GET *ACT*IVE! A RANDOMIZED CONTROLLED TRIAL OF THE FEASIBILITY AND EFFECTIVENESS OF AN ACCEPTANCE-BASED BEHAVIORAL INTERVENTION TO PROMOTE EXERCISE ADOPTION AND MAINTENANCE

by

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Get *ACT*ive! A Randomized Controlled Trial of the Effectiveness of an Acceptance-Based Behavioral Intervention to Promote Exercise Adoption and Maintenance

Thesis directed by Professor Kent E. Hutchison

Regular exercise confers tremendous benefits for health, yet nearly half of American women are insufficiently active. Increasingly, researchers have been turning to the study of affective/experiential-based determinants of exercise maintenance, but how best to address these factors and maximize health outcomes is not well understood. The novel perspective of this dissertation was that an Acceptance and Commitment Therapy (ACT)-based intervention targeting improvement on constructs of psychological flexibility (e.g., experiential acceptance, defusion, discomfort intolerance) would differentially impact exercise behavior over time.

A sample of *N* = 113 insufficiently active women aged 21 – 65 were randomly assigned to one of the three conditions: (1) an ACT-based health coaching intervention, (2) an education-based health coaching intervention, or (3) a no-health coaching control intervention. The study was divided into two phases, assessing exercise in terms of adoption (Phase 1) and maintenance (Phase 2). During Phase 1, all participants completed a 30-day exercise program and submitted daily exercise journals to the study team. Participants assigned to the ACT- or education-based conditions additionally took part in workshops at the beginning and end of Phase 1. All participants were contacted 3-months post-intervention for a follow-up assessment.

The central hypotheses were generally supported. Feasibility analyses revealed no between group differences, with the exception that participants assigned to the ACT-based condition rated their intervention highest on credibility/expected impact, and also tended to report greater satisfaction as compared to participants assigned to the other two conditions.

Planned contrasts tended to suggest participants assigned to the ACT-based condition completed more exercise over Phase 1 compared to participants assigned to the other two conditions, but, evidence for between condition effects on exercise maintenance at 3-months follow-up were mixed. However, our results showed that the ACT-based condition was particularly effective at improving experiential acceptance scores over the course of the intervention, and higher scores on experiential acceptance at the end of the intervention positively predicted exercise maintenance at 3-months follow-up. Future work should assess the optimal intervention "dose" for yielding the greatest impacts on experiential acceptance scores, and explore the relationship between change in experiential acceptance and behavior over a longer-term follow-up period.

Dedication

This thesis is dedicated to my mom-mom, Joyce Courtney Young (10/22/1927 – 05/07/2016), who endeavored a career of treating the sick and caring for the wellbeing of others long before me. I am so grateful for the many happy memories I have of our time together. I will keep you in my heart with me always, I am honored to have been your granddaughter and namesake. And to my parents, who always encouraged me to follow my passions and taught me that physical activity is the key to living a life of health and happiness.

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CHAPTER I

INTRODUCTION

Several decades of research have generated an enormous body of empirical support for the benefits of regular exercise participation. While all forms of exercise (i.e., cardiorespiratory, muscle strengthening, flexibility, and neuromuscular) recommended by national agencies (e.g., American College of Sports Medicine [ACSM], United States Department of Health and Human Services [USDHHS]) confer significant benefits for health and wellness, cardiorespiratory exercise, especially, has been implicated as a mechanism for both symptom reduction, and wellness enhancement across a broad range of health factors and endpoints (Garber et al., 2011; Schoenborn & Stommel, 2011; USDHHS, 2008). The results of one recent longitudinal, multi-cohort study found that compared to getting no exercise activity, engaging in 1 – 5 times the recommended minimum amount of weekly cardiorespiratory exercise reduced risk for all-cause mortality by 31-39% (Arem et al., 2015). Another recent epidemiological study found that between 6 – 10% of all the major non-communicable diseases could be eliminated with increases in regular cardiorespiratory exercise (Lee et al., 2012). This evidence leaves essentially no debate as to the transdiagnostic health benefits of regular cardiorespiratory exercise.

Issues with Exercise Adoption and Maintenance

According to the ACSM and USDHHS guidelines, adults are considered to be "sufficiently active" if they engage in 150 minutes of moderate-vigorous intensity cardiorespiratory exercise per week (Garber et al., 2011; Schoenborn & Stommel, 2011; USDHHS, 2008). Despite wide dissemination of exercise benefits and guidelines, only 50% of all American adults (54% of males and 46% of females) meet the *minimum* recommendations for weekly cardiorespiratory exercise, and a quarter of American adults engage in no exercise at all (National Center for Health Statistics [NCHS], 2013; USDHHS, 2015). There are also significant gender and age disparities in cardiorespiratory exercise participation. Across all age groups, women engage in fewer minutes per week of cardiorespiratory exercise than men of the same age (Carlson et al., 2010; NCHS, 2013), and rates of weekly exercise engagement for women decrease considerably throughout the lifespan (Carlson et al., 2010; NCHS, 2013). Thus, there is considerable public health incentive to identify ways of improving rates of cardiorespiratory exercise participation in the population broadly, and among women in particular.

Historically, exercise intervention programs have been moderately effective at encouraging individuals to initiate exercise; however, interventions focused on promoting long-term exercise maintenance have had considerably less success (Ekkekakis, Parfitt, & Petruzzello, 2011; Garber et al., 2011; Marcus et al., 2000, Marcus et al., 2006). Case in point, research shows that only around 50% of individuals who adopt an exercise program stay with it for more than six months (Ekkekakis et al., 2011; Marcus et al., 2000, Marcus et al., 2006). Numerous theoretical perspectives and comprehensive reviews regarding the promotion and maintenance of exercise behavior have been presented in the literature. Yet to date, there is no one theoretical model that consistently predicts a large proportion of the variability in maintenance of exercise behavior (Nigg, Borrelli, Maddock, & Dishman, 2008). As Rothman and colleagues (2011) have argued, a limitation of the dominant theoretical approaches is that they fail to provide guidance on how the underlying mechanisms that govern the adoption/initiation of a health behavior, such as exercise, may be insufficient to explain behavioral *maintenance*. Maintenance of a health behavior is typically defined in the literature as “sustained action over time.” This is a pragmatic operationalization, yet without attention to how this “sustained action” is influenced by fluctuating meta-motivational states, as well as contextual factors/barriers/decisions, which may also change over time, researchers are left with the same theoretical constructs used to understand behavior adoption (Rothman, Baldwin, Hertel, & Fuglestad, 2011).

Affective and Experiential Determinants of Exercise Behavior

A current, hotly debated topic in the health psychology/behavioral medicine literature concerns the extent to which social cognitive theories, which have a long history of application in exercise intervention research, have "outlived their usefulness" (Linde, Rhodes, Riley, & Spruijt-Metz, 2016; Sniehotta, Presseau, & Araújo-Soares, 2014), and the extent to which affective/experiential factors, historically omitted from dominant theoretical models, might help to elucidate the vast "intentions-behavior maintenance gap" observed in exercise research. As such, efforts to understand who will, and who will not maintain exercise have increasingly focused on affective determinants of behavior (Conner, McEachan, Taylor, O'Hara, & Lawton, 2015; Rhodes & Kates, 2015; Williams & Evans, 2014).

Consistent with the tenets of Hedonic Theory (Kahneman, 2003) and Self-Determination Theory (SDT; Ryan & Deci, 2000), which both posit people are likely to engage in activities they find pleasant (and are thus, intrinsically motivated to perform), and avoid activities they find unpleasant, the data show that more favorable affective responses to acute bouts of exercise predict both stronger intentions for future exercise (Kwan & Bryan, 2010a) and higher rates of exercise participation up to a year later (Kwan & Bryan, 2010b; Schneider, Dunn, & Copper, 2009; Williams et al., 2008; Williams, Dunsiger, Jennings, & Marcus, 2012). Similarly, positive affective attitudes about exercise (e.g., "exercise is pleasurable"), and anticipated affective reactions to exercise are positively related to exercise participation over time (Conner, McEachan, Taylor, O'Hara, & Lawton, 2014; Conner, Rhodes, Morris, McEachan, & Lawton, 2011; Dunton & Vaughan, 2008).

In response to these findings, some researchers, including the authors of the most recent ACSM position stand (Garber et al., 2011), have suggested that it may be beneficial, especially for those who are most deconditioned, to focus on promoting "affect-based" and/or "self-paced" exercise behavior. This rationale is based on work demonstrating a higher perceived sense of autonomy, and more favorable affective responses to exercise when exercise pace is self-selected, rather than imposed (Ekkekakis, Backhouse, Gray, & Lind, 2008; Ekkekakis, Parfitt, & Petruzzello, 2011; Rose & Parfitt, 2012; Vazou-Ekkekakis & Ekkekakis, 2009), even when the intensity of the exercise between the self-selected and imposed sessions is held constant (Hamlyn-Williams, Freeman, & Parfitt, 2014; Vazou-Ekkekakis & Ekkekakis, 2009).

A recent study by Williams et al., (2015) sought to address this question and found that low-active participants assigned to a self-paced, "do what feels good," walking prescription walked significantly more minutes per week than participants assigned to a moderate-intensity walking prescription over a period of 6-months. The authors argue that intrinsic motivation for exercise was more readily leveraged from participants in the self-paced condition because they were provided the opportunity to self-select the intensity and volume that felt best to them – rather than have the researchers tell them what pace to follow. At first blush, these findings suggest a shift in the way health professionals and researchers promote exercise to the public may be warranted: Perhaps we could foster more intrinsic motivation for exercise that would translate into higher sustained levels of exercise behavior downstream, if the emphasis on explicit exercise guidelines and prescriptions was lessened. However, upon examining the data more closely, it is apparent that although participants assigned to the self-paced walking condition did exercise more on average over the course of the study compared to participants assigned to the intensity-prescribed condition, a mere two weeks into the intervention, participants in both conditions *were already falling short of the goal to walk 150 minutes per week* (Williams et al., 2014). By six months, on average, participants in the self-paced group walked only 50% of this goal, and thus, were still not coming close to meeting national guidelines for exercise.

While some exercise is certainly better than none (Garber et al., 2011b), *optimal* benefits for health from moderate intensity exercise engagement (e.g., walking) are achieved at 3 – 5 times the recommended weekly exercise minimum (Arem et al., 2015), and at intensities that not only do not always feel good, but may, at times, feel outright awful – as is typically the case with vigorous-intensity exercise that raises heart rate beyond the ventalitory threshold[1] (Ekkekakis et al., 2011). For instance, one recent prospective cohort study discovered a strong inverse relationship between greater vigorous intensity exercise training and risk for all-cause mortality (Gebel et al., 2015). Improvements to cardiorespiratory fitness (CRF), achieved from the higher volume exercise, may explain these results as vigorous intensity exercise has been shown to confer greater benefits for CRF compared to moderate intensity exercise alone (Ramos, Dalleck, Tjonna, Beetham, & Coombes, 2015; Weston, Wisløff, & Coombes, 2013), and improvements to CRF are more strongly associated with reduced risk for all-cause mortality than is total volume of physical activity participation (Bouchard, Blair, & Katzmarzyk, 2015; Lee et al., 2011). Based on their findings, Gebel and colleagues concluded that, "vigorous exercise should be endorsed in clinical and public health activity guidelines to maximize the population benefits of physical activity" (p. E6).

[1] The ventalitory is a biological landmark that demarcates a disproportionate rise in CO_2 production over O_2 production.

Thus, it seems that a bit of a balancing act is required. One the one hand, we know that higher-volume/high-intensity confers the greatest benefits for health; yet, on the other hand, we know that higher-volume/high-intensity is experienced as highly unpleasant by most people, and especially by highly sedentary/overweight individuals (Ekkekakis et al., 2011). In terms of strategies that are likely to promote behavior that will most optimize subsequent health outcomes, it seems that focusing solely on leveraging intrinsically oriented regulatory mechanisms (i.e., pleasure and autonomy) will fall short. Instead, this dissertation proposes that what is needed is to find a balance between activating these regulatory factors, while also providing skills for managing discomfort and distress associated with performing higher volume/higher intensity exercise (Stevens & Bryan, 2015).

According to SDT (Ryan & Deci, 2000), behaviors performed for reasons other than the inherent enjoyment of the behavior itself are by definition *extrinsically* motivated; however, those behaviors may still be self-determined because extrinsic motivation exists of a continuum ranging from highly externalized, to highly internalized/autonomous (Ryan, Williams, Patrick, & Deci, 2009). "Integrated regulation" is an internalized form of *extrinsic* motivation, in which the person identifies with or personally values the behaviors they engage in (Ryan et al., 2009). Thus, relevant regulatory strategies that could be targeted in interventions in order to leverage integrated motivation might include skills that aid individuals in identifying and making salient their values, perusing committed action, and especially in the case of exercise behavior, which is strongly influenced by affect and feeling states, skills for managing both psychological and physical discomfort that may commonly derail behavioral intentions (Stevens & Bryan, 2015).

Fortunately, there is an empirically supported intervention model that targets exactly these regulatory strategies: Acceptance-based behavioral interventions, born from acceptance and commitment therapy (ACT), have shown promise for modifying maladaptive behaviors (Forman, Hoffman, Juarascio, Butryn, & Herbert, 2013; Gifford et al., 2004), and for promoting adaptive behaviors – including exercise (Butryn, Forman, Hoffman, Shaw, & Juarascio, 2011; Goodwin, Forman, Herbert, Butryn, & Ledley, 2012; Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007; Hawkes et al., 2013; Moffitt & Mohr, 2015). The goal of acceptance-based approaches is to foster "psychological flexibility," defined as mindful awareness and acceptance of aversive experiential content (unpleasant thoughts, feelings, emotions, sensations – all common to high volume/high intensity exercise), and increased focus on the consistency of behavior with one's values (Hayes, 2004). The novel perspective of this dissertation is that an ACT-based intervention might present an innovative and effective approach for promoting exercise behavior change, and particularly for promoting exercise behavior maintenance.

Acceptance and Commitment Therapy (ACT)

ACT is an empirically supported behavioral treatment approach that seeks to help individuals create a rewarding, meaningful life, while accepting the pain and discomfort that is inherent in human experience (Hayes, Luoma, Bond, & Masuda, 2006; Hayes, 2004). ACT is well supported in the literature as a beneficial intervention for anxiety and mood disorders (Forman, Herbert, Moitra, Yeomans, & Geller, 2007; Lappalainen et al., 2007), and has also been successfully applied for the treatment of various other mental health symptoms (e.g., psychosis, Bach & Hayes, 2002; Gaudiano & Herbert, 2006; Gratz & Gunderson, 2006). In addition to its application in psychotherapy contexts, ACT-based interventions have demonstrated effectiveness for the treatment of a wide range of health related conditions and behaviors including, diabetes (Gregg et al., 2007), chronic pain (Veehof, Oskam, Schreurs, & Bohlmeijer, 2011; Vowles, McCracken, & O'Brien, 2011; Wetherell et al., 2011), smoking cessation (Gifford et al., 2004), insomnia (Ong, Ulmer, & Manber, 2013), and obesity/weight management (Forman, Butryn, Hoffman, & Herbert, 2009; Forman et al., 2013; King, Haskell, Young, Oka, & Stefanick, 1995). More recently, researchers have begun to explore the effectiveness of ACT-based interventions for promoting exercise behavior.

To date, only two studies have looked at exercise behavior as the primary outcome of an ACT-based intervention (Butryn et al., 2011; Moffitt & Mohr, 2015); however, other research teams have looked at exercise as one of several outcomes of an ACT-based health behavior intervention (Hawkes et al., 2013). The majority of ACT-based behavioral health interventions to date have promoted exercise in conjunction with other health behaviors (healthy eating), in order to achieve other specific health outcomes – e.g., weight loss (Goodwin et al., 2012).

One of the two studies that has focused explicitly on using ACT to increase exercise behavior was a small pilot study that sought to compare the number of campus recreation center visits of college students receiving an ACT-based exercise promotion workshop or an exercise promotion educational workshop. Results revealed a significant time by condition effect such that participants in the ACT-based condition reported more frequent trips to the recreation center from baseline to 1-week post-intervention than did participants in the educational exercise promotion program (Butryn et al., 2011). By 4-weeks post-intervention, participants who received the ACT-based intervention were still attending the recreation center more than participants who received the educational workshop intervention; however, the between groups difference was no longer statistically significant (Butryn et al., 2011).

The lack of significant effect at follow-up in this study may very well be due to issues related to low power as there were only 35 and 19 participants assigned to the ACT-based and education workshop conditions, respectively. The use of recreation center visits as the main outcome measure of this study is also certainly a limitation. While number of visits to the recreation center may be an acceptable metric of exercise behavior for students on a college campus – it is a suboptimal metric for assessing exercise behavior from an external validity perspective because many Americans, not housed on a college campus, do not have access to a gym, and/or do not prefer to exercise in a gym. Additionally, there is no way to know what students in this study actually did for exercise once they arrived at the recreation center.

More work in this area by Hawkes et al., (2013) suggests that contrary to the lack of effect at follow-up in the Butryn et al. (2011) study, ACT-based interventions may be effective at fostering increases to exercise behavior that are maintained over time. In this study, Hawkes and colleagues (2013) sought to promote healthy lifestyle behaviors, including exercise, among colon cancer survivors. Results revealed that participants who received an ACT-based "health coaching" treatment reported significantly more minutes of moderate-to-vigorous physical activity (MVPA) participation at 6-months post-intervention than did those participants who received a "usual care" intervention.

Finally, the second ACT-based exercise specific intervention study conducted to date was run by Moffitt and Mohr (2015), who set out to evaluate the efficacy of a walking program supplemented by a self-managed, ACT-based intervention delivered to participants electronically via DVD. The results of this investigation revealed that participants who took part in the ACT-based skills DVD disseminated condition achieved a significantly greater increase in time spent walking (assessed via pedometer) after 12 weeks as compared to control participants who only took part in the walking program, and did not also receive the DVD. Additionally, participants assigned to the ACT-based DVD condition were more likely than controls to achieve the goals they set for themselves within the context of the 12-week walking program. Interestingly, this study showed that both controls and participants assigned to the ACT-based condition increased on metrics of physical activity up through 8 weeks, but by 12 weeks controls were walking significantly less than participants who received the ACT-based condition, falling back close to their baseline scores. Thus, the extended intervention time seemed to benefit participants assigned to the ACT-based condition by providing a longer opportunity to acquire and practice skills. Another way to interpret these findings might be that the ACT skills content had an enduring impact on walking behavior for participants. Whereas we expect any individual voluntarily participating in a physical activity intervention to initially increase his/her physical activity, equipping participants with ACT-based skills may have helped those participants to persist with the goal driven behavior over a longer period of time. One notable limitation of this study, however, is the lack of data on maintenance of exercise behavior post-intervention.

The Six Core Processes of ACT in the Context of Exercise Behavior

Six interrelated and overlapping core ACT processes are thought to foster psychological flexibility; these are, acceptance, cognitive defusion, contact with the present moment, self-as-context, values, and committed action. The interrelated nature of these ACT processes that give rise to the overarching construct of "psychological flexibility" is depicted by the ACT hexeflex model (see Figure 1; Hayes et al., 2006).

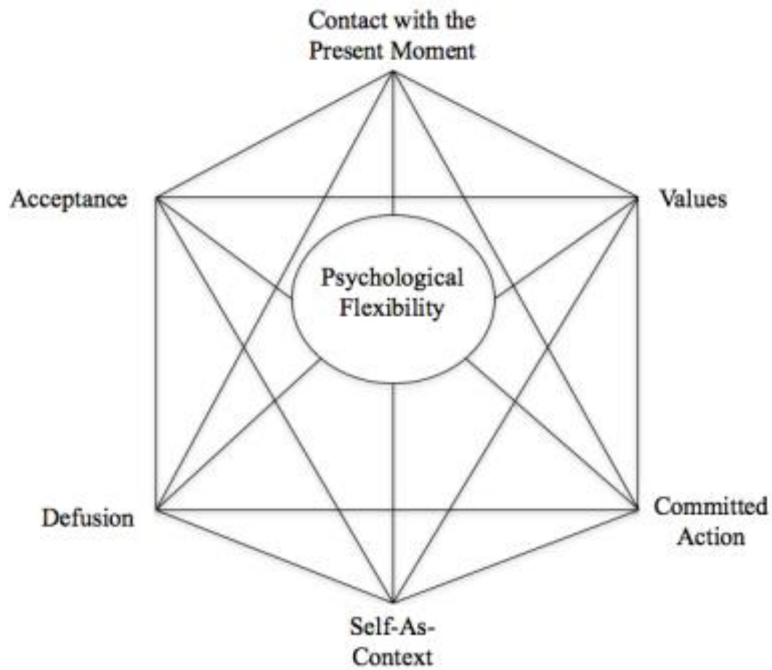


Figure 1. The ACT hexeflex model. Adapted from "Acceptance and Commitment Therapy: Model Process and Outcomes," by S.C. Hayes, J.B. Luoma, F.W. Bond, A. Masuda, & J. Lillis, 2006, *Behavior Research and Therapy, 44,* 1-2.

