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**Development and Initial Psychometric Evaluation of a Scale Measuring Factors
Related to Motivation for Exercise**

by

Gauri Junnarkar

Thesis submitted to
the School of Graduate Studies and Research
in partial fulfillment of the requirements for the
MSc degree in Epidemiology

University of Ottawa

January 2000



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ACKNOWLEDGEMENTS

The writing of this thesis has been a process that, though at times strenuous, has been extremely rewarding. It would not, however, have been possible were it not for a group of dedicated people, whose guidance and commitment were essential to its successful completion.

To Dr. Stephen Hotz, my Supervisor, and Co-supervisors Dr. Nicholas Birkett and Dr. Ron Plotnikoff, I present my gratitude, for your guidance and tutelage. Your expertise and dedication to this process will always be remembered. Drs. Hotz and Plotnikoff, your vast experience and expertise in the field of psychology and health behaviour has given me the tools necessary to complete this thesis, and for that, my many thanks. Dr. Birkett, thank you for your assistance and vision. Your ability to stimulate my thought processes into finding different ways of conceptualizing this project has been invaluable and has added depth to this endeavor. Collectively, my thesis committee continually challenged me and inspired in me the ability to challenge myself, broadening the horizons of my knowledge base, and of my thesis.

Dr. Robert Spasoff, I can never thank you enough for all of your motivation, and unending confidence in me and this project. Your unimaginable dedication to this undertaking gave me the strength to carry this thesis to its completion, and your active interest in me was above and beyond anything I could have expected.

Dr. Rama Nair, you were always much more to me than just a professor; your support and encouragement extended beyond the academic sphere. Whenever I needed advice, your door was always open and your hand always extended. To Faye Draper, thank you so much for your friendship and kindness. Your warmth and genuine

interest in my personal well being made the duration of my thesis and my stay in Ottawa easier.

Most of all, my eternal thanks to my family (Ashok, Mangala, and Rupa), all of whom provided me with their inexhaustible strength and faith, and whose ability to endure my trials and tribulations has been nothing short of extraordinary. To my most faithful companion, Sonu, whose comfort and vigilance during long nights at the computer was my saving grace, I thank you with infinite treats. To Mihir Date, thank you for your continual support and words of encouragement; you provided me with an open ear and an open mind, and for that I am grateful. And finally, a tremendous thanks to Becky Newton, whose genuine kindness and careful attention to the little things have helped me in ways too numerous to mention.

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1.0 ABSTRACT

Background: Low levels of physical activity in the population represent an ongoing public health concern and are a major target for health promotion. A psychometrically sound instrument that measures motivation for physical activity as a multi-dimensional construct would be helpful to public health planners. This thesis was guided by a series of research objectives, which were to: examine the literature to identify motivational factors for regular vigorous physical activity; draft an instrument that measures these motivational factors and pre-test it; conduct additional testing into how the items and instruction sets of the instrument were being understood; conduct an initial evaluation of the content, criterion-related, and construct validity of the instrument; and to assess the internal consistency and test-retest reliability of the instrument.

Methods: 1) *Instrument:* Following scale development work, the final scale comprised 82-items that were scored on a five-point Likert-type scale, measuring the following fifteen sub-scales: *Affect, Attitude, Affiliation, Barriers, Goals, Outcome expectancy, Personal Normative Beliefs (PNB), Rewards, Self-determination, Self-efficacy, Self-evaluation, Self-presentation, Social comparison, Social support, Time.* 2) *Procedure:* This cross-sectional study was conducted using a non-probability sample recruited from several private and governmental worksites or organizations.

Results: 1) *Content validity:* there was mutual agreement between the raters with respect to the factors represented in the instrument and the items making-up each sub-scale. 2) *Internal consistency:* Cronbach α coefficients, calculated using a split-half sample technique, revealed that all of the sub-scales demonstrated an adequate level of internal consistency ($\alpha \geq 0.70$). 3) *Criterion-related validity:* Pearson correlation coefficients revealed that the sub-scales of *Affect, Attitude, Barriers, Goals, Outcome*

expectancy, Personal Normative Beliefs (PNB), Self-determination, Self-efficacy, Self-evaluation, and Time demonstrated a modest to good relationships with both energy expenditure and intention ($r = 0.25 - 0.76$). Conversely, the sub-scales of *Affiliation, Rewards, Self-presentation, Social comparison, and Social support* demonstrated little to no association with either energy expenditure or intention ($r \leq 0.25$). 4) *Construct validity*: path analysis demonstrated that all of the sub-scales, except *Self-efficacy*, operated to influence energy expenditure as would be expected of variables that were motivational in nature, and exerted their influence through intention (i.e. indirect effects = 0.07-0.28; direct effects = 0.004 – 0.14). 5) *Test-retest reliability*: Pearson correlation coefficients revealed that all of the sub-scales in the instrument demonstrated an adequate level of stability over a two-week period ($r = 0.694 - 0.90$).

Conclusion: Two clusters of sub-scales emerged from the analyses. The first cluster included *Affect, Attitude, Barriers, Goals, Outcome expectancy, PNB, Self-determination, Self-efficacy, Self-evaluation, Time*, all of which performed consistently and reasonably well across all the tests, providing evidence for their reliability and validity and the interpretation that they represent factors of motivation for exercise. The second cluster of sub-scales, comprised *Affiliation, Rewards, Self-presentation, Social comparison, and Social support*, did not perform consistently across the analyses indicating a need for further refinement of their conceptualization and/or item structure. The observation that many of the sub-scales of this instrument demonstrated the appropriate relationship with the variables of interest (i.e. intention and energy expenditure), suggests that this instrument holds some promise as a survey measure in population health.

2.0 INTRODUCTION

Physical inactivity is an important public health issue. Not only has it been identified as a risk factor for several major chronic diseases, but it also contributes to the development of other risk factors. Conversely, regular physical activity* reduces both the morbidity and mortality associated with many major chronic diseases. Beyond its direct health benefits, regular physical activity can also improve psychological well being and mental health.

There is general consensus that the benefits accrued from increasing the prevalence of regular physical activity in the population represents a significant opportunity by which population health can be improved. Currently, in North America there is a considerable amount of emphasis placed on health promotion interventions addressing this goal.

However, despite the evidence documenting the wide range of benefits associated with being active, physical activity is still a behaviour that many people find difficult to initiate and maintain. Population data suggest that the majority of Canadians participate in little or no physical activity during the course of their day. Furthermore, of those who join exercise programs (i.e. are active) *, the majority have difficulty maintaining their participation over time and subsequently dropout. This pattern holds regardless of demographic characteristics or features of the environment. Only a small proportion of the Canadian population is active at a level that would enable them to derive an appreciable health benefit.

Given low levels of adoption and maintenance over time, physical inactivity represents an ongoing public health concern and a major target for health promotion.

* Refer to *Section 3.2.1* for definition.

Consequently, a great deal of effort has been placed on identifying ways to promote regular participation.

Much of the research on increasing physical activity participation has centered on identifying factors that influence its adoption and/or maintenance, as well as those factors that characterize an active person. One variable that appears to be central to physical activity participation is motivation. Understanding how to motivate people to become more active represents a pressing issue for health promotion efforts. However, there is currently no comprehensive, psychometrically sound instrument that measures motivational factors for physical activity. For this reason, the current thesis attempted to develop and test a new measure of motivational factors for physical activity.

This thesis first describes the literature concerning how motivation has been conceptualized and measured to date in the domain of physical activity. It also examines the shortcomings of existing questionnaires in order to justify the need for a new instrument. Then, by addressing a series of inter-related objectives that are organized in the thesis as discrete chapters, the development and the preliminary testing of the reliability and validity of the instrument is described. These sections describe the methods by which each objective was addressed and discuss the results obtained. The pattern of results that emerged from these objectives bears on the reliability and validity of the sub-scales of the instrument and assist in identifying those sub-scales in need of further refinement. The thesis concludes with a discussion of the strengths and weaknesses of the sub-scales comprising the instrument, required revisions to the instrument, implications of the results for future research, and some suggested uses of the scale in population health.

3.0 REVIEW OF THE LITERATURE

3.1 Overview

This chapter reviews the relevant literature to date on motivation in the context of physical activity and exercise*. It begins with an overview of the terminology and definitions of key study variables. Next, it discusses the problem of physical inactivity in the context of public health, as well as the approaches that have been used to increase physical activity participation. Specifically, it addresses the importance of the construct of motivation for physical activity and its promotion. It also critically reviews different approaches to the measurement of motivation for physical activity and the need for a new measure. Finally, it provides a definition of the terms adopted for the present investigation.

3.2 Definitions and Terminology

3.2.1 Definition of Exercise and Physical Activity

Physical activity is defined as, “any bodily movement produced by the skeletal muscles that result in energy expenditure” ^{1,2,3,4}. It is generally described in terms of kilocalories expended per unit time ², and is categorized according to its type, intensity, and purpose ¹.

Previously, the terms exercise and physical activity were used synonymously ¹. However, now exercise is considered a sub-category of physical activity and refers to planned, structured, and repetitive activities that were performed for the purpose of

* The terminology used in this field is variable. Until recently, the terms physical activity and exercise were used synonymously with each other, but now exercise is considered a sub-category of physical activity. Although different terms are used in the literature to describe the behavioural referent of interest, the research selected for this thesis only refers to those activities that are consistent with the definition of exercise. Specifically, these activities are performed to incur a health benefit, are repetitive and structured. However, for both convenience and accuracy, this thesis has retained the terms of physical activity/exercise as per how they were used (i.e. referred to) in the original literature.

maintaining physical fitness ^{2,4}. Exercise is described in terms of its frequency, duration, and intensity ^{2,5}.

Moderate physical activity and exercise refer to lower intensity activities that result in a smaller amount of energy expenditure, and may include activities of daily living such as walking, gardening, and house cleaning ⁶. Conversely, vigorous physical activity and exercise reflects higher intensity activities that result in a greater amount of energy expenditure. Vigorous physical activity has been defined variously as: “activities that make you sweat, breath harder, and feel your heart beat (this includes activities such as jogging, aerobics, and swimming)” ⁷; “activities that are done hard enough to make your heart rate and breathing increase by a large amount” ⁸; and by the American College of Sports Medicine (ACSM) as activities which increase cardio-respiratory fitness through an activity that is rhythmic and repetitive ⁵. Although several definitions have been used to describe vigorous physical activity and exercise, they all specify the physiological changes that arise as a result of participating in strenuous activities.

Regarding frequency and duration, the recommended minimal amount of moderate intensity physical activity and exercise is a minimum of thirty minutes of activity accumulated over most of the days of the week, preferably daily ⁹. The recommended amount of vigorous physical activity and exercise is at least 20 minutes of activity, three to four times a week ¹⁰⁻¹².

3.2.2 Definition of Motivation

Although motivation may seem to represent a simple concept, it has been the subject of considerable scientific attention for over 100 years. The theories that describe motivation can be placed along a continuum, ranging from mechanistic to cognitive, where the former describe people as being passive, reactive, and driven by psycho-physiological drives, while the latter portray people as proactive agents that

initiate action through cognitive processes ¹³. Contemporary theories of motivation include the social and cognitive variables that come into play when a person undertakes a behaviour ¹³, and they attempt to capture the influence that the environment has on behaviour ^{14,15}.

The definitions of motivation stem from several disciplines. Psychology defines motivation as the internal states and external goals that energize, direct, and sustain a behaviour, which is manifested in the amount of effort and persistence displayed towards the activity ^{16,17}. In education, it is defined as the conditions and processes that activate, direct, and sustain behaviour ¹⁸. Further, the exercise sciences describe motivation as those personality factors, social variables, and cognitions that interact to influence the activity and the magnitude of one's desire to act ^{19,20}.

Although the definitions vary, there is much similarity: motivation is dynamic and one is able to move between varying levels of motivation ²¹⁻²³. The definitions also differentiate between internal and external motivation. A behaviour is internally motivated when the source of energy or stimulation or reinforcement comes from within the person ^{14,24-36}. Conversely, a behaviour is externally motivated when the energy, stimulation, and/or reinforcement comes from sources external to the person ^{14,23,30,32}. These external influences include rewards ²³, punishment ^{23,35,37}, and environmental conditions ^{23,30}.

3.3 Scope of the Problem

3.3.1 Overview

It is well accepted that physical inactivity poses a major risk to the health of Canadians, and that being active has the potential to significantly improve overall health ³⁸. Coinciding with recommendations from the U.S. Surgeon General's Report, a consensus statement released by several Canadian health organizations has endorsed

a new public health message for Canadians, “Canadians are now encouraged to participate in regular physical activity at a level appropriate to their needs, interests, and capacity”. As well, provincial health ministers have stressed the importance of physical activity for improving the health and quality of life of Canadians ^{9,39}.

This recommendation is based on scientific evidence that physical activity is a powerful determinant of health ^{1,9,39}. For instance, not only does physical inactivity predict adverse health outcomes, but it is also now seen as being equal to tobacco use as the leading preventable cause of death ³⁹. The Healthy People 2000 report has listed physical activity first among twenty-two health behaviours because it has the potential to reduce the risk for several major chronic diseases ^{39,40}. Consequently, greater attention must be placed on identifying strategies that are effective in promoting regular physical activity.

3.3.2 The Benefits of Physical Activity for Population Health

The health benefits offered by physical activity are retained only if the activity is maintained ^{5,11,41,42}. Regular physical activity has been shown to reduce the all-cause mortality rate, whereas low levels of activity increase it ^{19,24,38,43-45}. It has been estimated that approximately 14 to 17 million adult Canadians could prevent an early death if they performed at least a small amount of physical activity every day ⁹.

Moreover, regular physical activity appears to decrease morbidity by reducing the risk for several major chronic diseases, such as coronary heart disease, hypertension, type II diabetes, osteoporosis, colon cancer, and obesity ^{1,2,12,38,40,45-52}. Regular physical activity has also been shown to improve the risk factors for major chronic diseases by exerting positive effects on blood lipid profile, resting blood pressure, body composition, weight management, glucose tolerance, insulin sensitivity, bone density, immune functions, and psychological functions ^{38,40,47,49-51}.

In addition to preventing chronic diseases and modifying risk factors, physical activity also leads to improvements in endurance, flexibility, and muscle and joint strength. This results in greater efficiency in performing daily activities, less back pain, and less disability with advancing age^{25,47,51,53,54}. Regular physical activity has also been shown to enhance psychological well-being and mental health by improving perceptions of self-esteem, feelings of depression and anxiety, as well as stress management^{25,40,46,52,55-62}.

Beyond the health benefits of an active lifestyle, evidence also points to the health-related economic impact of physical activity⁶³. Specifically, Canada's direct cost (i.e. hospitals, physicians, drugs, and research) in 1998, of treating conditions such as ischemic heart disease, diabetes type II, and colon cancer was roughly \$3 billion⁶⁴. It has been estimated that if 1% of sedentary Canadians were to become active then the annual savings, in 1993 dollars, would have been nearly \$11 million⁶⁵. Further, the economic saving attributed to an individual who moves from a sedentary lifestyle to one that includes physical activity of moderate intensity is two times greater than that of someone who quits smoking^{9,66}.

Physical inactivity is a public health burden because it is more prevalent than any other modifiable risk factor for chronic diseases³⁹. Despite the evidence regarding the health benefits of physical activity^{67,68}, regular physical activity remains a behaviour that many people have difficulty initiating and maintaining^{57,69,70}. In North America, during the course of the day most people participate in little or no leisure-time physical activity. Only 10% of the North American population is regularly active, whereas nearly 30% is completely sedentary⁷¹⁻⁷³.

3.3.3 Activity Patterns of Canadians

Within Canada several national surveys have been conducted between the late 1970s and 1995 ^{26,74-78}. Surveys between the late 1970s and mid 1980s (i.e. Canada Fitness Survey, Canada Health Survey) found that only between 21% and 25% of Canadians were active enough to sustain any cardiovascular benefits ^{75,77,78}. In contrast, the Canada Health Promotion Survey (1985) and the Community Risk Factors Survey (1985) found that between 53% and 67% of Canadian adults were active ^{74,76}. However, these figures are believed to be overestimates, because they did not distinguish between those who were active at a level to sustain cardiovascular benefits and those who were less active ^{74,76}.

More recently, a 1993 survey found that only 10% of Canadian adults were physically active ^{71,79}. While, a 1995 national survey by the Canadian Fitness and Lifestyle Research Institute (CFLRI) reported that roughly two in five Canadians (i.e. 37%) were sufficiently active to obtain any cardiovascular benefit ^{26,47,80}.

Although these surveys demonstrate that since the late 1970s and early 1980s the proportion of active Canadian adults has increased, best estimates suggest nearly 63% of the population is sedentary, or is active but not receiving any cardiovascular benefits ²⁶. Moreover, of those people who have begun an exercise program, nearly 50% dropout within the first three to six months ⁸¹. This proportion seems to hold regardless of demographic or environmental characteristics ⁸².

Across all age groups, more men appear to be active than women ^{26,75}. However, physical activity participation begins to decline with advancing age. This downward trend begins when young adults start to work full time and have a family (i.e. late 30s or early 40s) ^{26,75}. By the time adults have reached the age of 65, there are nearly less than half as many who are active, compared to adults in their 20s ²⁶.

For males, the decline continues until middle age at which point it stabilizes and remains constant throughout retirement, while for women, the decline continues throughout adulthood ²⁶.

3.3.4 Phases of Physical Activity Participation: Adoption and Maintenance

The following sections summarize the interventions that have been implemented to increase the adoption of physical activity, as well as cross-sectional studies that have identified the factors that influence the adoption and maintenance of physical activity.

3.3.4.1 Adopting Physical Activity

Although some strategies to increase physical activity participation have had some effect on the activity level of the population, the majority of them have failed ⁸³⁻⁸⁵. Very little evidence has demonstrated that mass media campaigns are effective, suggesting that change in the activity level of the population is rarely accomplished by providing health information alone ⁸⁶⁻⁸⁸.

On smaller samples, behavioural and cognitive-behavioural strategies have been employed. Although the results from studies that have employed these techniques have demonstrated a 10-75% increase in the frequency of physical activity participation ⁸⁹⁻⁹³, since they were conducted over a short period of time (<12 weeks) on white, young, self-selected males, the results are not generalizable to the population. Moreover, follow-up studies have revealed that the effects tend to be short-lived (i.e. 3 months), and that after 6 months the effect may be completely lost ⁹⁴.

Given the ineffectiveness of these intervention strategies, extensive research has been conducted to identify the characteristics of people who adopt physical activity, and what influences their decision to do so ^{69,95,96}. Some of these variables include the individual's feeling towards being active ^{69,95,96}, confidence in their abilities ⁹⁷⁻¹⁰⁰, the

outcomes anticipated from participating ^{58,101}, and the amount of support they receive from others ^{1,19,38,46,50,69,71-73,80,84}.

Since these factors significantly influence the adoption process and are characteristics of an active person, they could represent factors of motivation for physical activity.

3.3.4.2 Maintaining Physical Activity Participation

The poor maintenance of physical activity over time is a significant problem for health promotion ^{46,102}. Of those who join structured or unstructured exercise programs, nearly 50% drop out in the first 3 to 6 months ^{19,81,103}. This problem also exists at worksite fitness programs ¹⁰⁴, where despite the convenient location, only 30% of employees frequent these facilities and only 15% continue their participation over time ¹⁰⁴⁻¹⁰⁶.

