Developing and Validating a New Physical Activity Goal Instrument: Can the Reasons to Exercise (RE_X) Scale Identify Profiles that Enhance Physical Activity Behaviors?

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Authorization to Submit Dissertation

This dissertation of Vanessa Marie Kercher, submitted for the degree of Doctorate of Philosophy with a Major in Education and titled "Developing and Validating a New Physical Activity Goal Instrument: Can the Reasons to Exercise (RE_X) Scale Identify Profiles that Enhance Physical Activity Behaviors?" has been reviewed in final form. Permission, as indicated by the signatures and date below, is now granted to submit final copies to the College of Graduate Studies for approval.

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Abstract

Understanding what moves people to be physically active is key to identifying sources of motivation critical to promote engagement, persistence, and adherence in physical activity (PA) programs. Three separate, but related, studies were conducted to develop and validate comprehensive PA goal measure, the Reasons to Exercise (RE_X) Scale, and establish it as a viable measurement of reasons people have for exercising and/or being physically active. Study 1 developed the final RE_X Scale item pool. Initial evidence suggested the RE_X Scale was a valid and reliable measure, although additional work will need to be done to refine the instrument. Examination of the RE_X revealed nine latent factors held up under both the unrestricted (i.e., exploratory factor analyses) and restricted (i.e., covariance modeling), and based on Cronbach's alpha, the items within each hypothesized dimension were similar and closely related. Following the development of the RE_X, Study 2 assessed the psychometric properties of the Reasons to Exercise-Version 2 (RE_X-2) in another sample of active adults. A nine-factor, 36-item instrument demonstrated the RE_X-2 as a useful tool for measuring the reasons people have for exercising in two samples of adults. The multi-group CFAs for gender and age provided reasonable evidence of measurement and structural invariance using the difference in CFI scores as the criterion. Finally, Study 3 examined how clusters created by cluster analysis using reason subscales and PA categories differed across behavioral regulation, passion, mindsets, and PA patterns. The RE_X-2 subscales were used to create four unique, meaningful reason profiles, and five PA profile groups were formed using PA subscales. Differences among the reason and PA profiles were supportive of model predictions. In the reason profiles, the number of valued reasons and individuals exhibiting more autonomous-focused reasons for being physically active led to more desirable outcomes

that those with fewer valued exercise reasons or individuals exhibiting more control-focused reasons. In the PA profile findings, motivation was critical to PA engagement, and individuals engaging in higher-intensity type of physical activities were more autonomously motivated.

Keywords: Reasons to Exercise, Motivation, Physical Activity, Goals

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Dedication

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Introduction

Increasingly, exercise continues to be examined as an integral component linked to reducing many major causes of mortality and morbidity, including heart disease and type-2 diabetes (Center for Disease Control and Prevention [CDC], 2014), yet many individuals fail to regularly exercise. To promote more positive, physical activity (PA) behaviors, researchers have tried to understand why people engage in any form of PA (CDC, 2014). Measures were either developed or adapted to investigate the various reasons people have for exercising and/or be physically active, however, and these results have demonstrated systematic differences. Additionally, the psychometric properties of such instruments are questionable. Therefore, the purpose of this dissertation as to address this gap in the literature by investigating the reasons people have for exercising and/or being physically active. The aim was achieved through three separate, but related, studies that investigated the development and construct validation of the Reasons to Exercise (RE_X Scale). Before meaningful inquiries about the RE_X could be conducted, an instrument that accurately and reliability assessed the reasons people have for exercising and/or being physical active in recreational adults was needed. Prior research had used the Exercise Motives Inventory-2 (EMI-2; Markland & Ingledew, 1997), the Physical Activity Leisure Measurement Scale (PALMS; Molanorouzi, Khoo, & Morris, 2015), and the Exercise Sport and Incentive Questionnaire (ESIQ; Raedeke & Burton, 1997). However, available evidence suggested additional work was needed to establish these goal instruments were valid measures of reasons/goals. Thus, the purpose of Study 1 was to develop the RE_X Scale, which was developed for this dissertation.

Following the development of the RE_X's initial item pool, the psychometric validation, factor validity, and measurement invariance was assessed in Study 2. Specifically, Study 2

examined the factor validity of the Reason to Exercise (RE_X) Scale-Version 2 using CFA to test model fit in a sample of adults, and investigate whether model fit was maintained in a second adult sample. Preliminary construct validity was examined by comparing the RE_X-2 to several hypothesized psychosocial correlate variables. The measurement (i.e., equal forms, equal loadings, and equal intercepts) and structural (i.e., equal factor variances, equal factor covariance, and equal means) invariance of the RE_X-2 was also evaluated across gender and age.

Finally, in Study 3, cluster analysis was used to form goal profiles for why people exercise by creating naturally-occurring reason profiles and examining how profiles differed based on adults' motivational regulation, passion, and PA behaviors.

Manuscript 1: Re-Examining the Role of Goals in Physical Activity Motivation: Development of the Reasons to Exercise (RE_X) Scale

What are the reasons why people initiate, maintain, and adhere to a physically active lifestyle? Physical activity (PA) refers to any bodily movement produced by the skeletal muscles that result in energy expenditure above the basal metabolic rate (ACSM, 2014). Exercise is a subcomponent of PA that incorporates planned, structured, and repetitive movements aimed to improve or maintain physical fitness. (ACSM, 2014). The study of PA in people differing in age, gender, and activity type (Duda & Tappe, 1989; Egli, Bland, Melton, & Czech, 2011) is considered important for many reasons, particularly the need to identify determinants of a physically active lifestyle that is personally relevant (e.g., physical, mental, social, and/or health benefits) because it focuses on important reasons individuals have for being active that enrich their lives in meaningful ways while combatting obesity and its related health problems.

Historically, Maehr (1984) emphasizes that the study of motivation has been associated with internal processes: needs, drives, expectancies, goals, and intents. Generally, people will approach a task with certain goals of action reflecting their personal perceptions and beliefs about the particular activity in which they want to engage (Deci & Ryan, 2000). Individuals not only perceive success and failure differently because they have different reasons or goals for participation, but also because they make judgments about the worth of the task. Consequently, valued reasons or goals are widely thought to be the standards by which individuals judge personal success and failure (Maehr & Braskamp, 1986).

Additionally, Deci and Ryan (2000) state people can be motivated because they value an activity or because there is strong external coercion. Most behaviors have multiple motives

that are both intrinsic and extrinsic in nature. The issue of whether people make behavioral choices because of their interests and values, or do it for external reasons is a matter of significance in every culture and represents a basic dimension by which people make sense of their own and other's behavior (Deci & Ryan, 2000).

Although several theoretical approaches (e.g., achievement goal theory and self-determination theory) and instruments (Duda & Tappe, 1989; Markland & Ingledew, 1997; Molanorouzi, Khoo, & Morris, 2014) have investigated reasons and/or goals for exercising, a psychometrically-sound instrument that comprehensively examines reasons for PA in the general population is still needed. In order to address this problem, the aim of this study is to create the Reasons to Exercise (RE_X) Scale that provides a more comprehensive assessment of the reasons or goals that motivate people to be physically active by including both SDT and AGT conceptions to understand more about the informal goals, or "reasons" people have for engaging in PA, with an added focus on important personal and contextual factors (i.e., gender, age, PA type and amount) that may construct completely different reasons, experiences, and outcomes for people. Therefore, the research question examined in this study was can the development of the RE_X Scale identify a broad range of reasons/goals for exercise that provide initial evidence of good psychometric properties? Study 1 focuses on the development of the RE_X item pool and the refinement of the RE_X to final form.

Motivation to Be Physically Active: Two Major Conceptual Frameworks

Researchers, health professionals, and policy makers (Center for Disease Control and Prevention [CDC], 2014) have all sought to explore the reasons some people are physically active, whereas others are less active, or not active at all. Although the antecedents of participation in PA are highly complex, one important approach is to focus on a conceptual

framework that influences individual's initiation, maintenance, and adherence to PA behaviors. Two theoretical approaches were utilized to provide guidance and support for identifying the reasons people have to exercise, including: Achievement Goal Theory (AGT; Nicholls, 1984) and Self-Determination Theory (SDT; Deci & Ryan, 1985).

Achievement Goal Theory

Achievement Goal Theory (AGT; Nicholls, 1984) originated in the educational domain to understand how cognitions (e.g., thoughts) influence behavior. In the physical domain, AGT initially explored goal orientations in competitive sport, and to a lesser extent, recreational sport and exercise (Duda & Whitehead, 1998). AGT (Nicholls, 1984) represents an integrated and systematic approach to the study of human motivation in achievement settings because it involves not just the reasons for engaging in an achievement task but also the standards or criteria for judging successful performance. For instance, AGT (Rogers, Morris, & Moore, 2008) provides a conceptual structure for studying individuals in their environment regardless of the nature of that environment (e.g., home, gymnasium, or sporting field). Much of the literature (Duda & Tappe, 1989) examining goal orientations in PA settings have investigated the motivational, affective, and behavioral concomitants (Sebire, Standage, & Vansteenkiste, 2009) of dispositional goal orientations, but few have attempted to use a goal-based conceptual framework to understand motives for exercise and PA.

To use AGT to predict motivation and behavior, individuals' most valued goals must be identified in order to predict when a given goal will influence behavior. The term goal, as employed here, refers to the motivational focus of the reason one holds for the activity (i.e., What is the value of the activity?). According to Maehr (1984) meaning is the critical determinant of motivation in achievement situations. Whether or not individuals want to

invest themselves in a particular activity (e.g., exercise or PA) depends on what the activity means to them. Generally, people characteristically bring a certain package of meanings with them into a situation, which determines their behavior within the situation. Furthermore, these features affect the meanings that may arise for the person, and such meaning(s) that determines personal investment.

A number of goals may be operative in guiding how persons are motivated to invest time and energy. Maehr and Nicholls (1980) describe goals as critical mechanisms in achievement motivation. Nicholls (1984) believes achievement relates to behavior in which the goal is to develop or demonstrate high ability to oneself or to others and/or to avoid demonstrating low ability. According to AGT (Roberts, Treasure, & Balague, 1998), people's subjective experience and overt behavior should differ in predictable ways for different goals. In achievement situations (Roberts et al., 1998), this implies that individuals desire success to the extent that it indicates high ability and seek to avoid failure to the extent that it reveals low ability.

Goals define success and failure. Nicholls (1984) believes reaching valued goals and/or making meaningful progress toward reaching that goal(s) is typically perceived as success, whereas not attaining valued goals or making meaningful progress towards these goals is perceived as failure. Goals may vary among individuals across different contexts or domains (Duda & Whitehead, 1998; Harwood, Hardy, & Swain, 2000). Therefore, it is only possible to understand personal motivation by knowing what goals a person values in particular situations or domains. Maehr and Nicholls (1980) posited three primary types of achievement goals: ability, task, and social approval goals.

Nicholls (1980) subsequent work focused on two major achievement goal orientations, (a) task and (b) ego. Motivational orientations emphasized that more intrinsically-focused task orientations prompt greater development, growth, and enjoyment than do more extrinsically focused ego orientations. Maehr and Braskamp (1994) subsequent research and consulting in business prompted the development of personal investment theory (PIT) based on broader range of goals that were meaningful in this different achievement domain (i.e., competition, power, excellence, task involvement, affiliation, social concern, recognition, and financial awards).

Maehr and Braskamp (1992) developed the Inventory of Personal Investment (IPI) to measure these eight business incentives/goals, and the IPI was able to demonstrate goal profiles that could differentiate between different populations. Maehr and Braskamp (1994) also suggested that the specific goals adopted by, or not adopted by, workers' differed depending on their specific work context (e.g., What goals will best meet personal needs to advance one's career in their current organization or alternative organizations?). Maehr and Braskamp's (1994) PIT conceptual framework suggests that the greater the compatibility between PA participants' valued goals and the ability of their exercise program to meet those goals should increase engagement, which in a PA context might be operationalized as adherence. Perhaps in achievement (i.e., competitive sport and education) settings, task and ego are the most prominent goals for the majority of participants, and therefore are able to capture personal definitions of success. However, it is unlikely to be true in all achievement situations, or nonachievement settings, particularly diverse contexts such as exercise and PA. Clearly, exercise and PA include both achievement and nonachievement domains, and the goals that are relevant in these domains include additional valued goals (e.g., health, fitness,

weight control, and affiliation) other than task and ego. Therefore the restriction of examining only task and ego goals may have limited the understanding of how goals influence exercise and PA behavior, leaving a gap in current research literature.

Self-Determination Theory

Self-Determination Theory (SDT) is Deci and Ryan's (1985) theory of human motivation that addresses the conditions that promote optimal engagement, as well as the environmental factors that hinder or undermine self-motivation, social functioning, and personal well-being. The nature of motivation concerns magnitude, direction, and persistence, all aspects of activation and intention (Deci & Ryan, 2000). SDT (Deci & Ryan, 2000) posits that people are innately and proactively motivated to master their social environment. SDT (Rogers et al., 2008) is a theory for understanding the motives (rather than goals) people have for engaging in activity that has been refined over four decades.

According to Deci and Ryan (2000), people can be motivated because they value an activity or because there is strong external coercion. Deci and Ryan's (2000) SDT focuses on intrinsic versus extrinsic goals driving motivation. Most behaviors have multiple motives that are both intrinsic and extrinsic in nature. The issue of whether people behave according to their internal interests and values, or do it for reasons external to themselves, is a matter of significant interest to every culture and presents a basic dimension by which people make sense of their own and other's behavior (Deci & Ryan, 2000).

SDT (Deci & Ryan, 2000) posits that intrinsic rather than extrinsic motivation is considered the most powerful and sustainable type of motivation, particularly long-term. According to Deci and Ryan (2000), individuals who are intrinsically motivated are self-regulated (i.e., autonomous), engage in activities out of interest, experience a sense of volition,

and function without aid of external rewards or constraints (e.g., “I exercise because it’s fun”). SDT hypothesizes that individuals are extrinsically motivated when they engage in an activity or associate with behaviors that are characterized by motives being governed by some separable outcome (e.g., seeking approval, to attain a tangible outcome; low autonomy; Sebire et al., 2009). The focus of SDT is on creating conditions that enhance an individual’s innate need to successfully engage with their environment (Deci & Ryan, 2000). Deci and Ryan (1985) suggest that satisfaction of three psychological needs (i.e., competence, autonomy, and relatedness) increases intrinsic motivation for a task.

Furthermore, Deci and Ryan (2000) proposed that self-determination occurs on a continuum from amotivation (i.e., no motivation at all) to intrinsic motivation (i.e., motivated by purely internal reasons without external influence). The greater the satisfaction of needs, the more self-determined motivation would become, moving from amotivation thru extrinsic motivation to intrinsic motivation (Deci & Ryan, 2000). Additionally, within SDT, Deci and Ryan (2000) suggest that the more autonomy-supportive the motives, the more beneficial they should be for motivating desired behavior. Thus, more autonomy-supportive exercise/PA goals should promote greater PA adherence than would less autonomy supportive goals.

Nexus of SDT and AGT for Understanding PA Motivation

Developing a measure that is optimally suited for people engaging in PA requires understanding motivation within a sound conceptual framework. AGT and SDT have much in common in relation to what is proposed to motivate people to participate in exercise and PA. Both theories are driven by performance and competition related reasons, and how the conflict between them influence motivation. Both theories emphasize competence demonstration as important in motivation. Both refer to task and ego goals, and the

importance of each to ongoing motivation. AGT accounts for goals people primarily have in achievement settings, and thus is more narrowly focused compared to the goals SDT encompasses that work across multiple domains. Most instruments aimed toward understanding exercise and PA are based on either SDT or AGT, but not both. The uniqueness of a scale including both SDT and AGT concepts will help researchers and health professionals understand more about the informal goals, or "reasons" people have for engaging in PA, with an added focus on important personal and contextual factors (i.e., gender, age, PA type and amount) that may construct completely different reasons, experiences, and outcomes for people. As exercise/PA makes its way to the forefront of health promotion research, it is essential to understand the complex relationships of humans with their environment, and therefore provides an important reason to develop and validate a scale to identify the reasons why people engage in exercise/PA.

Uniqueness of PA Domain

In applying AGT to the PA setting, researchers (Duda & Whitehead, 1998; Raedeke & Burton, 1997) emphasized that individuals exercise for multiple reasons as suggested by the PIT framework, including both achievement and non-achievement domains that should promote a wider range of goals than do achievement domains alone. Achievement-related (Harwood et al., 2000) motives attempt to reach some standard of excellence such as task mastery (e.g., improving performance), outcome (e.g., positive social comparison such as doing well relative to others), and social recognition. Additionally, Raedeke and Burton (1997) suggest that people also are physically active for non-achievement related reasons such as becoming deeply absorbed in an activity (task absorption), emotion management, and social affiliation.

PA Goal Instruments

Several instruments (Duda & Whitehead, 1998; Markland & Ingledew, 1997) based on quantitative and qualitative approaches (Segar, Eccles, & Richardson, 2008) have been developed to explore the reasons people engage in PA. The qualitative research is beyond the scope of the present investigation because it examines reasons/goals for exercise in specific populations (e.g., women, middle-aged, sport specific populations) using unique approaches that encourage researchers to explore developing a generalizable and valid instrument that may be used to investigate reasons/goals across ages and genders. Nevertheless, before moving forward with the development of a new PA goal instrument, it is important to ask if there are so many instruments available to measure the reasons people engage in PA, then why should we create a new one? We believe the development of the RE_X Scale is important for a number of reasons. First, the RE_X Scale is intended to readdress an imbalance in previous research, where much of the research has been devoted to competitive sport (Fredrick & Ryan, 1993), young adults (Egli et al., 2011), non-exercisers (Markland & Ingledew, 1997), and diverse ranges of PA amounts and types (Molanorouzi et al., 2015). For instance, previous research (Fredrick & Ryan, 1993) has grouped PA types into individual sports, team sports, fitness and/or exercise, competitive sport, racquet sports, and football clubs. The results of such findings do provide important information about how such groups differ in their reasons for exercising, but do not help advance and integrate scientific research to provide educational and practical applications of exercise science which is the mission of many health-related organizations such as the American College of Sports Medicine (ACSM, 2014). Therefore, such findings contribute little, if any, to promoting PA similar to the approach used by health organizations that support the importance of integrating aerobic,

strength training, and flexibility strategies to maximize overall health benefits (ACSM, 2014; CDC, 2014).

Second, several current instruments used to measure reasons/goals for exercise have failed to conduct measurement invariance testing on important demographic variables. An instrument intended to be administered in a heterogeneous sample must establish that its measurement properties are equivalent in various subgroup populations. In order to establish compatibility of a scale across groups (e.g., age, gender, and PA types) measurement invariance analysis is crucial to the scale development and validation process. If a measure does not establish the equivalence of its measurement properties, particularly when developing a new instrument, one cannot conclude that the items in the measurement instrument operate similarly across the population. Another goal of developing the RE_X Scale is for it to be a measure that works across age, gender, PA levels and types. Finally, instruments need to follow contemporary scale development guidelines. During development of new instruments, such as the RE_X Scale, preliminary interviews are needed with a wide range of individuals who are physically active, item evaluation should be conducted by an expert exercise/PA panel, and feedback from pilot research should be included to foster improved psychometric properties. An important issue in the RE_X development process focused on whether the term "goal" or "reason" would resonate better with respondents. The strong consensus was goals were related to a formal process that most individuals did not utilize. However, most did have more informal reasons for being active that did influence their motivation. Thus, the more inclusive term "reason" was utilized in the development of this instrument.

AGT-Based PA Instruments

Previous exercise goal instruments (Markland & Ingledew, 1997; Molanorouzi et al., 2015; Raedeke & Burton, 1997) generally incorporate a larger number of goals then suggested by AGT for an achievement domain such as sport. Two PIT-based instruments include the 49-item, 10 subscale Personal Incentives for Exercise Questionnaire (PIEQ; Duda & Tappe, 1989) and the 62-item Exercise and Sport Incentive Questionnaire (ESIQ; Raedeke & Burton, 1997) that focused on why individuals participate in sport and exercise, and the breath of these reasons is a strength of using broader-based AGT models such as PIT (Duda & Tappe, 1989). Although other instruments generally incorporate both intrinsic and extrinsic-focused goals consistent with SDT, exercise and PA includes competitive and recreational sport, a variety of different types of formal exercise regimes and informally-based movement activities. In order to compare goals across exercise and PA domains, inventories need to include goals relevant to all these types of PA, and be able to identify a range of motivation regulation strategies (e.g., intrinsic or extrinsic) utilized in PA.

The RE_X Scale was designed as an improvement of the ESIQ and PIEQ for several reasons. First, exploratory factor analysis was used in both the PIEQ and ESIQ, but neither performed confirmatory factor analysis. A major weakness of EFA is the inability to quantify the goodness-of-fit of the resulting factor structure, a major contemporary psychometric criterion. Secondly, both instruments failed to explore invariance analysis as a means to examine whether measurement models are consistent across a variety of demographic variables such as age, gender, PA levels, and PA types. Pilot work assessing the RE_X Scale suggests that there are significant differences in the reasons people have for exercising depending on age. Because the goal of the RE_X Scale is to develop exercise programs using

an instrument that works across age groups, invariance testing is another strength of this instrument.

SDT-Based PA Instruments

Three major motive/goal instruments using SDT as their conceptual framework include: (a) the revised Motivation for Physical Activity Measure (MPAM-R; Fredrick & Ryan, 1993), (b) the revised Exercise Motivation Inventory (EMI-2; Markland & Ingledew, 1997), and (c) the Recreational Exercise Motivation Measure (REMM; Rogers et al., 2008), further abbreviated to create the (d) Physical Activity Leisure Motivation Scale (PALMS; Molanorouzi et al., 2014).

The 30-item MPAM-R (Fredrick & Ryan, 1993), an extension of the 23-item MPAM assesses 5 dimensions of PA involvement: two intrinsic subscales (i.e., "interests" and "enjoyment") and 3 extrinsic subscales (i.e., "social", "health/fitness", and "appearance"). Two studies reported moderate internal reliability of the MPAM-R, but neither study provided convincing support for the instrument's use with adult exercisers (Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997), and one study included a small sample, and therefore lacked generalizablity. The ability of the MPAM-R to dichotomize subscales to reflect intrinsic and extrinsic motivation consistent with SDT, and its usefulness in testing theoretically driven research questions is noteworthy. However, it seems clear from the exercise participation literature that individuals have a broader and more differentiated conception of reasons for exercise.

Markland and Ingledew (1997) 51-item EMI-2 was developed as an extension of the EMI. The EMI-2 defines 14 constructs measuring what they term "exercise motives" (i.e., stress management, revitalization, enjoyment, challenge, social recognition, affiliation,

competition, health pressures, ill-health avoidance, positive health, weight management, appearance, strength and endurance, and nimbleness).

The comprehensiveness of the EMI-2 and availability in different languages (Tenenbaum, Eklund, & Kamata, 2012) suggests the instrument holds broad appeal as a method of assessing exercise motivation reflecting intrinsic and extrinsic distinctions. Although it is limited in its assessment of psychological aspects (e.g., stress reduction) and it fails to include solitude-related reasons that may be found in recreationally active individuals, the EMI-2 covers a wide array of goals. Estimates of reliability (Ingeldew, Markland, & Medley, 1998; Markland & Ingledew, 1997) are evident, yet values reported in the literature vary considerably across EMI-2 subscales (α = 0.56-0.95) with different populations. Health Pressure (α = 0.69; Ingeldew et al., 1998; Markland & Ingledew, 1997) and Revitalization (α = 0.56; Ingeldew & Sullivan, 2002) displayed consistently lower reliability estimates in less active, middle-aged populations (Markland & Ingledew, 1997). Evidence of structural validity for responses to the EMI-2 is difficult to assess. Ingledew and Sullivan (2002) reported the results of measurement model analysis for EMI-2 scores based on single-factor measurement models in adolescents, while others (Markland & Ingledew, 1997) have reported results after grouping conceptually related EMI-2 subscales together before evaluating structural validity, and not using the full complement of EMI-2 items (Dacey, Baltzell, & Ziachkspowsky, 2008). The different solutions reported in the literature based on factor analysis make it difficult to interpret the evidence informing the measurement model underpinning the EMI-2, and thus the validity of the EMI-2 is difficult to appraise.

The 40-item PALMS (Molanorouzi et al., 2014) is a shortened version and extension of the 73-item REMM (Rogers et al., 2008), developed by selecting five items from each of the

eight factors in the REMM with the strongest psychometric properties to identify motives for PA in recreational exercisers (i.e., mastery, enjoyment, psychological, physical, appearance, others' expectations, affiliation, and competition/ego subscales). Despite the range of factors in the PALMS, it fails to identify reasons for exercise for health prevention or feelings (i.e., affective responses). The psychometric properties of the PALMS (Molanorouzi et al., 2014) also demonstrated marginal factor structure fit (comparative fit index [CFI] = 0.91), although internal reliability ($\alpha = 0.82$) is strong in diverse PA contexts. The internal consistency values in each subscale were generally high, the low being ($\alpha = 0.78$) for Mastery and Competition/Ego, suggesting all the subscales had moderate to strong internal consistency in a recreation sample. Given its length and ease of administration, Molonaourzu et al. (2014) recommend the PALMS over the REMM.

Exercise motivation research focused on measurement issues has produced a rich and diverse literature aiding theory development at the expense of creating an array of instruments assessing the focal constructs. Progress in terms of instrument development to assess exercise motivation is evident, but sustained attention to construct validation remains a fundamental issue in need of further research.

Focus of AGT Plus SDT-Based Comprehensive Instruments

A broad variety of goals, both intrinsic and extrinsic-based, drive exercise and PA behaviors, but questions continue to arise: "Why do people have so many goals they identify with?" and "Why do people select the goals that they have?" Clearly, the bandwidths of goals differ, and this difference should be reflected in assessments in line with AGT and SDT. AGT supports the importance of non-achievement and achievement goals to recognize the breadth of goal types, whereas SDT primarily suggests that people need both intrinsic and extrinsic

goals. Goals driven by AGT define success and failure, yet it is difficult to know what is going to motivate a person unless we know what they're goal(s) are to begin with.

SDT's ability to provide researchers with information about the categories of reasons people have for being PA is valuable for any instrument. For instance, according to SDT (Deci & Ryan, 2000) intrinsic goals are more self-determined (i.e., autonomous) than extrinsic goals, and consequently if such goals are easier to attain, they provide higher levels of autonomy when attained compared to extrinsic ones. For example, when comparing college students to middle-aged and elderly populations, reasons for engaging in exercise or PA are likely different, and for that reason it is important to have a variety of reasons that include intrinsic, extrinsic, and a combination of achievement goal motives (e.g., task and ego orientations).

Therefore, both AGT and SDT conceptual frameworks were utilized to identify what goals are important to people, but the domain (PA or exercise) is critically important to survey design as well. Because there are so many reasons that prompt people to be more active, an instrument needs to tap into all those categories in order to capture what works with all exercise populations. To understand how to develop effective interventions, it is important to investigate behaviors that encourage individuals to strive to attain certain reasons and not others. Developing instruments that can function as both research instruments and practical intake identification tools to maximize program compatibility may be critical to enhancing PA adherence.

RE_X Scale Development Procedural Framework

The RE_X Scale is designed as a revised and improved version of previously developed instruments (e.g., EMI-2 and PALMS) because of four important factors: (a) Item development included modification of items from existing instruments and composing new items to create 65-items represented in 13-factors; (b) the examination of the content validity of the scale through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) on a pilot sample; (b) Item refinement utilized an expert panel to refine item structure and content and provide feedback for item inclusion in the preliminary version; and (c) Item factor validation focused on the degree to which the RE_X items and dimensions consistently measure reasons to exercise for a wide range of exercisers.

The CFA of the hypothesized 13-factor, 65-item RE_X model indicated a poor fit in a pilot sample suggesting the factor structure was not representative of the reasons people have for exercising and/or being physically active. All items were then reviewed, and wording was revised to improve clarity (i.e., eliminate double-barreled items and wordiness) and enhance readability. Before eliminating items, the 13-factor, 65-item RE_X was investigated in another sample of adults.

The purpose of this study was to initially assess and refine the psychometric properties of the Reasons to Exercise (RE_X) Scale. Exploratory factor analysis (EFA) was used to assess the structural validity of the RE_X to identify a model factor structure by eliminating factors or items to help improve model fit from previous pilot findings. Exploratory structural covariance modeling was used to assess whether the measurement model extracted from the EFA was upheld. The reasons people have for engaging in exercise have been identified utilizing a number of theoretical approaches independently (e.g., AGT and SDT) for a number

of different populations (Molanorouzi et al., 2014; Raedeke & Burton, 1997; Segar et al., 2008). However, before meaningful inquiries about the reasons people have for being physically active can be conducted, an instrument that reliably and validity assessed such reasons is needed.

Method

Participants

Participants were 910 adults who were either members of a university wellness program (*N* = 253), members of a hospital-affiliated wellness center (*N* = 242), or personal contacts of the researcher (*N* = 415; see Table C.1). The average adult was middle-aged (*M* = 35.0 years; *SD* = 15.8), participated in sports (77.6 %), and included 40.3 % male and 59.2 % females. The participants consisted of 8 American Indian (1.1 %), 32 Asian (4.3 %), 18 African American, (2.4 %), 3 Hawaiian (0.4 %), 72 Hispanic (9.6 %), 597 Caucasians (79.5 %), and 21 (2.8 %) reporting "other" (see Table C.1).

Instruments

The survey was comprised of three instruments, including: (a) the Reasons to Exercise (RE_X) Scale (Version 1), (b) the Physical Activity Demographic and Background Questionnaire (PADBQ), and (c) the Physical Activity Goal Importance Inventory (PAGII).

RE_X Scale (Version 1). The initial 65-item RE_X Scale had 13 hypothesized dimensions, each with 5 items, including: (a) social (SOC); (b) mental health (MH); (c) appearance (APP); (d) weight management (WM); (e) revitalization (RV); (f) fitness (FIT); (g) feel good (FG); (h) solitude (SOL); (i) preventative health (PH); (j) health concerns (HC); (k) mastery (MAST); (l) competition (COM); and (m) muscular fitness (MF). Items included a standardized stem (i.e., "To you, how important is this reason for exercising and/or being

physically active...?") followed by content written to tap into important aspects of each of the 13 reason dimensions conceptualized for the RE_X Scale (see Table 1.1). Following Dillman's (2017) approach, each statement was evaluated using a 6-point Likert scale, ranging from 1 (not at all important) to 6 (extremely important; see Appendix A). Additionally, consistent with contemporary psychometric recommendations (Dillman, Smyth, & Christian, 2014), items were written targeting a 5^{th} grade reading level based on Microsoft Word's 2016 Flesch-Kincaid reading level analysis tool.

PADBQ. Participants self-reported their age, gender, ethnicity, and experience engaging in PA/exercise (see Appendix D).

PAGII. To measure reasons for exercise and PA, participants were asked to select their 5 most important reasons from a list of 13 hypothesized dimensions compiled based on RE_X Scale-Version 1 (see Appendix D).

Procedure

Upon receiving Institutional Review Board (IRB) approval (see Appendix K), an online survey was developed in Qualtrics (see Appendix D) and distributed to three samples: a university wellness program, a hospital-affiliated wellness center, and personal contacts of the researcher.

University wellness program. Approval was obtained to recruit participants from a university wellness center who were asked to complete a survey assessing the reasons people have for exercise. A banner entitled "What Moves You?" and a table were set up in the entrance of the center for one day where participants were asked to complete an 8-10 minute survey. Individuals who agreed to participate were provided a mini IPad to complete the Qualtrics survey electronically.

Hospital-affiliated wellness center. Participants were recruited in-person at a large hospital-affiliated wellness center. A table was set up in the main entrance of the facility for two days where people were asked to complete a 8-10 minute survey. Members who agreed to participate were given a tablet to complete the survey electronically.

Personal contacts. Personal contacts of the researcher were sent email invitations that included a URL to access the online Qualtrics survey and the researcher's contact information (see Appendix J).

Data Analysis Plan

Prior to analysis, all data were examined for missing data and cases, and cases with missing values were excluded from subsequent analyses. Data were also examined to confirm all values were within range, thus ensuring all cases include only the target population (i.e., at least 18 years of age). Univariate and multivariate outliers were identified using descriptive statistics and Mahalanobis distances, respectively. Finally, to assess the extent to which the assumption of normality had been satisfactorily met, skeweness and kurtosis were examined.

EFA was conducted using maximum likelihood (ML) extraction and direct oblimin rotation to allow for hypothesized correlations among factors. Factors with eigenvalues greater than or equal to 1.0 were retained in the solution. Following estimation, the measurement model was re-specified, eliminating items that (a) had no substantial loadings on any factor (loadings ≤ 0.40), (b) had simultaneous, substantial loadings on multiple factors (i.e., loadings ≥ 0.40 on more than one factor), and/or (c) did not fit conceptually with the other items identified as loading on the factor. To ensure that the final solution was not a function of a specific extraction method, the factor structure of the final measurement model was then re-estimated using principal axis (PA) and principal component (PC) extraction

methods. Cronbach's alpha was then calculated to assess the internal consistency of the items in each factor.

Version 23.0 of the Analysis of Moment Structure (AMOS; Arbuckle, 2011) was used to assess the fit of the model in which all-cross loadings were constrained to zero (i.e., exploratory structural covariance modeling). Consistent with the measurement model extracted from the EFA, the first item of each factor was set to 1.0 to define the metric of the latent factor, and the remaining items were freely estimated. The covariance between factors were freely estimated, and all covariances between error terms were set to zero.

Maximum likelihood estimation (MLE) was used to generate parameter estimates. The likelihood chi-square statistic, Tucker-Lewis index (TLI), CFI (Bentler, 1990), and root mean square error of approximation (RMSEA) were used to assess model fit. Following each model, modification indices were examined, and alternative specifications were explored to converge on a measurement model with maximal fit and parsimony. A composite assessment of these analyses was used to select the most appropriate items for retention in the final version of the RE_X item pool.

Results

Preliminary Analyses

Within this sample, 96 (10.6 %) participants did not complete the survey and 42 (4.6 %) were missing more than one data point on the RE_X. Thus, 772 (84.8 %) were retained of the 910 adults that participated. The majority of the RE_X items were nonnormal, with skewness and kurtosis *z* scores exceeding the recommended |3.3| threshold (Tabachnick & Fidell, 2012; see Table C.2). Given that the reasons people have for exercising are likely not normally distributed in the population and the fact that Tabachnick and Fidell (2012) suggest only

marginal improvements can be made by transforming nonnormality of this type and magnitude, no transformations were made to the data.

Exploratory Factor Analysis Results

Nine factors emerged from the EFA on the RE_X, and factor structure was consistent across each of the three extraction methods (see Table 1.3). The first factor represented both MF and FIT factor items, and was labeled as "fitness" (FIT), whereas the second factor included four items and was labeled "competition" (COM). The third factor also included four items and was labeled "weight management" (WM), as did the fourth factor that was labeled "health concerns" (HC). The fifth factor included five items and was labeled "solitude" (SOL), whereas the sixth factor included four items and was labeled "social" (SOC). The seventh and eight factor each included four items, with the former labeled appearance (APP) and the later sharing items from three different factors (i.e., MH, RV, and FG) that was renamed "mood enhancement" (ME); The last factor included three items and was labeled "preventative health" (PH). The factor loadings for the nine factors demonstrated primary loadings ranging from 0.61 to 0.92 (see Table 1.4).

Cronbach's Alpha Reliability Results

Internal consistency for the RE_X factors were acceptable, with Cronbach alpha values ranging from 0.81 to 0.92 (see Table 1.3).

Exploratory Structural Covariance Modeling Results

Initial fit for the structural covariance model of the 9 factors was satisfactory (*CFI* = 0.908; χ^2 (783) = 2886.32, $p < 0.001$; $\varepsilon = 0.059$ [0.057-0.061]; see Figure 1.1). The modification indices suggested model fit could be substantially improved with the

specification of a covariance between error terms separately for MF Items 2 and 4, COM Items 1 and 4, and HP Items 1 and 2.

Model fit for the structural covariance model improved (*CFI* = 0.92; χ^2 (780) = 2545.35, $p < 0.001$; $\varepsilon = 0.054$ [0.052-0.057]). However, due to content overlap between COM Items 1 and 4, along with HP Items 1 and 2, COM Item 4 and HP Item 2 were removed, and thus no longer were represented by an error covariance, respectively. Because MF Item 4 had the word "physical" in the item twice, it was also removed along with its error covariance representing MF item 4 with Item 2. Removing error covariances and items improved model fit (*CFI* = 0.93, χ^2 (629) = 2110.19, $p < 0.001$, $\varepsilon = 0.055$ [0.053-0.058]). All factor loadings were significant ($p < 0.001$; see Figure 1.2). The latent factors accounted for 52 to 67 % of the variance in FIT; 62-84 % in COM; 47-72 % in WM; 37-84 % in HC; 52-86 % in SOL; 43-78 % in SOC; 60-74 % in APP; 47-66 % in ME; and 43-70 % in PH.

Discussion

In this study, we conducted an exploratory investigation of the psychometric properties of the RE_X – a new measure developed for measuring the reasons people have for exercising and/or being physically active. The results of this initial effort to develop a valid, comprehensive measurement instrument aimed at assessing the reasons people have for exercising and/or being physically active were encouraging.

RE_X Development

The conceptual framework used to develop the RE_X was based on two motivational theories AGT and SDT. Both theories emphasize competence demonstration as important in motivation (i.e., driven by fitness-related and competition-related reasons) and support the influence of task and ego goals to ongoing motivation. Therefore, including both AGT and

SDT concepts encouraged writing 65 items designed to identify 13 factors, drawing from the tenets of both theories. In achievement-related domains, reasons may be based on attaining some standard of excellence (i.e., mastery and fitness factors with a focus on improving performance), outcome (i.e., competition factor related to social comparison against others), and recognition-related reasons (i.e., appearance factor). People may also participate for non-achievement related reasons in an effort to become deeply absorbed in activity (i.e., feel good and revitalization factors) and for social affiliation. In SDT, reasons for exercise may be associated with extrinsic reasons (i.e., preventative health, health concerns, and weight management factors) representing more controlled forms of motivation and thus reduce likelihood of PA persistence. Intrinsic reasons (i.e., feel good, revitalization, mental health, and solitude) have been suggested to be more autonomous forms of motivation and result in promoting positive PA behaviors.