Acceptance. Acceptance is a stance of being open to the reality of the present experience without attempts to modify, suppress, or terminate that experience in any way. Importantly, while individuals may not approve of or enjoy their present experience, they may be able to accept their experience as it is without engaging in attempts to change or avoid experiential content. For example, although an individual may not enjoy sensations of discomfort while exercising (e.g., shortness of breath, muscle soreness or cramping, fatigue), she may be able to accept those sensations of discomfort as they arise during exercise without attempts to think differently about the experience (modification), ignore the aversive sensations (suppression), or prematurely end the exercise bout (termination). Thus, acceptance is taught as an alternative to experiential avoidance. Support has been growing in the literature for the relationship between acceptance, mindfulness, and exercise behavior (Butryn et al., 2015; Gardner & Moore, 2012; Gilbert & Waltz, 2010; Ulmer, Stetson, & Salmon, 2010). One investigation concerning exercise maintenance among 266 YMCA members found that participants who were most successful at maintaining exercise tended to score higher on measures of mindfulness and acceptance, and lower on measures of cognitive suppression (Ulmer et al., 2010). Another found scores on experiential acceptance to be predictive of exercise behavior 6 months after participating in a weight loss intervention (Butryn et al., 2015).

Cognitive defusion. When people are "fused" to their mental events, they act as if their thoughts, memories, and mental images are factual, and thus, worthy of guiding or determining their behavior – even if those resultant behaviors are inconsistent with their ultimate goals and values. Cognitive defusion describes an ability to *defuse* (i.e., to separate and detach from) mental events such as thoughts, memories, and images. Critically, defusion is not about ignoring mental events. To the contrary, defusion involves noticing as mental events arise, but remaining detached from the content. For example, if during an exercise bout an individual begins to think about how her legs are burning and it is becoming harder to breathe, instead of interpreting those thoughts to mean that she cannot sustain the same intensity or that she should stop the exercise altogether, she may be able to notice that the thought has come up, but continue on with her workout as planned. Similarly, defusion can help to promote values-oriented behavior before engagement with the valued behavior has begun. For example, if an individual has made plans to attend a class at the gym after work, but after a long workday has thoughts that she is too tired to exercise, she may be able to defuse from those thoughts and attend her class at the gym despite thoughts of being too tired.

Self-as-context. The self-as-context process regards the perspective of the self as an observer of thoughts, feelings, and sensations without identifying with those experiences. In this way, thoughts, feelings, and sensations are experienced, but not conceptualized as defining anything about the self. For example, during exercise, an individual may be able to observe her thoughts or feelings that come up without interpreting them to mean something about her or her exercise experience. The concept of self-as-context is adjacent to the process of defusion in that self-as-context is activated when one engages in the act of defusion (the self is the observer, and the self observes thoughts, feelings, and/or sensations and allows them to pass and/or just be present without creating psychological attachment – e.g., dwelling, ruminating, worrying, with respect to those thoughts, feelings, and/or sensations).

Contact with the present moment. Contact with the present moment is about consciously shifting awareness to what is happening in the present moment. This means purposefully paying attention to internal physical or mental experiences, as well as external environmental stimuli, rather than acting on "auto-pilot." With respect to exercise, contact with the present moment may help individuals to increase their experiential awareness of the exercise experience (e.g., interoceptive cues from the body, mental events). Once individuals are more aware of their experience during exercise, they may then be able to use acceptance and defusion skills to help regulate their behavioral responses (e.g., become aware that it is harder to breath, accept that difficulty breathing is sometimes a byproduct of exercise, and defuse from mental events that encourage terminating exercise early). In addition to helping to manage aversive internal and external experiences by way of acceptance and defusion, fostering a greater sense of contact with the present moment may also help to increase the saliency of more positively valenced affect (i.e., pleasure) or attitudes (i.e., pride, accomplishment, satisfaction) that may be experienced during and/or after a bout of exercise. It has previously been proposed that increasing awareness of these experiences may serve to reinforce exercise behavior (Stevens & Bryan, 2012; Welch, Hulley, Ferguson, & Beauchamp, 2007).

Values. Values are desired life directions or qualities of existence that define how a person seeks to live his or her life on a long-term basis. Importantly, values are different from goals in that goals are constructs that can be attained, whereas values are directions that are informed by what is truly important to a person in his or her life. For example, an individual may have a goal of "increasing my fitness" because she values "enhanced quality of life." One line of research suggests that, for women in particular, those who value exercise for its quality of life enhancing outcomes (e.g. "feeling good," and "happiness") maintain exercise for significantly longer amounts of time compared to women who report valuing exercise for its long-term health, current health, or weight management benefits (Segar, Eccles, & Richardson, 2008, 2011; Segar & Richardson, 2014).

Committed action. Committed action involves choosing and sustaining behavioral actions that are informed by values. The pursuit of committed action involves the formation of concrete short and long term goals that can be achieved (versus values that can only be represented). For example, planning to wake up early to go for a run before work (even if tired upon awaking) with a friend because enhanced quality of life is held as a value. A commonly used format for helping individuals pursue committed action in applied practice is as follows: Individuals are asked to state what they are committing to ("I am committing to ____"), to define potential experiential barriers ("even if I feel/think_____," "or have desires to _____"), and to state how they will remind themselves of their valued reasons for engaging in the behavior in spite of barriers ("I will remind myself that I want to do _____ because it will align me closer with my value of ______").

Notably, this component of the ACT framework is highly consistent with the notion in the health behavior change literature of formulating "implementation intentions." More specifically, implementation intentions (see Gollwitzer, 1999), are “if-then” statements that explain “how, when, and where” an individual will take action towards his or her goal (Gollwitzer & Sheeran, 2006). Importantly, implementation intentions have been identified in meta-analytic research as better predictors of goal attainment than goal intentions, possibly because of the lessened demands on self-regulation that implementation intentions foster (Sheeran, Webb, & Gollwitzer, 2005). Thus, it bares reasoning that a similar way of structuring a plan for committed action that is aligned with personalized values, as noted above, may also be beneficial for helping individuals achieve their health behavior change goals.

Health Coaching: A Timely, Practical, and Effective Dissemination Format

“Health coaching” is a burgeoning area of clinical health intervention, particularly in the fields of integrated primary care and behavioral medicine (Olsen & Nesbitt, 2010). Health coaching has been defined as “the practice of health education and health promotion [facilitated by a behavioral health specialist (broadly defined)], to enhance the wellbeing of individuals and to facilitate the achievement of their health-related goals” (Palmer, Tubbs, & Whybrow, 2003; van Ryn, 1997). In this way, health coaching is an intervention format that can be used to address multiple behaviors and health risks. According to the American Academy of Family Physicians (AAFP), in recent years, health coaching (whether conducted face-to-face in clinic, online, or via telephone), has become a popular treatment format due to its flexible transdiagnostic application, as well as an overwhelming demand to support the behavioral health needs of patients in the medical system (e.g., mild-moderate mental health symptoms, diseases of lifestyle, chronic disease management; Bennett, Coleman, Parry, Bodenheimer, & Chen, 2010). A recent systematic review of the health coaching literature conducted by Kivela and colleagues (2014) found significant effects of health coaching interventions (delivered in a large variety of formats, and with a wide range of contact sessions) for improving outcomes related to weight management, physical activity, and mental health symptomatology.

In summation, health coaching is a timely, practical, and effective behavioral health intervention dissemination format; based on these qualities, health coaching may serve as an ideal dissemination format from which to deliver an ACT-based exercise intervention. This dissertation proposes that an ACT-based health coaching intervention that teaches practical skills for accepting and managing distress/discomfort related to aversive affective/experiential content in an exercise context, emphasizes values-driven behavior, and assists participants in manifesting committed action, will be more effective at promoting sustained exercise behavior than a time-matched health coaching intervention that focuses on educating participants about the health benefits of exercise (education-based health coaching condition), and/or a no-health coaching control condition.

Preliminary Evidence

As a precursor to the planned intervention project, a pilot study (Stevens & Bryan, in prep) was conducted with the goal of better understanding the relationships between exercise behavior and constructs that may be potentially impacted by an ACT-based exercise intervention. Data were collected from a sample of N = 249 participants (51% female) ages 18 – 27 (M = 19, SD = 1.39) from the University of Colorado Boulder online Sona System subject pool. *In terms of measurement*, participants were asked to report their current exercise behavior (total minutes of moderate and vigorous intensity exercise performed during an average week), intentions to engage in future moderate-vigorous intensity exercise (α = .887), and their degree of agreement with measures of experiential acceptance (in the context of exercise; α = .844) and discomfort intolerance (α = .763).

Additionally, participants were asked to identify the period of time that best matched how long they had been maintaining the ACSM's guideline for 150 minutes per week of moderate-vigorous intensity exercise (if at all). The sample was then separated into 3 exercise maintenance groups: (1) Non-exercise maintainers were defined as those individuals not meeting recommended guidelines for at least 150 minutes of moderate-vigorous exercise per week (n = 71); (2) short-term exercise maintainers were defined as those individuals who reported exercising at a moderate-vigorous intense pace, for at least 150 minutes per week, for at least 1-6 months (n = 67); and (3) long-term exercise maintainers were defined as those individuals who reported exercising at moderate-vigorous intense pace, for at least 150 minutes per week, for more than 6 months (n = 109).

Analyses of variance (ANOVA) demonstrated significant between group differences across measures of experiential acceptance and discomfort intolerance, with medium effects sizes (η^2 = .218 and .111, respectively). Follow-up tests revealed that long-term exercise maintainers were significantly different from both short-term and non-exercise maintainers in that they reported more experiential acceptance and less discomfort intolerance (all p's <.05, Cohen's d's range .425 – 1.13). Interestingly, short-term and non-exercise maintainers were not significantly different from each other on these constructs.

Next, bivariate correlations were computed in order to understand the relationships between exercise constructs (minutes and intentions) and experiential acceptance and discomfort intolerance, collapsing across all participants. Results showed that all pairs of bivariate relationships were significantly associated in the expected directions – i.e., experiential acceptance was positively correlated, whereas discomfort intolerance was negatively correlated with moderate intensity exercise minutes, vigorous intensity exercise minutes, and intentions for future moderate-vigorous intensity exercise, all *p*'s <.05, *r*'s range -.137 to -.545.

To follow up on these findings, three regression models were run to explore (cross-sectional) differences in the proportion of variance accounted for by the experiential acceptance and discomfort intolerance constructs in (1) total minutes of moderate intensity exercise (model 1), (2) total minutes of vigorous intensity exercise (model 2), and (3) intentions for future moderate-vigorous intensity exercise (model 3). All three overall models were statistically significant (all *p*'s <.001, R^2 = .043, .148, and .338 for models 1, 2, and 3 respectively). Significant main effects were found for experiential acceptance in all 3 models (all *p*'s <.015, standardized β's = .192, .288, and .396 for models 1, 2, and 3 respectively). Additionally, a significant main effect was observed for exercise intentions regressed on discomfort intolerance (model 3, $p < .001$, standardized $\beta = -.252$), but not for minutes of moderate intensity exercise (model 1); however, a non-significant trend was observed for minutes of vigorous intensity exercise regressed on discomfort intolerance (model 2, $p = .066$, standardized $\beta = -.137$).

The results of this pilot investigation suggest that experiential acceptance and discomfort intolerance are associated in meaningful ways with indices of exercise behavior and are consistent with similar work conducted in this area (Butryn et al., 2015; Ulmer et al., 2010). It is interesting that differences on these experiential constructs were most pronounced between long-term exercise maintainers and non-exercise maintainers, although the underlying mechanism of action cannot be explained with the present cross-sectional data. For instance, it could be that more experience with exercise results in changes on these experiential constructs over time, or it could be that as an individual becomes more physically fit (through more exercise training), his/her body experiences physiological adaptations that make exercise feel better (see Ekkekakis et al., 2011; Magnan, Kwan, & Bryan, 2013), thus, indirectly resulting in changes on experiential constructs. The observed lack of an association between discomfort intolerance and total minutes of moderate intensity exercise, when controlling for the influence of experiential acceptance, is logical given that moderate intensity exercise, in contrast to vigorous intensity exercise, is typically experienced as pleasant among healthy, normal weight individuals (Ekkekakis, Lind, & Vazou, 2010). Taken as a whole, the consistent relationships between exercise and experiential constructs suggest that participation in an intervention meant to specifically target psychological flexibility in the context of exercise may help to improve maintenance of exercise behavior over time.

Study Central Aims and Hypotheses

This dissertation seeks to address 3 central aims, as outlined below:

Aim 1. The first aim is to assess the feasibility of an ACT-based health coaching intervention versus a time-matched education-based health coaching intervention, and a no health coaching control intervention. Feasibility will be determined by assessing between group differences on participant retention/attrition, participant perceived program credibility/expected impact, participant satisfaction with the intervention program, intervention "dose" (e.g., number of exercise journals completed during the 30-day program), HR monitor use, and participant perceived ease of usability of the program materials (e.g., heart rate monitors and daily exercise journals).

Specifically, we will compare 4 sets of planned between-subjects comparisons: (1) the complex contrast of "health coaching vs. no-health coaching" (i.e., the combined effects of the ACT-based and education-based health coaching conditions versus the no-health coaching control condition), (2) the complex contrast of "ACT-based skills training vs. no ACT-based skills training" (i.e., the ACT-based condition versus the combined effects of the other two conditions), (3) the simple contrast of the "ACT-based health coaching condition vs. the education-based health coaching condition," and (4) the simple contrast of the "ACT-based health coaching condition vs. the no-health coaching control condition." It is hypothesized that (1) scores on indices of intervention feasibility will be comparable across conditions, if not more favorable for participants assigned to the ACT-based skills training condition, and (2) scores on indices of intervention feasibility for participants assigned to one of the two health coaching conditions will be comparable to scores for participants assigned to the no-health coaching control condition, if not more favorable.

Aim 2. The second aim of this dissertation is to test the effectiveness of a brief ACT-based health coaching intervention for increasing exercise behavior among physically inactive women, both in terms of exercise behavior adoption (study Phase 1) and maintenance (study Phase 2). In terms of the within-subjects effect of time, we predict that exercise behavior will increase during Phase 1 (from Visit 1 to Visit 2), and scores will remain higher than baseline at 3-months follow-up (for tests where 3 time points are available). However, it is unclear how exercise behavior may change from Visit 2 to 3-months follow-up, and thus, we will plan to explore post-hoc differences between scores at Visit 2 and 3-months follow-up pending a significant main effect of time result.

In terms of the between-subjects effects, it is hypothesized that exercise behavior at the end of Phase 1 may be similar among participants across conditions, however, the biggest between-condition effects will be observed during Phase 2 (maintenance). Specifically, based on past preliminary work in this area (Hawkes et al., 2013), it is hypothesized that participants enrolled in the ACT-based health coaching condition will engage in more exercise behavior over the course of the exercise maintenance phase, than will the participants enrolled in the education-based health coaching intervention and the no-health coaching control condition (individually and combined). To address this aim, we will again test the same 4 between-subjects planned contrasts described above.

Aim 3. Finally, the third aim of this dissertation is to assess change in proposed mechanisms of action – i.e., constructs purported to relate to "psychological flexibility" within the ACT framework. To this end, we will assess between group changes on psychological flexibility constructs from the start (Visit 1) to the end of the exercise intervention (Visit 2). It is expected that participants assigned to the ACT-based condition will show the greatest improvement on these measures as they will have been the only participants exposed to content specifically intended to facilitate skill acquisition in these areas. Again, we will plan to test the same 4 between-subjects contrasts specified above. Notably, the "health coaching vs. no health coaching" complex contrast will provide information regarding whether it is primarily the ACT-based skills content that yields improvement on psychological flexibility measures, or perhaps other non-specific factors transmitted via the participant-health coach dyad.

Lastly, in order to assess mechanisms of behavior change, we will test the strength of association between change in psychological flexibility constructs and change in exercise behavior completed during study Phases 1 and 2. If differences are observed across conditions on these psychological flexibility constructs, and if change in psychological flexibility constructs are significantly associated with change in exercise behavior scores, we will conduct follow-up path analyses to test the extent to which psychological flexibility constructs help explain changes in exercise behavior maintenance.

CHAPTER II

METHOD

Study Design

The Get *ACT*ive! Study was designed as a 3-month long, three-group, randomized controlled trial (RCT) for the promotion of exercise behavior adoption and maintenance among physically inactive women aged 21-65. The study was divided into two phases. Phase 1 was the exercise intervention/adoption phase; procedures during Phase 1 included a baseline data collection visit (Visit 1), a 30-day exercise intervention period with a daily exercise journal self-monitoring assignment, and an intervention-exit visit (Visit 2). Phase 2, the exercise maintenance phase, consisted of a follow-up assessment (conducted online) at 3-months post-intervention baseline. A detailed outline of all study visits and accompanying procedures is provided in Table 1.

Table 1

All Study Visits

Visit	Duration	Includes
Phase 1		
Visit 1 (ASAP after eligibility screen)	1.25 – 2 hours	- Overview of study procedures and measures - Informed consent - Assignment to condition - Administer Visit 1 assessment battery - Resting HR collection, calculate HR range for moderate and vigorous intensity exercise - Program HRM specific to participant - Description of exercise prescription - HRM use demonstration - Health coaching workshop (MAVC and EDUC conditions only) - Daily exercise journal assignment - Schedule visit 2 - Compensate participants $15
Begin 30-Day Cardiorespiratory Exercise Intervention	Goal = 150 minutes of cardiorespiratory per week (all participants)	-Daily exercise journal entries
Visit 2 (ASAP after end of 30-day exercise intervention)	.5 - 1 hour	- Return HRM - Health coaching booster workshop (MAVC and EDUC conditions only) - Administer Visit 2 assessment battery - Compensate participants $15 (for visit 2) - Compensate participants up to $30 ($1 per exercise journal completed).
Phase 2		
3-Month Post-Intervention Follow-Up	30 minutes	- Administer 3-Month Follow-up Survey (online) - Compensate participants with $10 Amazon gift card upon receipt of survey completion

Note. HR = heart rate; HRM = heart rate monitor; MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition.

Participants

A total of 207 individuals made contact with the study team and expressed interest in participating in the Get *ACT*ive! Study. Of these 207, a total of *N* = 119 met the study eligibility criteria and provided informed consent to participate in the research. Of these 119 participants, 6 completed the Visit 1 appointment and began the 30-day exercise program, but have yet to complete the Visit 2 appointment (follow-up appointment not yet due), 6 completed the Visit 1 appointment and began the 30-day exercise program, but dropped out of the research before completing the Visit 2 appointment, and 107 completed all components of the intervention (Visit 1, 30-day exercise program, and Visit 2). Thus, the sample that will be presented in the following analyses consists of the *N* = 113 participants who completed the Visit 1 appointment and were scheduled to have completed at least the Visit 2 appointment. See Figure 2 – CONSORT diagram.

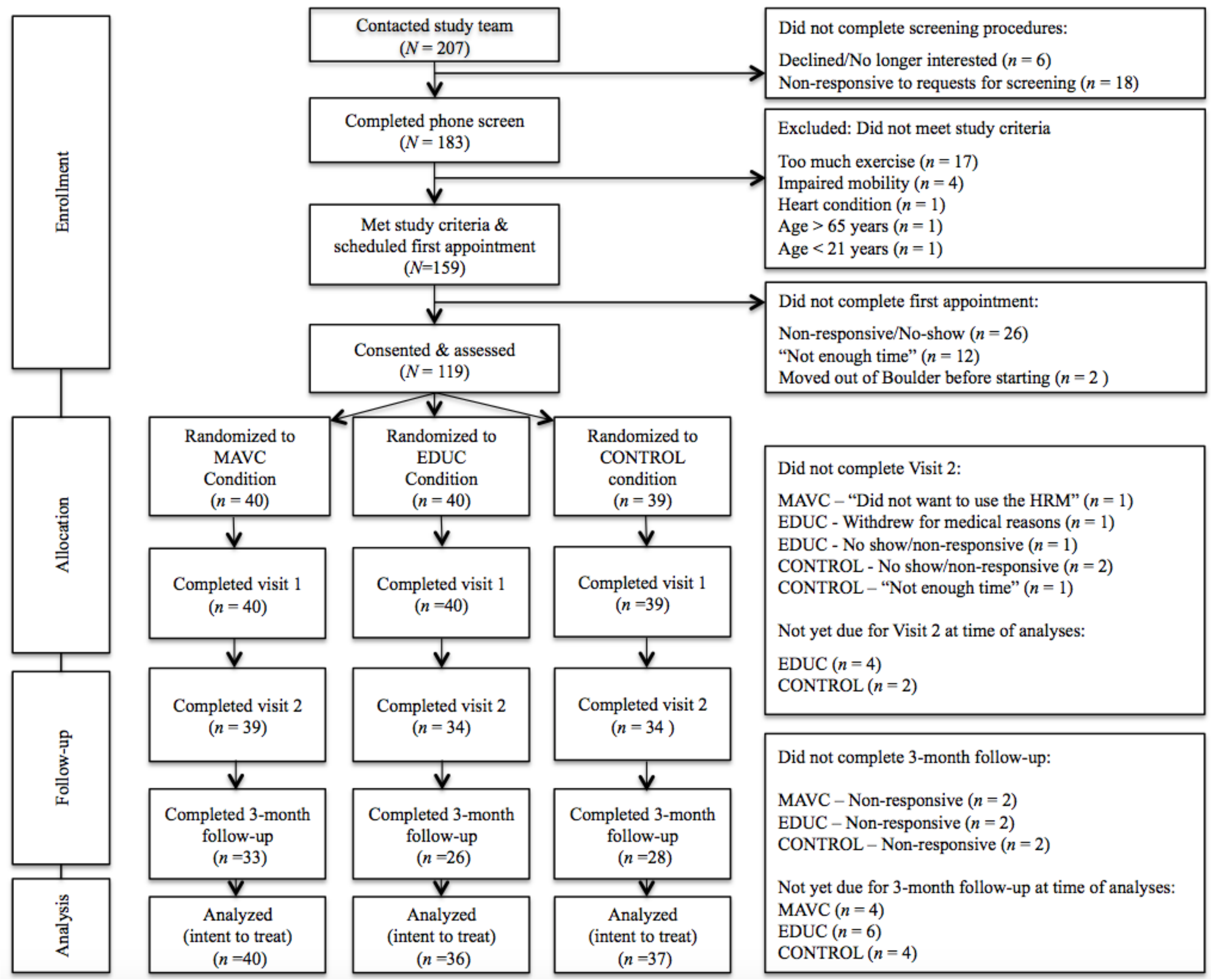


Figure 2. CONSORT diagram – Participant flow throughout the study. MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition; HRM = heart rate monitor.

