attrition

Among the 109 recruited participants, 3 participants (in the self-compassion group) dropped out at the beginning of the daily intervention period, 7 participants (5 in the self-compassion group, 2 in the control group) completed less than 4 writings (out of 7 writing), one participant in the self-compassion group completed all daily surveys beyond the time restriction (between 8pm to 5am every evening during the daily intervention period), 9 participants showed a lack of attention during the assessments at baseline, post-intervention, and/ or 1-month follow-up (i.e., answer all three check questions incorrectly in a given assessment; 5 in the self-compassion group, 4 in the control group). The data of these participants (n = 20) were discarded from data analysis, resulting in 89 valid cases (44 in the self-compassion group, 45 in the control group).

The analyzed sample (n = 89) was 82% female, with mean age = 21.51, SD = 4.11; mean BMI = 25.17, *SD* = 6.85. Among them, 46.1% reported being of Hispanic/ Latino origin. The racial background of participants was very diverse (27.0% Caucasian, 22.5% Asian, 15.7% Black/ African-American, 10.1% multi-race, 2.2% Native American/ American Indian, and 22.5% others). On average, participants perceived their exercise goals as important to them (self-compassion: mean = 4.91, *SD* = 0.91; control: mean = 4.93, *SD* = 1.05; $t(87) = -0.12$, $p = .91$), they felt they were in control of their exercise goals (self-compassion: mean = 4.95, *SD* = 0.89; control: mean = 4.82, *SD* = 1.01; $t(87) = 0.66$, $p = .51$), and that they were likely to accomplish their exercise goals (self-compassion: mean = 5.16, *SD* = 0.91; control: mean = 4.80, *SD* = 1.01; $t(87) = -.12$, $p = .08$). Results of independent-samples t-tests indicated that there were no significant group differences in these goal perceptions at baseline.

Excluding the invalid cases, the completion rate for the daily survey was 95.83% (mean = 6.71 days out of 7 days; 94.48% in the self-compassion group and 97.14% in the control group). The completion rate for the daily intervention session was 94.54% (mean = 6.62 writing out of 7 days; 94.48% in the self-compassion group and 94.60% in the control group. In term of objective physical activity assessment, 79.78% participants (n = 71) provided their step count information across the three weeks of physical activity assessment, one participant was not able to provide any step count information because he/ she did not own a smartphone and could not install the pedometer application.

Baseline Equivalence

Independent-samples t-tests were conducted to compare the self-compassion group and the control group on demographics and baseline variables of interest. The two

groups did not differ significantly on most demographics (i.e., age, BMI, race/ ethnicity; *ps* > .18) or baseline variables of interests ($p > .06$). Unexpectedly, the self-compassion group consisted of proportionally more male than the control group, $\chi^2(1) = 5.10$, $p = .024$. The self-compassion group also reported higher levels of baseline task self-efficacy, $t = 2.07$, $p = .041$, and higher levels of baseline intrinsic motivation, $t = 2.06$, $p = .043$. These results suggested that the random assignment was not successful. It might be attributed to the relatively small sample size. The proposed use of ANCOVAs in later analysis was appropriate.

Descriptive Statistics

Daily measures. Across the one-week daily intervention period, there were no significant difference in positive affect, $t(87) = 1.16$, $p = .25$ (self-compassion group: mean = 2.81, $SD = 0.83$; control group: mean = 2.62, $SD = 0.71$), negative affect, $t(87) = -0.44$, $p = .66$ (self-compassion group: mean = 1.56, $SD = 0.44$; control group: mean = 1.60, $SD = 0.58$) and perceived exercise goal progress, $t(87) = 1.15$, $p = .25$ (self-compassion group: mean = 3.59, $SD = 1.49$; control group: mean = 3.26, $SD = 1.21$).

Periodic assessments. The sample means and standard deviations of outcome variables and mechanism-related variables in the self-compassion group and the control group at the baseline, post-intervention, and 1-month follow-up assessments are presented in Table 3. The correlations of self-compassion components with baseline physical activity variables, baseline mechanism-related variables (exercise self-efficacy, autonomous motivation to exercise, and weight stigma), and baseline psychological and physical well-being variables are presented in Tables 4-6.

Manipulation Check

ANCOVAs were conducted to examine the effect of self-compassion writing at the post-intervention assessment and the 1-month follow-up assessments, with the baseline self-compassion components controlled. Results indicated that there was significant group difference in positive self-compassion at the post-intervention assessment, F (1, 73) = 5.75, p = .019, such that the self-compassion group reported significantly higher levels of positive self-compassion (medium effect) than the control group. However, no significant group differences were observed for positive self-compassion at the 1-month follow-up assessment F (1, 76) = 0.73, p = .40, as well as negative self-compassion at both time points (post-intervention: F (1, 73) = 0.11, p = .74; 1-month follow-up: F (1, 76) = 0.76, p = .39). While not being statistically significant, the effect size suggested that there might be small group difference in negative self-compassion at the 1-month follow-up assessment that was underpowered to be detected. The self-compassion group tended to report higher levels of negative self-compassion than the control group at the one-month follow-up assessment. Effect sizes are presented in Table 10.

Aim 1: Testing Group Differences in Physical Activity and Intention of Continued Exercise Goal(s) Pursuit

ANCOVAs were conducted to examine the effect of self-compassion writing at the post-intervention assessment and the 1-month follow-up assessments, with the baseline physical activity controlled. Results indicated that there were no significant group differences in recreational moderate physical activity (post-intervention: F (1, 62) = 0.04, p = .84; 1-month follow-up: F (1, 64) = 0.08, p = .78), reactional vigorous physical activity (post-intervention: F (1, 53) = 1.21, p = .28; 1-month follow-up: F (1,

58) = 0.06, p = .81), total reactional physical activity (post-intervention: F (1, 51) = 1.29, p = .26; 1-month follow-up: F (1, 54) = 0.07, p = .79) and weekly step count (post-intervention: F (1, 73) = 0.26, p = .61; 1-month follow-up: F (1, 72) = 0.10, p = .76) at the post-intervention assessment and the 1-month follow-up assessment. Effect sizes are presented in Table 3.

Independent-samples t-tests were conducted to examine the condition difference on intention to continue exercise goal(s) pursuit at the post-intervention assessment and the 1-month follow-up assessment. Results indicated that the self-compassion group reported significantly higher levels of intention to continue pursuing exercise goal(s) than the control group at the post-intervention assessment, t(74) = 2.06, p = .04, mean difference = 12.20 (95% CI: .42 – 23.97), but no significant group difference was observed at the one-month follow-up assessment, t(76) = 0.10, p = .92.

Aim 2: Testing Group Differences in Exercise Self-Efficacy, Autonomous Motivation to Exercise, and Weight Stigma

ANCOVAs were conducted to examine the effect of self-compassion writing on the post-intervention assessment and the 1-month follow-up assessments, with the baseline mechanism-related variables of interest controlled. Results indicated that there were no significant group differences in task self-efficacy (post-intervention: F (1, 73) = 1.06, p = .31; 1-month follow-up: F (1, 76) = 0.19, p = .67), barrier self-efficacy (post-intervention: F (1, 71) = 2.02, p = .16; 1-month follow-up: F (1, 74) = 0.29, p = .59), autonomous motivation to exercise (post-intervention: F (1, 73) = 1.57, p = .21; 1-month follow-up: F (1, 77) = 1.78, p = .19), psychological need satisfaction of autonomy (post-intervention: F (1, 73) = 0.32, p = .57; 1-month follow-up: F (1, 78) = 0.02, p = .89),

competence (post-intervention: F (1, 73) = 0.31, p = .58; 1-month follow-up: F (1, 78) = 0.58, p = .45), and relatedness (post-intervention: F (1, 73) = 0.00, p = .99; 1-month follow-up: F (1, 78) = 0.19, p = .66), exercise role identity (post-intervention: F (1, 72) = 0.13, p = .72; 1-month follow-up: F (1, 77) = 0.16, p = .69), exercise beliefs (post-intervention: F (1, 72) =0.02, p = .88; 1-month follow-up: F (1, 77) = 0.19, p = .66), as well as weight stigma (post-intervention: F (1, 72) = 0.00, p = 1.00; 1-month follow-up: F (1, 77) = 0.01, p = .92). Effect sizes are presented in Table 3.

While not being statistically significant, the effect sizes suggested that there might be small group differences that were underpowered to be detected. The self-compassion group tended to report higher levels of task self-efficacy (small effect) at the post-intervention assessment, and higher levels of autonomous motivation to exercise (small effect) at the post-intervention assessment and the 1-month follow-up assessment. Unexpectedly, the self-compassion group also tended to report lower levels of barrier self-efficacy (small effect) at the post-intervention assessment.

Aim 3: Testing Group Differences in Psychological and Physical Well-Being

ANCOVAs were conducted to examine the effect of self-compassion writing on the post-intervention assessment and the 1-month follow-up assessments, with the baseline health-related outcome variables of interest controlled. Results indicated that there were no significant group differences in mental health inventory (post-intervention: F (1, 73) = 0.85, p = .36; 1-month follow-up: F (1, 77) = 0.06, p = .77), WHO well-being index (post-intervention: F (1, 73) = 1.18, p = .28; 1-month follow-up: F (1, 77) = 0.01, p = .94), and perceived stress (post-intervention: F (1, 72) = 0.71, p = .40; 1-month follow-up: F (1, 76) = 1.32, p = .26). Effect sizes are presented in Table 3. While not being

statistically significant, the effect sizes suggested that there might be small group differences on the post-intervention assessment that was underpowered to be detected. The self-compassion group tended to report higher levels of psychological well-being (i.e., higher levels of mental health inventory and WHO well-being index, and lower levels of perceived stress; small effects).

Results of ANCOVAs also indicated there were no significant group differences in the levels of vitality (post-intervention: F (1, 73) = 0.10, p = .75; 1-month follow-up: F (1, 77) = 1.19, p = .28), fatigue (post-intervention: F (1, 74) = 0.01, p = .92; 1-month follow-up: F (1, 77) = 0.07, p = .80), and physical symptoms (post-intervention: F (1, 74) = 0.22, p = .64; 1-month follow-up: F (1, 76) = 0.18, p = .67). Effect sizes are presented in Table 3. While not being statistically significant, the effect sizes suggested that there might be small group differences that were underpowered to be detected. The self-compassion group tended to report higher levels of vitality (small effect) at the one-month follow-up assessment.

Aim 4: Testing the Moderating Role of Self-Compassion in the Relationship between Daily Exercise Goal Pursuit and Daily Affect

Data cleaning. Date and time stamps on the daily data were examined, entries were deleted if there were more than one record on the same day, and if they were completed after 5am the next morning; 7 entries were deleted among the 89 valid cases. As a result, 546 days of data (out of 623 potential days of data) were retained and available for analysis.

Preliminary Analysis. The multi-level data were analyzed using HLM 7.03 student edition (Raudenbush, Bryk, & Congdon, 2017); random effects were estimated at

level 1 and level 2 models. Unconditional models were run for daily variables (i.e., perceived exercise goal progress, minutes of physical activity, positive affect and negative affect) before examining the proposed hypotheses. In the unconditional model, no predictors were entered at level 1 or level 2. These models provided an estimate of the grand mean of a daily variable and partitioned the total variance of that daily variable into variability at level 1 (within-person level) and at level 2 (between-person level). Unconditional models also provided an estimate of the reliability of the estimates of the level 1 intercepts and *intraclass correlation* (ICC) for a variable. To calculate the ICC, the within-person level variance (σ^2) and between-person level variance (τ_{00}) were substituted into the following equation: ICC = τ_{00}/ (τ_{00} + σ^2). A large ICC would indicate that observations within subjects are not independent and that a multilevel approach is appropriate (e.g., Hox, 2010). Descriptive statistics (i.e., mean, τ_{00}, σ^2, ICC and reliability) for daily exercise goal progress, positive affect and negative affect are presented in Table 7. Results indicated that parameter estimates were reliable and that there was substantial variability remaining to be explained at level 1 and level 2 for all within-person variables. The ICCs indicated that a multilevel approach was appropriate.

Positive affect. The unconditional model revealed an ICC of .51. Thus, 51% of the variance in daily positive affect was at the between-person level and 49% of the variance in daily positive affect was at the within-person level. Because variance existed at both levels of the data structure, predictors were added at each level. The means-as-outcomes model added condition assignment (self-compassion vs. control) as a level-2 predictor variable. The regression coefficient relating condition assignment to daily positive affect was not statistically significant (b = 0.09, p = .25), indicating no

significant group difference in daily positive affect. Next, the random regression coefficients model was tested using time and daily exercise goal progress as level-1 predictor variables. The regression coefficient relating daily exercise goal progress to daily positive affect was positive and statistically significant (b = 0.11, $p < .001$). The regression coefficient relating time to daily positive affect was negative and statistically significant, b = -0.15, $p = .003$. In other words, daily positive affect was higher when participants made more progress in their exercise goal and when it was the beginning of the week. Finally, the intercepts- and slopes-as-outcomes model was tested with all predictors tested in the model simultaneously. The regression coefficient relating daily exercise goal progress (b = 0.11, $p < .001$) and time (b = -0.05, $p = .003$) to daily positive affect continued to be statistically significant. More importantly, the cross-level interaction between daily exercise goal progress and condition assignment was significant (b = -0.05, $p = .003$). Results suggested that the association between daily exercise goals progress and daily positive affect was weaker in the self-compassion group, compared with their control counterparts. Please see Table 8 for detailed results.