RE_X Refinement

The original hypothesized model for the RE_X began with 13 subscales, nine of which ultimately were confirmed empirically. The hypothesized existence of three unique reasons for exercising relating to “feeling good”, “revitalized”, and/ or “mentally healthy” did not seem to differ in nature to exercisers in this study. In other words, exercise reasons for feeling good were not distinctly different from their mental health or revitalization reasons for exercise, prompting these three reason categories to be collapsed into one single factor. The hypothesized factor “Mastery” was the only factor not represented in our sample following EFA, a result that could be due to two factors. First, if a mastery construct does exist conceptually, and in previous research (Molanorouzi et al., 2014), the items we developed in this study to represent mastery were poorly constructed. Secondly, it is possible that different

elements or aspects of mastery were represented in other factors important to recreational exercisers. For example, in the RE_X the fitness factor was similar to the mastery factor in content (e.g., 'for the physical fitness to take on challenges'). This content similarly may have been one reason why mastery was identified as a valid dimension in the PALMS but fitness was not. Finally, EFA results reduced the total number of RE_X items by eliminating weak or nonfactoring items, thus accomplishing one of the major goals of this initial study to get the RE_X to a more manageable length.

RE_X Further Refinement

The results of the exploratory structural covariance modeling (CV) supported the initial model fit of the RE_X, providing initial support for the construction of the instrument. CV was used to refine the item pool to its 38-item final form as well as test the RE_X measurement model by applying more rigorous statistical methods. Alpha reliabilities were strong (DeVellis, 2017), and the fit indices from CV are at least indicative of a good fitting model (Brown, 2015). Of the 38 items in the nine proposed subscales carried forward from the EFA, 38 items upheld the 9-factor model meeting the set inclusion criteria.

The merging of related subscales (e.g., mental health, revitalization, and feel good) did not drastically alter the conceptual relevance of the model, and these results were congruent with the results from the restricted examination of model fit. Although adults did not differentiate between revitalization, mental health, and feeling good as unique reasons they have for exercising, a combination of these reasons that are both mental and physical seemed to reflect the construct of mood enhancement. Consequently, this factor was renamed. Latent variables merging is one reason DeVellis (2017) recommends revising concepts that are better delineated through the process of instrument development, particularly because certain latent

variables operationalize into measurable factors that provide a more complex factor structure then initially hypothesized. According to DeVellis (2017), it was not surprising that some factors merged due to their conceptual congruence, a finding typical in early stages of scale development work.

An exploratory examination of the RE_X-Version 1 revealed nine latent factors that held up under both unrestricted (EFA) and restricted (exploratory structural covariance modeling) examination of model fit. Items had factor loadings greater than 0.50 on their respective factors, which indicates that the latent factors explained more than 25 % of the variability in how participants responded to the items. Thus, items were meaningful indicators of their respective latent constructs. The items in each factor also had acceptable internal consistency, as demonstrated by Cronbach alpha values greater than 0.80 (Kline, 2016). Despite the apparent structure of the preliminary version of the RE_X and the intriguing theoretical questions posed by the constructs represented, it should not be concluded that the initial version of the RE_X is a definitive, all-encompassing tool for assessing all the possible reasons people may have for exercising.

Study 1 progressed through one psychometric development cycle, resulting in revisions to items and latent constructs, which accomplished the goal of this initial study by reducing the total number of items and dimensions by eliminating less robust latent constructs and indictors. This study is not without limitations, with two key RE_X issues warranting caution and further exploration. First, even though the RE_X established initial evidence of good psychometric properties of the 9- factor, 38-item RE_X, the extent to which the hypothesized factor structure of the RE_X is maintained in a different sample of adults is unknown. Second, before the RE_X can be used to make meaningful comparisons between groups, the similarity

of the instrument's measurement structure across groups must be assessed. Thus, future work on the RE_X scale should conduct invariance analysis for gender and age, because previous research (Fredrick & Ryan, 1993; Markland & Ingledew, 1997) has suggested these variables influence reasons people have for exercising and/or being physically active. Following this study, the next step would be for additional data collection to conduct confirmatory factor analysis, gather preliminary construct validity evidence, and perform invariance analysis on the final RE_X Scale (Study 2).

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Table 1.1

Original Dimension Labels for the 65-Item RE_X Version 1

Dimension	Indicator	Item No.	Item
Social	soc1	1	..to feel connected with active people.
	soc2	14	..to spend time with friends.
	soc3	27	..for the social aspect.
	soc4	40	..to meet others who value exercise.
	soc5	53	..to be around others that motivate me to work out.
Mental Health	mh1	2	..to help lower stress.
	mh2	15	..to cope with stress.
	mh3	28	..for the mental health benefits.
	mh4	41	..to improve mental health.
	mh5	54	..to think clearly.
Appearance	app1	3	..to look good.
	app2	16	..to look fit.
	app3	29	..to look like I'm in good shape.
	app4	42	..to improve physical appearance
	app5	55	..to be more attractive.
Weight Management	wm1	4	..to lose weight.
	wm2	17	..to fit into the clothes I like.
	wm3	30	..to eat the foods I like.
	wm4	43	..to control weight.
	wm5	56	..to reach my ideal weight.
Revitalization	rv1	5	..for the refreshing feeling I get afterwards.
	rv2	18	..to enhance my mood.
	rv3	31	..for the energy boost.
	rv4	44	..to increase alertness.
	rv5	57	..to feel rejuvenated.
Fitness	fit1	6	..to maintain my physical fitness (e.g., strength).
	fit2	19	..to improve my physical fitness (e.g., endurance).
	fit3	32	..to have the physical fitness to take on physical challenges.
	fit4	45	..to have the physical fitness to accomplish daily activities.
	fit5	58	..to have a physically fit body.
Feel Good	fg1	7	..it feels good to move.
	fg2	20	..it makes me happy.
	fg3	33	..it feels good to sweat.
	fg4	46	..to feel good about myself.
	fg5	59	..to feel good physically the rest of the day.

Table 1.1 (continued)

Dimension	Indicator	Item No.	Item
Solitude	sol1	8	..to get time for myself.
	sol2	21	..to have alone time.
	sol3	34	..to be alone to think.
	sol4	47	..to have 'me' time.
	sol5	60	..for self-reflection.
Preventative Health	ph1	9	..to maintain my current health.
	ph2	22	..to live longer.
	ph3	35	..to maintain a positive quality of life.
	ph4	48	..to remain healthy as I age.
	ph5	61	..to prevent health issues in the future.
Health Concerns	hc1	10	..to help manage chronic pain.
	hc2	23	..to manage joint problems.
	hc3	36	..to manage a medical condition.
	hc4	49	..to control/deal with health concerns.
	hc5	62	..a doctor/health professional advised me to.
Mastery	mst1	11	..for the satisfaction of reaching a health/fitness goal.
	mst2	24	..to be my personal best in health/fitness.
	mst3	37	..to reach performance/fitness goals.
	mst4	50	..to give me personal challenges to face.
	mst5	63	..to reach new personal records ('PR').
Competition	com1	12	..to outperform others.
	com2	25	..because I enjoy competing.
	com3	38	..to compete with others.
	com4	51	..to outshine others.
	com5	64	..because I like to win.
Muscle Fitness	mf1	13	..to maintain my strength gains.
	mf2	26	..to be stronger.
	mf3	39	..to have lean/tone muscles.
	mf4	52	..for the strength to take on physical challenges.
	mf5	65	..to reach my maximum fitness level.

Note. Stem = "To you, how important is this reason for exercising and/or being physically active…?

Table 1.2

Correlation Matrix for RE_X Subscales and Descriptive Statistics for the Initial 13-Factor RE_X

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Social	--												
2. Mental Health	0.36	--											
3. Appearance	0.34	0.30	--										
4. Weight Management	0.16	0.24	0.57	--									
5. Revitalization	0.38	0.80	0.36	0.34	--								
6. Fitness	0.40	0.50	0.49	0.34	0.64	--							
7. Feel Good	0.41	0.69	0.45	0.32	0.83	0.71	--						
8. Solitude	0.32	0.58	0.22	0.15	0.57	0.37	0.58	--					
9. Preventative Health	0.28	0.58	0.29	0.30	0.63	0.66	0.63	0.39	--				
10. Health Concerns	0.25	0.32	0.10	0.34	0.30	0.24	0.18	0.25	0.38	--			
11. Mastery	0.45	0.45	0.49	0.30	0.54	0.73	0.65	0.47	0.48	0.30	--		
12. Competition	0.48	0.13	0.36	$0.07^{\#}$	0.17	0.34	0.29	0.25	0.10	0.09	0.53	--	
13. Muscle Fitness	0.44	0.42	0.50	0.27	0.54	0.83	0.63	0.35	0.55	0.22	0.82	0.49	--
Mean	3.20	4.56	4.38	4.13	4.59	4.82	4.70	3.71	4.93	3.05	4.12	2.72	4.40
SD	1.26	1.06	1.03	1.08	0.95	0.82	0.91	1.31	0.84	1.39	1.14	1.40	1.06

Note. All correlations significant at $p \leq 0.05$ unless otherwise noted ($^{\#}p > 0.05$).

Table 1.3

Exploratory Factor Analysis Pattern Matrix Loadings for the Revised 9-Factor, 38-Item RE$_X$

	Maximum Likelihood				Principal Axis				Principal Components			
Item *(Original Dimension Label)*	FIT	COM	WM	HC	FIT	COM	WM	HC	FIT	COM	WM	HC
..to have the physical fitness to take on physical challenges. (*fit3*)	**0.76**	-	-	-	**0.75**	-	-	-	**0.81**	-	-	-
..to be stronger. (*mf2*)	**0.76**	-	-	-	**0.76**	-	-	-	**0.78**	-	-	-
..to maintain my strength gains. (*mf1*)	**0.67**	-	-	-	**0.66**	-	-	-	**0.72**	-	-	-
..to improve my physical fitness (e.g., endurance). (*fit2*)	**0.60**	-	-	-	**0.60**	-	-	-	**0.65**	-	-	-
..to reach my maximum fitness level. (*mf5*)	**0.59**	-	-	-	**0.60**	-	-	-	**0.64**	-	-	-
..to compete with others. (*com3*)	-	**-0.89**	-	-	-	**-0.88**	-	-	-	**-0.88**	-	-
..because I like to win. (*com5*)	-	**-0.84**	-	-	-	**-0.85**	-	-	-	**-0.87**	-	-
..to outperform others. (*com1*)	-	**-0.83**	-	-	-	**-0.83**	-	-	-	**-0.87**	-	-
..because I enjoy competing. (*com2*)	-	**-0.81**	-	-	-	**-0.80**	-	-	-	**-0.82**	-	-
..to control weight. (*wm4*)	-	-	**0.87**	-	-	-	**0.87**	-	-	-	**0.90**	-
..to lose weight. (*wm1*)	-	-	**0.85**	-	-	-	**0.86**	-	-	-	**0.90**	-
..to reach my ideal weight. (*wm5*)	-	-	**0.70**	-	-	-	**0.70**	-	-	-	**0.76**	-
..to fit into the clothes I like. (*wm2*)	-		**0.51**	-	-	-	**0.51**	-	-	-	**0.63**	-
..to manage a medical condition. (*hc3*)	-	-	-	**0.93**	-	-	-	**0.88**	-	-	-	**0.88**
..to control/deal with health concerns. (*hc4*)	-	-	-	**0.83**	-	-	-	**0.78**	-	-	-	**0.80**
..to help manage chronic pain. (*hc1*)	-	-	-	**0.76**	-	-	-	**0.83**	-	-	-	**0.88**
..a doctor/health professional advised me to. (*hc5*)	-	-	-	**0.57**	-	-	-	**0.54**	-	-	-	**0.63**
Eigenvalue	11.79	4.40	3.87	3.07								
% of variance	28.06	10.50	9.22	7.30								
Cronbach's alpha	0.86	0.92	0.86	0.86								

Table 1.3 (continued)

Item *(Original Dimension Label)*	Maximum Likelihood					Principal Axis					Principal Components				
	SOL	SOC	APP	ME	PH	SOL	SOC	APP	ME	PH	SOL	SOC	APP	ME	PH
..to have alone time. (*sol2*)	**-0.94**	-	-	-	-	**0.94**	-	-	-	-	**0.94**	-	-	-	-
..to have 'me' time. (*sol4*)	**-0.93**	-	-	-	-	**0.93**	-	-	-	-	**0.92**	-	-	-	-
..to be alone to think. (*sol3*)	**-0.84**	-	-	-	-	**0.84**	-	-	-	-	**0.88**	-	-	-	-
..to get time for myself. (*sol1*)	**-0.74**	-	-	-	-	**0.73**	-	-	-	-	**0.78**	-	-	-	-
..for self-reflection. (*sol5*)	**-0.61**	-	-	-	-	**0.62**	-	-	-	-	**0.70**	-	-	-	-
..to spend time with friends. (*soc2*)	-	**0.79**	-	-	-	-	**-0.78**	-	-	-	-	**-0.84**	-	-	-
..to meet others who value exercise. (*soc4*)	-	**0.78**	-	-	-	-	**-0.78**	-	-	-	-	**-0.78**	-	-	-
..to be around others that motivate me to work out. (*soc5*)	-	**0.74**	-	-	-	-	**-0.73**	-	-	-	-	**-0.77**	-	-	-
..to feel connected with active people. (*soc1*)	-	**0.64**	-	-	-	-	**-0.64**	-	-	-	-	**-0.74**	-	-	-
..to look fit. (*app2*)	-	-	**-0.85**	-	-	-	-	**0.85**	-	-	-	-	**0.86**	-	-
..to look like I'm in good shape. (*app3*)	-	-	**-0.81**	-	-	-	-	**0.81**	-	-	-	-	**0.83**	-	-
..to look good. (*app1*)	-	-	**-0.77**	-	-	-	-	**0.77**	-	-	-	-	**0.83**	-	-
..to be more attractive. (*app5*)	-	-	**-0.72**	-	-	-	-	**0.72**	-	-	-	-	**0.80**	-	-
..to improve physical appearance. (*app4*)	-	-	**-0.69**	-	-	-	-	**0.71**	-	-	-	-	**0.72**	-	-
..to help lower stress. (*mh1*)	-	-	-	**0.68**	-	-	-	-	**0.68**	-	-	-	-	**0.80**	-
..to enhance my mood. (*rv2*)	-	-	-	**0.62**	-	-	-	-	**0.62**	-	-	-	-	**0.71**	-
..for the refreshing feeling I get afterwards. (*rv1*).	-	-	-	**0.60**	-	-	-	-	**0.59**	-	-	-	-	**0.66**	-
..it makes me happy. (*fg2*)	-	-	-	**0.48**	-	-	-	-	**0.48**	-	-	-	-	**0.53**	-
..to prevent health issues in the future. (*ph5*)	-	-	-	-	**-0.80**	-	-	-	-	**0.80**	-	-	-	-	**0.79**
..to remain healthy as I age. (*ph4*)	-	-	-	-	**-0.75**	-	-	-	-	**0.74**	-	-	-	-	**0.76**
..to live longer. (*ph2*)	-	-	-	-	**-0.63**	-	-	-	-	**0.63**	-	-	-	-	**0.84**
Eigenvalue	2.40	1.94	1.20	1.08	1.03										
% of variance	5.72	4.61	2.85	2.57	2.45										
Cronbach's alpha	0.92	0.86	0.91	0.84	0.81										

Note. FIT = fitness; MF = muscle fitness; COM = competition; WM = weight management; HC = health concerns; SOL = solitude; SOC = social affiliation; APP = appearance; MH = mental health; RV = revitalization; FG = feel good; PH = preventative health.

Table 1.4

Parameter Estimates for the 38-Item Factor Loadings of Revised RE_X

	Parameter Estimates		
Items	Unstandardized	Standardized	SE
fit3	1.00	0.72	
mf2	1.02	0.82	0.05
mf1	1.08	0.77	0.05
fit2	0.74	0.74	0.04
mf5	1.24	0.76	0.06
com3	1.00	0.92	
com5	0.94	0.85	0.03
com1	0.81	0.79	0.03
com2	0.99	0.87	0.03
wm4	1.00	0.85	
wm1	1.02	0.80	0.04
wm5	1.01	0.81	0.04
wm2	0.90	0.69	0.04
hc3	1.00	0.92	
hc4	0.96	0.90	0.03
hc1	0.76	0.72	0.03
hc5	0.62	0.61	0.03
sol2	1.00	0.90	
sol4	1.05	0.93	0.03
sol3	0.94	0.86	0.03
sol1	0.87	0.81	0.03
sol5	0.74	0.72	0.03
soc2	1.00	0.73	
soc4	1.18	0.88	0.05
soc5	1.15	0.83	0.05
soc1	0.84	0.66	0.05
app2	1.00	0.86	
app3	1.04	0.86	0.03
app1	0.82	0.79	0.03
app5	1.02	0.77	0.04
app4	0.96	0.86	0.03
mh1	1.00	0.69	
rv2	1.15	0.81	0.06
rv1	1.07	0.72	0.06
fg2	1.10	0.77	0.06
ph5	1.00	0.83	
ph4	0.91	0.83	0.04
ph2	0.86	0.66	0.05

Table 1.5

Correlation and Descriptive Statistics for the 9-Factor Revised RE_X

	1	2	3	4	5	6	7	8	9
1. Fitness	--								
2. Competition	0.47	--							
3. Weight Management	0.22	0.00[#]	--						
4. Health Concerns	0.19	0.06[#]	0.33	--					
5. Solitude	0.36	0.25	0.10	0.23	--				
6. Social	0.43	0.46	0.13	0.24	0.32	--			
7. Appearance	0.45	0.35	0.54	0.09	0.22	0.34	--		
8. Mood Enhancement	0.49	0.19	0.19	0.15	0.55	0.38	0.35	--	
9. Preventative Health	0.49	0.08	0.29	0.37	0.34	0.24	0.26	0.45	--
Mean	4.55	2.83	4.16	2.98	3.70	3.24	4.37	4.76	4.83
Standard Deviation	1.00	1.45	1.19	1.41	1.31	1.27	1.03	0.93	0.98

Note. All correlations significant at $p \leq 0.05$ unless otherwise noted ($^{\#}p > 0.05$).

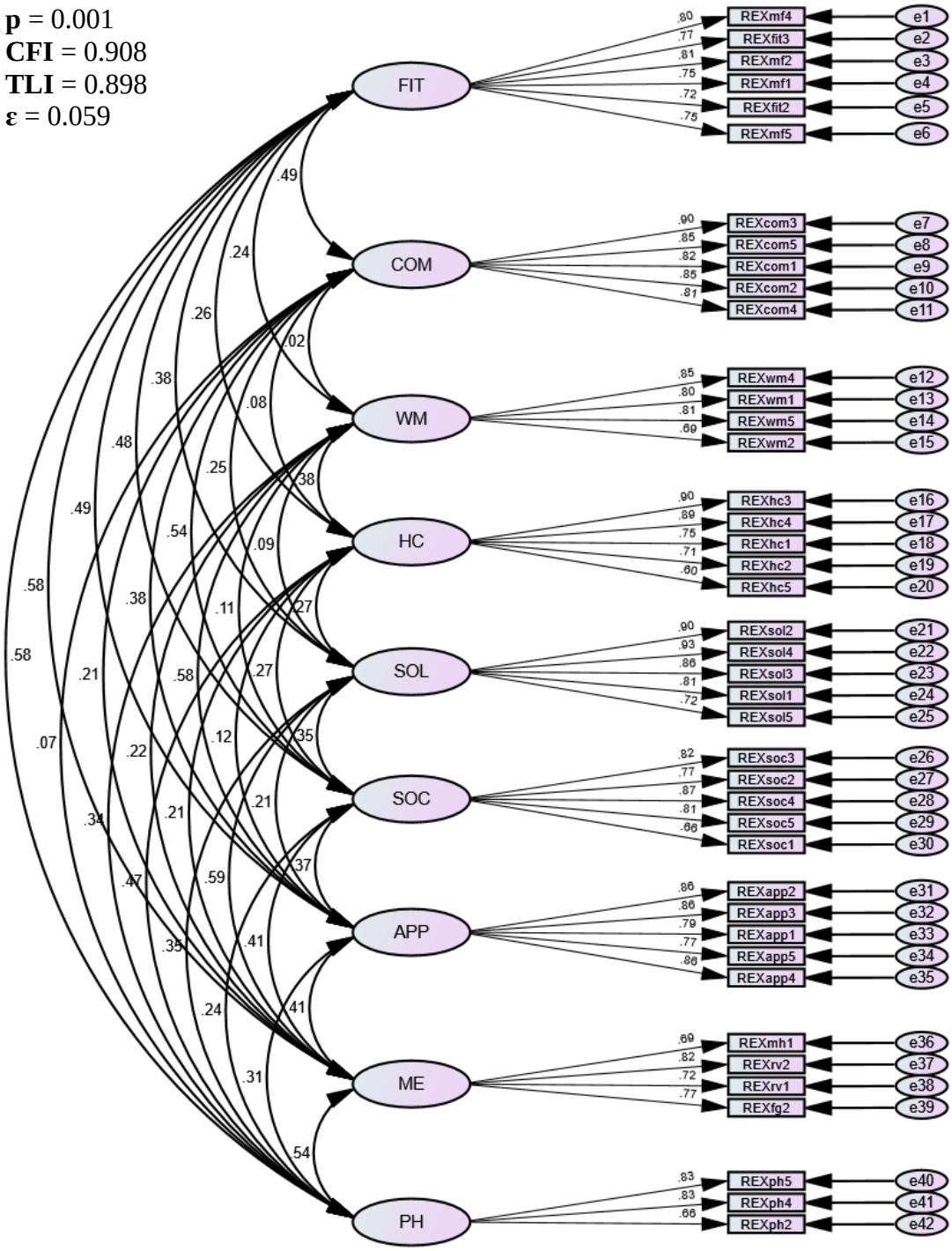

Figure 1.1. Structural Covariance Model for the Initial 43-Item, RE_X Scale Fit to Study 1 Sample. Maximum Likelihood (ML) model fit indices, standardized regression weights, and variance accounted for in individual items by the latent variable for the 43-item, 9-factor RE_X measurement model fit to Study 1 data. df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; ε = RMSEA; root mean square error of approximation.

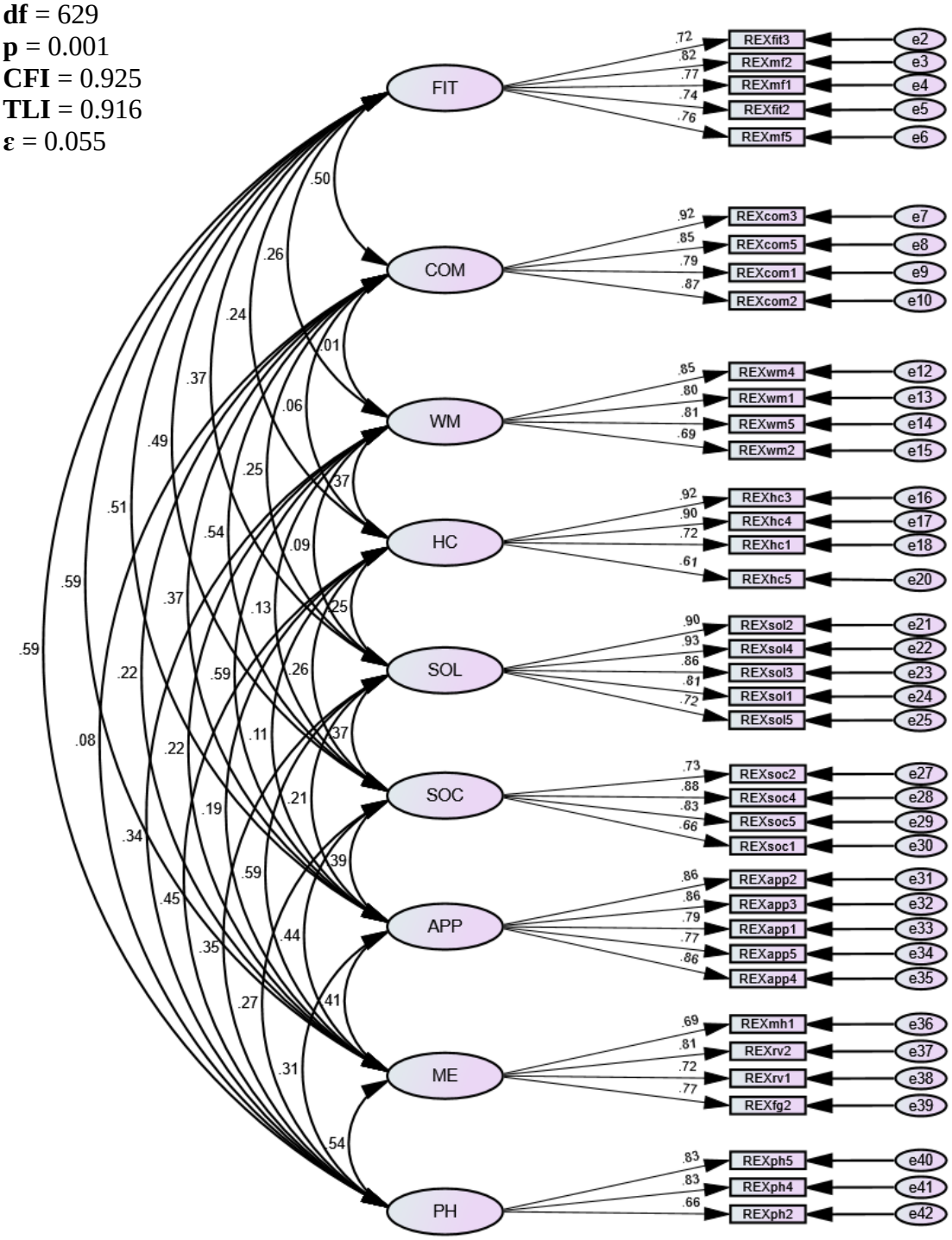

Figure 1.2 Structural Covariance Model on the Revised 38-Item, RE_X Scale Fit to Study 1 Sample. Maximum Likelihood (ML) model fit indices, standardized regression weights, and variance accounted for in individual items by the latent variable for the 38-item, 9-factor RE_X measurement model fit to Study 1 data. df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; ε = RMSEA; root mean square error of approximation.

Manuscript 2: Reasons to Exercise (RE_X-2) Scale: Factorial and Construct Validity and Invariance across Age and Gender

A number of researchers (Molanorouzi, Khoo, & Morris, 2015; Segar, Eccles, & Richardson, 2008) have argued that understanding what moves people is an important line of research in sport and exercise psychology. Identifying the sources of motivation of physically active people is critical to promoting engagement, persistence, and adherence in physical activity (PA). Two conceptual frameworks that have been most commonly utilized for assessing motivation in PA domains are Achievement Goal Theory (AGT; Nicholls, 1984) and Self-Determination Theory (SDT; Deci & Ryan, 1985). According to AGT (Nicholls, 1984), most adults' achievement goals revolve around the desire to demonstrate competence and to avoid demonstrating incompetence, and adults may define success and competence differently based either on self-referenced/task-involved standards (e.g., learning, improving, and mastering tasks) or other-referenced/ego-involved standards (e.g., outperforming others). Additionally, SDT (Ryan & Deci, 1985) suggests adults begin, continue, and persist in PA programs for different reasons that researchers can distinguish based on whether motivation is predominantly autonomous or controlled. According to Ryan and Deci (2000), intrinsic motivation is completely self-determined (i.e., autonomous), amotivation is completely non-determined and extrinsic motivation varies along a behavioral regulation continuum and refers to behaviors done to obtain separable outcomes, or to comply with contingences out of fear, threat or punishment (i.e., controlled) or more autonomous forms of regulation.

Two self-report scales have been primarily used to measure the reasons people exercise, including: the Exercise Motivation Inventory-2 (EMI-2; Markland & Ingledew, 1997) and the Physical Activity Leisure Motivation Scale (PALMS; Molanorouzi, Khoo, & Morris, 2014).

Despite the popularity of the EMI-2 and PALMS, questions remain regarding the psychometric properties of both instruments. In order to develop a comprehensive measure identifying reasons people have for being physically active, a sound conceptual and measurement framework is needed to guide instrument development. Tenenbaum, Eklund, and Akihito (2012) suggest given the health benefits of regular, high levels of PA, more research is needed to understand the nature and breadth of reasons people have for exercising and to identify which reasons promote higher versus lower PA levels. However, in order to identify people's most important or meaningful reasons for exercise, an instrument is needed that is based on (a) a strong conceptual framework and (b) psychometrically-sound contemporary instrument development practices. In Study 1, the item pool for a new Reasons to Exercise (RE_X-Version 1) Scale was developed that demonstrated face validity and solid psychometric support from exploratory factor analysis and exploratory structural covariance modeling. The purpose of this study is to demonstrate factorial and construct validity for the RE_X-2 as well as invariance across age and gender.

Beyond Instrument Development: Validation of the Revised Reasons to Exercise (RE_X-2) Scale

The development of psychological instruments generally begins with a clear conceptual framework that can be linked to item and dimension development (Kline, 2016; Tenenbaum, Eklund, & Akihito, 2012). However, theories do not remain stable across time. According to Tenenbaum et al. (2012), the accumulation of knowledge based on specific instruments needs to be adjusted to keep pace with measurement innovation. Therefore, measurement develops with the accumulation of knowledge and thus must be viewed as a process rather than a final product (Kline, 2016; Tenenbaum et al., 2012).

Overview of Initial RE_X Scale Development

In the development of the RE_X Scale, a new reason to exercise instrument, Study 1 focused on creating an initial RE_X item pool. Four instrument development strategies were fundamental for finalizing the item pool for the RE_X Scale (i.e., Version 1), including: (a) creating an item pool based on borrowing items from existing instruments, modifying existing items and/or creating new items based on the tenants of AGT and SDT, (b) getting a panel of five experts to rate all items on content validity related to 13 hypothesized dimensions, (c) using exploratory factor analysis (EFA) to examine initial factorial validity of items and subscales/dimensions, and (d) examining the refined item pool dimensions using exploratory structural covariance modeling to test model fit.

Additionally, consistent with contemporary psychometric recommendations (Dillman, Smyth, & Christian, 2014), items were written targeting a 5^{th} grade reading level based on Microsoft Word's 2016 Flesch-Kincaid reading level analysis tool. RE_X Scale items were responded to on a 6-point Likert type scale with the anchors of 1 (not at all important) and 6 (extremely important), to promote greater response variability (Dillman et al., 2014). Measures (DeVellis, 2012) with 5-to7-point scales have been shown to create greater variance that is necessary for examining the relationships among items and subscales and to create adequate coefficient alpha (i.e., internal consistency) reliability estimates.

The RE_X Scale is designed to be more psychometrically sound than existing instruments in one or more of four ways; including (a) using a Likert scale that measures level of importance of the reasons rather than utilizing a 'strongly agree'/'strongly disagree' format, (b) making use of an even number response set to eliminate identification of neutral responses, (c) incorporating a range of terms such as "physical activity" and "exercise" within items, and

(d) use of a sound and multifaceted conceptual model based on two prominent contemporary motivational theories (i.e., AGT and SDT). Written instructions accompanying the instrument included two important strategies: (a) “Items are assessing perceived reasons for exercise, so therefore there are no right or wrong answers.” and (b) A stem “To me, how important is this reason for exercising and/or being physically active?” was utilized to make items shorter and easier to understand.

Psychometric Guidelines for Instrument Refinement and Validation

Psychometrics (Bryne, 2016) has evolved as the subspecialty concerned with measuring psychological and social phenomena. According to DeVellis (2017), the measurement procedure used in instrument development to assess variables of interest are explored as part of a broader theoretical framework. Therefore, Kline (2016) emphasizes that the general purpose and process of statistical modeling is to provide an efficient way of describing the latent structure underlying a set of observed variables.

Factor Validity

Bryne (2016) emphasizes that factor analysis is one data analysis approach where the researcher examines the covariation among a set of observed variables in order to gather information on the underlying latent constructs (i.e., factors). Kline (2016) postulates that researchers create a theory-based statistical model where the primary task is to determine the goodness-of-fit between the hypothesized model and sample data. Psychometric guidelines for instrument refinement and validation require three additional steps beyond creation of a final initial item pool, including: (a) confirmatory factor validity (CFA), (b) demonstration of initial construct validity, and (c) measurement invariance testing.

In contrast to EFA, a tool used primarily for theory or instrument development (e.g., Study 1), Brown (2015) emphasizes that CFA is used for theory testing and refinement of the measurement model. This step is conducted to apply more rigorous statistical methods (e.g., alpha reliabilities, fit indices) during the later stages of instrument development to test parsimonious solutions by indicating the number of factors as well as the pattern of factor loadings (and cross-loadings, which are usually fixed to zero). CFA (Tenenbaum et al., 2012) confirms whether prior analyses have been conducted systematically and appropriately, and therefore provides the researcher with confidence that the finalized instrument possesses strong psychometric properties suitable for use in future research. *Hypothesis 2.1* states that CFA of the RE_X-2 Scale should demonstrate strong fit indices.

Construct Validation

Tenenbaum et al. (2012) argue that instrument development demonstrates construct validation based on a constellation of evidence from multiple sources to clarify test score interpretations. Construct validity (Brown, 2015) is focused on demonstrating that an instrument is measuring the construct that it purports to measure. An important component of construct validity is concurrent validity in which the new instrument is completed along with several other instruments that measure similar or correlate variables to the RE_X-2, and actual correlations between these constructs are compared to hypothesized relationships. Congruence between hypothesized and actual relationships then provides evidence to support the validity of the new instrument.

Tenenbaum et al. (2012) emphasize that core concerns arise when researchers do not clearly articulate the complete reliability and validity evidence for new instruments, and therefore instruments are published and utilized that do not meet minimal psychometric

standards. For instance, a measure may be reported to be valid that fails to demonstrate construct validity evidence. When this happens, research using this instrument may be unreliable. A single study (e.g., Markland & Ingledew, 1997) does not sufficiently provide construct validity (CV) support. Rather, Kline (2016) suggests CV is a continuous process of evaluation, reevaluation, refinement, and development that accumulates greater evidence for CV. The aim of this study is to provide solid preliminary support for the CV of the RE_X-2 Scale. *Hypothesis 2.2* postulates that preliminary concurrent validity evidence (i.e., correlation results between RE_X-2 subscales and correlate variables consistent with hypothesized relationships) will support the CV of the RE_X-2.

Invariance Analysis

Brown (2015) suggests that another pressing issue for instrument development is to examine its factorial stability across different populations (e.g., age and gender differences) to gauge the generalizability of the instrument, or measurement invariance. Kline (2016) emphasizes that measurement invariance "concerns whether scores operationalized from a construct have the same meaning under different conditions" (p. 251). According to Brown (2015), evaluating the equivalence of CFA parameters across groups provides a sophisticated approach to examining measurement invariance and population heterogeneity of CFA models. A CFA framework (Kline, 2016) provides researchers with the ability to examine all potential sources of invariance in the factor solution, including latent means and indicator intercepts, which permit a variety of important analytic opportunities for evaluating whether a scale's measurement properties are invariant across population subgroups. An instrument intended to be administered in a heterogeneous population must establish that its measurement properties are equivalent in various subgroup populations (e.g., gender and age). If a measure does not

establish the equivalence of its measurement properties, the items may not measure the underlying construct comparably across groups, and thus, the instrument is biased. In seeking evidence of multi-group equivalence, Bryne (2016) notes several important questions of concern, particularly when developing a new instrument, including (a) Do the items in the measurement instrument operate equivalently across different populations (e.g., gender and age)? (b) Is the factorial structure of a single instrument or of a theoretical construct equivalent across populations as measured either by items of a single assessment measure, or by subscale scores from multiple instruments (i.e., construct validity)? and (c) Does the factorial structure of a measurement instrument replicate across independent samples drawn from the sample population (i.e., cross validation)? *Hypothesis 2.3* predicts that the RE_X-2 should demonstrate invariance across gender and age.

Adherence of Existing Goal Instruments to Psychometric Refinement and Validation Guidelines

Review of existing goal instruments reveals that only two reasons to exercise measures, the revised Exercise Motivation Inventory (EMI-2; Markland & Ingledew, 1997), and the Physical Activity Leisure Motivation Scale (PALMS; Molanorouzi et al., 2014) (i.e., EMI-2 and PALMS) reported CFA results that meet the psychometric criteria above. Therefore, a brief examination of these two instruments is needed to provide information to fully identify the instrument's psychometric properties and demonstrate sufficient support (i.e., CV) for use of the instrument to measure reasons for exercise.

Although the EMI-2 and PALMS are the two self-report instruments that have demonstrated factorial validity for measuring the reasons (i.e., "participatory motives", "motives", or "goals") people exercise, CFA and alpha reliability results bring the

hypothesized structure of the EMI-2 and PALMS into question. The internal consistency (Ingeldew, Markland, & Medley, 1998; Ingeldew & Sullivan, 2002) for the EMI-2 varies considerably across subscales (ranging from 0.56 to 0.95), yet it seems that health pressures ($\alpha = 0.63$; Ingledew, 1998) and revitalization ($\alpha = 0.56$, Ingledew & Sullivan, 2002) consistently display reliability estimates below acceptable levels. Markland and Ingledew (1997) reported good fit for the 51-item, 14-factor (i.e., stress management; revitalization; enjoyment; challenge; social recognition; affiliation; competition; health pressures; ill-health avoidance; positive health; weight management; appearance; strength and endurance; nimbleness) EMI-2 model (i.e., comparative fit index [CFI] = 0.95, $p < 0.05$). These results suggests the EMI-2 measures a broad range of exercise motives that reflect intrinsic and extrinsic reasons for exercise. However, the methods used to investigate the psychometric properties of the EMI-2 seem questionable (Dacey, Baltzell, & Zaichkowsky, 2008; Ingeldew & Sullivan, 2002; Markland & Ingledew, 1997). For instance, CFA results have been based on single-factor measurement models for adolescents (Ingeldew & Sullivan, 2002), thus subscales were grouped together before evaluating structural validity (Markland & Ingledew, 1997), and they failed to use the full complement of EMI-2 items (Dacey et al., 2008).