Recruitment was conducted throughout the greater Boulder County area via flyers (posted on community bulletin boards, left in waiting rooms at community centers frequented by women – e.g., health clinics, churches/spiritual centers, coffee shops) and social media announcements (i.e., Craigslist, Facebook, University of Colorado listservs). Study recruitment materials described the opportunity to participate in a 30-day program designed to help women who exercise infrequently, or not at all, increase their exercise behavior. Age rage was selected to be consistent with NIH guidelines for "adult status" at the time of study recruitment (i.e., over 21 years of age; USDHHS, 2015), and guidelines for reducing the likelihood of an adverse event during exercise as assessed by the ACSM's recommended pre-exercise health screening measure, the Physical Activity Readiness Questionnaire (PAR-Q; Canadian Society for Exercise Physiology [CSEP], 2002; Garber et al., 2011).

Inclusion and exclusion criteria. Inclusionary and exclusionary criteria were established on the basis of known contraindications for moderate intensity exercise, as indicated by the PAR-Q, while purposefully keeping other aspects of inclusion criteria broad so as to balance generalizability and internal validity. Participants were eligible to participate in the present study if they were: (1) Female, (2) between ages 21-65, (3) insufficiently physically active for the past 3 months (i.e., did not meet ACSM guidelines for cardiorespiratory exercise – i.e., less than 150 minutes of moderate-vigorous cardiorespiratory exercise per week), (4) physically capable of safely engaging in at least moderate-intensity exercise with no health contraindications noted by the PAR-Q, (5) able and willing to access the Internet, (6) planning to remain in the Boulder County area for the next 30 days, and (7) willing to accept random assignment to condition.

Participants were explicitly ineligible to participate in the research if they were, (1) told by their doctor that they have a heart condition and should only do physical activity as prescribed by their doctor, (2) aware of chest pain during and/or not during physical activity, (3) prone to impaired balance (or loss of consciousness) from dizziness/light headedness, (4) aware of a muscle, bone, or joint problem or injury that limits movement, makes exercise painful, or could be made worse by exercising, (5) taking medication for a heart condition or high blood pressure, (6) currently prescribed psychotropic medications (antidepressant medication excluded) and/or diagnosed with a psychotic or neurological disorder, (7) currently receiving treatment of any kind for alcohol or drug abuse, and/or (8) currently pregnant or actively attempting to become pregnant.

Procedures Phase 1

Eligibility screening. Individuals who contacted the study team and expressed interest in participating were screened for eligibility. At the end of the eligibility screen, eligible individuals heard a presentation about the study and had the opportunity to ask any questions they had about participating. Eligible individuals who verbally indicated their willingness to participate were then scheduled for a Visit 1 appointment with the study team.

Orientation and informed consent. Upon arrival at the Visit 1 appointment, potential participants met with a research assistant to review the informed consent form. At this time, the research assistant reiterated the experimental procedures, compensations, risks and benefits of participating, the confidentiality of all data obtained, and the voluntary nature of all components of the study. Participants then had the opportunity to ask any questions they had about participating before being formally enrolled into the study.

Visit 1. After providing informed consent to participate in the research, participants were randomly assigned to one of three intervention conditions: (1) an ACT-based, mindful awareness, acceptance, and values clarity (MAVC) health-coaching condition; (2) a time-matched education-based (EDUC) health-coaching condition, or (3) a no-health coaching (CONTROL) condition. The assessments, exercise prescription, and study appointment schedules were the same across all three intervention conditions. Participants were run through study procedures one at a time.

Following assignment to condition, participants completed the Visit 1 Part 1 assessment battery and a measure of resting heart rate (HR) was collected after 5-minutes of seated rest (Pickering et al., 2005). While participants were completing survey measures on the computer, a research assistant used participants' resting HR to calculate estimated HR max values using the following formula, as recommended by the ASCM position stand for prescribing exercise to healthy adults (Garber et al., 2011; Gulati et al., 2010): HR max = 206 – (.88 × age). The research assistant then used participants' resting HR and HR max values to calculate HR reserve (HRR), which is the difference between HR max and resting HR (i.e., HRR = HR max – resting HR).

Exercise prescriptions. Personalized exercise intensity prescriptions for each participant were calculated as percent ranges of HRR according to the ACSM guidelines for moderate (40 – 59%HRR) and vigorous (60 – 89%HRR) intensity exercise: Target HR = %HRR + HR at rest (Garber et al., 2011). Percentage ranges of HRR for moderate and vigorous intensity were used for the exercise prescriptions in this study because prior work has found exercise prescriptions based on %HRR to be more accurate than prescriptions based on %HR max (Garber et al., 2011). Using each participant's information for age, weight, height, and HR max, the research assistant also programed a Polar FT60 HR monitor that each participant would be issued and asked to use to track her exercise behavior over the next 30 days.

Once participants completed the Visit 1 assessment battery, the research assistant demonstrated the use of the HR monitor and ensured that participants understood how to interpret HR value information during exercise, and how to operate the HR monitor to record exercise sessions. Next, the research assistant provided participants with instructions for the 30-day exercise prescription. All participants were told that they were being given the goal of accumulating 150-minutes or more per week of moderate-vigorous intensity exercise, but that they were free to choose what type exercise activities they would perform (as long as the activity sufficiently elevated their heart rate into at least the moderate intensity zone of their personalized prescription). Participants were told that this exercise goal was based on national guidelines for weekly exercise participation. All participants were also given a handout that provided information about their individual specific HR ranges for moderate and vigorous intensity cardiorespiratory exercise.

Intervention methodology. Procedures specific to participants assigned to each of the three intervention conditions are described in detail below.

CONTROL condition. Participants assigned to the CONTROL condition were provided information about their daily exercise journal self-monitoring assignment, scheduled for their Visit 2 follow-up appointment, and compensated $15 for their time.

The following rationale was provided to CONTROL participants regarding their daily exercise journal assignment:

> "Prior research shows that when people keep track of how often they exercise, they tend to exercise more frequently, that is why over the next 30 days we would like for you to record your exercise behavior in a daily journal. An electronic link to complete the exercise journal will be sent to your inbox each day and we would like for you to complete an entry every day for the next 30 days, even on days when you do not exercise."

Health coaching workshops. For participants randomized to one of the two health coaching conditions, immediately following completion of the exercise prescription and HR monitor instruction/demonstration procedures, a workshop instructor met one-on-one with the participant for approximately 45-60 minutes to complete the Visit 1 health coaching workshop procedures. The workshop instructors were 3 doctoral students in clinical psychology trained to disseminate workshop content in accordance with the workshop protocol scripts (for each of the two health coaching conditions, respectively). All health coaching workshop sessions were audio recorded, and recorded workshop sessions were reviewed periodically during study team meetings to help ensure adherence to the intervention content across workshop instructors and prevent drift.

Before leaving the Visit 1 appointment, participants assigned to the two health coaching conditions worked with their workshop instructor to schedule a time to come back for their Visit 2 appointment, and were compensated $15 for their time.

MAVC health-coaching condition. The protocol script used for this condition was adapted (with permission) from (a) Burtryn and Forman's PACT Workshop Manual for an Acceptance Based Behavioral Intervention to Promote Physical Activity, and (b) Burtryn and Forman's IMPACT Treatment Manual for an Acceptance Based Behavioral Intervention to Promote Physical Activity During Weight Loss Maintenance. Health coaching content for participants assigned to the MAVC condition emphasized skills for noticing (i.e., becoming more mindfully aware) and managing distressing thoughts and feelings in anticipation of, and during exercise. Workshop content also explicitly engaged participants in a discussion of their valued reasons for increasing their exercise behavior and their commitment to regular exercise participation over the next 30 days and beyond. All participants in this condition were provided a handout that outlined the Get *ACT*ive! Framework: (1) Accept your (exercise) experience and be present, (2) clarify your exercise related values, and (3) take action.

Participants were encouraged to fill out personalized sections of the handout during the course of the workshop. Regarding information given to MAVC participants about their daily exercise journals, these participants were given the following rationale:

> "Prior research shows that when people keep track of how they feel before, during, and after exercise, they tend to exercise more frequently. Additionally, we also think that it is important to make salient your reasons for being physically active – that is, to remind yourself of your exercise related values, and the extent to which your behavior is aligned, or not, with these values on a daily basis. Over the next 30 days we would like for you to record your exercise behavior, along with information regarding how you felt (before, during, and after exercise) and your perceived values alignment in a daily journal. An electronic link to complete the exercise journal will be sent to your inbox each day and we would like for you to complete an entry every day for the next 30 days, even on days when you do not exercise."

EDUC health-coaching condition. The protocol script used for this condition was adapted to outline content provided in a self-help work booklet (in the public domain), *Tips to Get You Active*, published by the National Institutes of Health (NIH, 2009, Publication No. 06-5578). Health coaching content for participants assigned to the EDUC condition emphasized didactic information dissemination regarding, primarily, the health benefits of exercise behavior. In addition to providing educational information, the *Tips to Get You Active* work booklet also included content regarding barrier identification and goal setting.

Participants in this condition were provided the NIH *Tips to Get You Active* work booklet as their Visit 1 handout, and a portion of this work booklet was re-introduced on the Visit 2 handout.

Regarding information given to EDUC participants about their daily exercise journals, these participants were given the following rationale:

> "Prior research shows that when people record details about their exercise behavior and performance, they tend to exercise more frequently. That is why over the next 30 days we would like for you to record your exercise performance behavior (i.e., total calories burned, average and max exercise bout HR values, perceived exertion and performance effort) in a daily journal. An electronic link to complete the exercise journal will be sent to your inbox each day and we would like for you to complete an entry every day for the next 30 days, even on days when you do not exercise. You will be able to retrieve information about your exercise bout performance from your heart rate monitor. Let's look at how to find that information on your heart rate monitor now."

30-day exercise program. Over the course of 30-days, participants exercised in locations of their choosing and submitted daily exercise journals. Research assistants monitored participants' completion of the daily exercise journals, and contacted participants if 3 or more days of entries were skipped. During these contacts, a research assistant would gently remind the participant of the daily exercise journal assignment, and also assess if any technical difficulties were preventing the participant from completing her journals. Participants were contacted about journal non-adherence up to 3 times. Participants who reliably submitted their exercise journals each day were not contacted until it was time to reach them with a reminder of their upcoming Visit 2 appointment (participants were contacted via email 1 week, and then again 1 day, before their scheduled Visit 2 appointment). All participants were told they could earn $1 for every exercise journal they completed over the course of the 30-day program (up to $30).

Visit 2. At the end of the 30-day exercise period, participants (all conditions) returned to the laboratory to complete the Visit 2 assessment battery, return their study-issued HR monitors, and receive a health coaching workshop booster session (if applicable – MAVC and EDUC participants only).

After completing the Visit 2 appointment, participants were no longer asked to engage in formal self-monitoring (i.e., in the form of filling out daily exercise journals) regarding their exercise behavior. Further, participants were not given any new information with respect to an exercise prescription at this appointment so as not to interfere with effects of intervention condition on self-directed exercise behavior maintenance. At the end of the Visit 2 appointment, participants were compensated $15 for their time that day, as well as up to $30 for completing their daily exercise journals during the 30-day exercise program ($1 for each journal completed). All participants were reminded that the research team would be contacting them to complete the 3-Month Follow-Up Survey via email.

Procedures Phase 2

Participants were not asked to return to the laboratory again following completion of the Visit 2 procedures. The central aim of Phase 2 of the Get *ACT*IVE! Study was to collect data regarding participants' exercise behavior in the time since they completed the 30-day exercise program. Participants were contacted via email by the study team with an encrypted link to complete the 3-Month Follow-Up Survey. Participants were able to click on the link and complete the survey from a location of their choosing. As compensation for completing this follow-up survey, participants were provided a $10 Amazon gift card. Participants who were non-responsive to email prompts to complete the follow-up survey were contacted via telephone and/or email by a member of the research team to inquire as to whether or not they wanted to continue participating in the research program.

Measures: Demographics

Participants answered a series of demographic questions that assessed information regarding their age, race/ethnicity, height/weight, highest level of education obtained, current employment, total household income, marital status, dependent children, and mental health status (see Table2). On average, participants were 39.22 years old (*SD* = 14.01; range: 21 - 65) and overweight as classified by BMI (*M* = 25.64, *SD* = 4.75; range: 16.64 – 46.64). Additionally, a majority of participants were White, well educated (majority had at least a Bachelor's degree), employed (majority were at least part-time, if not full-time employed), earning less than the average household income for the United States (i.e., $53,657; DeNavas-Walt & Proctor, 2014), either never married (*n* = 45) or married (*n* = 39), and living without dependent children in their homes (*n* = 67). Sample demographics are shown in Table 2. Screening analyses revealed no statistically significant between groups differences on demographic constructs at baseline.

Two measures, the Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001) and the Generalized Anxiety Disorder Scale (GAD-7; Spitzer et al., 2006), which are in the public domain and are thus, commonly administered in community mental health and primary care health centers, were used to briefly assess participants' mental health status at the time of study enrollment.

Depression symptom screening. The Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) is a 9-item screening instrument used to measure severity of depression symptomatology. Scores for each item range from 0 – 3; patients indicate whether they have been bothered by symptoms "not at all" (0 points), "several days in the past 2 weeks" (1 point), "more than half the days in the past 2 weeks" (2 points), or "nearly every day in the past 2 weeks" (3 points). Scale scores are then summed and scores of 5, 10, 15, and 20 represent mild, moderate, moderately severe, and severe depression, respectively. At baseline, on average, participants reported experiencing mild symptoms of depression during the past 2-weeks (M = 5.29, SD = 3.95); however, some participants (n = 14) did score within the moderate – severely depressed range on this measure (α = .801).

Anxiety symptom screening. The Generalized Anxiety Disorder Scale (GAD-7; Spitzer et al., 2006) is a 7-item screening instrument used to measure severity of generalized anxiety symptomatology. Scores for each item range from 0 – 3; patients indicate whether they have been bothered by symptoms "not at all" (0 points), "several days in the past 2 weeks" (1 point), "more than half the days in the past 2 weeks" (2 points), or "nearly every day in the past 2 weeks" (3 points). Scale scores are then summed and scores of 5, 10, and 15 are used as thresholds for indicating mild, moderate, and severe anxiety, respectively. At baseline, on average, participants were not experiencing elevated symptom levels of generalized anxiety (M = 4.14, SD = 3.79); however, some participants (n = 10) did score within the moderate – severely anxious range on this measure (α = .867).

Table 2

Participant Baseline Demographics

	Total (N = 113)				
	MAVC (n = 40) *M* (*SD*)	EDUC (n = 36) *M* (*SD*)	CONTROL (n = 37) *M* (*SD*)	Test Statistic	*p*
Age	40.95 (12.20)	39.14 (16.22)	37.43 (13.67)	F(2,110) = .602	.549
Race/Ethnicity: *N*				χ^2(10, N = 113) = 7.00	.726
American Indian or Alaska Native	1	1	0		
Asian	1	0	2		
Black	1	0	0		
Hispanic/Latina	4	3	3		
Multiracial	2	0	1		
White	31	32	31		
BMI (kg/m^2)	25.65 (5.01)	25.32 (4.51)	25.95 (4.80)	F(2,110) = .157	.855
BMI Category: N (%)				χ^2(6, N = 113) = 1.00	.986
Underweight < 18.5	1	1	2		
Healthy Weight / Normal Weight 18.5 – 24.9	19	16	17		
Overweight 25-29.9	12	13	11		
Obese 30 +	8	6	7		
Highest Level of Education: N (%)				χ^2(6, N = 113) = 19.04	.128
High-school diploma or GED	5	0	3		
Some post high-school education	5	10	6		
Bachelor's degree	15	14	20		
Advanced degree	15	12	8		
Employment				χ^2(8, N = 113) = 14.52	.069
Full-time employed, work 30 + hours per week	23	12	16		
Part-time, work < 30 hours per week	11	12	7		
Full time student	1	5	4		
Homemaker	2	0	5		
Unemployed, disabled, or retired	3	7	5		
Total Annual Household Income				χ^2(10, N = 111) = 12.35	.262
$0 – 19,999	8	13	10		
$20,000 – 39,999	11	9	7		
$40,000 -59,999	6	2	9		

$60,000 – 79,999	4	2	6		
$80,000 – 999,999	5	5	1		
$100,000 +	6	4	3		
Marital Status				$\chi^2(12, N = 113) = 15.27$	.227
Never married	15	17	13		
Divorced	5	3	3		
Widowed	1	0	0		
Separated	0	1	0		
Engaged	0	3	0		
Domestic partner	4	2	7		
Married	15	10	14		
Dependent Children in the Household				$\chi^2(2, N = 113) = 1.22$	.545
Yes	18	12	16		
No	22	24	21		
Brief Mental Health Screening:					
Patient Health Questionnaire (PHQ-9)				$F(2,110) = .325$	.723
Range: 0 – 19	4.90 (4.25)	5.61 (3.77)	5.41 (3.85)		
Generalized Anxiety Disorder Scale (GAD-7)				$F(2,110) = .298$	.743
Range: 0 – 18	4.13 (3.98)	4.50 (4.12)	3.81 (3.31)		

Note. *SD* = standard deviation; BMI = body mass index; MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition.

Measures: Intervention Feasibility Constructs.

Intervention retention. The total number of participants from each of the 3 conditions who completed the Visit 1 appointment and who were due for their Visit 2 and 3-month follow-up assessments will be used to assess intervention retention.

Intervention program credibility and expected impact. The original Credibility/Expectancy Questionnaire (CEQ; Devilly & Borkovec, 2000) is a 6-item questionnaire that was designed to measure treatment expectancy and rationale credibility for use in clinical outcome research. For the purposes of the present investigation, the CEQ was modified by replacing "therapy" and "treatment" with "the Get *ACT*ive! study" and "training program." In addition, the last two of the original six questions were not administered given low relevance to the context of an exercise intervention, and one question specifically inquiring about program credibility was added: "At this point, how would you rate the GET *ACT*IVE! program's credibility in terms of helping you to become more physically active/increase your exercise behavior?" where 0 = *no credibility* and 10 = *high credibility*). Thus, the adapted version of the CEQ used in this investigation was 5 items scored on an 11-point Likert scale (ranging from 0-10 and anchored to be specific to the item). For instance, "At this point, how effective do you think the GET *ACT*ive! program will be at helping you to become more physically active/increase your exercise behavior?" scored 0 = *not at all effective*, to 10 = *very effective*; and "At this point, how comfortable would you feel recommending the GET *ACT*IVE! program to a friend in need of similar support and instruction for becoming more physically active/increasing her exercise behavior?" 0 = *not at all comfortable,* to 10 = *very comfortable.* Responses were averaged across the 5 items (at each time point) to create composite scores ranging from 0 – 10. The CEQ was administered on both the Visit 1 and Visit 2 assessment batteries in order to assess for changes in participant credibility perceptions and expectations concerning the Get *ACT*ive! study from pre- to post-intervention (Visit 1, α = .917; Visit 2, α = .922).

Program satisfaction. Program satisfaction was measured using an 8-item Participant Satisfaction Questionnaire (PSQ-8). The PSQ-8 measure was created for the purpose of this investigation by modifying a validated measure of client satisfaction with psychotherapy treatment, the Client Satisfaction Questionnaire (CSQ-8; Attkisson & Greenfield, 1996). Participants were asked, "How would you rate the quality of support and instruction that you've received as a participant in the GET *ACT*IVE! study?" scored 1 = *poor*, to 4 = *excellent;* "How satisfied are you with the amount of support and instruction you have received as the result of participating in the GET *ACT*IVE! study?" scored 1 = *very dissatisfied*, to 4 = *very satisfied*; and "To what extent has the GET *ACT*IVE! study met your needs for increasing your exercise behavior?" scored 1 = *none of my needs have been met*, to 4 = *all of my needs have been met*. Responses were averaged across the 8 items to create a composite score ranging from 1 – 4. Additionally, the PSQ-8 has one qualitative question that asks participants if they have any comments, concerns, or suggestions about the program they would like to share with the study team. Responses to this question were examined qualitatively. The PSQ-8 was only administered at the Visit 2 appointment (α =.926).

Intervention dose: Exercise journal adherence. Completion of the daily exercise journals serves as a metric for each participants' intervention "dose." That is, the number of daily exercise journals completed out of 30 is an indicator of how much of the intervention the participant took part. The survey platform used to collect data for the daily exercise journals, Qualtrics, provides timestamp information regarding when a respondent begins and ends a survey. Adherence to the daily exercise journal self-monitoring assignment was assessed using these timestamp data.

Heart rate monitor use. In addition to reviewing objective data obtained from the returned HR monitors (see below), 3 additional pieces of information were collected from participants in order to assess use of the HR monitor over the course of the intervention. Specifically, a single item on the daily exercise journals asked participants to report whether or not they remembered to use their HR monitor on days when they reported exercising. Additionally, two questions on the Visit 2 survey asked, (1) “How often did you use the heart rate monitor you were given to record your exercise bouts over the past 30 days?” scored 0 = *never*, 1 = *rarely*, 2 = *sometimes*, 3 = *most of the time*, 4 = *every time*, and (2) “If you never or rarely used the heart rate monitor to record your exercise sessions, please tell us, why not?” response options: “too difficult to use,” “forgot to use,” “too uncomfortable,” “technical difficulties (e.g., could not get HR signal),” “another reason.” If participants selected “another reason” they were provided space to contribute their own response; these comments were examined qualitatively.