Similar results were yielded when hour(s) of physical activity was tested as an alternative indicator of exercise goal pursuit. The random regression coefficients model was tested using time and daily hour(s) of physical activity as level-1 predictor variables. The regression coefficient relating daily hour(s) of physical activity to daily positive affect was positive and statistically significant (b = 0.45, $p < .001$). The regression coefficient relating time to daily positive affect was negative and statistically significant, b = -0.04, $p = .003$. In other words, daily positive affect was higher when participants made more progress in their exercise goal and when it was the beginning of the week.

The intercepts- and slopes-as-outcomes model was also tested with all predictors tested in the model simultaneously. The regression coefficient relating daily hour(s) of physical activity (b = 0.42, $p < .001$) and time (b = -0.04, $p = .001$) to daily positive affect continued to be statistically significant. More importantly, the cross-level interaction between daily hour(s) of physical activity and condition assignment was significant (b = -0.22, $p = .005$). Results suggested that the association between daily hour(s) of physical activity and daily positive affect was weaker in the self-compassion group, compared with their control counterparts. Please see Table 9 for detailed results.

Negative affect. The unconditional model revealed an ICC coefficient of .50. Thus, 50% of the variance in daily negative affect was at the between-person level and 50% of the variance in daily negative affect was at the within-person level. Because variance existed at both levels of the data structure, predictors were added at each level. The means-as-outcomes model added condition assignment (self-compassion vs. control) as a level-2 predictor variable. The regression coefficient relating condition assignment to daily negative affect was not statistically significant (b = -0.02, $p = .71$), indicating on significant group difference in daily negative affect. Next, the random regression coefficients model was tested using time and daily exercise goal progress as level-1 predictor variables. The regression coefficient relating daily exercise goal progress to daily negative affect was positive and statistically significant (b = -0.03, $p < .001$). The regression coefficient relating time to daily negative affect was negative and statistically significant, b = -0.06, $p = .002$. In other words, daily negative affect was lower when participants made more progress in their exercise goal and when it got closer to the end of the week. Finally, the intercepts- and slopes-as-outcomes model was tested with all

predictors tested in the model simultaneously. The regression coefficient relating daily exercise goal progress (b = -0.03, p = .002) and time (b = -0.06, p < .001) to daily negative affect continued to be statistically significant. More importantly, the cross-level interaction between daily exercise goal progress and condition assignment was significant (b = 0.02, p = .021). Results suggested that the association between daily exercise goal progress and daily negative affect was weaker in the self-compassion group, compared with their control counterparts. Please see Table 10 for detailed results.

Similar results emerged when hour(s) of physical activity was tested as an alternative indicator of exercise goal pursuit. The random regression coefficients model was tested using time and daily hour(s) of physical activity as level-1 predictor variables. The regression coefficient relating daily hour(s) of physical activity to daily negative affect was positive and statistically significant (b = -0.06, p < .001). The regression coefficient relating time to daily negative affect was negative and statistically significant, b = -0.11, p = .003. In other words, daily negative affect was lower when participants made more progress in their exercise goal and when it got closer to the end of the week. The intercepts- and slopes-as-outcomes model was also tested with all predictors tested in the model simultaneously. The regression coefficient relating daily hour(s) of physical activity (b = -0.12, p < .001) and time (b = -0.06, p < .001) to daily negative affect continued to be statistically significant. More importantly, the cross-level interaction between daily hour(s) of physical activity and condition assignment was significant (b = 0.07, p = .006). Results suggested that the association between daily hour(s) of physical activity progress and daily negative affect was weaker in the self-compassion group, compared with their control counterparts. Please see Table 11 for detailed results.

Discussion

Existing studies have shown that self-compassion is related to physical activity and related outcomes (e.g., Ferguson, Kowalski, Mack, & Sabiston, 2015; Magnus, Kowalski, & McHugh, 2010; Mosewich, Kowalski, Sabiston, Sedgwick, & Tracy, 2011; Semenchuk, Strachan, & Fortier, 2018). However, these studies were mostly cross-sectional, which prevented researchers from drawing causal inferences about relationships of self-compassion with physical activity and related outcomes. While a few experimental studies were conducted to examine the effect of self-compassion on physical activity related outcomes (e.g., adaptive responses in difficult sports events; Mosewich, Crocker, Kowalski, & DeLongis, 2013; Reis et al., 2015), no existing studies have examined level of physical activity as an outcome, or the potential underlying mechanisms through which self-compassion may influence physical activity. The present study attempted to bridge the gap in the literature by examining the feasibility and effectiveness of a self-compassion intervention in promoting (1) physical activity (i.e., minutes of physical activity per week, intention of continued exercise goals pursuit), (2) exercise self-efficacy, autonomous motivation to exercise, weight stigma, and (3) health-related outcomes, as well as to (4) examine the potential buffering role of self-compassion in the association between daily exercise goal progress and daily mood.

The hypotheses were partially supported. The one-week self-compassion writing internvention successfully induced positive self-compassion. Consist with the hypothesis, the positive association between daily exercise goal progress and daily positive affect was weaker among the self-compassion group, compared with their control counterparts. Similarly, the negative association between daily exercise goal progress and daily

negative affect was weaker among the self-compassion group, compared with their control counterparts. Participants induced with self-compassion were less vulnerable to the affective consequences of thwarted exercise goal progress compared with their control counterparts. These findings provided some evidence that self-compassion may serve a soothing function when individuals encounter occasional setbacks when pursuing their exercise goals. They also resonated with the findings of Hope and colleagues (2014), who found that trait self-compassion moderated the association between goal progress and affect among university freshmen in a daily diary study.

Affect is closely tied to goal progress (Carver & Scheier, 1982; Crocker & Graham, 1995), and it has important implications for goal maintenance (Baumeister, Bratlsavsky, Muraven & Tice, 1998; Bulley, Donaghy, Payne, & Mutrie, 2009; Semenchuk, Strachan, & Fortier, 2018). Perhaps individuals induced with self-compassion (the self-compassion group) were less threatened by their goal failures (Leary, Tate, Adams, Allen, & Hancock, 2007; Mosewich, Crocker, Kowalski, & DeLongis, 2013; Reis et al., 2015), and viewed their exercise goal(s) as mastery oriented goals instead of performance oriented goals (Neff, Hsieh, & Dejitterat, 2005). They might thus view their success and setbacks as normal parts of the habit building process, and thus being less emotionally invested in exercise goal progress. In turn, they might feel less demotivated when they were not able to reach their set goal(s) occasionally and able to maintain their intention to pursue exercise goals.

More importantly, these findings indicated that the soothing function of self-compassion induction did not let people off the hook. Consistent with previous studies indicating that self-compassion was not significantly associated with self-complacency

but was with self-improvement (Breines & Chan, 2012; Leary et al., 2007; Neff, 2003a), there were no significant group differences in the amount of physical activity and related outcomes reported by the self-compassion group and the control group at the post-intervention assessment and the one-month follow-up assessment in the present study. While the self-compassion group experienced less negative emotions when they were not making sufficient progress in their exercise goal(s), they remained as motivated as their control counterparts to pursue their exercise goals. Indeed, the self-compassion group even reported higher levels of intention to continue exercise goal(s) pursuit at the post-intervention assessment than the control group at the post-intervention assessment. These findings resonated with previous research that showed self-compassion induction could lead to greater motivation to take responsibility for one's failures and make amends (Breines & Chan, 2012; Leary et al., 2007).

While it is exciting to learn that inducing self-compassion could improve individuals' intention to continue exercise goal(s) pursuit, it should be noted that the effect did not last very long. The significant group difference in the intention to continue exercise goal(s) pursuit observed at the post-intervention assessment faded away at the one-month follow-up assessment. In addition, there were no significant differences in self-reported physical activity (moderate and vigorous physical activity), nor objective measure of physical activity (i.e., weekly step count). It is unclear why the higher levels of intention to continue exercise goal(s) pursuit observed in the self-compassion group at the post-intervention assessment did not translate into higher levels of physical activity behavior at the post-intervention assessment nor the one-month follow-up assessment. There are at least three possible reasons that may explain the intention-behavior gap: (1)

The timeline of assessments might not match the timeline of behavioral change. It is possible that the intention of physical activity at the post-intervention assessment did not immediately translate into behavior, and thus, no group differences in physical activity were observed at the post-intervention assessment. On the other hand, after the post-intervention assessment, there was a gap of 3 to 4 weeks before participants completed the one-month follow-up assessment. Physical activity based on the intention assessed at the post-intervention assessment might not last long enough to be captured at the one-month follow-up assessment. (2) The measures of physical activity might not be precise and comprehensive enough. Participants might not accurately recall their physical activity in the self-reported assessments. The pedometer application could only assess physical activity that involved walking or running and it missed activities such as swimming or muscle-strengthening exercises. While participants were asked to always carry their smartphone, there was no guarantee that participants actually carried their smartphones when they were walking or exercising. Without the function of wear time tracking in the pedometer application, there was no way to verify how much time a day that the participants actually carried their smartphones, and whether all activities of walking/ running were adequately tracked. (3) This intention-behavior gap is a common observation in many physical activity interventions (Rhodes & Bruijn, 2013). A random-effects meta-analysis study indicated that the overall intention-physical activity gap was 46% (Rhodes & Bruijn, 2013). This finding suggested that having an intention is necessary but not sufficient to cause behavioral change in physical activity. To act on intention, individuals may also need planning, self-regulation (action control) and self-efficacy (Sniehotta, 2009). Indeed, the meta-analysis study also revealed that there were

more people who failed to translate their intention into physical activity than people who did not have intention to be physically active (36% vs. 21%; Rhodes & Bruijn, 2013). Perhaps, future physical activity intervention research should also focus on intention translation strategies (Sniehotta, 2009). Nonetheless, intention is an important and proximal predictor of physical activity. Meta-analysis has been conducted and concluded that intention has a stronger association with physical activity (r = .51, corrected for sampling error and measurement error) than any known correlates of physical activity (Hagger, Chatzisarantis, & Biddle, 2002). This study provided preliminary evidence that inducing self-compassion could promote individuals' intention to continue exercise goal(s) pursuit, and that it might serve as a foundation for future physical activity intervention research.

In addition, in contrast to the hypotheses, no significant group differences were observed on any of the proposed mechanism variables (i.e., exercise self-efficacy, autonomous motivation to exercise, and weight stigma). The statistical nonsignificance might be attributed to the combination of small effect size and inadequate sample size. Based on the effect size estimate, the self-compassion group tended to report higher levels of task self-efficacy at the post-intervention assessment, and higher levels of autonomous motivation to exercise at the post-intervention assessment and the 1-month follow-up assessment, which were consistent with the hypotheses. Future research may replicate this study using a stronger experimental manipulation (i.e., larger effect size) that targets exercise self-efficacy and autonomous motivation to exercise (e.g., Hargreaves, Mutrie, & Fleming, 2016; Knittle et al., 2015), as well as with a larger sample (i.e., large sample size).

Unexpected, differential effects of the self-compassion writing intervention on the two components of exercise self-efficacy (i.e., task self-efficacy and barrier self-efficacy) were observed in this study. Self-compassion writing had a small (non-significant) and positive effect on task self-efficay, but a small (non-significant) and negative effect on barrier self-efficacy. There are at least two possible explanations for these differences. First, when participants reviewed their barriers in a self-compassionate manner, they might be more likely to accept their occasional setbacks and failures in a less defensive way, and hence retain their interest to continue pursuing their exercise goals. Specifically, they may have less mood fluctuations upon success or failures of exercise goal(s), and higher levels of task self-efficacy and intentions to continue exercise goal(s) pursuit). However, the strong emphasis on emotion regulation in the self-compassion writing intervention might also distract participants from problem solving their identified barriers. The self-compassion group might not have spent as much time as the control counterparts to brainstorm about practical solutions to tackle their identified barriers of physical activity. Qualitative analysis of participants' daily writing may help verify this speculation. Second, it is possible that the barrier self-efficacy scale only captured common barriers (e.g., bad weather, conflicted schedules, under personl stress), and not individual participants' unique barriers in pursuing their exercise goal(s). Indeed, some items of the barrier self-efficacy scale were not relevant to individuals who did not join any exercise programs and exercise alone (e.g., I didn't like the particular activity program that I was invovled in, an instructor does not offer me any encouragement). Future research should include an additional barrier self-efficacy question such as "I feel confident in adhering to my physical activity goals despite the barriers that I identified in

this study" to increase the personal relevance and sensitivity of the barrier self-efficacy measure. Previous research indicated that task self-efficacy and barrier self-efficacy play distinct roles in promoting physical activity (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998; Rogers et al., 2006). While task self-efficacy is important when individuals begin to adopt a new habit of physical activity, barrier self-efficacy tends to play a more important role in maintaining the habit of physical activity (Blanchard et al., 2007). Future research should investigate ways to promote task self-efficacy without jeopardizing barrier self-efficacy simultaneously.