People who maintain physical activity are more concerned about health matters, perceive themselves as being in better health, and have greater interest in physical activity and being fit ¹⁰⁷⁻¹¹⁰. Other attributes include the attitude toward being active ^{27,46,70,111-116}, the tendency to set goals ¹¹⁷, the amount of support received from others ^{1,8,84,118-123}, confidence in one's abilities ^{6,7,42,58,70,113,124-129}, the outcomes anticipated from participating ⁵⁸, the positive feelings towards being active ^{95,122,130,131}, the sense of control over being active ¹³¹⁻¹³³, and the extent to which interpersonal bonds are formed with others ¹³⁴⁻¹³⁹.

Given that these factors have been shown to influence maintenance, they too could be viewed as being factors of motivation for physical activity.

3.3.5 Motivation and Physical Activity

A 1995 survey of approximately 2500 Canadians that asked about the barriers to being physically active revealed that, for more than 50%, the “lack of motivation” was rated as being a significant barrier ¹⁴⁰. Interestingly, this finding was consistent across both active and inactive individuals ¹⁴⁰.

One reason for the limited success of many intervention programs may be that motivation for physical activity has not been well understood or addressed. Understanding and measuring motivation for regular physical activity has been acknowledged to be a high priority for health promotion insofar as it would support health promotion endeavors in this area ⁴². In depth analysis of the issue of motivation for physical activity is to be found in *Section 3.4* of this thesis, which critically reviews this literature as a step toward the development of a new measure.

3.4 Measurement of Motivation

3.4.1 Overview

Several instruments have been developed to measure motivation for physical activity or exercise. These scales possess varying degrees of precision (validity) and reliability.

A psychometrically sound instrument must be characterized by adequate reliability and validity ¹⁴¹⁻¹⁴³. A reliable instrument measures something in a reproducible and consistent manner ¹⁴²⁻¹⁴⁶. Specifically, it must be capable of producing results that are stable over time in the absence of a true change in the factor (i.e. test-retest reliability) and it must be characterized by homogeneity (i.e. internally consistent) ^{141,143,147}.

Further, a valid instrument must measure the phenomenon that it purports to ¹⁴⁸. The validity of an instrument can be ascertained a variety of ways such as, establishing

that it is comprehensive (i.e. its items reflect the domain being studied), or that it is predictive of, or correlated with relevant outcome(s) of interest. It can also be established by demonstrating that the instrument is: able to differentiate between people, or groups who are known to vary on the outcome(s) of interest; correlated in meaningful ways to other scales that measure a similar or related concept(s); and characterized by a coherent factor structure.

The following sub-sections focus on two areas. First, it discusses existing instruments measuring motivation for exercise/physical activity, as well as their psychometric properties. Second, it draws attention to the need for a new measure of motivational factors for physical activity.

3.4.2 Existing Instruments of Motivation for Physical Activity or Exercise

3.4.2.1 Self-motivation Inventory (SMI)

Based on evidence accumulated from the medical compliance and achievement literature, Dishman, Ickes, and Morgan applied the concept of self-motivation to the area of exercise adherence ¹⁴⁹. Self-motivation is a trait-like construct that describes the personal tendency to engage in a behaviour and persist, even in the absence of extrinsic rewards or situational influences ^{112,149,150}. The term self-motivation, as described by Dishman et al., has been used synonymously with that of goal-directedness ¹⁵¹.

Asserting that self-motivation is the only psychological predictor of adherence to exercise programs ¹⁴⁹, Dishman et al., developed the 40 item Self-motivation Inventory (SMI). They hypothesize that those who score highly on the SMI will attend an exercise program more regularly than those who attain lower scores ¹⁴⁹.

The SMI has undergone extensive psychometric assessment and it is evident that although the SMI possesses adequate reliability, the evidence regarding its validity

is less convincing (cf. Table 1, pg. 16). For example, a study that attempted to cross-validate the findings of Dishman found that although the SMI scores were correlated with the skills involved in adherence to exercise, the investigators of this study argued that the coefficients were too modest to argue for validation support ¹⁵².

Moreover, the results from tests of criterion-related validity of the SMI are mixed. The assertion that the SMI predicts both attendance and adherence to exercise programs has not been substantiated. Although there are a few studies that have demonstrated the predictive ability of the SMI ^{149,150}, the majority have found no association between self-motivation and either current exercise participation or adherence ^{24,98,127,153} (cf. Table 1, pg. 16). With respect to current exercise behaviour, one study reported that among a group of formerly sedentary, middle-aged females in an aerobics program, self-motivation did not predict either in-class exercise participation or out of class activity ($p > 0.05$) ¹²⁷. Another study of a community based aerobics program (10 weeks) also found that attendance was not influenced by subjects' self-motivation levels (e.g. low, medium, high) since no difference was observed in the overall attendance of participants based on their initial SMI scores ($F_{2,180} = 1.14$, $p = 0.32$)

¹⁰³.

Several studies have also demonstrated that self-motivation is not related to, or predictive of exercise adherence ^{103,154,155}. For instance, a study by Garcia and King showed that self-motivation was not positively related to adherence at either six- or twelve-months (1-6 months: $r = -0.02$, $p = \text{NS}$; 7-12 months: $r = 0.10$, $p = \text{NS}$) ¹⁵⁵. This observation was reinforced by the results from another study on a community based fitness program, which also demonstrated that over the course of the program (5 weeks), self-motivation did not significantly affect adherence ($F_{1,48} = .63$, $p \geq 0.05$) ¹⁰³.

Table 1: Psychometric Properties of the Self-motivation Inventory (SMI)

INSTRUMENT	RELIABILITY		Content	VALIDITY	
	Internal Consistency (N)	Test-Retest (N)		Criterion-Related (N)	Construct (N)
Self-motivation Inventory (SMI) 24,103,127,149,150,152-155	<u>Study 1 (399)</u> $\alpha = 0.91$ <u>Study 2 (48)</u> $\alpha = 0.86$ <u>Study 6 (94)</u> $r = 0.92$	<u>Study 2 (48)</u> $r = 0.86 - 0.92$, $p < 0.001$ <u>Study 7 (252)</u> $r = 0.83 - 0.85$, $p < 0.05$	Examined by creators.	<u>Study 1 (399)</u> • Criterion = exercise frequency $r = 0.23$, $p < 0.001$ <u>Study 3 (64)</u> • Criterion = exercise adherence $r = 0.33$, $p < 0.005$ <u>Study 4 (646)</u> • Criterion = fitness program participation $R^2 = 0.26$, $p < 0.001$ <u>Study 5 (52)</u> • Criterion = overall exercise attendance $F_{2,180} = 1.14$, $p = 0.32$ • Criterion = exercise program adherence $F_{1,48} = .63$, $p > 0.05$ <u>Study 6 (94)</u> • Criterion = adherence to structured exercise program $R^2 = \text{N.S.}$ <u>Study 7 (252)</u> • SMI scores: Pre-test to Post-test periods (155.8 to 155.5) <u>Study 8 (76)</u> • Discriminant analysis: adherers vs. drop-outs Female: $F = 0.0004$, $p = \text{NS}$; Male: $F = 0.03$, $p = \text{NS}$. <u>Study 9 (220)</u> • Criterion = exercise $r = 0.17$, $p < 0.05$ • Criterion = enjoyment $r = \text{NS}$. <u>Study 10 (69):</u> • Criterion = exercise adherence → 1-6 months and 7-12 months respectively $r = -0.02$, $p = \text{NS}$; 0.10, $p = \text{NS}$.	<u>Study 1 (399)</u> • Factorial Validity → 11 factor solution, accounting for 40.5% of the variability in responses. <u>Study 2 (48)</u> • Convergent Validity → Ego Strength Scale $r = 0.63$, $p < 0.005$ → Social Desirability Scale $r = 0.36$, $p < 0.001$ <u>Study 9 (220)</u> • Convergent Validity → Heiby Frequency of Self-reinforcement Questionnaire $r = 0.36$, $p < 0.05$ → Wallston Health Locus of Control Measure: * Internal $r = 0.21$, $p < 0.05$ * Powerful Others $r = -0.15$, $p < 0.05$ * Chance $r = -0.27$ → Zung's Self-rating Depression Scale $r = -0.39$, $p < 0.05$ → Spielberger's State-trait Anxiety Inventory $r = -0.49$, $p < 0.05$

Similarly, the results from a study on members of an employee work-site fitness program, also revealed that subjects' self-motivation level was not a significant predictor of adherence to a structured exercise program ($p>0.05$) ¹⁵⁴.

In addition to being unable to predict attendance and adherence to exercise programs, the SMI may not adequately capture the construct of self-motivation. This was evident in a study on female college students in a weight training class where goal conditions were manipulated ²⁴. The observation that the performance of groups differing in goal conditions supported the notion that challenging goals lead to a higher level of performance and motivation compared to unchallenging goals ²⁴. However, the SMI was unable to capture this trend, as subjects' self-motivation scores remained unchanged over the course of the study (SMI scores: Pre-test=155.8; Post-test = 155.5) ²⁴. This indicates that because the SMI measures motivation as a trait-like construct it is insensitive to changes in motivation over time ²⁴.

Furthermore, the conceptual framework of the SMI is fairly restrictive. According to the SMI, motivation is an uni-dimensional construct. This conceptualization of motivation is contrary to the current belief, which is that motivation is a multi-dimensional construct ^{14,109,156-159}.

Given these findings, several investigators believe that the SMI is of limited utility in explaining motivation for exercise ^{46,103,127,155}.

3.4.2.2 Personal Incentives for Exercise Questionnaire (PIEQ)

The PIEQ was developed by Duda and Tappe ¹⁶⁰, and is based on the Personal Inventory Theory (PIT) (cf. *Section 5.2.2.1.1*) ¹⁶¹. The PIT posits that behaviour is influenced by the meaning an individual attaches to a situation or context ¹⁶². The PIEQ assesses the motivational focus of exercise behaviour ^{160,162}. Its 48-items (Version 1) broadly classify the personal incentives related to exercise into ten dimensions labeled

as: appearance, fitness, competition, mental benefits, affiliation, mastery, flexibility/agility, social recognition, health benefits, and weight management ¹⁶⁰.

The PIEQ has demonstrated modest stability and internal consistency (cf. Table 2, pg. 19). However, only some of its factors have demonstrated adequate criterion-related validity by virtue of their ability to predict current exercise behaviour for both middle-aged and older adults ^{162,163}. For example, social recognition accounted for nearly 15% of the variance in participation for an organized exercise program ($p < 0.05$) ¹⁶³ (cf. Table 2, pg. 19). Other incentives that correlated with greater exercise participation were fitness, mental benefits, and affiliation ($r = 0.30, -0.13$, and 0.25 respectively) ¹⁶³ (cf. Table 2, pg. 19). For college students enrolled in exercise classes of differing intensity levels, the factors discriminating between groups were appearance ($F = 18.81$, $p < 0.001$), fitness ($F = 17.65$, $p < 0.001$), mental benefits ($F = 9.69$, $p = 0.002$), weight management ($F = 8.19$, $p = 0.01$), and social recognition ($F = 5.97$, $p = 0.02$) ¹⁶².

Some of the factors of the PIEQ also predict future exercise involvement ¹⁶³. The variables that significantly predicted participation six-months into the future were mastery incentive and health benefits, accounting for 19% and 7% respectively, of the variance in future exercise behaviour ($p < 0.07$) (cf. Table 2, pg. 19) ¹⁶³.

Although recent work has demonstrated adequate criterion-related validity for some of its motivational components, the content validity of the PIEQ suffers from some shortcomings. Some of the items reflect general beliefs about exercise or oneself, rather than describing the motivational focus for exercise behaviour ¹⁶⁴. Moreover, some of the motivational components of the PIEQ contain an insufficient number of items to adequately represent the domain of interest.

Table 2: Psychometric Properties of the Personal Incentives for Exercise Questionnaire (PIEQ)

INSTRUMENT	RELIABILITY		Content	VALIDITY	
	Internal Consistency (N)	Test-Retest (N)		Criterion-Related (N)	Construct (N)
Personal Incentives for Exercise Questionnaire (PIEQ) 160,162,163	<u>Study 1 (535)</u> $\alpha = 0.74 - 0.94$ <u>Study 2 (352)</u> $\alpha = 0.77 - 0.92$ <u>Study 3 (135 college men)</u> $\alpha = 0.74 - 0.94$ <u>Study 4 (217 college women)</u> $\alpha = 0.77 - 0.92$	<u>Study 3 (106)</u> $r = 0.58 - 0.86$, $p < 0.05$	Examined by Creators.	<u>Study 5 (47)</u> • <i>Criterion</i> = current exercise participation → Social Recognition $R^2 = 0.15$, $p < 0.05$ • <i>Criterion</i> = greater exercise participation → Fitness, Mental Benefit, Affiliation $r = -0.13$ to 0.30 , $p < 0.05$ • <i>Criterion</i> = Future exercise behaviour → Mastery, Health $R^2 = 0.07 - 0.19$, $p < 0.07$ <u>Study 6 (294)</u> • <i>Criterion</i> = exercise classes of differing intensity levels → Appearance: $F = 18.81$, $p < 0.001$ → Fitness: $F = 17.65$, $p < 0.001$ → Mental benefits: $F = 9.69$, $p = 0.002$ → Weight management: $F = 8.19$, $p = 0.01$ → Social Recognition: $F = 5.97$, $p = 0.02$	<u>Study 1 (535)</u> • <i>Factorial Validity</i> 10 factor solution.

Another limitation of the PIEQ is that it does not capture the range of factors that have been shown to motivate exercise. For example, none of the sub-scales of the PIEQ tap into an affective component (e.g. enjoyment)¹⁶⁴, which has been shown to be a very strong motivational factor for exercise behaviour^{1,25,111,137,138,165,166}, nor do they incorporate the barriers that diminish the likelihood of exercise participation. As well, many of the motivational components represented in this instrument could be construed

as belonging to the broader outcome-expectancy framework. However, perhaps the most fundamental shortcoming of the PIEQ is that it fails to operationalize the motivational factors it purports to be measuring.

3.4.2.3 Personal Estimation and Attraction Scale (PEAS)

The PEAS is based on Sonstroem's Psychological Model for Physical Activity Participation ^{167,168}, which attempts to capture the variety of interests adolescent boys have in sport and physical activity situations ¹⁶⁷. The PEAS measures respondent's estimation of their capability in vigorous physical activity and the extent to which they like vigorous physical activities ^{167,169,170}.

The PEAS has been used infrequently in the field of physical activity ¹⁷¹⁻¹⁷³. Examination of its psychometric properties reveals that it possesses adequate reliability and factorial validity (cf. Table 3, pg. 21) ^{168,171-173}. However, there are inconsistencies surrounding its criterion-related validity. Some studies have demonstrated that the factors of estimation and attraction were significantly related to the level of involvement and participation in fitness programs for males and females, with correlations for these factors ranging between 0.21 and 0.53 ($p < 0.05$) (cf. Table 3, pg. 21) ^{170,172,173}.

In contrast, other studies have shown that these dimensions are not equally associated with physical activity participation (cf. Table 3, pg. 21) ^{168,169,171}. Specifically, a study on members and non-members of a work-site fitness program reported that only the factor of estimation significantly predicted group membership ($R^2 = 0.28$, $p < 0.05$) (cf. Table 3, pg. 21) ¹⁶⁹. Similarly, discriminant analysis revealed that only the factor of estimation was able to significantly differentiate between members and non-members ($p = 0.001$) (cf. Table 3, pg. 21) ¹⁶⁹.

Table 3: Psychometric Properties of the Physical Estimation and Attraction Scale (PEAS)

INSTRUMENT	RELIABILITY		Content	VALIDITY	
	Internal Consistency (N)	Test-retest (N)		Criterion-Related (N)	Construct (N)
Physical Estimation and Attraction Scale (PEAS) 167-173	<u>Study 1 (171)</u> Kuder-Richardson 20= 0.87 - 0.90 <u>Study 2 (187)</u> Kuder-Richardson 20= 0.87 - 0.89	<u>Study 3 (40)</u> r = 0.92 - 0.94, p<0.05	Examined by creator.	<u>Study 1 (94 males)</u> • Criterion = level of activity → Attraction; $R^2 = 0.17$, p<0.05 <u>Study 1 (77 females)</u> • Criterion = level of activity → Estimation; $R^2 = 0.13$, p<0.05 <u>Study 2 (187)</u> • Criterion = fitness level → Estimation & Attraction r = 0.41 - 0.53, p<0.05 <u>Study 3 (109)</u> • Criterion = level of participation → Estimation & Attraction r = 0.46 - 0.48, p<0.05 <u>Study 4 (646)</u> • Criterion = fitness program participation → Estimation; $R^2=0.28$, p<0.05 • Criterion = exercise group membership → Estimation; Wilk's Lambda = 0.67, p = 0.001 <u>Study 6 (165)</u> • Criterion = activity level → Estimation & Attraction r = 0.21 - 0.36, p<0.05	<u>Study 5 (710)</u> • Factorial Validity → 7 factor solution, accounting for 49.3% of the variability in responses. <u>Study 7A (488 males)</u> • Factorial Validity → 27 factor solution, accounting for 60.2% of the variability in responses. • Canonical Analysis → 27 factor solution, accounting for 60.2% of the variability in responses. • α Factor Analysis → 27 factor solution, accounting for 70.7% of the variability in responses. <u>Study 7B (347 females)</u> • Factorial Validity → 26 factor solution, accounting for 64% of the variability in responses. • Canonical Analysis → 26 factor solution, accounting for 60.4% of the variability in responses. • α Factor Analysis → 26 factor solution, accounting for 64% of the variability in responses.

Furthermore, it has been reported that the relative contribution of these factors differs by sex, even though they were not hypothesized to. The dimension of attraction was a significant predictor of the level of participation for males ($R^2=0.17$, p<0.05) but

not for females ¹⁶⁸. Conversely, the dimension of estimation significantly predicted the level of participation for females ($R^2=0.13$, $p<0.05$) but not for males (cf. Table 3, pg. 21) ¹⁶⁸.

In addition to being unable to systematically predict behaviour, the content validity of the PEAS suffers from several shortcomings. For instance, the PEAS only consists of two motivational factors. This is contrary to the current conceptualization of motivation, which is that it is a multi-dimensional construct ^{14,109156-159}. Further, not only its conceptualization narrow in that it does not capture factors that prevent and/or diminish physical activity participation, but some of sub-scales are tapping into two distinct motivational concepts simultaneously.

Beyond the limitations identified with respect to the content of the PEAS, its item composition is also problematic. Many of the items within this instrument fail to capture the motivational focus on physical activity, representing general beliefs about, or personal preferences for physical activity. In addition, some of the items of the PEAS are poorly written in that they tap into two different aspects of the motivational concept they are proposed to be measuring.

3.4.2.4 Reasons for Exercise Inventory (REI)

The Reasons for Exercise Inventory (REI) was developed by Silberstein and colleagues to examine motives for exercise ¹⁷⁴. The REI is a 24-item questionnaire that consists of seven rationally conceived sub-scales measuring reasons for exercising, including: weight control, fitness, mood, attractiveness, health, enjoyment, and tone ^{174,175}.