The Cronbach alpha values for the PALMS (Molanorouzi et al., 2014) have been modest ($\alpha = 0.79$), with subscale internal consistency coefficients ranging from 0.78 to 0.95, but the PALMS has only been validated in Malaysian ($N = 502$; Molanorouzi et al., 2014) and Australian populations ($N = 202$; Chowdhury, 2012). Additionally, Molonorouzi et al. (2014) reported marginal fit for the 40-item, 9-factor (i.e., competition/ego; appearance; other's expectations; affiliation; physical condition; psychological condition; mastery; and enjoyment) PALMS model ($CFI = 0.91$, $p < 0.05$), even though Chowdhury (2012) reported

an improved fit (*CFI* = 0.97, $p < 0.001$) in a community sample of 202 volunteers (*M* age = 28.7, *SD* = 10.3) drawn from various organizations, clubs, and leisure centers. These reports suggest inconsistency in the model fit.

The EMI-2 (Markland & Ingledew, 1997) is the only measure to conduct invariance analysis across gender. Recognizing that the study included a small sample of 282 males (*M* age = 38.6, *SD* = 9.9) and 143 females (*M* age = 36.1, *SD* = 9.6), Markland and Ingledew (1997) conducted a series of several CFA's, but neither included the complete model (i.e., 14 factors) of the hypothesized EMI-2, and thus failed to utilize the most robust approach (Kline, 2016). To propose the complete EMI-2 (Markland & Ingledew, 1997) is invariant across gender, statistical analysis should have assessed the construct validity with CFA when all subscales were included in the model, which is the approach used with Structure Equation Modeling (SEM) analysis. SEM is conducted with the aim of including all of the constructs within an instrument undergoing validation in order to get a true picture of model fit. Kline (2016) suggests statistical results following SEM procedures to be a better reflection of the proposed hypothesis being tested. Additionally, when developing a new scale, equal intercepts and equal means are important to test because equal intercepts assess whether items within the scale are biased (Kline, 2016), and failure to meet this standard is a limitation of the EMI-2. Finally, it is not clear how the decrements in fit were assessed with the EMI-2. However, CFA is a systematic approach used to remove/add constraints to identify specific areas within the model that might be problematic.

Overall, these findings suggest that further psychometric testing is justified for refining measures exploring the reasons people have for being physically active, and that caution should be used when interpreting the results of instruments such as the EMI-2 and PALMS,

particularly when comparing samples from different contexts. Finally, future research should explore potential modifications to measures, such as removing items with low construct validity (i.e., items that respondents may interpret as indicators of both 'revitalization' or 'feel good' dimensions), that may improve the overall precision of the instrument and reduce measurement error that may confound substantive inquiries. The limitations identified suggest that the development of a new reasons for exercise instrument that meets contemporary instrument development guidelines seems warranted.

The RE_X-2 Scale

The RE_X-2 Scale (see Appendix B) is a shortened, revised and improved form of previously developed RE_X-Version 1 (see Study 1), after examination of instrument content through EFA and CM (see Study 1). To create the initial 43-item RE_X-2, twenty-seven items were removed from Version 1 of the RE_X after examination of the factorial validity of the scale through EFA and because of conceptual and theoretical fit issues. One factor was renamed, which was not included in Version 1, and added to RE_X-2, and five new items were generated. These items were then reviewed, and wording was revised to improve clarity (i.e., eliminate double-barreled items and wordiness) and readability.

The purpose of this study was to assess the psychometric properties of the Reasons to Exercise Scale-Version 2 (RE_X-2). Three separate, but related studies assessed the psychometric properties of the RE_X-2 Scale. Study 2A assessed the factor validity of the RE_X-2 Scale using CFA to test model fit in a sample of adults, and investigate whether model fit was maintained in a second adult sample. Study 2B assessed preliminary construct validity by comparing the RE_X-2 to several psychosocial correlate variables and examining whether hypothesized relationships were consistent with observed data. Finally, Study 2C assessed the

measurement (i.e., equal forms, equal loadings, and equal intercepts) and structural (i.e., equal factor variances, equal factor covariance, and equal means) invariance of the RE_X-2 across gender and age.

Study 2A: Validation of the RE_X-2

Method

Participants. Participants were solicited from a hospital-affiliated wellness center (N = 186), personal contacts of the researcher (N = 464), or ResearchMatch (N = 954). The overall sample were randomly dichotomized into two sub-samples of equal size (N = 802) for use in the calibration and validation phases of the study. The calibration sample consisted of 316 males (39.4 %), 444 females (55.4 %), and 42 respondents (5.2 %) who did not indicate gender. The validation sample consisted of 313 males (39 %), 452 females (56.4 %), and 79 respondents (4.9 %) who did not indicate gender. The average adult was middle-aged ($_{calibration}$ M = 44.3 years; SD = 16.6 and $_{validation}$ M = 46.5 years; SD = 16.8), and more than half participated in sports ($_{calibration}$ = 63.7 % and $_{validation}$ = 64.7 %).

Instruments. The survey comprised of two instruments, including Version 2 of the Reasons to Exercise (RE_X-2) Scale and the Physical Activity Demographic and Background Questionnaire (PADBQ).

RE_X-2 Scale (Version 2). The initial RE_X-2 Scale contained 9 factors represented by 43 items (see Appendix B), including: (a) fitness (FIT); (b) competition (COM); (c) solitude (SOL); (d) social (SOC); (e) appearance (APP); (f) weight management (WM); (g) health concerns (HC); (h) mood enhancement (ME); and (i) preventative health (PH). A standardized stem (i.e., "To you, how important is this reason for exercising and/or being physically active?") followed by content statements written to tap into important aspects of each

dimension. Each statement was evaluated using a 6-point Likert scale, ranging from 1 (not at all important) to 6 (extremely important).

PADBQ. Participants were asked to self-report their age, gender, and ethnicity, as well as identify the years of engagement in PA/sports and predominant types of PA regularly performed (see Appendix E).

Procedure. An online survey was developed in Qualtrics (see Appendix E) and distributed to three convenience samples: hospital wellness center members, personal contacts of the researcher, and ResearchMatch volunteers.

Hospital wellness center. Participants' were recruited in-person at a large hospital-affiliated wellness center in the Northwest. A table was set up in the main entrance of the facility for two days where people were asked to complete an 8-10 minute survey. Members who agreed to participate were given a tablet to complete the survey electronically.

Personal contacts. Personal contacts of the researcher were sent email invitations that included a URL to access the online Qualtrics survey and the researcher's contact information.

ResearchMatch. A large population of volunteers were recruited on ResearchMatch, a registry supported by the National Institute of Health. Volunteers were provided with an announcement (see Appendix J) informing them of the nature of the study. Only those who agreed to participate in the study were sent email invitations that included a URL to access the online Qualtrics survey and the researcher's contact information. A total of 1,357 participants agreed to participate in the study and were provided with a link to the survey. Thus, the response rate was approximately 77.8 % (N = 1,056).

Data analysis plan. All data were examined for missing values, and prior to performing CFA, preliminary analyses were conducted on the univariate distributions of all the variables

to verify whether they were normally distributed with low levels of skewness and kurtosis. Univariate and multivariate outliers were identified using descriptive statistics and Mahalanobis distance, respectively. CFA was conducted using Version 23.0 of the Analysis of Moment Structure (AMOS; Arbuckle, 2011) on the RE_X-2 Scale. Each subscale was included in a path diagram for the two separate subsamples (i.e., calibration and validation sample), with each CFA to be measured by its own set of observed indicator variables designated to measure each latent dimension. Maximum likelihood estimation (MLE) was used to generate parameter estimates. The likelihood chi-square statistic (Brown, 2015), Tucker-Lewis index (TLI), Comparative Fit Index (CFI), and root mean square error of approximation (RMSEA) were used to assess model fit across the two samples. Using a multi-group CFA, invariance analyses were conducted for equal form, equal factor loadings, equal intercepts, equal factor variances, equal factor covariances, and equal latent means (Brown, 2016). Unless determined to be noninvariant, once a constraint was imposed, it was held for all subsequent models. Model fit compared to the equal form model was evaluated using the CFI difference test (CFI_{DIFF}) and the chi-square difference test (χ^2_{DIFF}), with a CFI_{DIFF} and *p*-value cut-off of 0.01, respectively (Bryne, 2016). Given the sensitivity of the χ^2_{DIFF} test to sample size (Bryne, 2016), the CFI_{DIFF} test held greater weight in fit decisions.

Results

Preliminary analyses. Data cleaning results revealed that 227 (12.5 %) participants did not complete the survey, 46 (2.5 %), were missing more than one data point on the RE_X-2, and 4 cases were identified as outliers (0.2 %). Thus, of the 1882 adults that participated, 1,604 (84.8 %) were retained. When comparing age and gender, including missing values did

not change the results, but complete questionnaires were preferred for the validation of the RE_X-2 Scale.

The descriptive statistics and reliability scores of the final RE_X-2 items and subscales are presented in Table 2.1, including the mean and standard deviation scores, as well as the alpha reliability scores for the nine subscales.

CFA for calibration sample. Initial fit of the 43-item measurement model was satisfactory (see Figure A.2; $CFI = 0.906$; χ^2 (824) = 3454.35, $p > 0.001$). The modification indices suggested model fit could be substantially improved with the removal of PH Item 4 and ME Item 1. Because these items were theoretically different from the remaining items in their associated factor, these items were removed. To reduce the RE_X-2 to 4 items per subscale, a goal for the final instrument, the following other items were removed: WM Item 5, ME Item 5, SOL Item 5, and APP Item 2 for having highly similar meaning as other items within their associated subscales. Therefore, the final RE_X-2 measurement model is represented by 9 factors and 36-items (see Figure 2.1). As a result of item removal, model fit improved substantially ($CFI = 0.941$; χ^2 (558) = 1922.23, $p = 0.001$), suggesting the RE_X-2 measurement model represents a reasonable representation of the relationships among variables in the calibration data sample. The latent factors accounted for 56 to 65 % of the variance in FIT; 67 to 88 % in COM; 48 to 81 % in WM; 38 to 80 % in HC; 58 to 88 % in SOL; 62 to 80 % in SOC; 74 to 86 % in APP; 68 to 78 % in ME; and 53 to 75 % in PH.

CFA for validation sample. The fit of the 9 factor, 36-item RE_X-2 measurement model was good ($CFI = 0.937$; χ^2 (558) = 1958.80, $p > 0.001$), and represented in Figure 2.2. The primary factor loadings on the 9 factors ranged from 0.58 to 0.93. The latent factors accounted for 54 to 62 % of the variance in FIT; 65 to 87 % in COM; 45 to 84 % in WM; 34

to 78 % in HC; 58 to 87 % in SOL; 64 to 80 % in SOC; 70 to 86 % in APP; 71 to 77 % in ME; and 51 to 57 % in PH.

Calibration and validation sample invariance analysis. The equal form model demonstrated acceptable fit (*CFI* = 0.939; χ^2 (1116) = 3881.03, $p < 0.001$; see Table 2.2), indicating the basic configuration model was invariant across the samples. The equal loadings model passed the CFI_{DIFF} test and the invariance criterion for the more sensitive χ^2_{DIFF} test (*CFI* = 0.939; χ^2 (1143) = 3903.32, $p > 0.05$; see Table 2.2), demonstrating that weighting of individual items were invariant across the samples. The equal intercepts model passed the CFI_{DIFF} test and the more sensitive χ^2_{DIFF} test (*CFI* = 0.939; χ^2 (1170) = 3926.58, $p > 0.05$; see Table 2.2), indicating the intercepts were invariant across the samples. The equal factor variances and covariances passed the CFI_{DIFF} test and the χ^2_{DIFF} test (*CFI* = 0.939; χ^2 (1178) = 3935.08, p > 0.05 and *CFI* = 0.939; χ^2 (1214) = 3990.62, $p > 0.05$), respectively. The equal means model passed the CFI_{DIFF} test and the sensitive χ^2_{DIFF} test (*CFI* = 0.939; χ^2 (1224) = 4001.87, $p > 0.05$; see Table 2.2), indicating the means were invariant across the samples.

The CFI change was less than 0.01 and the RMSEA change was less than 0.015 between all increasingly constrained models from the equal form model to the equality of latent means for both samples. Inspection of the sequence of increasingly constrained invariance tests using the CFI_{DIFF} and χ^2_{DIFF} test scores as the criterion (Brown, 2015) provides evidence of measurement and structural invariance of the RE_X-2 across two samples. Therefore, the results from the invariance tests indicated that the two random groups of adults did not significantly differ in the statistical parameters of their responses to the RE_X-2 items for factor loadings, factor intercepts, latent factor error variances, latent factor covariances, or latent means.

Discussion

The results of this refinement study was to develop a valid measurement instrument (i.e., RE_X-2) to assess reasons people have for exercising. Nine distinct dimensions of reasons emerged from an exploratory factor analysis (see Study 1), and the measurement model representing these nine dimensions appeared to fit two independent and random samples of respondents equally well. The apparent existence of both a solitude and social component as reasons people have for exercising are important to highlight. Previous researchers (Raedeke & Burton, 1997) have supported this finding, but neither confirmatory factor analysis nor measurement invariance testing had previously been assessed. Additionally, mood enhancement as a dimension has potentially important theoretical ramifications. In the PALMS, the dimension "psychological condition" relates to managing stress (e.g., ‘to cope with stress’, ‘for stress-release’, ‘to relax’, etc.). Contrary to this finding, the RE_X-2 mood enhancement subscale incorporates both physical (i.e., ‘for the refreshing feeling I get afterwards’) and mental components (i.e., ‘it makes me happy’) experienced from being physically active, but stress items did not factor as part of this subscale. In contrast to stress, mood enhancement items tap into exercising to feel good and promote positive emotions. Given the lack of coherence between mood enhancement items and the one stress-related item, support for a single item focusing on stress is more difficult to defend substantively, and also due to a lower factor loading score compared to the other items.

Despite the strong factorial validity of the RE_X-2 and the obvious links to AGT and SDT of underlying subscales, and questions posed by the constructs that they represent, these results for this version of the RE_X-2 have only shown initial face and factorial validity for assessing reasons to exercise. As with all measurement studies, additional psychometric work

is needed. Furthermore, additional factors may have emerged if slightly different items were incorporated into the RE_X-2. For example, the appearance subscale represents similar items associated with ego/recognition. Similarly, no items were included in this study that specifically addressed mastery as reasons to exercise (e.g., 'to improve my personal record' and 'to do my personal best'). Thus, it is possible that additional dimensions of reasons to exercise and/or to be physically active might have emerged if additional appropriate items were included in the original item pool. Further research is needed before the RE_X-2 becomes a viable psychometric measurement tool. Of greater importance, the psychometric properties of the RE_X-2 must be further examined within a variety of populations, in a variety of non-active populations, and using a variety of administration modalities.

Study 2B: Construct Validation

Study 2A was designed to establish initial evidence of good psychometric properties of the nine-factor, 36-item RE_X-2 using CFA. Thus, the purpose of Study 2B was to provide additional construct validation of the RE_X-2 Scale beyond the initial face and factor validity already reported. We sought to confirm the measure's factor structure, thereby providing evidence for this instruments reliability and construct validity. First, we examined the relationship between RE_X-2 subscales and motivational correlates because of the association of these variables in the exercise adherence literature (Chowdhury, 2012; Markland & Ingledew, 1997; Segar et al., 2008). Ryan and Deci (2000) posit different types of motivation along a continuum (i.e., motivation regulation), each one reflecting the extent to which a behavior has been internalized or self-determined by the individual (i.e., autonomous). Ingledew and Markland (2008) highlighted that exercising for intrinsic reasons (e.g., participants exercising for revitalization or personal challenge reasons) were experienced as

autonomous while extrinsic reasons (e.g., exercising for weight control and appearance reasons) was experienced as controlling. Based on research supporting motivation, we hypothesized three fundamental dimensions consistent with the intrinsic-extrinsic motivation components of the SDT, utilizing the RE_X-2 subscales related to relative autonomy highlighted in Figure 2.3. More specifically, *Hypothesis 2.4* proposes an intrinsic autonomous dimension (Autonomous RE_X), comprising mood enhancement and solitude, a mix of autonomous and controlled dimensions (Neutral RE_X), namely social, fitness, weight management, and preventative health, and an extrinsic controlled dimension (Controlled RE_X) including appearance, health concerns, and competition reasons on the RE_X-2 Scale. We also hypothesized the autonomous RE_X dimension would be strongly and positively correlated with relative autonomy scores and to be inversely associated with the controlling RE_X dimension and relative autonomy scores.

Segar et al. (2008) highlighted that goals influence the types of motivation typically used to motivate exercisers to be physically active, with autonomy-focused goals promoting more autonomous forms of motivational regulation (i.e., intrinsic motivation and integrated and identified regulations) and control-related goals prompting more controlled forms of regulation (i.e., introjected and external regulation) and sedentary behaviors. Therefore, we hypothesized that our three fundamental dimensions would be consistent with the intrinsic-extrinsic motivation components of the SDT utilizing the RE_X-2 subscales to influence PA (Figure 2.3). Consequently, *Hypothesis 2.5* posits the autonomous RE_X-2 dimension to have a positive correlation with PA, whereas controlled RE_X-2 dimension would have a weak correlation with PA.

We also examined the relationship between RE_X-2 subscales and two other motivation-related psychosocial correlates (e.g., mindsets and passion). Vallerand (2008) theorized passion to be a consequence of the type of goals chosen, with harmonious passion positively related to more autonomy-related goals and obsessive passion more related to control-related goals. Therefore, the reasons a person has for being physically active should be associated with a form of passion and thus be reflected in the motivational force to engage in pursuit of PA. *Hypothesis 2.6* postulates that harmonious passion would have a strong, positive correlation with autonomous RE_X-2 subscales, obsessive passion would be positively correlated with controlled RE_X-2 subscales, and neutral RE_X-2 subscales would have moderate, positive correlations with both harmonious and obsessive passion (see Figure 2.5).

Contrary to passion, mindsets (Dweck, 2006) seem to be an important antecedent of goals, particularly exercise-related ones, with growth mindsets promoting goals that are more autonomous and fixed mindsets relating to more controlling goals. Specifically, individuals with fixed mindsets would be more likely to pursue activities with goals to help them shine, and avoid experiences necessary to grow and flourish, whereas individuals with growth mindsets take necessary risks to attain their goals with little worry of failure because it provides a chance to learn. *Hypothesis 2.7* posits a positive, moderate to strong correlation between growth mindset and autonomous RE_X-2 subscales, whereas fixed mindsets would be correlated moderately with controlled RE_X-2 subscales. Finally, neutral RE_X-2 subscales should demonstrate low to moderate positive correlations with growth and fixed mindsets (see Figure 2.5).

Method

From the initial data set of 1,604 participants in Study 2A, participants were removed from the study if they failed to complete an entire section of the questionnaire (*N* = 329), resulting in a sample of 1,275 (79.5 %) participants.

Participants. Participants consisted of 531 males (41.6 %), 743 females (58.3 %), and 1 respondent (0.1 %) who did not indicate gender. The average adult was middle-aged (*M* = 46.5 years; *SD* = 16.8), engaged in PA (*M* = 29.8 years; *SD* = 19.6), and almost two-thirds participated in sports (63.6 %).

Instruments. The RE_X-2 Scale and PADBQ were again used (see Study2A for details). Additionally, the (a) the Behavioral Regulation in Exercise Questionnaire-3 (BREQ-3), (b) the Conceptions of the Nature of Athletic Ability Questionnaire-Version 2 (CNAAQ-2), (c) the Passion Scale (PS), and (d) the International Physical Activity Questionnaire (IPAQ) were also utilized to examine the RE_X-2's preliminary concurrent validity.

BREQ-3. The BREQ-3 measures amotivation, external, introjected, identified, integrated, and intrinsic forms of exercise behavior regulation based on Deci & Ryan's (1985) SDT continuum conception of extrinsic and intrinsic motivation. Confirmatory factor analysis (Markland & Tobin, 2004) reported the BREQ-3 model to demonstrate a good fit (*CFI* = 0.95, *p* = 0.23) with adult exercisers. Acceptable Cronbach alpha reliabilities were reported on external (α = 0.79), introjected (α = 0.80), identified (α = 0.73), integrated (α = 0.83), and intrinsic (α = 0.86) regulation. Additionally, the BREQ-3 may be used as a multidimensional instrument by giving separate scores for each subscale, or as a unidimensional index of the degree of self-determination, known as the 'relative autonomy index' (RAI; Ryan & Connell,

1989). The RAI is a single score derived by summing subscale scores in order to provide an index of the degree to which respondents feel self-determined (see Appendix F).

CNAAQ-2. The CNAAQ-2 (Wang & Biddle, 2001) is a 12-item questionnaire that examines conception of ability as a growth or fixed entity. The 'growth' subscale is assessed with 6-items (e.g., 'To be successful, you need to develop knowledge, techniques and skills, and practice them regularly'). Fixed beliefs were examined by a 6-item subscale (e.g., 'It is difficult to change how good you are at anything'). Responses are made on a 5-point Likert scale that range from 1 (strongly disagree) to 5 (strongly agree). The original CNAAQ-2 has shown satisfactory psychometric properties including support from CFA (Wang and Biddle, 2001). Reliability for the incremental subscale has demonstrated acceptable internal consistency ($\alpha = 0.76$) for incremental beliefs, with entity beliefs quite similar ($\alpha = 0.75$; see Appendix G).

PS. The PS (Vallerand & Blanchard, 2003) is a 14-item instrument used to examine passion for exercise as being harmonious or obsessive. The 'harmonious' subscale was assessed with 7-items (e.g., 'Exercise is in harmony with other activities in my life'), whereas 'obsessive' passion also included a 7-item subscale (e.g., 'I have a tough time controlling my need to exercise'). Responses are made on a 7-point Likert-scale ranging from 1 (do not agree at all) to 7 (completely agree). The original PS has shown satisfactory psychometric properties including support from CFA (Vallerand & Blanchard, 2003). Vallerand and Blanchard (2003) reported adequate Cronbach's alpha values for harmonious ($\alpha = 0.71$-0.84) and obsessive passion ($\alpha = 0.85$-0.92; see Appendix H).

IPAQ. The IPAQ (Craig et al., 2003) is an international instrument used to obtain comparable estimates of PA undertaken across a set of domains. Total scores require duration

(in minutes) and frequency (days) from a range of activities (e.g., sitting and walking) for moderate, and vigorous activity to provide a general measure of an individual's PA during the most recent seven-day period (Craig et al., 2003). Reports (Craig et al., 2003) on the IPAQs ability to measure PA levels have demonstrated a test-retest reliability coefficient of 0.80 among 18 to 65 year olds in diverse settings (see Appendix E).

Procedure. Following IRB approval (see Appendix K), an online survey was developed in Qualtrics, and participants from a hospital-affiliated wellness program in the Northwest, personal contacts of the researcher, and ResearchMatch volunteers were asked to respond to an 8-10 minute survey.

Data analysis plan. Correlational relationships between all of the dimensions identified in Study 2A for the RE_X-2 Scale as well as subscales of the BREQ-3, CNAAQ-2, PS, and IPAQ were examined, and actual relationships were compared to conceptually driven hypotheses derived from Deci & Ryan's (2000) SDT continuum model of motivational regulation and AGT conceptual predictions.

Results

Concurrent validity examines the congruence between hypothesized and actual relationships for criterion variables of interest. In this study, the RE_X-2 subscales and dimensions (i.e., autonomous, neutral, and controlled reasons) were correlated with three psychosocial correlate variables, including behavioral regulation (i.e., external, introjected, identified, integrated, and intrinsic regulation), passion (i.e., harmonious and obsessive), and mindsets (i.e., growth and fixed). Additionally, the relationship between these psychosocial correlate variables and PA was also assessed. Comparison between hypothesized and actual relationships allowed examination of preliminary concurrent validity. In general, mindset

should influence the goals/reasons chosen, which in turn, should influence psychosocial (i.e., passion and behavioral regulation) and behavioral (i.e., PA levels) outcomes. Growth mindsets should be most strongly related to autonomous and neutral reasons to exercise, more autonomous forms of behavioral regulation, harmonious passion, and moderate to high PA levels, whereas fixed mindsets should demonstrate the strongest relationship with controlled and neautral reasons to exercise, less autonomous forms of behavioral regulation, obsessive passion and moderate to lower PA levels (see Figure 2.5).

BREQ-3 correlation results. Bivariate correlational analyses were conducted on the subscale scores for the nine factors in the RE_X-2 Scale and the five BREQ-3 dimensions. Consistent with our hypotheses, results confirmed that the autonomous RE_X dimension (i.e., mood enhancement and solitude) demonstrated significantly strong, positive relationships with RAI scores ($r = 0.59$), whereas neutral RE_X dimensions (i.e., social, fitness, preventative health, and weight management) demonstrated modest ($r = 0.38$) to weak positive relationships with controlled RE_X ($r = 0.18$; see Table 2.3). Inconsistent with our hypotheses, fitness appeared to be an autonomous-related reason to exercise while competition was perceived as a more conceptually neutral reason people have for exercising in terms of its relationship to RAI scores. These findings suggest that competition is more intrinsic than we initially hypothesized in recreationally active exercisers.

PS correlation results. Correlation results revealed 8 out of the 9 RE_X-2 subscales supported hypotheses by demonstrating a positive relationship with harmonious passion, but contrary to our hypotheses, 7 out of the 9 RE_X-2 subscales also positively related to obsessive passion. For the three RE_X dimensions, autonomous RE_X showed strong positive relationships with harmonious ($r = 0.63$) and obsessive ($r = 0.55$, $p < 0.05$) passion, although the pattern

was weaker for controlled reasons with both obsessive and harmonious passion. Contrary to our hypotheses, it appears that in recreational exercisers with conceptual reasons for exercise that are either autonomous or controlled impact both types of passion in a positive way, ranging from .36 to .63, even though autonomous reasons revealed stronger relationships with passion than did controlled reasons (see Table 2.4). Interestingly, the RE_X-2 subscale health concerns was not significantly correlated with either harmonious or obsessive types of passion, whereas the subscales of preventative health and appearance showed the weakest relationship with both types of passion, which was consistent with hypotheses.

CNAAQ-2 correlation results. Correlation results revealed 8 out of the 9 RE_X-2 subscales supported hypotheses by demonstrating a positive relationship with growth mindset, whereas 6 out of the 9 RE_X-2 subscales were negatively related to fixed mindset (see Table 2.5). For the three RE_X dimensions, autonomous RE_X showed a positive relationship with growth mindset and a negative relationship with fixed mindset while the reverse pattern was true for the controlled dimension (see Table 2.4). Interestingly, for the conceptually neutral (i.e., social, fitness, weight management, and preventative health) reasons, they tended to be consistent with autonomous reasons and inconsistent with controlled reasons in relation to mindset. Interestingly, for the RE_X-2 subscales, mood enhancement ($r = 0.28$, $p < 0.05$) showed the strongest correlation with growth mindset, whereas health concerns ($r = 0.10$) was the only significant reason positively associated with a fixed mindset. Surprisingly, the RE_X-2 subscales of appearance and competition also showed a positive relationship with growth mindset, albeit a weak one.

PA correlation results. Correlation results revealed 7 out of the 9 RE_X-2 subscales supported hypotheses by demonstrating moderate to weak positive relationships with vigorous

(*r* = .12 to .31; *M* = .24) and moderate (*r* = .08 to .20; *M* = .25) PA, and 6 out of the 9 RE_X-2 subscales revealed weak, positive correlations with walking (*r* = .06 to .13; *M* = .11). Interestingly, the RE_X-2 competition subscale showed the strongest relationship with all forms of PA, ranging from 0.13 to .31, suggesting the importance of reasons associated with competition for increasing PA behaviors in recreationally active adults. Correlation results showed 6 of 9 RE_X-2 subscales showed a negative relationship with sitting (-.10 to -.13; *M* = -.12). Noteworthy were the nonsignificant correlations between the RE_X-2 subscales of weight management, appearance, and health concerns with any form of PA (see Table 2.5).

For the three conceptual RE_X dimensions, autonomous RE_X-2 showed modest to weak positive relationships with physical activity (*r* = .10 to .30; *M* = .21) and negative relationships with sitting (*r* = -.14) while the link was weaker for controlled reasons (*r* = .10 to .22; *M* = .16). Interestingly, the higher the RAI score the greater engagement in PA and the reduced amount of time spent sitting when weighed against the other two conceptual reason dimensions. Congruent with our hypotheses, autonomous reasons for exercise and higher RAI scores demonstrated a positive relationship with higher engagement in PA and lower amount time spent being sedentary compared to those with more control-related reasons for exercising and/or being physically active.

Discussion

The purpose of Study 2B was to provide additional construct validation of the RE_X-2 Scale beyond the initial face and factorial validity by examining the correlations between the RE_X-2 Scale and theoretically-related correlate constructs. Our confidence in the measure was strengthened by our results (see Appendix C, Table C.8). Consistent with our theoretical rationale, the RE_X-2 Scale represented a range of autonomous and controlled reasons people

have for exercising and/or being physically active. The RE_X-2 subscale mood enhancement presented the highest relative autonomy score and strong link with intrinsic regulation, whereas the subscale health concerns represented more controlling forms of motivation with the lowest RAI score. Unpredictably, the RE_X-2 subscale competition revealed a modest, positive relationship with integrated and intrinsic regulation and a weak relationship with external and introjected regulation, suggesting competition is more autonomous than initially hypothesized for PA. Although outcome-focused (e.g., competition) goals lead to low persistence in many achievement situations, it may be true in exercise settings. For example, compared to organized sport programs, exercise settings are more diverse and have less stringent definitions of success, less public evaluation, and allow participants more control over task difficulty (e.g., opponent selection). In recreational exercisers, this more diverse, flexible and individualized competitive structure may enable participants to more easily attain outcome-related reasons for exercising. In PA, competition may act more like social support than social comparison. Furthermore, compared to sport domains, recognition in exercise settings is more contingent on improvement and participation, not necessarily on doing well in reference to socially defined standards of excellence, making it achievable for most participants to attain recognition regardless of exercising for reasons focused on competition.

Similarly, the RE_X-2 subscale fitness demonstrated a strong autonomous focus with exercise more so than did solitude and social affiliation reasons. This finding was not surprising given the research (Raedeke & Burton, 1997) supporting the positive relationship between mastery and task-focused goals on positive exercise behaviors. Nicholls (1984) argues that performance incentives lead to high motivation because success (e.g., goal attainment) is based on self-evaluative standards such as improving fitness, mastering skills,

or becoming completely involved in the activity, which is attainable for all participants to consistently accomplish. Personal control over task difficulty makes it possible for exercisers to attain consistent success and perceive high ability, both important prerequisites to on-going exercise participation.

The finding that autonomy (i.e., integrated and intrinsic regulation) rather than more controlling motivation (i.e., external and introjected regulation) positively guided physical activity behaviors is consistent with self-determination theory (SDT) and previous research (Ingledew & Markland, 2008). In this sample of recreationally active adults, integrated and intrinsic regulation positively predicted participation, whereas introjected weakly related to physical activity and external regulation was not significant. In Ingledew and Markland's (2008) study on older adults, identified but not intrinsic regulation positively predicted participation, and external regulation negatively related to participation. Markland (2008) suggested that, with increasing age, health issues become more salient, emphasizing the positive effect of identified regulation, and weight concerns are more prevalent, thus bringing out the negative effect of external regulation. The RE_X-2 subscales related to harmonious passion consistent with our hypotheses, even though obsessive passion did not share the strong relationship anticipated with our controlled reason dimension (i.e., weight management, appearance, and health concerns). Contrary to other findings, in this sample of adults, obsessive passion did not lead to undesirable outcomes as hypothesized. Rather, autonomous reasons for exercising (e.g., mood enhancement, solitude, social, and fitness) promoted higher levels of harmonious and obsessive passion, with harmonious exhibiting slightly stronger relationships than obsessive. Amiot, Vallerand, and Blanchard (2006) suggested that under certain circumstances (e.g., highly competitive context) harmoniously passionate individuals

may experience conflict between high levels of sustained activity involvement necessary to reach high levels of performance where their harmoniously oriented needs and goals, which (in addition to involvement in the passionate activity) also may include personal development and engagement in other life pursuits. However, disregarding other life pursuits at the expense of increased engagement in the activity corresponds well with the objectives sought by obsessively passionate individuals, and therefore these individuals are more likely to experience less conflict than their harmoniously passionate counterparts do. Because this is the first study to focus on the reasons people have for being physically active, whereas past research on passion has focused on the general population, it is possible that physical activity is similar to highly competitive environments (Amiot et al., 2006).

The RE_X-2 subscales reported weak, positive relationships with growth that did not meaningfully represent the reasons for exercising that hadbeen conceptualized. Seven of the nine RE_X-2 subscales were negatively correlated with fixed mindsets, suggesting that the RE_X-2 subscales represent a range of factors that are more growth rather than fixed oriented, an encouraging finding. The weak relationships suggest that in recreational exercisers, mindsets may not be as strong an antecedent of PA motivation as hypothesized.

Conventional research has studied motivation in a univariate approach one variable at a time such as intrinsic motivation (e.g., such as intrinsic motivation; Wang & Biddle, 2001). In the SDT, Deci and Ryan (1985) found that compared to extrinsic reasons, intrinsic reasons (e.g., the feeling of satisfaction, enjoyment, and a desire to persist at the activity) led to greater persistence in the activity than did extrinsic ones. However, people often engage in exercise for a variety of reasons such as appearance, fitness, and/or health reasons rather than in isolation. This study supports that it is more appropriate to consider people's behaviors are

influenced by several types of motivation, and that motivation should not be studied in isolation as a single entity but should focus on the pattern of their various motivations. From a methodological perspective, the present series of analyses show a considerable amount of detailed and useful support for the construct validity of the RE_X-2, and provide initial concurrent validity evidence for the development of a comprehensive reasons to exercise instrument. The results also seem to provide valuable and pertinent information regarding the utility of the RE_X-2. With the aid of the RE_X-2 Scale, health and fitness professionals should be able to better identify the nature of people's motivation based on their reasons to exercise, and encourage and promote autonomous more than controlled reasons for PA participation.

Study 2C: Factorial Invariance

Study 2A suggested the nine-factor, 36-item RE_X-2 is a useful tool for measuring the reasons people have for exercising in two random samples of adults. However, before the RE_X-2 Scale can be used to make meaningful comparisons between groups, the similarity of the instrument's measurement structure across populations must be assessed. Measurement invariance (Chen, 2007) is a prerequisite for comparing different groups (e.g., gender and age), because it is important to ensure that results are based on instruments that measure the same constructs among groups. Unfortunately, several instruments investigating the reasons people have for being physically active do not test measurement invariance, yet report (Molanorouzi et al., 2015) findings when comparing differences between groups (e.g., women compared to men). When groups are compared based on instruments that do not provide evidence (i.e., invariance) of measuring the same constructs across populations consistently interpretation problems occur. Therefore the conclusions drawn from a study may be biased, or invalid, if the measures that we rely on do not actually have the same meanings across gender or age.

Thus, the purpose of Study 2C was to conduct invariance analysis on the RE_X-2 Scale for gender and age because previous research (Molanorouzi et al., 2015) suggests these variables may influence reasons for exercise.

Method

From the initial data set of 1,604 adults in Study 2B, participants were removed from the study if they failed to complete a section of the RE_X-2 (N = 79), resulting in a sample of 1,525.

Participants. For the gender invariance analysis, participants consisted of 629 males (41.2 %) and 896 females (58.6 %). For the age invariance analyses, participants consisted of 872 (57.2 %) < 50 years of age (M age = 32.8, years; SD = 8.8), 653 (42.8 %) ≥ 50 years of age (M age = 62.3 years; SD = 7.4).

Measures. The RE_X-2 Scale and the PADBQ were used to collect study data (see Study 2A for details).

Data analysis plan. Using the measurement model identified in Study 2A, measurement and structural invariance were assessed across gender (i.e., male exercisers compared to female exercisers) and age (i.e., exercisers less than 50 years of age compared to exercisers 50 years of age or greater). Using a multi-group confirmatory factor analysis (CFA), invariance analyses were conducted for equal form, equal factor loadings, equal intercepts, equal factor variances, equal factor covariances, and equal latent means (Brown, 2015). Unless determined to be noninvariant, once a constraint was imposed it was held for all potential subsequent models. Model fit compared to the equal form model were evaluated using the CFI difference test (CFI_{DIFF}) and the chi-square difference test (χ^2_{DIFF}), with a CFI_{DIFF} and p-value cut-off of 0.01, respectively (Brown, 2015). Although, χ^2_{DIFF} is routinely reported in CFA research, an important criticism suggests that in many instances (e.g., small N, non-normal data) its

underlying distribution is not χ^2 distributed (Brown, 2015; i.e., compromising the statistical significance tests of the model χ^2), and it is inflated by sample size, and thus large *N* solutions are routinely rejected on the basis of χ^2, even when differences between S and Σ are negligible. Given the sensitivity of the chi-square difference test, the CFI_{DIFF} was relied on more heavily based on less stringent standards in the evaluation of model fit.

Results

CFA for female exercisers. Initial fit of the RE_X-2 measurement model was good (*CFI* = 0.935; χ^2 (558) = 2171.01, $p > 0.01$), and all factor loadings were significant ($p > 0.001$; see Table 2.6). The latent factors accounted for 53 to 66 % of the variance in FIT; 65 to 87 % in COM; 48 to 83 % in WM; 39 to 80 % in HC; 60 to 88 % in SOL; 59 to 77 % in SOC; 72 to 82 % in APP; 66 to 79 % in ME; and 47 to 71 % in PH.

CFA for male exercisers. Initial fit of the RE_X-2 measurement model was good (*CFI* = 0.939; χ^2 (558) = 1700.00, $p > 0.01$; see Table 2.6), and all factor loadings were significant. The latent factors accounted for 59 to 65 % of the variance in FIT; 66 to 87 % in COM; 46 to 83 % in WM; 34 to 81% in HC; 53 to 87 % in SOL; 65 to 82 % in SOC; 69 to 90 % in APP; 68 to 76 % in ME; and 53 to 78 % in PH.