Program material usability (exercise journals and HR monitors). Two 4-item scales were created specifically for the purpose of assessing participants’ perceptions regarding the usability of two key intervention materials – the daily exercise journals and the HR monitors. Specifically, participants were asked how “helpful” and “effective” they found the exercise journals and the HR monitors (respectively) to be in terms of supporting their efforts to become more physically active/increase exercise behavior, scored 1 = *not helpful*, to 4 = *very helpful*; and 1= *not effective*, to 4 = *very effective*; the extent to which they “enjoyed” filling out the daily journals/using the HR monitors, scored 1 = *did not enjoy*, to 4 = *enjoyed very much*; and the degree of "effort" filling out the daily journals/using the HR monitors required, scored 1 = *no effort*, to 4 = *a lot of effort*. These measures were administered only at Visit 2.

Process evaluation. Two research assistants, uninformed of the central study aims and hypotheses, independently rated a random sample of 20% of the workshop 1, and 20% of the workshop 2 audio recordings according to a fidelity checklist, as recommended by Borrelli (2012). These checklists assessed 11 key intervention components (for both MAVC and EDUC conditions, respectively) for workshop 1, and 9 key intervention components (for both MAVC and EDUC conditions, respectively) at Visit 2. Inter-rater reliability analyses using the Kappa statistic were performed to determine consistency among raters for both workshop sessions.

The two research assistants also provided ratings for workshop instructor effectiveness and participant engagement during the Visit 1 and Visit 2 workshops; 10 effectiveness and engagement items were scored on a scale from 1 = *strongly disagree*, to 7 = *strongly agree*. For example, research assistants were asked to rate the extent to which, "The workshop leader had excellent rapport with the participant," "The workshop leader emphasized using workshop content in a way that would "work" for the participant," and "The workshop leader expressed that the participant would need to change her way of thinking about exercise in order to change her behavior" (reversed scored). Items 1 – 5 on this scale were validated by prior work from Bryan and colleagues (2009) to assess the fidelity of similar intervention content dissemination. Importantly, examination of scale descriptives indicated that Cronbach's alpha would be notably improved with the omission of items 8, 9 (reverse scored), and 10 (reverse scored); thus, the final workshop instructor effectiveness/participant engagement scale scores used in the analyses were composites of the 7 items averaged (at each time point) and ranged 1-7 (Visit 1 workshop, α = .709, Visit 2 workshop, α = .962). Fidelity checklists and workshop leader effectiveness/participant engagement ratings scales for both the Visit 1 and Visit 2 workshops are provided in Appendices A and B.

Measures: Exercise Behavior Constructs

Objective measure of exercise behavior – Polar FT60 HR monitors. At study Visit 1, all participants were given water resistant Polar FT60 HR monitors, programed to be specific to their personalized information regarding date of birth, height, weight, and HR max. Participants were instructed to use the HR monitor every time that they engaged in a purposeful bout of exercise over the course of their 30-day exercise program. Due to prohibitive costs, and the rolling enrollment nature of this study, it was not possible to have participants continue to use the HR monitors throughout Phase 2 of the study. Data extracted and used in analyses from participant HR monitors includes, (1) total minutes of exercise completed over the 30-day period, (2) total number of days the HR monitor was worn to record an exercise bout, and (3) average exercise bout HR. Bouts of activity from the HR monitors were screened to ensure the bout met criteria to be considered cardiorespiratory exercise of at least moderate intensity. This was done by comparing average HR score during the bout against participants' exercise HR prescription; if the average HR value for a bout was lower than the bottom end of that participant's moderate intensity HR zone prescription, the data from that recording were excluded from the final analyses. Additionally, instances of user error were removed[2]. Note that we also computed a "minutes per exercise day" variable by dividing the total number of exercise minutes completed over 30-days by the number of days exercise was indicated.

[2] Participants were instructed to only wear their HR monitors to record intentional bouts of moderate-vigorous intensity exercise. However, there were a number of instances where it appeared that participants were wearing their monitor to record their HR throughout the day (i.e., like a Fitbit), or had accidentally left the recorder running unstopped. We determined that recordings in excess of 10 hours that contained missing and/or no HR data, or average HR values close to participants' resting HRs would be considered "user error."

Subjective measures of exercise behavior. Four subjective measures of exercise behavior were used to collect information about the amount of exercise performed over the course of the study from baseline (Visit 1) through 3-months follow-up. These measures were:

Daily exercise journals. Over the course of the 30-day exercise intervention, participants were asked to fill out daily exercise journals. Although some of the information participants were asked to monitor on these journals differed by condition (i.e., monitoring of performance data for EDUC participants, monitoring of feeling states/affect and consistency with values for MAVC participants), all participants were asked to indicate whether or not they exercised that day, and if they did, what activity they performed and for how long they did it.

If participants forgot or neglected to record exercise journal entries on any day during their 30-day intervention, they would be presented with a calendar at their Visit 2 appointment displaying the days they had failed to record and asked if they could recall if they did any exercise on those days. If they did, they were asked what they did and how long they did it for, and later that information was added to the exercise journal data file and counted towards their total minutes. Note, however, non-completed journal entries were still counted as missing for the exercise journal adherence outcome (i.e., “journal entry days” – intervention “dose”).

Data utilized from the exercise journals included: (1) The total number of days exercise was performed over 30 days, and (2) the total number of exercise minutes completed over 30 days. As with HR data, reported bouts of exercise were screened to ensure the reported bout met criteria to be considered cardiorespiratory exercise of at least moderate intensity. Note, again, that we also computed a “minutes per exercise day” variable by dividing the total number of exercise minutes reported in the journals over 30-days by the number of days exercise was indicated.

Self-reported total cardiorespiratory exercise minutes. Participants were asked to report, during a typical 7-day period, how many total minutes they spend engaging in both moderate intensity and vigorous intensity cardiorespiratory exercise. Participants were given the following definition of cardiorespiratory exercise:

> "Cardiorespiratory exercise is defined as any sport or activity that works large groups of muscles, increases your heart rate and breathing rate, and is maintained continuously for a minimum of 10 minutes. Most daily activities such as, grocery shopping, cooking, or doing the laundry do not work your body hard enough to count toward the recommended minutes of cardiorespiratory exercise per week. Thus, moderate-vigorous cardiorespiratory exercise is exercise that you perform intentionally – not exertion that might arise from daily activities."

Next, participants were given the following definition of vigorous intensity exercise, and asked to reported how many total minutes they spend engaging in vigorous intensity exercise on average, per week:

> "Vigorous-intensity exercise activities are those that greatly increase the rate that you are breathing and the amount that you are sweating. Exercise at this level of intensity will cause your heart to beat rapidly and will make it difficult to say more than a few words without pausing for a breath. Here are some examples of activities that require a vigorous level of physical effort: Running, swimming laps, climbing flights of stairs, hiking up hills, interval training, or riding your bike uphill."

Finally, participants were given the following definition of moderate intensity exercise, and asked to reported how many total minutes they spend engaging in moderate intensity exercise on average, per week:

> "Moderate-intensity exercise activities are those that work you hard enough to raise your heart rate and cause you to break a sweat. One way to tell that you are exercising at a moderate intensity level is that you are able to talk, but not sing, the words to your favorite song. Here are some examples of activities that require a moderate level of physical effort: Brisk walking, jogging, trekking on mostly level ground, or riding your bike on mostly level ground."

Values for TOTAL minutes of moderate and vigorous intensity exercise were summed (at each time point) to yield a total cardiorespiratory minutes variable. These items were administered at all 3 time points.

7-day physical activity recall. The Stanford 7-Day Physical Activity Recall Assessment (PAR; Blair et al., 1985) is an interviewer-administered assessment of exercise behavior at various intensities. Participants are provided a definition of moderate-vigorous physical activity, and asked to report how many times in the past week they engaged in physical activity of at least moderate intensity for at least 30 or more minutes at a time. Next, participants are asked to recall all exercise bouts completed over the past 7 days where the activity performed was at least of moderate intensity. Thus, in total, this measure provides a value for the total number of minutes of exercise (that is at least moderate intensity) over the past 7 days. This scale was administered on the Visit 1 and Visit 2 assessment batteries only.

Voluntary exercise. The Voluntary Exercise Questionnaire (VEQ; Bryan & Rocheleau, 2002) is a 3-item measure of exercise performed over the last month and week. Participants first read a definition of cardiorespiratory exercise: “Any activity that uses large muscle groups, is done for at least 20 minutes, and is performed at a level that causes your breathing rate to be heavy and your heart to beat faster.” They then completed three items concerning their recent exercise behavior: (1) “In the past month only, how often did you engage in cardiorespiratory exercise?” scored 1 = *never,* to 7 = *often;* (2) “In the past month only, what is the average number of days per week that you engaged in cardiorespiratory exercise?” scored 0 – 7 days; and (3) “In the past week only, how many days did you engage in cardiorespiratory exercise,” scored 0 – 7 days. Responses to these items were summed to yield current exercise behavior scores (at each time point) ranging from 1 – 21. This scale was administered at all 3 time points (Visit 1, α = .689, Visit 2, α = .870, 3-month follow-up, α = .891).

Measures: Psychological Flexibility Constructs

Experiential Acceptance. The Physical Activity Acceptance Questionnaire (PAAQ; Butryn et al., 2015) is a 10-item scale used to measure a person's ability to accept physical and psychological discomfort in the context of exercise. All items on the PAAQ are rated on a 7-point Likert scale scored, 1 = *strongly disagree* to 7 = *strongly agree.* Experiential acceptance is a stance of openness to the present experience (i.e., one's thoughts and feelings) without attempts to modify, suppress, or terminate that experience in any way. Thus, participants who strongly endorse questions such as, "I avoid exercising if it is going to make me feel physically uncomfortable, bored, or pressed for time," and/or "If I were to have the thought, exercising today won't be enjoyable, it would likely derail me from my exercise plan," are low on experiential acceptance. Conversely, participants who strongly agree with items such as, "When I start to feel out of breath or tired during exercise I usually find a way to keep going," and/or "I can tolerate discomfort (e.g., fatigue, boredom, sweating) while I am exercising" are high on experiential acceptance. Responses to these items were summed to yield PAAQ total scores (at each time point) ranging from 10 – 70 where higher scores represent stronger experiential acceptance. This scale was administered on the Visit 1 and Visit 2 assessment batteries only (Visit 1, α = .841, Visit 2, α = .850).

Discomfort intolerance. The Discomfort Intolerance Scale (DIS; Schmidt, Richey, & Fitzpatrick, 2006) is a brief, 6-item measure assessing participants' general difficulty managing and regulating physical distress and discomfort. Items on this measure are scored on a 6-point Likert scale from 1 = *not at all like me*, to 6 = *very much like me* and represent the extent to which participants perceive themselves as being unable to tolerate discomfort. For instance, participants who strongly endorse items such as, “When I begin to feel physically uncomfortable, I quickly take steps to relieve the discomfort,” are high on discomfort intolerance, whereas participants who strongly endorse items such as, “I can tolerate a great deal of physical discomfort,” are low on discomfort intolerance. Responses to these items were summed to yield DIS total scores (at each time point) ranging from 6 – 36. All items were coded such that stronger agreement with each DIS item indicates greater discomfort intolerance. This scale was administered on the Visit 1 and Visit 2 assessment batteries only (Visit 1, α = .815 and Visit 2, α = .872).

Defusion. The Drexel Defusion Scale (DDS; Forman et al., 2012) is a 10-item scale used to measure participants’ ability to psychologically distance themselves from negative thoughts and feeling states. Items on this measure are rated on a 6-point Likert scale from 0 = *not at all*, to 5 = *very much* representing the extent to which participants are typically able to defuse from each type of internal experience. For example, “You see your favorite food and have the urge to eat it, to what extent would you normally be able to defuse from cravings for food?” Also, “Imagine you are having a thought such as, ‘‘*I can’t do this’’* or ‘‘*I just can’t get started*,’’ to what extent would you normally be able to defuse from thoughts about motivation or ability?” Because the concept of defusion is not a well-known psychological construct, the DDS begins with a very thorough set of instructions:

> “Defusion” is a made up term that is used in psychology to describe a state of achieving “distance” from internal experiences like thoughts, feelings, cravings and physical sensations like pain or discomfort…
>
> Getting some “distance” from your thoughts allows you to see them for what they are. When you think a thought, it “colors” your world. When you see a thought from a distance, you can still see *how* it “colors” your world (you understand what it means), but you also see that you are doing the “coloring.” In other words, you are the observer of

> your thoughts.
>
> For example, you may do something embarrassing and have the thought, ‘‘I’m such an idiot!’’ If you are able to defuse from this thought, you will be able to see it as just a thought (i.e., “I’m having the thought that I am an idiot”). You can see that the thought is something in your mind that may or may not be true. If you are not able to defuse, you might take the thought as literally true (i.e., “I really am an idiot”), and your feelings and actions would likely be impacted as a result.
>
> Similarly, when you are defused from an emotion you can see yourself having the emotion, rather than simply being in it. When you are defused from a craving or a sensation of pain, you do not just experience the craving or pain, you see yourself having them. Defusion allows you to see thoughts, feelings, cravings, and pain as simply processes taking place in your brain. The more defused you are from thoughts or feelings, the less automatically you act on them.
>
> Based on this definition of defusion, please rate each scenario below according to the extent to which you would normally be in a state of defusion in the specified situation.
>
> *Important:* you are not being asked about the degree to which you would think certain thoughts or feel a certain way, but the degree to which you would be able to defuse from the example thoughts and feelings if you were to experience them.”

Responses to DDS items were summed to yield DDS total scores (at each time point) ranging from 0 – 50. Stronger agreement with each DDS item indicates better ability to defuse from thoughts and feelings. This scale was administered on the Visit 1 and Visit 2 assessment batteries only (Visit 1, α = .842, Visit 2, α = .839).

Exercise-specific defusion. In order to assess participants’ ability to psychologically distance themselves from negative thoughts and feeling states in the context of exercise behavior, in particular, a 10-item “Boulder” Defusion Scale (BDS: Stevens & Bryan, in prep) was developed for the purposes of this study (items were pilot tested ahead of time). The BDS was designed to be similar in content to each item on the DDS, but asked with respect to an exercise context. For example, “While exercising, you are breathing heavy, your heart is pounding, and your legs are burning from muscle fatigue, to what extent would you normally be able to defuse from physical discomfort during exercise?” Also, “Imagine you are having thoughts like, “*I’ll* *never be able to keep this up long term*," or "*I don't think I can find time to exercise regularly*," to what extent would you normally be able to defuse from thoughts about not maintaining an exercise routine?"

The full list of 10 items on BDS is provided in Appendix C. As is the case for the DDS, items on the BDS are rated on a 6-point Likert scale from 0 = *not at all*, to 5 = *very much* representing the extent to which participants are typically able to defuse from each type of internal experience. Stronger agreement with each BDS item indicates better ability to defuse from negative thoughts and feelings as they arise in the context of exercise. Responses to these items were summed to yield BDS total scores (at each time point) ranging from 0 – 50. This scale was administered on the Visit 1 and Visit 2 assessment batteries only (Visit 1, $\alpha = .911$, and Visit 2, $\alpha = .906$).

Mindfulness. The Philadelphia Mindfulness Questionnaire (PHLMS; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008) is a 20-item scale designed to measure two dimensions of mindfulness: present moment awareness and non-judgment/acceptance. For instance, participants who strongly endorse items such as, "I am aware of what thoughts are passing through my mind," and/or "I notice changes inside my body like my heart beating faster or my muscles getting tense," are high on present moment awareness. Conversely, participants who strongly endorse items such as, "I tell myself that I shouldn't have certain thoughts," and/or "I try to distract myself when I feel unpleasant emotions," are low on non-judgment/acceptance. All items on this measure are rated on a 5-point Likert scale scored, 1 = *never* to 5 = *always.* Responses to these items were summed to yield PHLMS total scores (at each time point) ranging from 20 – 100. On the overall scale, all items are coded such that stronger agreement with each PHLMS item indicates greater mindfulness skill (more acute present moment awareness, greater non-judgmental/accepting stance towards one's experience). This scale was administered on the Visit 1 and Visit 2 assessment batteries only (Visit 1, α = .819, Visit 2, α = .854).

Exercise values. Four items assessing participants' alignment with common exercise-related values were created for the purpose of this study. These items were based on prior qualitative research conducted by Segar and colleagues (2011) showing these 4 valued domains as the most commonly reported reasons for valuing exercise among a large sample of middle-aged women. These items were administered on the Visit 1 assessment battery only. For the purposes of the present study, participants were given the following instructions:

> "Below are statements regarding commonly reported reasons for valuing exercise. Please tell us the extent to which you agree with each of these statements on a scale from 1 = *strongly disagree* to 10 = *strongly agree*.

(1) "I value exercise because I believe being physically active will have a positive impact on my health as I age, and help me to prevent illnesses like cancer or heart disease later in life."

(2) "I value exercise because I believe being physically active will have a positive impact on my current health."

(3) "I value exercise because I believe being physically active will have a positive impact on my weight and/or physical appearance."

(4) "I value exercise because I believe being physically active has immediate benefits for my day-to-day quality of life."

CHAPTER III

RESULTS

Planned Analyses to Address Study Aim 1

The first aim of this dissertation concerns the feasibility of the 2 health coaching intervention conditions versus CONTROL, and the MAVC intervention versus the EDUC and CONTROL intervention conditions (independently and combined). In order to address questions of intervention feasibility, as outlined by study Aim 1, we ran a series of between group tests with planned comparisons and explored descriptive statistics across constructs.

Intervention attrition. As noted in Figure 2, a total of $N = 6$ participants withdrew from the study before study Visit 2, and an additional 7 were lost to attrition by the 3-month follow-up survey (total N =13 lost to attrition). Chi-square tests of independence were run to assess for differential dropout rates across conditions at both time points (coded 0 = retained, 1 = dropped). Results revealed no significant between group differences on drop-out at Visit 2, $\chi^2(2, N = 113) = 1.21$, $p = .546$, or 3-months follow-up, $\chi^2(2, N = 113) = .266$, $p = .875$, see Table 3.

Intervention program credibility and expected impact. A one-way ANOVA was conducted to assess between condition differences on credibility/expected impact scores (CEQ) at baseline (Visit 1); no significant between condition differences were observed, $F(2,110) = .626$, $p = .537$, $\eta^{2\,=}$ .011. Across conditions, average credibility/expected impact scores were high at both Visit 1 ($M = 8.87$, $SD = 1.41$) and Visit 2 ($M = 8.01$, $SD = 2.13$). To test for between group differences on credibility/expectancy scores at the end of the intervention (Visit 2), we ran a one-way analysis of covariance (ANCOVA) controlling for CEQ scores at Visit 1. The overall model was statistically significant, $F(2,104) = 4.23$, $p = .017$, $\eta^{2\,=}$ .077. Examination of complex contrasts revealed that MAVC participants perceived their intervention program to be more credible/expected a greater impact compared to participants in the other two conditions (EDUC & CONTROL) conditions, p = .005, Cohen's d = .469. Additionally, a trend was observed such that participants assigned to one of the two health coaching conditions perceived their intervention program to be more credible/expected a greater impact compared to participants assigned to the CONTROL condition, p = .062, Cohen's d = .179. However, simple contrasts revealed that participants assigned to the MAVC condition perceived their intervention program to be more credible/expected a greater impact compared to participants in the CONTROL, p = .007, Cohen's d = .480, and EDUC conditions, p = .036, Cohen's d = .457, respectively, suggesting that the effect was largely driven by scores from MAVC participants, see Table 3.

Program satisfaction. Overall, participants reported a high degree of satisfaction with their respective intervention condition as measured by the PSQ-8 (M = 3.46, SD = .61). Although the overall omnibus test for differences across group means was not statistically significant, $F(2,104) = 1.59$, p = .208, $\eta^{2} =$ .030, the complex contrast comparing MAVC vs. the combination of EDUC & CONTROL was marginal, p = .080, Cohen's d =.292, as was the simple contrast between MAVC vs. CONTROL, p = .106, Cohen's d =.243, suggesting a trend for participants to be more satisfied with receiving the ACT-skills based content versus the educational content or no content. All other pairs of planned complex and simple contrasts were non-significant, see Table 3.

Intervention dose: daily exercise journal adherence. On average, across all conditions, participants completed 26.84 (SD = 6.34) out of 30 possible daily exercise journals. Adherence ranged from 0 – 30 journals completed, with the majority of participants, n = 69, completing all 30 journals. A one-way ANOVA revealed that groups did not differ significantly on the number of daily exercise journals completed out of 30 days, $F(2,109) = 1.58$, $p = .210$, $\eta^2 = .028$; and all pairs of planned complex and simple contrasts were also non-significant, see Table 3.

Heart rate monitor use. Heart rate monitor use during the course of the 30-day exercise program was assessed using both subjective and objective metrics, as discussed below.

Subjective reporting of heart rate monitor use. In order to compute a HR monitor subjective use score for each participant, we divided the number of days participants reported remembering to wear their HR monitor by their total number of exercise days, as reported in their journals (subjective HRM use – “computed” score). Overall, participants reported wearing their HR monitor to record their exercise sessions 77.51% (*SD* = 23.34%) of the time. A one-way ANOVA revealed that groups did not differ significantly on scores of subjective HR monitor adherence, $F(2,104) = 1.52$, $p = .225$, $\eta^2 = .038$; and all pairs of planned complex and simple contrasts were also non-significant, see Table 3.