On the other hand, in contrast to the hypotheses, no significant group differences were observed in any of the psychological and physical well-being variables (i.e., subjective well-being, perceived stress, vitality, fatigue, and physical symptoms). The statistical nonsignificance might, again, be attributed to the combination of small effect size and inadequate sample size. Based on the effect size estimate, the self-compassion group tended to report higher levels of subjective well-being, lower levels of perceived stress at the post-intervention assessment, as well as higher levels of vitality at the one-month follow-up assessment, which were consistent with the hypotheses. It should be noted that the self-compassion writing exercise adopted in this study was relatively brief (around 5 to 10 minutes per session) compared to typical self-compassion exercise (20 minutes per session; Imrie & Troop, 2012; Wong & Mak, 2016). Future research could replicate this study using a more extensive self-compassion writing exercise (larger effect) and a larger sample (i.e., larger sample size).

Limiations and Future Directions

There were a few limitations to this research. First, the experimental manipulation was not strong enough to induce a large and sustainable effect. In fact, there were some arguments against barrier identification, despite its prevalence in physical activity interventions (Ashfond, Edmunds, & French, 2010). A meta-analysis indicated mixed findings on the association between barrier identification and exercise self-efficacy; the inclusion of barrier identification might decrease the effect size of physical activity interventions (Ashfond, Edmunds, & French, 2010). If delivered inaccurately, barrier identification is simply an explicit exploration of the reasons that individuals cannot perform physical activity, rather than an opportunity for individuals to identify thoughts and action that help them increase the chances of successfully performing physical activity in the future (Ashfond, Edmunds, & French, 2010). Future research may use alternative self-compassion writing paradigms that facilitate a self-compassionate approach to physical activity habit-building experience, without excessive focus on barriers. For instance, participants could describe how they can put self-compassion into action. Future research may also use stronger experimental manipulations (e.g., adding weekly writing exercises after the daily intervention period, including psychoeducation sessions on the concept of self-compassion, and a variety of self-compassion exercises) and a longer duration of the self-compassion intervention (e.g., Mak et al., 2018; Mosewich, Crocker, Kowalski, & DeLongis, 2013). Researchers may also consider integrating a brief self-compassion intervention into existing physical activity intervention(s) that target improvements in exercise self-efficacy and autonomous motivation to exercise (Hargreaves, Mutrie, & Fleming, 2016; Knittle et al., 2015) to maximize the effect of physical activity intervention.

Second, this study had only examined exercise self-efficacy, autonomous motivation to exercise, and weight stigma as potential underlying mechanisms relating to self-compassion and physical activity. Results indicated that the self-compassion writing intervention only yielded small effects on exercise self-efficacy and autonomous motivation to exercise, and the baseline data indicated that self-compassion components were not significantly associated with any of the proposed mechanisms. It is possible that these variables may serve better as moderators instead of mediators of the brief self-compassion physical activity intervention. The intervention may work better among those with higher levels of controlled motivation and weight stigma. Future research should explore the possibility of moderating effects, and explore other potential mechanisms such as coping, self-regulation, emotion regulation, goal disengagement and engagement (Reis et al., 2015; Semenchuk, Strachan, & Fortier, 2018; Terry & Leary, 2011). On the other hand, the self-compassion writing intervention failed to reduce negative self-compassion (i.e., self-criticism, isolation and over-identification). Future research should explore the potential role of negative self-compassion in physical activity, as well as the underlying mechanisms.

Third, in this study, participants were encouraged to set goals that adhere to the recommendation (i.e., at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity), or goals that best fit their needs and interests. Given most participants were not active when they first participated in this study, the personalized exercise goal(s) that participants set may not be realistic to pursue. Future research should emphasize the gradual process of building a habit of physical activity, as well as the importance of

personal needs and interest in goal setting, and encourage participants to set goals that are realistic to pursue. Researchers may also examine the effect of brief self-compassion intervention on disengaging from less effective exercise goals and reengaging in more effective exercise goals.

Fourth, this study did not examine the amount of muscle-strengthening activities as an outcome. According to the Physical Activity Guidelines for Americans (United States Department of Health and Human Services, 2008), individuals should have muscle-strengthening activities of moderate/ greater intensity on two or more days a week. Future research should examine whether self-compassion impacts muscle-strengthening activities, and if so, through what mechanisms.

Conclusion

Despite limitations, this study made significant contributions to the self-compassion and physical activity literatures. This is one of the first studies that examined the feasibility and the effect of a brief, self-compassion writing intervention in promoting exercise goal adherence and related outcomes. This study provided preliminary evidence that inducing self-compassion could buffer the association between daily exercise goal progress and daily mood, and that it could lead to higher levels of intention to pursue exercise goals in short-term. It is recommended that future research should expand on these findings and explore the possibility of integrating self-compassion in a larger-scale physical activity intervention, and investigate potential mechanisms that were not examined in this study.

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Table 1. Sample means and standard deviations at baseline, post-intervention and 2-week follow-up assessment in feasibility study 1

Measures	**Baseline**		**Post-Intervention**		**2-week Follow-up**		**Effect Size, η_p^2 (Baseline vs.)**	
	Self-compassion	Control	Self-compassion	Control	Self-compassion	Control	Post-intervention	2-week follow-up
Exercise Efficacy Scale	4.28 (1.03)	4.99 (1.17)	4.31 (0.72)	4.86 (1.00)	4.61 (1.02)	5.17 (1.01)	0.036	0.030
Exercise Motivations Inventory								
- Stress management	5.17 (1.28)	5.52 (1.00)	4.88 (1.76)	4.85 (1.08)	5.10 (1.34)	4.65 (1.63)	0.011	0.128
- Revitalization	4.85 (1.33)	5.18 (1.52)	4.54 (2.00)	4.54 (1.41)	4.81 (1.70)	4.55 (1.48)	0.003	0.055
- Enjoyment	4.75 (1.45)	4.90 (1.64)	4.63 (1.53)	4.27 (1.88)	4.94 (1.71)	4.43 (1.59)	0.015	0.037
- Challenge	4.69 (1.53)	4.91 (1.10)	4.62 (1.84)	4.18 (1.41)	4.78 (1.81)	4.28 (1.58)	0.057	0.085
- Social recognition	2.65 (1.66)	2.87 (1.47)	2.65 (1.38)	2.67 (1.50)	2.79 (1.49)	2.55 (1.61)	0.007	0.041
- Affiliation	2.48 (1.38)	2.93 (1.36)	2.98 (1.36)	2.44 (1.83)	3.33 (1.84)	2.13 (1.26)	0.054	0.161
- Competition	2.70 (1.44)	3.90 (1.95)	2.92 (1.77)	3.25 (2.07)	3.40 (1.93)	2.80 (1.83)	0.035	0.256
- Health pressure	2.98 (1.63)	2.49 (1.64)	2.92 (1.20)	2.78 (1.67)	3.72 (1.76)	2.57 (1.32)	0.000	0.099
- Ill-health avoidance	4.98 (1.40)	5.03 (1.56)	5.35 (1.65)	4.67 (2.01)	5.67 (1.32)	4.45 (1.95)	0.077	0.199
- Positive health	5.85 (1.05)	6.13 (0.85)	5.79 (1.54)	5.69 (1.24)	5.88 (1.40)	5.55 (1.22)	0.011	0.051
- Weight management	5.38 (1.79)	5.53 (1.66)	5.06 (2.02)	5.42 (1.83)	5.77 (1.49)	4.73 (1.89)	0.000	0.121
- Appearance	5.47 (1.25)	4.92 (1.22)	5.35 (1.50)	4.77 (1.55)	5.44 (1.34)	4.43 (1.63)	0.024	0.137
Behavioral Regulation in Exercise Questionnaire								
- Intrinsic regulation	2.79 (0.79)	2.55 (1.46)	2.83 (0.62)	2.77 (1.33)	3.15 (0.67)	2.81 (0.89)	0.026	0.063
- Identified regulation	3.14 (0.59)	2.77 (1.08)	3.22 (0.55)	2.97 (0.60)	3.22 (0.55)	2.79 (0.76)	0.028	0.068
- Introjected regulation	2.38 (1.40)	1.98 (1.43)	2.89 (1.19)	2.36 (1.29)	2.60 (0.90)	2.33 (1.19)	0.082	0.072
- External regulation	1.08 (1.33)	0.76 (1.23)	1.42 (1.56)	0.71 (1.21)	1.09 (1.28)	0.82 (1.40)	0.180	0.167
- Relative autonomy index	-1.52 (3.59)	-1.07 (4.41)	-3.65 (4.05)	-1.07 (4.66)	-0.79 (2.34)	-1.83 (5.86)	0.231	0.030
German Psychological Need Satisfaction in Exercise Scale								
- Autonomy	4.67 (1.48)	4.93 (1.61)	4.82 (1.24)	4.72 (1.13)	4.64 (1.50)	5.53 (1.14)	0.004	0.209
- Competence	4.17 (1.65)	4.42 (1.44)	4.17 (1.06)	4.96 (1.10)	4.10 (1.49)	5.15 (1.25)	0.190	0.251
- Relatedness	3.53 (1.74)	3.62 (1.70)	3.48 (1.35)	3.67 (1.90)	3.56 (1.77)	3.60 (2.11)	0.010	0.006
Modified Weight Bias Internalization Scale	4.32 (1.54)	2.80 (1.84)	4.10 (1.74)	3.08 (2.07)	4.33 (1.62)	2.76 (1.69)	0.029	0.019
Weight Self-Stigma Questionnaire	2.48 (1.04)	2.19 (1.20)	2.51 (1.28)	2.06 (1.44)	2.64 (1.18)	2.40 (1.49)	0.024	0.080
Self-Compassion Scale								
- Positive self-compassion	3.00 (0.92)	3.37 (0.72)	2.77 (0.82)	3.18 (0.69)	2.76 (0.85)	3.38 (0.62)	0.010	0.084
- Negative self-compassion	3.39 (0.92)	3.02 (0.97)	3.32 (0.86)	2.80 (0.97)	3.21 (1.11)	2.68 (1.06)	0.057	0.026
Vitality Scale	4.10 (1.44)	4.33 (1.46)	4.40 (1.55)	4.44 (1.41)	3.64 (1.77)	4.83 (1.22)	0.002	0.159
Fatigue Assessment Scale	2.63 (0.75)	2.27 (0.69)	2.55 (0.73)	2.18 (0.66)	2.75 (1.01)	2.03 (0.71)	0.025	0.049
Physical Symptom Checklist	1.52 (0.46)	1.31 (0.34)	1.33 (0.19)	1.44 (0.42)	1.42 (0.27)	1.41 (0.52)	0.110	0.006

Mental Health Inventory	150.67 (32.22)	160.67 (30.17)	149.92 (30.50)	168.00 (31.24)	151.25 (36.28)	170.20 (37.72)	0.106	0.028
WHO (Five) Well-Being Index	3.49 (1.07)	3.41 (1.11)	3.52 (1.42)	3.75 (1.05)	3.40 (1.25)	4.12 (1.03)	0.017	0.113
Perceived Stress Scale	1.98 (0.61)	1.55 (0.79)	1.85 (0.54)	1.61 (0.70)	1.92 (0.74)	1.42 (0.88)	0.005	0.008
Exercise goal adherence								Cramer's
- Number of participants attempt to keep up with goal	N/A	N/A	N/A	N/A	9 out of 12	8 out of 10		V = .06
- Minutes per week					132.86 (99.16)	70.00 (57.45)		Cohen's d = 0.78

Table 2. Sample means and standard deviations at baseline, post-intervention and 1-month follow-up assessment in feasibility 2