Gender invariance analyses. The equal form model demonstrated acceptable fit (*CFI* = 0.936; χ^2 (1116) = 3871.06, $p > 0.01$), and all factor loadings were significant ($p > 0.001$; see Table 2.6). The equal loadings model passed the CFI_{DIFF} test, and it also exceeded the invariance criterion for the more sensitive χ^2_{DIFF} test (*CFI* = 0.936; χ^2 = 3938.78, $p < 0.01$; see Table 2.6). Examination of the loadings suggested four potentially noninvariant loadings: WM Item 3, which was 0.137 unstandardized units higher for men; APP Item 5 was 0.132 unstandardized units higher for females; HC Item 2 was 0.215 unstandardized units higher for

males, and HC Item 3 was 0.222 units higher for males. Upon release of the constraints on these four loadings, the model passed the χ^2 (1139) = 3902.22, $p > 0.05$.

The equal intercepts model passed the CFI_{DIFF} test, but failed the invariance criterion for the more sensitive χ^2_{DIFF} test (*CFI* = 0.930; χ^2 (1166) = 4197.52, $p < 0.01$; see Table 2.6). Examination of the intercepts suggested 14 potentially noninvariant intercepts: PH Items 2 and 3, which were 0.122 and 0.105 unstandardized units higher for women; FIT Items 2, 3, and 4, which were 0.318, 0.285, and 0.103 unstandardized units higher for women, COM Item 1 which was 0.127 units lower for women; WM Items 2 and 3, which were 0.807 and 0.175 unstandardized units higher for women; HC Item 1 that was 0.112 units lower for men; SOL Item 1 which was 0.206 units higher for women; APP Items 3 and 5 that were 0.094 units higher for men and 0.116 units lower for women, respectively, and SOC Items 1 and 3, which were 0.150 and 0.175 unstandardized units lower for women. Upon release of the constraints on these fourteen intercepts, the model passed the *CFI* = 0.932; χ^2 (1151) = 3920.47, $p > 0.05$. The equal factor variance model passed the CFI_{DIFF} test, and exceeded the more sensitive χ^2_{DIFF} test *CFI* = 0.935; χ^2 (1161) = 3988.15, $p < 0.01$). The equal factor covariance model passed the CFI_{DIFF} test, and did not pass the more sensitive χ^2_{DIFF} test *CFI* = 0.933; χ^2 (1197) = 4093.54, $p < 0.01$).

CFA for exercisers under age of 50. Initial fit of the RE_X-2 measurement model was good (*CFI* = 0.937; χ^2 (558) = 2085.76, $p > 0.05$; see Table 2.6), and all factor loadings were significant ($p < 0.01$; see Table 2.6). The latent factors accounted for 57 to 61 % of the variance in FIT; 66 to 89 % in COM; 49 to 81 % in WM; 40 to 77 % in HC; 57 to 86 % in SOL; 67 to 79 % in SOC; 72 to 83 % in APP; 66 to 77 % in ME; and 56 to 72 % in PH.

CFA for exercisers over age of 50. Initial fit of the RE_X-2 measurement model was good (*CFI* = 0.932; χ^2 (558) = 1804.35 $p < 0.05$; see Table 2.6), and all factor loadings were significant ($p > 0.001$). The latent factors accounted for 53 to 68 % of the variance in FIT; 58 to 83 % in COM; 43 to 83 % in WM; 31 to 82 % in HC; 56 to 88 % in SOL; 63 to 78 % in SOC; 69 to 88 % in APP; 66 to 77 % in ME; and 47 to 78 % in PH.

Age invariance analyses. The equal form model demonstrated acceptable fit (*CFI* = 0.935; χ^2 (1116) = 3890.16, $p > 0.05$), indicating the basic configuration model was invariant across the samples. The equal loadings model passed the CFI_{DIFF} test, but exceeded the invariance criterion for the more sensitive χ^2_{DIFF} test (*CFI* = 0.934; χ^2 (1143) = 3890.16, $p > 0.05$; see Table 2.6). Examination of the loadings suggested COM Item 2 was noninvariant, which was 0.157 unstandardized units lower for exercisers over the age of 50. Upon release of the constraint on this loading, the model passed the χ^2 (1142) = 3929.04, $p > 0.05$.

The equal intercepts model passed the CFI_{DIFF} test but failed the invariance criterion for the more sensitive χ^2_{DIFF} test (*CFI* = 0.930; χ^2 (1169) = 3890.16, $p < 0.01$; see Table 2.6). Examination of the intercepts suggested 13 potentially noninvariant intercepts: FIT Items 3 and 5 which were 0.349 unstandardized units higher for those over 50 years of age, and 0.111 units lower for those under the age of 50; COM Item 1 which was 0.155 unstandardized units higher for exercisers under 50; WM Item 2 which was 0.139 units higher for exercisers under 50; HC Item 2 which was 0.17 unstandardized units higher for exercisers over 50 years;, SOC Items 2, 3, and 4, which were 0.136, 0.147, and 0.365 unstandardized units higher for exercisers under the age of 50, respectively; APP 5 which was 0.12 unstandardized units higher for those under 50; ME Item 3 was 0.148 units higher for those under 50 years of age; and PH Items 2, 3, and 5, which were 0.294, 0.235, and 0.441 units higher for adults over 50

years of age, respectively. Upon releasing the constraints on these intercepts, the model passed the *CFI* = 0.934; χ^2 (1156) = 3945.70, $p > 0.05$.

The equal variance model passed the CFI_{DIFF} test, but did not pass the more sensitive χ^2_{DIFF} test *CFI* = 0.932; χ^2 (1165) = 4069.43, $p < 0.01$). The equal factor covariance model passed the CFI_{DIFF} test, but exceeded the more sensitive χ^2_{DIFF} test *CFI* = 0.930; χ^2 (1201) = 4180.69, $p < 0.01$). Because we were primarily interested in understanding measurement invariance, we did not identify noninvariant items based on the chi-square difference test, and therefore relied on the CFI_{DIFF} test for structural invariance (e.g., equal factor variances and covariances).

The CFI change was less than 0.01 and the RMSEA change was less than 0.015 between all increasingly constrained models from the equal form model to the equality of factor covariances for both samples. Inspection of the sequence of increasingly constrained invariance tests using the CFI_{DIFF} test scores as the criterion (Brown, 2015) provides evidence of measurement invariance of the RE_X-2 across gender and age. Therefore, the results from the invariance tests indicated that the two groups (e.g., female/male exercisers and young/older exercisers) did not substantially differ in the following statistical parameters of their responses to the RE_X-2 items for: factor loadings, factor intercepts, latent factor variances, and latent factor covariances.

Discussion

Separate CFAs for each subsample (female/male exercisers and younger/older exercisers) supported the nine–factor structure of the RE_X-2 Scale established in Study 2A. The multi-group CFAs for gender and age provided reasonable evidence of measurement and structural invariance using the difference in CFI scores as the criterion (Chen, 2007).

Although a number of the models (i.e., equal loadings, equal intercepts, equal factor variances and covariances) did not pass the more stringent and sensitive of the invariance criteria (i.e., the chi-square difference test), all of the invariance models passed the CFI difference test.

In reviewing the chi-square difference test results for men and women, the individual factor loading results suggest measuring weight management (i.e., Item 3- to control weight), appearance (i.e., Item 5- to be more attractive), and in greater magnitude health concern Items 2 and 3 reveal evidence of noninvariance. Specifically, health concern Item 2 related to being physically active to manage a medical condition, and Item 3 focuses on controlling/dealing with a health concern as a reason to exercise. These findings suggest that for some reason these items are operating somewhat differently in their intended content for men and women. Highlighting two of the 14 noninvariant equal intercepts results, the findings suggest fitness Items 2 and 3 as noninvariant. Specifically, men and women do not respond in the same manner when it comes to being physically active for reasons related to being stronger or to improve physical endurance. Nevertheless, the results provided good support for the invariance of the factor structure across males and females using all the items in the RE_X-2.

Identifying noninvarance based on the stringent chi-square difference results, the individual factor loadings measuring competition Item 2 suggests that younger and older exercisers respond differently to enjoying competition as a reason to exercise. Additionally, highlighting five items from the 13 noninvariant intercepts based on the chi-square difference test, it seems that younger and older adults do not respond similarly to fitness (i.e., Item 3), social (i.e., Item 4), or in preventative health (i.e., Items 2, 3 and 5) as reasons for being physically active. Specifically, fitness Item 3 suggests younger and older exercisers do not respond similarly to reasons for being physically active for strength maintenance reasons, for

motivation from social interaction, and more obviously for preventative health reasons related to valuing health with increasing age (i.e., Item 2), preventing health issues (i.e., Item 3), or to slow down the negative effects of aging (i.e., Item 5). Of importance, the mean age of the two groups represented a 30-year difference, which may represent two to three different generations, and therefore increase the likelihood of differing reasons in a person that is 18 years of age compared to someone over the age of 70 years.

Despite the generally positive measurement invariance results of the RE_X-2 and underlying dimension questions posed by the constructs that they represent, these findings are preliminary. This version of the RE_X-2 is good but has only shown initial measurement invariance for the reasons people have for exercising and/or being physically active across gender and age. As with all measurement studies, additional psychometric work is needed. For example, there are other reasons people have for being physically active related to family as well as to be one with nature. Further research is needed in this area before the RE_X-2 Scale becomes a more comprehensive and refined psychometric measurement tool. Of greater importance, the psychometric properties of the RE_X-2 must be further examined for different types and levels of physical activity, in a variety of non-active populations, and using a variety of administration modalities. Together, the findings suggest the items of the RE_X-2 are sound but could benefit from further refinement. For the time being, caution should be considered when interpreting findings related to the RE_X-2 when comparing genders and extreme age groups.

Strengths and limitations of this research center around the complexity of the RE_X-2 measurement model. The initial 43-item RE_X-2 predicting 9 latent factors presents a complex model. However, the complexities of the model may be moderated by basing instrument

development on a solid conceptual framework. Several strengths can be highlighted from this study. First, this is the only study to our knowledge that has conducted measurement invariance in the development and validation process on a measure investigating the reasons people have for exercising and/or being physically active. Clearly, the ability to test a complete model comprising all 9 factors was a strength of the present study. Although it has been suggested (Markland & Ingledew, 1997) that a good fitting model would be unrealistic with many factors, the RE_X-2 has proven otherwise.

A second strength is that the short commitment of time to complete the RE_X-2 decreases the likelihood of boredom or fatigue when responding to the scale. Also of importance the fact that data in the present study were evaluated for missing values, and only responses with totally complete data were analyzed while conforming to sample size constraints regarding the ratio of cases to the number of model parameters that require statistical estimation (i.e., N:q rule; Kline, 2016). From a methodological perspective, the present series of analyses also show that considerable amount of detailed and useful information about the construct validity of the RE_X-2 can be gained by adopting a rigorous and sequential approach to a model testing.

In conclusion, this study gives strong substantive support for the RE_X-2 as a measure of a broad range of reasons for exercising. It is anticipated that the RE_X-2 will prove to be a valid and reliable means of assessing reasons for exercise across different populations and researchers are encouraged to use it to investigate both theoretical and applied questions in the area of health and exercise psychology. The RE_X-2 also has potential to be used as an instrument to help understand the reasons people have for exercising and/or being physically active and how such reasons are related to the types of motivation they have for such reasons.

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Table 2.1

Descriptive Statistics of the Revised RE$_X$-2 for Calibration and Validation Sample in Study 2A

Item	Calibration Sample (N = 802)				Validation Sample (N = 802)			
Fitness (FIT)	M	SD	Skewness	Kurtosis	M	SD	Skewness	Kurtosis
fit2 - to be stronger.	4.71	1.08	-0.86	0.78	4.80	1.05	-0.83	0.39
fit3 - to maintain my strength gains.	4.23	1.31	-0.54	-0.31	4.37	1.27	-0.62	-0.10
fit4 - to improve my physical endurance.	4.59	1.13	-0.68	0.20	4.66	1.12	-0.77	0.30
fit5 - to reach my maximum fitness level.	3.77	1.44	-0.25	-0.72	3.90	1.43	-0.31	-0.77
	α = 0.86				α = 0.84			
Social (SOC)								
soc1 - to connect with active people.	2.93	1.47	0.33	-0.92	2.99	1.46	0.28	-0.99
soc2 - to spend time with friends.	2.88	1.53	0.37	-1.00	3.02	1.51	0.25	-0.99
soc3 - to meet others who value exercise.	2.53	1.44	0.70	-0.50	2.51	1.39	0.64	-0.54
soc4 - to be around others that motivate me to work out.	2.82	1.55	0.43	-0.93	2.85	1.50	0.41	-0.90
	α = 0.91				α = 0.89			
Weight Management (WM)								
wm1 - to lose weight.	4.01	1.47	-0.53	-0.59	3.97	1.55	-0.47	-0.86
wm2 - to fit into the clothes I like.	3.70	1.52	-0.25	-0.98	3.75	1.58	-0.30	-0.98
wm3 - to control weight.	4.31	1.40	-0.73	-0.29	4.27	1.47	-0.71	-0.42
wm4 - to reach my goal weight.	3.83	1.60	-0.36	-0.98	3.78	1.64	-0.31	-1.09
	α = 0.90				α = 0.90			
Health Concern (HC)								
hc1 - to help manage chronic pain.	3.07	1.68	0.26	-1.23	3.07	1.73	0.25	-1.30
hc2 - to manage a medical condition.	3.37	1.79	0.05	-1.39	3.37	1.79	0.03	-1.40
hc3 - control or deal with health concerns.	3.87	1.58	-0.32	-1.01	3.90	1.59	-0.34	-1.03
hp4 - a doctor or health professional advised it.	2.85	1.66	0.44	-1.07	2.86	1.65	0.41	-1.07
	α = 0.86				α = 0.83			
Appearance (APP)								
app1 - to look good.	4.11	1.34	-0.55	-0.29	4.07	1.35	-0.45	-0.48
app3 - to look like I'm in shape.	3.91	1.45	-0.44	-0.65	3.84	1.44	-0.30	-0.80
app4 - to improve my physical appearance.	4.05	1.40	-0.48	-0.51	4.00	1.41	-0.41	-0.63
app5 - to be more attractive.	3.73	1.48	-0.22	-0.84	3.68	1.49	-0.16	-0.93
	α = 0.94				α = 0.93			

Table 2.1 (continued)

Item	Calibration Sample (*N* = 802)				Validation Sample (*N* = 802)			
Mood Enhancement (ME)	M	SD	Skewness	Kurtosis	M	SD	Skewness	Kurtosis
me2 - for the refreshing feeling I get afterwards.	4.24	1.44	-0.64	-0.44	4.27	1.43	-0.62	-0.50
me3 - to enhance my mood.	4.38	1.32	-0.78	0.09	4.42	1.37	-0.81	0.02
me4 - it makes me happy.	4.33	1.45	-0.75	-0.30	4.39	1.50	-0.76	-0.37
me6 - for the positive mindset I experience post-workout.	4.06	1.54	-0.50	-0.80	4.17	1.55	-0.58	-0.67
	α = 0.88				α = 0.89			
Solitude (SOL)								
sol1 - to make time for myself.	3.69	1.53	-0.26	-1.00	3.80	1.59	-0.28	-1.07
sol2 - to have alone time.	3.13	1.63	0.19	-1.13	3.17	1.66	0.17	-1.20
sol3 - to be alone to think.	3.02	1.61	0.29	-1.10	3.10	1.67	0.27	-1.20
sol4 - to have ‘me’ time.	3.14	1.66	0.24	-1.19	3.24	1.71	0.18	-1.28
	α = 0.93				α = 0.93			
Competition (COM)								
com1 - to outperform others.	2.15	1.39	1.05	0.08	2.05	1.30	1.22	0.68
com2 - because I enjoy competing.	2.39	1.55	0.91	-0.37	2.35	1.50	0.86	-0.41
com3 - to compete with others.	2.06	1.39	1.30	0.71	2.03	1.32	1.27	0.74
com4 - because I like to win.	2.08	1.43	1.32	0.75	2.05	1.38	1.24	0.51
	α = 0.94				α = 0.93			
Preventive Health (PH)								
ph1 - to live longer.	4.67	1.27	-0.95	0.31	4.69	1.30	-0.98	0.39
ph2 - to remain healthy as I age.	5.06	1.05	-1.29	1.65	5.06	1.04	-1.35	2.09
ph3 - to prevent health issues in the future.	4.96	1.08	-1.11	1.11	4.99	1.10	-1.23	1.45
ph5 - to slow down the negative effects of aging.	4.23	1.38	-0.58	-0.45	4.29	1.41	-0.58	-0.47
	α = 0.85				α = 0.86			

N*ote*. M = Mean; SD = Standard Deviation; α = Cronbach Alpha value.

Table 2.2

Goodness-of-Fit Indices for the Measurement of Invariance Using the Revised 36-Item RE$_X$-2

	χ^2	df	$\chi^2_{DIFF}(df_{DIFF})$	CFI	CFI_{DIFF}	TLI	ε, 90% CI	Δ ε
Calibration Sample (*N* = 802)	1922.230	558	--	0.941	--	0.933	0.055 [0.053-0.058]	--
Validation Sample (*N* = 802)	1958.802	558	--	0.937	--	0.929	0.056 [0.053 -0.059]	--
Invariance Analyses								
Equal Form	3881.032	1116	--	0.939	--	0.931	0.039 [0.038-0.041]	--
Equal Loadings	3903.318	1143	22.29 (27)	0.939	0.000	0.933	0.039 [0.037-0.040]	0.000
Equal Intercepts	3926.576	1170	45.54 (54)	0.939	0.000	0.935	0.038 [0.037-0.040]	- 0.001
Equal Factor Variances	3935.078	1178	54.05 (61)	0.939	0.000	0.935	0.038 [0.037-0.040]	- 0.001
Equal Factor Covariances	3990.615	1214	109.58 (98)	0.939	0.000	0.936	0.038 [0.036-0.039]	- 0.001
Equal Factor Means	4001.866	1224	120.83 (108)	0.939	0.000	0.937	0.038 [0.036-0.039]	- 0.001

Table 2.3

Correlations and Descriptive Results for the Revised 36-Item RE_X-2 and BREQ-3

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Mood enhancement	--																	
2. Solitude	.64	--																
3. Social	.48	.39	--															
4. Fitness	.56	.37	.42	--														
5. Weight management	.21	.15	.16	.25	--													
6. Preventative health	.41	.26	.23	.57	.30	--												
7. Appearance	.41	.24	.24	.43	.59	.31	--											
8. Health concerns	.11	.11	.10	.17	.30	.26	.07	--										
9. Competition	.34	.33	.51	.40	.04#	.12	.29	-.05#	--									
10. Autonomous RE_X	.89	.92	.48	.50	.19	.36	.35	.12	.37	--								
11. Neutral RE_X	.58	.41	.67	.77	.65	.71	.57	.31	.38	.54	--							
12. Controlled RE_X	.44	.35	.44	.52	.50	.37	.71	.57	.62	.43	.66	--						
13. Extrinsic Regulation	-.01#	.01#	.15	.06	.24	.09	.18	.21	.14	.00#	.20	.28	--					
14. Introjected Regulation	.36	.25	.20	.35	.30	.24	.42	.02#	.23	.33	.39	.34	.25	--				
15. Identified Regulation	.64	.43	.36	.56	.09	.42	.28	-.01#	.28	.58	.49	.28	-.04#	.50	--			
16. Integrated Regulation	.59	.41	.45	.57	.05#	.39	.29	-.04#	.39	.55	.50	.33	-.02#	.45	.80	--		
17. Intrinsic Regulation	.68	.49	.46	.47	.02#	.26	.22	-.07	.35	.63	.42	.25	-.11	.28	.71	.71	--	
18. Relative autonomy	.64	.45	.41	.49	-.07	.29	.15	-.11	.31	.59	.38	.18	-.37	.16	.77	.82	.91	--
Mean	4.24	3.22	2.71	4.34	3.91	4.72	3.89	3.20	2.06	3.73	3.91	3.05	1.59	3.02	4.00	3.39	3.53	15.16
Standard Deviation	1.29	1.47	1.27	1.03	1.35	1.02	1.30	1.37	1.22	1.24	.81	.82	.75	1.16	.88	1.22	1.16	6.21

Note. All correlations are significant at $p \leq 0.05$ unless otherwise noted. #$p > 0.05$.

Table 2.4

Correlations between Hypothesized RE$_X$-2 Dimensions, Mindset and Passion Subscales, and PA Categories

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Autonomous RE$_X$	--											
2. Neutral RE$_X$	0.54	--										
3. Controlled RE$_X$	0.43	0.66	--									
4. Relative autonomy	0.59	0.38	0.18	--								
5. Growth Mindset	0.25	0.30	0.25	0.22	--							
6. Fixed Mindset	-0.18	-0.07	0.03$^{\#}$	-0.24	-0.17	--						
7. Obsessive Passion	0.55	0.41	0.36	0.62	0.23	-0.07	--					
8. Harmonious Passion	0.63	0.52	0.37	0.76	0.34	-0.18	0.80	--				
9. Vigorous PA	0.30	0.25	0.22	0.36	0.16	-0.05$^{\#}$	0.40	0.42	--			
10. Moderate PA	0.19	0.14	0.15	0.21	0.08	-0.03$^{\#}$	0.26	0.26	0.40	--		
11. Walking	0.13	0.10	0.10	0.12	0.04$^{\#}$	-0.06	0.14	0.14	0.21	0.36	--	
12. Sitting	-0.14	-0.12	-0.10	-0.18	-0.03$^{\#}$	0.02$^{\#}$	-0.21	-0.19	-0.17	-0.17	-0.11	--
Mean	3.73	3.92	3.05	15.16	4.06	2.15	3.74	4.70	190.1	181.0	288.3	298.04
Standard Deviation	1.24	0.81	0.82	6.21	0.62	0.78	1.39	1.31	218.2	218.1	311.1	162.47

Note. All correlations are significant at $p \leq 0.05$ unless otherwise noted, $^{\#}p > 0.05$. Autonomous RE$_X$ = mood enhancement and solitude; Neutral RE$_X$ = social, fitness, weight management, and preventative health; Controlled RE$_X$ = appearance, health concerns, and competition. PA = physical activity in minutes over 7 day period.

Table 2.5

Correlations between Hypothesized RE_X-2, Behavioral Regulation, Mindsets and Passion Subscales, and PA Categories

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. Mood enhancement	-																						
2. Solitude	.64	-																					
3. Social	.48	.39	-																				
4. Fitness	.56	.37	.42	-																			
5 .Weight management	.21	.15	.16	.25	-																		
6. Preventative health	.41	.26	.23	.57	.30	-																	
7. Appearance	.41	.24	.24	.43	.59	.31	-																
8. Health concerns	.11	.11	.10	.17	.30	.26	.07	-															
9. Competition	.34	.33	.51	.40	.04#	.12	.29	-.05#	-														
10. Extrinsic	-.01#	.01#	.15	.06	.24	.09	.18	.21	.14	-													
11. Introjected	.36	.25	.20	.35	.30	.24	.42	.02#	.23	.25	-												
12. Identified	.64	.43	.36	.56	.09	.42	.28	-.01#	.28	-.04#	.50	-											
13. Integrated	.59	.41	.45	.57	.05#	.39	.29	-.04#	.39	-.02#	.45	.80	-										
14. Intrinsic	.68	.49	.46	.47	.02#	.26	.22	-.07	.35	-.11	.28	.71	.71	-									
15. Relative autonomy	.64	.45	.41	.49	-.07	.29	.15	-.11	.31	-.37	.16	.77	.82	.91	-								
16. Growth	.28	.19	.22	.28	.19	.16	.26	.01	.22	.08	.26	.28	.25	.26	.22	-							
17. Fixed	-.21	-.13	-.01#	-.12	.01#	-.09	-.07	.10	.02	.17	-.03#	-.21	-.15	-.22	-.24	-.17	-						
18. Obsessive	.57	.45	.42	.46	.04#	.27	.28	.02#	.41	.01#	.46	.67	.70	.60	.62	.23	-.07	-					
19. Harmonious	.67	.49	.52	.54	.08	.35	.29	.01#	.43	-.04#	.36	.72	.78	.74	.76	.34	-.18	.80	-				
20. Vigorous	.29	.26	.28	.30	.02#	.12	.13	.00#	.31	-.05#	.16	.34	.38	.34	.36	.16	-.05#	.40	.42	-			
21. Moderate	.18	.16	.16	.16	-.01#	.09	.08	.02#	.20	-.01#	.07	.18	.21	.20	.21	.08	-.03#	.26	.26	.40	-		
22. Walking	.11	.12	.11	.13	.01#	.04#	.06	.01#	.13	.01#	.02#	.08	.11	.12	.12	.04#	-.06	.14	.14	.21	.36	-	
23. Sitting	-.13	-.13	-.13	-.13	.00#	-.10	-.02#	-.05#	-.12	.02#	-.01#	-.13	-.16	-.18	-.18	-.03#	.02#	-.21	-.19	-.17	-.17	-.11	-

Note. All correlations are significant at $p \leq 0.05$ unless otherwise values in # exceeded respective cut-off value = $p > 0.05$.

Table 2.6

Goodness-of-Fit Indices for the Measurement of Invariance Analyses Using the 36-Item RE$_X$-2

	χ^2	df	$\chi^2_{DIFF}(df_{DIFF})$	CFI	CFI_{DIFF}	TLI	ε, 90% CI	Δ ε
Males (*N* = 629)	1700.000	558	-	0.939	-	0.931	0.057 [0.054-0.060]	-
Females (*N* = 896)	2171.012	558	-	0.935	-	0.926	0.057 [0.054-0.059]	-
Gender Invariance Analyses								
Equal Form	3871.061	1116	-	0.936	-	0.928	0.040 [0.039-0.042]	-
Equal Loadings	3938.782	1143	**67.72 (27)**	0.936	0.000	0.929	0.040 [0.039-0.041]	0.000
Equal Intercepts	4197.515	1166	**326.45 (50)**	0.930	- 0.006	0.919	0.041 [0.040-0.043]	0.001
Equal Factor Variances	3988.151	1161	**117.09 (45)**	0.935	- 0.001	0.929	0.040 [0.039-0.041]	0.000
Equal Factor Covariances	4093.536	1197	**222.48 (81)**	0.933	- 0.003	0.930	0.040 [0.039-0.041]	0.000
< 50 years of age (*N* = 872)	2085.757	558	-	0.937	-	0.929	0.056 [0.054-0.059]	-
≥ 50 years of age (*N* = 653)	1804.350	558	-	0.932	-	0.923	0.059 [0.056-0.062]	-
Age Invariance Analyses								
Equal Form	3890.160	1116	-	0.935	-	0.926	0.040 [0.039-0.042]	-
Equal Loadings	3941.770	1143	**51.61 (27)**	0.934	-0.001	0.927	0.040 [0.039-0.041]	0.000
Equal Intercepts	4136.296	1169	**246.14 (53)**	0.930	-0.005	0.925	0.041 [0.039-0.042]	0.000
Equal Factor Variances	4069.427	1165	**179.27 (49)**	0.932	-0.003	0.926	0.040 [0.039-0.042]	0.001
Equal Factor Covariances	4180.685	1201	**290.53 (85)**	0.930	-0.005	0.927	0.040 [0.039-0.042]	0.001

Note. Values in boldface exceeded their respective cut-off values (i.e., χ^2_{DIFF} values exceeded a probability of 0.01 and CFI_{DIFF} values exceeded a difference by 0.01.

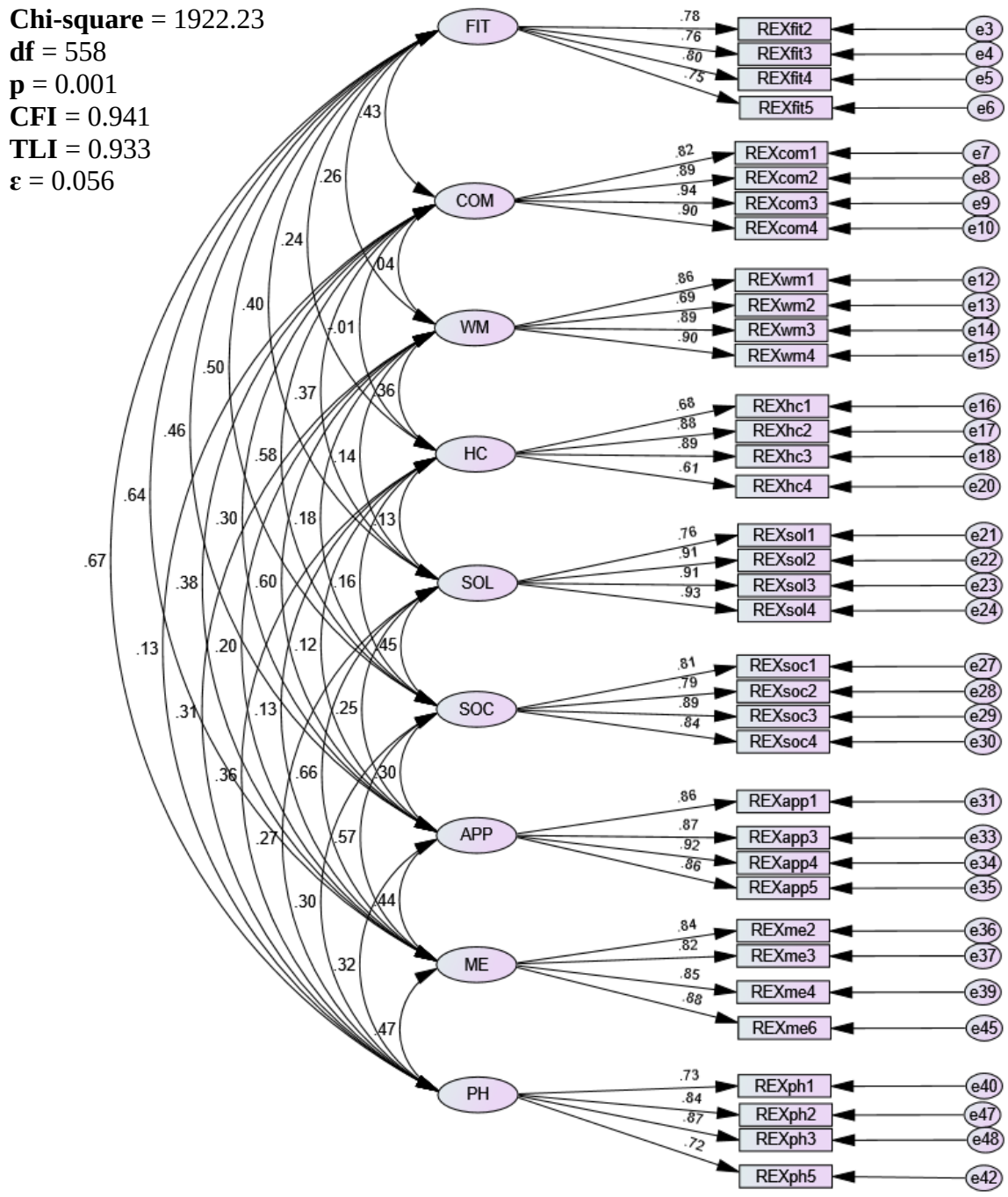

Figure 2.1. Standardized Confirmatory Factor Analysis Solution for the RE_X-2 in the Calibration Sample. Maximum Likelihood (ML) model fit indices, standardized regression weights for the 36-item, 9-factor, RE_X-2 Scale. df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; ε = RMSEA; root mean square error of approximation.

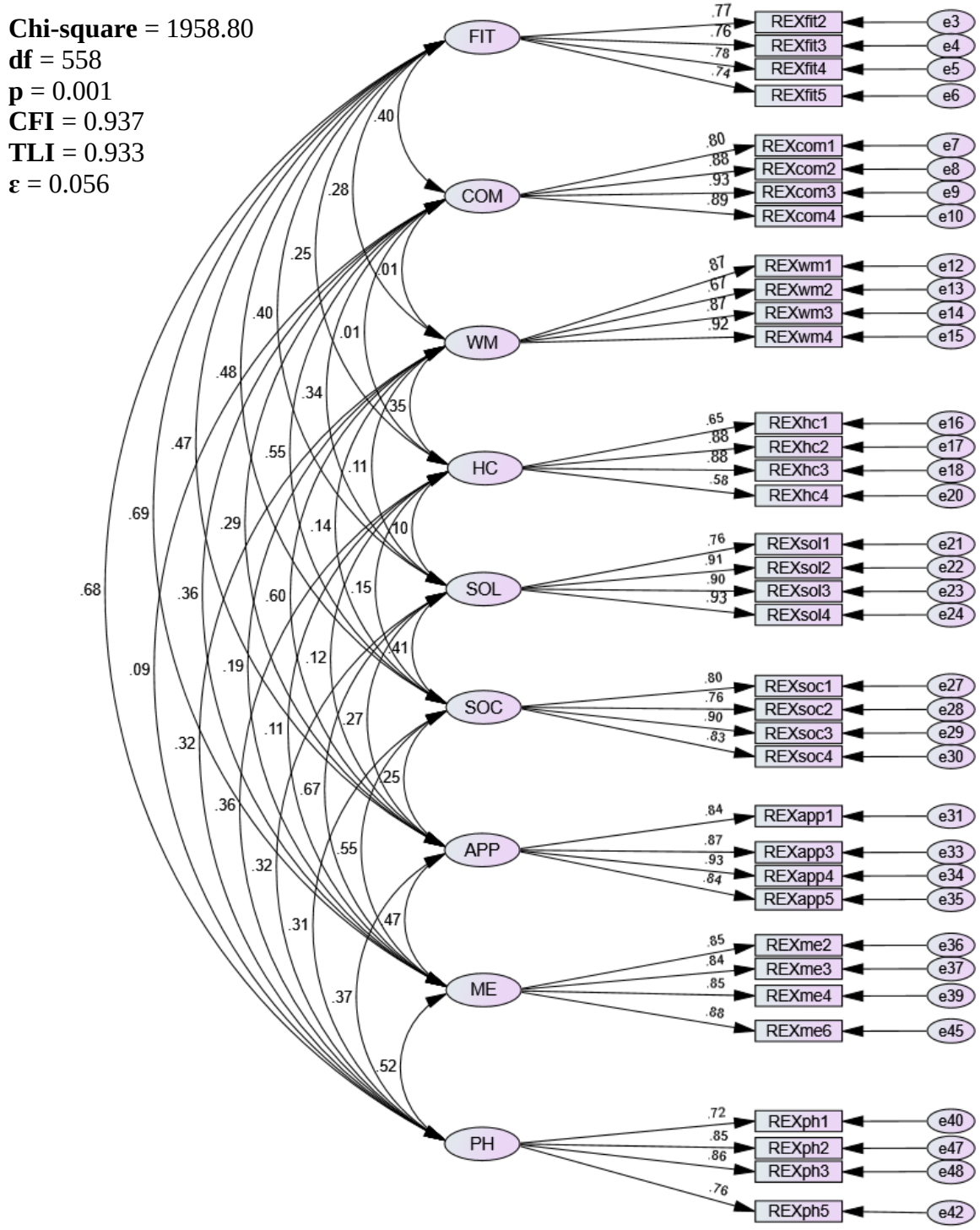

Figure 2.2. Standardized Confirmatory Factor Analysis Solution for the RE_X-2 in the Validation Sample. Maximum Likelihood (ML) model fit indices, standardized regression weights for the 36-item, 9-factor, RE_X-2 Scale. df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; ε = RMSEA; root mean square error of approximation.

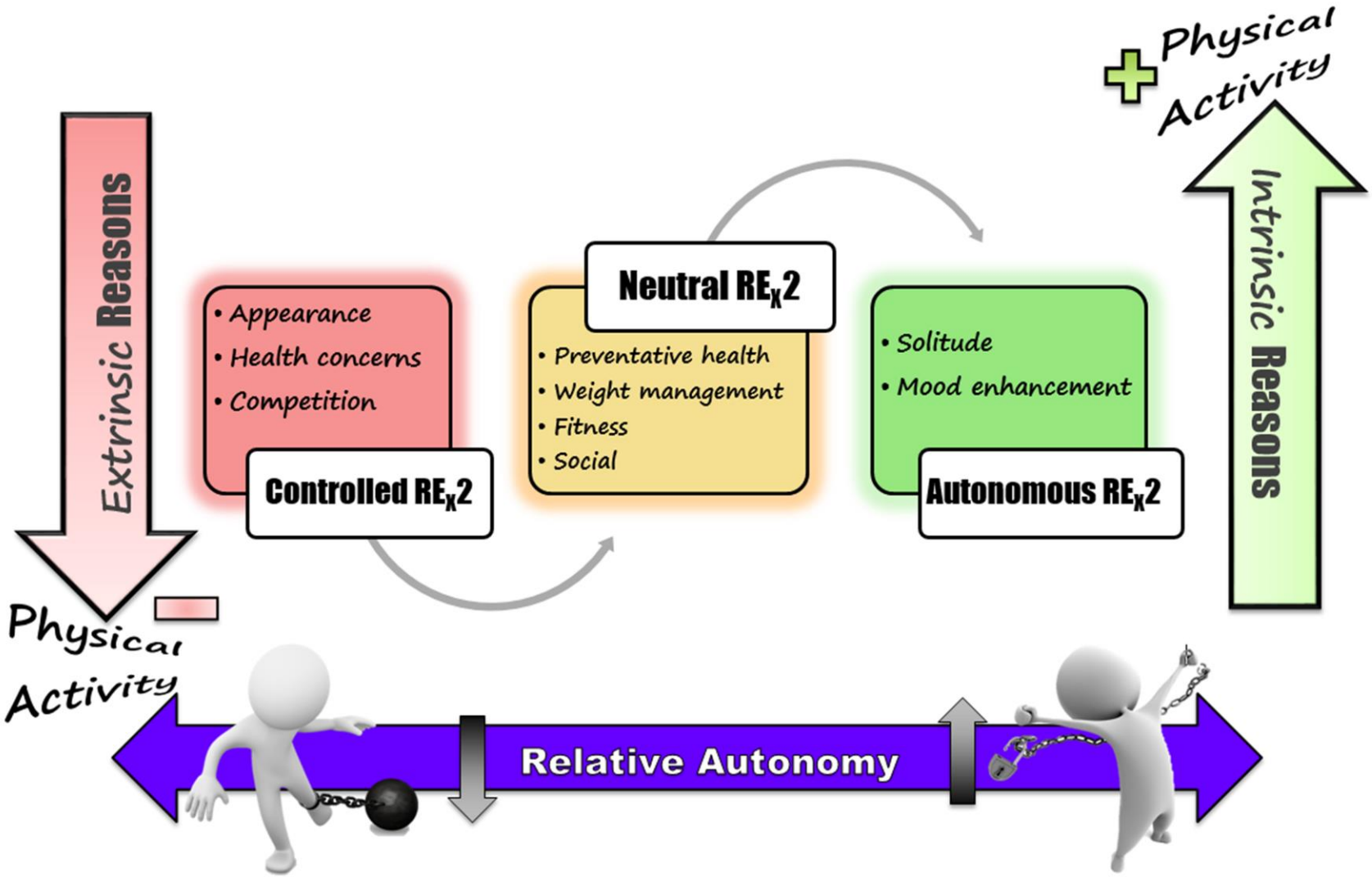

Figure 2.3. RE_X-2 Relative Autonomy Continuum.