As a second method of assessing HR monitor use over the course of the 30-day exercise program, a single item on the Visit 2 survey asked participants to report, using a 5-point Likert scale, how often they used the HR monitor to record their exercise bouts over the past 30 days (subjective HRM use – “self-reported” score). On average, participants reported using the HR monitor “most of the time” ($M = 2.98$, $SD = .905$), and a one-way ANOVA again showed no significant differences across groups, $F(2,104) = 1.66$, $p = .195$, $\eta^2 = .033$; all pairs of planned complex and simple contrasts were also non-significant, see Table 3.

Participants who reported “never” or “rarely” using their study issued HR monitors during the 30-day exercise program, $n = 7$, were asked to let the study team know what barriers got in their way. Participants responded: “I forgot,” $n = 1$, “it was too uncomfortable,” $n = 1$, “my watch was stolen,” $n = 1$, “I thought it would be too complicated to understand,” $n = 1$, “I already owned another monitor," *n* = 1, "I disliked the look of the monitor" *n* = 1, and "it made me feel bound to a standard – nervous that my heart rate might not be good enough," *n* = 1.

Table 3

Summary of Between Group Frequencies and Means: Feasibility Constructs

	M (*SD*)		
Construct	MAVC	EDUC	CONTROL
Intervention attrition at Visit 2: *n*	1	2	3
Intervention attrition at 3-months follow-up: *n*	4	4	5
Credibility and expected impact (CEQ)[1]	**8.60 (1.46)**	**7.61 (2.67)**	**7.73 (2.08)**
Program satisfaction (PSQ-8)[2]	**3.56 (.498)**	**3.36 (.690)**	**3.43 (.622)**
Daily exercise journal adherence: *n*	25.85 (6.52)	28.37 (4.91)	26.49 (7.18)
Subjective HRM use – computed[3]: %	71.58 (22.30)	82.31 (24.29)	78.34 (22.82)
Subjective HRM use – self-reported[4]	3.03 (.707)	2.76 (1.06)	3.15 (.906)
Objective HRM use: *n* days	13.67 (7.01)	13.70 (8.34)	12.88 (6.87)

Note. *SD* = standard deviation; HRM = heart rate monitor; MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. **Bolded text** highlights significant or marginal differences in means across conditions.

[1] CEQ = Credibility/Expectancy Questionnaire. Higher scores reflect greater credibility/expected impact (scale range: 0-10).

[2] PSQ-8 = 8-item Participant Satisfaction Questionnaire. Higher scores reflect more satisfaction (scale range: 1-4).

[3] Computed as the number of days participants reported remembering to wear their HR monitor divided by their total number of exercise days as reported in their journals.

[4] Measured using a single item, "How often did you use the heart rate monitor you were given to record your exercise bouts over the past 30 days?" (scale range: 0 = *never* to 4 = *every time*).

Objective heart rate monitor use. The HR monitor recordings (data extracted from participants' study-issued Polar FT60 HR monitors) provided additional, objective, data regarding HR monitor adherence ("Objective HRM use"). On average, participants wore their HR monitors on 13.42 (*SD* = 7.31; range 1 to 30) days out 30. A one-way ANOVA again showed no significant differences across intervention groups, $F(2,100) = .134$, $p = .875$, $\eta^{2\,=}$ .003; and all pairs of planned complex and simple contrasts were also non-significant, see Table 3.

In order to examine the strength of association between objective and subjective reports of HR monitor adherence, we estimated the bivariate correlations between (1) subjective HRM use – "computed" scores, (2) subjective HRM use – "self-reported" scores, and (3) objective

HRM use scores. Small/moderate to large, positive relationships were observed between all pairs of constructs suggesting that these measures were measuring similar underlying content. Notably, the strength of these correlations was strongest between the two subjective measures, and the weakest between the objective and subjective – self-reported item, see Table 4.

Table 4

Bivariate Correlations among HR Monitor Adherence Constructs

Construct	1	2	3
1. Subjective HRM use – computed[1]	–	.639**	.322**
2. Subjective HRM use – self-reported[2]: %		–	.219*
3. Objective HRM use			–

Note. HRM = heart rate monitor; * $p < .05$, ** $p < .01$.

[1] Computed as the number of days participants reported remembering to wear their HR monitor divided by their total number of exercise days as reported in their journals.

[2] Measured using a single item, "How often did you use the heart rate monitor you were given to record your exercise bouts over the past 30 days?" (scale range: 0 = *never* to 4 = *every time*).

Program material usability (exercise journals and HR monitors). Two, 4-item measures assessed participants' perceptions regarding the usability of the daily exercise journals and the HR monitors. Descriptive statistics were run for all 4 items on both scales (the 4 exercise journal items and the 4 HR monitor items) in order to assess how participants felt about each aspect of the materials' usability. The majority of participants reported enjoying using the exercise journals and HR monitors, found them to be effective and very helpful, but did find that they required some amount of effort to use. No significant between group differences were observed on these items as assessed by chi-square tests of independence, see Table 5.

Table 5

Summary of Between Group Frequencies and Chi-Square Tests of Independence: Usability of Key Intervention Items

	Exercise Journals			HR Monitor		
	MAVC (*n*)	EDUC (*n*)	CONTROL (*n*)	MAVC (*n*)	EDUC (*n*)	CONTROL (*n*)
Helpfulness	$\chi^2(6, N = 107) = 6.380, p = .382$			$\chi^2(6, N = 107) = 7.034, p = .318$		
Not helpful	2	1	5	0	0	2
Somewhat helpful	4	4	7	4	5	3
Helpful	10	10	10	8	3	4
Very helpful	23	15	15	23	23	23
Effectiveness	$\chi^2(6, N = 107) = 3.489, p = .745$			$\chi^2(6, N = 107) = 6.798, p = .340$		
Not effective	3	5	2	0	0	2
Somewhat effective	6	7	7	3	6	4
Effective	12	12	12	10	5	7
Very Effective	18	10	12	22	20	19
Enjoyment	$\chi^2(6, N = 107) = 2.165, p = .904$			$\chi^2(6, N = 107) = 3.886, p = .692$		
Did not enjoy	5	6	4	3	3	2
Somewhat enjoyed	17	13	12	2	4	5
Enjoyed	12	10	14	11	6	11
Enjoyed very much	5	5	3	19	18	14
Effort	$\chi^2(6, N = 107) = 12.608, p = .053$			$\chi^2(6, N = 107) = 7.693, p = .261$		
No effort	6	9	15	8	12	8
Some effort	25	20	18	17	14	18
Moderate effort	7	4	0	10	3	5
A lot of effort	1	1	0	0	2	1

Note. HR = heart rate; MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition.

Workshop process evaluation. The process evaluation showed that the MAVC and EDUC health coaching intervention workshops were implemented with a high degree of fidelity. In order to provide workshop leaders some liberty to tailor conversations with participants on a case-by-case basis, workshop scripts were not intended to be read strictly verbatim. Thus, based on recommendations by Borrelli (2011) that 80% content adherence be considered a benchmark for high fidelity of intervention implementation, workshop 1 and 2 recordings were considered to be in compliance with critical program content if 9 out of 11 of the workshop 1 checklist items were covered, and 8 out of 9 of the workshop 2 checklist items were covered. All sessions reviewed met these guidelines. Raters determined that for MAVC workshops, workshop leaders covered *M* = 10.69 (*SD* = .87) checklist points during the workshop 1 sessions, and *M* = 8.93 (*SD* = .99) checklist points during the workshop 2 sessions. For EDUC workshops, raters determined that workshop leaders covered *M* = 10.94 (*SD* = .44) checklist points during the workshop 1 sessions, and 9.00 (*SD* = .39) checklist points during the workshop 2 sessions. Strong inter-rater agreement was observed for checklist item content for workshop 1, κ = .962 (95%CI, .933 - .991), $p < .001$, and workshop 2, κ = .900 (95%CI, .842 - .957), $p < .001$.

Overall, workshop instructor effectiveness/participant engagement scale ratings for workshops 1 and 2 were high (workshop 1: *M* = 6.73, *SD* = .306; workshop 2: *M* = 6.82, *SD* = .525). One-way ANOVAs were run to compare workshop instructor effectiveness/participant engagement ratings across conditions at both time points; results revealed a statistically significant main effect of condition for the workshop 1 recordings, such that ratings were slightly higher for MAVC workshops (*M* = 6.88, *SD* = .119) than for EDUC workshops (*M* = 6.57, *SD* = .306), $F(1,30) = 10.996$, $p = .002$, $\eta^{2 =}$ .268; but differences between the MAVC (*M* = 6.57, *SD* = .306) and EDUC (*M* = 6.57, *SD* = .306) recordings were not significantly different for workshop 2, $F(1,26) = .057$, $p = .483$, $\eta^{2 =}$ .019.

Planned Analyses to Address Study Aim 2

The second aim of this dissertation concerns the effectiveness, in terms of increasing exercise behavior and impacting maintenance over time, of the 2 health coaching intervention conditions versus CONTROL, and the MAVC intervention versus the EDUC and CONTROL intervention conditions. In order to assess hypotheses associated with Aim 2, we ran a series of between group tests with planned comparisons and evaluated change over time (study Phases 1 and 2) using repeated measures analyses.

Baseline exercise behavior. One-way ANOVAs were conducted to assess between condition differences on exercise behavior at baseline (Visit 1); no significant between group effects were observed suggesting successful randomization to condition, see Table 6. We also estimated bivariate correlations in order to understand the strength of association between self-reported exercise constructs before the start of the intervention. Moderate, positive correlations were observed between all pairs of constructs suggesting that these measures were measuring similar underlying content, see Table 7.

Table 6

ANOVAs for Between Group Differences at Baseline: Exercise Constructs

	M (*SD*)					
Construct	MAVC	EDUC	CONTROL	*F* test	*p*	η^2
Self-reported exercise minutes[1]	73.63 (60.83)	106.97 (150.87)	89.62 (130.53)	$F(2,110) = .746$	.477	.013
PAR total minutes[2]	48.92 (49.02)	83.47 (106.76)	61.65 (66.60)	$F(2,110) = 1.93$	.149	.034
Voluntary exercise behavior[3]	6.40 (3.41)	6.67 (4.30)	6.46 (3.02)	$F(2,110) = .056$	.945	.001

Note. *SD* = standard deviation; MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition; PAR = 7-day Physical Activity Recall assessment.
[1] Total self-reported minutes of moderate-vigorous intensity exercise completed during an average week.
[2] Total minutes of moderate-vigorous intensity exercise completed in the past week as assessed by an interviewer.
[3] Measured using the Voluntary Exercise Questionnaire (VEQ); higher scores reflect more exercise (scale range: 2-21).

Table 7

Bivariate Correlations among Exercise Self Report Measures at Baseline

Construct	1	2	3
1. Self-reported exercise minutes[1]	–	.396**	.393**
2. PAR total minutes[2]		–	.446**
3. Voluntary exercise behavior[3]			–

Note. ** $p < .01$.
[1] Total self-reported minutes of moderate-vigorous intensity exercise completed during an average week.
[2] Total minutes of moderate-vigorous intensity exercise completed in the past week as assessed by an interviewer.
[3] Measured using the Voluntary Exercise Questionnaire (VEQ); higher scores reflect more exercise (scale range: 2-21).

Exercise completed during the 30-day exercise program. In order to assess how exercise completed over the 30-day exercise program differed by condition, we ran a series of one-way ANOVAs using data obtained from the daily exercise journals and the HR monitors.

Note, results for the number of objectively recorded exercise days (via the HR monitor) is reported under the Aim 1 results section above. Thus, test results are not repeated for between-group differences on that construct here.

With the exception of minutes of exercise per exercise day as reported in the daily journals, means for the MAVC condition were the highest across all tests performed (indicating more exercise completed). However, no significant between group differences were observed across the five omnibus tests. Still, planned comparison tests revealed the complex contrast comparing MAVC vs. the combination of EDUC & CONTROL on total number of daily journal exercise minutes was marginal, $p = .075$, Cohen's $d = .342$; as was the simple contrast between MAVC vs. CONTROL on the same measure, $p = .072$, Cohen's $d = .403$. The pattern of means was such that, for both comparison tests, MAVC participants reported a higher total number of exercise minutes in the daily journals, see Table 8.

When interpreting the total minute values from the exercise journals and the HR monitor, it is helpful to consider what these values mean in terms of whether or not the goal of achieving "sufficiently active" status (150 minutes of exercise per week) was met or not. Achieving this goal could also be represented as the total number of minutes per day necessary to reach 150 minutes per week – i.e., 150 minutes/7 days = 21.43 minutes of exercise per day. Translating this value to be on the same metric as the total minute values measured by the daily journals and HR monitors provides the total minute value needed to reach the threshold of "sufficiently active" by the end of the intervention, – i.e., 21.43 X 30 days = 642.86. Thus, participants achieving a total of 642.86 minutes or more of exercise over the course of 30-days would be considered in compliance with guidelines for weekly moderate-vigorous intensity exercise. Examining the between group means for total minutes of exercise as reported by the daily journals, it is clear that on average, participants in all three conditions meet the threshold for "sufficient" weekly exercise. However, examining the between group means for total minutes of exercise as measured *objectively* by the HR monitors, only participants in the MAVC condition were meeting threshold for "sufficient" weekly exercise.

Table 8

ANOVAs for Between Group Differences on Exercise Behavior During the 30-Day Program

	M (*SD*)					
Construct	MAVC	EDUC	CONTROL	*F* test	*p*	η^2
Daily journal total exercise days	16.20 (6.02)	13.94 (8.30)	14.12 (7.41)	*F*(2,109) = 1.16	.318	.021
Daily journal total minutes	**886.45 (575.70)**	**739.43 (461.14)**	**679.47 (442.44)**	*F*(2,109) = 1.76	.177	.031
Daily journal minutes per exercise days	55.20 (26.37)	56.99 (24.27)	49.81 (22.51)	*F*(2,109) = .824	.441	.015
HRM total minutes	**659.64 (496.85)**	**591.07 (347.78)**	**517.15 (361.759)**	*F*(2,103) = 1.07	.346	.021
HRM minutes per exercise day	54.66 (38.06)	54.13 (31.40)	47.06 (20.42)	*F*(2,103) = .638	.530	.013

Note. *SD* = standard deviation; HRM = heart rate monitor; MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. **Bolded text** highlights significant, marginal, or notable differences in means across conditions.

Additionally, we estimated bivariate correlations between exercise constructs (total minutes, and minutes per exercise day) collected subjectively in the daily exercise journals, and objectively using the HR monitors. Small to large, positive relationships were observed between all pairs of constructs, again, suggesting that the measures were measuring similar underlying content, see Table 9. Notably, this is an impressive result as this level of agreement between objectively and subjectively measured exercise behavior is somewhat uncommon in exercise research (Prince et al., 2008).

Table 9

Bivariate Correlations among Daily Exercise Journal and HR Monitor Data

Construct	1	2	3	4
1. Daily journal total minutes	–	.452**	.676**	.269**
2. Daily journal minutes per exercise day		–	.194*	.380**
3. HRM total minutes			–	.442**
4. HRM minutes per exercise day				–

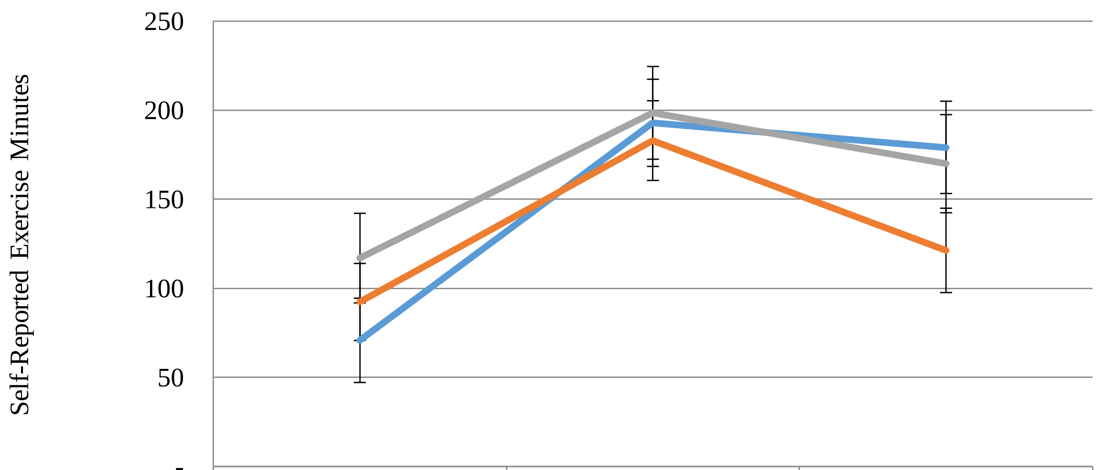
Note. HRM = heart rate monitor; * $p < .05$, ** $p < .01$.

Change in exercise behavior over time. Next, a series of mixed ANOVAs where condition (MAVC, EDUC, CONTROL) was the between subjects variable, and time (Visit 1, Visit 2, 3-months follow-up) was the within-subjects variable were performed in order to determine change in exercise behavior from baseline (Visit 1) through Phase 2 (3-months follow-up).

Self-reported exercise minutes. A statistically significant main effect of time was observed for change in self-reported total minutes of moderate-vigorous intensity exercise performed during an average week, $F(2,160) = 16.23$, $p < .001$, $\eta^2 = .169$. Additionally, examination of the within-subjects contrasts revealed a statistically significant quadratic effect of time, $F(1,80) = 20.30$, $p < .001$, $\eta^2 = .202$. The pattern of means suggests that self-reported minutes of exercise were highest at Visit 2 and lowest at Visit 1. Pairwise comparisons showed that, collapsing across condition, means at Visit 1 ($M = 92.10$, $SD = 129.34$) were significantly different from means at Visit 2, ($M = 191.26$, $SD = 117.10$), $p <.001$, Cohen's $d = -.804$, and significantly different from means at 3-months follow-up, ($M = 156.89$, $SD = 138.48$), $p = .002$, Cohen's $d = -.484$. However, the pairwise difference (with Bonferoni adjustment) between Visit 2 and Visit 3 was non-significant, $p = .143$.

The main effect of condition, $F(2,80) = .709$, $p = .495$, $\eta^2 = .017$, and the condition X time interaction effect were non-significant, $F(4,160) = 1.04$, $p = .390$, $\eta^2 = .025$. However, a trend was observed for the complex contrast comparing the two health coaching conditions vs.

CONTROL at 3-months follow-up, *p* = .116, Cohen's *d* = .412, and the simple contrast between MAVC vs. CONTROL at 3-months follow-up, *p* = .114, Cohen's *d* = .522. It is clear from examining the pattern of means displayed in Figure 3 (condition X time means are reported with the figure) that all three conditions considerably increased the amount of time they spent exercising from Visit 1 to Visit 2. By 3-months follow-up, participants across all conditions reported fewer total minutes of exercise performed during an average week, but the drop-off was only marginal for participants assigned to one of the two health coaching conditions, whereas the drop-off was much more steep for CONTROL participants. All other pairs of planned complex and simple contrasts were non-significant.

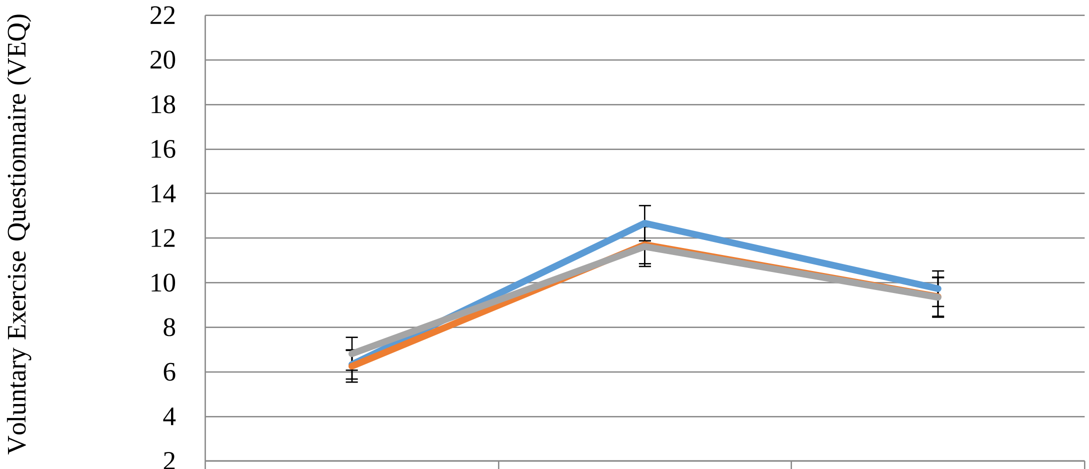


	Visit 1 Means	Visit 2 Means	3-Month Follow-Up Means
MAVC	70.83	192.93	179.17
CONTROL	92.39	182.96	121.32
EDUC	117.00	198.54	170.00

Figure 3. Self-reported total exercise minutes: Pattern of means across time and condition. MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. Error bars represent ±SE.