Only a few studies have employed the REI ¹⁷⁴⁻¹⁷⁸. Although the REI has demonstrated adequate internal consistency across each of its sub-scales (cf. Table 4, pg. 23), researchers have been unable to clearly establish its factor structure ^{175,176}. One

factor analytic study demonstrated that the REI consists of six independent sub-scales (i.e. sexual attractiveness, general appearance, weight control, fitness and health, mood, and enjoyment) (cf. Table 4)¹⁷⁶. In contrast, another study found that the REI consists of four independent sub-scales (fitness/ health management, appearance/weight management, stress/mood management, and socializing) (cf. Table 4)¹⁷⁵.

Table 4: Psychometric Properties of the Reasons for Exercise Inventory (REI)

INSTRUMENT	RELIABILITY		Content	VALIDITY	
	Internal Consistency (N)	Test-retest (N)		Criterion-Related (N)	Construct (N)
<i>Reasons for Exercise Inventory (REI)</i> 174-178	<u>Study 1 (92)</u> $\alpha = 0.67 - 0.81$ <u>Study 2 (137)</u> $\alpha = 0.73 - 0.91$ <u>Study 3 (366)</u> $\alpha = 0.76 - 0.87$	Not as yet examined	Examined by creators.	<u>Study 2 (137)</u> • Criterion = frequency of exercise participation → Appearance Weight Management $r = 0.33$, $p < 0.001$ <u>Study 3 (366)</u> • Criterion = level of participation $r = \text{NS}$. $(p > 0.05)$	<u>Study 2 (137)</u> • Factorial validity → 4 factor solution, accounting for 64.6% of the variability in responses. <u>Study 3 (366)</u> • Confirmatory Factor Analysis → 6 factor solution → Chi-square statistic = 4.030, $p < 0.001$ → Goodness-of-fit = 0.946

There is also some uncertainty regarding the relationship of its components with exercise behaviour. Application of the four factor structure to exercise behaviour revealed that only the dimension of appearance/ weight management was significantly related to the frequency of exercise participation ($r = 0.33$, $p < 0.001$) (cf. Table 4)¹⁷⁵. Conversely, none of the dimensions from the six factor structure were related to the level of exercise participation ($p > 0.05$) (cf. Table 4)¹⁷⁶.

Furthermore, the conceptualization of motivation for exercise used in this instrument is fairly narrow and restrictive. Specifically, it does not tap into many of the motivational factors that influence exercise behaviour, such as the individual's confidence in their abilities ⁹⁷⁻¹⁰⁰, the outcomes anticipated from participating ^{58,101}, and the amount of support they receive from others ^{19,38,46,50,80}. Further, many of the factors represented in this instrument can be viewed as belonging to a broader concept, specifically the outcomes that individuals expect from exercising. As well, the REI only describes factors that enhance motivation, rather than including those that serve to diminish it.

In terms of the item composition of this instrument, it too suffers from some shortcomings. For instance, not only are some of the items conceptually unrelated to the other items within their respective sub-scale, but they also appear to be simultaneously tapping into two aspects of the motivational concept they purport to be measuring.

3.4.2.5 Exercise Motivation Inventory (EMI)

The Exercise Motivation Inventory (EMI) is based on two theories of motivation, the Personal Investment Theory and Cognitive Evaluative Theory (cf. *Sections 5.2.2.1.1, 5.2.2.1.2*) ¹⁶⁴. It is a psychometrically derived instrument that measures the reasons for exercising ¹⁶⁴. Items were generated from the literature on exercise participation, as well as through focus groups and interviews. The reasons for exercising were categorized according to the framework of the PIEQ (cf. *Section 3.4.2.2*) and the construct of enjoyment. These dimensions were labeled as: stress management, weight management, regular exercise-creation, social recognition, enjoyment, appearance, personal development, affiliation, ill-health avoidance, competition, fitness, and health pressures ¹⁶⁴.

A study that examined the psychometric properties of the EMI revealed that its sub-scales were reliable (cf. Table 5). Moreover, both factor analytic and cross-validation work have consistently supported the underlying structure of the EMI (cf. Table 5) ¹⁶⁴. As well, the EMI has demonstrated adequate convergent validity as its sub-scales of “enjoyment” and “re-creation” were both significantly correlated ($r = 0.50 - 0.55$, $p < 0.001$) with the sub-scale of “interest/enjoyment” from the Intrinsic Motivation Inventory (IMI) (cf. Table 5) ¹⁶⁴. However, these results should be interpreted with caution since the people included in this study were all active and reported participating in exercise at least once a week for at least an hour each time.

Table 5: Psychometric Properties of the Exercise Motivation Inventory (EMI)

INSTRUMENT	RELIABILITY		Content	VALIDITY	
	Internal Consistency (N)	Test-retest (N)		Criterion-Related (N)	Construct (N)
<i>Exercise Motivation Inventory (EMI)</i> ¹⁶⁴	<u>Study 1 (249)</u> $\alpha = 0.63 - 0.92$	<u>Study 1 (249)</u> $r = 0.59 - 0.88$, $p < 0.05$	Examined by creators.	Not yet established	<u>Study 1 (249)</u> • <i>Convergent Validity</i> (i.e. with Enjoyment from IMI) → Enjoyment $r = 0.55$, $p < 0.001$ → Re-creation $r = 0.50$, $p < 0.001$ • <i>Factorial Validity</i> → 11 factor solution, accounting for 69% of the variability in responses. • <i>Cross-validation</i> → 12 factor solution, accounting for 69.4% of the variability in responses.

Since the EMI has yet to be tested as a predictor of exercise behaviour, its criterion-related validity has not been established. Further, since the EMI is based on the framework of the PIEQ its content suffers from many of the same limitations, such as its failure to incorporate barriers that inhibit exercise participation. However, even though the authors state that they examined the content validity of the EMI, comparing it to the conceptualization of motivation adopted for the present study, the EMI is quite narrow and also fails to include factors that diminish motivation for exercise behaviour.

Moreover, with respect to the factors represented within this instrument, an inherent weakness is that some of the sub-scales only partially represent the domain of interest. For instance, both the fitness and health-related sub-scales do not assess some of the most obvious fitness-related reasons for exercising, such as for becoming stronger or developing greater endurance. As well, the health-related sub-scale only focused on the avoidance of ill-health, neglecting potential positively oriented motives.

In addition to the shortcomings pertaining to the motivational factors of the EMI, its item composition is also problematic. Specifically, the wording of the items and the instructional sets are such that they are only applicable to individuals who currently exercise, where they fail to tap into the reasons that non-exercisers may have for taking up exercise. More so, not only are some of the items unrelated to the other items within their respective sub-scale, but they are also poorly worded, in that they are tapping into two aspects of the motivational concept they purport to be measuring.

Therefore, despite the EMI possessing adequate reliability and factorial validity, the lack of criterion-related validity and its narrow conceptualization of motivation limits its utility as an instrument of motivation for exercise behaviour.

3.4.2.6 Motivation for Physical Activity Measure (MPAM)

The Motivation for Physical Activity Measure (MPAM) was created by Frederick and Ryan to describe the most frequent motives for participating in sports and physical activity ¹³¹. This instrument is partially based on the extrinsic-intrinsic motivation dichotomy of the Cognitive Evaluative Theory (CET) (cf. *Section 5.2.2.1.2*) ¹⁴. The MPAM is a 23-item self-report questionnaire that consists of three factors labeled as interest/enjoyment, competence, and body-related. Theoretically, the motives of interest/enjoyment and competence reflect aspects of intrinsic motivation, whereas the body-related motive reflects an aspect of extrinsic motivation ¹³¹.

The MPAM is relatively new and has not been as extensively studied as some other instruments. Studies examining its psychometric properties revealed that it was both stable and internally consistent (cf. Table 6, pg. 28). As well, factor analytic work has consistently supported the underlying three factor structure of the MPAM (cf. Table 6, pg. 28) ¹³¹. Application of the MPAM to the physical activity domain has demonstrated that it possesses adequate criterion-related validity, where its factors have been shown to be related to both current and future physical activity participation. For instance, one study has shown that not only were all three factors significantly correlated with the frequency of physical activity participation ($r = 0.15 - 0.32$), but they were also related to the amount of energy expenditure ($r = 0.16 - 0.25$) (cf. Table 6, pg. 28) ¹³¹.

Some of the motivational components of the MPAM have also been shown to predict future exercise behaviour. For men, the body-related motive significantly differentiated between adherers and non-adherers (cf. Table 6, pg. 28) ⁹⁵.

In addition, for both men and women, the dimension of interest/enjoyment was significantly related to, and predictive of adherence to physical activity ($R^2 = 0.18 - 0.25$, $p < 0.05$) (cf. Table 6, pg. 28) ⁹⁵.

Table 6: Psychometric Properties of the Motivation for Physical Activity Measure (MPAM)

INSTRUMENT	RELIABILITY		Content	VALIDITY	
	Internal Consistency (N)	Test-retest (N)		Criterion-Related (N)	Construct (N)
<i>Motivation for Physical Activity Measure (MPAM)</i> 95,131	<u>Study 1 (150)</u> $\alpha = 0.87 - 0.92$ <u>Study 2 (376)</u> $\alpha = 0.90 - 0.91$	<u>Study 2 (376)</u> $r = 0.69 - 0.90$, $p < 0.05$	Examined by creators.	<u>Study 2 (376)</u> • <i>Criterion</i> = weekly participation → Competence, Enjoyment, & Body-related $r = 0.15 - 0.32$, $p < 0.01$ • <i>Criterion</i> = MET scores → Enjoyment, Competence & Body-related $r = 0.16 - 0.25$, $p < 0.01$ • <i>Criterion</i> = physical activity adherence → Males: Enjoyment $R^2 = 0.18$, $p < 0.05$ → Females: Enjoyment $r = 0.25$, $p < 0.05$	<u>Study 1 (150)</u> • <i>Factorial Validity</i> → 3 factor solution, accounting for 60% of the variability in responses. <u>Study 2 (376)</u> • <i>Factorial Validity</i> → 3 factor solution, accounting for 63% of the variability in responses.

Although the MPAM has demonstrated adequate reliability, as well as factorial and criterion-related validity, it only taps into a few facets of motivation and similar to the scales reviewed above its items do not adequately cover the domain of relevant factors of motivation. In addition, at the item-level, the MPAM contains items that are poorly worded, unrelated to other items within their respective sub-scale, and tapping into two different aspects of the motivational concept it purports to ascertain.

In light of these shortcomings the utility of the MPAM as a measure of motivation for physical activity may be somewhat limited.

3.4.2.7 Intrinsic Motivation Inventory (IMI)

The Intrinsic Motivation Inventory (IMI) is based on the Self-determination Theory (cf. *Section 5.2.2.1.3*)¹⁷⁹. It is a 27-item instrument that was developed by Ryan¹⁵⁷ to assess intrinsic motivation towards an activity¹⁷⁹. The principal components of intrinsic motivation examined in this questionnaire are interest-enjoyment, perceived competence, effort-importance, and pressure-tension^{34,157,165}.

Examination of the psychometric properties of the IMI in the competitive sports and leisure exercise settings has demonstrated that it is modestly reliable and possesses adequate factorial validity (cf. *Table 7*)^{179,180}.

Table 7: Psychometric Properties of the Intrinsic Motivation Inventory (IMI)

INSTRUMENT	RELIABILITY		Content	VALIDITY	
	Internal Consistency (N)	Test-retest (N)		Criterion-Related (N)	Construct (N)
<i>Intrinsic Motivation Inventory (IMI)</i> 34,179,180	<u>Study 1 (116)</u> $\alpha = 0.68 - 0.87$ <u>Study 2 (265)</u> $\alpha = 0.72 - 0.93$	<u>Study 1 (116)</u> $r \geq 0.80$	Examined by creators.	Not yet established	<u>Study 1 (116)</u> • <i>Confirmatory Factor Analysis</i> → Chi-square statistic (df) = 252.36 (101), $p < 0.05$ <u>Study 2 (265)</u> • <i>Confirmatory Factor Analysis</i> → Chi-square statistic (df) = 357.05 (179), $p < 0.05$

However, there is no evidence to date for its criterion-related validity. The few studies that have applied the IMI to exercise behaviour have focused on describing how other variables are related to the factors of the IMI, rather than directly examining the relationship between the IMI and exercise behaviour. For example, one study

demonstrated that highly efficacious participants differed from inefficacious participants in terms of their competence, enjoyment for exercise, amount of effort they expended, and the amount of tension they experienced ($F=6.24$, $p<0.001$) ¹⁷⁹.

Another study revealed that when participants with little experience in exercise received feedback, they were more competent about (19% increase), expended greater effort towards (8% increase), and reported greater enjoyment from (12% increase) their exercise participation, compared to when they received no feedback ³⁴. However, as mentioned above, there has been little research on how the factors of the IMI are directly related to leisure exercise behaviour.

Beyond the lack of evidence for the criterion-related validity, the IMI suffers from some other shortcomings. It only focuses on intrinsic motivation and as such, is unable to capture the process by which factors external to the person serve to motivate exercise behaviour. Further, the item composition of this instrument is problematic. In particular, the items within the IMI represent general beliefs and personal preferences, rather than capturing the motivational influence its respective factors exert on exercise behaviour. As well, the sub-scales contain an insufficient number of items to adequately represent the motivational domains of interest.

Thus, given that the criterion-related validity of the IMI is yet to be established, coupled with its limited conceptualization of motivation and item composition, the IMI cannot be considered to be an adequate measure of motivation for physical activity.

3.4.2.8 Activity Feeling Scale I and II (AFS-I, AFS-II)

The AFS-I was developed by Reeve (1986) to measure the four components of intrinsic motivation, labeled as perceived competence, self-determination, affiliation, and excitement ¹⁸¹. The AFS-II is identical to the AFS-I, except for the addition of one factor that measures tension experienced during the activity ¹⁸². This construct was included

because it is believed to be an emotional marker for internal factors that are antagonistic to intrinsic motivation ^{183,184}.

Examination of the psychometric properties of the AFS-II (cf. Table 8), revealed that although it possesses adequate reliability, its validity is less clear. Only one study to date has applied the AFS to exercise behaviour. The results of this study revealed that college students participating in a bowling program who maintained the activity were more competent ($F_{2,24}=3.54$, $p<0.05$), self-determined ($F_{2,85}=5.15$, $p<0.01$), excited ($F_{2,47}=9.78$, $p<0.01$), and experienced greater feelings of affiliation ($F_{2,22}=3.51$, $p<0.05$) than those who did not maintain the activity ¹³³. Although this study indicated that the factors of the AFS were related to exercise behaviour, further research is required before its criterion-related validity can be established.

Table 8: Psychometric Properties of the Activity Feeling Scale (AFS)

INSTRUMENT	RELIABILITY		Content	VALIDITY	
	Internal Consistency (N)	Test-retest (N)		Criterion-Related (N)	Construct (N)
Activity Feeling Scale (AFS) 133,181,182, 185	<u>Study 1 (161)</u> $\alpha \geq 0.80$ <u>Study 2 (47)</u> $\alpha = 0.81-0.83$	Not as yet examined.	Examined by researcher.	<u>Study 2 (47)</u> • Criterion = adherence to exercise program → Competence $F_{2,24}=3.54$, $p<0.05$ → Self-determination $F_{2,85}=5.15$, $p<0.01$, → Excitement $F_{2,47}=9.78$, $p<0.01$, → Affiliation $F_{2,22}=3.51$, $p<0.05$	<u>Study 3 (61)</u> • Factor analysis: → 4 factor solution, accounting for 69% of the variability in responses.

Another problem with the AFS is that its factors only reflect aspects of intrinsic motivation. The AFS fails to include the situational or environmental factors that enhance and/or diminish motivation. Consequently, the AFS cannot be considered a broad measure of motivation for exercise behaviour.

Further, the item composition of this instrument suffers from some shortcomings. Instead of capturing the motivational focus that its respective factors exert on exercise behaviour, its items reflect general beliefs about exercise, or personal preferences for a particular type of activity. More so, there appear to be an insufficient number of items to adequately represent the motivational concepts of interest.

3.4.2.9 Summary

The previous sub-sections have described instruments that have measured motivation for exercise behaviour or physical activity. These instruments differ in their process of development, conceptualization of motivation, and the factors included to represent motivation.

Examination of the psychometric properties of each scale has revealed that each possesses their own merits and weaknesses. The majority of instruments described have demonstrated adequate test-retest reliability and internal consistency. However, there is considerable variability in the evidence concerning their validity.

Beyond this, a fundamental problem shared by all of these instruments is that their content validity has been assessed in relation to a very narrow conceptualization of motivation. This thesis has adopted a much broader conceptualization, and from this perspective the content of these scales is inadequate. Many of them focus solely on intrinsic motivation and fail to include those factors that are external to the person that energize and direct exercise behaviour, as well as influence the likelihood of exercise participation. This is a significant limitation because a comprehensive measure of

motivation must address factors internal and external to the person because both are highly associated with motivation for physical activity/exercise ^{14,186}. According to Deci and Ryan, it is highly unlikely that people will participate in, and adhere to an exercise program purely for internal reasons (e.g. fun, enjoyment) or for external reasons (e.g. rewards) ²⁰⁵. McAuley and colleagues also state the importance of both aspects of motivation because although exercise can be initially adopted for external reasons (e.g. improving appearance), as time progresses and physical conditioning and skills improve the internal reason for exercising (e.g. enjoyment) become more salient ¹⁷⁹. Clearly, an instrument measuring motivation for physical activity or exercise must tap into both internal and external factors of motivation ^{1,187}.

Another problem common to the instruments reviewed above was that at the item level they possess shortcomings. Specifically, they represent more general beliefs or preferences, do not sufficiently represent the motivational domains of interest, are unrelated to other items within their respective sub-scale, tap into more than one aspect of the motivational concept they are measuring, and are limited in their generalizability to exercisers and non-exercisers.

Based on the problems and shortcomings identified at the item- and sub-scale level, coupled with the issues of how motivation is conceptualized, it appears that the existing instruments in the field were in need of extensive modifications. The particular revisions that were required entailed: broadening the operationalization of motivation; including a range of factors internal and external to the person; operationalizing the factors represented; expanding the domain represented by the motivational factors; combining sub-scales that are conceptually similar; and separating sub-scales that capture two conceptually distinct motivational factors; re-writing items so that they capture the motivational focus of physical activity, adequately represent the domain of interest, and tap only into one aspect of the motivational concept they represent.

However, the cumulative nature of these changes were such that they would have left very little of the existing instrument in tact, resulting in an entirely different instrument than that originally conceived by their respective creator(s). Thus, based on the nature and pervasiveness of the issues specific to the conceptualization and composition of the instruments in the field, it was felt that none could be considered adequate, and that their shortcomings could not be overcome. For these reasons, there appeared to be a need to create a robust measure of motivation conceptualized as a multi-dimensional construct.

3.5 Terminology Adopted for the Current Thesis

The terms adopted in this thesis to describe the key variables of interest were originally: regular vigorous physical activity (RVPA) and motivation for physical activity. Vigorous physical activity was defined as, “activities that make you sweat, breath harder, and feel your heart beat. This includes activities such as jogging, aerobics, and swimming” ⁷. It was considered regular if it was performed for at least 20 minutes, three to four times a week ^{11,12,40}.