Measures	**Baseline**		**Post-Intervention**		**1 month Follow-up**		**Effect Size, η_p^2 (baseline vs.)**	
	Self-compassion	Control	Self-compassion	Control	Self-compassion	Control	Post-intervention	1-month
Task Self-Efficacy Scale	66.89 (25.61)	69.71 (34.85)	60.80 (40.38)	68.83 (31.23)	59.13 (27.94)	58.20 (23.19)	0.046	0.000
Barrier Self-Efficacy Scale	53.77 (24.74)	42.05 (24.16)	44.17 (23.30)	52.68 (27.50)	42.00 (24.96)	34.75 (26.70)	0.033	0.067
Behavioral Regulation in Exercise Questionnaire-3								
- Intrinsic regulation	1.75 (1.02)	2.33 (0.99)	2.50 (1.31)	2.43 (1.27)	1.75 (1.06)	3.38 (0.63)	0.160	0.297
- Integrated regulation	0.72 (0.64)	1.78 (1.20)	1.40 (1.01)	1.61 (1.44)	1.31 (0.75)	2.75 (0.54)	0.003	0.519
- Identified regulation	1.97 (0.64)	2.53 (0.90)	2.50 (0.85)	2.29 (1.29)	1.88 (0.81)	2.88 (0.60)	0.005	0.258
- Introjected regulation	1.47 (0.92)	0.97 (0.71)	1.45 (1.07)	1.21 (0.94)	1.75 (0.68)	1.75 (1.08)	0.015	0.000
- External regulation	0.78 (1.15)	0.53 (0.54)	0.40 (0.89)	0.43 (0.75)	1.34 (1.59)	0.13 (0.25)	0.003	0.094
- Amotivation	0.50 (0.47)	0.28 (0.48)	0.30 (0.45)	0.00 (0.00)	0.28 (0.34)	0.19 (0.38)	0.246	0.007
- Relative autonomy index	4.14 (5.21)	10.22 (6.25)	9.65 (6.52)	10.71 (7.75)	4.47 (6.71)	15.94 (2.52)	0.203	0.244
German Psychological Need Satisfaction in Exercise Scale								
- Autonomy	4.70 (1.19)	4.91 (1.20)	6.42 (2.99)	7.69 (2.75)	6.78 (2.47)	6.75 (2.31)	0.001	0.000
- Competence	3.70 (1.42)	3.78 (1.30)	5.75 (3.77)	5.67 (2.54)	6.17 (3.15)	5.25 (2.06)	0.000	0.045
- Relatedness	3.15 (1.17)	3.70 (1.91)	4.17 (3.38)	4.35 (2.67)	5.14 (3.29)	4.00 (2.30)	0.003	0.059
Exercise Identity Scale								
- Role identity	1.75 (1.26)	2.75 (1.53)	1.33 (0.33)	3.10 (1.51)	1.72 (1.02)	4.08 (2.08)	0.106	0.335
- Exercise beliefs	2.52 (1.23)	3.60 (1.31)	3.28 (1.93)	3.64 (1.46)	2.72 (0.97)	4.21 (2.20)	0.017	0.109
Modified Weight Bias Internalization Scale	2.99 (1.55)	1.78 (0.58)	2.62 (0.85)	1.79 (0.32)	2.17 (1.21)	1.71 (0.72)	0.101	0.128
Self-Compassion Scale								
- Positive self-compassion	3.41 (0.66)	3.33 (0.51)	3.15 (1.28)	3.45 (0.86)	3.29 (1.03)	2.75 (0.36)	0.016	0.021
- Negative self-compassion	2.90 (0.56)	2.70 (1.38)	2.82 (0.90)	2.45 (1.10)	2.79 (0.73)	3.25 (0.57)	0.003	0.002
Mental Health Inventory	155.00 (29.44)	167.67 (30.40)	160.75 (38.76)	166.00 (26.81)	162.00 (49.67)	146.57 (29.90)	0.063	0.394
WHO (Five) Well-Being Index	2.42 (1.25)	2.98 (0.90)	2.04 (2.05)	2.37 (1.42)	2.30 (1.49)	2.20 (1.01)	0.006	0.002
Perceived Stress Scale	1.55 (0.59)	1.46 (0.78)	1.40 (0.54)	1.10 (0.66)	1.83 (0.60)	1.78 (0.84)	0.013	0.001
Vitality Scale	3.89 (1.11)	5.41 (1.00)	4.03 (1.79)	4.69 (1.36)	3.61 (1.68)	4.05 (1.84)	0.026	0.001
Fatigue Assessment Scale	2.59 (0.58)	1.82 (0.37)	2.54 (0.95)	2.20 (0.62)	2.60 (0.59)	2.45 (0.37)	0.000	0.014
Physical Symptom Checklist	1.44 (0.55)	1.38 (0.34)	1.48 (0.53)	1.49 (0.29)	1.19 (0.26)	1.38 (0.17)	0.002	0.241
Self-Reported Recreational Recalled leisure physical activity (PA; minutes per week)								
- Moderate PA	4.44 (13.33)	73.33 (163.71)	72.00 (161.00)	20.00 (48.99)	30.00 (64.14)	0.00 (0.00)	0.061	0.059
- Vigorous PA	25526 (50.77)	15.00 (42.43)	18.00 (24.90)	206.67 (268.45)	26.25 (37.39)	80.00 (138.56)	0.208	0.013
- Total PA	30.00 (50.00)	97.50 (186.83)	90.00 (174.64)	226.67 (270.53)	56.25 (95.91)	80.00 (138.56)	0.063	0.005

Accelerometer (MET)	1.67 (1.22)	1.11 (0.05)	1.96 (1.93)	1.13 (0.10)	1.63 (1.13)	1.20 (0.24)	0.076	0.075

Table 3. Sample means and standard deviations at baseline, post-intervention and 1-month follow-up assessment in main study

Measures	**Baseline**		**Post-Intervention**		**1 month Follow-up**		**Effect Size, η_p^2 (baseline vs.)**	
	Self-compassion	Control	Self-compassion	Control	Self-compassion	Control	Post-intervention	1-month
Task Self-Efficacy Scale	78.77 (14.97)	71.53 (17.85)	63.37 (26.75)	51.95 (27.18)	59.72 (25.05)	58.33 (27.95)	.014	.002
Barrier Self-Efficacy Scale	46.42 (23.64)	43.58 (21.73)	36.89 (20.53)	39.77 (19.99)	39.61 (18.14)	40.00 (22.40)	.028	.004
Behavioral Regulation in Exercise Questionnaire-3								
- Intrinsic regulation	2.69 (0.97)	2.26 (1.03)	2.67 (1.00)	2.41 (1.09)	2.90 (0.82)	2.40 (1.02)	.001	.022
- Integrated regulation	1.84 (1.13)	1.71 (1.07)	1.97 (1.32)	1.72 (1.05)	2.10 (1.15)	1.75 (1.15)	.012	.012
- Identified regulation	2.65 (0.84)	2.49 (0.94)	2.57 (0.91)	2.55 (0.94)	2.68 (0.83)	2.51 (0.87)	.000	.000
- Introjected regulation	1.93 (1.06)	1.99 (1.22)	1.99 (1.29)	2.06 (1.24)	2.09 (1.14)	1.95 (1.31)	.001	.009
- External regulation	0.76 (0.84)	0.86 (1.02)	0.74 (0.98)	0.93 (1.06)	0.93 (0.88)	1.02 (1.23)	.013	.001
- Amotivation	0.27 (0.49)	0.37 (0.56)	0.22 (0.45)	0.34 (0.52)	0.28 (0.49)	0.47 (0.92)	.015	.012
- Relative autonomy index	10.15 (6.13)	7.85 (6.85)	10.41 (6.22)	8.29 (6.11)	10.79 (5.69)	7.81 (6.84)	.021	.023
German Psychological Need Satisfaction in Exercise Scale								
- Autonomy	5.11 (0.71)	4.94 (1.07)	6.46 (2.32)	6.13 (2.27)	6.26 (2.27)	6.18 (2.09)	.004	.000
- Competence	4.26 (1.11)	3.78 (1.27)	5.05 (2.15)	4.92 (2.19)	5.07 (2.07)	4.99 (1.93)	.004	.007
- Relatedness	3.87 (1.46)	3.96 (1.22)	4.47 (2.47)	4.52 (2.30)	4.58 (2.20)	4.40 (1.97)	.000	.002
Exercise Identity Scale								
- Role-Identity	2.80 (1.73)	2.42 (1.59)	3.12 (1.71)	2.74 (1.63)	3.11 (1.82)	2.78 (1.66)	.002	.002
- Exercise Beliefs	3.78 (1.50)	3.76 (1.52)	3.86 (1.87)	3.80 (1.68)	3.85 (1.74)	3.82 (1.66)	.000	.002
Modified Weight Bias Internalization Scale	3.16 (1.63)	3.31 (1.48)	2.83 (1.88)	2.96 (1.51)	2.85 (1.46)	3.02 (1.37)	.000	.000
Self-Compassion Scale								
- Positive self-compassion	3.31 (0.58)	3.32 (0.63)	3.55 (0.74)	3.23 (0.65)	3.31 (0.68)	3.42 (0.72)	.073	.009
- Negative self-compassion	3.03 (0.81)	3.02 (0.80)	2.89 (0.93)	2.93 (0.91)	2.97 (0.93)	2.78 (0.93)	.002	.010
Vitality Scale	4.50 (1.34)	4.28 (1.15)	4.33 (1.38)	4.34 (1.37)	4.63 (1.39)	4.22 (1.40)	.001	.015
Fatigue Assessment Scale	2.22 (0.64)	2.47 (0.67)	2.31 (0.71)	2.42 (0.70)	2.28 (0.72)	2.49 (0.89)	.000	.001
Physical Symptom Checklist	17.75 (4.35)	18.78 (4.66)	17.64 (3.98)	17.68 (3.36)	16.92 (4.72)	17.00 (4.38)	.003	.002
Mental Health Inventory	158.70 (22.96)	159.33 (28.82)	160.06 (26.47)	155.49 (31.40)	160.85 (28.71)	163.44 (37.89)	.011	.001
WHO (Five) Well-Being Index	2.60 (1.02)	2.56 (0.99)	2.75 (0.98)	2.51 (1.05)	2.77 (1.05)	2.75 (1.15)	.016	.000
Perceived Stress Scale	1.71 (0.71)	1.74 (0.73)	1.76 (0.76)	1.88 (0.76)	1.77 (0.72)	1.57 (0.87)	.010	.017
Self-Reported Recreational Recalled leisure physical activity (PA; minutes per week)								
- Moderate PA	26.89 (88.85)	8.18 (45.92)	8.89 (27.92)	10.66 (31.33)	9.31 (35.04)	9.87 (30.06)	.001	.001
- Vigorous PA	77.13 (294.07)	25.08 (55.62)	11.14 (24.59)	28.24 (76.98)	37.04 (119.80)	30.88 (84.36)	.022	.001
- Total PA	116.57 (344.50)	34.08 (97.84)	16.25 (33.52)	37.50 (82.43)	50.87 (142.86)	41.91 (98.24)	.025	.001

Weekly step count	45197.33 (19358.53)	38538.75 (17468.09)	49319.48 (22627.25)	41812.82 (19200.56)	45186.87 (22313.91)	39314.23 (18405.65)	.004	.001
Intention of continued exercise goal pursuit			73.17 (24.42)	60.98 (26.70)	64.62 (30.48)	63.97 (28.61)	Cohen's d = 0.477	Cohen's d = 0.022

Table 4. Correlation between self-compassion components and physical activity variables

Variable	2	3	4	5	6
1. Positive self-compassion	-.36***	.17	.06	.11	-.11
2. Negative self-compassion	-	-.11	.05	.00	-.05
3. Moderate physical activity		-	.27*	.53***	.22
4. Vigorous physical activity			-	.96***	.09
5. Total physical activity				-	.16
6. Weekly step count					-

Note. * $p < .05$, *** $p < .00$

Table 5. Correlation between self-compassion components and physical activity mechanism variables

Variable	2	3	4	5	6	7	8	9	10	11
1. Positive self-compassion	-.36***	.24*	.12	.16	.19	.21^{+}	.13	.10	.08	-.17
2. Negative self-compassion	-	-.20	-.14	-.04	.11	-.03	-.06	-.04	.13	.44***
3. Task self-efficacy		-	.35**	.34**	.25*	.28**	.30**	.32**	.32**	-.22*
4. Barrier self-efficacy			-	.16	.21*	.21*	.23*	.19	.11	-.03
5. Relative autonomy index				-	.37***	.59***	.18	.62***	.62***	-.17
6. Autonomy					-	.41***	.22*	.07	.21^{+}	.03
7. Competence						-	.32**	.47***	.55***	.01
8. Relatedness							-	.21*	.23*	-.02
9. Exercise role identity								-	.67***	-.08
10. Exercise beliefs									-	.25*
11. Weight stigma										-

Note. $^{+}p = .05$, * $p < .05$, *** $p < .0011$

Table 6. Correlation between self-compassion components and well-being variables

Variable	2	3	4	5	6	7	8
1. Positive self-compassion	-.36***	.38***	.49***	-.34**	.41***	-.28**	-.31**
2. Negative self-compassion	-	-.51***	-.27*	.55***	-.41***	.42***	.26*
3. Mental Health Inventory		-	.69***	-.74***	.60***	-.46***	-.41***
4. WHO (Five) Well-Being Index			-	-.58***	.67***	-.34**	-.26*
5. Perceived Stress Scale				-	-.52***	.40***	.29**
6. Vitality					-	-.58***	-.33**
7. Fatigue						-	.55***
8. Physical symptoms							-

Note. $^{+}p = .05$, * $p < .05$, *** $p < .0011$

Table 7. Descriptive statistics for daily variables

Variable	Mean	Within-personal level variance (σ^2)	Between-person level variance (τ_{00})	ICC	Reliability
Positive affect	2.71	0.49	0.51	0.51	0.86
Negative affect	1.58	0.22	0.22	0.50	0.85
Perceived exercise goal progress	3.42	3.77	1.22	0.76	0.66
Hour(s) of physical activity	0.41	0.37	0.11	0.23	0.64

Note. Statistics are based on n = 89 participants and 546 diary entries.