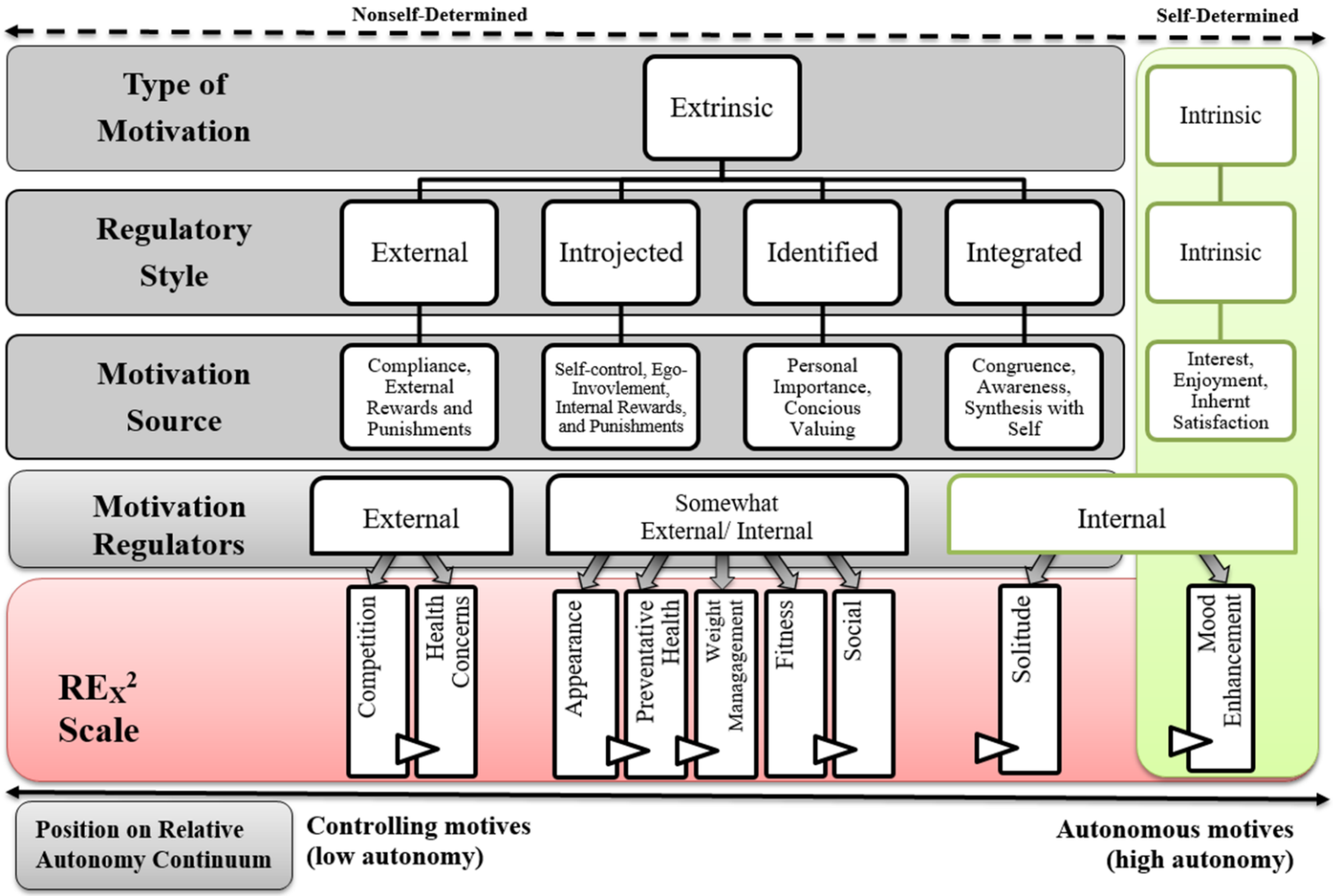

Figure 2.4. The RE_X-2 Scale and the Self-Determination, Motivation Regulation Continuum.

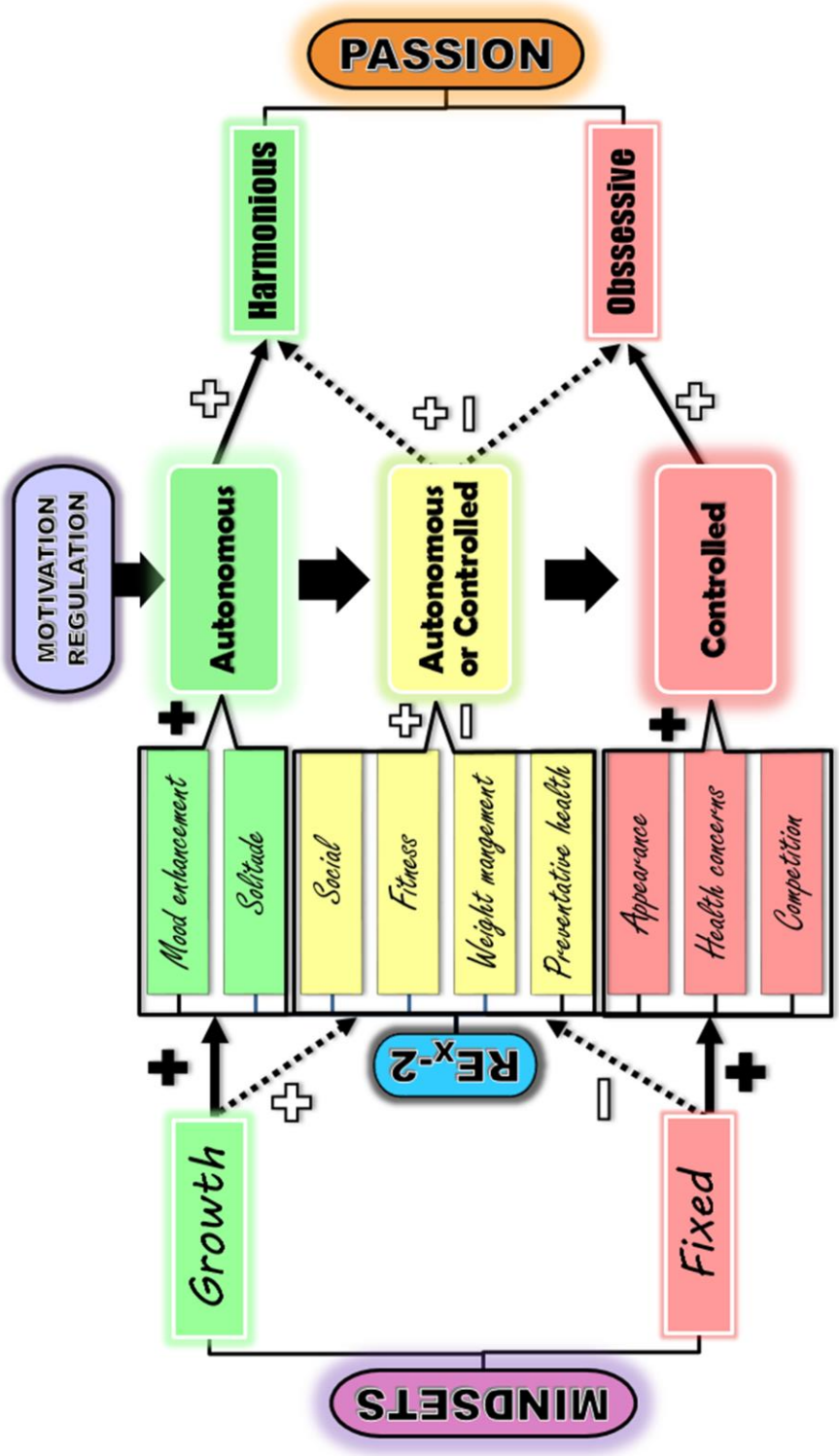

Figure 2.5. Hypothesized Relationships between RE_X-2 Passion, and Mindset Subscales.

Manuscript 3: Reasons for Exercise Profiles: Their Role in Adults' Motivation, Passion, and Physical Activity Levels

"Step it up!", "Everybody walk!", and "Why walk? Why not!" (Center for Disease Control and Prevention [CDC], 2016) represent comprehensive initiatives dedicated to solving physical inactivity behaviors in children and adults in the United States. Research (CDC, 2014) demonstrates that the vast majority of Americans struggle to lead healthy, active lifestyles or fail to adhere to their exercise program, but for those that maintain physically active lives, it is important to understand why/how they maintain such behaviors.

Motivation (Ryan & Deci, 2000) addresses the conditions that promote optimal engagement, as well as factors that hinder self-motivation and overall well-being. According to Deci and Ryan's (1985) Self-Determination Theory (SDT), intrinsic goals are self-determined (i.e., autonomous) and lead to positive health outcomes, whereas extrinsic goals are non-self-determined (i.e., controlled) and generally lead to maladaptive, negative health outcomes. According to Achievement Goal Theory (AGT; Nicholls, 1984), goals for exercise define success and failure in any task, and thus reaching valued goals is perceived as success, whereas not attaining personally important goals is perceived as failure. Because goals vary among individuals across different contexts, it is only possible to understand motivation by knowing what goals a person values within a specific context or domain

Therefore, the purpose of this study is to use cluster analysis to assess whether the reasons people exercise can be captured by a limited number of naturally-occurring profiles in a large sample of adults engaging in a wide range of physical activities. A second purpose examines how physical activity (PA) profiles differ on psychosocial (i.e., motivational regulation and passion), and behavioral outcomes.

Role Played by Reasons for Exercise in Sustainable PA Behaviors

What is it that leads people to remain engaged in PA long-term? Understanding the reasons that people engage in PA seems to be an important part of motivation and critical to the promotion of engagement and persistence in physical activities. Goals (Ingledew & Markland, 2008; Nicholls, 1984) are key motivational constructs that vary among individuals across different contexts. Therefore, to understand people's motivation is, in part, to know what goals they value.

Goals Define Success

Beyond promoting PA, researchers need to consider individual differences in definitions of success and failure if they hope to promote health/fitness. According to Achievement Goal Theory (AGT; Nicholls, 1984), valued goals are the standards individuals' use to judge success and failure, and at the heart of exercisers' goals is the desire to demonstrate consistent attainment of valued goals while avoiding goal failure. Exercisers (Nicholls, 1984) can define success differently based on either self-referenced/task-involved standards (e.g., mastering and improving skills and performance) or other-referenced/ego-involved standards (e.g., outperforming others and recognition; Nicholls, 1984). Consistent attainment of valued goals (i.e., success) should allow individuals to feel successful and thereby enhance motivation.

Antecedents and Consequences of Reasons to Exercise

Mindsets are important antecedents of goals/reasons to exercise, whereas three hypothesized consequences of exercise goals/reasons are motivational regulation, passion, and PA behaviors. These constructs and theoretical evidence to support the relationships between them are critical to exercise adherence.

Mindsets. Dweck (1999) postulates people who differ in ability beliefs will differ in how they view effort and ability as causes of success in two distinct ways, or "mindsets" (i.e., growth and fixed). A 'fixed' mindset (Dweck, 2006) emphasizes that ability in a domain is fixed and uncontrollable, and thus may only be minimally enhanced through practice and effort. A 'growth' mindset views ability as changeable and capable of extensive development with effort and training (Dweck, 2006). Thus, mindsets seem to be an important antecedent of goals, particularly exercise-related ones, with growth mindsets promoting more autonomous goals and fixed mindsets more controlling ones.

Motivational regulation. SDT (Ryan & Deci, 2000) posits different types of motivational regulations, each one reflecting the extent to which a behavior has been internalized by the individual. Intrinsic motivation (Ryan & Deci, 2000) is completely self-determined (i.e., autonomous) and is reflected in behaviors performed for enjoyment and stimulation provided by the activity itself, whereas amotivation is non-self-determined (i.e., controlled). Ryan and Deci (2000) divide extrinsic motivation into four types of regulation represented along a continuum from autonomous to controlled that vary in the degree to which motivation has been internalized (i.e., autonomous) based on relative autonomy index (RAI) scores. Beginning with the most self-determined (Standage & Ryan, 2012), they are integrated regulation (i.e., outcomes or behaviors are congruent with the individual because the activity is assimilated with one's sense of self), identified regulation (i.e., refers to behaviors that stem from the conscious valuing of an activity being important to their goals), introjected regulation (i.e., focuses on avoiding guilt or promoting pride to heighten self-esteem), and the most controlled is external regulation (i.e., refers to actions carried out to gain an external reward, comply with social pressure, or avoid punishment).

Goals (Segar, Eccles, & Richardson, 2008) are hypothesized to influence the types of regulation typically used to motivate exercisers, with autonomy-focused goals promoting more autonomous forms of motivational regulation (i.e., intrinsic motivation and integrated and identified regulation) and control-related goals prompting more controlled forms of regulation (i.e., introjected and external regulation).

Passion. Vallerand (2012) defines the dualistic model of passion (DMP) as a self-defining activity one likes (or even loves), finds important (or highly values), and thus represents central features of a person's identity. The DMP (Vallerand, 2012) proposes two types of passion, obsessive and harmonious, distinguished by whether the activity is internalized into one's identify. In obsessive passion (Vallerand, Rousseau, Grouzet, & Grenier, 2006), self-esteem and social recognition contingencies lead individuals to become dependent on the passionate activity and to suffer emotionally in the face of failure, whereas with harmonious passion, authentic integration of the self is at play, allowing the person to engage fully in the activity that they are passionate about with a secure sense of self-esteem and an openness to experience the world in a nondefensive and mindful manner. Again, passion (Vallerand, 2008) seems to be the consequence of the types of goals chosen, with harmonious passion positively related to more autonomy-related goals and obsessive passion related to control-focused ones.

PA behaviors. PA is an important focus for health professionals, researchers, and health organizations because it can have a significant effect on a wide range of health conditions (e.g., heart disease and type-2 diabetes). According to population surveillance studies of PA levels (CDC, 2014), large numbers of people are insufficiently active to gain PA health benefits. Sallis and Owen (1999) describe five important phases within a behavioral

epidemiology framework to provide a more focused approach to PA behaviors that may be associated with disease outcomes and how these relate to the occurrence of disease in the population. In relation to PA, this framework (Sallis & Owen, 1999) includes (a) to establish the link between PA and health, (b) to develop methods for accurate assessment of PA, (c) to identify factors associated with different levels of PA, (d) to evaluate interventions designed to promote PA, and (e) to translate findings from research into practice. This series of studies is focused on the role goals play in accomplishing these objectives, particularly how autonomy-related goals should enhance PA behaviors and control-related goals should reduce PA levels.

Identifying Meaningful PA Reason Profiles: How Do They Relate to Key Antecedent and Consequent Variables?

Maehr and Braskamp (1986) argue that compatibility between (a) valued goals and (b) individual PA program's ability to attain those valued goals is a key to sustained, high levels of PA motivation. Assessment of compatibility is beyond the scope of this study. However, when identifying factors associated with different PA levels, profiling provides important evidence about the types of cognitive and behavioral patterns that lead to greater or lesser PA. For example, will certain exercise goals be associated consistently with greater or lesser PA? Thus, the focus of Study 3 was to create exercise goal/reason profiles and see how these groups differ on passion, mindsets, and PA. Profiles were created by clustering on RE_X-2 subscales and investigating how both the number and nature of valued goals influence profiles and desired outcomes. Clusters were labelled based on the reasons that most prominently define their character. The most critical analyses focused on differences between profiles on a series of outcome variables and how closely they matched conceptual predictions.

Relationship between Antecedents and Consequences

Goals and mindsets. According to Dweck (2006), mindsets influence what people strive for (i.e., goals) and what they see as success. For people with growth mindsets, goals may represent personal success when they work hard to become their personal best, whereas for those with a fixed mindset, success is about establishing superiority and maintaining a desired image. In the school setting, Dweck (2006) found that goals influenced whether a person gave up in the face of failure or were motivated by failure. Although much of Dweck's (2006) research on mindsets has taken place in school settings, similar results are expected in PA and exercise settings. For instance, in the PA domain a growth mindset may focus on goals that challenge them and require hard work and effort, whereas a fixed mindset may prompt exercisers to expect success automatically, prompting each task to be a threat of their self-image. Therefore, individuals with fixed mindsets are more likely to pursue activities with goals designed to help them shine and avoid the sorts of experiences necessary to grow and flourish, whereas individuals with growth mindsets should take necessary risks to attain their goals, with little worry of failure because it provides the best chance to learn and improve. *Hypothesis 3.1* predicts a positive relationship between growth mindsets and self-referenced/task involved reasons for exercise, whereas fixed mindsets will be positively associated with other-referenced/ego-involved reasons for PA.

Goals and motivational regulation. According to Ingledew and Markland (2008), extrinsic reasons/goals such as appearance and weight management are experienced as controlling (e.g., participants exercising to lose weight or look good) and thus contribute minimally to long-term PA participation. Reasons/goals such as personal challenge and social affiliation are experienced as autonomous (e.g., exercising for growth or to be with

others/friends) and thus, contribute positively to long-term PA participation (Markland & Ingledew, 1997). Markland & Ingledew (2008) also reported the negative effects of extrinsic reasons (i.e., weight management, appearance, and health pressures) on autonomy in comparison to the positive effects intrinsic reasons (i.e., enjoyment and affiliation) provide. Thus, indirect evidence (Ingledew & Markland, 2008) has been reported for why exercising for intrinsic reasons is experienced as autonomous while extrinsic PA reasons such as exercising for weight control and appearance reasons are experienced as controlling. *Hypothesis 3.2* posits that intrinsic reasons for exercise will be positively associated with autonomous forms of regulation, whereas extrinsic reasons for exercise will be positively associated with controlled forms of regulation.

Goals and passion. The DMP (Vallerand, 1997; Vallerand & Ratelle, 2002) further posits that values and goals concerning uninteresting activities can be internalized in either a controlled or autonomous fashion. Obsessive passion (Vallerand, 2012), like motivational regulation, prompts controlled internalization of the activity, and entails a relative lack of control over the passionate activity, rigid persistence, and conflict with other activities in the person's life. Harmonious passion (Vallerand, 2012) originates from an autonomous internalization in identity and entails control over the activity and a harmonious coexistence of the passionate activity with other activities, thus producing a motivational force to engage willingly and personal endorsement to pursue the activity. *Hypothesis 3.3* postulates that harmonious passion will be positively associated with autonomy-related goals, whereas obsessive passion will be positively associated with control-focused goals.

Goals and PA. Researcher's (e.g., Segar, 2015) continued need to understand PA behaviors in adults suggest that the reasons people have for exercise are tied to the meaning

they hold for exercise (Maehr & Braskamp, 1986), and therefore PA meaning is determined by the primary reasons (i.e., "the why", Segar, p.231) people initiate it. Many adults' reasons for exercise include: "to feel good", "to live longer", "to look good", "to outperform others", and "to lose weight" (Friederichs, Bolman, Oenema, & Lechner, 2015; Ingledew & Markland, 2008; Segar et al., 2008; Teixeira, Carraca, Markland, Silva, & Ryan, 2012), but what is key to understanding the influence of such reasons begs the question, "Do certain reasons lead to a 'successful cycle promoting positive motivation' or a 'vicious cycle of experiencing failure' (Segar, 2015) when engaging in PA?" Goals should have a strong relationship to PA because they represent how success and failure are defined and the attributions made to explain them. *Hypothesis 3.4* predicts that the relationship between reasons for exercise and PA will be stronger for individuals exhibiting more intrinsic and autonomous reasons for exercise than those utilizing extrinsic and controlling ones.

Types of Profiles

Generally, profiles may differ in terms of the quantity (i.e., total number of reasons above the mean) or quality (e.g., autonomous versus controlled nature of reasons or relative autonomy index scores; Moran, Diefendoff, Tae-Yeol, & Zhi-Qiang, 2012) of the variables on which the profiles are derived.

Number of goals. Maehr and Braskamp (1986) posit that a number of goals may be operative in guiding how individuals invest time and energy. According to AGT, people's behaviors should differ in predictable ways based on different goal profiles. Embracing multiple goals provides more opportunities to attain success and avoid failure, but what is less understood is whether the total number of goals influence PA behaviors, with more valued goals providing more opportunities to experience success than profiles with fewer important

goals. *Hypothesis 3.5* postulates that profiles that value more positive reasons for exercise will lead to greater PA levels than will profiles that have fewer valued exercise reasons.

Individual reasons to exercise. Most exercisers have unique goal profiles that they are trying to meet through exercise. However, numerous studies (Friederichs et al., 2015; Guerin & Fortier, 2012; Moran et al., 2012) have been conducted on dimensions of motivational constructs identifying profiles such as self-determination and amotivation in isolation. For instance, Guerin and Fortier (2012) reported individuals identified in a self-determined motivation cluster displayed higher levels of interest/enjoyment than did those from a more controlled regulation cluster. However, enjoyment was the only variable measured in this study, and the sample sized was rather limited (N = 120). Few attempts (Segar et al., 2008; Wang & Biddle, 2001) have been made to understand the individual differences in goal patterns on motivational constructs when looking across a comprehensive profile of scores. *Hypothesis 3.6* posits that several profiles will be identified based on the nine reasons people have for exercise, where profiles will differ significantly on psychosocial and behavioral outcomes such as mindsets, motivational regulation, passion, and PA behaviors.

Exercise frequency, intensity, and duration. The growing concern (American College of Sports Medicine [ACSM], 2014; CDC, 2014) that many people are not accruing enough PA to promote health benefits encourages research investigations focused on gaining a better understanding of the association between the quality of a person's motivation and their level of health-enhancing exercise behavior. The adaptive behavioral concomitants of motivation such as effortful and sustained behavioral engagement in PA of moderate to vigorous intensity are most likely to occur when an individual partakes in the activity for autonomous reasons. Raedeke and Burton (1997) investigated leisure time PA and reported that high-active

individuals place importance on different reasons for exercise than less-active individuals. High active (Raedeke & Burton, 1997) and moderately-high active adults differed from their less active counterparts by placing more importance on health-related incentives (i.e., health fitness and mental health), whereas highly active differed from moderately high active and less active adults by placing more importance on achievement-related incentives (i.e., feel good, task, and outcome incentives). *Hypothesis 3.7* postulates high PA clusters will display greater levels of growth mindsets, autonomous forms of motivational regulation, and harmonious passion compared to less active clusters.

Profile Research and Practitioner Tools

Profile research (Moran et al., 2012) has been performed in the context of work, physical education (Wang, Chatzisarantis, Spray, & Biddle, 2002), and to a lesser extent PA. Some studies (Friederichs et al., 2015; Moran et al., 2012) find two to five clusters, but most studies report cluster solutions of three or four (Guerin & Fortier, 2012) . In adults, PA behaviors of autonomous motivation profiles display more favorable characteristics compared to less self-determined clusters (Friederichs et al., 2015). No studies to our knowledge have attempted to identify profiles based solely on participatory reasons for exercise, nor have they explored the role of mindsets on motivational constructs hypothesized to influence PA behaviors. Therefore, it is hoped that several implications can be drawn from this profile study. First, cluster analysis will be a useful method for differentiating between profiles in a large group of adults ranging from younger to older, with activity levels ranging from low to extremely high PA. In addition, the results of this study should provide additional support for the importance of reasons for exercise that people adopt, whether those reasons are more autonomous or controlled, and the degree to which such reasons promote harmonious or

obsessive passion. Finally, the results of this study may help to encourage health-related professionals to recognize the importance of the reasons people have to initiate exercise, and how such reasons may influence psychological variables that increase or decrease adherence to exercise programs.

Therefore, the purpose of this study is to use cluster analysis to form reason profiles for why people exercise and engage in PA by exploring naturally-occurring profiles, in a large sample of adults across a wide range of PAs. A second purpose was to examine how the profiles differ on adult's motivational regulation, passion, mindset, and exercise behaviors.

Method

From the initial data set of 1,604 participants, participants were removed from the study if they failed to complete an entire section of the questionnaire (N = 329), resulting in a sample of 1,275, (79.5 %) participants.

Participants

Participants were solicited from a hospital-affiliated wellness center (N = 186), personal contacts of the researcher (N = 464), or ResearchMatch (N = 954). Participants consisted of 531 males (41.6 %), 743 females (58.3 %), and 1 respondent (0.1 %) who did not indicate gender. The average adult was middle-aged (M = 46.5 years; SD = 16.8), engaged in PA (M = 29.7 years; SD = 19.5), and over half participated in sports (63.6 %).

Instruments

The survey was comprised of six instruments, including: (a) the Reasons to Exercise Scale (RE_X-2)-Version 2, (b) Physical Activity Demographic and Background Questionnaire (PADBQ), (c) International Physical Activity Questionnaire (IPAQ), (d) the Behavioral Regulation in Exercise Questionnaire-3 (BREQ-3), (e) the Conceptions of the Nature of Athletic Ability Questionnaire-Version 2 (CNAAQ-2), and (f) the Passion Scale (PS).

RE_X-2 Scale (Version 2). Items included a standardized stem (i.e., "To you, how important is this reason for exercising and/or being physically active?") followed by content statements written to tap into important aspects of each of the nine subscales identified in Manuscript 2 (see Appendix E). Each statement was evaluated using a 6-point Likert scale, ranging from 1 (not at all important) to 6 (extremely important). Preliminary factor and construct validity identified in Study 2 were promising, and the RE_X-2 was invariant across age and gender.

PADBQ. Participants were asked to self-report their age, gender, ethnicity, and experience engaging in PA/exercise (see Appendix D).

IPAQ. The IPAQ is an internationally-recognized instrument used to obtain comparable estimates of PA undertaken across a set of domains. Total scores require duration (in minutes) and frequency (days) from activities such as sitting, walking, moderate, and vigorous activity to provide a general measure of an individual's PA during the most recent seven-day period (Craig et al., 2003). Reports (Craig et al., 2003) on the IPAQ's ability to measure PA levels have demonstrated a test-retest reliability coefficient of 0.80 among 18 to 65 year-olds in diverse settings (see Appendix E).

BREQ-3. The BREQ-3 measures external, introjected, identified, integrated, and intrinsic forms of regulation of exercise behavior based on Deci and Ryan's (1985) SDT continuum conception of extrinsic and intrinsic motivation. Confirmatory factor analysis (Markland & Tobin, 2004) reported the BREQ-3 model to demonstrate a good fit (*CFI* = 0.95, $p = 0.02$) with adult exercisers. Acceptable Cronbach alpha reliabilities were reported on external ($\alpha = 0.79$), introjected ($\alpha = 0.80$), identified ($\alpha = 0.73$), integrated ($\alpha = 0.83$) and intrinsic ($\alpha = 0.86$) regulation. Additionally, the BREQ-3 may be used as a multidimensional instrument by giving separate scores for each subscale, or as a unidimensional index of the degree of self-determination, known as the 'relative autonomy index' (RAI; Ryan & Connell, 1989). The RAI is a single score derived by summing subscale scores in order to provide an index of the degree to which respondents feel self-determined (see Appendix F).

CNAAQ-2. The CNAAQ-2 (Wang & Biddle, 2001) is a 12-item questionnaire that examines conception of ability as a growth or fixed entity. The 'growth' subscale is assessed with 6-items (e.g., 'To be successful, you need to develop knowledge, techniques and skills, and practice them regularly.'). Fixed beliefs also included a 6-item subscale (e.g., 'It is difficult to change how good you are at anything.'). Responses were made on a 5-point Likert scale that range from 1 (strongly disagree) to 5 (strongly agree). The original CNAAQ-2 has shown satisfactory psychometric properties including support from CFA (Wang & Biddle, 2001). Reliability for the incremental/growth subscale has demonstrated acceptable internal consistency ($\alpha = 0.76$), with entity/fixed beliefs quite similar ($\alpha = 0.75$; see Appendix G).

PS. The Passion Scale (PS; Vallerand & Blanchard, 2003) is a 14-item questionnaire used to examine passion for exercise as being harmonious or obsessive. The 'harmonious' subscale is assessed by 7-items (e.g., 'Exercise is in harmony with other activities in my life'),

whereas ‘obsessive’ passion also is measured by a 7-item subscale (e.g., ‘I have a tough time controlling my need to exercise’). Responses are made on a 7-point Likert-scale ranging from 1 (do not agree at all) to 7 (completely agree). Vallerand and Blanchard (2003) reported adequate Cronbach’s alpha values for harmonious (α = 0.71-0.84) and obsessive passion (α = 0.85-0.92; see Appendix H).

Procedure

Following IRB approval, an online survey was developed using Qualtrics and distributed to a hospital-affiliated wellness center, personal contacts of the researcher, and ResearchMatch (see Appendix K).

Hospital-affiliated wellness center. Access was obtained to recruit participants’ in-person at a large hospital-affiliated wellness center. A table was set up in the main entrance of the facility for two days where people were asked to complete an 8-10 minute survey. Members who agreed to participate were given a choice of a tablet to complete the survey electronically or a paper version of the survey.

Personal contacts. Personal contacts of the researcher were sent email invitations that included a URL to access the online Qualtrics survey and the researcher’s contact information.

ResearchMatch. A large population of volunteers were recruited on ResearchMatch, a registry supported by the National Institute of Health. Volunteers were provided with an announcement (see Appendix J) informing them of the nature of the study. Only those who agreed to participate in the study were sent email invitations that included a URL to access the online Qualtrics survey and the researcher's contact information.

Data Analysis Plan

All analyses were conducted using SPSS Version 23. Screening for missing data and univariate and multivariate normality and outliers was performed. Internal consistency reliability (i.e., Cronbach's alpha) was assessed for each construct. Descriptive statistics, (i.e. means, standard deviations, and bivariate correlations) were calculated to provide a descriptive profile of the sample.

As recommended (Gore, 2000; Tan, Steinbach, & Kumar, 2006) hierarchical clustering was used to get the range of clusters to be analyzed (i.e., 2-5 clusters) and non-hierarchical cluster analysis created the clusters actually extracted. This 2-step approach allowed researchers to form clusters with high internal and external homogeneities (Hair & Black, 2000). Prior to conducting the cluster analysis, RE_X-2 scores, motivation regulation, passion, mindset, and PA scores were transformed into z-scores. Because hierarchical cluster analysis is sensitive to outliers, multivariate outliers (individual with Mahalanobis Distance > 18.47, $p < 0.001$) and univariate outliers (scores of more than 3 SD below or above the mean) were removed from the dataset. The hierarchical cluster analysis was conducted using Wards' method based on squared Euclidian distances. Ward's method (Friederichs et al., 2015) was used because it trivializes the within-cluster differences that are found in other methods. The extracted initial cluster centers were used as non-random starting points in an iterative k-means clustering procedure. The numbers of clusters were derived from the agglomeration schedule, by locating the largest increase in coefficients. Due to the data-driven nature of cluster analysis, two approaches were used to assess the stability of the potential motivation profiles and addressed in the results section.

To examine the relationship between reason profiles, reasons for exercise (i.e., RE_X-2), motivational regulation (BREQ-3), passion (PS), mindsets (CNAAQ-2), and physical activity (IPAQ), four types of analysis were conducted, including: (a) correlational analysis for all dimensions, (b) cluster analysis (CA) to develop profiles, (c) multivariate analysis of variance (MANOVA) to assess profile group differences for RE_X-2, motivational regulation, passion, mindsets, and PA outcome variables, and (d) analysis of variance (ANOVA) follow up was performed if Wilk's lambda was significant. All analyses were evaluated using a significance level set at $p < 0.05$.

Results

Descriptive and Correlational Results

The means and standard deviations of the RE_X-2, psychosocial variables, and physical activity (PA) levels are shown in Table 3.1. The correlations between the RE_X-2, BREQ-3, PS, CNAAQ-2, and PA subscales are shown in Table 3.1. Correlations for RE_X-2 subscales and the motivational regulation correlate variables were higher for autonomous-focused reasons (i.e., ME, SOL, SOC, FIT, COM) and lower for control-focused (i.e., WM, PH, APP, and HC) reasons. For autonomous reasons, RE_X-2 correlations ranged from .36 to .69, (mean r = .53), whereas for controlled reasons, the range of correlations was from .10 to 41 (mean r = .25). Similarly, autonomous reasons demonstrated stronger positive relationships with harmonious (r = .44 to .67, mean r = .55) and obsessive passion (r = .41 to .57, mean r = .49) compared to controlled reason subscales (r = .08 to .35, mean r = .22). Correlations for the RE_X-2 subscales with both mindset and PA were weak, except for vigorous activity which ranged from .12 to .30 (mean r = .21).

Cluster Results for RE_X-2 Subscales

The 4-cluster solution resulted in the most interesting profile pattern for examining RE_X-2 subscales, and this solution was selected because it was most consistent with conceptual predictions and previous motivation research. Table 3.1 represents the chosen 4-cluster reason solution that was most interpretable for this sample, and the figure provides standardized mean scores for each of the criterion variables. The 4-cluster solution was selected because it theoretically represented both 'intrinsic-extrinsic' and 'high-low' motivation profiles based on reasons participants had for exercising.

Cluster 1 was labeled 'Multi-Reason Positive (MR^+) Profile' due to all RE_X-2 subscale scores above the mean, and fitness, competition, solitude, social, appearance, mood enhancement and preventative health >.5 SD above the mean, and weight management and health concern reasons .4 and .3 SD above the mean.

The second cluster was labeled 'Autonomous-Focused Profile' because the four reasons above the mean (i.e., mood enhancement, solitude, competition, and social) were intrinsic in focus and fitness was the only slightly below the mean. Cluster 3 was characterized as 'Multi-Reason Negative (MR-) Profile' because this profile exhibited all reasons below the mean with health concerns the only reasons higher than .5 SD below the mean. Finally, Cluster 4 was characterized as 'Control-Focused Profile' because the four most extrinsically-focused subscales were all above the mean (i.e., weight management, appearance, health concerns, and preventative health), with fitness which was a mix of intrinsic and extrinsic items, also slightly above the mean.

MANOVA Results for RE_X-2 Profiles

Profile differences were examined for motivation regulation, passion, mindsets, and PA using MANOVA with univariate ANOVA follow-up (see Table 3.2).

RE_X-2 profile differences for motivation regulation subscales. MANOVA results comparing the five BREQ-3 subscales across the 4-cluster reasons solution revealed there was a statistically significant difference between the motivational regulation variables used by these four reasons clusters, $F(15, 3384) = 61.23$, $p < 0.001$; Wilk's Lambda = .515; partial eta^2 = .198. Follow-up ANOVA results indicated differences in motivation regulation across cluster groups, including: (a) external, $F(3, 1230) = 14.51$, $p < 0.001$, partial $eta^2 = .034$; (b) introjected $F(3, 1230) = 82.16$, $p < 0.01$, partial $eta^2 = .167$; (c) identified $F(3, 1230) = 220.75$, $p < 0.01$, partial $eta^2 = .329$; (d) integrated $F(3, 1230) = 215.58$, $p < 0.001$, partial $eta^2 = .345$; (e) intrinsic $F(3, 1230) = 233.62$, $p < 0.001$, partial $eta^2 = .363$; and (f) relative autonomy $F(3, 1230) = 192.51$, $p < 0.001$, partial $eta^2 = .320$.

According to the Bonferroni post-hoc tests, compared to MR- Cluster and CF, MR+ Cluster and AF scored significantly higher on relative autonomy, intrinsic, integrated, and identified motivation regulation. Compared to the other clusters, members of the MF- Cluster scored significantly lower on relative autonomy and more autonomous forms of motivational regulation (i.e., identified, integrated, and intrinsic motivation regulation). Compared to the MF- Cluster, members of the MF+ Cluster scored higher on external and introjected regulation (i.e., controlled forms of motivation) as well as on more autonomous-forms of motivation (i.e., identified, integrated and intrinsic). Consistent with Markland and Ingledew (2002), this finding suggests that holding controlled reasons is not necessarily problematic as long as autonomous reasons are also held. Thus, although intrinsic goals tend to be pursued

for autonomous reasons and extrinsic goal tend to be pursued for controlled reasons, the content of, and the reason for pursuing such goals, seemed to support both quantity and quality hypotheses.

RE_X-2 profile differences for passion subscales. MANOVA results comparing the two subscales of the PS (i.e., harmonious and obsessive) across the four reason profile solution demonstrated a significant multivariate main effect, F (6, 2446) = 122.94, $p < 0.001$; Wilk's Lambda $\wedge$ = .590; partial eta^2 = .232 (see Table 3.2). Follow-up ANOVA results indicated that all four RE_X-2 clusters differed on all possible comparisons for both harmonious F(3, 1224) = 271.45, $p < 0.01$, partial eta^2 = .400 and obsessive passion F(3, 1224) = 183.21, $p < 0.01$, partial eta^2 = .310.

Follow-up ANOVA results revealed members of Cluster MR+ reported significantly higher scores for both harmonious and obsessive passion compared to all the other clusters with MR- demonstrating the lowest scores. Overall, in both obsessive and harmonious passion, MR+ cluster demonstrated the highest scores followed by AF, CF, and MR- clusters. These results suggest that reasons that are more positive outshine soley autonomous reasons (e.g., MR+ compared to AF profile).