Motivation was originally conceptualized as a multi-dimensional latent construct that energizes and directs physical activity participation, and was viewed as one of many determinants of physical activity. The dimensions of motivation are represented by factors both internal and external to the person that serves to enhance or diminish the likelihood of participation ^{*}.

^{*} The terms determinants and factors can be distinguished from each other in terms of the level at which they operate to influence physical activity. For this thesis, factors are considered a subset of determinants. Some determinants of physical activity are from the external environment, while others are internal to the person. The focus of this thesis is those determinant(s) and factor(s) that are motivational in nature (cf. *Section 5.2.1, Figure 2*, pg. 45).

However, as described in *Section 7.3.2.1*, respondents were not interpreting the term physical activity as it was intended. Consequently, it was necessary to redefine the terms used for this thesis. The term regular vigorous physical activity was replaced by the term regular vigorous exercise (RVE). The definition adopted for vigorous exercise was “activities that are done hard enough to make your heart rate and breathing increase by a large amount”⁸. Once again, it was considered regular if it was performed for at least 20 minutes, three to four times a week^{11,12,40}. Since, the behavioural referent changed the definition of motivation also had to be slightly altered to capture exercise behaviour instead of physical activity. Thus, it was redefined with respect to exercise behaviour as the behavioural referent of interest, instead of physical activity.

4.0 THESIS OVERVIEW

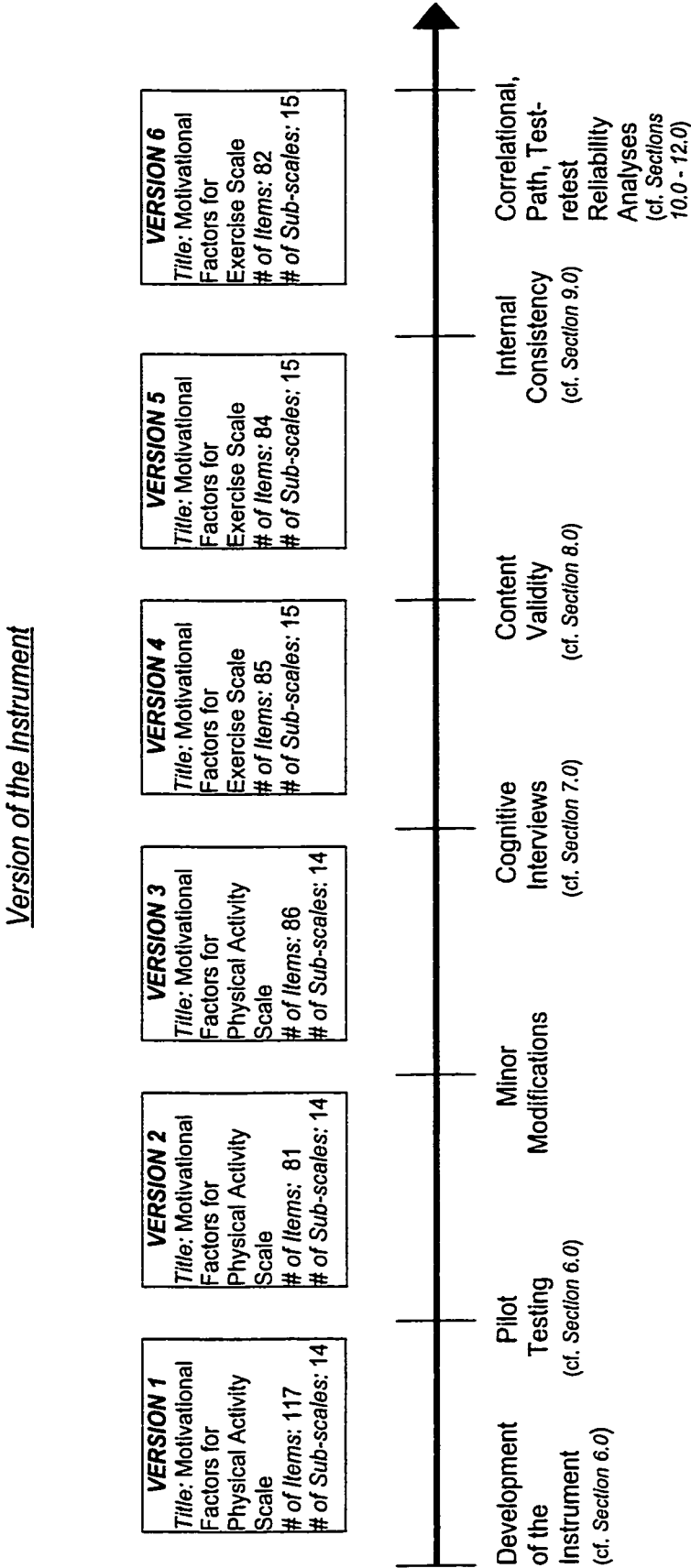
The goal of this study was to develop a scale measuring motivational factors for physical activity* and conduct preliminary testing of its psychometric properties. The development and testing of this instrument was guided by a series of research objectives that are organized into discrete chapters. In each chapter, the research objective and the methods used to address it, as well as a discussion of the findings is described. The decision to refine the operationalization and/or item structure of a sub-scale was made after examining the pattern of results across all the analyses in this study. The thesis concludes with a chapter that integrates the findings across the objectives with respect to the functioning of the sub-scales and the refinements to the instrument. The study objectives are summarized in the sub-sections below. An overview of the study outlining the activities performed and the versions of the instrument employed is provided in Figure 1 (cf. pg. 37).

4.1 Objective 1 – Identification of Presumed Motivational Factors

The first objective of this study was to examine the literature in order to identify the theoretically and/or empirically supported factors, presumed to be motivational in nature, that should be represented in a measure of motivational factors for regular vigorous physical activity (cf. *Section 5.0*). Various disciplines (e.g. epidemiology, psychology, physical education, recreation/leisure) were explored in order to identify the

* This instrument was originally conceived as a measure of motivational factors for physical activity, labeled as the Motivational Factors for Physical Activity Scale (MFPAS). However, as described in *Section 7.3.2.1*, the term physical activity was redefined because participants were not interpreting it as it was intended. Consequently, the term exercise replaced physical activity and as such, the instrument became a measure of motivational factors for exercise behaviour, labeled as the Motivational Factors for Exercise Scale (MFES). This did not affect either the content or the conceptualization of this instrument since the research from which the motivational concepts were derived had studied activities that were consistent with the definition of exercise adopted for this study.

Figure 1: Outline of the Thesis – Versions of the Instrument Used and Activities Performed



presumed motivational factors from the literature that direct and energize physical activity participation, as well as influence the likelihood of its occurrence.

To be selected in this study, the factors identified from the literature had to be statistically associated with physical activity and had to be consistent with the conceptualization of motivation adopted for this study. Comparing their operational definitions and merging those that were alike reduced the conceptual similarity between the selected factors. This yielded a core group of presumed motivational factors that represented the most significant concepts to date from the literature.

4.2 Objective 2 -- Development and Pre-testing of the Instrument

The second objective was to draft an instrument that measured the presumed motivational factors identified from the literature, as well as to pre-test the instrument in order to assess how it was performing (i.e. distribution of item responses, inter-item correlation, homogeneity of sub-scales).

The development of the Motivational Factors for Physical Activity (MFPAS) began after the presumed motivational factors had been identified from the literature and operationally defined. The items of the MFPAS were either newly created to reflect the operational definitions of these factors or were extracted from existing instruments and re-written (i.e. modified), this yielded *Version 1* of the MFPAS (cf. Figure 1, pg. 37).

The pre-testing of the MFPAS was conducted on a non-probability sample of participants who were recruited from several private and governmental organizations in Toronto. At these sites, participants were informed that the purpose of the questionnaire was to learn about their thoughts and feelings about being active. They were unaware that motivational factors for physical activity were being ascertained. Participants received *Version 1* of the MFPAS (cf. Figure 1, pg. 37), and upon completing it were asked to provide feedback on its content and structure. The data

collected from this pre-testing phase was subjected to various analyses (i.e. frequency distributions, Cronbach α) to determine how individual items and the entire sub-scales were functioning. At the item level, an item was retained in the MFPAS if it was free of a “floor” or “ceiling” effect, and demonstrated modest inter-correlation (i.e. $r \geq 0.30$) with the other items in the sub-scale. However, at the sub-scale level, a sub-scale was retained if it was characterized by a sufficient degree of internal consistency (i.e. Cronbach $\alpha \geq 0.70$).

4.3 Objective 3 -- Cognitive Interviews

The third objective of this study was to conduct additional testing of the MFPAS to gain insight into how its items and instruction sets were being interpreted, and to modify the items and/or instructional sets in order to ensure comprehension. To ensure that the MFPAS was clear and comprehensible, as well as to examine the recall and response strategies required of the instrument, one-on-one cognitive interviews were conducted at a municipal recreation centre. Participants involved in the cognitive interview phase of this study completed *Version 3* of the MFPAS (cf. [Figure 1](#), pg. 37).

These interviews were used to identify ambiguous or unfamiliar terms, as well as isolate instruction sets and items that required a complex recall strategy or were difficult to understand. The results obtained from this process were used to make informed decisions about the modifications required to the MFPAS.

4.4 Objective 4 -- Content Validity

The fourth objective of this study was to determine whether the Motivational Factors for Exercise Scale (MFES)* captured concepts that represent factors of motivation for exercise behaviour. This objective addressed what is generally referred to as content validity. Two raters assessed the “content” of *Version 4* of the MFES (cf. [Figure 1](#), pg. 37). Each rater was asked via a series of questions whether: the factors captured in the MFES reflected an aspect of motivation for exercise behaviour; if the items within each sub-scale captured an aspect of the concept they were proposed to represent; and if there was an area within the sub-scales that had not been adequately ascertained by its items. The consistency between raters was used to determine which items and factors were to be retained in the MFES. Specifically, a factor or item was retained only if there was 100% agreement between the raters, where both raters felt that a factor represented an aspect of motivation for exercise behaviour and that an item reflected an aspect of the motivational concept its sub-scale was purported to be measuring.

4.5 Objective 5 -- Internal Consistency

The fifth objective of this study examined one aspect of the reliability of the MFES, specifically whether its sub-scales were characterized by an adequate level of internal consistency.

This aspect of reliability was examined on a non-probability sample of participants who were recruited from a municipal recreation centre and its affiliated sites, as well as from worksites in the Regional Municipality of Ottawa-Carleton (RMOC).

* Based on the results obtained from the cognitive interviews (cf. *Objective 3, Section 7.3.2.1*), the behavioural referent was changed from physical activity to exercise. As such, the Motivational Factors for Physical Activity Scale (MFPAS) became the Motivational Factors for Exercise Scale (MFES).

Participants involved in this phase of the study completed *Version 5* of the MFES (cf. Figure 1, pg. 37).

Given that the MFES was designed to be a multi-factorial instrument and that its items were scored on a five-point Likert-type scale, sub-scale specific estimates of internal consistency were calculated via the Cronbach α statistic. In order to provide greater evidence for the internal consistency of the sub-scales of the MFES, the Cronbach α 's were calculated twice. Preliminary assessment of the internal consistency of the sub-scales was performed on 50% of respondents who had been randomly selected and formed the group *Fall Sample A*. After the necessary refinements were made to the MFES, the internal consistency was re-calculated using the remaining 50% of the sample that formed the group *Fall Sample B*. A sub-scale was considered homogeneous if its Cronbach α was ≥ 0.70 .

4.6 Objective 6 – Criterion-related Validity

The sixth objective of this study was to determine the criterion-related validity of the sub-scales of the MFES by examining the manner in which its sub-scale were related to participants' level of energy expenditure and intention to exercise. This aspect of validity was examined using the data obtained from the sample described in the previous objective (cf. *Objective 5*). To address this objective *Version 6* of the MFES (cf. Figure 1, pg. 37) was utilized, as well as the Physical Activities Questionnaire (PAQ) and the Demographic Questionnaire. Pearson correlation was used to determine the association between the sub-scales of the MFES and current energy expenditure, as well as between the sub-scales and the intention to exercise (i.e. *coefficient of validity*). The magnitude of the association between the sub-scales and energy expenditure, as well as between the sub-scales and intention were interpreted using a pre-determined classification scheme.

4.7 Objective 7 -- Construct Validity

The seventh objective for this study was to obtain preliminary evidence bearing on the construct validity of the MFES by examining whether the nature and magnitude of the direct and indirect relationships between the sub-scales, level of energy expenditure, and intention to exercise suggests that the MFES sub-scales reflect factors of motivation. The purpose of this objective was to provide evidence to address the question of whether the sub-scales were functioning simply as predictors of exercise or whether they represented factors of motivation.

To determine the nature of the relationship between the sub-scales of the MFES, energy expenditure and intention, path analysis was performed. The data used to address this objective, as well as the instruments employed for this analysis were the same as described in the previous objective (cf. *Objective 5*).

4.8 Objective 8 -- Test-retest Reliability

The last objective addressed in this study was to determine whether each sub-scale of the MFES was characterized by an adequate degree of test-retest reliability. This aspect of reliability was examined on a non-probability sample of participants that had been recruited from the National Research Council (NRC).

The test and retest phases of this study were separated by a two-week interval, where both stages of this study were conducted via electronic mail. Since the MFES is proposed to be a multi-factorial instrument, sub-scale specific reliability coefficients were estimated via Pearson correlations. The analysis for this portion of the study utilized *Version 6* of the MFES (cf. Figure 1, pg. 37), as well as the Physical Activities Questionnaire (PAQ) and the Demographic Questionnaire.

4.9 Ethical Review

Prior to beginning the data collection for this study, the Vice-Dean (Research) indicated that formal ethical review of the project was not required. The ethical issues considered for this study concerned how much information respondents needed in order to be able to provide informed consent to participate. Participants were fully informed as to the requirements of their participation and the nature of the questions they would be asked, and were free to elect to participate or not, or withdraw at any time (Appendix 5).

5.0 OBJECTIVE 1 – IDENTIFICATION OF PRESUMED MOTIVATIONAL FACTORS

- ◆ To review the literature in order to identify the theoretically and/or empirically supported factors that should be represented in a measure of motivational factors for regular vigorous physical activity.

5.1 Research Question

The research question for this objective was:

- ◆ Which of the factors that have been related to physical activity are consistent with the definition of motivation used in this study?

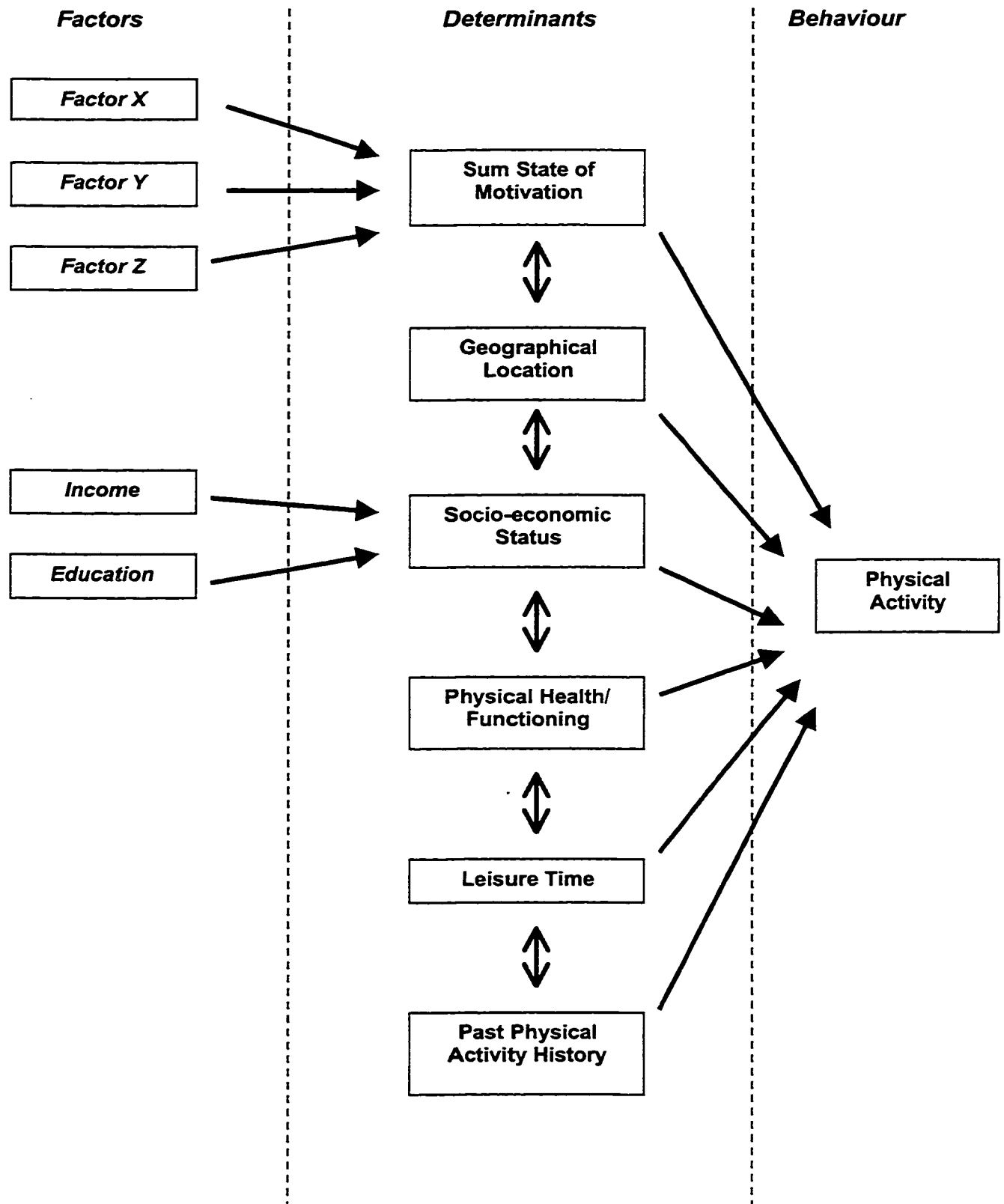
5.2 Procedure

5.2.1 Underlying Framework

The basic framework guiding this study was that motivation represents one of a number of determinants of physical activity that serves to enable or prevent physical activity from occurring. The determinants of physical activity are associated with each other to varying degrees, collectively exerting an effect on actual behaviour. Further, some of the determinants of physical activity, such as motivation, are composed of a number of factors. These factors can be classified as being either internal to or external to the person.

The framework guiding this thesis, as well as some examples of the determinants of physical activity is provided in Figure 2 (cf. pg. 45).

Figure 2: A Schematic of the Underlying Framework Guiding the Study



5.2.2 Identifying Factors Related to Physical Activity

The literature was reviewed in order to determine the factors that should be included in a multi-dimensional measure of motivational factors for physical activity. Since the behaviour of interest for this thesis was physical activity, the literature review only pertains to this particular behaviour. Consequently, approaches to the study of motivation for other behaviours are not discussed in this thesis.