Table 8. Multilevel Fixed and Random Effects Parameter Estimates for Positive Affect I

	Unconditional Model		Means-as-Outcomes Model		Random Effect Model		Intercepts and Slopes as Outcomes Model	
Fixed Effect	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept (β_{0j})	2.71***	0.08	2.71***	0.08	2.91***	0.09	2.90***	0.09
Condition Assignment (Υ_{01})			0.09	0.08			0.10	0.08
Time (β_{1j})					-0.05**	0.02	-0.05**	0.02
Perceived Exercise Goal Progress (β_{2j})					0.11***	0.02	0.11***	0.02
Condition Assignment (Υ_{21})							-0.05**	0.02
Random Effect								
Within-Person Level								
Var (nj) = σ^2	0.49		0.49		0.38		0.39	
Between-Person Level								
Var (u_{0j}) = τ_{00}	0.51		0.51		0.43		0.42	
Var (u_{1j}) = τ_{11}					0.01		0.01	
Var (u_{2j}) = τ_{22}					0.01		0.00	
Cov (u_{0j}, u_{1j}) = τ_{01}					0.00		0.00	
Cov (u_{0j}, u_{2j}) = τ_{02}					0.01		0.02	
Cov (u_{1j}, u_{2j}) = τ_{03}					0.00		0.00	

Note. * $p < 0.05$, ** $p < 0.01$, ***$p < 0.00$

Table 9. Multilevel Fixed and Random Effects Parameter Estimates for Positive Affect II

	Unconditional Model		Means-as-Outcomes Model		Random Effect Model		Intercepts and Slopes as Outcomes Model	
Fixed Effect	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept (β_{0j})	2.71***	0.08	2.71***	0.08	2.71***	0.08	2.71***	0.08
Condition Assignment (Υ_{01})			0.09	0.08			0.11	0.08
Time (β_{1j})					-0.04*	0.02	-0.04*	0.02
Hour(s) of Physical Activity (β_{2j})					0.45***	0.08	0.42***	0.08
Condition Assignment (Υ_{21})							-0.22**	0.08
Random Effect								
Within-Person Level								
Var (nj) = σ^2	0.49		0.49		0.37		0.37	
Between-Person Level								
Var (u_{0j}) = τ_{00}	0.51		0.51		0.53		0.53	
Var (u_{1j}) = τ_{11}					0.01		0.01	
Var (u_{2j}) = τ_{22}					0.18		0.13	
Cov (u_{0j}, u_{1j}) = τ_{01}					0.03		0.03	
Cov (u_{0j}, u_{2j}) = τ_{02}					0.02		0.04	
Cov (u_{1j}, u_{2j}) = τ_{03}					0.00		0.01	

Note. * $p < 0.05$, ** $p < 0.01$, ***$p < 0.00$

Table 10. Multilevel Fixed and Random Effects Parameter Estimates for Negative Affect I

	Unconditional Model		Means-as-Outcomes Model		Random Effect Model		Intercepts and Slopes as Outcomes Model	
Fixed Effect	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept (β_{0j})	1.58***	0.05	1.58***	0.05	1.81***	0.08	1.82***	0.08
Condition Assignment (Υ_{01})			-0.02	0.05			-0.05	0.05
Time (β_{1j})					-0.06***	0.01	-0.06***	0.01
Perceived Exercise Goal Progress (β_{2j})					-0.03**	0.01	-0.03**	0.01
Condition Assignment (Υ_{21})							0.02*	0.01
Random Effect								
Within-Person Level								
Var (nj) = σ^2	0.22		0.22		0.19		0.19	
Between-Person Level								
Var (u_{0j}) = τ_{00}	0.22		0.22		0.40		0.40	
Var (u_{1j}) = τ_{11}					0.00		0.00	
Var (u_{2j}) = τ_{22}					0.00		0.00	
Cov (u_{0j}, u_{1j}) = τ_{01}					-0.03		-0.03	
Cov (u_{0j}, u_{2j}) = τ_{02}					-0.01		-0.01	
Cov (u_{1j}, u_{2j}) = τ_{03}					0.00		0.00	

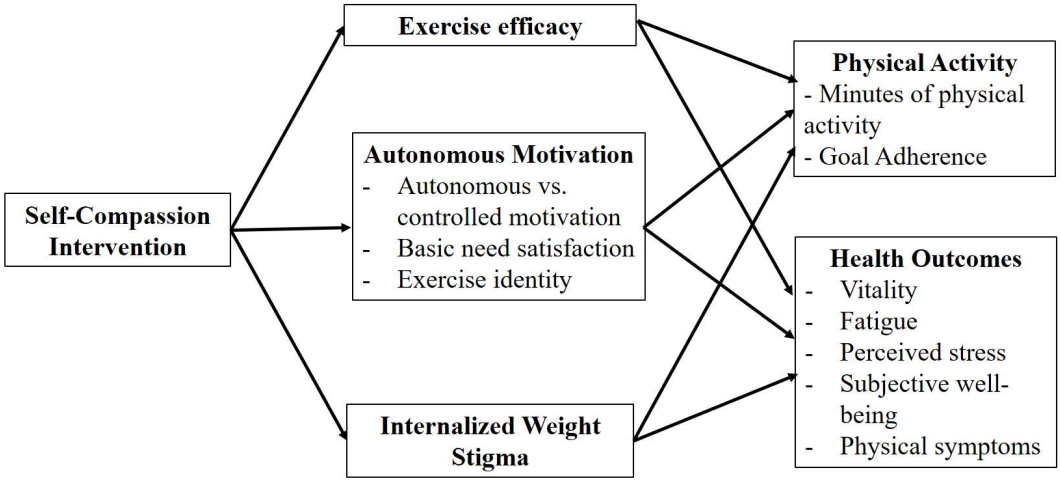
Note. * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Table 11. Multilevel Fixed and Random Effects Parameter Estimates for Negative Affect II

	Unconditional Model		Means-as-Outcomes Model		Random Effect Model		Intercepts and Slopes as Outcomes Model	
Fixed Effect	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept (β_{0j})	1.58***	0.05	1.58***	0.05	1.58***	0.05	1.58***	0.05
Condition Assignment (Υ_{01})			-0.02	0.05			-0.04	0.05
Time (β_{1j})					-0.06***	0.01	-0.06***	0.01
Hour(s) of Physical Activity (β_{2j})					-0.11***	0.03	-0.12***	0.03
Condition Assignment (Υ_{21})							0.07**	0.02
Random Effect								
Within-Person Level								
Var (nj) = σ^2	0.22		0.22		0.18		0.18	
Between-Person Level								
Var (u_{0j}) = τ_{00}	0.22		0.22		0.23		0.23	
Var (u_{1j}) = τ_{11}					0.00		0.00	
Var (u_{2j}) = τ_{22}					0.02		0.01	
Cov (u_{0j}, u_{1j}) = τ_{01}					-0.02		-0.02	
Cov (u_{0j}, u_{2j}) = τ_{02}					-0.06		-0.05	
Cov (u_{1j}, u_{2j}) = τ_{03}					0.00		0.01	

Note. * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Figure 1. Conceptual Model of Intervention



Appendix A – Script for Loving Kindness Mediation

To begin this practice

Let yourself be in a relaxed and comfortable position

We're going to do the practice of cultivation positive emotion

In this case, loving kindness

Which is the desire for someone to be happy

Or yourself to be happy

It's not dependent on something, it's not conditional

It's just a natural opening of the heart

To someone else or to yourself

So you can check in to your body and notice how you're feeling right now

Letting whatever is here, be here

Now let yourself bring to mind

Someone whom, the moment you think of them, you feel happy

See if you can bring to mind

It could be a relative, a close friend

Some with not too complicated a relationship

Just a general sense, that when you think of them you feel happy

Can pick a child

or you can always choose a pet, a dog or a cat

A creature it's fairly easy to feel love for

So let them come to mind

Have them-- have a sense of them being in front of you

You can feel them, sense them, see them

And as you imagine them

Notice how you're feeling inside

Maybe you feel some warmth

Or there's some heat to your face

A smile, sense of expansiveness

This is a loving kindness

This is a natural feeling that's accessible to all of us at any moment

So now having this loved one in front of you

Begin to wish them well

May you be safe and protected from danger

May you be happy and peaceful

May you be healthy and strong

May you have ease and wellbeing

And as I say these words, you can use my words or your own words

And have a sense of letting this loving kindness come from you

And begin to touch this loved one

Reaching out

You might think in images

You might have a sense of color or light

You might just have a feeling

The words may continue to bring on more of this feeling

And I encourage you to say whatever feels meaningful to you

May you be free from stress and anxiety

May you be free from all fear

And so as you're sending out these words and these feelings of loving kindness

Also check into yourself and see how you're feeling inside

And now imagine that this loved one turns around

And begins to send it back to you

So see if you can receive the loving kindness

Take it in

And they're wishing you well, may you be happy

Meaning you

May you be peaceful and at ease

May you be safe and protected from all danger

May you have joy, well-being

Letting yourself take it in

Now if you're not feeling anything at this point

Or before in the meditation

It's not a problem

This is a practice that plants seeds

And if you're feeling something else other than lovingkindness

Just check into that

What is it I'm feeling

There may be something to learn here

Now if it's possible and it's not always easy to do this

But see if you can send loving kindness to yourself

You can imagine it coming down your body from your heart

You can just have a sense of it

May I be safe and protected from danger

May I be healthy and strong

May I be happy and peaceful

May I accept myself just as I am

And as you ask yourself the question “what do I need to be happy?”

See what arises

And offer that to yourself

May I have meaningful work

A joyful life

Close friends and family

And now checking into yourself

And noticing what it is you feel as you do this

And now let yourself bring to mind one person

Or a group of people that you wish to send the loving kindness to

Imagine them in front of you

Sense them, feel them

May you be happy and peaceful

May you be free from all stress and anxiety and fear

Worry

Grief

May you have joy and happiness

Wellbeing

And now let this loving kindness expand out

Spreading

Touching anyone that you want to touch right now

In all directions

People you know, people you don't know

People you have difficulty with

People you love

Just imagine expanding and touching

And each person or animal

Whoever is touched by this loving kindness

Each person is changed

You can imagine that

So may everyone everywhere be happy and peaceful and at ease

May we all experience great joy

[bell rings]

Appendix B

Please identity a (potential) barrier that interfere you from adhering to your exercise goal today.

Mindfulness: Please bring awareness to the barrier, and its related emotions or thoughts. Write about your emotions, thoughts, physiological responses, behavior, or any responses related to this barrier. Feel your emotions exactly as they are—not belittling it nor making it overly dramatic. You can write about any emotions or thoughts, no matter they are positive or negative, strong or weak. Even if you cannot explicitly feel any emotions, it is also worth your attention. As you write, try to be accepting and nonjudgmental of your experience.

Common humanity: Write down the ways in which your barrier is connected to others' experience. This may include acknowledging that being human means being imperfect, and that all people have these sorts of failing experiences ("everyone experience barriers when pursuing his/ her goals sometimes, it's only human"). The journey of pursuing physical activity goal is not completely smooth. Everyone experience both ups and downs in this journey. We all share similar experience; everyone's experience is not particularly more or less than the others. As you write, you may write about how would other people respond when they also experience similar barriers.

Self-kindness: For this barrier in particular, write down some words of comfort to yourself. As you recall this barrier or failing experience, please adopt a kind and understanding attitude, write down some words of comfort to yourself. As you write, you may imagine a understanding and compassionate friend, when (s)he know about your barrier/ failing experience, how does

(s)he feel? What does (s)he tell you? Try to adopt a gentle, caring and reassuring tone and embody feelings of unconditional understanding and compassion throughout the writing process.

Appendix C

Daily email/ text content

Monday

This is the first day of the week, we hope you have a great kick-start for your exercise goals.

The progress in goal pursuit can affect our emotions, we may experience positive emotions such as happiness, energization, contentment, or negative emotions such as disappointment and frustration.

It is important to adequately acknowledge all your feelings and thoughts, both positive and negative. Also, remember that there is no right or wrong in your experiences. So, please embrace your feelings and thoughts as they are, do not exaggerate or belittle these experiences.

Tuesday

This is the second day of the week, we hope you are doing well and working toward your exercise goals.

The journey of goal pursuit is not completely smooth. Everyone experience both ups and downs in this journey. Please remember that we are not alone in our experience, whether it is triumphs, setbacks or barriers, there are people going through the same experience as you do. You are not alone.

Wednesday

This is the third day of the week, we hope you are doing well and working toward your exercise goals.

Self-reflection is helpful in the journey of goal pursuit. However, sometimes, we are being too harsh on ourselves. We may blame ourselves on things that are uncontrollable, or resent on our failings. When our friends have similar experience, we can give them kindness, care and

reassurance, why we are not able to treat ourselves in the same way? Please remember that we are all human beings, and we deserve compassion and unconditional understanding in our struggles, and praises in our successes.

Thursday

This is the fourth day of the week, we hope you are doing well and working toward your exercise goals.

What are your feelings and thoughts about your exercise goal? Do your experience any changes in your feelings and thoughts in the past few days? These experiences are worthy of your attention. Also, remember that you are not alone in this journey of goal pursuit. Don't forget to give yourself some kindness and encouragement in this process, everyone deserves it.

Friday

This is the fifth day of the week, we hope you are doing well and working toward your exercise goals.