RE_X-2 profile differences for mindset subscales. MANOVA results comparing two subscales of the CNAAQ-2 (i.e., fixed and growth mindsets) across the four reason profile solution demonstrated a significant multivariate main effect, F(6, 2458) = 23.06, $p < 0.001$; Wilk's Lambda $\wedge$ = .896; partial eta^2 = .053. ANOVA results indicated differences on growth and fixed mindsets among the clusters, F(3, 1230) = 271.45, $p < 0.01$, partial eta^2 = .090 for growth F(3, 1230) = 183.21, $p < 0.01$, partial eta^2 = .022 for fixed. For fixed mindsets, CF members reported significantly higher scores on fixed mindsets compared to the other clusters,

whereas members of the MR+ Cluster demonstrated the highest scores on growth mindset compared to the other clusters.

RE_X-2 profile differences for PA. MANOVA results compared PA variables on the 4-cluster reason solution and revealed there was a statistically significant multivariate main effect, $F(12, 3247) = 14.47$, $p < 0.001$; Wilk's Lambda $\wedge = .871$; partial $eta^2 = .045$. Follow-up ANOVA results indicated that all four PA measures differed across cluster groups, including: (a) vigorous PA $F(3, 1230) = 50.46$, $p < 0.01$, partial $eta^2 = .432$; (b) moderate PA $F(3, 1230) = 19.14$, $p < 0.01$, partial $eta^2 = .110$; (c) walking $F(3, 1230) = 7.35$, $p < 0.01$, partial $eta^2 = .018$; and (d) sitting $F(3, 1230) = 10.39$, $p < 0.001$, partial $eta^2 = .025$.

According to Bonferroni post-hoc tests, MR+ and AF Clusters reported the highest scores for VPA and MPA compared to the other clusters. The CF Cluster also represented the lowest amount of time spent in VPA and MPA compared to members of the other clusters. Compared to MF+ and CF cluster members, MR+ and AF clusters reported significantly lower amount of time spent sitting, with MR- cluster representing the highest sitting scores, and the MF+ cluster reporting the lowest amount of sitting.

Cluster Results for PA Categories

The descriptive statistics for the entire sample indicated that over a 7-day period this sample engaged in a mean total of 157.4 minutes of vigorous PA (VPA; *SD* = 157.4), 142.8 minutes of moderate PA (MPA; *SD* = 140.10), 246.2 minutes of walking PA (WPA *SD* = 253.9), and 302.1 minutes of sitting per day sitting (SIT; *SD* = 161.2).

A 5-PA cluster solution resulted in the most interesting PA profile patterns because it represented unique profile of groups varying in PA intensity. Table 3.3 represents the chosen

5-PA cluster that was most interretable for this sample, and Figure 3.2 provides standardized mean scores for each of the criterion variables for each cluster.

Cluster 1 was labeled ‘Low PA Profile’ (LPA) because members PA category scores were below the mean on all four PA categories including sitting and engaged in the least number of PA minutes (i.e., total activity in vigorous, moderate, and walking PA) for the week (*M* = 337.4; *SD* = 183.3). The second cluster was labeled ‘High Intensity Profile’ (HIPA) because vigorous PA was over 1.2 SD above the mean, whereas the moderate intensity, walking, and sitting scores were below the mean. The HIPA cluster engaged in a total of 766.4 min•wk (*SD* = 258.3). Cluster 3 was characterized as the ‘Moderate Intensity Profile’ (MIPA) because this profile exhibited moderate PA scores .95 SD above the mean, low positive vigorous and walking PA scores, and sitting scores over half a SD below the mean. The MIPA cluster engaged in a total of 932.5 min•wk (*SD* = 297.9) of PA.

The fourth cluster was labeled the ‘Walking PA profile’ (WPA) because walking scores were over 1.5 SD above the mean, whereas high and moderate intensity PA and sitting scores were at or below the mean. The WIPA cluster engaged in a total of 1195.3 min•wk (*SD* = 344.3), which was signified to be the highest amount of PA engagement compared to the other clusters. Finally, Cluster 5 was characterized as the ‘Sitting PA Profile’ (SPA) because sitting scores were over 1.1 SD above the mean, whereas high and moderate intensity and walking PA scores were nearly half a SD below the mean. Additionally, the SPA cluster engaged in the lowest amount of PA engagement with a total mean of 358.7 min•wk (*SD* = 238.9).

MANOVA Results for PA Profiles

Profile differences were examined for RE_X-2, motivation regulation, passion, and mindset subscales using MANOVA with univariate ANOVA follow-up (see Table 3.3).

PA profile differences for RE_X-2 subscales. MANOVA results comparing the nine RE_X-2 subscales across the 5-PA cluster solution revealed there was a statistically significant difference between PA profiles between the REx-2 variables used by these five-PA clusters, $F(36, 4334) = 3.84$, $p < 0.001$; Wilk's Lambda $\wedge = .889$; partial $eta^2 = .029$. Follow-up ANOVA results indicated that five reasons showed differences across the five PA-cluster profiles, including: (a) mood enhancement, $F(4, 1164) = 14.07$, $p < 0.001$, partial $eta^2 = .046$; (b) solitude $F(4, 1164) = 7.97$, $p < 0.001$, partial $eta^2 = .027$; (c) social, $F(4, 1164) = 15.71$, $p < 0.001$, partial $eta^2 = .051$; (d) fitness, $F(4, 1164) = 16.60$, $p < 0.001$, partial $eta^2 = .054$; and (e) competition, $F(4, 1164) = 13.13$, $p < 0.001$, partial $eta^2 = .043$. Bonferroni post-hoc results demonstrated among the 5-PA clusters that compared to the SIT and LPA profiles, HIPA members reported significantly higher scores for mood enhancement, solitude, social, fitness, and competition reasons for exercising. No significant differences were found for preventative health, weight management, appearance, or health concern reasons on any of the 5-PA profiles.

PA profile differences for motivation regulation subscales. MANOVA results compared the five BREQ-3 subscales across the 5-cluster PA solution and revealed a statistically significant difference among the variables, $F(20, 3848) = 8.19$, $p < 0.001$; Wilk's Lambda $\wedge = .871$; partial $eta^2 = .034$. The ANOVA results indicated that all five of the BREQ-3 subscales and the RAI score revealed significant difference across cluster profiles, including: (a) extrinsic $F(4, 1164) = 2.83$, $p < 0.05$, partial $eta^2 = .010$; (b) introjected F(4,

1164) = 3.63 , $p < 0.01$, partial eta^2 = .012; (c) identified F(4, 1164) = 26.54, $p < 0.001$, partial eta^2 = .084; (d) integrated F(4, 1164) = 32.38, $p < 0.001$, partial eta^2 = .100; (e) intrinsic F(4, 1164) = 23.54, $p < 0.001$, partial eta^2 = .080; and (f) RAI F(4, 1164) = 33.40, $p < 0.001$, partial eta^2 = .103.

Compared to the HIPA cluster, all of the clusters reported significantly higher scores on external regulation, with the SIT profile having the highest score. Compared to all of the clusters, the SPA profile demonstrated significantly lower scores on identified, integrated, intrinsic, and RAI scores (see Table 3.3). Similarly, compared to the LPA, HIPA and MIPA clusters demonstrated significantly higher scores in identified, integrated, intrinsic, and RAI scores. The HIPA profile displayed significantly lower scores on external regulation compared to the SPA and LPA profiles. Results revealed a significant difference between the SPA and LPA profiles with LPA demonstrating higher scores on intrinsic regulation.

Profile differences for passion subscales. MANOVA results comparing two subscales of the PS (i.e., harmonious and obsessive) across the five PA profile solution demonstrated a significant multivariate main effect, F(8, 2314) = 18.69, $p < 0.001$; Wilk's Lambda $\wedge$ = .882; partial eta^2 = .061. Follow-up ANOVA results indicated that both passion subscales differed across the cluster groups on harmonious F(4, 1158) = 34.64, $p < 0.001$, partial eta^2 = .104 and obsessive passion F(4, 1158) = 33.62, $p < 0.001$, partial eta^2 = .107.

Significant ANOVA results were followed up with pairwise comparisons and found no significant difference existed between the HIPA and MIPA clusters on harmonious and obsessive passion scores. The SIT cluster represented the lowest scores on both obsessive and harmonious passion compared to the other clusters. Both the harmonious and obsessive passion revealed similar magnitudes across the 5-PA clusters, and represented from highest to

lowest scores HIPA, MIPA, WPA, LPA, and SPA. These results suggest that higher levels of both passion types relate to higher levels of PA engagement.

PA profile differences for mindset subscales. MANOVA results comparing two subscales of the CNAAQ-2 (i.e., fixed and growth mindset) across the five PA profile solution demonstrated a significant multivariate main effect, $F(8, 2326) = 23.06$, $p < 0.05$; Wilk's Lambda $\wedge = .985$; partial $eta^2 = .008$. Follow-up ANOVA results indicated that the growth subscale was different across the cluster groups, $F(4, 1164) = 3.36$, $p < 0.05$, partial $eta^2 = .011$, but not fixed mindsets. Compared to the LPA and SIT clusters, the HIPA profile reported significantly higher growth scores.

Discussion

The findings from this study further expand on research examining the reasons people have for exercising and physical activity (PA) levels, particularly how profiles created by clustering on reasons and PA differ signficantly across motivation, passion, and mindsets. Specifically, this investigation created four different profiles of reasons people have for being physically active, and five different profiles based on types and levels of PA to examine how both sets of profiles differed on psychosocial and/or PA variables. Briefly, the discussion condensed the seven origional study hypotheses and focused on (a) how well the protocol was able to create unique profiles based on the reasons people have for exercise that vary on a range of psychosocial and behavioral outocmes, and (b) the ability of PA profiles to differentiate between a range of psychosocial variables.

Reasons for Exercise Cluster Comparisons

Multivariate analysis of variance results were used to examine the hypotheses by comparing the reason profiles across the nine RE_X-2 subscales, five motivational regulation

subscales, two mindset and passion subscales, and four PA categories. As hypothesized, the reason profiles results were supportive of being able to create unique profiles based on RE_X-2 subscales, with each profile varying on a range of psychosocial and behavioral outcomes. The present study demonstrated that cluster analysis assisted in identifying groups of individuals based on the reasons the people have for exercising and/or being physically active. The four unique RE_X-2 clusters created included (1) the Multi-Reason Positive (MR+) Profile – individuals in this cluster scored high all on intrinsic and extrinsic reasons for exercising; (2) the Autonomous-Focused (AF) Profile – individuals in this cluster scored above the mean on intrinsic reasons for exercising but below on extrinsic reasons; (3) the Multi-Reason Negative (MR-) Profile – individuals in this cluster scored low on all reasons, with health concerns the highest reason; and (4) the Control-Focused (CF) Profile – individuals in this cluster scored above the mean on extrinsic reasons and below the mean on intrinsic reasons for exercising.

Profile differences on reasons for exercise. Results comparing the reason profiles on a range of psychosocial and exercise behavior variables yielded interesting results. Multi-reason (MR+) positive exercisers reported more favorable levels on all psychosocial and exercise behavior variables, whereas the MR negative (MR-) exercisers reported least favorable scores. Interestingly, compared to the Autonomous-Focused (AF) profile, the MR+ profile was more advantageous in promoting desirable scores on motivation regulation subscales. For example, there were significant profile differences with MR+ revealing a greater, positive impact on autonomy supportive subscales (i.e., identified, integrated, and intrinsic motivation regulation) than the AF Profile. Additionally, the MR+ Profile resulted in more favorable relationships between passion and PA behaviors than did the AF Profile. These findings are supported by Maehr and Braskamp (1986)'s work highlighting how the number of goals also

relate to how one invests their time and energy, and therefore highly valued goals are suggested to provide more opportunities to experience success than when individuals have fewer important goals. In this study, clearly the number of valued reasons led to more desirable outcomes compared to profiles with fewer valued exercise reasons (e.g., MR+ Profile versus MR- Profile).

For variables expected to promote positive PA behaviors, such as individuals exhibiting more intrinsic/autonomous-focused reasons (i.e., MR+ and AF Profiles), results were significant and consistent. For example, in the MR+ and AF Profiles, PA levels were signficantly higher in all PA intensities (i.e., vigorous, moderate, and walking), whereas sedentary behavior (i.e., sitting) was significantly lower compared to profiles exhibiting more extrinsic/control-focused reasons for exercisisng (i.e., MR- and CF Profiles).

Lastly, one consistent theme attesting to having meaningful reason clusters was demonstrated through the motivation regulation and passion subscales. As expected extrinsic reasons (i.e., weight management, health concerns, and appearance) were experienced as controlling, whereas intrinsic reasons (i.e., mood enhancement, solitude, social, and fitness) were experienced as being more autonomous, and therefore contributed greatly to the distinctions among the four clusters. In line with our motivational regulation findings, the passion scale represented central features that a person identifies with (Vallerand, 2012). Of the four reason profiles, both the MR+ and AF profiles reported significantly higher, positive scores in both obsessive and harmonious passion than did the two more control-focused profiles.

Compared to motivational regulation and passion, mindsets and PA results were not as striking across reason profiles, except for vigorous PA behaviors. Because mindsets relate

more to achievement than to nonachievement oriented settings, the RE_X-2 subscales' focus more on non-achievement reasons may account for why these results were less remarkable than initially hypothesized. As for PA levels, it may be that with PA once exercisers reach a level of PA that meets their personal goal or needs, then PA behaviors may be something one simply wants to maintain rather than grow.

Physical Activity Behaviors Cluster Comparisons

The results comparing the PA profiles across the reason subscales and psychosocial correlate variables yielded thought-provoking findings. As hypothesized, the cluster analysis on PA categories was successful in creating unique profiles, with clusters differing on the RE_X-2, motivatonal regulation, passion, and mindset subcales. Five unique PA clusters included (1) a Low PA (LPA) Profile – individuals in this cluster engaged in the least amount of PA and spent most of their time sitting; (2) a High Intensity PA (HIPA) Profile – individuals in this cluster engaged most in vigorous PA; (3) a Moderate Intensity PA (MIPA) Profile – individuals in this cluster engaged most in moderate PA (MPA); (4) a Walking PA Profile (WPA) – individuals in this cluster participated most in walking; and (5) a Sitting PA Profile (SPA) – individuals in this cluster exhibited high levels of sedentary behavior.

PA profile differences. HIPA and MIPA reported the highest scores on solitude, social, fitness and competition reasons and were significantly higher than were the sedentary group (i.e., SPA). These findings suggest that exercisers that engage in higher-intensity or moderate-intensity type of PA also appear to value solitude, social, fitness, and competition reasons more than those who are more sedentary. The Low PA cluster had lower scores on solitude, social, fitness and competition than did the HIPA cluster, suggesting exercisers that participate in more intense levels of PA value these reasons. Interestingly, among the 5-PA

clusters, there were no differences between preventative health, weight management, appearance, or health concern reasons for exercise.

Consistent in the PA profile findings, it was evident that motivation was critical to PA engagement, particularly in adults engaging in higher intensity PA. For example, compared to all the other clusters, the HIPA profile contained higher scores on autonomous forms of motivational regulation (i.e., identified, integrated, and intrinsic regulation) for exercising and lower scores on controlling forms of motivation regulation (i.e., external and introjected regulation). Additionally, the RAI suggests that the HIPA had the highest autonomy score followed by the MIPA and WPA clusters confirming the importance of motivation in more intense forms of PA engagement.

Another unique quality of the 5-PA clusters was the size of the HIPA profile, which included only ~ 12 % of the sample. Similarly, the MIPA represented ~ 11 %, and the WPA profile included 10% of the population, whereas ~ 68 % of the participants represented either the low or sedentary profile despite the recruitment efforts of this study focusing on active adults. The sample size underlines that even exercisers perceived to be highly physically active may not be as active as health professionals believe them to be.

Strengths and Limitations

The present study has several strengths, limitations and implications. One strength was the large research sample studied, consisting of recreationally active adults (motivated respondents) varying in age levels from 18 to 87 years of age. However, because this study did have a broad sample, it may be why it was hard to identify definitive differences among the groups compared to having collected data on a more homogenous sample. A future study would be to explore the reason clusters by comparing the reason clusters by age categories

(e.g., 20-35 compared to 36-50, etc.) to discover whether the same clusters may be representative of specific age categories.

As with any study, there were some limitations in this study. First, the design of the study is cross sectional. Therefore, it is not possible to infer causal relationships from the results. Second, PA was assessed using a self-report measure. Lastly, it must be emphasized that the subscales utilized in the RE_X-2 Scale are the reasons recreationally active adults have for exercising and/or being physically active. Therefore, whether the reason identified in the RE_X-2 are the same reasons non-physically active adults would report is unknown. Despite these limitations, several implications can be drawn from this study. First, this study illustrated that cluster analysis is a useful method for differentiating between the reasons people have for exercising as well as PA levels in a large sample of active adults. This approach provides more unique information compared to studies focusing on motivational profiles which categorize individuals as only high or low in autonomous motivation. Rather the results of this study provide additional support for the importance of autonomous and controlling forms of motivation in the context of the reasons people have for being physically active. From this perspective, health professionals should not limit their focus to producing immediate increases in PA behavior in their clients by focusing on autonomous reasons for exercise, but also attempt to increase the overall number of valued reasons one has for exercising.

When trying to better understand reasons and their influence on PA levels, one less understood area worthy of further investigation is program compatibility. Program compatibility (Raedeke & Burton, 1997) involves the extent to which individuals believe that their current PA pursuits allow them to attain valued reasons for exercise. According to

Raedeke and Burton (1997), individuals who perceive that their activity choices allow them to attain desired reasons for exercise should demonstrate higher activity levels than those who do not. Consequently, high physically active individuals should theoretically perceive higher program compatibility with valued reasons that those who are less active.

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Table 3.1

Descriptives and Correlations for RE$_X$-2 Subscales, Behavioral Regulation, Passion, Mindsets, and PA Categories

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. Mood enhancement	--																						
2. Solitude	.63	--																					
3. Social	.49	.40	--																				
4. Fitness	.58	.37	.43	--																			
5. Weight management	.21	.16	.18	.28	--																		
6. Preventative health	.41	.26	.26	.60	.30	--																	
7. Appearance	.44	.26	.28	.46	.60	.34	--																
8. Health concerns	.06	.11	.11	.17	.31	.24	.07	--															
9. Competition	.35	.35	.52	.40	.05$^{\#}$	.17	.30	-.04$^{\#}$	--														
10. External	-.01$^{\#}$	.01$^{\#}$	.16	.07	.23	.10	.18	.22	.15	--													
11. Introjected	.38	.25	.21	.36	.30	.26	.41	.01$^{\#}$	.23	.25	--												
12. Identified	.64	.43	.36	.57	.10	.42	.30	-.03$^{\#}$	.29	-.04$^{\#}$	.50	--											
13. Integrated	.60	.42	.45	.58	.06	.40	.32	-.06	.40	-.01$^{\#}$	.45	.80	--										
14. Intrinsic	.69	.49	.47	.48	.03$^{\#}$	.29	.24	-.08	.36	-.10	.29	.72	.71	--									
15. RAI	.64	.45	.41	.49	-.06	.30	.18	-.13	.32	-.36	.16	.78	.82	.91	--								
16. Harmonious	.67	.49	.52	.54	.08	.35	.31	-.02$^{\#}$	.44	-.04$^{\#}$	.37	.72	.78	.74	.76	--							
17. Obsessive	.57	.45	.42	.47	.05$^{\#}$	.29	.29	.00$^{\#}$	.41	.01$^{\#}$	.46	.67	.71	.60	.62	.80	--						
18. Growth	.28	.19	.23	.27	.19	.18	.27	.00$^{\#}$	.21	.07	.25	.29	.26	.27	.23	.35	.23	--					
19. Fixed	-.20	-.13	.00$^{\#}$	-.13	-.01$^{\#}$	-.09	-.07	.10	.02$^{\#}$	.16	-.03$^{\#}$	-.22	-.15	-.22	-.25	-.18	-.07	-.18	--				
20. Vigorous PA	.29	.25	.29	.29	.04$^{\#}$	.13	.13	-.01$^{\#}$	.30	-.04$^{\#}$	.15	.33	.37	.33	.36	.42	.39	.15	-.05$^{\#}$	--			
21. Moderate PA	.18	.15	.17	.16	-.01$^{\#}$	.08	.08	.01$^{\#}$	.20	-.01$^{\#}$	.07	.17	.21	.19	.20	.25	.26	.07	-.02$^{\#}$	.40	--		
22. Walk PA	.12	.13	.11	.13	.00$^{\#}$	.03$^{\#}$	.06$^{\#}$	.00$^{\#}$	.14	.02$^{\#}$	.02$^{\#}$	.08	.10	.12	.11	.14	.14	.05$^{\#}$	-.06	.21	.36	--	
23. Sitting	-.11	-.12	-.13	-.13	.01$^{\#}$	-.09	-.02$^{\#}$	-.05$^{\#}$	-.12	.01$^{\#}$	.00$^{\#}$	-.12	-.15	-.17	-.18	-.18	-.20	-.04$^{\#}$	.02$^{\#}$	-.17	-.17	-.11	--
Mean	4.2	3.2	2.7	4.3	3.9	4.7	3.9	3.2	2.1	1.6	3.0	4.0	3.4	3.5	15.2	4.7	3.7	4.1	2.15	189.7	180.3	290.1	312.6
SD	1.3	1.4	1.2	1.0	1.3	.96	1.2	1.3	1.2	.76	1.1	.87	1.2	1.1	6.1	1.3	1.3	.61	.78	217.5	217.2	312.6	162.1

Note. All correlations significant at $p \leq 0.05$ unless otherwise notes. $^{\#}$ $p > 0.05$. SD = standard deviation.

Table 3.2

MANOVA Results Comparing RE$_X$-2 for Behavioral Regulation, Passion, Mindsets, and PA Categories

4-Reason Profiles	Multi-Reason Positive (MR+) *N*= 361		Autonomous Focused (AF) *N* = 259		Multi-Reason Negative (MR-) *N* = 232		Control Focused (CF) *N* = 382			
Motivation	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**F**	**eta^2**
External	1.72	.87	1.41	.59	1.43	.59	1.69	.82	14.513***	.034 [a,b,e,f]
Introjected	3.53	1.08	2.84	1.08	2.17	.99	3.14	1.04	82.163***	.167 [a,b,c,d,e,f]
Identified	4.51	.60	4.22	.68	3.08	.92	3.92	.67	200.753***	.329 [a,b,c,d,e,f]
Integrated	4.23	.84	3.65	1.08	2.19	.96	3.14	1.21	215.580***	.345 [a,b,c,d,e,f]
Intrinsic	4.24	.76	3.99	.84	2.34	1.04	3.26	.98	233.624**	.363 [a,b,c,d,e,f]
RAI	18.72	4.65	17.85	4.86	9.48	5.2	13.48	5.53	192.508***	.320 [b,c,d,e,f]
Passion										
Obsessive	4.69	1.16	4.06	1.09	2.55	1.04	3.93	1.18	183.21***	.310 [a,b,c,d,e,f]
Harmonious	5.68	.85	5.01	.96	3.36	1.12	4.42	1.06	271.45***	.400 [a,b,c,d,e,f]
Mindset										
Growth	4.30	.53	3.94	.55	3.79	.63	4.07	.68	40.25***	.090 [a,b,c,e,f]
Fixed	2.09	.78	2.05	.79	2.02	.72	2.34	.79	9.015***	.022 [b,d,f]
Physical Activity										
Vigorous	278.45	246.68	221.69	218.95	82.849	143.94	148.94	183.88	50.459***	.110 [a,b,c,d,e,f]
Moderate	234.51	259.61	207.31	223.13	114.08	172.11	151.07	174.54	19.138***	.045 [b,c,d,e]
Walking	336.99	343.26	302.96	326.25	216.32	263.38	281.99	292.07	7.356***	.018 [b,d]
Sitting	266.80	158.14	282.35	152.45	330.25	170.43	317.42	160.95	10.390***	.025 [b,c,d,e]

Note. Significance between profile groups is denoted by a = P1 vs. P2, b = P1 vs. P3, c = P1 vs. P4, d = P2 vs. P3, e = P2 vs. P4; f = P3 vs. P4. **p<0.01. ***p <0.001.

Table 3.3

MANOVA Results Linking Cluster Membership to Correlations of the PA Profiles

5-PA Profiles	LPA *N* = 403		HIPA *N* = 143		MIPA *N* = 127		WPA *N* = 116		SPA *N* = 380			
RE_X-2	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**F**	**eta^2**
Mood enhancement	4.07	1.30	1.68	1.05	4.58	1.17	4.43	1.25	3.94	1.34	14.07***	.046 [a,b,c,g,h,j]
Solitude	3.12	1.50	3.64	1.37	3.42	1.41	3.26	1.48	2.91	1.4	7.97***	.027 [a,g,i]
Social	2.58	1.22	3.21	1.36	3.05	1.24	2.73	1.16	2.39	1.16	15.71***	.051 [a,b,f,g,i]
Fitness	4.20	1.04	4.69	.80	4.64	.93)	4.53	.86	4.07	1.08	16.59***	.054 [a,b,c,g,i,j]
Preventative health	4.75	.96	4.76	1.10	4.87	1.01	4.69	.98	4.59	1.05	2.42**	.008
Weight management	3.95	1.33	3.89	1.28	3.80	1.25	3.84	1.38	3.88	1.41	.38	.001
Appearance	3.79	1.30	4.04	1.14	3.93	1.35	4.00	1.33	3.79	1.33	1.68	.006
Health concerns	3.30	1.37	3.15	1.38	3.14	1.36	3.33	1.31	3.08	1.31	1.74	.006
Competition	1.89	1.09	2.47	1.35	2.34	1.31	2.08	1.18	1.78	1.06	13.13***	.043 [a,b,g,i]
Motivation												
External	1.62	.75	1.40	.57	1.60	.86	1.53	.72	1.64	.77	2.83**	.010 [a,g]
Introjected	2.89	1.31	3.28	1.12	3.12	1.24	2.90	1.22	2.99	1.15	3.63***	.012 [a]
Identified	3.86	.87	4.48	.58	4.34	.77	4.02	.81	3.77	.92	26.54***	.084 [a,b,f,g,h,i,j]
Integrated	3.21	1.17	4.09	.97	3.89	1.11	3.45	1.16	2.99	1.21	32.38***	.100 [a,b,f,g,h,i,j]
Intrinsic	3.40	.93	4.07	.93	3.88	1.08	3.73	1.04	3.16	1.20	23.54***	.075 [a,b,d,g,i,j]
Relative Autonomy	14.36	6.05	18.76	4.52	17.43	6.13	16.14	5.77	12.95	6.22	33.40***	.103 [a,b,c,d,f,g,i,j]
Passion												
Obsessive	3.53	1.31	4.47	1.19	4.38	1.33	3.88	1.31	3.24	1.33	34.64***	.107 [a,b,d,f,g,h,i,j]
Harmonious	4.49	1.28	5.41	1.03	5.25	1.18	4.85	1.24	4.23	1.29	33.62***	.104 [a,b,d,f,g,i,j]
Mindset												
Growth	3.99	.63	4.19	.58	4.11	.67	4.06	.61	4.00	.61	3.36**	.011 [a,g]
Fixed	2.15	.77	2.14	.87	2.10	.75	2.06	.69	2.22	.80	1.37	.005

Note. Significance between profile groups is denoted by a = P1 vs. P2, b = P1 vs. P3, c = P1 vs. P4, d = P1 vs. P5, e = P2 vs. P3, f = P2 vs. P4; g = P2 vs. P5, h = P3 vs. P5, i = P3 vs. P4, j = P4 vs. P5. **p<0.01. ***p <0.001.

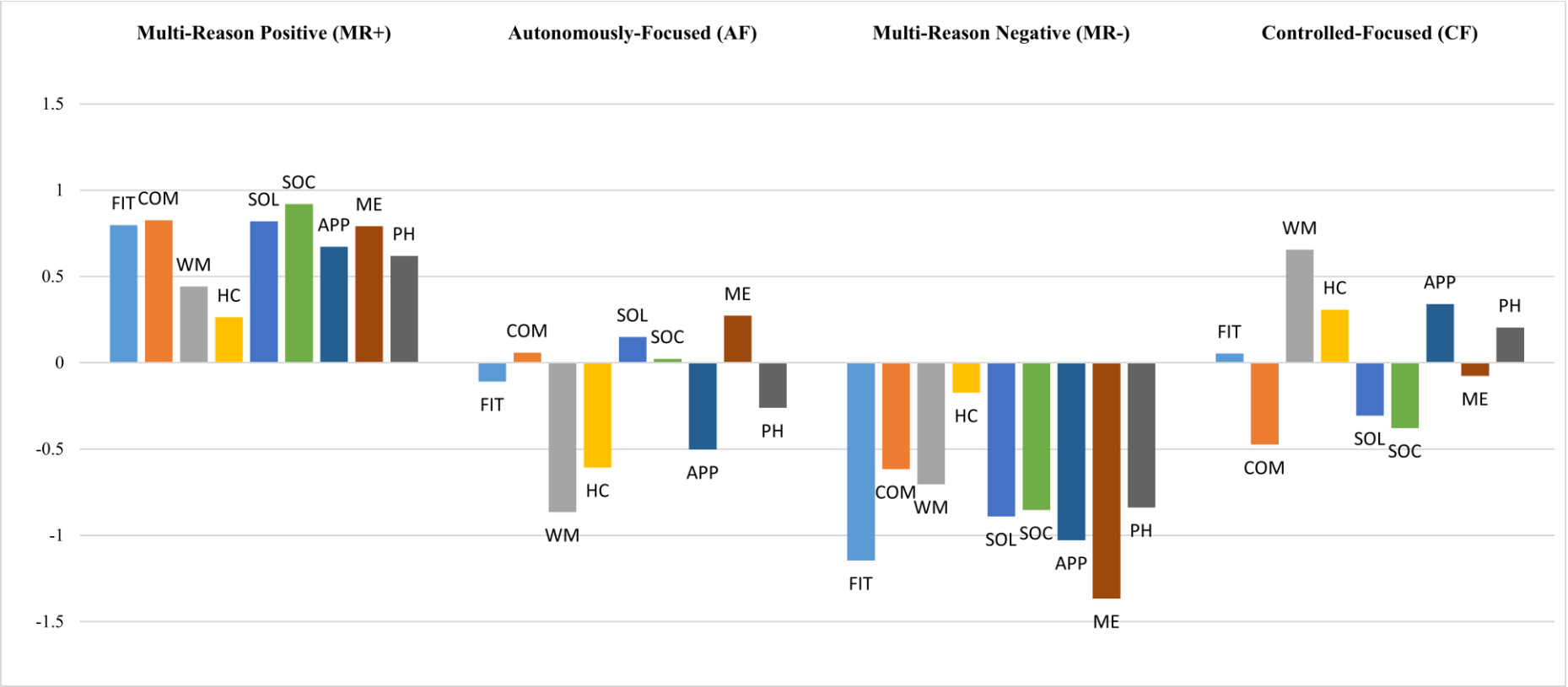


Figure 3.1. Four Profile Solution for the RE_X-2 Subscales. Profiles include MR+ = Multi-Reasons Positive; AF = Autonomous Focused; MR- = Multi-Reasons Negative; CF = Control Focused. FIT = Fitness; COM = Competition; WM = Weight Management; HC = Health Concerns; SOL = Solitude; SOC = Social; APP = Appearance; ME = Mood Enhancement; and PH = Preventative Health.

Figure 3.2. Five Profile Solution for the Physical Activity Clusters. Profiles include LPA= Low PA; HIPA = High Intensity PA; MIPA = Moderate Intensity PA; WPA= Walking PA; and SPA = Sitting PA. Vig = Vigorous; Mod = Moderate; Walk = Walking; Sit = Sitting; and PA = Physical Activity

Appendix A

Reasons to Exercise (RE_X) Scale -Version 1

RE_X items are evaluated on a 6-point Likert scale (1 = not at all important; 6 = extremely important). Items will include a standardized stem (i.e., "To you, how important is this reason for exercising and/or being physically active?") followed by content written to tap into important aspects of each of the 13 reason dimensions. Items with "**" were eliminated to reduce items within the scale or "$*^R$" re-worded while maintaining the theoretical and hypothesized structure of the RE_X.

Social Reasons (SOC) centers on exercising to experience social interaction with others, and engage in group processes (i.e., 'to be with other active people').

1. …to feel connected with active people. (soc1) $*^R$
2. …to spend time with friends. (soc2)
3. …for the social aspect. (soc3) **
4. …to meet others who value exercise. (soc4)
5. …to be around others that motivate me to work out. (soc5)

Mental Health (MH) focuses on exercising to reduce negative emotions (i.e., stress/anxiety and depression) while increasing positive emotions (i.e., self-esteem and self-confidence).

1. …to help lower stress. (mh1)
2. …to cope with stress. (mh2) **
3. …for the mental health benefits. (mh3) **
4. …to improve mental health. (mh4) **
5. …to think clearly. (mh5) **

Appearance (APP) highlights exercise reasons to improve appearance and be more attractive to others (i.e., 'to look good').

1. …to look good. (app1)
2. …to look fit. (app2)
3. …to look like I'm in good shape. (app3) $*^R$
4. …to improve physical appearance. (app4) $*^R$
5. …to be more attractive. (app5)

Weight Management (WM) focuses on exercising to gain, maintain, or lose weight.

1. …to lose weight. (wm1)
2. …to fit into the clothes I like. (wm2)
3. …to eat the foods I like. (wm3) **
4. …to control weight. (wm4)
5. …to reach my ideal weight. (wm5) $*^R$

Revitalization (R) emphasizes exercising for energizing and restoring feelings of well-being (i.e., 'to boost my energy').

1. …for the refreshing feeling I get afterwards. (rv1)
2. …to enhance my mood. (rv2)
3. …for the energy boost. (rv3) **
4. …to increase alertness. (rv4) **
5. …to feel rejuvenated. (rv5) **

Fitness (FIT) places importance on exercising for overall physical fitness reasons (i.e., 'to maintain/improve strength or endurance').

1. …to maintain my physical fitness (e.g., strength). (fit1) **
2. …to improve my physical fitness (e.g., endurance). (fit2)
3. …to have the physical fitness to take on physical challenges. (fit3)
4. …to have the physical fitness to accomplish daily activities. (fit4) **
5. …to have a physically fit body. (fit5) **

Feel Good (FG) highlights exercising for enjoyment, fun, and positive feelings from movement (i.e., 'because it makes me feel good').

1. …it feels good to move. (fg1) **
2. …it makes me happy. (fg2)
3. …it feels good to sweat. (fg3) **
4. …to feel good about myself. (fg4) **
5. …to feel good physically the rest of the day. (fg5) **

Solitude (SOL) focuses on exercising alone and enhancing self-reflection time (i.e., 'to have alone time').

1. …to get time for myself. (sol1) *[R]
2. …to have alone time. (sol2)
3. …to be alone to think. (sol3)
4. …to have 'me' time. (sol4)
5. …for self-reflection. (sol5)

Preventative Health (PH) places importance on exercising to protect, promote, and maintain good health (i.e., 'to improve my health').

1. …to maintain my current health. (ph1) **
2. …to live longer. (ph2)
3. …to maintain a positive quality of life. (ph3) **
4. …to remain healthy as I age. (ph4)
5. …to prevent health issues in the future. (ph5)

Health Concerns (HC) emphasizes exercising to control chronic disease and reduce health-related risks factors that threaten health (i.e., 'to manage joint problems').

1. …to help manage chronic pain. (hc1)
2. …to manage joint problems. (hc2) **
3. …to manage a medical condition. (hc3)
4. …to control/deal with health concerns. (hc4) *^{R}
5. …because a doctor/health professional advised me to. (hc5) *^{R}

Mastery (MAST) targets exercising to promote improvement and mastery (i.e.,' to improve my performance').

1. …for the satisfaction of reaching a health/fitness goal. (mast1) **
2. …to be my personal best in health/fitness. (mast2) **
3. …to reach performance/fitness goals. (mast3) **
4. …to give me personal challenges to face. (mast4) **
5. …to reach new personal records ('PR'). (mast5) **

Competition (COMP) emphasizes exercising to compete and outperform others (i.e., 'to outperform others').

1. …to outperform others. (com1)
2. …because I enjoy competing. (com2)
3. …to compete with others. (com3)
4. …to outshine others. (com4) **
5. …because I like to win. (com5)

Muscular Fitness (MF) places importance on exercising to promote muscular fitness (i.e., 'to tone my muscles').

1. …to maintain my strength gains. (mf1)
2. …to be stronger. (mf2)
3. …to have lean/toned muscles. (mf3) **
4. …for the strength to take on physical challenges. (mf4) **
5. …to reach my maximum fitness level. (mf5)

Appendix B

Reasons to Exercise (RE_X-2) Scale -Version 2

RE_X-2 items are evaluated on a 6-point Likert scale (1 = not at all important; 6 = extremely important). Forty-three items include a standardized stem (i.e., "To you, how important is this reason for exercising and/or being physically active") followed by content written to tap into important aspects of each of the 9 reason dimensions conceptualized for the RE_X-2 Scale. Items with a "+" were added to the RE_X-2(see Study 1) and items identified with "***" were eliminated to reduce items within the scale while maintaining theoretical and hypothesized structure for Version 2 of the RE_X-2 Scale.

Fitness (FIT) places importance on exercising to promote improve cardiovascular and muscular fitness (i.e., 'to improve overall physical fitness').

1. ...to have the physical fitness to take on challenges. (fit1)***
2. ...to be stronger. (fit2)
3. ...to maintain my strength gains. (fit3)
4. ...to improve my physical endurance. (fit4)
5. ...to reach my maximum fitness level. (fit5)

Social Reasons (SOC) centers on exercising to experience social interaction with others, and engage in group processes (i.e., 'to be with other active people').

1. ...to connect with active people. (soc1)
2. ...to spend time with friends. (soc2)
3. ...to meet others who value exercise. (soc3)
4. ...to be around others that motivate me to work out. (soc4)

Weight Management (WM) focuses on exercising to gain, maintain, or lose weight.

1. ...to lose weight. (wm1)
2. ...to fit into the clothes I like. (wm2)
3. ...to control weight. (wm3)
4. ...to reach my goal weight.(wm4) +
5. ...to eat what I like and not gain weight. (wm5) ***

Health Concerns (HC) emphasizes exercising to control chronic disease and reduce health-related risks factors that threaten health (i.e., 'to manage joint problems').