Identifying the literature describing the factors related to physical activity began by searching "Medline (OVID version)" and "Psych Info". The appropriate literature between 1968 and 1998 was identified using a variety of text words and subject headings such as: "physical activity", "exercise", "adoption", "adherence", "initiation", "maintenance", "motivation", "intrinsic motivation", "extrinsic motivation", "drive", "incentives", "goals", "self-motivation", "aspirations", "persistence", "model", "theory", "health behaviour", "theoretical models", and "behavioural models".

The literature that was identified crossed a variety of disciplines, such as epidemiology, exercise sciences, recreation/leisure, and psychology. Surveying studies across these disciplines led to the identification of a wide range of factors.

The research in these disciplines has been based on several theories describing the factors relevant to physical activity and exercise behaviour^{22,117,151,163,188-194}. At the same time, other research has also been conducted independent of any theoretical framework. Hence, the literature examined in this study was either theoretically based (e.g. from theories of motivation or health behaviour) or non-theory based and purely empirically derived *.

* The wording in this field is inconsistent and can be confusing. To ensure accuracy, the studies described in this chapter are those which employed a behavioural referent that was consistent with the definition of vigorous physical activity adopted for this thesis. However, for ease and convenience the terms used to describe the behaviour of interest are those that were used in the cited studies themselves, so the reader should understand that the terms exercise and physical activity have been used synonymously in this chapter and are consistent with their use in the studies cited.

This section first describes the relevant theories of motivation, and then the determinants of physical activity. Following this, it describes how each of these approaches has been used to identify the factors that are associated with motivation for physical activity.

5.2.2.1 Factors Derived from the Theories of Motivation

This sub-section focuses on those theories that have directly examined the relationship between various factors and motivation. These theories include variables that are purported to influence motivation by increasing or decreasing it.

5.2.2.1.1 The Personal Investment Theory (PIT)

The Personal Investment Theory (PIT) was developed by Maehr and Braskamp to describe intrinsically motivating factors ^{151,162}. According to the PIT, the meaning an individual attaches to a situation is what determines their level of commitment, and is believed to be the source of motivation for the activity ^{151,162,164}. The meaning that is attached to a situation is determined by three interrelated facets:

- I. Personal incentives for performing the behaviour or the goals that have been set ^{151,164}. Incentives can be intrinsic to the person (e.g. skill development, outperforming others), extrinsic to the person (e.g. social recognition, approval), social in nature (e.g. affiliation with others), or health related (e.g. fitness, stress reduction) ¹⁹².
- II. Sense of self, which includes: self-competence (one's judgment of their ability to successfully perform the behaviour); self-reliance (a sense of personal control and causation) ^{151,195,196}; goal directedness (describes one's propensity towards goal-setting and organizing their behaviour to attain their

goals); and social identity (perceptions of the association with specific groups of people who are considered important) ^{151,164,192}.

III. Perceived options, which represent the perceived availability and acceptability of alternatives and/or opportunities in a specific situation ^{151,161,164,192}.

The PIT has predicted leisure activity levels and exercise behaviour for both younger and older adults ^{151,160,162,163,185,191,197,198,199}. However, studies indicate that the contribution of these motivational factors in explaining exercise behaviour is variable ^{151,162,192}. In one study, the only factors that significantly differentiated between participation levels were task incentives ($F=20.0$, $p=0.00$), competence ($F=26.2$, $p=0.00$), goal-directedness ($F=19.56$, $p=0.00$), self-reliance ($F=4.2$, $p=0.02$), and barriers ($F=9.34$, $p=0.00$), correctly classifying 66% of subjects ¹⁹². Surprisingly, none of the other factors, especially those of health/extrinsic incentives or social expectations, were related to the level of participation ¹⁹². Conversely, in another study health (e.g. mental benefit, appearance, weight management, fitness) and extrinsic incentives (e.g. social recognition) were important ^{151,162}, where they significantly differentiated between the activity levels of structured exercise classes ($p<0.02$) ¹⁶².

It appears that the motivational factors of the PIT that are related to exercise behaviour are those of personal incentives (i.e. health and extrinsic incentives), perceived competence, goal-directedness, self-reliance, and perceived options (i.e. barriers).

5.2.2.1.2 The Cognitive Evaluative Theory (CET)

Deci and Ryan developed the Cognitive Evaluative Theory (CET) to provide a theoretical framework for describing intrinsic motivation ^{14,37,121,200,201}. According to the CET, intrinsic motivation is defined as the psychological need for competence and self-

determination ^{23,201}. The former refers to the individual's assessment of how effectively they have performed the behaviour ^{14,183}, while the latter refers to the degree to which the individual perceives they have choice and control over their behaviour. The CET posits that the level of intrinsic motivation is directly proportional to changes in the perception of competence and self-determination ^{14,23,188,200,201}.

External factors (e.g. feedback, rewards, etc.) can function to either increase or decrease an individual's perception of competence and self-determination, in turn influencing their level of intrinsic motivation and behaviour ^{31,193,202}. According to the CET, there are two mechanisms by which external factors are believed to exert their effect on motivation, either through their informational characteristics or their controlling aspects ^{31,193,201}. Informational characteristics provide the person with feedback about their performance ^{14,156,202,203}. If the informational aspect of an external event was positive, intrinsic motivation would increase, whereas if it was negative, intrinsic motivation would decrease ^{32,182,201,202}. On the other hand, controlling aspects of the environment increase the external pressure an individual feels towards the activity and reduces their perceptions of self-determination ^{14,201}. When feelings of self-determination are reduced the behaviour becomes attributed to the external event rather than to the individual ^{32,37,156}. The shift in the locus of causality from internal to external causes the individual's motivation to decrease ^{32,201}. Although external events can have both a controlling and informational component to them, most often one is more salient than the other and as such, only influences motivation in one direction ³². Thus, the CET proposes that intrinsic motivation will fluctuate depending on whether external events (e.g. feedback, rewards, etc.) function to increase or decrease perceptions of competence and self-determination.

The CET has had a significant impact on research in the areas of motivation for sports and exercise ^{188,190,203}. Several investigators have examined the effect that the motivational factors of competence and self-determination have had on exercise participation ^{34,131,188,193}. For example, Frederick and Ryan found that perceived competence was positively correlated with the intensity, duration, and frequency of participation ($r = 0.17$ to 0.23 , $p < 0.01$) ¹³¹. In another study, the factor of self-determination was manipulated, where women enrolled in a fitness program were either given a choice in their activity, or were told that their program had been developed without considering their preferences (i.e. activity type). The results revealed that women who felt they had no control over their exercise behaviour had a much lower attendance than women who were told that their preferences had been considered ¹³².

Extensive work has also been conducted on the influence that external events (e.g. rewards) have on perceptions of competence and self-determination ^{132,201}. There is support for the notion that controlling an individual's exercise participation causes feelings of tension and frustration, in turn decreasing their intrinsic motivation ^{132,205}. Likewise, athletes who felt compelled to prove their competence to themselves by achieving external rewards experienced greater pressure and tension, which in turn decreased their intrinsic motivation level and performance ^{157,193}.

On the other hand, providing individuals with positive feedback about their performance has been shown to increase feelings of competence ^{34,193}. For instance, several studies have demonstrated that individuals whose participation was regulated through informational characteristics (e.g. receiving positive feedback or praise) reported greater feelings of choice autonomy and competence, which increased their intrinsic motivation level ^{23,34}. Research has also shown the importance of feedback, especially for those with little experience with physical activity ³⁴. For these individuals,

providing informational feedback increased their competence level by 19% compared to when they did not receive information ³⁴.

Overall, the results described above provide empirical support for the relationship between the motivational factors of the CET and behaviour. Thus, a person will be more intrinsically motivated to be active when they feel competent about, and in control of their behaviour ^{14,32,158,206}.

5.2.2.1.3 The Self-determination Theory (SDT)

The SDT is very similar to the CET in that it proposes that intrinsic motivation arises from the psychological needs of self-determination and competence ^{14,18,33,37,133,183,203,207,208}. However, the SDT adds another component of intrinsic motivation, labeled as relatedness. It reflects the desire to form close emotional bonds with, to be attached to, and be involved in warm relationships with people ^{133,183,209,210}. The SDT has been modified by Reeve who added the motivational component of excitement, which is the extent to which a person feels alive, active, and not bored during the activity, and has also modified the terminology using the term affiliativeness instead of relatedness ^{133,211}. According to Reeve, affiliation can serve to adjust the level (e.g. increase or decrease) of intrinsic motivation, where individuals who feel close ties with others are more likely to be intrinsically motivated as compared to those who do not ¹³³. Thus, according to the SDT and its modified version (Reeve), the motivational components that influence behaviour are competence, self-determination, relatedness (affiliation), and excitement.

Beyond the findings from the studies on the relationship between exercise behaviour and the motivational components of competence and self-determination (i.e. the CET) (cf. *Section 5.2.2.1.2*), research also suggests that activities that provide opportunities for affiliation are more intrinsically motivating compared those that do not

^{138,212-214}. It appears that interacting with people is one of the most important reasons cited for leisure-time sports and physical activity involvement ^{134-139,215}. As well, research has shown that affiliation influences adherence ^{25,130}, as there appears to be a positive relationship between adherence to exercise programs and the identification with those who are active ^{151,216-218}.

However, the need for affiliation appears to be specific to certain groups of adults ²⁵. The Campbell Survey of Well Being reported that females (35%) more often than males (24%) rated socializing as an important aspect of their leisure time involvement ⁷². Likewise, in a study by Biddle and Bailey ²¹⁹, as well as the Canada Fitness Survey, the social aspects of an activity were more important for women than for men ^{25,131}. Studies have also shown that older adults are more likely to be active to satisfy their need for companionship and affiliation than are younger adults ^{18,133,163,220}. Thus, it appears that having social contacts (i.e. satisfying the need for affiliation) encourages more women and older adults to be active ²⁵.

There is also evidence that the motivational component of excitement also plays an important role in influencing physical activity participation. Several correlational and experimental studies have demonstrated that excitement serves both as a correlate and as an antecedent to changes in intrinsic motivation ^{182,185,211,221}. Further, Reeve demonstrated that individuals who maintained a bowling activity were not only more excited towards it than those who did not, but they were also more intrinsically motivated ($F_{2,47}=9.78, p<-.01$) ¹³³.

In summary, based on the results from these studies it appears as though all of the motivational components of the SDT are relevant to being active.

5.2.2.1.4 The Goal-setting Theory (GST)

According to Lock and Latham's Goal Setting Theory (GST) ²²², motivation is augmented when people have goals because behaviour is consciously regulated by goals ^{18,121}. The GST defines a goal as what the individual is consciously striving to accomplish or attain ¹¹⁷.

Goal-setting functions as a motivational factor because it focuses and directs the activity, mobilizes the amount of effort expended, lends to greater persistence, and promotes the development of the appropriate strategies to enhance performance ^{117,176,194,223}. However, goal-setting alone is not sufficient, rather it is the combination of the individual's commitment to the goal and their tendency to set goals. In this context, commitment refers to whether the person has accepted the goal or not ^{117,223}.

Goals are believed to operate through an internal comparison process where the individual evaluates their on-going performance against an internal standard ¹¹⁷. It is the specific qualities of the goal, such as their specificity, level, and proximity that create standards of adequacy and work towards obtaining their goals ^{224,225}. For instance, Locke and colleagues assert that short-term goals can be used to attain long-term goals, and that challenging goals produce better performance than easy goals ²²³. However, if the goals are unrealistic and lead to continual failure then one's motivation towards the task will decrease ^{14,18,25,117,214,226,227}.

The GST has only recently been applied to sports and exercise and the evidence gathered to date has been equivocal ^{117,228}. Several studies have examined the effect that rewards and feedback have on exercise behaviour ²²⁸⁻²³¹. For example, the results obtained from one experiment revealed that subjects who received positive feedback not only found the activity more interesting and enjoyable ($F_{1,27}=12.75$, $p<0.001$), but were also more intrinsically motivated than those who received negative feedback ($F_{1,72}=7.72$, $p<0.007$) ²³⁰. Similarly, the results obtained from a study that tested goal

and feedback conditions on a basketball test found that the group which received feedback significantly out-performed the group that did not ($p < 0.05$)²²⁹.

There are also several studies that provide support for the GST that have examined how goal conditions affect performance, independent of feedback^{24,232-235}. These experiments have shown differences in the performance between groups that varied on goal specificity and proximity for archery^{24,232-234,236}, sit-ups, swimming^{232,237} and bowling tests²³⁵. One such study, examined the effect of goal specificity on weight training and found that the assigned goal group performed significantly better than other groups ($F_{2,242} = 54.11$, $p < 0.0001$)²⁴.

In contrast, there are a few studies that have manipulated goal attainability and proximity and observed no significant difference between goal groups on exercise behaviour^{228,238,239}. Although the results reveal that the goal condition did not affect performance per se, it was the subject's expectations of their future performance that was highly associated with their actual performance ($r = 0.72$ to 0.92 , $p < 0.001$), accounting for between 70% to 85% of the variance^{228,238}.

The findings indicate that there is some inconsistency in the findings of research driven by the GST¹¹⁷. A possible reason for this is that regular exercise and/or fitness programs do not naturally lend themselves to performance goals because there are no clear measures of success or standards of comparison^{225,240}. Another reason, and perhaps more plausible, is that in the exercise domain subjects in the control group were spontaneously setting their own goals in addition to the ones assigned to them^{117,228,239}. This was found to be true, where in the studies described above, investigators report that between 34% and 88% of subjects in the control group were spontaneously setting their own goal(s)^{24,228,230,233,239}. This indicates that the performance goals set by subjects significantly influenced their participation.

Although regular exercise may not naturally lend itself to goal-setting, there is evidence that goal-setting tendencies, feedback, and rewards are components in the regulation of this behaviour and also that they are important factors of motivation.

5.2.2.1.5 Summary of the Theories of Motivation

Based on the results obtained from the studies that have applied these theories of motivation to both physical activity and exercise behaviour, it is apparent that not all the motivational factors influence participation. The factors from each theory of motivation that appear able to influence physical activity were:

⇒ *From the Personal Investment Theory (PIT):*

- Personal incentives (i.e. health and extrinsic)
- Self-reliance
- Perceived options (i.e. barriers)
- Competence
- Goal-directedness

⇒ *From the Cognitive Evaluative Theory (CET):*

- Competence
- Self-determination

⇒ *From the Self-determination Theory (SDT) and its modified version:*

- Competence
- Affiliation/relatedness
- Self-determination
- Excitement

⇒ *From the Goal-setting Theory (GST):*

- Goal-setting
- Rewards
- Feedback

These factors are likely to represent aspects of motivation because they have been related to the regulation of physical activity. Not only were they shown to influence the likelihood of individuals being active, but they are also theoretically plausible explanations as to why and how each is involved in directing and energizing participation.

5.2.2.2 Factors Related to Physical Activity

In addition to studies based on theories of motivation, many investigators have attempted to identify factors that are predictors and/or correlates of physical activity. There have been two approaches to the research in this area. The first, and most widely utilized, has evaluated the explanatory power of different constructs drawn from theories of health behaviour (as distinct from the theories of motivation) ^{70,93,109,126,241,242}. The second approach has been to identify factors associated with physical activity using measures that have not been drawn from a particular theory. Although this latter approach method has been used less frequently, several important factors have been rationally conceived or elicited through qualitative methods ^{8,28,42,50,69,73,243,131,164,175,176,242-249}.

Regardless of the approach used, in this type of research there is often an implicit assumption that some process of motivation is involved when an individual participates in physical activity. Although in these lines of research motivation is not measured directly, there is an implicit inference that particular variables which influence physical activity represent factors of motivation, influence the level of motivation, and the likelihood the behaviour(s) will be performed ^{14,33,70,180,244,250,251,252-256}.

For these reasons, it was anticipated that this body of evidence might contain other variables that could be considered to be factors of motivation.

5.2.2.2.1 Factors Derived from the Theories of Health Behaviour

All the theories in this sub-section are based on the social-cognitive paradigm. This assumes that people are capable of self-reflection and regulation, both of which are necessary in order to actively influence the environment instead of passively responding to it ^{117,249}.

These models belong to the family of expectancy-value theories, which assume that people will initiate a behaviour that will lead to desirable consequences ^{10,257}.

5.2.2.2.1.1 The Theories of Reasoned Action and Planned Behaviour (TRA/TPB)

The Theory of Reasoned Action (TRA), developed by Fishbein and Ajzen, posits that a person's behaviour is primarily determined by their intention ^{1,256,258,259}. This in turn is influenced by their: attitude towards the behaviour, which is formulated by combining the perceived importance of, and consequence(s) from performing the behaviour ^{1,20,116,140,256,259}; and subjective norms, which are perceptions of the expectations held by significant others, and the individual's desire to comply with them ^{1,73,116,140,250,251,256,258,259}.

The Theory of Planned Behaviour (TPB) is an extension of the TRA and builds on it by adding the construct of perceived behavioural control. This variable was included in order to capture the resources that are required for the adoption of the behaviour ^{1,258}. A concept that is somewhat similar to the construct of perceived behavioural control, but that is not to be mistaken with it is that of self-determination from the Self-determination Theory (cf. *Section 5.2.2.1.3*). Although these two variables are closely related, their conceptual divergence arises from the fact that self-determination focuses on the choice(s) behind enacting a behaviour, whereas behavioural control taps into the perceived control an individual feels they have over the behaviour.

The TRA and TPB are perhaps the most widely applied theories in the field of exercise behaviour. Of the variables proposed by these theories, intention has received the most attention. Although research indicates that intention significantly predicts exercise behaviour ^{46,58,70,111,114,115,118,258,260-266}, there is only one study that has demonstrated a strong relationship between them ($R^2 = 0.67$) ¹¹⁵. The majority of research has shown that intention accounts for a small to moderate amount of the total variance in exercise behaviour ($R^2 = 0.09-0.46$) (cf. [Appendix 1](#)) ^{111,114,118,241,258,261-266}.

Regarding the other variables, research has shown that attitude was significantly related to, and influenced exercise participation, while subjective norm did not. Specifically, attitude is a stronger predictor of exercise than subjective norm, where it has been shown to explain between 5% to 67% of the variance in exercise behaviour (cf. [Appendix 1](#)) ^{1,27,46,70,111-116,260,262,266}. As well, perceived behavioural control has been found to be predictive of exercise behaviour (cf. [Appendix 1](#)) ^{70,111,112}, where its inclusion into the model can explain an additional 4% to 27% of the variance in exercise behaviour, beyond the contribution of attitude and subjective norm ^{46,111-113,117,126,260,267,268}.

Although the constructs of intention, attitude, and behavioural control appear to be relevant to exercise behaviour, only attitude is believed to be an important factor of motivation for exercise behaviour ^{69,240}. The variable intention cannot be considered a factor of motivation because it is a proximal determinant of behaviour that is involved in the mechanism by which motivation is transformed into action ^{1,116,248,256,258,269}. Further, the variable perceived behavioural control cannot be viewed as a motivational factor because it does not capture the process by which exercise behaviour is influenced, rather it describes the static resources that are required for the behaviour.