Sometimes, we get caught up in our own little world, and we lose sight that there are other people who are experiencing similar struggles. Instead of isolating ourselves in our struggles, try thinking how our experience relates to others', you may be surprised by the commonality of our struggles. Also, remember, it is always a good practice to acknowledge your feelings and thoughts, and give yourself some kindness and encouragement.

Saturday

This is the sixth day of the week, we hope you are doing well and working toward your exercise goals.

Do you remember occasions that you are overly judgmental about yourself, occasions that you already feel miserable, guilty, and yet, you keep criticizing yourself? So often that we hold a very

high standard of ourselves, we forget that we are purely human beings - being imperfect and flawed is normal. Like others, we need compassion in our downfalls. So, please don't run away from your feelings and thoughts in negative moments, adequately acknowledge your experience. And remember, you are not alone in those moments.

Sunday

This is the last day of the week, I hope you are doing well and working toward your exercise goals.

Often time, we are our biggest enemy in the journey of goal pursuit. In our setbacks or struggles, we tend to forget that we are purely human, all of us have different sorts of limitations and flaws. Sometime, when we feel inadequate, we tend to isolate ourselves, exaggerate our experience as if no one would understand, and judge ourselves as harshly as possible. However, these mentalities do more harm than help.

So, stop being our own enemies! From now on, when you experience struggles in the journey of goal pursuit, please (1) be mindful of your feelings and thoughts, (2) acknowledge that you are not alone, and your ups and downs are just parts of the shared human experience, and (3) give yourself compassion and unconditional understanding.

Note. The italic content was presented to the self-compassion group only.

Appendix D

Please write focusing on what you did with your time in the last 24 hours. As you write, try to stick to your actual behaviors. You may experience feelings about what happened, or have opinions about the events during the course of writing, do not process or write about them. Write only about the facts - what happened, perhaps hour by hour, but not about your feelings or opinions.

Appendix E – Daily Measures

PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and indicate to what extent you have felt this way today.

1= very slightly or not at all
2= a little
3= moderately
4= quite a bit
5= extremely

1. interested
2. distressed
3. excited
4. upset
5. strong
6. guilty
7. scared
8. hostile
9. enthusiastic
10. proud
11. irritable
12. alert
13. ashamed
14. inspired
15. nervous
16. determined
17. attentive
18. jittery
19. active
20. Afraid

Daily Recreational Physical Activity
Did you exercise today? Yes/ No

The following statements describe feelings or thoughts related your daily recreational physical activity. Read each item and indicate to what extent you have felt this way today.
1= not at all … 4= somewhat … 7=completely

1. You achieved your exercise goal today.
2. Your exercise goals are important to you.
3. You feel in control of your exercise goals
4. You can accomplish your exercise goals.

Please report all the exercises that you did today, the type of exercise and for how many minutes for each type of exercise.
1a. Type of exercise _____
b. Number of minutes _____
2a. Type of exercise _____
b. Number of minutes _____
3a. Type of exercise _____
b. Number of minutes _____

Were there any barriers to meeting your exercise goal today? What were they?
_____

Did you miss any daily surveys in the past two days? Yes/ No

Please report any exercises (the type(s) of exercise and number of minutes) that you did yesterday that you did not get to report on a daily survey.
Type(s) of exercise _____
Number of minutes _____

Please report any exercises (the type(s) of exercise and number of minutes) that you did two days ago that you did not get to report on a daily survey.
Type(s) of exercise _____
Number of minutes _____

Appendix F – Periodical Measures

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.

2. 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***

3. 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**

4. 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***

5. 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**

6. 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***

7. 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.

8. 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***

9. 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.

10. 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***

11. How much time did you usually spend on one of those days to **bicycle** from place to place?
_____ **hours per day**
_____ **minutes per day**
12. 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***

13. 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.

14. 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***

15. 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**

16. 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***

17. 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**

18. 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***

19. 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.

20. 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***

21. How much time did you usually spend on one of those days **walking** in your leisure time?
_____ **hours per day**
_____ **minutes per day**

22. 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***

23. 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**

24. 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***

25. 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.

26. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?
_____ **hours per day**
_____ **minutes per day**

27. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekend day**?
_____ **hours per day**
_____ **minutes per day**

Exercise Efficacy Scale (Haworth & Yeung, 2009)*

This form lists different elements relating to you carrying out regular exercise or physical activities. This should be considered as at least 30 minutes of activity on most days of the week.

Think about how confident you are that you could get yourself to perform each task described. Rate your degree of confidence by recording a number from 0 to 100 in the score column.

	How confident are you that you can:	Cannot Do at all do			Moderately certain I can do						Absolutely certain I can	
1.	Carry out exercise/ activities correctly	0	10	20	30	40	50	60	70	80	90	100
2.	Carry out exercise/ activities when recovering from illness/ injury	0	10	20	30	40	50	60	70	80	90	100
3.	Adapt exercise/ activities to suit my ability/ progress	0	10	20	30	40	50	60	70	80	90	100
4.	Carry out exercise/ activities when tired	0	10	20	30	40	50	60	70	80	90	100
5.	Carry out exercise/ activities in my home	0	10	20	30	40	50	60	70	80	90	100
6.	Carry out exercise/ activities when I am feeling anxious/ stressed	0	10	20	30	40	50	60	70	80	90	100
7.	Carry out exercise/ activities at fitness facilities in the community	0	10	20	30	40	50	60	70	80	90	100
8.	Carry out exercise/ activities without	0	10	20	30	40	50	60	70	80	90	100

	family/ friends support											
9.	Monitor any changes in my responses to exercise/ activities	0	10	20	30	40	50	60	70	80	90	100
10.	Carry out exercise/ activities when I am feeling low in mood	0	10	20	30	40	50	60	70	80	90	100
11.	Carry out exercise/ activities as a regular part of my day to day routine	0	10	20	30	40	50	60	70	80	90	100
12.	Carry out exercise/ activities when I have not carried them out for prolonged periods of time	0	10	20	30	40	50	60	70	80	90	100
13.	Carry out exercise/ activities when I am by myself	0	10	20	30	40	50	60	70	80	90	100
14.	Carry out exercise/ activities when I feel physical discomfort	0	10	20	30	40	50	60	70	80	90	100
15.	Carry out exercise/ activities without professional support	0	10	20	30	40	50	60	70	80	90	100
16.	Carry out exercise/ activities with other people	0	10	20	30	40	50	60	70	80	90	100
17.	Carry out exercise/ activities when I have lots of other things to do	0	10	20	30	40	50	60	70	80	90	100

***** Not included in the main study

Task Self-Efficacy Scale (self-developed)

		Not at all Confident					Moderately Confident				Extremely Confident
1.	I believe that I could adhere to my exercise goal	0	10	20	30	40	50	60	70	80	90	100

Barriers Self-Efficacy Scale (Rogers et al., 2006)

	I believe that I could adhere to my exercise goal if:	Not at all Confident					Moderately Confident				Extremely Confident
1.	The weather was very bad (hot, humid, rainy, cold).	0	10	20	30	40	50	60	70	80	90	100
2.	I was bored by the program or activity.	0	10	20	30	40	50	60	70	80	90	100
3.	I was on vacation.	0	10	20	30	40	50	60	70	80	90	100
4.	I was not interested in the activity.	0	10	20	30	40	50	60	70	80	90	100
5.	I felt pain or discomfort when exercising.	0	10	20	30	40	50	60	70	80	90	100
6.	I had to exercise alone.	0	10	20	30	40	50	60	70	80	90	100
7.	It was not fun or enjoyable.	0	10	20	30	40	50	60	70	80	90	100
8.	It became difficult to get to the exercise location.	0	10	20	30	40	50	60	70	80	90	100
9.	I didn't like the particular activity program that I was involved in.	0	10	20	30	40	50	60	70	80	90	100

Behavioral Regulation in Exercise Questionnaire (BREQ; Mullen, Markland, & Ingledew, 1997)*

Please indicate how true the following statements are for you.

		Not true for me		Sometime true for me		Very true for me
1	I exercise because other people say I should.	0	1	2	3	4
2	I take part in exercise because my friends/family/spouse say I should.	0	1	2	3	4
3	I exercise because others will not be pleased with me if I don't.	0	1	2	3	4
4	I feel under pressure from my friends/family to exercise.	0	1	2	3	4
5	I feel guilty when I don't exercise.	0	1	2	3	4
6	I feel ashamed when I miss an exercise session.	0	1	2	3	4
7	I feel like a failure when I haven't exercised in a while.	0	1	2	3	4
8	I value the benefits of exercise.	0	1	2	3	4
9	It's important to me to exercise regularly.	0	1	2	3	4
10	I think it is important to make the effort to exercise regularly.	0	1	2	3	4
11	I get restless if I don't exercise regularly.	0	1	2	3	4
12	I exercise because it's fun.	0	1	2	3	4
13	I enjoy my exercise sessions.	0	1	2	3	4
14	I find exercise a pleasurable activity.	0	1	2	3	4

15	I get pleasure and satisfaction from participating in exercise.	0	1	2	3	4

* Not included in the main study

Behavioral Regulation in Exercise Questionnaire (BREQ-3; Markland & Tobin, 2004; Wilson, Rodgers, Loitz, & Scime, 2006)

Please indicate how true the following statements are for you.

		Not true for me		Sometime true for me		Very true for me
1	It's important to me to exercise regularly	0	1	2	3	4
2	I don't see why I should have to exercise	0	1	2	3	4
3	I exercise because it's fun	0	1	2	3	4
4	I feel guilty when I don't exercise	0	1	2	3	4
5	I exercise because it is consistent with my life goals	0	1	2	3	4
6	I exercise because other people say I should	0	1	2	3	4
7	I value the benefits of exercise	0	1	2	3	4
8	I can't see why I should bother exercising	0	1	2	3	4
9	I enjoy my exercise sessions	0	1	2	3	4
10	I feel ashamed when I miss an exercise session	0	1	2	3	4
11	I consider exercise part of my identity	0	1	2	3	4
12	I take part in exercise because my friends/ family/ partner say I should	0	1	2	3	4
13	I think it is important to make the effort to exercise regularly	0	1	2	3	4
14	I don't see the point in exercising	0	1	2	3	4

15	I find exercise a pleasurable activity	0	1	2	3	4
16	I feel like a failure when I haven't exercised in a while	0	1	2	3	4
17	I consider exercise a fundamental part of who I am	0	1	2	3	4
18	I exercise because others will not be pleased with me if I don't	0	1	2	3	4
19	I get restless if I don't exercise regularly	0	1	2	3	4
20	I think exercising is a waste of time	0	1	2	3	4
21	I get pleasure and satisfaction from participating in exercise	0	1	2	3	4
22	I would feel bad about myself if I was not making time to exercise	0	1	2	3	4
23	I consider exercise consistent with my values	0	1	2	3	4
24	I feel under pressure from my friends/ family to exercise	0	1	2	3	4

Exercise Identity Scale (Anderson & Cychosz, 1994)

		Strongly disagree						Strongly agree
1	I consider myself an exerciser.	1	2	3	4	5	6	7
2	When I describe myself to others, I usually include my involvement in exercise.	1	2	3	4	5	6	7
3	I have numerous goals related to exercising.	1	2	3	4	5	6	7
4	Physical exercise is a central factor to my self-concept.	1	2	3	4	5	6	7
5	I need to exercise to feel good about myself.	1	2	3	4	5	6	7
6	Others see me as someone who exercises regularly.	1	2	3	4	5	6	7
7	For me, being an exerciser means more than just exercising.	1	2	3	4	5	6	7
8	I would feel a real loss if I were forced to give up exercise.	1	2	3	4	5	6	7
9	Exercising is something I think about often.	1	2	3	4	5	6	7

Psychological Need Satisfaction in Exercise Scale (Wilson, Rogers, Rodgers, & Wild, 2006)

The following statements refer to situations in which you exercise. Please indicate how much the following statements apply to you personally.

		I do not agree at all						I very strongly agree
1	I feel that I am able to complete exercises that are personally challenging	1	2	3	4	5	6	7
2	I feel confident I can do even the most challenging exercises	1	2	3	4	5	6	7
3	I feel confident in my ability to perform exercises that personally challenge me	1	2	3	4	5	6	7
4	I feel capable of completing exercises that are challenging to me	1	2	3	4	5	6	7
5	I feel like I am capable of doing even the most challenging exercises	1	2	3	4	5	6	7
6	I feel good about the way I am able to complete challenging exercise	1	2	3	4	5	6	7
7	I feel free to exercise in my own way	1	2	3	4	5	6	7
8	I feel free to make my own exercise program decisions	1	2	3	4	5	6	7
9	I feel like I am in charge of my exercise program decisions	1	2	3	4	5	6	7
10	I feel like I have a say in choosing the exercises that I do	1	2	3	4	5	6	7
11	I feel free to choose which exercises I participate in	1	2	3	4	5	6	7
12	I feel like I am the one who decides what exercises I do	1	2	3	4	5	6	7

13	I feel attached to my exercise companions because they accept me for who I am	1	2	3	4	5	6	7
14	I feel like I share a common bond with people who are important to me when we exercise together	1	2	3	4	5	6	7
15	I feel a sense of camaraderie with my exercise companions because we exercise for the same reasons	1	2	3	4	5	6	7
16	I feel close to my exercise companions who appreciate how difficult exercise can be	1	2	3	4	5	6	7
17	I feel connected to the people who I interact with while we exercise together	1	2	3	4	5	6	7
18	I feel like I get along well with other people who I interact with while we exercise together	1	2	3	4	5	6	7

Exercises Motivations Inventory (Markland & Ingledew, 1997)*

Please indicate how strongly you agree or disagree to the following reasons for exercising.