1. ...to help manage chronic pain. (hc1)
2. ...to manage a medical condition. (hc2)
3. ...to control or deal with health concerns. (hc3)
4. ...a doctor or health professional advised it. (hc4)

Appearance (APP) highlights exercise reasons to improve appearance and be more attractive to others (i.e., 'to look good').

1. ...to look good. (app1)
2. ...to look fit. (app2) ***
3. ...to look like I'm in shape. (app3)
4. ...to improve my physical appearance. (app4)
5. ...to be more attractive. (app5)

Mood Enhancement (ME) focuses on exercising to reduce negative emotions (i.e., stress) while increasing positive emotions (i.e., mood and self-confidence) and restorative feelings (i.e. energy boost) of well-being (i.e., enjoyment) resulting from movement (i.e., 'it makes me feel good').

1. ...to help lower stress. (me1)
2. ...for the refreshing feeling I get afterwards. (me2)
3. ...to enhance my mood. (me3)***
4. ...it makes me happy. (me4)
5. ...for the confidence boost I get from being physically active. (me5) +***
6. ...for the positive mindset I experience post-workout. (me6) +

Solitude (SOL) focuses on exercising alone and enhancing self-reflection time (i.e., 'to have alone time').

1. ...to make time for myself. (sol1)
2. ...to have alone time. (sol2)
3. ...to be alone to think. (sol3)
4. ...to have 'me' time. (sol4)
5. ...for self-reflection. (sol5)***

Competition (COM) emphasizes exercising to compete and outperform others (i.e., 'to outperform others').

1. ...to outperform others. (com1)
2. ...because I enjoy competing. (com2)
3. ...to compete with others. (com3)
4. ...because I like to win. (com4)

Preventative Health (PH) places importance on exercising to protect, promote, and maintain good health (i.e., 'to improve my health').

1. ...to live longer. (ph1)
2. ...to remain healthy as I age. (ph2)
3. ...to prevent health issues in the future. (ph3)
4. …to enrich my quality of life. (ph4) +***
5. ...to slow down the negative effects of aging. (ph5) +

Table C.1

Frequency for Demographic Variables in Study 1 Sample

	Manuscript 1			
	University	Hospital	Personal Contacts	Total
Initial *N*	253	242	415	910
Final *N* (% retained)	235 (30.4 %)	223 (28.9 %)	214 (40.7 %)	772
	Frequency (%)			
Gender				
Males	131 (43.2 %)	92 (30.4 %)	80 (26.4 %)	303 (40.1 %)
Females	101 (22.5 %)	128 (28.6 %)	219 (48.9 %)	448 (59.3 %)
Prefer not to answer	3 (75 %)	1 (25 %)	0 (0.0 %)	4 (0.5 %)
Race/ethnicity				
American Indian/Alaskan Native	4 (1.7 %)	4 (1.8 %)	0 (0.0 %)	8 (1.1 %)
Asian	16 (6.8 %)	3 (1.4 %)	13 (4.4 %)	32 (4.3 %)
Black/African American	9 (3.8 %)	2 (0.9 %)	7 (2.4 %)	18 (2.4 %)
Hawaiian	1 (0.4 %)	2 (0.9 %)	0 (0.0 %)	3 (0.4 %)
Hispanic	17 (7.2 %)	1 (0.5 %)	54 (18.2 %)	72 (9.6 %)
White	175 (74.5 %)	208 (94.5 %)	215 (72.4 %)	598 (79.5 %)
Other	13 (5.5 %)	0 (0.5 %)	8 (2.7 %)	21 (2.8 %)
Sports Participation				
No sports	48 (29.1 %)	45 (27.3 %)	72 (43.6 %)	165 (22.1 %)
Youth	2 (26.5 %)	2 (25.0 %)	4 (50.0 %)	8 (1.1 %)
Middle school/Junior high	54 (26.5 %)	79 (38.7 %)	71 (34.8 %)	204 (27.3 %)
High school	64 (36.4 %)	46 (26.1 %)	66 (37.5 %)	176 (23.5 %)
Intramurals	4 (36.4 %)	6 (42.9 %)	4 (28.6 %)	14 (1.9 %)
College	2 (50.0 %)	0 (0.0 %)	2 (50.0 %)	4 (0.5 %)
Professional	58 (38.4 %)	26 (17.2 %)	67 (44.4 %)	151 (20.2 %)
Olympics	3 (11.5 %)	12 (46.2 %)	11 (42.3 %)	26 (3.5 %)

Table C.1 (continued)

	Manuscript 1			
	University	Hospital	Personal Contacts	Total
Education				
No schooling completed	1 (33.3 %)	1 (33.3 %)	1 (33.3 %)	3 (0.4 %)
Nursery school to 8th grade	0 (0.0 %)	0 (0.0 %)	1 (100.0 %)	1 (0.1 %)
Some high school, no diploma	0 (0.0 %)	11 (100.0 %)	0 (0.0 %)	11 (1.5 %)
High school diploma	88 (60.3 %)	21 (14.4 %)	37 (25.3 %)	146 (19.5 %)
Trade/technical/vocational certification	0 (0.0 %)	4 (33.3 %)	8 (66.7 %)	12 (1.6 %)
Some college credit, no degree	13 (25.5 %)	19 (37.3 %)	19 (37.3 %)	51 (6.8 %)
Associate's degree	52 (25.4 %)	64 (31.2 %)	89 (43.4 %)	205 (27.4 %)
Bachelor's degree	4 (26.7 %)	6 (40.0 %)	5 (33.3 %)	15 (2.0 %)
Some graduate school, no degree	15 (25.0 %)	15 (25.0 %)	30 (50.0 %)	60 (6.8 %)
Master's degree	17 (33.3 %)	25 (49.0 %)	9 (17.6 %)	51 (6.8 %)
Professional degree	16 (29.1 %)	14 (25.5 %)	25 (45.5 %)	55 (7.4 %)
Doctorate degree	29 (21.0 %)	36 (26.1 %)	73 (52.9 %)	138 (18.4 %)
	Mean (SD)			
Age	27.3 (12.4)	45.2 (17.8)	34.2 (12.6)	35.3 (15.9)
Number of Years Engaging in PA	17.9 (13.2)	32.1 (19.3)	21.0 (14.3)	23.3 (16.6)

Table C.2

Item Descriptives for the 65-item, RE_X Scale Version 1

Item	Mean	SD	Skewness z Score	Kurtosis z Score
REXsoc1	3.340	1.442	1.659	-5.148
REXsoc2	3.200	1.545	1.727	-5.983
REXsoc3	2.990	1.484	3.750	-5.097
REXsoc4	3.020	1.513	3.568	-5.341
REXsoc5	3.430	1.578	-0.148	-6.369
REXmh1	4.760	1.143	-9.932	1.824
REXmh2	4.550	1.299	-8.455	-1.159
REXmh3	4.670	1.226	-9.659	0.750
REXmh4	4.570	1.297	-9.398	0.563
REXmh5	4.240	1.329	-5.068	-3.273
REXapp1	4.520	1.064	-7.057	1.580
REXapp2	4.510	1.193	-8.852	1.932
REXapp3	4.300	1.231	-6.420	-0.545
REXapp4	4.530	1.133	-8.523	2.688
REXapp5	4.040	1.353	-4.352	-3.670
REXwm1	4.060	1.437	-5.568	-3.955
REXwm2	3.970	1.498	-5.966	-3.835
REXwm3	3.990	1.432	-4.125	-4.159
REXwm4	4.430	1.336	-10.261	1.188
REXwm5	4.200	1.418	-6.852	-2.813
REXrv1	4.770	1.171	-12.170	5.256
REXrv2	4.700	1.115	-9.500	2.710
REXrv3	4.630	1.124	-9.784	2.938
REXrv4	4.160	1.355	-6.159	-1.989
REXrv5	4.670	1.136	-8.648	1.063
REXfit1	5.180	0.933	-15.216	12.386
REXfit2	5.030	0.930	-10.761	5.631
REXfit3	4.580	1.286	-10.500	2.102
REXfit4	4.580	1.243	-9.330	0.369
REXfit5	4.720	1.077	-9.886	3.506
REXfg1	4.940	1.057	-12.364	5.716
REXfg2	4.850	1.120	-11.239	3.835
REXfg3	3.990	1.526	-5.523	-4.034
REXfg4	4.920	1.083	-14.170	10.011
REXfg5	4.780	1.067	-10.705	4.938
REXsol1	4.180	1.473	-5.023	-4.659
REXsol2	3.550	1.533	-0.261	-5.705
REXsol3	3.440	1.506	0.830	-5.438
REXsol4	3.570	1.553	0.000	-6.176

Table C. 2 (continued)

Item	Mean	SD	Skewness *z* Score	Kurtosis *z* Score
REXsol5	3.800	1.421	-2.261	-4.790
REXph1	5.210	0.897	-14.761	11.523
REXph2	4.650	1.250	-10.341	2.239
REXph3	4.920	1.040	-11.795	5.932
REXph4	5.010	1.054	-12.966	6.210
REXph5	4.860	1.154	-11.898	4.233
REXhc1	3.000	1.677	4.068	-6.602
REXhc2	3.300	1.685	1.341	-7.176
REXhc3	3.110	1.733	3.375	-7.023
REXhc4	3.430	1.710	0.170	-7.409
REXhc5	2.420	1.619	9.739	-3.125
REXmst1	4.400	1.286	-7.420	-0.977
REXmst2	4.610	1.265	-10.489	1.989
REXmst3	4.260	1.356	-7.045	-1.670
REXmst4	3.880	1.476	-3.977	-4.494
REXmst5	3.480	1.651	-0.148	-6.801
REXcom1	2.600	1.530	7.352	-3.989
REXcom2	3.220	1.691	2.136	-7.011
REXcom3	2.790	1.626	6.068	-5.449
REXcom4	2.290	1.406	11.705	0.835
REXcom5	2.730	1.661	6.932	-4.977
REXmf1	4.370	1.308	-8.011	-0.511
REXmf2	4.640	1.151	-10.909	5.483
REXmf3	4.490	1.219	-8.932	1.847
REXmf4	4.350	1.338	-7.705	-0.960
REXmf5	4.140	1.508	-6.102	-3.830

Table C.3

Correlations with Descriptives, Skewness, and Kurtosis Values for the 13-Factor RE_X

	1	2	3	4	5	6	7	8	9
1. Fitness	1.00								
2. Competition	0.43	1.00							
3. Weight Management	0.27	0.11	1.00						
4. Health Concerns	0.19	0.01$^{\#}$	0.32	1.00					
5. Solitude	0.41	0.38	0.22	0.15	1.00				
6. Social	0.48	0.52	0.23	0.17	0.46	1.00			
7. Appearance	0.43	0.32	0.62	0.10	0.29	0.29	1.00		
8. Mood Enhancement	0.61	0.37	0.30	0.15	0.67	0.51	0.49	1.00	
9. Preventative Health	0.62	0.18	0.34	0.30	0.34	0.33	0.35	0.51	1.00
Mean	4.35	2.15	3.88	3.29	3.29	2.82	3.97	4.30	4.74
Standard Deviation	1.26	1.06	1.03	1.08	0.95	0.82	0.91	1.31	0.84
Skew *z* score	**-7.79**	**18.46**	**-7.41**	1.05	1.90	**5.98**	**-6.41**	**-10.79**	**-13.56**
Kurtosis *z* score	-0.47	3.34	**-4.14**	**-8.48**	**-8.65**	**-6.32**	**-4.22**	-1.67	**3.75**

Note. All correlations significant at $p \leq 0.05$ unless otherwise noted ($^{\#}p > 0.05$). Skew and kurtosis *z* scores in boldface exceed the conventional |3.3| standard for normality. FIT = fitness; COMP = competition; WM = weight management; HC = health concerns; SOL = solitude; SOC = social affiliation; APP = appearance; ME = mood enhancement; PH = preventative health.

Table C.4

Item Descriptives for the 43-item, RE_X-2 Scale

Item	Mean	SD	Skewness *z* Score	Kurtosis *z* Score
REXfit1	4.250	1.338	-8.951	-3.369
REXfit2	4.750	1.066	-13.869	4.902
REXfit3	4.300	1.289	-9.557	-1.730
REXfit4	4.620	1.123	-11.836	1.967
REXfit5	3.840	1.433	-4.574	-6.148
REXsoc1	2.960	1.464	5.016	-7.844
REXsoc2	2.950	1.522	5.016	-8.230
REXsoc3	2.520	1.418	10.934	-4.246
REXsoc4	2.840	1.525	6.885	-7.525
REXwm1	3.990	1.509	-8.148	-5.992
REXwm2	3.730	1.549	-4.492	-8.033
REXwm3	4.290	1.436	-11.820	-2.918
REXwm4	3.800	1.620	-5.475	-8.533
REXwm5	3.610	1.539	-1.344	-8.279
REXhc1	3.070	1.703	4.164	-10.361
REXhc2	3.370	1.789	0.607	-11.426
REXhc3	3.880	1.584	-5.377	-8.377
REXhc4	2.860	1.654	6.967	-8.770
REXapp1	4.090	1.345	-8.213	-3.197
REXapp2	4.140	1.336	-7.869	-3.385
REXapp3	3.880	1.442	-6.066	-5.984
REXapp4	4.020	1.405	-7.246	-4.721
REXapp5	3.700	1.485	-3.131	-7.262
REXme1	4.480	1.295	-13.557	1.139
REXme2	4.260	1.432	-10.295	-3.869
REXme3	4.400	1.346	-13.115	0.393
REXme4	4.360	1.475	-12.377	-2.803
REXme5	4.210	1.394	-9.738	-3.484
REXme6	4.120	1.542	-8.820	-6.066
REXsol1	3.750	1.563	-4.344	-8.475
REXsol2	3.150	1.641	2.934	-9.549
REXsol3	3.060	1.637	4.607	-9.410
REXsol4	3.190	1.685	3.508	-10.115
REXsol5	3.280	1.582	1.459	-9.082

Table C.4 (continued)

Item	Mean	SD	Skewness z Score	Kurtosis z Score
REXcom1	2.100	1.344	18.557	2.910
REXcom2	2.370	1.525	14.508	-3.180
REXcom3	2.050	1.358	21.082	6.000
REXcom4	2.070	1.408	21.016	5.262
REXph1	4.680	1.284	-15.852	2.852
REXph2	5.060	1.043	-21.607	15.197
REXph3	4.970	1.088	-19.197	10.410
REXph4	4.720	1.196	-14.770	2.721
REXph5	4.260	1.392	-9.508	-3.770

Table C.5

Parameter Estimates for 43-Item RE_X-2 in Calibration and Validation Sample in Study 2A

	Parameter Estimates		
Items	Unstandardized	Standardized	SE
fit1	1.00	0.61	
fit2	1.01	0.77	0.05
fit3	1.19	0.76	0.05
fit4	1.11	0.81	0.04
fit5	1.32	0.75	0.06
com1	1.00	0.82	
com2	1.23	0.89	0.03
com3	1.16	0.94	0.02
com2	1.15	0.90	0.03
wm1	1.00	0.86	
wm2	0.84	0.70	0.03
wm3	0.99	0.89	0.02
wm4	1.12	0.89	0.02
wm5	0.60	0.51	0.03
hc1	1.00	0.68	
hc2	1.36	0.88	0.05
hc3	1.22	0.89	0.04
hc4	0.87	0.61	0.04
sol1	1.00	0.76	
sol2	1.24	0.90	0.03
sol3	1.24	0.91	0.03
sol4	1.32	0.93	0.03
sol5	1.06	0.80	0.03
soc1	1.00	0.81	
soc2	1.01	0.79	0.03
soc3	1.07	0.89	0.03
soc4	1.09	0.84	0.03
app1	1.00	0.86	
app2	1.01	0.87	0.02
app3	1.12	0.89	0.02
app4	1.11	0.91	0.02
app5	1.09	0.85	0.03

Table C. 5 (continued)

me1	1.00	0.70	
me2	1.31	0.83	0.04
me3	1.25	0.84	0.04
me4	1.38	0.84	0.04
me5	1.20	0.78	0.04
me6	1.49	0.87	0.05
ph1	1.00	0.72	
ph2	0.93	0.82	0.03
ph3	1.01	0.86	0.03
ph4	0.93	0.72	0.03
ph5	1.09	0.72	0.04

Table C.6

Parameter Estimates for Revised 36-Item Factor Loadings of the RE_X-2 in Study 2A

Estimates	**Calibration**			**Validation**		
Items	Unstandardized	Standardized	SE	Unstandardized	Standardized	SE
fit2	1.00	0.79		1.00	0.77	
fit3	1.18	0.77	0.05	1.19	0.76	0.06
fit4	1.08	0.82	0.04	1.08	0.78	0.05
fit5	1.26	0.75	0.05	1.31	0.74	0.06
com1	1.00	0.83		1.00	0.80	
com2	1.20	0.89	0.04	1.27	0.88	0.04
com3	1.14	0.94	0.03	1.18	0.93	0.04
com4	1.13	0.91	0.03	1.19	0.89	0.04
wm1	1.00	0.86		1.00	0.87	
wm2	0.85	0.70	0.04	0.79	0.67	0.04
wm3	1.01	0.91	0.03	0.95	0.87	0.03
wm4	1.12	0.88	0.03	1.11	0.92	0.03
hc1	1.00	0.70		1.00	0.67	
hc2	1.33	0.88	0.06	1.40	0.88	0.04
hc3	1.20	0.90	0.06	1.24	0.88	0.04
hc4	0.90	0.64	0.05	0.85	0.58	0.05
sol1	1.00	0.76		1.00	0.76	
sol2	1.28	0.91	0.05	1.24	0.91	0.04
sol3	1.27	0.91	0.05	1.23	0.90	0.04
sol4	1.34	0.93	0.05	1.32	0.93	0.04
soc1	1.00	0.81		1.00	0.80	
soc2	1.06	0.81	0.04	0.98	0.76	0.04
soc3	1.09	0.88	0.04	1.07	0.89	0.03
soc4	1.10	0.85	0.04	1.07	0.83	0.04
app1	1.00	0.88		1.00	0.84	
app3	1.06	0.86	0.03	1.10	0.87	0.04
app4	1.09	0.92	0.03	1.16	0.93	0.03
app5	1.10	0.88	0.03	1.10	0.83	0.04

Table C.6 (continued)

Estimates	**Calibration**			**Validation**		
Items	Unstandardized	Standardized	SE	Unstandardized	Standardized	SE
me1	1.00	0.66		1.00	0.70	
me2	1.39	0.83	0.07	1.35	0.85	0.06
me4	1.43	0.84	0.07	1.41	0.85	0.06
me6	1.60	0.88	0.08	1.49	0.87	0.07
ph1	1.00	0.74		1.00	0.72	
ph2	0.93	0.83	0.04	0.94	0.85	0.04
ph3	0.99	0.87	0.04	1.01	0.86	0.04
ph5	0.99	0.68	0.05	1.14	0.76	0.06

Table C.7

Item Descriptives for the RE_X-2, BREQ-3, CNAAQ-2, PS, and PA Categories

Item	Mean	SD	Skewness	Kurtosis
REXme1	4.410	1.292	-0.777	0.069
REXme2	4.200	1.430	-0.577	-0.529
REXme4	4.320	1.480	-0.705	-0.435
REXme6	4.070	1.556	-0.507	-0.795
REXsol1	3.670	1.561	-0.216	-1.063
REXsol2	3.090	1.633	0.212	-1.150
REXsol3	3.020	1.631	0.315	-1.131
REXsol4	3.120	1.670	0.262	-1.195
REXsoc1	2.870	1.435	0.374	-0.870
REXsoc2	2.840	1.504	0.390	-0.955
REXsoc3	2.410	1.379	0.773	-0.301
REXsoc4	2.720	1.487	0.501	-0.820
REXfit2	4.720	1.084	-0.840	0.558
REXfit3	4.260	1.298	-0.539	-0.316
REXfit4	4.590	1.125	-0.725	0.267
REXfit5	3.770	1.432	-0.237	-0.786
REXwm1	3.940	1.515	-0.467	-0.781
REXwm2	3.670	1.541	-0.240	-0.992
REXwm3	4.250	1.454	-0.680	-0.464
REXwm4	3.760	1.641	-0.298	-1.101
REXph1	4.610	1.306	-0.905	0.193
REXph2	5.070	1.038	-1.358	1.977
REXph3	4.970	1.084	-1.176	1.328
REXph5	4.240	1.395	-0.576	-0.482
REXapp1	4.050	1.345	-0.451	-0.448
REXapp3	3.850	1.442	-0.359	-0.750
REXapp4	3.980	1.414	-0.421	-0.616
REXapp5	3.670	1.483	-0.167	-0.891
REXhc1	2.990	1.694	0.322	-1.213
REXhc2	3.280	1.781	0.111	-1.378

Table C.7 (continued)

Item	Mean	SD	Skewness	Kurtosis
REXhc2	3.280	1.781	0.111	-1.378
REXhc3	3.830	1.580	-0.261	-1.071
REXhc4	2.720	1.587	0.528	-0.891
REXcom1	2.020	1.277	1.184	0.548
REXcom2	2.290	1.470	0.963	-0.158
REXcom3	1.960	1.284	1.389	1.125
REXcom4	1.960	1.326	1.424	1.169
BREQext1	1.840	1.028	1.086	0.457
BREQext2	1.670	0.991	1.447	1.469
BREQext3	1.340	0.784	2.688	7.509
BREQext4	1.510	0.924	1.914	3.170
BREQintroj1	3.440	1.264	-0.362	-0.789
BREQintroj2	2.630	1.332	0.322	-0.990
BREQintroj3	2.840	1.425	0.129	-1.236
BREQintroj4	3.160	1.350	-0.158	-1.073
BREQidtif1	4.100	1.111	-1.080	0.389
BREQidtif2	4.350	0.883	-1.413	1.810
BREQidtif3	4.250	0.938	-1.228	1.143
BREQidtif4	3.280	1.400	-0.283	-1.120
BREQintegr1	3.720	1.251	-0.749	-0.422
BREQintegr2	2.990	1.530	-0.026	-1.448
BREQintegr3	3.090	1.503	-0.100	-1.397
BREQintegr4	3.740	1.269	-0.765	-0.444
BREQintrin1	3.160	1.333	-0.140	-1.027
BREQintrin2	3.610	1.242	-0.582	-0.566
BREQintrin3	3.530	1.268	-0.511	-0.674
BREQintrin4	3.820	1.212	-0.844	-0.154
CNAAQLearn1	3.990	1.053	-1.138	0.786
CNAAQLearn2	3.960	0.934	-0.952	0.611
CNAAQLearn3	4.480	0.738	-1.821	4.569
CNAAQImprove1	3.770	1.099	-0.945	0.274
CNAAQImprove2	4.110	0.872	-1.105	1.234

Table C.7 (continued)

Item	Mean	SD	Skewness	Kurtosis
CNAAQImprove3	4.050	0.916	-1.024	0.802
CNAAQStable1	2.220	1.155	0.737	-0.555
CNAAQStable2	1.770	0.977	1.437	1.597
CNAAQStable3	2.400	1.135	0.514	-0.788
CNAAQGift1	2.210	1.162	0.575	-0.895
CNAAQGift2	2.220	1.104	0.569	-0.751
CNAAQGift3	2.120	1.071	0.684	-0.601
PShm1	5.490	1.407	-1.204	1.327
PShm2	4.980	1.584	-0.740	-0.020
PShm3	4.970	1.627	-0.896	0.091
PShm4	5.200	1.608	-0.989	0.323
PShm5	3.890	1.878	-0.130	-1.191
PShm6	4.850	1.723	-0.795	-0.216
PShm7	3.530	1.944	0.134	-1.267
PSob1	4.840	1.808	-0.640	-0.664
PSob2	3.380	1.824	0.361	-0.964
PSob3	5.000	1.874	-0.788	-0.530
PSob4	3.480	1.907	0.165	-1.279
PSob5	2.670	1.539	0.807	-0.151
PSob6	2.590	1.737	0.912	-0.322
PSob7	4.240	1.780	-0.441	-0.869
VigPA	190.058	218.220	1.741	3.337
ModPA	181.033	218.066	2.294	6.421
WalkPA	288.333	311.065	1.621	2.125
Sitting	298.045	162.473	0.232	-0.945

Table C.8

Relationships between RE_X-2 Subscales and Dimensions, Passion, and Mindsets

	External		Introjected		Identified		Integrated		Intrinsic		Harmonious		Obsessive		Growth		Fixed		RAI	
Mood enhancement	+/-L	-.01#	+/-L	.36	+M	.64	+H	.59	+H	.68	+H	.67	+L:M	.57	+M:H	.28	-L:M	.21	+H	.64
Solitude	+/-L	-.01#	+/-L	.25	+M	.43	+H	.41	+H	.49	+H	.49	+L:M	.45	+M:H	.19	-L:M	.13	+H	.45
Social	+/-L	.15	+/-L	.20	+M	.36	+H	.45	+H	.46	+M:H	.52	+L:M	.42	+M:H	.22	-L	-.01#	+M:H	.41
Fitness	+L:M	.06	+L:M	.35	+M	.56	+M:H	.57	+M:H	.47	+M:H	.54	+L:M	.46	+L:M	.28	-L	.12	+M:H	.49
Preventative health	+L:M	.09	+M:H	.24	+L:M	.42	+L	.39	+L	.26	+L:M	.35	+M:H	.27	+L:M	.16	+L	-.09#	+L:M	.29
Weight management	+M:H	.24	+/-L:M	.30	+L:M	.09	+L	.05#	+L	.02#	+L:M	.08	+M:H	.04#	-L	.19	+L	.01#	+L:M	.07
Appearance	+M:H	.18	+/-L:M	.42	+L:M	.28	+/-L	.29	+/-L	.22	+L:M	.29	+M:H	.28	-L	.26	+L:M	.07	+L	.15
Health concerns	+M:H	.21	+/-L:M	-.02#	+L:M	-.01#	+/-L	-.04#	+/-L	-.07	+H	.01#	+H	.02#	-L:M	.01	+M:H	.10	+L	.11
Competition	+M:H	.14	+/-L:M	.23	+L:M	.28	+/-L	.39	+/-L	.35	+H	.43	+H	.41	-L:M	.22	+M:H	.02	+L	.31
Autonomous RE_X	+/-L	.00#	+/-L	.33	+M	.58	+H	.55	+H	.63	+L:M	.63	+L:M	.55	+M:H	.25	-L:M	.18	+H	.59
Neutral RE_X	+L:M	.20	+L:M	.39	+M	.49	+M	.50	+M:H	.42	+M:H	.52	+M:H	.41	+L:M	.30	+L:M	.07	+M	.38
Controlled RE_X	+H	.28	+H	.34	+L:M	.28	+/-L	.33	+/-L	.25	+H	.37	+H	.36	-L:M	.25	+M:H	.03#	+L	.18

Note. All correlations are significant at $p \leq 0.05$ unless otherwise values in # exceeded respective cut-off value = $p > 0.05$. Positive correlation = + ; Negative correlation = - ; L = Low (weak relationships); M = moderate relationship; and H = high (strong) relationship.

Table C.9

Parameter Estimates and Standard Errors for 36-Item-Factor Loadings for the RE_X-2

	Females			**Males**		
Items	Unstandardized	Standardized	SE	Unstandardized	Standardized	SE
fit2	1.00	0.78		1.00	0.80	
fit3	1.25	0.78	0.05	1.13	0.77	0.05
fit4	1.14	0.81	0.05	1.03	0.80	0.05
fit5	1.28	0.73	0.06	1.29	0.77	0.06
com1	1.00	0.80		1.00	0.82	
com2	1.29	0.87	0.04	1.19	0.89	0.04
com3	1.20	0.94	0.04	1.15	0.93	0.04
com4	1.17	0.90	0.04	1.17	0.89	0.04
wm1	1.00	0.87		1.00	0.87	
wm2	0.76	0.70	0.03	0.77	0.68	0.04
wm3	0.92	0.86	0.03	1.02	0.91	0.03
wm4	1.16	0.91	0.03	1.07	0.90	0.03
hc1	1.00	0.74		1.00	0.58	
hc2	1.26	0.90	0.05	1.61	0.88	0.10
hc3	1.11	0.88	0.04	1.45	0.90	0.09
hc4	0.81	0.62	0.05	0.94	0.59	0.08
sol1	1.00	0.78		1.00	0.73	
sol2	1.30	0.91	0.04	1.23	0.91	0.05
sol3	1.28	0.90	0.04	1.24	0.91	0.05
sol4	1.35	0.94	0.04	1.31	0.93	0.06
soc1	1.00	0.79		1.00	0.84	
soc2	1.02	0.77	0.04	0.99	0.81	0.04
soc3	1.10	0.88	0.04	1.04	0.91	0.04
soc4	1.10	0.82	0.04	1.06	0.88	0.04
app1	1.00	0.86		1.00	0.86	
app3	1.09	0.85	0.03	1.10	0.90	0.03
app4	1.10	0.91	0.03	1.16	0.95	0.04
app5	1.15	0.88	0.03	1.05	0.83	0.03

Table C.9 (continued)

	Females			Males		
Items	Unstandardized	Standardized	SE	Unstandardized	Standardized	SE
me1	1.00	0.65		1.00	0.70	
me2	1.51	0.84	0.07	1.27	0.84	0.06
me4	1.55	0.84	0.07	1.32	0.85	0.07
me6	1.70	0.89	0.08	1.44	0.88	0.07
ph1	1.00	0.68		1.00	0.80	
ph2	0.91	0.83	0.04	0.95	0.86	0.04
ph3	0.99	0.84	0.05	1.00	0.89	0.04
ph5	1.12	0.72	0.06	1.02	0.73	0.05

Table C.9 (continued)

	Adults < 50 years of Age			**Adults ≥ 51 Years of Age**		
Items	Unstandardized	Standardized	SE	Unstandardized	Standardized	SE
fit2	1.00	0.77		1.00	0.80	
fit3	1.29	0.78	0.05	1.12	0.78	0.05
fit4	1.08	0.79	0.05	1.09	0.82	0.05
fit5	1.34	0.76	0.06	1.19	0.73	0.06
com1	1.00	0.82		1.00	0.76	
com2	1.20	0.87	0.04	1.36	0.89	0.06
com3	1.19	0.94	0.03	1.18	0.91	0.05
com4	1.17	0.90	0.04	1.19	0.89	0.05
wm1	1.00	0.87		1.00	0.88	
wm2	0.82	0.70	0.03	0.76	0.65	0.04
wm3	0.93	0.87	0.03	1.02	0.91	0.03
wm4	1.11	0.90	0.03	1.11	0.90	0.03
hc1	1.00	0.70		1.00	0.63	
hc2	1.32	0.88	0.06	1.41	0.89	0.08
hc3	1.19	0.86	0.05	1.22	0.91	0.07
hc4	0.88	0.63	0.05	0.85	0.56	0.07
sol1	1.00	0.75		1.00	0.75	
sol2	1.28	0.91	0.04	1.24	0.91	0.05
sol3	1.26	0.90	0.04	1.22	0.90	0.05
sol4	1.35	0.93	0.05	1.29	0.94	0.05
soc1	1.00	0.82		1.00	0.80	
soc2	0.98	0.77	0.04	1.03	0.79	0.05
soc3	1.07	0.89	0.03	1.04	0.88	0.04
soc4	1.06	0.83	0.04	1.06	0.85	0.04

Table C.9 (continued)

	Adults < 50 years of Age			**Adults ≥ 51 Years of Age**		
Items	Unstandardized	Standardized	SE	Unstandardized	Standardized	SE
app1	1.00	0.88		1.00	0.83	
app3	1.05	0.86	0.03	1.14	0.87	0.04
app4	1.08	0.91	0.03	1.18	0.94	0.04
app5	1.07	0.85	0.03	1.11	0.85	0.04
me1	1.00	0.68		1.00	0.65	
me2	1.42	0.82	0.07	1.41	0.85	0.08
me4	1.50	0.85	0.07	1.39	0.83	0.08
me6	1.63	0.89	0.07	1.53	0.86	0.08
ph1	1.00	0.77		1.00	0.70	
ph2	0.93	0.84	0.04	0.89	0.84	0.05
ph3	0.97	0.85	0.04	1.00	0.88	0.05
ph5	1.09	0.75	0.05	0.98	0.68	0.06

Appendix D

Qualtrics Version of the RE_X Scale

Informed Consent

People have many reasons when it comes to moving through exercise and/or being physically active, and we hope you can tell us more about what moves you, personally! Participation will take approximately 8-10 minutes and will involve completing this brief, anonymous survey. There are no additional responsibilities or expectations, and you will not be asked to provide any personally identifiable information within the survey.

You are being asked to participate in this study because the success of this project cannot be completed without input and responses from you, but there are no penalties if you choose not to complete the questionnaire or to skip an item(s). This study has been certified as exempt by the University of Idaho Institutional Review Board, which found no foreseeable risks associated with the study. By responding to items, you are granting permission to the investigators to use your anonymous answers in our research. If you have any questions at any time regarding this study, please contact Vanessa Martinez at vanessam@uidaho.edu.

○ I have read the above information, and I AGREE to participate in this study.

○ I DO NOT agree to participate in this study.

>> NEXT >>

Survey Instructions

Section A -- Reasons for Exercise

The next 8 short sections will tell us more about what *your* personal reason is for exercising and/or being physically active even if you are *not* currently active.

There are no right or wrong answers, so please select the first answer that pops into your head and best represents *your* personal response when responding to each question.

To continue, please select the tab "NEXT" at the bottom of each page.

[Select >>NEXT>> below]

>> NEXT >>

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
1...to feel connected with active people?	○	○	○	○	○	○
2...to help lower stress?	○	○	○	○	○	○
3...to look good?	○	○	○	○	○	○
4...to lose weight?	○	○	○	○	○	○
5...for the refreshing feeling I get afterwards?	○	○	○	○	○	○
6...to maintain my physical fitness (*e.g., strength*)?	○	○	○	○	○	○
7...it feels good to move?	○	○	○	○	○	○
8...to get time for myself?	○	○	○	○	○	○
9...to maintain my current health?	○	○	○	○	○	○

>> NEXT >>

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
10...to help manage chronic pain?	○	○	○	○	○	○
11...for the satisfaction of reaching a health/fitness goal?	○	○	○	○	○	○
12...to outperform others?	○	○	○	○	○	○
13...to maintain my strength gains?	○	○	○	○	○	○
14...to spend time with friends?	○	○	○	○	○	○
15...to cope with stress?	○	○	○	○	○	○
16...to look fit?	○	○	○	○	○	○
17...to fit into the clothes I like?	○	○	○	○	○	○

>> NEXT >>

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
18...to enhance my mood?	○	○	○	○	○	○
19...to improve my physical fitness (*e.g., endurance*)?	○	○	○	○	○	○
20...it makes me happy?	○	○	○	○	○	○
21...to have alone time?	○	○	○	○	○	○
22...to live longer?	○	○	○	○	○	○
23...to manage joint problems?	○	○	○	○	○	○
24...to be my personal best in health/fitness?	○	○	○	○	○	○
25...because I enjoy competing?	○	○	○	○	○	○

>> NEXT >>

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
26...to be stronger?	○	○	○	○	○	○
27...for the social aspect?	○	○	○	○	○	○
28...for the mental health benefits?	○	○	○	○	○	○
29...to look like I'm in good shape?	○	○	○	○	○	○
30...to eat the foods I like?	○	○	○	○	○	○
31...for the energy boost?	○	○	○	○	○	○
32...to have the physical fitness to take on physical challenges?	○	○	○	○	○	○
33...it feels good to sweat?	○	○	○	○	○	○

>> NEXT >>

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
34...to be alone to think?	○	○	○	○	○	○
35...to maintain a positive quality of life?	○	○	○	○	○	○
36...to manage a medical condition?	○	○	○	○	○	○
37...to reach performance/fitness goals?	○	○	○	○	○	○
38...to compete with others?	○	○	○	○	○	○
39...to have lean/tone muscles?	○	○	○	○	○	○
40...to meet others who value exercise?	○	○	○	○	○	○
41...to improve mental health?	○	○	○	○	○	○
42...to improve physical appearance?	○	○	○	○	○	○

>> NEXT >>

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
43...to control weight?	○	○	○	○	○	○
44...to increase alertness?	○	○	○	○	○	○
45...to have the physical fitness to accomplish daily activities?	○	○	○	○	○	○
46...to feel good about myself?	○	○	○	○	○	○
47...to have 'me' time?	○	○	○	○	○	○
48...to remain healthy as I age?	○	○	○	○	○	○
49...to control/deal with a health concern?	○	○	○	○	○	○
50...to give me personal challenges to face?	○	○	○	○	○	○

>> NEXT >>

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
51...to outshine others?	○	○	○	○	○	○
52...for the strength to take on physical challenges?	○	○	○	○	○	○
53...to be around others that motivate me to work out?	○	○	○	○	○	○
54...to think clearly?	○	○	○	○	○	○
55...to be more attractive?	○	○	○	○	○	○
56...to reach my ideal weight?	○	○	○	○	○	○
57...to feel rejuvenated?	○	○	○	○	○	○

>> NEXT >>

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
58...to have a physically fit body?	○	○	○	○	○	○
59...to feel good physically the rest of the day?	○	○	○	○	○	○
60...for self-reflection?	○	○	○	○	○	○
61...to prevent health issues in the future?	○	○	○	○	○	○
62...a doctor/health professional advised me to?	○	○	○	○	○	○
63...to reach new personal records ('PR')?	○	○	○	○	○	○
64...because I like to win?	○	○	○	○	○	○
65...to reach my maximum fitness level?	○	○	○	○	○	○

>> NEXT >>

Top 5 Reasons for Exercise

Section B -- Top 5 Reasons for Exercise

The following section will tell us what the top 5 most important reasons for exercising and/or being physically active are for *you*, *personally*.

Please select the item that represents your most important reasons by dragging each item into the associated box with "1" being most important.

[Select >>NEXT>> to continue]

>> NEXT >>

1. What are your *top 5* reasons for exercising and/or being physically active?

(Drag ONE reason to each box)

Items	# 1 MOST IMPORTANT Reason	# 2 Reason
Social aspect		
Mental health		
Weight control		
Appearance		
Feel good		
Revitalization		# 3 Reason
Improvement		
Competition		
Fitness		
Preventive health		
Health concern		
Solitude	# 4 Reason	# 5 Reason

>> NEXT >>

Demographics

Section C -- Demographics

The 6 questions in this section ask you for demographic information about you so we can compare across different categories (e.g., males vs females).