Voluntary exercise. A statistically significant main effect of time was observed for change in voluntary exercise behavior (VEQ scores) over time and across conditions, $F(2,168)$ = 64.31, $p < .001$, $\eta^2 = .434$. Additionally, examination of the within-subjects contrasts revealed a statistically significant quadratic effect of time, $F(1,84) = 84.12$, $p < .001$, $\eta^2 = .500$. The pattern of means suggests that voluntary exercise behavior was highest at Visit 2 and lowest at Visit 1. Pairwise comparisons showed that, collapsing across condition, means at Visit 1 (*M* = 6.44, *SD* = 3.73) were significantly different from means at Visit 2, (*M* = 12.05, *SD* = 4.52), $p < .001$, Cohen's *d* = -1.35, and means at Visit 1 were significantly different from means at 3-months follow-up, (*M* = 9.49, *SD* = 4.53), *p* = .002, Cohen's *d* = -.733. Additionally, the pairwise difference (with Bonferroni adjustment) between Visit 2 and Visit 3 was also significant, $p < .001$, Cohen's *d* = .565, suggesting that collapsing across groups, voluntary exercise scores decreased from Visit 2 to 3-months follow-up.

The main effects of condition, $F(2,84) = .150$, *p* = .861, $\eta^2 = .004$, and the condition X time interaction effect were non-significant, $F(4,168) = .433$, *p* = .785, $\eta^2 = .010$; however, the complex contrast comparing MAVC vs. the combination of EDUC & CONTROL at Visit 2 approached near statistical significance, *p* = .057, Cohen's *d* = .223, as did the simple contrasts between MAVC vs. CONTROL at Visit 2, *p* = .094, Cohen's *d* = .229, and MAVC vs. EDUC at Visit 2, *p* = .114, Cohen's *d* = .217. All other pairs of planned complex and simple contrasts were non-significant, see Figure 4 (condition X time means are reported with the figure).

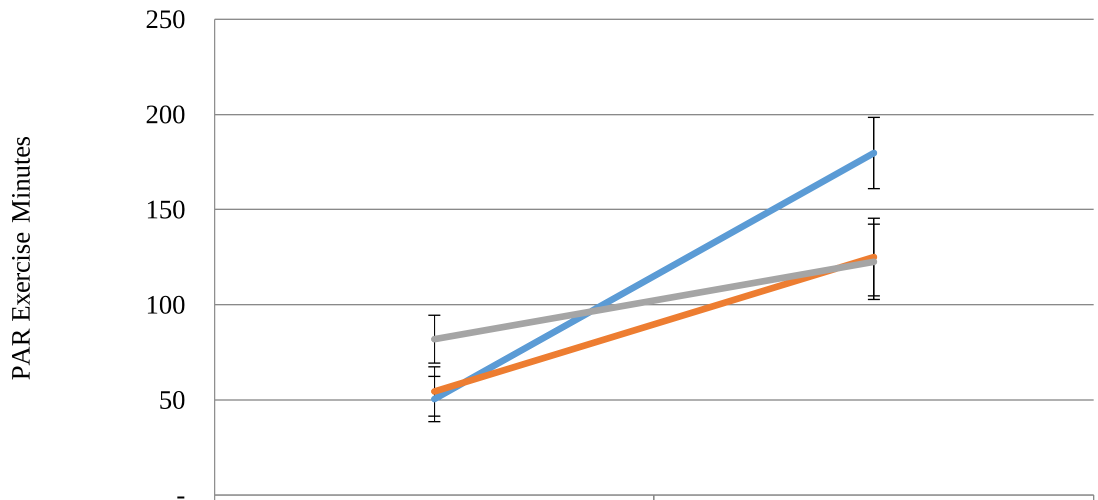


	Vist 1 Means	Vist 2 Means	3-Month Follow-Up Means
MAVC	6.33	12.67	9.73
CONTROL	6.25	11.71	9.36
EDUC	6.81	11.62	9.35

Figure 4. Self-reported voluntary exercise behavior: Pattern of means across time and condition. VEQ = Voluntary Exercise Questionnaire; higher scores represent more voluntary exercise behavior (scale range: 2 – 21). MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. Error bars represent ±SE.

PAR exercise minutes. Using the 7-day PAR assessment (note that the PAR data was only collected at Visit 1 and Visit 2), a statistically significant main effect of time was observed, $F(1,101) = 48.43$, $p < .001$, $\eta^2 = .324$, such that on average, collapsing across groups, higher scores on minutes of exercise performed in the past week were observed at Visit 2 ($M = 144.22$, $SD = 117.45$) versus Visit 1 ($M = 61.95$, $SD = 73.94$), Cohen's $d = -.838$. Although the main effect of condition was non-significant, $F(2,101) = .948$, $p = .391$, $\eta^2 = .018$, a significant condition X time interaction effect was observed, $F(2,101) = 5.36$, $p = .006$, $\eta^2 = .096$, suggesting that the difference in PAR minute means across conditions differed by time. Simple main effects tests were conducted to follow up on this significant interaction effect, and results revealed a significant difference across conditions at Visit 2, $F(2,102) = 2.64$, $p = .053$, $\eta^2 = .063$. The complex contrast for MAVC vs. the combination of EDUC & CONTROL at Visit 2 was significant, $p = .019$, Cohen's $d = .459$, as were the simple contrasts between MAVC vs.

CONTROL, p = .051 Cohen's d = .465, and MAVC vs. EDUC, p = .038, Cohen's d = .453, such that at Visit 2, MAVC participants were completing more minutes of exercise in the past week compared to the other two conditions (individually and combined). The complex contrast comparing health coaching vs. CONTROL was non-significant, see Figure 5 (condition X time means are reported with the figure).



	Visit 1 Means	Visit 2 Means
MAVC	50.45	179.74
CONTROL	54.41	125.06
EDUC	81.91	122.56

Figure 5. Minutes of exercise completed in the last week: Pattern of means across time and condition. PAR = Interviewer administered 7-day Physical Activity Recall (PAR) assessment. MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. Error bars represent ±SE.

Planned Analyses to Address Study Aim 3

Understanding changes in proposed mechanisms of action within the ACT-based framework was the third aim of this dissertation. To address this aim, we ran a series of repeated measures tests (with planned contrasts) to explore change on psychological flexibility constructs across time and between conditions, and also examined the strength of association between psychological flexibility constructs and exercise behavior during both study phases.

First, in order to assess for successful randomization to intervention condition, we conducted a series of one-way ANOVAs to compare means on psychological flexibility constructs at baseline (Visit 1). No significant between group differences were observed across all measures analyzed, suggesting successful randomization, see Table 10.

Table 10

ANOVAs for Between Group Differences at Baseline: Psychological flexibility Constructs

	M (*SD*)					
Construct	MAVC	EDUC	CONTROL	*F* test	*p*	η^2
Experiential Acceptance[1]	40.53 (9.80)	37.11 (10.03)	38.16 (8.00)	*F*(2,110) = 1.40	.246	.024
Discomfort Intolerance[2]	18.08 (5.25)	20.33 (5.95)	18.76 (4.64)	*F*(2,110) = 1.79	.172	.031
Defusion[3]	29.00 (8.65)	29.22 (7.23)	25.84 (7.08)	*F*(2,110) = 2.24	.111	.039
Exercise-specific defusion[4]	26.70 (9.26)	27.19 (8.91)	23.62 (9.02)	*F*(2,110) = 1.69	.190	.030
Mindfulness[5]	69.65 (9.07)	68.28 (6.76)	69.73 (8.37)	*F*(2,110) = .281	.755	.005
Healthy aging value[6]	8.88 (1.49)	8.69 (2.03)	9.24 (1.16)	*F*(2,110) = .133	.326	.020
Current health value[6]	9.00 (1.36)	9.00 (1.55)	9.24 (1.12)	*F*(2,110) = .403	.669	.007
Weight/appearance value[6]	8.20 (1.83)	8.33 (1.57)	8.32 (1.53)	*F*(2,110) = .079	.924	.001
Quality of life value[6]	9.38 (1.08)	9.67 (.535)	9.51 (.804)	*F*(2,110) = 1.13	.328	.020

Note. *SD* = standard deviation. MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition.

[1] Measured using the Physical Activity Acceptance Questionnaire (PAAQ); higher scores reflect greater experiential acceptance (scale range: 10-70).

[2] Measured using the Discomfort Intolerance Scale (DIS); higher scores represent less discomfort tolerance (scale range: 6-36).

[3] Measured using the Drexel Defusion Scale (DDS); higher scores reflect greater ability to defuse from negative thoughts and feeling states (scale range: 0 – 50).

[4] Measured using the Boulder Defusion Scale (BDS); higher scores reflect greater ability to defuse from negative thoughts and feeling states in the context of exercise (scale range: 0 – 50).

[5] Measured using the Philadelphia Mindfulness Scale (PHLMS); higher scores reflect greater mindful awareness and non-judgmental/accepting stance (scale range: 20– 100).

[6] A single item measure assessing degree of value alignment; (scale range: 1 = *strongly disagree* to 10 = *strongly agree*).

Change in psychological flexibility constructs over time. Next, a series of mixed ANOVAs where condition (MAVC, EDUC, CONTROL) is the between-subjects variable, and time (Visit 1, Visit 2) was the within-subjects variable, were performed in order to determine change in ACT-based constructs from baseline through the end of the intervention.

Experiential acceptance. A statistically significant main effect of time was observed for change in experiential acceptance (PAAQ scores), $F(1,104) = 26.54$, $p < .001$, $\eta^2 = .208$, such that on average, collapsing across groups, higher scores on experiential acceptance were observed at Visit 2 ($M = 42.33$, $SD = 9.78$) versus Visit 1 ($M = 38.46$, $SD = 9.34$). Although the condition X time interaction effect was non-significant, $F(2,104) = 2.00$, $p = .140$, $\eta^2 = .038$, a significant main effect of condition was observed, $F(2,104) = 4.35$, $p = .015$, $\eta^2 = .079$, suggesting that differences on experiential acceptance scores existed across groups, collapsing across time. The complex contrast comparing MAVC vs. the combination of EDUC & CONTROL at Visit 2 was significant, $p = .001$, Cohen's $d = .712$, as were the simple contrasts at Visit 2 between MAVC vs. EDUC, $p = .007$, Cohen's $d = .635$, and MAVC vs. CONTROL, $p = .002$, Cohen's $d = .791$. However, the complex contrast comparing health coaching vs. CONTROL was non-significant. This pattern of results suggests that assignment to the MAVC condition was associated with higher experiential acceptance scores across all comparisons, see Figure 6 (condition X time means are reported with the figure).

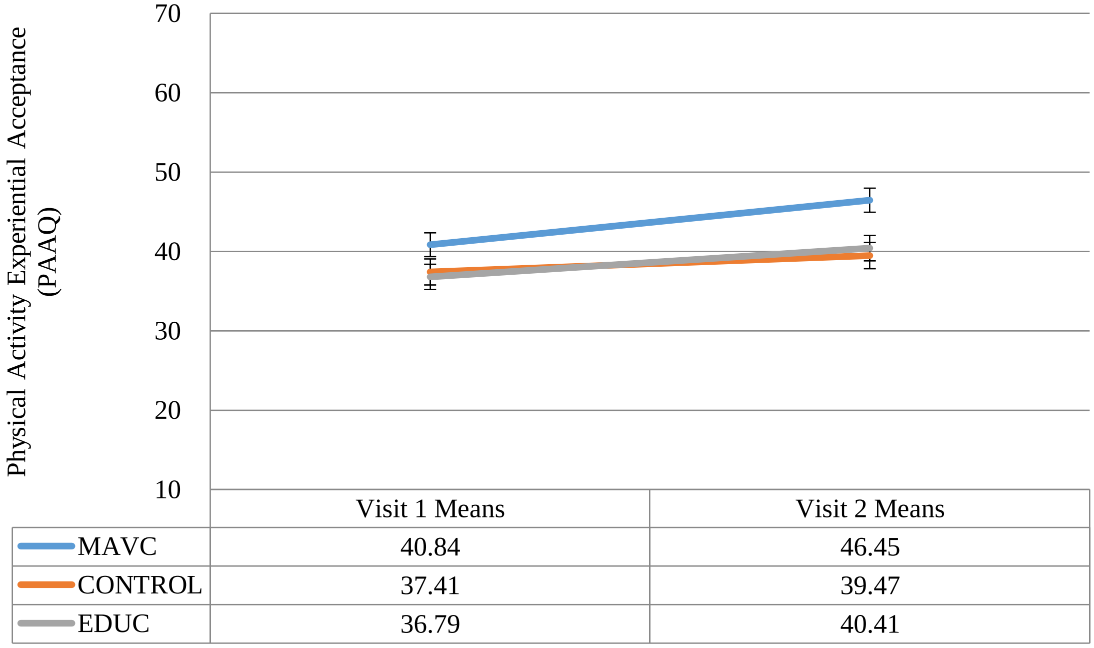
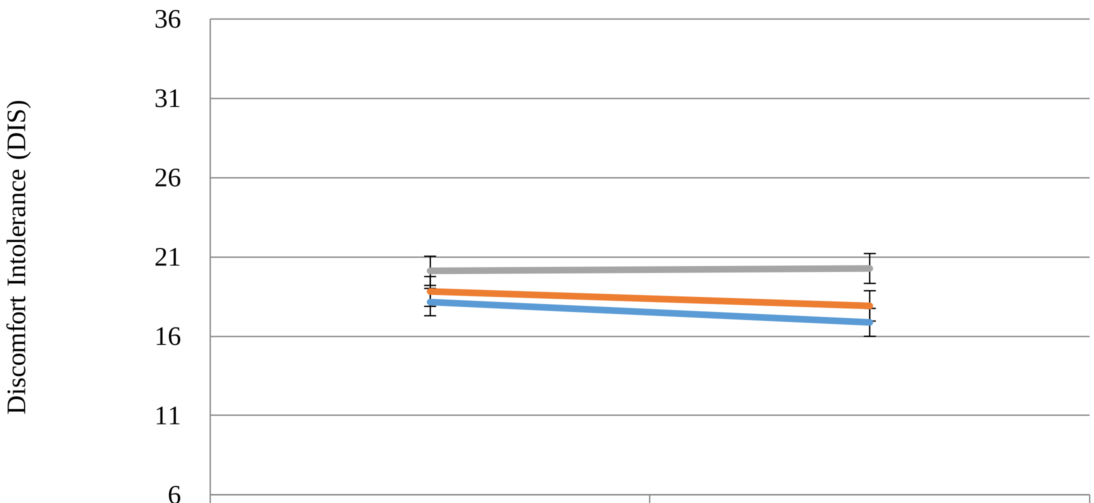


Figure 6. Physical activity experiential acceptance: Pattern of means across time and condition. PAAQ = Physical Activity Acceptance Questionnaire, higher scores represent greater experiential acceptance (scale range: 1 – 70). MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. Error bars represent ±SE.

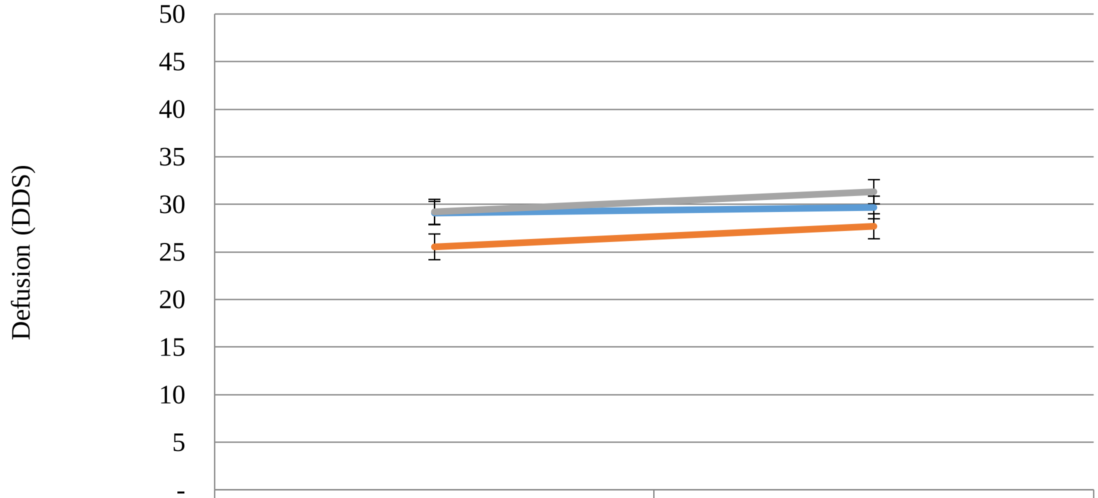
Discomfort intolerance. The next test, assessing change in discomfort intolerance (DIS scores) across time and between conditions revealed a statistically significant main effect of time, $F(1,104) = 4.06$, $p = .047$, $\eta^2 = .038$, such that on average, collapsing across groups, slightly lower scores on discomfort intolerance were observed at Visit 2 ($M = 18.28$, $SD = 5.63$) versus Visit 1 ($M = 19.00$, $SD = 5.34$). Although the condition X time interaction effect was non-significant, $F(2,103) = 1.62$, $p = .203$, $\eta^2 = .030$, a trend was observed for the main effect of condition, $F(2,103) = 2.52$, $p = .085$, $\eta^2 = .047$, suggesting that differences on discomfort intolerance scores may exist across groups, collapsing across time. The complex contrast comparing MAVC vs. the combination of EDUC & CONTROL was significant at Visit 2, p = .048, Cohen's d = -.416; as was the simple contrast between MAVC vs. EDUC at Visit 2, p = .010, Cohen's d = -.607. The pattern of means was such that being in the MAVC condition was associated with lower discomfort intolerance across both comparisons see Figure 7 (condition X time means are reported with the figure). All other pairs of planned complex and simple contrasts were non-significant.



	Visit 1 Means	Visit 2 Means
MAVC	18.15	16.87
CONTROL	18.82	17.91
EDUC	20.12	20.27

Figure 7. Discomfort intolerance: Pattern of means across time and condition. DIS = Discomfort Intolerance Scale; higher scores represent less ability to tolerate discomfort (scale range: 6 – 36). MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. Error bars represent ±SE.

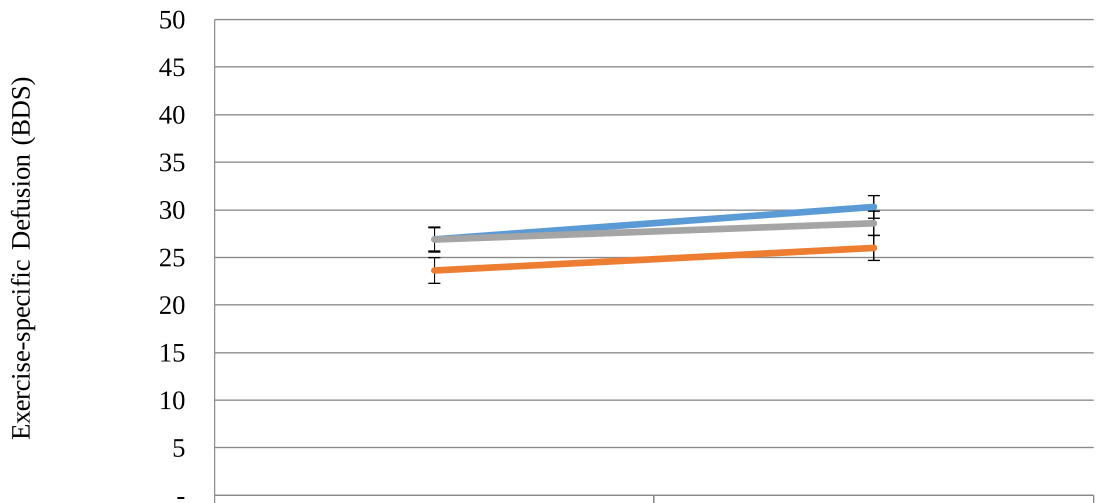
Defusion. Nearly the same pattern of results was observed for change in defusion (DDS scores) across time and between conditions. Specifically, a significant main effect of time, $F(1,104) = 6.00$, $p = .016$, $\eta^2 = .056$, was observed such that on average, collapsing across groups, slightly higher scores on defusion were observed at Visit 2 ($M = 29.60$, $SD = 7.50$) versus Visit 1 ($M = 28.04$, $SD = 7.75$). Although the condition X time interaction effect was non-significant, $F(2,104) = .642$, $p = .528$, $\eta^2 = .012$, the main effect of condition was marginal, $F(2,104) = 2.63$, $p = .077$, $\eta^2 = .049$, suggesting that differences on defusion scores may exist across groups, collapsing across time. The complex contrast between the two health coaching conditions vs. COTROL was marginal, $p = .078$, Cohen's $d = .368$. However, all other pairs of planned complex and simple contrasts were non-significant, see Figure 8 (condition X time means are reported with the figure).



	Visit 1 Means	Visit 2 Means
MAVC	29.08	29.67
CONTROL	25.53	27.69
EDUC	29.21	31.32

Figure 8. Defusion: Pattern of means across time and condition. DDS = Drexel Defusion Scale; higher scores represent greater defusion ability (scale range: 0 – 50). MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. Error bars represent ±SE.