	I exercise…	Strongly Disagree						Strongly Agree
1	To give me space to think	1	2	3	4	5	6	7
2	Because it helps to reduce tension	1	2	3	4	5	6	7
3	To help manage stress	1	2	3	4	5	6	7
4	To release tension	1	2	3	4	5	6	7
5	Because it makes me feel good	1	2	3	4	5	6	7
6	Because I find exercise invigorating	1	2	3	4	5	6	7
7	Because after exercising I feel refreshed	1	2	3	4	5	6	7
8	To recharge my batteries	1	2	3	4	5	6	7
9	Because I enjoy the feeling of exerting myself	1	2	3	4	5	6	7
10	Because I find exercising satisfying in and of itself	1	2	3	4	5	6	7
11	For enjoyment of the experience of exercising	1	2	3	4	5	6	7
12	Because I feel at my best when exercising	1	2	3	4	5	6	7
13	To give me goals to work towards	1	2	3	4	5	6	7
14	To help me explore the limits of my body	1	2	3	4	5	6	7
15	To give me personal challenges to face	1	2	3	4	5	6	7

16	To develop personal skills	1	2	3	4	5	6	7
17	To measure myself against personal standards	1	2	3	4	5	6	7
18	To show my worth to others	1	2	3	4	5	6	7
19	To compare my abilities with other peoples'	1	2	3	4	5	6	7
20	To gain recognition for my accomplishments	1	2	3	4	5	6	7
21	To accomplish things that others are incapable of	1	2	3	4	5	6	7
22	To spend time with friends	1	2	3	4	5	6	7
23	To enjoy the social aspects of exercising	1	2	3	4	5	6	7
24	To have fun being active with other people	1	2	3	4	5	6	7
25	To make new friends	1	2	3	4	5	6	7
26	Because I like to win in physical activities	1	2	3	4	5	6	7
27	Because I enjoy competing	1	2	3	4	5	6	7
28	Because I enjoy physical competition	1	2	3	4	5	6	7
29	Because I find physical activities fun, especially when competition is involved	1	2	3	4	5	6	7
30	Because my doctor advised me to exercise	1	2	3	4	5	6	7
31	To help prevent an illness that runs in my family	1	2	3	4	5	6	7
32	To help recover from an illness/injury	1	2	3	4	5	6	7

33	To avoid heart disease	1	2	3	4	5	6	7
34	To prevent health problems	1	2	3	4	5	6	7
35	To avoid ill-health	1	2	3	4	5	6	7
36	Because I feel I have to exercise to stay healthy	1	2	3	4	5	6	7
37	To help me live a longer, more healthy life	1	2	3	4	5	6	7
38	To have a healthy body	1	2	3	4	5	6	7
39	Because I want to maintain good health	1	2	3	4	5	6	7
40	To feel more healthy	1	2	3	4	5	6	7
41	To stay slim	1	2	3	4	5	6	7
42	To lose weight	1	2	3	4	5	6	7
43	To help control my weight	1	2	3	4	5	6	7
44	Because exercise helps me to burn calories	1	2	3	4	5	6	7
45	To help me look younger	1	2	3	4	5	6	7
46	To have a good body	1	2	3	4	5	6	7
47	To improve my appearance	1	2	3	4	5	6	7
48	To look more attractive	1	2	3	4	5	6	7

* Not included in the main study

Modified Weight Bias Internalization Scale (Pearl & Puhl, 2014)

		Strongly Disagree						Strongly Agree
1	Because of my weight, I feel that I am just as competent as anyone	1	2	3	4	5	6	7
2	I am less attractive than most other people because of my weight	1	2	3	4	5	6	7
3	I feel anxious about my weight because of what people might think of me	1	2	3	4	5	6	7
4	I wish I could drastically change my weight	1	2	3	4	5	6	7
5	Whenever I think a lot about my weight, I feel depressed	1	2	3	4	5	6	7
6	I hate myself for my weight	1	2	3	4	5	6	7
7	My weight is a major way that I judge my value as a person	1	2	3	4	5	6	7
8	I don't feel that I deserve to have a really fulfilling social life, because of my weight	1	2	3	4	5	6	7
9	I am OK being the weight that I am	1	2	3	4	5	6	7
10	Because of my weight, I don't feel like my true self	1	2	3	4	5	6	7
11	Because of my weight, I don't understand how anyone attractive would want to date me	1	2	3	4	5	6	7

Weight Self-Stigma Questionnaire (Lillis, Luoma, Levin, & Hayes, 2010)*

		Strongly Disagree				Strongly Agree
1	I'll always go back to being overweight	1	2	3	4	5
2	I caused my weight problems	1	2	3	4	5
3	I feel guilty because of my weight problems	1	2	3	4	5
4	I became overweight because I'm a weak person	1	2	3	4	5
5	I would never have any problems with weight if I were stronger	1	2	3	4	5
6	I don't have enough self-control to maintain a healthy weight	1	2	3	4	5
7	I feel insecure about others' opinions of me	1	2	3	4	5
8	People discriminate against me because I've had weight problems	1	2	3	4	5
9	It's difficult for people who haven't had weight problems to relate to me	1	2	3	4	5
10	Others will think I lack self-control because of my weight problems	1	2	3	4	5
11	People think that I am to blame for my weight problems	1	2	3	4	5
12	Others are ashamed to be around me because of my weight	1	2	3	4	5

*Not included in the main study

Mental Health Inventory (MHI-38; Veit & Ware, 1983)

INSTRUCTIONS: Please read each question and choose ONE statement that best describes how things have been FOR YOU during the past two weeks. There are no right or wrong
answers.

1. How happy, satisfied, or pleased have you been with your personal life during the past month?
    1 Extremely happy, could not have been more satisfied or pleased
    2 Very happy most of the time
    3 Generally, satisfied, pleased
    4 Sometimes fairly satisfied, sometimes fairly unhappy
    5 Generally dissatisfied, unhappy
    6 Very dissatisfied, unhappy most of the time
2. How much of the time have you felt lonely during the past month?
    1 All of the time
    2 Most of the time
    3 A good bit of the time
    4 Some of the time
    5 A little of the time
    6 None of the time
3. How often did you become nervous or jumpy when faced with excitement or unexpected
situations during the past month?
    1 Always
    2 Very often
    3 Fairly often
    4 Sometimes
    5 Almost never
    6 Never
4. During the past month, how much of the time have you felt that the future looks hopeful
and promising?
    1 All of the time
    2 Most of the time
    3 A good bit of the time
    4 Some of the time
    5 A little of the time
    6 None of the time
5. How much of the time, during the past month, has your daily life been full of things that
were interesting to you?
    1 All of the time
    2 Most of the time
    3 A good bit of the time

4 Some of the time
5 A little of the time
6 None of the time

6. How much of the time, during the past month, did you feel relaxed and free from tension?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

7. During the past month, how much of the time have you generally enjoyed the things you
do?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

8. During the past month, have you had any reason to wonder if you were losing your mind,
or losing control over the way you act, talk, think, feel, or of your memory?

1 No, not at all
2 Maybe a little
3 Yes, but not enough to be concerned or worried about
4 Yes, and I have been a little concerned
5 Yes, and I am quite concerned
6 Yes, I am very much concerned about it

9. Did you feel depressed during the past month?

1 Yes, to the point that I did not care about anything for days at a time
2 Yes, very depressed almost every day
3 Yes, quite depressed several times
4 Yes, a little depressed now and then
5 No, never felt depressed at all

10. During the past month, how much of the time have you felt loved and wanted?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

11. How much of the time, during the past month, have you been a very nervous person?

1 All of the time

2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

12. When you have got up in the morning, this past month, about how often did you expect to
have an interesting day?

1 Always
2 Very often
3 Fairly often
4 Sometimes
5 Almost never
6 Never

13. During the past month, how much of the time have you felt tense or "high-strung"?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

14. During the past month, have you been in firm control of your behaviour, thoughts, emotions or feelings?

1 Yes, very definitely
2 Yes, for the most part
3 Yes, I guess so
4 No, not too well
5 No, and I am somewhat disturbed
6 No, and I am very disturbed

15. During the past month, how often did your hands shake when you tried to do something?

1 Always
2 Very often
3 Fairly often
4 Sometimes
5 Almost never
6 Never

16. During the past month, how often did you feel that you had nothing to look forward to?

1 Always
2 Very often
3 Fairly often
4 Sometimes
5 Almost never
6 Never

17. How much of the time, during the past month, have you felt calm and peaceful?
    1 All of the time
    2 Most of the time
    3 A good bit of the time
    4 Some of the time
    5 A little of the time
    6 None of the time
18. How much of the time, during the past month, have you felt emotionally stable?
    1 All of the time
    2 Most of the time
    3 A good bit of the time
    4 Some of the time
    5 A little of the time
    6 None of the time
19. How much of the time, during the past month, have you felt downhearted and blue?
    1 All of the time
    2 Most of the time
    3 A good bit of the time
    4 Some of the time
    5 A little of the time
    6 None of the time
20. How often have you felt like crying, during the past month?
    1 Always
    2 Very often
    3 Fairly often
    4 Sometimes
    5 Almost never
    6 Never
21. During the past month, how often have you felt that others would be better off if you were
dead?
    1 Always
    2 Very often
    3 Fairly often
    4 Sometimes
    5 Almost never
    6 Never
22. How much of the time, during the past month, were you able to relax without difficulty?
    1 All of the time
    2 Most of the time
    3 A good bit of the time
    4 Some of the time
    5 A little of the time

6 None of the time

23. How much of the time, during the past month, did you feel that your love relationships,
loving and being loved, were full and complete?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

24. How often, during the past month, did you feel that nothing turned out for you the way
you wanted it to?

1 Always
2 Very often
3 Fairly often
4 Sometimes
5 Almost never
6 Never

25. How much have you been bothered by nervousness, or your “nerves”, during the past month?

1 Extremely so, to the point where I could not take care of things
2 Very much bothered
3 Bothered quite a bit by nerves
4 Bothered some, enough to notice
5 Bothered just a little by nerves
6 Not bothered at all by this

26. During the past month, how much of the time has living been a wonderful adventure for
you?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

27. How often, during the past month, have you felt so down in the dumps that nothing could
cheer you up?

1 Always
2 Very often
3 Fairly often
4 Sometimes
5 Almost never

6 Never

28. During the past month, did you think about taking your own life?
    1 Yes, very often
    2 Yes, fairly often
    3 Yes, a couple of times
    4 Yes, at one time
    5 No, never
29. During the past month, how much of the time have you felt restless, fidgety, or impatient?
    1 All of the time
    2 Most of the time
    3 A good bit of the time
    4 Some of the time
    5 A little of the time
    6 None of the time
30. During the past month, how much of the time have you been moody or brooded about things?
    1 All of the time
    2 Most of the time
    3 A good bit of the time
    4 Some of the time
    5 A little of the time
    6 None of the time
31. How much of the time, during the past month, have you felt cheerful, lighthearted?
    1 All of the time
    2 Most of the time
    3 A good bit of the time
    4 Some of the time
    5 A little of the time
    6 None of the time
32. During the past month, how often did you get rattled, upset or flustered?
    1 Always
    2 Very often
    3 Fairly often
    4 Sometimes
    5 Almost never
    6 Never
33. During the past month, have you been anxious or worried?
    1 Yes, extremely to the point of being sick or almost sick
    2 Yes, very much so
    3 Yes, quite a bit
    4 Yes, some, enough to bother me
    5 Yes, a little bit
    6 No, not at all
34. During the past month, how much of the time were you a happy person?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

35. How often during the past month did you find yourself trying to calm down?
1 Always
2 Very often
3 Fairly often
4 Sometimes
5 Almost never
6 Never

36. During the past month, how much of the time have you been in low or very low spirits?
1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

37. How often, during the past month, have you been waking up feeling fresh and rested?
1 Always, every day
2 Almost every day
3 Most days
4 Some days, but usually not
5 Hardly ever
6 Never wake up feeling rested

38. During the past month, have you been under or felt you were under any strain, stress or
pressure?
1 Yes, almost more than I could stand or bear
2 Yes, quite a bit of pressure
3 Yes, some more than usual
4 Yes, some, but about normal
5 Yes, a little bit
6 No, not at all

WHO (Five) Well-Being Index (Bech, 1999; Bech, Gudex, & Johansen, 1996)

Please indicate for each of the five statements which is closest to how you have been feeling over the last two weeks.