As for the relationship between attitude and motivation, this has typically been inferred by observing differences between adherers and non-adherers to exercise programs ^{69,240}. One study found that participants in an exercise program who were told

that athletic coordination was mostly determined by genetics were less motivated compared to those who were told that athletic coordination could be improved with practice ($F_{1,45}=8.91, p<.006$)²⁴⁰. Another study demonstrated that there were significant differences in the attitudes of adherers and non-adherers, where non-adherers believed that more effort was required to be active ($F_{1,126}=13.16, p=0.001$)⁵². Furthermore, research has shown that the more positive an individual's attitude is towards exercise behaviour, the greater their commitment towards it^{150,270,271}.

5.2.2.2.1.2 The Social Cognitive Theory (SCT)

According to Bandura's Social Cognitive theory (SCT)²⁵², behaviour is determined by three variables^{1,250,266,272}. The first is self-efficacy expectancy, which is a person's judgment of their ability to accomplish a particular behaviour^{1,70,180,252,258,273-275}. The greater the confidence an individual has in their abilities, the greater the likelihood they will perform the behaviour^{258,275}, even in the presence of barriers^{12,33,180,244,252,256,258,266,274}.

The second variable from the SCT is outcome expectancy which refers to beliefs that a specific behaviour and course of action will lead to a desired benefit or outcome^{1,18,252,256,266}. The last factor from the SCT is outcome value, which is the subjective importance placed on the outcome^{1,33,36,58,70,180,250,252,256,258}. An individual will engage in a behaviour if they are confident in their abilities, believe that performing it will lead to desired outcomes, and place importance on the outcomes.

Numerous studies have shown that these variables predict exercise behaviour across both structured and unstructured programs^{4,46,70,98,99,124,125,180,241,266,274}. Collectively, they explain between 16% to 46% of the variance in exercise behaviour^{70,266}, and account for 16% of the variance in the frequency of weekly exercise participation (cf. Appendix 2)^{63,231,263}.

The most widely studied variables have been those of self-efficacy and outcome-expectancy. Both have been shown to be highly correlated with current exercise behaviour^{100,253,277,278}. Several cross-sectional studies have also demonstrated that both self-efficacy and outcome-expectancy are predictive of an individual's intention to exercise^{58,97-99,114,115,253,256,261}, accounting for between 16% and 26% of the variance respectively (cf. Appendix 2)²⁴¹.

Regarding self-efficacy, it represents a factor for which there is overwhelming and generalizable evidence of a positive relationship with exercise behaviour^{1,46,123,159,243,245,253,279}. For instance, self-efficacy not only differentiates between an individual who has the ability to, and does not have the ability to begin an exercise program ($F_{1,144}=6.27$, $p<0.02$)²⁴¹, but it also predicts 25% of the variance in exercise behaviour for those beginning an exercise program (cf. Appendix 2)²⁷⁴.

Self-efficacy has also been shown to be predictive of future exercise behaviour^{6,7,42,58,70,85,99,113,124-129,266}. It differentiates between those who are able to continue their participation over time and those who are not ($F_{1,144}=4.87$, $p<0.05$)²⁴¹, as well as predict 42% of the variance in exercise behaviour for those adhering to an exercise program (cf. Appendix 2)²⁷⁴.

In addition to self-efficacy, the outcome(s) expected from the behaviour are also thought to serve as a source of motivation for the activity²⁶⁶. Studies have found that for men^{162,280} and college students¹³⁹, the outcomes that motivated exercise participation were those related to fitness and health, whereas for women the expected improvements in body-image and mental-health related benefits motivated participation^{162,175}.

The SCT also posits that collectively these factors can influence motivation when a person sets a goal, evaluates their performance against an internal standard or goal^{33,70,180,250,252,253,266}. This self-evaluative process energizes the person to perform until they

reach their goal ^{250,266,254,281}. Studies have demonstrated that dissatisfaction with one's performance increases motivation, especially when the individual still maintains the belief that the standard they are aiming for is attainable ²⁵⁴.

5.2.2.2.1.3 The Theory of Interpersonal Behaviour (TIB)

The Theory of Interpersonal Behaviour proposes that the likelihood of performing a behaviour depends on the habit of performing it, the strength of the habit, and the intentions to perform it ²⁸². Barriers or facilitating conditions can also alter the likelihood of performing a behaviour because they influence the formation of habits and intention ^{116,267,282}.

The TIB posits that at first intention influences behaviour, but that with repetition it becomes more habitual ²⁵⁸. The intention to, and habit of performing a behaviour are influenced by four factors. The first is a cognitive component, which involves appraising the advantages and disadvantages of performing the behaviour. The second is the affective component, which is the emotional response to the notion of adopting or maintaining the behaviour, as well as the feelings that arise during the course of the behaviour ¹¹⁶. Positive affect refers to feelings such as contentment or relaxation ^{25,95,201}, whereas negative affect refers to feelings such as uneasiness or anxiety ⁹⁵.

The third factor that influences habit and intention is the social component, which is formed through the analysis of the attitudes of other people surrounding the individual ²⁵⁸. It is made up of: normative beliefs, which are the individual's evaluation of the appropriateness of performing the behaviour; and role beliefs, which are the appropriateness of performing the behaviour given the person's role in various social networks. The last factor is the personal normative belief, which is the person's sense of responsibility and willingness to behave according to personal principles that may be independent of societal norms ^{116,258,282}.

The TIB has not been extensively used to study exercise behaviour. In one study that applied this theory, not only were all of its factors significantly predictive of the intention to exercise ($R^2=0.25$, $p<0.0001$), but they were strong predictors of the frequency of exercise participation ($R^2=0.33$, $p<0.0001$) (cf. [Appendix 3](#))¹¹⁶.

With respect to the individual variables of the TIB, although some studies have shown that past behaviour influences current exercise behaviour^{258,263}, others have shown that establishing a habit to exercise does not make it more automatic^{116,258}. However, in all these studies, the results revealed that the factors most significantly related to exercise behaviour were those of personal normative belief (PNB) and affect^{116,263,283}. It has been suggested that people who believe that physical activity participation is important to them (e.g. demonstrate a strong personal normative belief) are most likely to be active. This was found to be true for Canadians, where 44% of people surveyed who were highly active reported that physical activity participation was personally important to them²⁷⁹.

With respect to the relationship between affect and physical activity, several studies have demonstrated that, for both men and women, not only is positive affect associated with the intention to participate in physical activity^{1,164,165,258}, but that it is also predictive of the current level of participation and adherence^{95,249}. Conversely, negative affect appears to be highly correlated with inactivity⁶⁹, and program withdrawal^{95,130,284}. Specifically, the lack of interest in, and the lack of enjoyment from exercise have been negatively correlated with vigorous exercise, yielding correlations between -0.29 and -0.27⁶⁹.

One of the most common motives people cite for being active is that they enjoy it^{25,164}. Several investigators believe that enjoyment, or positive affect, is one of the strongest motivating factors for being active^{137,138,166,285}. It has been suggested that how one feels about being active, rather than what they believe, is what motivates

participation ¹³³. Similarly, PNB is believed to be a motivational factor because it reflects a willingness to behave according to personal principles that may be independent of cultural and social norms ²⁵⁸. A person will be motivated to engage in physical activity in order to remain consistent with their own principles.

5.2.2.2.1.4 Summary of the General Theories of Health Behaviour

Based on the results obtained from the studies that have applied the theories of health behaviour, it appears that not all the factors derived from these frameworks are consistently related to physical activity. The factors that appear to be able to consistently influence physical activity participation were those of:

⇒ *From the Theories of Reasoned Action and Planned Behavior (TRA/TPB):*

- Attitude

⇒ *From the Social Cognitive Theory (SCT):*

- Self-efficacy
- Outcome-expectancy
- Self-evaluation

⇒ *From the Theory of Interpersonal Behaviour (TIB):*

- Affect
- Personal Normative Belief (PNB)

According to several investigators they each represent an important component of motivation. There is evidence that each of these factors are involved in the process that directs and energizes physical activity participation, and that they are also able to influence the likelihood it occurs.

Although intention does not represent a motivational factor per se, as explained in *Section 5.2.2.2.1.1*, it is involved in the mechanism by which physical activity is enacted ^{1,112,248,256,258,269}. Specifically, intention is believed to be the most immediate and powerful determinant of behaviour, mediating the role between motivational factors and actual behaviour. In particular, the magnitude of the intention to be active corresponds to, and is directly modified by the factors that motivate physical activity participation ^{1,20,116,248,251,252,256,258}. Moreover, physical activity is a behaviour that is self-initiated *but* action delayed. The motivation to be physically active is believed to stimulate intention straightaway, which then undergoes further processing and elaboration, resulting in a temporal delay before motivation is actually realized and behaviour occurs ²⁰.

Thus, given its involvement in the process by which motivation is transformed into action, intention reflects a concept that would be relevant to measure in the thesis, as it could serve as an indicator against which participants' responses could be tested.

5.2.2.2.2 Non-theory Derived Factors Related to Physical Activity

This sub-section examines the determinants of physical activity that are independent of a theoretical framework and that have been shown to directly or indirectly influence motivation for physical activity participation.

5.2.2.2.2.1 Self-presentation

Despite the messages from health-care professionals about the health benefits associated with regular activity, people still rank the potential aesthetic advantages (e.g. improving physical fitness, looking good, etc.) of exercise as being more important ¹⁷⁶. Consequently, it has been suggested that for exercise behaviour, self-presentational concerns underlie the desire to improve one's image ²⁸⁶.

Self-presentation is defined as the process through which people monitor and attempt to influence how they are perceived by other people ^{285,287}. Some of the more common reasons given for being active reflect self-presentation concerns, such as: physical appearance, where people strive to improve or maintain a desired appearance (e.g. to avoid appearing unattractive) ²⁸⁸; and social identity, where people are strive to maintain the identity of a fit or athletic person ^{137,285}.

However, for some, concerns about how they will be perceived by others can result in social anxiety ²⁸⁶. This type of anxiety has been termed social physique anxiety (SPA) and is defined as the feelings one experiences when they see others negatively critiquing their appearance ²⁸⁶. SPA is counter-productive because it detracts from the good feelings generated from exercise ²⁸⁵. Some individuals are so worried about making the appropriate impression on others that they will avoid exercising all together ²⁸⁵. Consequently, the self-presentational insecurities can also decrease motivation towards the activity ²⁸⁹.

For example, a study by Crawford and Eklund reported that subjects with higher levels of anxiety about their physique preferred exercise settings that minimized exposure of their physique (e.g. where shorts and t-shirt could be worn), while subjects with low anxiety about their physique chose settings that emphasized their figure (e.g. where leotards could be worn) ¹⁷⁷. Another study demonstrated that over the course of an exercise program the anxiety that participants felt about their body significantly decreased as their hip and abdominal measurements reduced ($p < 0.01$) ²⁸⁶. Further, reductions in the circumference of specific body areas, coupled with greater perceptions of self-efficacy, accounted for 52% of change in social physique anxiety ($F_{6,56} = 9.97$, $p < 0.0001$) ²⁸⁶.

Although self-presentational concerns have been shown to prevent participation and decrease motivation for some individuals, these concerns/anxieties can also promote participation for other individuals. Specifically, for some, dissatisfaction with one's appearance is cited as a primary motivator for exercise ²⁴². Consequently, Self-presentational is a factor that appears to influence an individual's motivation for physical activity.

5.2.2.2.2 Barriers

A barrier is a perceived situational or circumstantial constraint that prevents a person from engaging in physical activity. Barriers include lifestyle demands that work against exercise ²⁴⁴.

Exercise is a behaviour that is vulnerable to many barriers that can be either actual or perceived ²⁶⁹. Some of the commonly cited barriers to being active include: effort, where people feel that it requires too much work or that it takes too much discipline; time, where people believe that they are too busy and that there is not enough time; physical aspects, such as concerns of looking uncoordinated or feeling uncomfortable; social, where people express that they do not receive enough encouragement or have friends to do it with; and specific, such as suffering from a medical problem ^{243,245}.

Barriers have been significantly related to various aspects of physical activity participation among both younger and older adults ^{1,8}, and the general population ^{69,140,246,290,291}. Barriers have been found to influence the likelihood that exercise will occur ^{8,126,248}, where not only were they negatively correlated with the intention to participate in ($r = -0.25$, $p < 0.001$) ²⁴⁶, and the adoption of exercise ($r = -0.30$ to -0.48 , $p < 0.05$) ²⁹⁰, but they were also able to discriminate between those who intend and do not intend to exercise ($p < 0.001$) ²⁴⁶.

Barriers also affect the current level of participation. For example, in a community sample ⁶⁹, not only were barriers negatively related to vigorous exercise participation ($r = -0.22$, $p < 0.05$), but they were also predictive of inactivity ($\beta = -0.32$, $p < 0.00001$) ⁶⁹. Similarly, another study showed that barriers accounted for 40% of the variance in exercise behaviour among joggers and non-exercisers ²⁹¹.

Beyond influencing current behaviour, perceived barriers have also been found to be significantly related to exercise adherence ^{99,113,126-129,266,290}. The results from one such study revealed that barriers were negatively correlated with the individual's intentions to maintain their exercise behaviour ($r = -0.50$ to -0.55 , $p < 0.01$) ²⁹⁰. As such, not only do barriers exert an influence on all levels of participation ²⁹², but they also consistently appear to decrease the likelihood that exercise behaviour will occur ^{126,293,294}.

5.2.2.2.2.3 Social Support

Social support can be defined as the comfort, assistance, and/or information that a person receives formally or informally through contact with individuals or groups ⁷³. It can be provided by people (e.g. family, friends, peers, instructors) through social relations, such as attachment, social integration, guidance, buddy system, spousal participation, and encouragement ^{13,295,296}.

Many researchers believe that social networks provide motivational support ^{50,297-299}. Social support is thought to motivate behaviour because individuals who receive support will be more likely to feel confident about their behaviour compared to those who receive no support. As well, social support encourages persistence for difficult behaviours ⁵⁰. It is believed to be a motivational factor because it assists in the self-regulation of behaviour ^{8,118-121,249}.

Research has shown that social support is one of the most influential environmental factors for exercise behaviour^{80,120,300-302}. For instance, studies such as the Campbell Survey of Well-being reported that the lack of support from a partner was a significant barrier to physical activity participation for 18% of Canadian females and 12% of males²⁵.

Social support also facilitates the adoption of new activity habits^{8,69,120,121}. Studies have demonstrated that social support significantly contributed to the process by which exercise behaviour was adopted, where it was highly correlated with ($r=0.23$ and 0.24 , $p<0.05$)²⁹⁰, and predictive of the adoption of exercise behaviour ($p<0.02$)⁸.

Several studies have also shown that social support is positively and consistently associated with exercise participation^{1,84,249,270,302}. For example, one such study demonstrated that social support from spouses, peers, exercise partner(s), or instructor was significantly associated with ($r= 0.25$ and 0.44 , $p<0.05$), and predictive of current participation ($p<0.05$)²⁹⁵. Social support also assists with the maintenance of physical activity^{8,118-121,249}. Research has demonstrated that social support exerts a positive effect on exercise adherence^{19,46,73,130,169,303,304}, whereas lack of support is related to poor exercise compliance¹³⁶.

Another study revealed that social support was predictive of vigorous physical activity participation over a 24 month period for initially sedentary women ($R^2 = 0.22$, $p<0.03$)⁸. Thus, it appears that the social resources available to a person represent an important motivational factor for physical activity.

5.2.2.2.4 Summary of the Determinants of Physical Activity

From the studies described above it is evident that self-presentation, barriers, and social support are strongly related to various aspects of physical activity. They too can be viewed as motivational factors because they are able to energize and direct participation, as well as influence the likelihood of engaging in physical activity.

5.2.3 Establishing the Terminology

After reviewing the literature on the theory and non-theory based research to date on the factors relevant of physical activity and motivation, the available evidence suggests that motivation for physical activity is a dynamic construct. Further, it also appears that motivation consists of a variety of cognitive, affective, environmental, and value-related factors that can be dichotomized as representing aspects internal or external to the person. Hence, motivation should be viewed as a multi-dimensional construct comprising a number of internal and external factors.

Guided by the research to date, for the present study motivation was conceptualized and defined as a multi-dimensional latent construct that energizes and directs physical activity participation. Motivation represents factors both internal and external to the person that serve to enhance or diminish the likelihood of participation and adherence. An internally motivating component was defined as one where the source of energy or stimulation comes from within the person, whereas an externally motivating component was one where the energy, stimulation, or reinforcement comes from sources external to the person.

5.2.4 The Process of Selecting and Including the Factors Identified from the Literature in the Study

In order for the factors identified from the literature to be selected for this study, they had to satisfy two criteria. First, they had to have been significantly associated with physical activity. Second, they had to be consistent with the conceptualization and definition of motivation adopted for this study, as described above. That is, there had to be evidence that the factor functioned to energize and direct physical activity, represented an aspect either internal or external to the person, and influenced the likelihood of physical activity participation. Factors that were able to successfully satisfy both these criteria were selected for this study and were presumed to be motivational in nature (i.e. represent a factor of motivation).

Upon selecting the presumed motivational factors from the literature, their operational definitions were then compared. This ensured that the most parsimonious set of factors were included in the study, and that those presumed motivational factors that were conceptually similar were merged. This reduced the redundancy among the constructs and yielded a consolidated set of factors. Following this, each of the presumed motivational factors was categorized according to whether it reflected a concept that was either internal or external to the person.

5.2.5 Establishing Operational Definitions for the Presumed Motivational Factors

Formulating an operational definition for each of the presumed motivational factors selected from the literature occurred over three stages. First, the frequency with which its existing definition had been used in the literature was examined. This served as a surrogate measure of how well it was accepted by researchers in the field. Second, the relevance and appropriateness of each definition to physical activity was

considered. Finally, each operational definition was modified to ensure that it was consistent with the definition of motivation for physical activity used in this study.

Establishing an operational definition for each of the presumed motivational factors included in the study was important because it served to describe the concepts that the factors represented. Since each factor was to be represented by a sub-scale in a measure of motivation for regular vigorous physical activity, operationally defining each was necessary to guide the drafting and constructing of items for the new instrument.

5.3 Results and Modifications

5.3.1 The Condensed List of Presumed Motivational Factors Selected from the Literature

The process of identifying the factors from the literature (cf. *Section 5.2.2*), selecting those that were consistent with the conceptualization of motivation used in this study (cf. *Section 5.2.4*), and reducing the redundancy between factors (i.e. similar concepts being labeled differently) (cf. *Section 5.2.4*) yielded a condensed pool of fifteen presumed motivational factors.