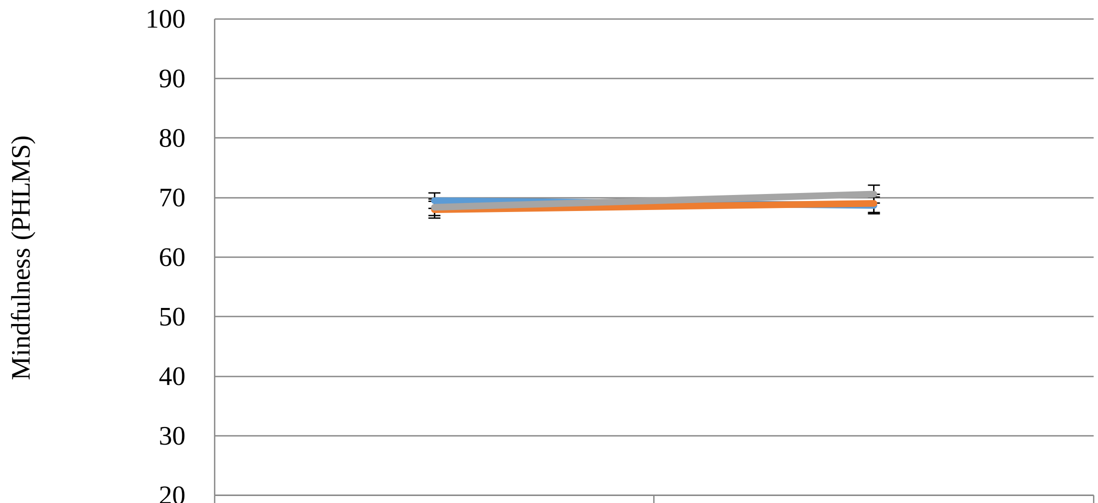
Exercise specific defusion. Again, essentially the same pattern of results was observed for change in exercise-specific defusion (BDS scores) across time and between conditions. Specifically, a significant main effect of time, $F(1,104) = 11.25$, $p = .001$, $\eta^2 = .099$, was observed such that on average, collapsing across groups, higher scores on exercise-specific defusion were observed at Visit 2 ($M = 28.44$, $SD = 8.31$) versus Visit 1 ($M = 25.89$, $SD = 9.06$). Although the condition X time interaction effect was non-significant, $F(2,104) = .467$, $p = .628$, $\eta^2 = .009$, a trend for a main effect of condition was observed, $F(2,104) = 2.25$, $p = .111$, $\eta^2 = .042$, suggesting that differences on exercise-specific defusion scores may exist across groups, collapsing across time. The complex contrast between the two health coaching conditions vs. COTROL was significant at Visit 2, $p = .050$, Cohen's $d = .430$, and a trend was observed for the complex contrast comparing MAVC vs. the combination of EDUC & CONTROL at Visit 2, *p* = .072, Cohen's *d* = .370. Additionally, the simple contrast between MAVC vs. CONTROL at Visit 2 was significant, *p* = .030, Cohen's *d* = .551; but, the simple contrast between MAVC vs. EDUC at Visit 2 was non-significant. The pattern of means is such that being in one of the two health coaching conditions resulted in higher exercise-specific defusion scores at Visit 2 compared to being assigned to CONTROL. Additionally, assignment to the MAVC condition resulted in higher exercise-specific defusion scores at Visit 2 compared to assignment to the CONTROL condition, see Figure 9 (condition X time means are reported with the figure).



	Visit 1 Means	Visit 2 Means
MAVC	26.90	30.31
CONTROL	23.63	26.00
EDUC	26.88	28.59

Figure 9. Exercise-specific defusion: Pattern of means across time and condition. BDS = Boulder Defusion Scale; higher scores represent greater defusion ability (scale range: 0 – 50). MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. Error bars represent ±SE.

Mindfulness. Lastly, the main effects of time, $F(1,104) = 1.95$, $p = .165$, $\eta^2 = .019$, condition, $F(2,104) = .132$, $p = .876$, $\eta^2 = .003$, and the condition X time interaction, $F(2,104) = 2.30$, $p = .105$, $\eta^2 = .043$, for change in mindfulness (PHLMS scores) were all non-significant. All pairs of planned complex and simple contrasts were also non-significant; no notable changes on average scores across time and/or across conditions were observed for this measure, see Figure 10.



	Visit 1 Means	Visit 2 Means
MAVC	69.49	68.69
CONTROL	67.97	69.03
EDUC	68.38	70.59

Figure 10. Mindfulness: Pattern of means across time and condition. PHLMS = Philadelphia Mindfulness Scale; higher scores reflect greater mindful awareness and non-judgmental/accepting stance (scale range: 20 – 100). MAVC = mindful awareness, acceptance, and values clarity (MAVC) health coaching condition; EDUC = education and performance health coaching condition; CONTROL = no health coaching control condition. Error bars represent ±SE.

Values. Because it was not a goal of the MAVC health coaching condition to attempt to change participants' values over the course of the intervention, we did not assess endorsement of the 4 commonly held exercise values again at Visit 2. Thus, repeated measures tests were not possible for these 4 items. Instead, we were primarily interested in understanding and describing what participants valued about exercise at the beginning of the intervention. Interestingly, at Visit 1, across all conditions, means for degree of alignment with values were highest for the quality of life value, and lowest for the weight loss/physical appearance value; however, in terms of magnitude of agreement, alignment was rated strong-very strong across all 4 items suggesting that on average, all 4 values were relevant to participants and their motivation to incorporate exercise into their lives (see Table 10 above).

In order to assess the strength of association between change in psychological flexibility constructs over the course of the intervention and change in exercise behavior over the course of the intervention, and through the maintenance phase, we computed difference score values for all of the psychological flexibility constructs and all of the exercise behavior constructs. Difference scores for the psychological flexibility constructs were computed as Visit 2 score – Visit 1 score; and difference scores for the exercise constructs were computed as Visit 2 score – Visit 1 score for change in exercise over Phase 1 (adoption), and 3-month follow-up score – Visit 1 score for change in exercise over Phase 2 (maintenance). After computing the difference scores, we estimated bivariate correlations between (1) the psychological flexibility-difference scores and exercise difference scores through Phase 1 (see Table 11), and (2) the psychological flexibility-difference scores and exercise difference scores through Phase 2 (see Table 12).

Table 11

Bivariate Correlations Between Change in Psychological Flexibility Constructs and Change in Exercise Behavior Through Phase 1 (Adoption)

Construct	Exercise total minutes change	PAR exercise minutes change	Voluntary exercise bx change (VEQ)
Experiential acceptance[1] change	.110	.185	.265**
Discomfort intolerance[2] change	-.063	-.078	-.224*
Defusion[3] change	.031	.030	.132
Exercise-specific defusion[4] change	.165	.200*	.250*
Mindfulness[5] change	.160	.048	.015

Note. PAR = 7-day Physical Activity Recall assessment. VEQ = Voluntary Exercise Questionnaire. Bx = behavior. All constructs are computed as Visit 2 – Visit 1 differences scores. * $p < .05$, ** $p < .01$.

[1] Measured using the Physical Activity Acceptance Questionnaire (PAAQ); higher scores reflect greater experiential acceptance (scale range: 10-70).

[2] Measured using the Discomfort Intolerance Scale (DIS); higher scores represent less ability to tolerate discomfort (scale range: 6-36).

[3] Measured using the Drexel Defusion Scale (DDS); higher scores reflect greater ability to defuse from negative thoughts and feeling states (scale range: 0 – 50).

[4] Measured using the Boulder Defusion Scale (BDS); higher scores reflect greater ability to defuse from negative thoughts and feeling states in the context of exercise (scale range: 0 – 50).

[5] Measured using the Philadelphia Mindfulness Scale (PHLMS); higher scores reflect greater mindful awareness and non-judgmental/accepting stance (scale range: 20– 100).

Table 12

Bivariate Correlations Between Change in Psychological Flexibility Constructs and Change in Exercise Behavior Through Phase 2 (Maintenance)

Construct	Exercise total minutes change	Voluntary exercise bx change (VEQ)
Experiential acceptance[1] change	.252*	.075
Discomfort intolerance[2] change	-.046	-.119
Defusion[3] change	.090	.134
Exercise-specific defusion[4] change	.220*	.246*
Mindfulness[5] change	.165	.068

Note. PAR = 7-day Physical Activity Recall assessment. VEQ = Voluntary Exercise Questionnaire. Bx = behavior. All constructs are computed as Visit 2 – Visit 1 differences scores. * $p < .05$, ** $p < .01$.

[1] Measured using the Physical Activity Acceptance Questionnaire (PAAQ); higher scores reflect greater experiential acceptance (scale range: 10-70).

[2] Measured using the Discomfort Intolerance Scale (DIS); higher scores represent less discomfort tolerance (scale range: 6-36).

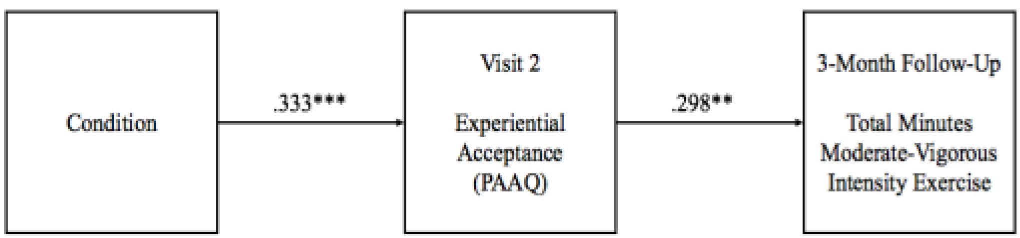
[3] Measured using the Drexel Defusion Scale (DDS); higher scores reflect greater ability to defuse from negative thoughts and feeling states (scale range: 0 – 50).

[4] Measured using the Boulder Defusion Scale (BDS); higher scores reflect greater ability to defuse from negative thoughts and feeling states in the context of exercise (scale range: 0 – 50).

[5] Measured using the Philadelphia Mindfulness Scale (PHLMS); higher scores reflect greater mindful awareness and non-judgmental/accepting stance (scale range: 20– 100).

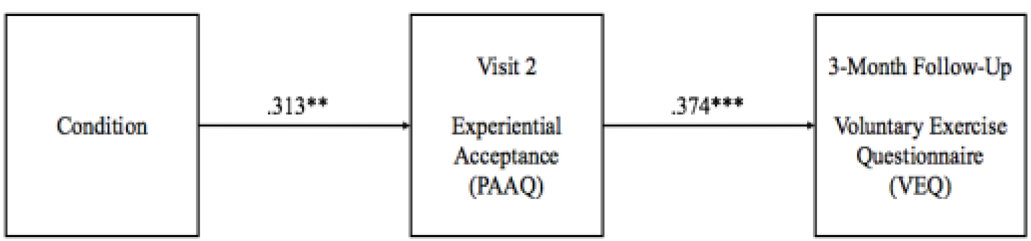
Mechanisms of behavior change maintenance. A goal of study aim 3 was to assess mechanisms of action on behavior change maintenance as informed by the ACT framework. Because we observed strong condition differences on experiential acceptance (PAAQ scores) over the course of the intervention, as well as small – moderate bivariate correlations between change in experiential acceptance scores and change in exercise behavior scores at both Visit 2 and 3-months follow-up, we decided to conduct exploratory path analyses to test the indirect effects of condition on exercise behavior at 3-months follow-up through Visit 2 experiential acceptance scores. We estimated two models; one with self-reported total minutes of exercise at 3-month follow-up as the DV, and one with the voluntary exercise (VEQ) assessed at 3-month follow-up as the DV. In these models, the exogenous variable of condition was coded to compare MAVC to the other two conditions, such that MAVC = 1 and EDUC and CONTROL = 0.

Across both models tested, we observed significant, small to moderate effects of condition on Visit 2 acceptance scores such that MAVC participants scored higher on experiential acceptance at Visit 2 compared to the combined EDUC and CONTROL participants. Additionally, across both models tested, we observed significant, small to moderate effects of experiential acceptance scores at Visit 2 on 3-month follow-up exercise behavior, see Figures 11 and 12. The nature of these relationships suggests exposure to the MAVC condition was more effective than exposure to the EDUC and CONTROL conditions on increasing experiential acceptance over the course of the exercise intervention, and scoring higher on experiential acceptance at Visit 2 was predictive of (1) total minutes of self-reported moderate-vigorous intensity exercise performed during an average week at 3-months follow-up (see Figure 11), and (2) voluntary exercise scores (VEQ) at 3-months follow-up (see Figure 12). Importantly, this finding adds additional to support to the strong, albeit cross-sectional, results observed from our pilot data between experiential acceptance scores and exercise maintenance (Stevens & Bryan, in prep).



$\chi^2(1, N = 113) = .003, p = .954$, CFI = 1.00

Figure 11. Path model predicting 3-month follow-up total minutes of moderate-vigorous intensity exercise. PAAQ = Physical Activity Acceptance Questionnaire; higher scores reflect greater acceptance. Coefficients are standardized path coefficients. The contrast was coded: MAVC = 1, EDUC = 0, CONTOL = 0; ** $p < .01$, *** $p < .001$.



$\chi^2(1, N = 113) = .653, p = .419$, CFI = 1.00

Figure 12. Path model predicting 3-month follow-up voluntary exercise behavior. PAAQ = Physical Activity Acceptance Questionnaire; higher scores reflect greater acceptance. Coefficients are standardized path coefficients. VEQ = Voluntary Exercise Questionnaire; higher scores reflect more exercise behavior engagement. The contrast was coded: MAVC = 1, EDUC = 0, CONTOL = 0; ** $p < .01$, *** $p < .001$.

CHAPTER IV

DISCUSSION

This dissertation project was designed as a three-group, RCT for the promotion of exercise behavior (adoption and maintenance) among physically inactive women aged 25-65. The study was divided into two phases. Phase 1 was the exercise adoption phase involving a baseline data collection visit and workshop (condition dependent), a 30-day exercise intervention period (all conditions), and an intervention-exit data collection visit and workshop (condition dependent). Phase 2, the exercise maintenance phase, involved a follow-up assessment (conducted online) at 3-months post-intervention.

Overview of Main Outcomes

Overall the central hypotheses were generally supported. First, we sought to assess the feasibility of the MAVC intervention compared to the EDUC and CONTROL interventions, and proposed that scores on indices of intervention feasibility would be comparable across conditions, if not more favorable for participants assigned to one of the two health coaching conditions (MAVC and/or EDUC). This hypothesis was well supported. Feasibility analyses revealed no between-group differences on participant retention/attrition, intervention "dose"/adherence (in terms of journal completion and HR monitor use), perceived usability of key intervention materials, or workshop delivery fidelity. Additionally, we found evidence that MAVC participants were slightly more satisfied with their intervention, and rated their intervention more highly on measures of credibility/expected impact compared to participants in the other two conditions.

Next, we sought to assess the effectiveness of the three intervention conditions for increasing and sustaining exercise behavior over time. We proposed that exercise behavior would increase across all groups during Phase 1 (from Visit 1 to Visit 2), and remain higher than baseline at 3-months follow-up. This hypothesis was also supported as significant main effects of time were observed across all exercise measures studied. In general, the observed pattern was such that means for exercise measures were highest at Visit 2, and lowest at Visit 1. For the two measures that were collected at 3 time points, we observed that exercise behavior significantly increased from Visit 1 to Visit 2, and remained significantly higher than Visit 1 scores at 3-months follow-up.

In terms of the between subjects-effects, we hypothesized that exercise behavior at the end of Phase 1 may be similar among participants across conditions, with the biggest between-condition effects observed during Phase 2 (maintenance). Support for this hypothesis was somewhat mixed. Although not all contrasts were significant at the .05 alpha level, the overall trend across the various Phase 1 exercise behavior outcome measures was that means for the MAVC intervention were higher than means for the EDUC or CONTROL interventions, thus, supporting the first part of our hypothesis. Notable effects observed during Phase 1 included a trend for higher total minutes of exercise completed during the 30-day program (assessed by the daily journals) by MAVC participants compared to the combined effect of the other two conditions, as well as a time by condition interaction observed at Visit 2 for PAR total minutes such that MAVC participants completed more minutes of exercise in the past week at Visit 2 compared to participants in the EDUC and CONTROL conditions (individually, and combined). Additionally, MAVC participants were the only group whose average total minutes score, as recorded *objectively* by the HR monitors, reached threshold for achieving the goal of completing

150-minutes of exercise per week over the course of the 30-day intervention. These results are consistent with findings from the Butryn et al., (2011) study, which found superior efficacy for an ACT-based skills training intervention over an education-based intervention for fostering short-term increases in exercise behavior over a month long intervention period.

In terms of differences across conditions during Phase 2 (maintenance), we found partial support for our hypothesis. Namely, the combined effect of receiving one of the two health coaching workshops resulted in trend towards more self-reported exercise minutes at 3-months follow-up as compared to participants in the CONTROL condition. This finding is perhaps consistent with the results of a recent systematic review by Kivela and colleagues (2014) demonstrating efficacy of brief health coaching interventions for impacting physical activity. Additionally, we found a trend for the simple contrast between MAVC and CONTOL participants at 3-months follow-up on the same measure. Thus, although differences were not observed on exercise maintenance between participants assigned to MAVC or EDUC, a trend was emerging for declining maintenance of exercise behavior for participants who received the no health coaching condition. A longer term follow up period is needed to better understand how between condition effects may continue to differentiate over time.

The third and final aim of this dissertation was to assess change in proposed mechanisms of action – i.e., constructs purported to relate to “psychological flexibility” within the ACT framework. To this end, we predicted that participants assigned to MAVC would show the greatest improvement on these measures, as they were the only participants exposed to content specifically intended to facilitate skill acquisition in those specific areas. The central hypotheses were generally supported. In terms of between groups change on psychological flexibility constructs over the course of the intervention, MAVC participants tended to score higher on constructs of psychological flexibility at Visit 2 compared to participants in the other two conditions. Gains on the construct of experiential acceptance (PAAQ) were especially differentiated across conditions, with MAVC participants showing the highest means at Visit 2. Follow-up path models demonstrated indirect effects on exercise behavior maintenance through experiential acceptance scores at Visit 2 from condition membership. Importantly, these results build on prior results observed by Butryn et al., (2015) for a relationship between PAAQ scores and exercise outcomes at short-term follow-up, as well as the results of our pilot data, which suggested notable associations between experiential acceptance and group membership as a long-term exercise maintainer.

Strengths & Future Directions

Compared to other recent attempts to incorporate ACT-based skills content into an intervention designed to promote increases in exercise/physical activity Butryn et al., 2011; Moffitt & Mohr, 2015) the present study continues to build on the evidence base by utilizing a randomized study design, but adding a third comparison arm, including a post-intervention-exit follow-up assessment, incorporating more meaningful measures of exercise behavior (Butryn et al., 2011 used “visits to the university recreation center” as the primary exercise outcome variable), and assessing mechanisms of exercise change through experiential acceptance. Because self-monitoring alone is a highly effective behavior change technique (Michie, Abraham, Whittington, McAteer, & Gupta, 2009), the inclusion of a no-health coaching/self-monitoring only control condition allows for better understanding of the “added benefit” of the ACT-based skills condition. This condition helps to partial out the impact of the ACT-based skills content from the potential impact of non-specific factors transmitted via workshop leader to participant in the education-based health coaching dyad, or as in the case of the Butryn et al.,

(2011) study, whose intervention was run using a group format, non-specific factors transmitted via other group members.

In thinking about future directions, however, it may be useful to consider increasing the intervention "dose." For instance, the participants in the study conducted by Butryn et al., (2011) received two 2-hour workshops 2 weeks apart (versus two 1-hour workshops approximately 4 weeks as in the present study). More frequent contact with participants may be ideal, especially as participants are first learning how to apply the skills discussed in the workshop to their own experience. Additional support for this position comes from the results of the second ACT-skills based exercise intervention conducted by Moffitt and colleagues (2015). This study, which compared the efficacy of a 12-week walking program supplemented with an ACT-based DVD intervention, against a 12-week walking program with no additional supplementation, found that pairwise comparisons between groups on walking behavior were negligent up through week 8 of the intervention, but large for comparisons during weeks 8 – 12. This study did not assess outcomes post-intervention, so it is not clear how long lasting gains observed from weeks 8 – 12 were maintained, but it does suggest that it took several weeks for participants to absorb and become adequately versed with skills to see large impacts on behavior. That participants in the MAVC condition were generally exercising more than participants in the other two conditions at Visit 2 (when exercise increased greatly across all groups) suggests that perhaps additional exposure to the ACT-based content could help "scale up" the effects of the intervention even more. This may be especially true in light of the significant experiential acceptance path model findings – that is, if group membership was strongly related to gains on the experiential acceptance measure, and higher scores on the experiential acceptance measure at Visit 2 were predictive of exercise maintenance, then increasing the "dose" of the skills training content facilitating gains on experiential acceptance, cold have downstream effects on behavior.

Limitations

Due to the demography of the greater Boulder community, the most prominent limitation of this research is the lack of diversity in the sample characteristics. Indeed, our sample was largely homogeneous as a majority of participants were White, college educated, and at least part-time, if not full-time employed. Future work would benefit from recruiting a more diverse sample so as to better understand how the results would generalize to not only the general populous, but also to more medically complex individuals, rather than the sedentary but otherwise healthy individuals enrolled in the present study. Perhaps this limitation is one issue that could be somewhat easily addressed by translating the structure of the MAVC workshop presented in this dissertation to be disseminable in a more applied "real world" behavioral health setting, such as an integrated primary care clinic. The popularity and demand for behavioral health services and resources is significant, and ever growing in the United States (Beacham, Kinman, Harris, & Masters, 2011), and such a setting could provide an ideal opportunity to disseminate the content covered within the MAVC intervention to a much broader, and potentially much more health impacted, portion of the population.

Lack of ability (due to limited funding resources) to collect data on objectively measured exercise throughout the study follow-up period is undoubtedly a second limitation of this research. While it is certainly preferred in the exercise literature that exercise self-report measures be supplemented with objective measures of exercise behavior (Haskell, 2012), it is worth noting, again, that we observed a high degree of agreement between exercise data reported subjectively in participants' daily exercise journals and exercise data collected objectively via participants' HR monitors during the 30-day intervention period ($r = .676$, $p < .001$). Such a result suggests participants enrolled in the present study are reasonably reliable reporters. However, it is also possible that use of the HR monitors increased accuracy of reporting on the journals, because participants used their HR monitor to record their workout, and then entered the values from their monitor into the journal. It is our hope that the collection of two relatively different exercise behavior self-report measures (one open ended, one Likert scale) through the follow-up period will help to inform questions regarding consistency of responding.