		At no time	Some of the time	Less than half of the time	More than half of the time	Most of the time	All of the time
1	I have felt cheerful and in good spirits	0	1	2	3	4	5
2	I have felt calm and relaxed	0	1	2	3	4	5
3	I have felt active and vigorous	0	1	2	3	4	5
4	I woke up feeling fresh and rested	0	1	2	3	4	5
5	My daily life has been filled with things that interest me	0	1	2	3	4	5

Perceived Stress Scale (Cohen, Kamark, & Mermelstern, 1983)

The questions in this scale ask you about your feelings and thoughts during the last 2 weeks. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

		Never	Almost Never	Sometimes	Fairly Often	Very Often
1	I am bothered by fatigue	0	1	2	3	4
2	I get tired very quickly	0	1	2	3	4
3	I don't do much during the day	0	1	2	3	4
4	I have enough energy for everyday life	0	1	2	3	4
5	Physically, I feel exhausted	0	1	2	3	4
6	I have problems starting things	0	1	2	3	4
7	I have problems thinking clearly	0	1	2	3	4
8	I feel no desire to do anything	0	1	2	3	4
9	Mentally, I feel exhausted	0	1	2	3	4
10	When I am doing something, I can concentrate quite well	0	1	2	3	4

Vitality Scale (Ryan, & Frederick, 1997)

Please respond to each of the following statements by indicating the degree to which the statement is true for you in the last 2 weeks

		Not at all True			Somewhat True			Very True
1	I feel alive and vital.	1	2	3	4	5	6	7
2	I don't feel very energetic.	1	2	3	4	5	6	7
3	Sometimes I feel so alive I just want to burst.	1	2	3	4	5	6	7
4	I have energy and spirit.	1	2	3	4	5	6	7
5	I look forward to each new day.	1	2	3	4	5	6	7
6	I nearly always feel alert and awake.	1	2	3	4	5	6	7
7	I feel energized.	1	2	3	4	5	6	7

Fatigue Assessment Scale (Michielsen, De Vries, & Van Heck, 2003)

The following 10 statements refer to how you usually feel. For each statement, you can choose one out of five answer categories

		Never	Sometimes	Regularly	Often	Always
1	I am bothered by fatigue	1	2	3	4	5
2	I get tired very quickly	1	2	3	4	5
3	I don't do much during the day	1	2	3	4	5
4	I have enough energy for everyday life	1	2	3	4	5
5	Physically, I feel exhausted	1	2	3	4	5
6	I have problems starting things	1	2	3	4	5
7	I have problems thinking clearly	1	2	3	4	5
8	I feel no desire to do anything	1	2	3	4	5
9	Mentally, I feel exhausted	1	2	3	4	5
10	When I am doing something, I can concentrate quite well	1	2	3	4	5

Hopkins Symptoms Checklist: Somatization Subscale (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974)

Please indicate if you have felt these symptoms in the past two weeks including today.

		Not at all	A little bit	Quite a bit	Extremely
1	Headaches	1	2	3	4
2	Faintness or dizziness	1	2	3	4
3	Pain in the heart or chest	1	2	3	4
4	Feeling low in energy or slowed down	1	2	3	4
5	Pain in the lower part of your back	1	2	3	4
6	Soreness of your muscles	1	2	3	4
7	Trouble getting your breathe	1	2	3	4
8	Hot or cold spells	1	2	3	4
9	Numbness or tingling in parts of your body	1	2	3	4
10	A lump in your throat	1	2	3	4
11	Weakness in parts of your body	1	2	3	4
12	Heavy feelings in your arms or legs	1	2	3	4

Self-Compassion Scale (Neff, 2003a)

Please read each statement carefully before answering. To the left of each item, indicate how often you behave in the stated manner, using the following scale.

		Almost Never				Almost Always
1	I'm disapproving and judgmental about my own flaws and inadequacies.	1	2	3	4	5
2	When I'm feeling down I tend to obsess and fixate on everything that's wrong.	1	2	3	4	5
3	When things are going badly for me, I see the difficulties as part of life that everyone goes through.	1	2	3	4	5
4	When I think about my inadequacies, it tends to make me feel more separate and cut off from the rest of the world.	1	2	3	4	5
5	I try to be loving towards myself when I'm feeling emotional pain.	1	2	3	4	5
6	When I fail at something important to me I become consumed by feelings of inadequacy.	1	2	3	4	5
7	When I'm down and out, I remind myself that there are lots of other people in the world feeling like I am.	1	2	3	4	5
8	When times are really difficult, I tend to be tough on myself.	1	2	3	4	5
9	When something upsets me I try to keep my emotions in balance.	1	2	3	4	5
10	When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.	1	2	3	4	5
11	I'm intolerant and impatient towards those aspects of my personality I don't like.	1	2	3	4	5

12	When I'm going through a very hard time, I give myself the caring and tenderness I need.	1	2	3	4	5
13	When I'm feeling down, I tend to feel like most other people are probably happier than I am.	1	2	3	4	5
14	When something painful happens I try to take a balanced view of the situation	1	2	3	4	5
15	I try to see my failings as part of the human condition.	1	2	3	4	5
16	When I see aspects of myself that I don't like, I get down on myself.	1	2	3	4	5
17	When I fail at something important to me I try to keep things in perspective.	1	2	3	4	5
18	When I'm really struggling, I tend to feel like other people must be having an easier time of it.	1	2	3	4	5
19	I'm kind to myself when I'm experiencing suffering.	1	2	3	4	5
20	When something upsets me I get carried away with my feelings.	1	2	3	4	5
21	I can be a bit cold-hearted towards myself when I'm experiencing suffering.	1	2	3	4	5
22	When I'm feeling down I try to approach my feelings with curiosity and openness.	1	2	3	4	5
23	I'm tolerant of my own flaws and inadequacies.	1	2	3	4	5
24	When something painful happens I tend to blow the incident out of proportion.	1	2	3	4	5
25	When I fail at something that's important to me, I tend to feel alone in my failure.	1	2	3	4	5

26	I try to be understanding and patient towards those aspects of my personality I don't like.	1	2	3	4	5

Demographic questions*

1. Are you at least 18 years old?

Yes
No

2. What is your age?

_____

3. What is your sex?

Male
Female
Other _____

4. What is your Racial Background?

White/Caucasian
Native American/American Indian
Black/African-American
Asian
Native Hawaiian/Pacific Islander
Multi-Race
Other: _____

5. What is your ethnicity?

Hispanic/Latino
Nonhispanic/Nonlatino

6. Are you a student at the University of Houston?

Yes
No

7. What is your student status?

Part-time (1-11 credits)
Full-time (12+ credits)
Not applicable

8. Class standing:

Freshman
Sophomore
Junior
Senior
Graduate

9. What is your height?

Feet _____

Inches _____

10. What is your weight in pounds?

_____

*Only included in the baseline survey

Physical Activity Questionnaire for Everyone (PAR-Q+; Warburton, Jamnik, Bredin, Gledhill, 2014)*

Regular physical activity is fun and healthy, and more people should become more physically active every day of the week. Being more physically active is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

Please read the 7 questions below carefully and answer each one honestly: check YES or NO.		Yes	No
1.	Has your doctor ever said that you have a heart condition OR high blood pressure?		
2.	Do you feel pain in your chest at rest, during your daily activities of living, OR when you do physical activity?		
3.	Do you lose balance because of dizziness OR have you lost consciousness in the last 12 months? Please answer NO if your dizziness was associated with over-breathing (including during vigorous exercise).		
4.	Have you ever been diagnosed with another chronic medical condition?		
5.	Are you currently taking prescribed medications for a chronic medical condition?		
6.	Do you have a bone or joint problem that could be made worse by becoming more physically active? Please answer NO if you had a joint problem in the past, but it does not limit your current ability to be physically active. For example, knee, ankle, shoulder or other.		
7.	Has your doctor ever said that you should only do medically supervised physical activity?		

If you answered NO to all of the questions above, you are cleared for physical activity.

If you answered YES to one or more of the questions above, please GO TO SECTION 2.

Please read the questions below carefully and answer each one honestly: check YES or NO.			Yes	No
1.		Do you have Arthritis, Osteoporosis, or Back Problems?	If yes, answer questions 1a-c	If no, go to question 2
	1a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)		

	1b.	Do you have joint problems causing pain, a recent fracture or fracture caused by osteoporosis or cancer, displaced vertebra (e.g., spondylolisthesis), and/ or spondylolysis/pars defect (a crack in the bony ring on the back of the spinal column)?		
	1c.	Have you had steroid injections or taken steroid tablets regularly for more than 3 months?		
2.	Do you have Cancer of any kind?		If yes, answer questions 2a-b	If no, go to question 3
	2a.	Does your cancer diagnosis include any of the following types: lung/bronchogenic, multiple myeloma (cancer of plasma cells), head, and neck?		
	2b.	Are you currently receiving cancer therapy (such as chemotherapy or radiotherapy)?		
3.	Do you have Heart Disease or Cardiovascular Disease? This includes Coronary Artery Disease, High Blood Pressure, Heart Failure, Diagnosed Abnormality of Heart Rhythm		If yes, answer questions 3a-e	If no, go to question 4
	3a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)		
	3b.	Do you have an irregular heart beat that requires medical management? (e.g. atrial brillation, premature ventricular contraction)		
	3c.	Do you have chronic heart failure?		
	3d.	Do you have a resting blood pressure equal to or greater than 160/90 mmHg with or without medication? (Answer YES if you do not know your resting blood pressure)		
	3e.	Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months?		
4.	Do you have any Metabolic Conditions? This includes Type 1 Diabetes, Type 2 Diabetes, Pre-Diabetes		If yes, answer questions 4a-c	If no, go to question 5
	4a.	Is your blood sugar often above 13.0 mmol/L? (Answer YES if you are not sure)		
	4b.	Do you have any signs or symptoms of diabetes complications such as heart or		

		vascular disease and/or complications affecting your eyes, kidneys, and the sensation in your toes and feet?		
	4c.	Do you have other metabolic conditions (such as thyroid disorders, pregnancyrelated diabetes, chronic kidney disease, liver problems)?		
5.	Do you have any Mental Health Problems or Learning Difficulties? This includes Alzheimer's, Dementia, Depression, Anxiety Disorder, Eating Disorder, Psychotic Disorder, Intellectual Disability, Down Syndrome)		If yes, answer questions 5a-b	If no, go to question 6
	5a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)		
	5b.	Do you also have back problems affecting nerves or muscles?		
6.	Do you have a Respiratory Disease? This includes Chronic Obstructive Pulmonary Disease, Asthma, Pulmonary High Blood Pressure		If yes, answer questions 6a-d	If no, go to question 7
	6a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)		
	6b.	Has your doctor ever said your blood oxygen level is low at rest or during exercise and/or that you require supplemental oxygen therapy?		
	6c.	If asthmatic, do you currently have symptoms of chest tightness, wheezing, laboured breathing, consistent cough (more than 2 days/week), or have you used your rescue medication more than twice in the last week?		
	6d.	Has your doctor ever said you have high blood pressure in the blood vessels of your lungs?		
7	Do you have a Spinal Cord Injury? This includes Tetraplegia and Paraplegia		If yes, answer questions 7a-c	If no, go to question 8
	7a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)		

	7b.	Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting?		
	7c.	Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as Autonomic Dysreflexia)?		
8.	Have you had a Stroke? This includes Transient Ischemic Attack (TIA) or Cerebrovascular Event		If yes, answer questions 8a-c	If no, go to question 9
	8a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)		
	8b.	Do you have any impairment in walking or mobility?		
	8c.	Have you experienced a stroke or impairment in nerves or muscles in the past 6 months?		
9.	Do you have any other medical condition not listed above or do you live with two chronic conditions?		If yes, answer questions 9a-c	
	9a.	Have you experienced a blackout, fainted, or lost consciousness as a result of a head injury within the last 12 months OR have you had a diagnosed concussion within the last 12 months?		
	9b.	Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, kidney problems)?		
	9c.	Do you currently live with two chronic conditions?		

If you answered NO to all of the follow-up questions about your medical condition, you are ready to become more physically active:

- It is advised that you consult a qualified exercise professional (e.g., a CSEP-CEP or CSEP-CPT) to help you develop a safe and effective physical activity plan to meet your health needs.
- You are encouraged to start slowly and build up gradually – 20-60 min. of low- to moderate-intensity exercise, 3-5 days per week including aerobic and muscle strengthening exercises.
- As you progress, you should aim to accumulate 150 minutes or more of moderate-intensity physical activity per week.
- If you are over the age of 45 yrs. and NOT accustomed to regular vigorous physical activity, please consult a qualified exercise professional (CSEP-CEP) before engaging in maximal effort exercise.

If you answered YES to one or more of the follow-up questions about your medical condition:

- You should seek further information from a licensed health care professional before becoming more physically active or engaging in a fitness appraisal and/or visit a or qualified exercise professional (CSEP-CEP) for further information.

Delay becoming more active if:

- You are not feeling well because of a temporary illness such as a cold or fever – wait until you feel better
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the PARmed-X for Pregnancy before becoming more physically active OR
- Your health changes - please talk to your doctor or qualified exercise professional (CSEP-CEP) before continuing with any physical activity programme

***Only included in baseline survey for screening purpose**