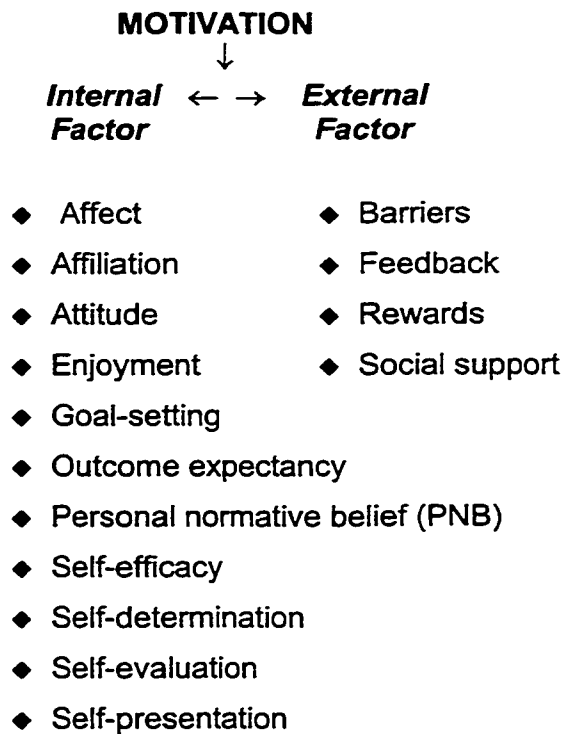
These presumed motivational factors represented the most significant concepts to date from the literature and consisted of individual concepts, as well as situational/environmental ones, that had been shown to directly or indirectly influence motivation for physical activity. The condensed set of presumed motivational factors that were selected for, and included in this study are summarized in Table 9 (cf. pg. 72). The internal-external classification of the presumed motivational factors selected for this study is provided in Figure 3 (cf. pg. 73).

Table 9: Condensed List of Presumed Motivational Factors Selected from the Literature

<i>Concept Label *</i>	<i>Description</i>
<i>Attitude</i>	The pros and cons of performing the behaviour, and the perceived importance of, and consequences from performing the behaviour.
<i>Self-efficacy</i>	Judgments about the ability to accomplish the behaviour at a given level.
<i>Outcome-expectancy</i>	Beliefs that a specific behaviour and course of action will lead to the desired benefits and/or outcomes.
<i>Self-evaluation</i>	Evaluating performance against an internal standard, becoming either satisfied or dissatisfied with the performance.
<i>Affect</i>	The emotional response to the behaviour, and the feelings that arise during the course of it.
<i>Personal Normative Beliefs (PNB)</i>	Sense of responsibility and willingness to behave according to principles that are independent of societal norms and pressures.
<i>Self-presentation</i>	Process by which people monitor and attempt to influence how they are perceived by other people.
<i>Barrier</i>	Situational or circumstantial constraints that prevent a behaviour from occurring.
<i>Social support</i>	The comfort, assistance, and/or information that a person receives formally or informally through contact with individuals or groups.
<i>Self-determination</i>	Sense/perception of choice and control over the behaviour.
<i>Goals</i>	Tendency to set-goals and focus, organize, and direct behaviour to attain goals.
<i>Enjoyment</i>	The extent to which a person feels alive, active, and not bored during the activity.
<i>Feedback</i>	Aspects of the external environment that provides information about performance/progress or the correctness of technique.
<i>Rewards</i>	Internal or external reinforcement that is contingent upon performing the behaviour.
<i>Affiliation</i>	The desire to form close emotional bonds with, to be attached to, and be involved in warm relationships with people.

★ A label was adopted for this study to represent each of the presumed motivational factors identified from the literature.

Figure 3: Internal-External Classification of the Presumed Motivational Factors



5.3.2 Operational Definitions for the Presumed Motivational Factors Selected from the Literature

The operational definitions for the fifteen presumed motivational factors are provided in Table 10 (cf. pg. 74).

Table 10: Operational Definitions for the Presumed Motivation Factors Selected from the Literature

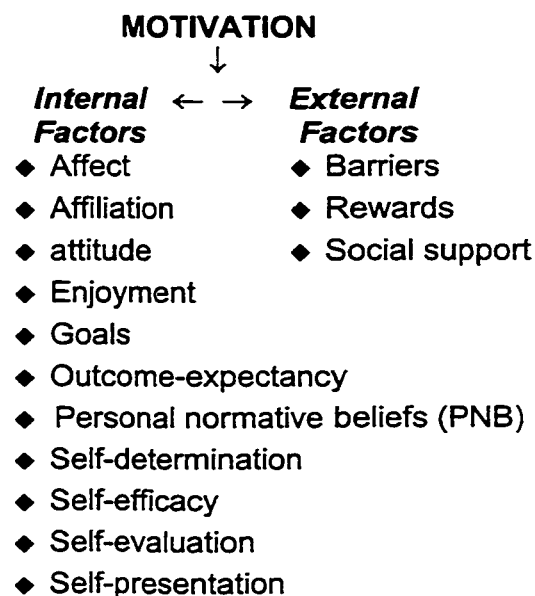
Concept Label *	Operational Definition Adopted
<i>Affect</i>	A person's emotional response to the thought of participating in physical activity, or the feelings that participating in physical activity will produce.
<i>Affiliation</i>	The extent to which physical activity satisfies one's need for, or desire to be emotionally connected and interpersonally involved with others.
<i>Attitude</i>	The positive or negative evaluations about participating in physical activity.
<i>Barriers</i>	Situational or circumstantial constraints or barriers that impede a person from participating in physical activity.
<i>Enjoyment</i>	The amount of attraction or appeal felt towards physical activity. It is the extent to which the person does not feel bored during physical activity.
<i>Feedback</i>	Information given to the participant regarding their physical activity performance.
<i>Goals</i>	One's tendency to set goals and arrange their physical activity participation in accordance with these goals.
<i>Outcome-expectancy</i>	The degree to which one believes that physical activity will lead to certain outcomes.
<i>Personal Normative Belief (PNB)</i>	The individual's beliefs about the personal appropriateness of participating in physical activity, and its importance to them.
<i>Rewards</i>	Internally or externally produced reinforcement that is contingent upon performing exercise behaviour.
<i>Self-determination</i>	The perception of being able to have choice in initiating, maintaining, and regulating physical activity participation, as opposed to having environmental circumstances determine it.
<i>Self-efficacy</i>	The individual's appraisals of their ability to participate in physical activity under particular circumstances.
<i>Self-evaluation</i>	An evaluation of one's attributes in relation to physical activity.
<i>Self-presentation</i>	The need to be perceived favourably by others when engaging in physical activity.
<i>Social support</i>	Provisions of social relations, such as attachment, social integration, guidance, buddy system, spousal participation, encouragement, or feedback.

★ A label was adopted for this study to represent each of the presumed motivational factors identified from the literature.

5.3.3 Further Refining the Presumed Motivational Factors Selected from the Literature

In the process of finalizing the set of presumed motivational factors to be included in this study, one major change was made to the fifteen factors that had been originally selected from the literature (cf. *Section 5.3.1* and *Table 9*, pg. 72). Upon further examination of each factor's operational definition, it became apparent that two of the presumed motivational factors could be merged together to create a more concise concept. Specifically, the factors of "*Rewards*" and "*Feedback*" were combined because "*Feedback*" could be considered a form of reward that originates from sources external to the person. Although the presumed motivational factor still retained the label "*Rewards*", it represented a broader concept. The modified factor of "*Rewards*" was still operationalized as, "an internally or externally produced reinforcement for the behaviour, that is contingent upon performing the behaviour". This modification yielded fourteen presumed motivational factors. The internal-external classification of these factors is provided in *Figure 4*.

Figure 4: The Presumed Motivational Factors Included in this Study



6.0 OBJECTIVE 2 -- DEVELOPMENT AND PRE-TESTING OF THE INSTRUMENT

There were two objectives for this phase of the study:

- ◆ To draft items measuring the 14 presumed motivational factors that were previously identified from the literature in order to create the first draft version of the Motivational Factors for Physical Activity Scale (MFPAS).
- ◆ To pre-test the Motivational Factors for Physical Activity Scale (MFPAS) in order to assess the distribution of item responses, inter-item correlation, and sub-scale homogeneity.

6.1 Research Question

The research questions for this phase of the study were:

- ◆ Are the distributions of responses at the item level acceptable? Specifically, are responses to the items free of a “floor” or “ceiling” effect?
- ◆ Are the items within each sub-scale of the MFPAS characterized by at least modest inter-item correlations?
- ◆ Are the sub-scales that comprise the MFPAS characterized by an acceptable degree of internal consistency?

6.2 Procedure

6.2.1 Developing Items for the Motivational Factors for Physical Activity Scale (MFPAS)

The drafting of items for the Motivational Factors for Physical Activity Scale (MFPAS) followed an iterative process, where revisions were made at various stages in item and sub-scale development. It was decided a-priori that each sub-scale representing the presumed motivational factors identified from the literature would consist of at least three items. The items comprising the MFPAS were either newly

created to reflect the operational definitions of the presumed motivational factors or were drawn from existing instruments and re-written (i.e. modified) in order to more accurately reflect the factors.

Further, given that intention is a proximal determinant of physical activity^{1,112,248, 256,258,269}, and that it could serve as an indicator of a concept against which participants' responses could be tested, five additional items were added to the MFPAS to reflect the overall concept of the intention to participate in physical activity.

Thus, the draft version (i.e. *Version 1*) of the MFPAS (cf. Figure 1, pg. 37) was a 117-item questionnaire that scored items on a 5-point Likert-type scale. It represented the fourteen presumed motivational factors identified from the literature and the construct of intention to participate in physical activity. The origins of the items within each sub-scale of *Version 1* of the MFPAS is summarized in Table 11 (cf. pg. 78).

6.2.2 Pilot Testing the Motivational Factors for Physical Activity Scale (MFPAS)

6.2.2.1 Protocol and Collection Period

The pilot work on the MFPAS (*Version 1*) (cf. Figure 1, pg. 37) was conducted on a non-probability sample. Participants were recruited from several private and governmental organizations in Toronto. This method of sampling was believed to be appropriate and sufficient for preliminary work such as this because the results obtained were only to be used to refine the instrument.

Two methods were used to disseminate the questionnaires at these sites. The first involved sending the questionnaires directly to a contact person at the specific worksite, who was then responsible for distributing them to their employees and/or colleagues. The second method involved personally delivering the questionnaires to the employees of the worksite.

Table 11: The Origin of Items within each Sub-scale of Version 1 of the Motivational Factors for Physical Activity Scale (MFPAS)

<i>Factor</i>	<i># of Items in Sub-scale</i>	<i>Newly Drafted # of Items</i>	<i>Origin of the Items Modified from Existing Scale(s)</i>	
			<i># of Items</i>	<i>Source(s)</i>
<i>Affect</i>	6	6	0	—
<i>Affiliation</i>	6	3	3	• Bagozzi & Kimmel (1995)²⁰ • Frederick & Ryan (1993)¹³¹ • Steinhardt & Young (1992)¹⁵⁰
<i>Attitude</i>	8	8	0	—
<i>Barrier</i>	13	7	6	• DuCharm & Brawley (1995)²⁴⁴ • McAuley, Bane, & Mihalko (1995)²⁸⁶
<i>Enjoyment</i>	6	2	4	• Frederick & Ryan (1993)¹³¹ • Steinhardt & Young (1992)¹⁵⁰
<i>Goals</i>	13	11	2	• DuCharm & Brawley (1995)²⁴⁴ • Plotnikoff et al. (1997)³⁰⁵
<i>Intention</i>	5	5	0	—
<i>Outcome-expectancy</i>	8	4	4	• Bagozzi & Kimmel (1995)²⁰ • Frederick & Ryan (1993)¹³¹
<i>PNB</i>	5	2	3	• Bagozzi & Kimmel (1995)²⁰ • Plotnikoff et al. (1997)³⁰⁵
<i>Rewards</i>	7	6	1	• McAuley, Bane, Mihalko (1995)²⁸⁶
<i>Self-determination</i>	7	3	4	• Boyce & Wanda (1994)²⁴ • DuCharm & Brawley (1995)²⁴⁴ • Plotnikoff et al. (1997)³⁰⁵
<i>Self-efficacy</i>	12	3	9	• Frederick & Ryan (1993)¹³¹ • Plotnikoff et al. (1997)³⁰⁵
<i>Self-evaluation</i>	8	7	1	• Steinhardt & Young (1992)¹⁵⁰
<i>Self-presentation</i>	5	5	0	—
<i>Social support</i>	8	4	4	• Bagozzi & Kimmel (1995)²⁰ • Duncan & McAuley (1993)³⁰⁶
TOTAL	117	76	41	—

At these sites, participants were unaware that motivation for physical activity was being measured. Rather, they were informed that the purpose of the questionnaire was to learn about their thoughts and feelings about being active, as well as what prevents them from being active.

Those who agreed to participate in the pilot testing phase were asked to complete the questionnaire immediately upon receiving it. Once the questionnaires were completed, each participant was verbally informed of the purpose of the MFPAS and the pilot work. Then participants were provided with the opportunity to give feedback about the content and structure of the MFPAS (*Version 1*) by answering a set of standard questions.

6.2.2.2 Inclusion and Exclusion Criteria

Potential participants were eligible for inclusion in the pilot testing phase if they were:

- ⇒ Proficient in English
- ⇒ Between the ages of 18 to 75.

Among those initially selected, participants were excluded if they:

- ⇒ Had an injury/illness that limited or prevented current physical activity participation.

6.2.2.3 Instrument(s)

Participants involved in this phase of this study completed *Version 1* of the MFPAS (cf. *Section 6.2.1*, and Figure 1, pg. 37).

6.2.2.4 Analyses Performed

6.2.2.4.1 MFPAS Item-pool Composition

To determine which items were to be retained in the MFPAS, two criteria were established against which the results from the pilot testing phase were to be compared.

First, each item had to be free of a “floor” or “ceiling” effect. The presence of a floor/ceiling effect was deemed to be significant because at this stage in the development of the MFPAS it would indicate an item(s) that did not yield an adequate amount of variability in its responses. An item was determined to be free of this problem if three of the five response options had been selected by fewer than 90% of the participants ¹⁴². However, if an item had less than three of its five response options selected by 90% of the participants, the presence of a “floor” or “ceiling” effect was inferred and the item was deleted.

To examine the distribution of responses for each item of the MFPAS simple descriptives and frequencies were calculated by SPSS 7.0 *Statistics (Frequencies)* (SPSS Inc. 1989-1995).

The second criteria concerning item retention required modest inter-correlation with other items in the sub-scale ^{142,307}. Prior to calculating the inter-item correlations, all the negatively worded items of the MFPAS were reverse scored (i.e. positively instead of negatively). An item was retained if its correlation with the others on the same sub-scale was ≥ 0.30 . An item with a low inter-item correlation was eliminated unless the internal consistency of the entire sub-scale suffered significantly as a consequence of its removal.

Given that the MFPAS scores responses were on a five-point Likert-type scale, the average inter-item correlation within each sub-scale was measured by the Cronbach alpha (α) statistic. The Cronbach α coefficients were calculated by SPSS 7.0 *Scale (Reliability Analysis)* (SPSS Inc. 1989-1995). SPSS 7.0 *Scale* utilizes a listwise deletion,

whereby any participant(s) with a missing value(s) on any item(s) in the sub-scale is excluded from the entire analysis.

6.2.2.4.2 Homogeneity of the MFPAS Sub-scales

To determine if each sub-scale of the MFPAS was homogeneous and should be retained in the instrument it had to be characterized by a sufficient degree of internal consistency. Although the internal consistency of a test/sub-scale should be as high as possible, generally a Cronbach α value of ≥ 0.70 is deemed acceptable^{142,143,145}. Thus, a sub-scale was considered homogeneous and was retained in the MFPAS if its Cronbach α statistic was ≥ 0.70 .

The Cronbach α statistics were calculated via SPSS 7.0 *Scale (Reliability Analysis)* (SPSS Inc., 1989-1995) with a listwise deletion strategy (cf. *Section 6.2.2.4.1*).

6.3 Results and Implications for the Composition of the MFPAS

6.3.1 Demographic Characteristics of Participants

Of the fifty-five respondents who were recruited for the pilot phase of the study, only fifty-one satisfied the inclusion criteria. The pilot sample consisted of 28 males (55%) and 23 females (45%). The average age of respondents was 35.3 years ($\sigma = 12.1$ years), with age ranging between 21 and 57 years.

6.3.2 Results from the Pilot Testing of the MFPAS

6.3.2.1 Response Distributions among the MFPAS Items

Based on the criteria specified in *Section 6.2.2.4.1*, some significant item-level modifications occurred within the MFPAS. Comparing the results obtained from the pilot testing phase to the pre-established criteria, only 81 items from *Version 1* of the MFPAS

did not demonstrate a floor/ceiling effect and were modestly inter-correlated. Consequently, these items were retained in the instrument. However, 36 items from *Version 1* of the MFPAS were unable to satisfy one or both of the pre-specified criteria and were eliminated from the instrument. A summary of the item-specific results is provided in [Table 12](#), while a detailed description is provided in [Appendix 4](#).

Table 12: Item-Specific Results from the Pilot Testing Phase of Version 1 of the Motivational Factors for Physical Activity Scale (MFPAS)

# of Items	Criteria Satisfied		Retained	
	Presence of a Floor/Ceiling Effect	Moderate Inter-Item Correlation	Yes	No
13	Yes	No	—	✓
5	Yes	Yes	—	✓
18	No	No	—	✓
81	No	Yes	✓	—

Based on these changes, the post-pilot version of the MFPAS (*Version 2*) consisted of 81 items (cf. [Figure 1](#), pg. 37).

6.3.2.2 Sub-scales within the MFPAS

The results obtained from the pilot-testing phase of the MFPAS revealed that the α coefficient for each sub-scale was ≥ 0.70 and ranged from 0.70 to 0.93. Since the α coefficient for each sub-scale was above the pre-specified cut-point of 0.70, it demonstrated an acceptable degree of internal consistency and supported the retention of all sub-scales for the next phase of the study.

The sub-scale specific α coefficients of the MFPAS (*Version 1*) can be found in [Table 13](#) (cf. pg. 83).

Table 13: Sub-scale Specific Cronbach α Coefficients from the Pilot Testing Phase of Version 1 of the Motivational Factors for Physical Activity Scale (MFPAS)

Sub-scale	N	α Coefficient
<i>Affect</i>	51	0.83
<i>Affiliation</i>	51	0.88
<i>Attitude</i>	51	0.74
<i>Barrier</i>	51	0.88
<i>Enjoyment</i>	51	0.92
<i>Goals</i>	51	0.89
<i>Intention</i>	51	0.84
<i>Outcome-expectancy</i>	51	0.83
<i>PNB</i>	51	0.93
<i>Rewards</i>	51	0.78
<i>Self-determination</i>	51	0.71
<i>Self-efficacy</i>	51	0.93
<i>Self-evaluation</i>	51	0.71
<i>Self-presentation</i>	51	0.70
<i>Social support</i>	51	0.88

Therefore, *Version 2* of the MFPAS retained the fourteen presumed motivational factors, as well as the construct of intention (cf. [Figure 1](#), pg. 37).

6.3.2.3 Qualitative Feedback From Participants

Of the 51 participants who were included in this phase of the study, 10 provided feedback about the nature of the MFPAS. Since this feedback was not elicited by a set of structured questions, the comments received were both general and non-specific. In general, participants stated that the MFPAS was too long and that it contained a fair bit of redundancy.

6.4 Discussion

The pilot work performed on the MFPAS was the first formal testing of this instrument. The results provided preliminary insight into some important characteristics

of the MFPAS at both the item and sub-scale level. However, at this time the MFPAS was still in its preliminary initial stages of development.

Several modifications were made to the instrument. At this stage of development, the items appeared capable of capturing a sufficient degree of variability in responses and are not prone to floor or ceiling effects, as well as that the items within each sub-scale are measuring a similar concept. Collectively, the results provide initial evidence that the present composition and structure of the MFPAS are adequate.