A third limitation of this research is the relatively short maintenance period. As prior work has shown, the greatest drop off for exercise behavior maintenance across groups tends to occur around 6-months (Ekkekakis et al., 2011a; Garber et al., 2011; Marcus et al., 2000, 2006). Thus, when attempting to study maintenance behavior, it is ideal to include follow-up assessments that span at least 6-months or more. While it was not possible to present follow-up data beyond 3-months in this dissertation, plans to conduct additional follow-up analyses with the same sample of participants are underway.

Summary & Conclusions

There are tremendous transdiagnostic health benefits to be gained from engaging in regular cardiorespiratory exercise. Yet to date, dominant theoretical approaches generally fail to predict a large proportion of the variability in maintenance of exercise behavior (Ekkekakis et al., 2011a; Garber et al., 2011; Marcus et al., 2000, 2006), in part, it has been argued, because differences between underlying mechanisms of behavior adoption and behavior maintenance are not well specified (Rothman et al., 2011).

A growing contingency of researchers have begun to suggest affective/experiential factors may be particularly important determinants of exercise behavior maintenance (Kwan &

Bryan, 2010a; Rhodes & Kates, 2015; Williams & Evans, 2014; Williams et al., 2012; Williams et al., 2014; Williams, 2008), but how best to address these factors in the context of an intervention so as to maximize the health benefits of exercise is not well understood. Indeed, there is considerable divergence of opinion on this matter in the field. From an epidemiology perspective, there is considerable evidence to suggest that higher-volume/higher-intensity exercise activities are consistently independently associated with health benefits and reduced risk of all-cause mortality (Gebel et al., 2015). And researchers conducting this type of exercise behavior hazards ratio work frankly conclude their papers by recommending that higher-volume/higher-intensity exercise be encouraged *even more* strongly in national activity guidelines.

On the other side of the matter, a contingency of exercise researchers in the social and behavioral science fields have amassed convincing evidence to suggest higher-volume/higher-intensity exercise activities are experienced as highly unpleasant, and demonstrate worse outcomes for uptake and maintenance when higher-volume/higher-intensity exercise is prescribed (Ekkekakis et al., 2011; Lind, Ekkekakis, & Vazou, 2008; Parfitt, Olds, & Eston, 2015). In contrast to the epidemiologists, these researchers disseminate their work with running heads such as, “Hard/heavy intensity is too much,” “Pain for no additional gain,” and “Doing what feels good (and avoiding what feels bad),” and suggest that efforts to promote exercise to the public should de-emphasize adherence to national guidelines, and instead promote “affect-based” and/or “self-determined/self-paced” exercise. Recent work exploring the efficacy of these approaches (Williams et al., 2015), however, has fallen short of demonstrating that an “affect-based/self-determined/self-paced” approach yields exercise behavior change and maintenance of exercise volume most strongly linked to optimal health outcomes. Case in point, just two weeks into the Williams et al. (2015) study, participants in both the intensity-based and self-paced conditions were already falling short of the goal to walk 150 minutes per week. At six months follow-up, participants walked only 50% of this goal on average.

In an effort to inform ways of addressing this apparent rift in the literature, this dissertation proposed that rather than lessen or deemphasize national guidelines for exercise, more work is needed to understand if it is feasible (and effective) to train participants in use of ACT-based skills for managing the kind of psychological and physical discomfort/distress that is inherent with maintaining a regular exercise routine in accordance with guidelines for optimal health benefits (Stevens & Bryan, 2015). Acceptance-based behavioral interventions seek to promote “psychological flexibility” by fostering increased focus on values-consistent behavior and teaching skills for regulating aversive experiential content through mindful awareness and acceptance. These central tenants dovetail nicely with the concept of “integrated regulation” from self-determination theory (SDT) which purports that people will pursue behaviors that are not necessarily experienced as inherently pleasurable, and may be unpleasant, if they personally identify with or value what the behavior adds to their life.

Converging these several lines of research and theory, and backed by pilot data supporting strong (cross-sectional) relationships between greater experiential acceptance, less discomfort intolerance, and exercise maintenance (Stevens & Bryan, in prep), this dissertation sought to build on the work of other researchers (i.e., Butryn et al., 2011; Hawkes et al., 2013; Moffitt & Mohr, 2015) who have begun to investigate the feasibility and effectiveness of delivering ACT-based interventions for the promotion of exercise behavior.

Our results showed that the MAVC condition was particularly effective at improving experiential acceptance scores over the course of the intervention, and higher scores on experiential acceptance at the end of the intervention positively predicted exercise behavior maintenance across both measures studied. Taken as a whole, these findings build upon the evidence base demonstrating the importance of experiential acceptance as mechanism of exercise behavior maintenance. Future work should focus on understanding the optimal intervention "dose" for yielding the greatest impacts on experiential acceptance scores, as well as study the relationship between change in experiential acceptance and behavior over a longer-term follow-up period.

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Appendix A

The Get *ACT*IVE! Study Workshop Content Fidelity Checklist & Workshop Leader Effectiveness & Participant Engagement Ratings Visit 1

Fidelity Rating Visit 1

Who is rating this audio recording?
- ❍ T
- ❍ K

Workshop leader initials:
- ❍ SH
- ❍ SYW
- ❍ RV

Date of workshop: ________

Participant number: ________

For the following items, examples provided under content criterion need NOT be read verbatim by workshop leaders.

The workshop leader provided rationale for workshop.
- ❍ Covered
- ❍ NOT covered

The workshop leader inquired about the participant's exercise history.
- ❍ Covered
- ❍ NOT covered

The workshop leader introduced the “ACT” model. Example: “Accept your experience during exercise and be present, clarify your exercise related values, & take action.”
- ❍ Covered
- ❍ NOT covered

The workshop leader introduced the NIH “Tips to Get You ACTIVE” handout. Example: “We will be using this handout, published by the National Institutes for Health (NIH) to guide our discussion today.”
- ❍ Covered
- ❍ NOT covered

The workshop leader assessed the participant's personal barriers related to exercise and summarized the participant's ambivalence (if present). Example: Ex., “Why do you think it is difficult to be as physically active as you might like to be?; What things often get in your way?; What’s hard about keeping up with an exercise routine for you personally?;” Dilemma – playing tug-of-war with self; workshop leader provides some kind of summary of this information (“On the one hand ____, and on the other hand you also want ____”).
- ❍ Covered
- ❍ NOT covered

The workshop leader discussed and defined cardiorespiratory exercise. Example: "Cardiorespiratory exercise is defined as any sport or activity that works large groups of muscles, increases your heart rate and breathing rate, and is maintained continuously for a minimum of 10 minutes."
- ❍ Covered
- ❍ NOT covered

The workshop leader discussed “short-term” vs. “long-term mind.” Example: “Short-term mind pays close attention to the parts about exercise or getting started with exercise that we expect to be unpleasant; long-term minds are better at remembering the reasons why we care about exercising and why it’s important for us to do it even if it sometimes feels unpleasant while we are getting started and/or while we’re exercising.”
- ❍ Covered
- ❍ NOT covered

The workshop leader introduced and discussed ACSM exercise guidelines. Example: “Adults should get at least 150 minutes of moderate-intensity exercise per week; Exercise recommendations can be met through 30-60 minutes of moderate-intensity exercise (five days per week) or 20-60 minutes of vigorous-intensity exercise (three days per week).”
- ❍ Covered
- ❍ NOT covered

The workshop leader introduced & discussed the concept of cultivating mindfulness of the exercise experience. Example: “A key to changing your behavior is your willingness to be mindfully aware of your internal experiences, and second tolerate your thoughts, feelings, sensations, etc. without trying to change them; mindfulness does not mean relaxation;" quicksand metaphor, tug-of-war metaphor.
- ❍ Covered
- ❍ NOT covered

The workshop leader introduced & discussed the health benefits of exercise. Example: “Health benefits are additive; relationship between exercise and specific health outcomes (premature death, cardiorespiratory health, metabolic health, weight/obesity, musculoskeletal health, functional ability and fall prevention, cancer, mental health.”
- ❍ Covered
- ❍ NOT covered

The workshop leader introduced, discussed, & practiced the concept of “defussion” with the participant. Example: “When we are “fused” with our internal experiences, those experiences often end up guiding our behavior, learn to look your thoughts rather than them – to be the observer of your thoughts, label internal experiences for what they are – just thoughts, just feelings, and just sensations; You can’t stop the waves, but you can learn to surf;” experiential practice by holding legs out.
- ❍ Covered
- ❍ NOT covered

The workshop leader instructed the participant on how to become more active (“Tips” handout) Example: “Step 1: Pick an activity you enjoy; Step 2: Set a goal, make a plan, and add it to your calendar.”
- ❍ Covered
- ❍ NOT covered

The workshop leader introduced “Get off your But(ts)!” Example: “The “yes-but” or “reason giving” trap; replace your “BUT” statements with “AND” statements”
- ❍ Covered
- ❍ NOT covered

The workshop leader discussed common exercise road blocks & plan for overcoming them. Example: “Time, motivation/interest, weather, money; participant’s top 3 and plan for overcoming them”
- ❍ Covered
- ❍ NOT covered

The workshop leader introduced and discussed values clarification around exercise. Example: “Step 1: Identify and be more aware of your values (what are the things that you value the MOST in your life etc.); Step 2: Integrate your values and behaviors to overcome barriers (are you willing to accept a certain amount of discomfort/distress in the short term, in order to live a life more consistently aligned with your values in the long term?); Passengers on the bus metaphor”
- ❍ Covered
- ❍ NOT covered

The workshop leader discussed how to be safe during exercise. Example: “Warm up and cool down; Start slowly; Drink fluids & make sure to fuel yourself before and after exercise; Take it easy at first and see how you feel before trying more challenging workouts”
- ❍ Covered
- ❍ NOT covered

The workshop leader discussed committed action to exercise/Action planning. Example: “What are you going to do?; How are you going to do it?; What challenges or barriers might come up?; What will you do if you encounter barriers or challenges?;” Commitment statement: I commit to ____even if I feel _______ or have desires to ________. I will remind myself that _________.”
- ❍ Covered
- ❍ NOT covered

The workshop leader discussed keeping up with exercise. Example: “Choosing physical activities you enjoy and that match your interests and abilities; As you reach your goals, think about how you can do even more; reward yourself”
- ❍ Covered
- ❍ NOT covered

The workshop leader explained affect and values self-monitoring assignment. Example: “Prior research shows that when people keep track of how they feel before, during, and after exercise, they tend to exercise more frequently – we also think that it is important to make salient your reasons for being physical active – that is, to remind yourself of your exercise related values.”
- ❍ Covered
- ❍ NOT covered

The workshop leader explained performance self-monitoring assignment <div> <div>Example: "Prior research has shown that when people record details about their exercise and performance, they tend to exercise more frequently. You will be able to retrieve this information from your heart rate monitor.”
- ❍ Covered
- ❍ NOT covered

Workshop Leader Effectiveness & Participant Engagement Ratings:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
1. The workshop leader had excellent rapport with the participant.	❍	❍	❍	❍	❍	❍	❍
2. The workshop leader was able to keep the participant's attention throughout the workshop.	❍	❍	❍	❍	❍	❍	❍
3. The participant was actively engaged with the workshop content.	❍	❍	❍	❍	❍	❍	❍
4. The participant enjoyed herself during the workshop.	❍	❍	❍	❍	❍	❍	❍
5. The participant learned something during the workshop.	❍	❍	❍	❍	❍	❍	❍
6. The workshop leader actively attempted to help the participate apply the workshop content to her own personal wants/needs/values.	❍	❍	❍	❍	❍	❍	❍
7. The workshop leader expressed acceptance of the participants' individual experience with exercise (past, present, imagined future) without judgment.	❍	❍	❍	❍	❍	❍	❍
8. The workshop leader emphasized using workshop content in a way that would "work" for the participant.	❍	❍	❍	❍	❍	❍	❍

9. The workshop leader was highly directive in terms of "telling" the participant what to do to increase her exercise behavior (rather than eliciting the participant's own thoughts and ideas).	❍	❍	❍	❍	❍	❍	❍
10. The workshop leader expressed that the participant would need to change her way of thinking about exercise in order to change her behavior.	❍	❍	❍	❍	❍	❍	❍

If applicable, please note any unusual circumstances or occurrences that disturbed normal workshop session conditions, including technical difficulties:

Note. Fidelity checklists and workshop leader effectiveness/participant engagement ratings scales for Visit 1

Appendix B

The Get *ACT*IVE! Study Workshop Content Fidelity Checklist & Workshop Leader Effectiveness & Participant Engagement Ratings Visit 2

Fidelity Rating Visit 2

Who is rating this audio recording?
- ❍ T
- ❍ K

Workshop leader initials:
- ❍ SH
- ❍ SYW
- ❍ RV

Date of workshop

Participant number

Note: For the following items, examples provided under content criterion need NOT be read verbatim by workshop leaders.

The workshop leader asked about/reviewed the participant's progress with exercise over the past 30 days
- ❍ Covered
- ❍ NOT covered

The workshop leader asked about participant's experience setting personal exercise goals
- ❍ Covered
- ❍ NOT covered

The workshop leader asked about participant's experience monitoring affect and values consistency in the exercise journal Example: What did you notice about your ratings of affect (how you felt) before, during, and after exercise?
- ❍ Covered
- ❍ NOT covered

The workshop leader asked about participant's experience monitoring exercise performance in the exercise journal Example: "How many calories did you burn on average? How long were your exercise sessions on average?"
- ❍ Covered
- ❍ NOT covered

The workshop leader reminded the participant of the "ACT" model Example: "Accept your experience during exercise and be present, clarify your exercise related values, & take action."
- ❍ Covered
- ❍ NOT covered

The workshop leader introduced making a plan for exercise going forward using NIH handout
- ❍ Covered
- ❍ NOT covered

The workshop leader reviewed "short-term" vs. "long-term mind" Example: "Short-term mind pays close attention to the parts about exercise or getting started with exercise that we expect to be unpleasant; long-term minds are better at remembering the reasons why we care about exercising " – Friction metaphor

- Covered
- NOT covered

(Working through the NIH handout) – The workshop leader discussed picking an activity that will be enjoyed Example: "Do you have any ideas for seeking out new types of exercise going forward? Anything you want to try but haven't yet? If so, why?"

- Covered
- NOT covered

The workshop leader reviewed the concept of "defussion" with the participant Example: "Remember that you can help yourself defuse from your internal experiences (thoughts, feelings, emotions, sensations) as you notice them by labeling them for what they are – just thoughts, just feelings, just emotions, and just sensations;" "Look at your thoughts rather than from them. Be the observer of your thoughts;" – "drop the rope;" "I'm having the thought that _____;" "Replace BUT statements with AND statements" Experiential practice leg hold exercise

- Covered
- NOT covered

(Working through the NIH handout) – The workshop leader discussed setting goals, making plans, and adding plans to a calendar Example: "Make your goals specific, include what you will do, when you will do it, and how long you will do it for."

- Covered
- NOT covered

The workshop leader did experiential practice of defusion/acceptance skill with participant -Hold legs out straight from chair Example: "As you notice the thoughts and feelings that come up for you, practice just accepting them as they are there, make a commitment to tolerating them, and practice distancing yourself from them."

- Covered
- NOT covered

(Working through the NIH handout) – The workshop leader discussed overcoming exercise roadblocks and barriers Example: "What were the top 3 barriers/road blocks that kept you from being active over the past 30 days? What strategies did you try to overcome those barriers? What worked and what didn't work so well? What solutions do you think might help you to overcome those barriers going forward?"

- Covered
- NOT covered

The workshop leader reviewed and discussed values clarification around exercise Example: "Why do you want to be more physically active? What are some ways that being more physically active has and will continue to enrich your life? Why is it important to you that you make exercise a part of your lifestyle going forward?"

- Covered
- NOT covered

(Working through the NIH handout) – The workshop leader discussed tracking exercise progress Example: "Did you find it helpful to monitor your exercise by filling out the journal over the past month? If yes, what was helpful? If not, what was not so helpful? Do you think you would like to keep a journal of your own going forward?"

- Covered
- NOT covered

The workshop leader reviewed committed action to exercise/Action planning Example: "What are you going to do?; How are you going to do it?; What challenges or barriers might come up?; What will you do if you encounter barriers or challenges?;" Commitment statement: "I commit to ____even if I feel _______ or have desires to ________. I will remind myself that _________."

❍ Covered
❍ NOT covered

(Working through the NIH handout) –The workshop leader discussed rewards for goal accomplishment Example: "When you accomplish a goal, reward yourself! What ways do you think you could reward yourself for achieving your exercise goals going forward?"

❍ Covered
❍ NOT covered

Workshop Leader Effectiveness & Participant Engagement Ratings

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
1. The workshop leader had excellent rapport with the participant.	❍	❍	❍	❍	❍	❍	❍
2. The workshop leader was able to keep the participant's attention throughout the workshop.	❍	❍	❍	❍	❍	❍	❍
3. The participant was actively engaged with the workshop content.	❍	❍	❍	❍	❍	❍	❍
4. The participant enjoyed herself during the workshop	❍	❍	❍	❍	❍	❍	❍
5. The participant learned something during the workshop.	❍	❍	❍	❍	❍	❍	❍
6. The workshop leader actively attempted to help the participate apply the workshop content to her own personal wants/needs/values.	❍	❍	❍	❍	❍	❍	❍
7. The workshop leader expressed acceptance of the participants' individual	❍	❍	❍	❍	❍	❍	❍

experience with exercise (past, present, imagined future) without judgment.							
8.The workshop leader emphasized using workshop content in a way that would “work” for the participant.	❍	❍	❍	❍	❍	❍	❍
9.The workshop leader was highly directive in terms of “telling” the participant what to do to increase her exercise behavior (rather than eliciting the participant’s own thoughts and ideas).	❍	❍	❍	❍	❍	❍	❍
10. The workshop leader expressed that the participant would need to change her way of thinking about exercise in order to change her behavior.	❍	❍	❍	❍	❍	❍	❍

If applicable, please note any unusual circumstances or occurrences that disturbed normal workshop session conditions, including technical difficulties:

Note. Fidelity checklists and workshop leader effectiveness/participant engagement ratings scales for Visit 2

Appendix C

The Boulder Defusion Scale

Now we want to ask you about the extent to which you think you could defuse from thoughts and feelings that may come up before or during exercise. Remember, "defusion" is a made up term that is used to describe a state of achieving "distance" from internal experiences like thoughts and feelings. The more defused you are from thoughts or feelings, the less automatically you act on them.

Based on this definition of defusion, please use the scale provided below to rate each scenario below according to the extent to which you would normally be in a state of defusion in the specified situation.

Important: you are not being asked about the degree to which you would think certain thoughts or feel a certain way, but the degree to which you would be able to defuse from the example thoughts and feelings if you were to experience them.

Not at all	A little	Somewhat	Moderately	Quite a lot	Very much
0	1	2	3	4	5

1. You become frustrated with your performance during a workout. To what extent would you normally be able to defuse from feelings of frustration.

2. You had planned to exercise today but now you are having the urge to skip your workout. You are having thoughts like "It's too much effort to go workout now, I'll do it tomorrow" or "trying to fit in a workout today will make me feel too rushed." To what extent would you normally be able to defuse from thoughts about skipping your workout?

3. While exercising, you are breathing heavy, your heart is pounding, and your legs are burning from muscle fatigue. To what extent would you normally be able to defuse from physical discomfort during exercise?

4. While exercising, you start to feel insecure about how you look and/or your performance. To what extent would you normally be able to defuse from anxious thoughts like, "Other people are probably laughing at me," or "I'm not any good at this?"

5. Imagine that you are having a thought such as, ‘‘I can’t do this exercise,’’ or “I don’t have any time to exercise.” To what extent would you normally be able to defuse from thoughts about lack of ability to exercise?

6. Imagine you are having a thought such as, “I just can’t get started” or “I don’t feel like exercising today.” To what extent would you normally be able to defuse from thoughts about lack of motivation for exercise?

7. Imagine that you feel disappointed about not meeting an exercise or fitness related goal. To what extent would you normally be able to defuse from feelings of disappointment about an exercise or fitness goal?

8. You have been struggling to see progress towards your exercise goals and are feeling stuck in a rut. You experience thoughts such as, “I will never improve” or “I might as well give up.” To what extent would you normally be able to defuse from thoughts of hopelessness regarding your exercise goals?

9. Imagine you are having thoughts like, “I’ll never be able to keep this up long term” or “I don’t think I can find time to exercise regularly.” To what extent would you normally be able to defuse from thoughts about not maintaining an exercise routine?

10. A friend invites you to try a new type of exercise with him/her that you have not done before (for example, a new sport/activity or a new fitness class at the gym). In anticipation of getting started, you begin to have thoughts that you might not like it, or that you will get hurt, or that others will make fun of you. You start to notice your heart racing, butterflies in your stomach, and your hands trembling. To what extent would you normally be able to defuse from sensations of nervousness about trying a new type of exercise?

11. Using the scale below, please tell us about the extent to which you found the questions you just answered confusing or hard to understand.

Not at all confusing/hard to understand	**A little confusing/hard to understand**	**Somewhat confusing/hard to understand**	**Moderately confusing/hard to understand**	**Very confusing/hard to understand**
1	**2**	**3**	**4**	**5**