[Select >>NEXT>> to continue]

>> NEXT >>

1. What is your gender?

- ○ Male
- ○ Female
- ○ I prefer not to answer.

2. What is your age?

>> NEXT >>

3. How would you describe yourself?

Please check all racial/ethnic groups that apply.

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Pacific Islander
- ☐ White
- ☐ Hispanic
- ☐ Other (please specify):

>> NEXT >>

4. How many <u>total</u> *years* have you been physically active?

5. Did you participate in any sports?

- ○ Yes
- ○ No

>> NEXT >>

5a. What is the highest level of sport you participated in?

- ○ Youth sport
- ○ Middle school/Junior high sport
- ○ High school sport
- ○ Intramural-based sport
- ○ College sport
- ○ Professional sport
- ○ Olympic sport

>> NEXT >>

6. What is the highest level of school you have completed?

- ○ No schooling completed
- ○ Nursery school to 8th grade
- ○ Some high school, no diploma
- ○ High school diploma
- ○ Trade/technical/vocational certification
- ○ Some college credit, no degree
- ○ Associate degree
- ○ Bachelor's degree
- ○ Some graduate school, no degree
- ○ Master's degree
- ○ Professional degree
- ○ Doctorate degree

>> NEXT >>

Are you interested in receiving a copy of the results from this study?

Yes ○ No ○

We need your help following this study! *Would you be interested in helping us do a follow up on your reasons for exercise?*

Yes ○ No ○

If you selected "yes" for either of the above questions, please provide your e-mail address:

>> NEXT >>

Thank you for completing this survey!

We appreciate your time and insights!

Please feel free to write any comments in the space below. If you have any additional questions or concerns, please email Vanessa Martinez
at **vanessam@uidaho.edu.**

Appendix E

Qualtrics Version of the RE_X-2 Scale

NEXT

Informed Consent

People have many reasons when it comes to moving through exercise and/or being physically active, and we hope you can tell us what moves you and what keeps you moving! Participation will take approximately 12-15 minutes and will involve completing this anonymous survey. There are no additional responsibilities or expectations, and you will not be asked to provide any personally identifiable information within the survey.

You are being asked to participate in this study because the success of this project cannot be completed without input and responses from you, but there are no penalties if you choose not to complete the questionnaire or to skip an item(s). This study has been certified as exempt by the University of Idaho Institutional Review Board, which found no foreseeable risks associated with the study. By responding to items, you are granting permission to the investigators to use your anonymous answers in our research. If you have any questions at any time regarding this study, please contact Vanessa Martinez at vanessam@uidaho.edu. I have read the above information and ....

I AGREE	I DO NOT AGREE
to participate in this study.	to participate in this study.
○	○

NEXT

Section A -- Reasons for Exercise

The next 43, short questions will tell us about what *your* personal reason is for exercising and/or being physically active even if you are not currently active.

There are no right or wrong answers, so please select the first answer that pops into your head when responding to questions on the next page.

[Select NEXT to continue]

NEXT

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
1...to have the physical fitness to take on challenges.	○	○	○	○	○	○
2...to connect with active people.	○	○	○	○	○	○
3...to lose weight.	○	○	○	○	○	○
4...to help manage chronic pain.	○	○	○	○	○	○
5...to look good.	○	○	○	○	○	○
6...to help lower stress.	○	○	○	○	○	○
7...to make time for myself.	○	○	○	○	○	○
8...to outperform others.	○	○	○	○	○	○

NEXT

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
9...to live longer.	○	○	○	○	○	○
10...to be stronger.	○	○	○	○	○	○
11...to spend time with friends.	○	○	○	○	○	○
12...to fit into the clothes I like.	○	○	○	○	○	○
13...to manage a medical condition.	○	○	○	○	○	○
14...to look fit.	○	○	○	○	○	○
15...for the refreshing feeling I get afterwards.	○	○	○	○	○	○
16...to have alone time.	○	○	○	○	○	○
17...because I enjoy competing.	○	○	○	○	○	○

NEXT

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
18...to remain healthy as I age.	○	○	○	○	○	○
19...to maintain my strength gains.	○	○	○	○	○	○
20...to meet others who value exercise.	○	○	○	○	○	○
21...to control weight.	○	○	○	○	○	○
22...to control or deal with health concerns.	○	○	○	○	○	○
23...to look like I'm in shape.	○	○	○	○	○	○
24...to enhance my mood.	○	○	○	○	○	○
25...to be alone to think.	○	○	○	○	○	○
26...to compete with others.	○	○	○	○	○	○

NEXT

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
27...to prevent health issues in the future.	○	○	○	○	○	○
28...to improve my physical endurance.	○	○	○	○	○	○
29...to be around others that motivate me to work out.	○	○	○	○	○	○
30...to reach my goal weight.	○	○	○	○	○	○
31...a doctor or health professional advised it.	○	○	○	○	○	○
32...to improve my physical appearance.	○	○	○	○	○	○
33...it makes me happy.	○	○	○	○	○	○
34...to have 'me' time.	○	○	○	○	○	○
35...because I like to win.	○	○	○	○	○	○

NEXT

"To me, *how important* is this reason for exercising and/or being physically active..?"

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Highly Important	Extremely Important
36...to enrich my quality of life.	○	○	○	○	○	○
37...to reach my maximum fitness level.	○	○	○	○	○	○
38...to eat what I like and not gain weight.	○	○	○	○	○	○
39...to be more attractive.	○	○	○	○	○	○
40...for the confidence boost I get from being physically active.	○	○	○	○	○	○
41...for self-reflection.	○	○	○	○	○	○
42...to slow down the negative effects of aging.	○	○	○	○	○	○
43...for the positive mindset I experience post-workout.	○	○	○	○	○	○

NEXT

Are there any other reasons you have for exercising and/or being physically active that we did not ask?

If so, please tell us what reasons you have below so that we can improve this survey! IF you do not have any other reasons, Select NEXT to continue!

NEXT

Section B -- Motivation

The next 20, short questions relate to what *motivates* you to exercise even if you are not currently active.

There are no right or wrong answers, so please select the answer that represents how true each statement is for you, *personally.*

[Select NEXT to continue]

NEXT

Please mark the bubble to indicate *how true* each statement is for *you*.

	Not true for me	....	Sometimes true for me	....	Very true for me
1. It's important to me to exercise regularly.	○	○	○	○	○
2. I exercise because it's fun.	○	○	○	○	○
3. I feel guilty when I don't exercise.	○	○	○	○	○
4. I exercise because it is consistent with my life goals.	○	○	○	○	○
5. I exercise because other people say I should.	○	○	○	○	○
6. I value the benefits of exercise.	○	○	○	○	○
7. I enjoy my exercise sessions.	○	○	○	○	○
8. I feel ashamed when I miss an exercise session.	○	○	○	○	○

NEXT

Please mark the bubble to indicate *how true* each statement is for *you*.

	Not true for me	....	Sometimes true for me	....	Very true for me
9. I consider exercise part of my identity.	○	○	○	○	○
10. I take part in exercise because my friends/family/partner say I should.	○	○	○	○	○
11. I think it is important to make the effort to exercise regularly.	○	○	○	○	○
12. I find exercise a pleasurable activity.	○	○	○	○	○
13. I feel like a failure when I haven't exercised in a while.	○	○	○	○	○
14. I consider exercise a fundamental part of who I am.	○	○	○	○	○
15. I exercise because others will not be pleased with me if I don't.	○	○	○	○	○

NEXT

Please mark the bubble to indicate *how true* each statement is for *you*.

	Not true for me	....	Sometimes true for me	....	Very true for me
16. I get restless if I don't exercise regularly.	○	○	○	○	○
17. I get pleasure and satisfaction from participating in exercise.	○	○	○	○	○
18. I would feel bad about myself if I was not making time to exercise.	○	○	○	○	○
19. I consider exercise consistent with my values.	○	○	○	○	○
20. I feel under pressure from my friends/family/partner to exercise.	○	○	○	○	○

NEXT

Section C -- Physical Activity

The next 8 questions relate to your physical activity over the last *7 days*. We will ask about whether your exercise intensity is VIGOROUS (hard effort) or MODERATE (moderate effort), and about WALKING over the last 7 days.

Think only about those activities you did for at least *10 minutes* at a time.

[Select NEXT to continue]

NEXT

Think about all the vigorous activities that you did in the last *7 days*.

Vigorous refers to activities that take HARD physical effort where you're breathing hard and fast and your heart rate increases *significantly*. If you're working this hard you won't be able to say more than a few words without pausing for a breath with activities like heavy lifting, digging, high intensity aerobics/cardio, or sprinting.

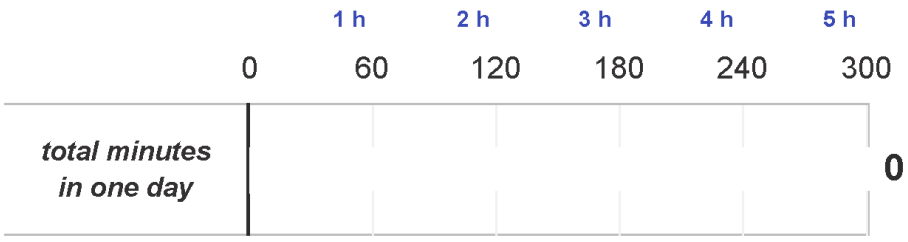
1. In the last *7 days* (d), on how many days did you do vigorous physical activities? (Select "0" if none)

0 d	1 d	2 d	3 d	4 d	5 d	6 d	7d
○	○	○	○	○	○	○	○

NEXT

1a. How much time did you usually spend doing vigorous physical activities on ONE of those days?

(Drag the bar to select total minutes in ONE day)



NEXT

Think about all the moderate activities you did in the last *7 days*.

Moderate is where you're working hard enough to raise your heart rate and break into a sweat. You should be able to talk but unable to sing the words to a song when doing activities like carrying light loads, bicycling at a regular pace, doubles tennis, and jogging.Think only about those activities you did for at least *10 minutes* at a time.

2. During the last *7 days* (d), on how many days did you do moderate physical activities? Do not include walking.

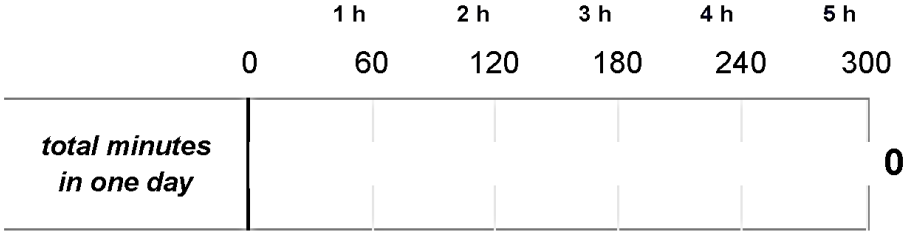
(Select "0 d" if none)

0 d	1 d	2 d	3 d	4 d	5 d	6 d	7d
○	○	○	○	○	○	○	○

NEXT

2a. How much time did you spend doing moderate physical activities on ONE of those days?

(Drag the bar to select total minutes in ONE day)



NEXT

WALKING PHYSICAL ACTIVITY

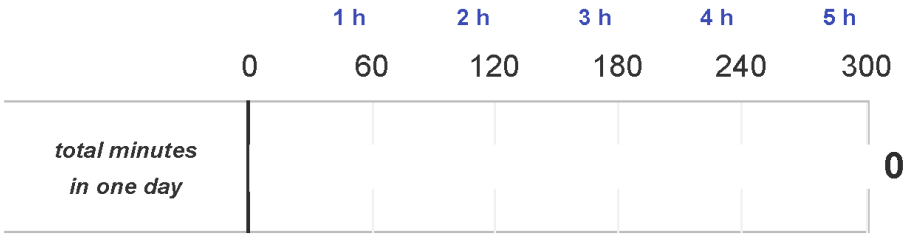
Think about all the time you spent walking in the last 7 days.

3. During the last *7 days* (d), on how many days did you walk for at least 10 minutes at a time? (Select "0 d" if none)

0 d	1 d	2 d	3 d	4 d	5 d	6 d	7d
○	○	○	○	○	○	○	○

NEXT

3a. How much time did you usually spend walking on ONE of those days? (Drag the bar to select total minutes in ONE day)



4. What TYPE of physical activities do you engage in MOST?
Please list the activities you engage in MOST below, and select next when you're done. *Examples: Outdoor walking, biking, hiking, elliptical, spinning, weight-lifting etc.*

NEXT

The last question is about the time you spent SITTING on <u>weekdays</u> in the last 7 days. This may include sitting at a desk or work, visiting friends, reading or sitting or lying down to watch TV. There is no right or wrong answer so please answer this question openly and honestly.

5. In the last 7 days, how much time did you spend SITTING on <u>ONE</u> weekday?

(Drag the bar below; each line on the bar represents 1 hour = 60 min)

0 60 120 180 240 300 360 420 480 540 600

total minutes in one day

0

NEXT

Section D -- Demographics

The 6 questions in this section ask you for demographic information about you so we can compare across different categories (e.g., males vs females).

1. What is your gender?

Male ○ Female ○ I prefer not to answer. ○

NEXT

2. What is your age? ***(Note! Make sure no spaces between numbers)***

3. How would you describe yourself? ***Please check all racial/ethnic groups that apply.***

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Pacific Islander
- ☐ White
- ☐ Hispanic
- ☐ Other (please specify):

NEXT

4. How many total years have you been physically active?
(Note! Make sure no spaces between numbers)

5. Did you participate in any sports?

- Yes
- No

NEXT

5a. What is the highest level of sport you participated in?

- Youth sport
- Middle school/Junior high sport
- High school sport
- Intramural-based sport
- College sport
- Military services
- Master level sport
- Professional sport
- Olympic sport

NEXT

6. What is the highest level of school you have completed?

- ○ No schooling completed
- ○ Nursery school to 8th grade
- ○ Some high school, no diploma
- ○ High school diploma
- ○ Trade/technical/vocational certification
- ○ Some college credit, no degree
- ○ Associate degree
- ○ Bachelor's degree
- ○ Some graduate school, no degree
- ○ Master's degree
- ○ Professional degree
- ○ Doctorate degree

NEXT

Section E -- Mindsets

The next 12 questions relate to your mindset when exercising and/or being physically active even if you are *not* currently active.

There are no right or wrong answer so please select the answer that represents *how strongly you agree* with each statement on the next page.

[Select NEXT to continue]

NEXT

Please mark the bubble to indicate *how strongly you agree* with each statement.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
1. You have a certain level of physical ability and you cannot really do much to change that level.	○	○	○	○	◉
2. To be successful physically, you need to learn techniques and skills, and practice them regularly.	○	○	○	○	○
3. Even if you try, your physical ability will change very little.	○	○	○	○	○
4. You need to have certain “gifts” to be good at physical tasks.	○	○	○	○	○
5. You need to learn to work hard to be good at physical skills.	○	○	○	○	○
6. For physical or performance tasks, if you work hard it, you will always get better.	○	○	○	○	○
7. To be good at physical tasks, you need to be born with the basic qualities which allow you to be successful.	○	○	○	○	○

NEXT

Please mark the bubble to indicate how strongly you agree with each statement.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
8. To reach a high level of physical performance, you must go through periods of learning and training.	○	○	○	○	○
9. How good you are at physical skills will always improve if you work at it.	○	○	○	○	○
10. It is difficult to change how good you are at physical tasks.	○	○	○	○	○
11. To be good at physical tasks you need to be naturally gifted.	○	○	○	○	○
12. If you put enough effort into physical skills or tasks, you will always get better at it.	○	○	○	○	○

NEXT

Section F -- Passion

The next 14 questions relate to passion for exercising and/or being physically active even if you are not currently active.

There are no right or wrong answers so please select the answer that represents *how strongly you agree* with each statement on the next page.

[Select NEXT to continue]

NEXT

Please mark the bubble to indicate how strongly you agree with each statement.

	Do not agree at all	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Completely agree
1. Exercise allows me to have a variety of experiences.	○	○	○	○	○	○	○
2. I can't live without being physically active.	○	○	○	○	○	○	○
3. Learning new things about myself allows me to appreciate physical activity even more.	○	○	○	○	○	○	○
4. I can't stop myself from exercising.	○	○	○	○	○	○	○
5. Exercise reflects the qualities I like about myself.	○	○	○	○	○	○	○
6. It's difficult to imagine my life without being physically active.	○	○	○	○	○	○	○
7. Physical activity is in harmony with other activities in my life.	○	○	○	○	○	○	○

NEXT

Please mark the bubble to indicate how strongly you agree with each statement.

	Do not agree at all	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Completely agree
8. I am emotionally dependent on exercise.	○	○	○	○	○	○	○
9. Exercise is a passion that I still manage to control.	○	○	○	○	○	○	○
10. I have a tough time controlling my need to be physically active.	○	○	○	○	○	○	○
11. Physical activity allows me to have memorable experiences.	○	○	○	○	○	○	○
12. I have almost a compulsive need to exercise.	○	○	○	○	○	○	○
13. I am fully devoted to exercise.	○	○	○	○	○	○	○
14. My mood depends on being physically active.	○	○	○	○	○	○	○

NEXT

Are you interested in receiving a copy of the results from this study?

Yes ○ No ○

Would you be interested in helping us do a follow up on your reasons for exercise?

Yes ○ No ○

If you selected "yes" for either of the above questions, please provide your e-mail address:

NEXT

Thank you for completing this survey!

You've just helped someone earn their doctoral degree!

If you have any additional questions or concerns, please e-mail Vanessa Martinez at **vanessam@uidaho.edu.**

Appendix F

Behavioral Exercise Regulations Exercise Questionnaire (BREQ-3)

Motivation regulation items are evaluated on on a 5-point Likert scale (0 = not true for me; 4 = very true for me) with five subscales, amotivation, external, introjected, identified, integrated, and intrinsic regulation following the statement "Why do you engage in exercise? *Amotivation was not used in this dissertation, but is a part of the BREQ-3.

Amotivation*
I don't see why I should have to exercise.
I can't see why I should bother exercising.
I don't see the point in exercising.
I think exercising is a waste of time.

External regulation
I exercise because other people say I should.
I take part in exercise because my friends/family/partner say I should.
I exercise because others will not be pleased with me if I don't.
I feel under pressure from my friends/family to exercise.

Introjected regulation
I feel guilty when I don't exercise.
I feel ashamed when I miss an exercise session.
I feel like a failure when I haven't exercised in a while.
I would feel bad about myself if I was not making time to exercise.

Identified regulation
It's important to me to exercise regularly.
I value the benefits of exercise.
I think it is important to make the effort to exercise regularly.
I get restless if I don't exercise regularly.

Integrated regulation
I exercise because it is consistent with my life goals.
I consider exercise part of my identity.
I consider exercise a fundamental part of who I am.
I consider exercise consistent with my values.

Intrinsic regulation
I exercise because it's fun.
I enjoy my exercise sessions.
I find exercise a pleasurable activity.
I get pleasure and satisfaction from participating in exercise.

The relative autonomy index (RAI) is a single score derived from the subscales that gives an index of the degree which respondents feel self-determined. The index is obtained by applying a weighting to each subscale and then summing these weighted scores. Each subscale is multiplied by its weighting and these these weighted scores are summed. Higher positive scores indicate greater relative autonomy, whereas lower negative scores indicate more controlled regulation.

For the BREQ-3 the weightings are as follows:

*Amotivation	- 3
External regulation	- 2
Introjected regulation	- 1
Identified regulation	+1
Integrated regulation	+ 2
Intrinsic regulation	+ 3

Appendix G

Conceptions of the Nature of Athletic Ability Questionnaire-Version 2 (CNAAQ-2)

Responses are made on a 5-point scale anchored by 1 (strongly disagree) and 5 (strongly agree).

Fixed Mindset = Stable and Gift

1. You have a certain level of ability in physical activity and you cannot really do much to change that level.
2. Even if you try, your ability to be physically active will change very little.
3. It is difficult to change how good you are at being physically active.
4. You need to have certain "gifts" to be good at being physically active.
5. To be good at being physically active, you need to be born with the basic qualities, which allow you success.
6. To be good at being physically active you need to be naturally gifted.

Growth Mindset = Improvement and Learning

1. With physical activity, if you work hard at it, you will always get better.
2. How physically active you are will always improve if you work at it.
3. If you put enough effort into physical activity, you will always get better at it.
4. To be successfully physically active, you need to learn techniques and skills and practice them regularly.
5. You need to learn to work hard to be good at being physically active.
6. To reach a high level of performance in physical activity, you must go through periods of learning and training.

Appendix H

Passion Scale

Passion items are evaluated on a 7-point Likert scale (1 = do not agree at all; 7 = completely agree) with two subscales, harmonious and obsessive passion.

Harmonious Passion

1. Exercise allows me to live a variety of experiences.
2. The new things that I discover in exercise allow me to appreciate it even more.
3. Exercise reflects the qualities I like about myself.
4. Exercise is in harmony with the other activities in my life.
5. Exercise is a passion that I still manage to control.
6. Exercise allows me to live memorable experiences.
7. I am completely taken with exercise.

Obsessive Passion

1. I can't live without exercise.
2. I can't help exercising.
3. I have difficulties imagining my life without exercise.
4. I am emotionally dependent on exercise.
5. I have a tough time controlling my need to exercise.
6. I have almost an obsessive feeling about exercise.
7. My mood depends on me being able to do it.

Appendix I

Supplementary Figures

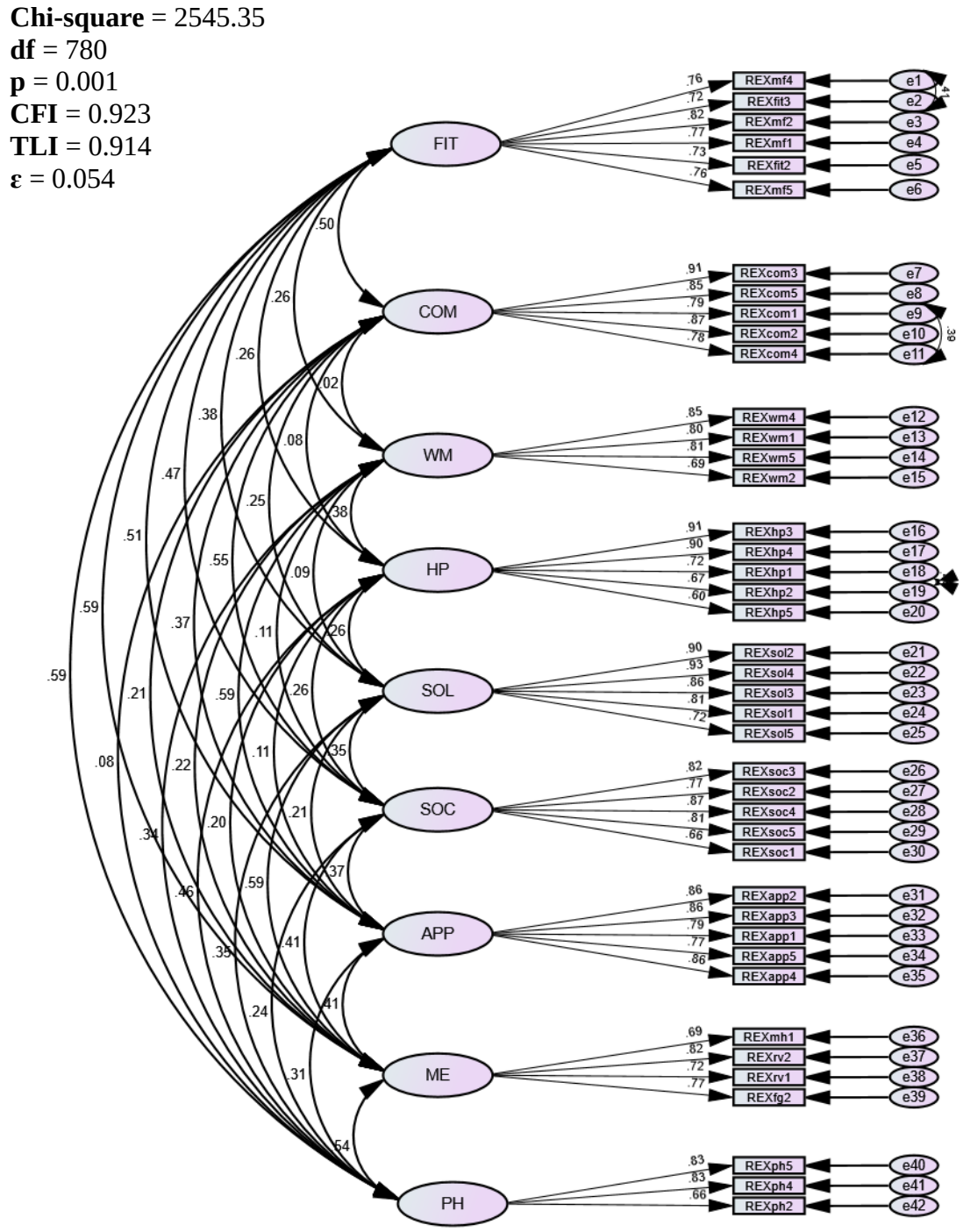


Figure I.1. Structural Covariance Measurement Model with Standardized Estimates for the Revised 38-item, 9-factor, RE_X Scale in Study 1 Sample.

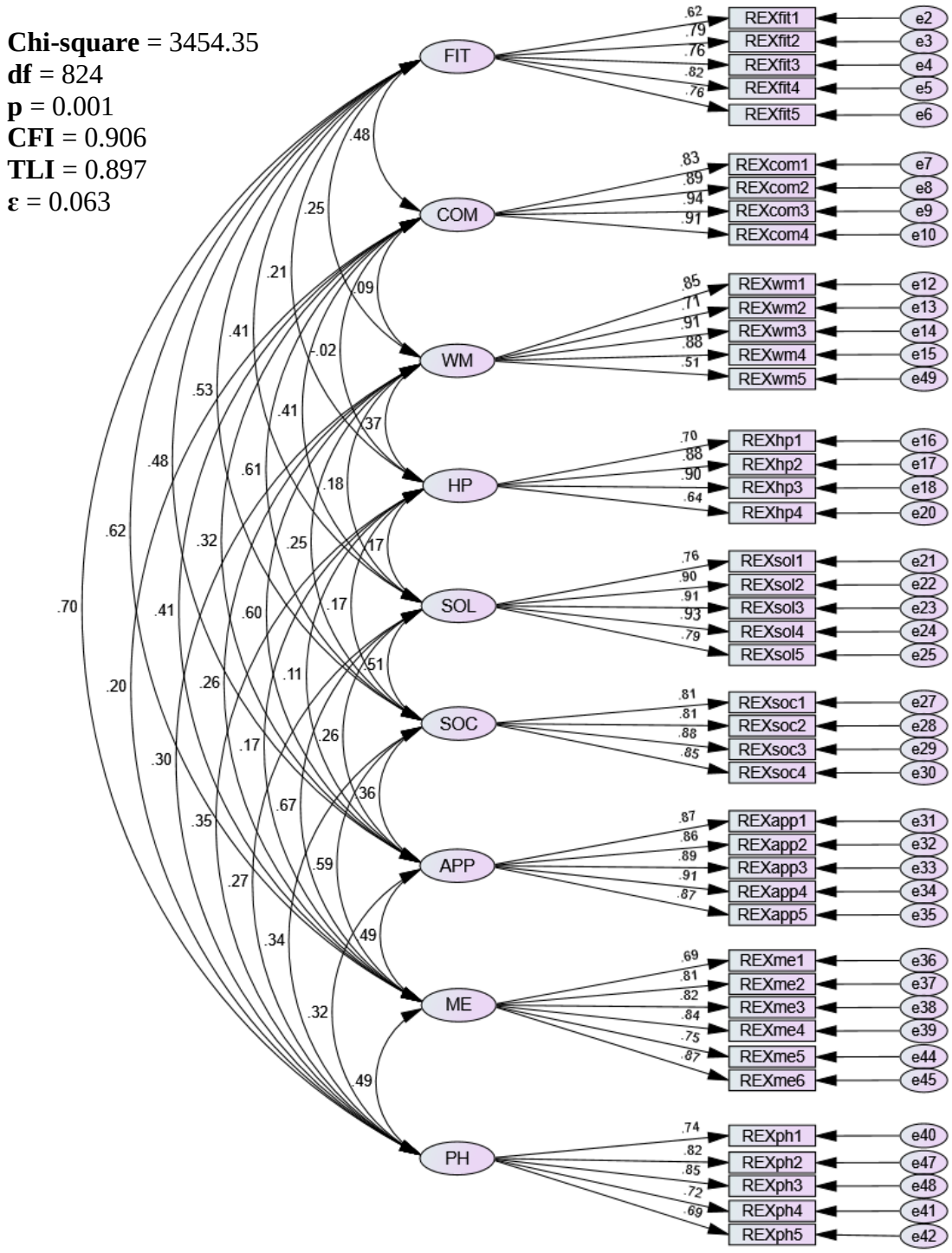


Figure I.2. Measurement Model with Standardized Estimates for the 43-Item, RE_X-2 Scale for Calibration sample in Study 2A.

Appendix J

Recruitment Efforts

Research Match Announcement

What moves you? Even if you're not currently active, what reasons would help you get started? This dissertation study involves research investigating the reasons people have for exercising and/or being physically active. People have many reasons when it comes to moving through exercise and/or being physically active, and we hope you can tell us more about what moves you, personally!

For those of you that have been exercising or physically active all your lives-**What keeps you moving? Is it motivation? Passion? How about your mindset?**

Help us learn more by participating in our short survey even if you are **not** active because we're interested in your responses! This study is open to men and women 18 and older. All men and women are encouraged to participate! Participation will take approximately 12-15 minutes and will involve completing a brief, anonymous survey. This survey is actually a part of my dissertation research, which is why I am extremely passionate about this topic and I know this process will help me learn and grow.

There will be no compensation for this study, but all participants will have an opportunity to learn about the results of the study.

Research Match Email

From: Vanessa Martinez [vanessam@uidaho.edu]
To: {insert volunteer e-mail address}
Subject: Research Match-Dissertation Survey: What Moves You?

Good Morning/Afternoon/Evening {Research Match Volunteer name},

My name is Vanessa Martinez and I am interested in what moves people to exercise and/or be physically active even if they are not active. Currently I am working on my doctorate degree in Sport Psychology and Exercise Physiology at the University of Idaho. Throughout my academic career, I have become fascinated by the reasons people engage in exercise and physical activity. People have many reasons for being physically active, such as to feel good or to enhance the quality of their life. I'm interested in exploring these reasons further.

What moves you? Even if you're not currently active, what reasons would help you get started?

For those of you that have been exercising or physically active all your lives-What keeps you moving? Is it motivation? Passion? How about your mindset?

I would love to hear about what each of your reasons are for exercising and/or being physically active, so I have set up an online survey, which will take about 12-15 minutes to complete! I am extremely excited to be working on a topic that I have a real passion for and thank you in advance for your interest in this study!

To access the survey, please copy and paste the following URL in your web browser.
https://uidaho.co1.qualtrics.com/SE/?SID=SV_9YacZwuPo2MmZJb

This study has been certified as exempt by the University of Idaho (Protocol 15-962), and participation is voluntary and anonymous. If you have questions, please feel free to email me at vanessam@uidaho.edu.

I sincerely thank you for your time and consideration, and I wish you all the very best in your upcoming exercise and physical activity programs!

Many thanks,

Vanessa M. Martinez, ABD, M.Ed.
Doctoral Candidate in Exercise Science
University of Idaho, Moscow, ID
Member at Large | Student Affairs Committee
American College of Sports Medicine
Phone: (956) 459-8878
Email: vanessam@uidaho.edu

Recruitment Follow-Up Email

From: Vanessa Martinez [vanessam@uidaho.edu]
To: {insert volunteer e-mail address}
Subject: Research Match-Dissertation Survey: What Keeps You Moving?

Good Morning/Afternoon/Evening {Research Match Volunteer name},

What's your reason? What moves you to be physically active? If you're not currently active, what reasons would motivate you to move?

How do your reasons relate to motivation and passion? What's your mindset have to do with physical activity?

I recently sent you an email asking you to respond to a brief survey about what moves you to exercise and/or be physically active even if you are not active. If you have already completed the survey, I appreciate your help and insight! If you have not yet had a chance to complete the survey, would you please spare 12-15 minutes to share your reasons? This short survey, which is part of my dissertation research, is a vital step for helping us learn how to implement exercise and physical activity programs designed to help move people and keep them moving!

Follow this link to the Survey:
https://uidaho.co1.qualtrics.com/SE/?SID=SV_9YacZwuPo2MmZJb

The reasons that move you are important! Getting direct feedback about what motivates you to move is crucial to understanding what moves people and what keeps people moving!

The IRB at the University of Idaho has certified this study as Exempt (Protocol 15-962). Your participation is voluntary, and your responses will be kept confidential. You may discontinue participation at any point during the survey, and your data will not be used in the study's results. Should you have any further questions or comments, please feel free to contact me at vanessam@uidaho.edu or 956-459-8878.

Sincerely,

Vanessa M. Martinez, ABD, M.Ed.
Doctoral Candidate in Exercise Science
University of Idaho, Moscow, ID
Member at Large | Student Affairs Committee
American College of Sports Medicine
Phone: (956) 459-8878
Email: vanessam@uidaho.edu

Appendix K

Institutional Review Board Protocol Exempt Certification

FW: Exempt Certification for IRB project 15-962

Research Administration Portal Message

To: Damon Burton

From: Jennifer Walker

IRB Coordinator, University of Idaho Institutional Review Board
University Research Office
Moscow, ID 83844-3010

Date: 10/22/2015 3:05:00 PM

Title: Development and Validation the Reasons to Exercise Scale

Project: 15-962

Certified: Certified as exempt under category 2 at 45 CFR 46.101(b)(2).

On behalf of the Institutional Review Board at the University of Idaho, I am pleased to inform you that the protocol for the above-named research project has been certified as exempt under category 2 at 45 CFR 46.101(b)(2).

This study may be conducted according to the protocol described in the Application without further review by the IRB. As specific instruments are developed, modify the protocol and upload the instruments in the portal. Every effort should be made to ensure that the project is conducted in a manner consistent with the three fundamental principles identified in the Belmont Report: respect for persons; beneficence; and justice.

It is important to note that certification of exemption is NOT approval by the IRB. Do not include the statement that the UI IRB has reviewed and approved the study for human subject participation. Remove all statements of IRB Approval and IRB contact information from study materials that will be disseminated to participants. Instead please indicate, 'The University of Idaho Institutional Review Board has Certified this project as Exempt.'

Certification of exemption is not to be construed as authorization to recruit participants or conduct research in schools or other institutions, including on Native Reserved lands or within Native Institutions, which have their own policies that require approvals before Human Subjects Research Projects can begin. This authorization must be obtained from the appropriate Tribal Government (or equivalent) and/or Institutional Administration. This may include independent review by a tribal or institutional IRB or equivalent. It is the investigator's responsibility to obtain all such necessary approvals and provide copies of these approvals to ORA, in order to allow the IRB to maintain current records.

As Principal Investigator, you are responsible for ensuring compliance with all applicable FERPA regulations, University of Idaho policies, state and federal regulations.

This certification is valid only for the study protocol as it was submitted to the ORA. Studies certified as Exempt are not subject to continuing review (this Certification does not expire). If any changes are made to the study protocol, you must submit the changes to the ORA for determination that the study remains Exempt before implementing the changes. Should there be significant changes in the protocol for this project, it will be necessary for you to submit an amendment to this protocol for review by the Committee using the Portal. If you have any additional questions about this process, please contact me through the portal's messaging system by clicking the `Reply¿ button at either the top or bottom of this message.

Jennifer Walker

Jennifer Walker

University *of* Idaho
Office of Research Assurances
Institutional Review Board
875 Perimeter Drive, MS 3010
Moscow ID 83844-3010
Phone: 208-885-6162
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irb@uidaho.edu

To: Damon Burton

Cc: Vanessa M Martinez

From: Jennifer Walker
IRB Coordinator

Date: June 29, 2016

Title: Development and Validation the Reasons to Exercise Scale
IRB #: 15-962

Submission Type: Protocol Amendment Request Form

Review Type: Exempt

Protocol Approval Date: 10/22/2015

Protocol Expiration Date: None

The Institutional Review Board has reviewed and **approved** the amendment to your above referenced Protocol.

This amendment is approved for the following modifications:

- Using ResearchMatch and the Summit Wellness Center for recruitment and increasing the participant estimate to 800-1000

there be significant changes in the protocol anticipated for this project, you are required to submit another protocol amendment request for review by the committee. Any unanticipated/adverse events or problems resulting from this investigation must be reported immediately to the University's Institutional Review Board.

Kalispell Regional Medical Center
KALISPELL REGIONAL HEALTHCARE

Institutional Review Board
310 Sunnyview Lane | Kalispell, MT 59901 | (406) 758-7495
FWA00010549 | IRB00004635

Jun 30, 2016

Brad Roy, Ph.D
310 Sunnyview Lane
Kalispell, MT 59901

Study Title: *Development and Validation the Reasons to Exercise Scale*

Dear Dr. Roy and Ms. Martinez,

This letter is to officially notify you that after an expedited review the Kalispell Regional Medical Center (KRMC) Institutional Review Board (IRB) have determined that this study meets criteria IAW 45 CFR 46.110 of minimal risk to patients and has given its approval for the above referenced study.

All protocol modifications and/or deviations must be IRB approved prior to implementation.

If you wish for the study to be re-approved annually, please provide a Progress Report (see IRB Handbook page 16 E – The Review Process) to the IRB, summarizing your use of the protocol during the year no later than 30 days prior to your expiration date. This study will expire on 06/30/2017. If there are any adverse events or outcomes related to this study, please notify the IRB immediately.

We look forward to working with you and would like you to present your findings to the board upon conclusion. If there are any further questions, please feel free to contact me at (406) 758-7495.

Sincerely,

Carl Long, MD
IRB Member
Kalispell Regional Medical Center
(406) 758-7495