Despite this, the feedback obtained from participants indicated that the MFPAS was in need of further refinement. Although this information was both general and non-specific, it did highlight the need to further refine the content of the MFPAS using more formalized and specific techniques. It was determined that prior to proceeding further with the validation of the MFPAS, additional pre-testing of its sub-scales was required. One technique that would resolve many of the issues raised by the participants in this phase of the study was one-on-one cognitive interviewing. The feedback obtained from these participants influenced the objective for the next phase of this thesis.

7.0 OBJECTIVE 3 – COGNITIVE INTERVIEWS

The objectives for this phase of the study were:

- ◆ To conduct cognitive interviews in order to determine the clarity of the items comprising the Motivational Factors for Physical Activity Scale (MFPAS) and its instructional sets to gain insight into how they were being interpreted.
- ◆ To modify the items and/or instructional sets in order to ensure comprehension.

7.1 Research Question

The research questions for this phase of the study were:

- ◆ Are the items and the instructions sets of the MFPAS interpreted the way they were intended to be?
- ◆ Is there any ambiguity with respect to the phrasing of items and the terminology used in the MFPAS?
- ◆ Which items and/or instructional sets of the MFPAS need to be modified and in what ways?

7.2 Procedure

7.2.1 Additional Testing of the Motivational Factors for Physical Activity Scale (MFPAS)

7.2.1.1 Cognitive Interviews *

To ensure that the MFPAS was clear and comprehensible, one-on-one cognitive interviews were conducted to investigate participant recall and response strategies to the questionnaire ³⁰⁸⁻³¹⁰.

* In the period between the Pilot Testing phase (cf. *Section 6.2.2*) and the Cognitive Interviews (cf. *Section 7.2.1.1*) the following changes were made to *Version 2* of the MFPAS: two items were drafted for each of the sub-scales of *Affect*, and *Self-evaluation*; one item was drafted for each of the sub-scales of *Enjoyment*, and *Outcome-expectancy*; an item was eliminated from the sub-scale of *Barrier*. These changes yielded *Version 3* of the MFPAS (cf. *Figure 1*, pg. 37), which was used in the current phase of the study (cf. *Section 7.2.1.1*).

Cognitive interviewing is a procedure that is used to determine whether questions are operating as intended, and in the process, provides insight as to why they may be failing ^{308,310,311}. This technique helps identify hidden problems that may affect the integrity of the questionnaire and the quality of responses to its items ³¹¹.

7.2.1.1.1 Protocol

The cognitive interviews were conducted at the RA Centre (Recreation Association of the Public Service of Canada) as part of an annual Health Fair. The opportunity to participate in this study was advertised in the Ottawa Citizen and in the RA Centre's monthly publication. A display booth was set up in the lobby during the Health Fair. New and existing members of the RA Centre either volunteered to participate in the study, or were directly approached and asked to participate. Thus, a convenience sample of participants was accrued from this site.

Upon agreeing to take part in the interviews, participants completed a consent form and were informed that the session would be recorded. Partial disclosure was selected as the method of choice for informing participants of the purpose of the interviews and the nature of the study. This method was preferable because fully disclosing the purpose of the questionnaire and the interview would have biased the process. More so, concealing the nature of the objectives did not place respondents at any risk. As such, those interviewed were only informed that what was of interest was to understand the reasons people have for participating in physical activity.

Two investigative strategies were employed in the interviews. The first was the paraphrasing technique, where respondents were given the instruction set for the MFES and were asked to repeat, in their own words, what it was asking of them. As well, participants were specifically asked to explain how they interpreted the words "regular physical activity". This was used to assess whether the instruction set was too complex,

as well as if participants were missing important qualifiers (e.g. time periods, specific referents, etc.)³⁰⁸.

The second technique employed was the concurrent-think-aloud procedure. It uses standard probes as guides to explore respondents' thought processes^{308,311}. Each participant was provided with questions from one of the sub-scales of the MFPAS. A total of three participants were interviewed for each sub-scale of the MFPAS.

Upon being provided with the items representing a sub-scale, participants were asked to "think aloud" and describe their thought process as they interpreted the questions and formulated their responses. This method was useful for identifying if participants experienced any difficulty understanding items, as well as gaining insight into the information they were using to generate their answers^{308,311}. This portion of the interview was recorded so that their responses could be analyzed at a later time. At no point in the interview process were participants' responses directed, rather standard open-ended probes were utilized to clarify statements and extract greater detail.

Each interview lasted for approximately fifteen to twenty minutes. After completing the interview, each participant was fully informed of the purpose of the session and the questions that they had completed. Then, each participant was provided with the opportunity to give feedback about the motivational factor and items they had just completed by answering a set of standard questions. Each participant was asked about their overall impression of the motivational factor and the items they had just completed. Standard probes were used to extract greater detail about whether the motivational concept was relevant to those interviewed, as well as whether the items adequately reflected the concept they were proposed to be measuring or if there was something that had not been addressed. The interview concluded with an open-ended question that probed into what motivated and/or prevented them from being regularly active.

7.2.1.1.2 Inclusion and Exclusion Criteria

The inclusion and exclusion criteria for the cognitive interviews were the same as those described in the previous chapter (cf. Section 6.2.2.2).

7.2.1.1.3 Instrument(s)

Participants involved in the cognitive interviews completed *Version 3* of the MFPAS (cf. Figure 1, pg. 37).

7.3 Results and Implications for the Composition of the MFPAS

7.3.1 Demographic Characteristics of Participants

Forty-two people agreed to participate in the interviews. However, one participant was excluded due to a severe disability that limited their exercise participation, so a total of forty-one individuals were interviewed. The average age of participants was 49.4 years ($\sigma = 13.8$ years), with age ranging between 27 and 73 years. A total of 21 males (51%) and 20 females (49%) were interviewed.

7.3.2 Results from the Cognitive Interviews

The cognitive interviews provided insight into how various aspects of the MFPAS were being interpreted. It assisted in identifying items and instruction sets that were either difficult to understand, required complex recall strategies, or contained ambiguous/unfamiliar terms³¹⁰. The results obtained were used to make informed decisions about modifications to the MFPAS. The following sub-sections describe in detail the results and modifications.

7.3.2.1 Modifications to the Terminology of the MFPAS

The results from the cognitive interviews revealed that it was necessary to change the term used to describe the behaviour of interest because the term “*physical activity*” was not being interpreted as was intended. For some participants it referred to initiating activity (e.g. getting active), whereas for other participants it referred to maintaining the activity (e.g. being active on a regular basis).

To ensure that the behavioural referent was being interpreted as intended and that participants were referring to the same phase of participation, the term “*physical activity*” was replaced by the term “*exercise*”. The word “*exercise*” was adopted for two reasons. First, respondents interpreted “*exercise*” as being the “*act*” rather than the “*process*” of being active. Second, participants were more familiar with, and therefore, more accustomed to using the word “*exercise*” to describe the activities being tapped by the questionnaire.

Given the changes to the behavioural referent, its operational definition also had to be modified. The results from the interviews revealed that there was some confusion surrounding the physiological changes that were described in relation to vigorous physical activity, as well as with the examples provided of vigorous activities. Participants explained that they were unsure how to respond because they felt that for physical activity to be considered vigorous all the physiological changes cited (i.e. sweat, breathe harder, feel your heart beat) had to occur. Also, when formulating their answers, they considered vigorous activities to be only those provided in the examples given on the questionnaire (i.e. jogging, aerobics, swimming).

The definition of vigorous exercise that was adopted for the next version of the questionnaire was simpler and did not provide any examples of specific activities. In the modified version of the instrument, vigorous exercise was defined as “*those activities that make your heart rate and breathing increase by a large amount*”⁸.

Other implications of changing the behavioural referent were that the title of the questionnaire, as well as the items within each sub-scale had to be modified to reflect exercise behaviour. Thus, the post-cognitive interview version of the instrument was called the Motivational Factors for Exercise Scale (MFES) (*Version 4*) (cf. [Figure 1](#), pg. 37) *.

7.3.2.2 Modifications to the Sub-scales of the MFPAS

Based on the results of the cognitive interviews some of the presumed motivational factors represented in the MFPAS had to be revised. It also became apparent that there was the need to include new factors to capture concepts that were not represented in the instrument.

The participants perceived the sub-scales of *Affect* and *Enjoyment* to be very similar. The results from the interviews revealed that interviewees were using the words to describe either an affective state or feeling of enjoyment as though they were synonymous with each other. This indicated that both the interpretation of the items from these sub-scales, and the process by which participants formulated their responses were similar. Further, participants explicitly stated in their feedback that the items from both the sub-scales of *Affect* and *Enjoyment* were tapping into the same concept. It was the opinion of those interviewed that the sub-scale of *Affect* more broadly captured the emotions one experiences while being active, while the sub-scale of *Enjoyment* ascertained a sub-type of emotion.

Upon examination of the operational definitions of these sub-scales, it became apparent that these two factors could be merged together to create a more concise

* The change in the behavioural referent did not have any implications on the content (i.e. sub-scales) or the conceptualization of this instrument because the research from which the presumed motivational factors were derived studied activities that were consistent with the definition of exercise adopted for this study.

concept. Consequently, the presumed motivational factor of “*Enjoyment*” was integrated into the factor of “*Affect*” because it could be viewed as a sub-type of emotion or feeling. The revised factor of “*Affect*” now captured both the positive and negative emotions about being active.

Beyond minimizing the redundancy between motivational factors, the results from the cognitive interviews also revealed the need to add two new motivational factors. The first factor added was labeled as “*Time to Self*” (a.k.a. *Time*). This factor was included because some participants felt that the social aspect of being active motivated their participation, while others felt that what motivated their activity was that it provided the opportunity to have some time to themselves, away from other people. In order to capture a broad range of motivational concepts that influence the likelihood of being active, the decision was made to include this sub-scale in the instrument.

The second presumed motivational factor that was added was labeled as “*Social comparison*”. It was included because the existing factor of “*Self-evaluation*” was not being interpreted as intended. For some participants, their performance in a particular activity was evaluated by comparing it against an internal standard that they had created. However, for other participants, their performance was evaluated by comparing it to standard that was set by other people. In order to capture this latter type of self-evaluation, the proposed motivational factor of “*Social comparison*” was added.

Thus, the post-cognitive interview version of this instrument (*Version 4*) represented fifteen presumed motivational factors and the concept of intention (cf. [Figure 1](#), pg. 37). A summary of the changes to the factors represented in *Version 4* of this instrument is provided in [Table 14](#) (cf. pg. 92), while the operational definitions of the new/refined factors is provided in [Table 15](#) (cf. pg. 92). The internal-external classification of the fifteen presumed motivational factors can be found in [Figure 5](#) (cf. pg. 92).

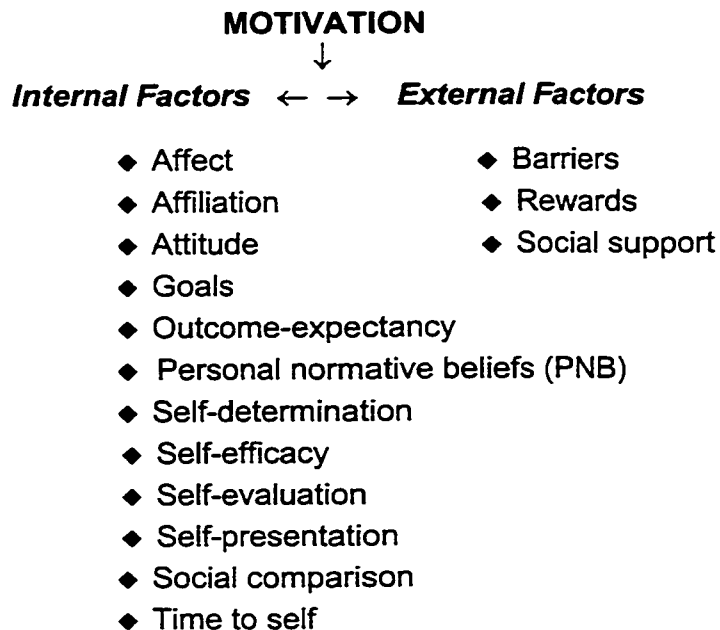
Table 14: Modifications to the Presumed Motivational Factors Represented in Version 4 of the Motivational Factors for Exercise Scale (MFES)

Factor	Modification(s)
<i>Affect</i>	Absorbed factor of “ <i>Enjoyment</i> ” (MFPAS Version 3)
<i>Social Comparison</i>	New concept added.
<i>Time to Self</i>	New concept added.

Table 15: Operational Definitions of the New and Modified Factors of the Motivational Factors for Exercise Scale (MFES)

New or Modified Factor	Operational Definition
<i>Affect</i>	A person's emotional response to the thought of performing a given behaviour, or the feelings that performing the behaviour will be produce.
<i>Social Comparison</i>	The result of individuals making certain types of comparison with others people in relation to their exercise performance.
<i>Time to Self</i>	The extent to which exercising alone satisfies the person's needs to do something that does not require people.

Figure 5: The Post-Interview List of Presumed Motivational Factors Represented in Version 4 of the Motivational Factors for Exercise Scale (MFES)



7.3.2.3 Item Level Modifications

The feedback obtained from the cognitive interviews also resulted in several changes at the item-level of the MFES. For instance, according to those interviewed, some of the sub-scales were not being adequately represented by their items. Participants felt that the sub-scale of *Outcome-expectancy* did not reflect the two most common outcomes people expect from being active: to maintain a desirable weight and to be healthy. Accordingly, two new items were drafted and included into this sub-scale to represent these concepts. These items were, “*Regular exercise will help me maintain a desirable weight*” and “*Regular exercise will help me be as healthy as I can be*”.

Similarly, for the sub-scale of *Self-determination*, participants stated that their activity level was largely determined by their current life circumstances/situation. Since this was not reflected in any of the items in this sub-scale, a new item “*My exercise is determined by what is going on in my life*” was drafted and included in the instrument to capture this relevant concept.

As described in Section 7.3.2.2 above, several changes were made to the presumed motivational factors represented in this instrument. One modification was the addition of two new factors, *Time to Self* and *Social Comparison*. For each of these sub-scales, four new items were written. Another change was the integration of *Enjoyment* into *Affect*. As a result, the items from the sub-scale of *Enjoyment* were combined with those from *Affect*.

Beyond adding or merging items within the sub-scales, the feedback from the interviews also assisted in identifying an item that was not appropriate for the sub-scale it was created for. Within the sub-scale of *Goals*, the thought process that directed participants’ response to the item “*Getting regular physical activity is not a high priority for me*” revealed that it was tapping into concept that was inconsistent with the operational definition of this sub-scale. Further, the feedback obtained from participants

with respect to this item was that it was completely unrelated to the other items in this sub-scale because it neither reflected a goal or the goal-setting process.

Comparing the operational definition of this sub-scale to the problematic item revealed that in fact it was not appropriately placed. However, in examining the operational definitions for the other sub-scales it became evident that this item was suited for the sub-scale of *Personal Normative Beliefs (PNB)* because it captured the inherent (i.e. personal) value of participating in physical activity. For this reason, this item was moved to the sub-scale of *PNB*.

The results from the interviews also assisted in identifying twelve problematic items that had to be eliminated for a variety of reasons. For instance, the results indicated that the item "*I choose my own physical activity goals*" from the *Self-determination* sub-scale had to be removed because it was unrelated to the operational definition of this sub-scale. Further, the cognitive process by which participants formulated their responses indicated that it was tapping into two concepts simultaneously, the amount of control an individual has over their participation and their goal-setting tendencies. For these reasons, this item was eliminated from the sub-scale of *Self-determination*.

Similarly, the item "*Regular physical activity will give me time to myself*" from the sub-scale *Outcome-expectancy* was eliminated because it tapped into two motivational concepts. Although having time to oneself represents an outcome one could expect from being physically active, it also taps into a concept that is inherent to the newly added motivational factor of *Time to Self*. Since this item was not unique to either sub-scale it was removed from the instrument.

Another item that was eliminated from the sub-scale of *Outcome-expectancy* was "*Doing regular physical activity would put me at risk for getting an injury*". During the interview process it became apparent that while this item reflected an outcome one

could anticipate from being active, it was not a significant concern to most participants. As well, the feedback that participants provided at the end of the session regarding this item was that it was tapping into an outcome that was irrelevant to them. Likewise, the item *"At the end of the day, I am too tired to be physically active"* from the *Barrier* sub-scale was not relevant to those interviewed, where all the participants stated even after a long day they found the energy to participate in some degree of activity. Since neither of these items reflected something that prevented participation, it became apparent that they were not providing useful information and were subsequently eliminated from the instrument.

Other items that were eliminated at this stage were from the sub-scales of *Affect*, *PNB*, *Enjoyment*, and *Self-evaluation*. Specifically, one item was eliminated from *Affect* and *PNB*, three from *Enjoyment*, and two from *Self-evaluation* because they were not providing useful or unique information. The item *"Getting regular physical activity makes me feel fulfilled"* from *Affect*, the item *"Being physically active on a regular basis is not important to me"* from *PNB*, as well as the items *"I find physical activity to be exciting"*, *"I enjoy the time I spend being physically active"*, *"I find getting physical activity to be unsatisfying"* from the *Enjoyment* sub-scale were eliminated because they were perceived by respondents as being redundant with the other items in these sub-scales.

Further, the items *"I have higher expectations of my physical activity performance than most people I know"* and *"When it comes to physical activity, I rate myself to be as capable as most other people"* from the sub-scale *Self-evaluation* were eliminated because from observing the cognitive process participants underwent to formulate their answers to these questions, as well as their actual responses it became evident that everyone was perceiving themselves very positively. Since all participants were responding exactly the same it was decided that these items had to be deleted from this sub-scale.

As well, an item was removed from the sub-scale of *Social support* because it was difficult to interpret and required a complex retrieval/recall strategy. Reviewing participants' thought processes for the item "*There is no one I feel comfortable talking to about the problems I experience with physical activity*" revealed that there was a great deal of variability interpreting the terms "comfortable" and "problems". Further, many participants expressed that this was only relevant when they began being active and as a result, in order to answer this question they employed a variety of estimation and guessing techniques. Given some of the confusion surrounding the terminology used, coupled with the complex thought process involved, it was decided that this item be eliminated from the sub-scale.

Outside of the major changes described, there were also many minor modifications to the instrument. Much of these focused on revising and simplifying the items, as well as increasing the consistency in the terminology.

Thus, the post-cognitive interview version of this instrument (*Version 4*) (cf. Figure 1, pg. 37) consisted of 85 items.

7.4 Discussion

The cognitive interviews provided useful information about how respondents were interpreting the behavioural referent, instruction sets, and items. It has also identified a variety of comprehension and recall problems that were inherent to the instrument.

The results from these sessions were used to make informed decisions about the content of the MFES and re-wording, as well as whether the items were eliciting relevant and appropriate information. This assisted in correcting and modifying many of the hidden problems that would have otherwise affected the quality and the accuracy of the information produced by the MFES.

The changes described above improved both the quality and the accuracy of the MFES in several ways. The manner in which the items and instruction sets could be interpreted was made more consistent by eliminating terms that were vague/ambiguous and unfamiliar, or that could be interpreted a variety of ways. Further, the need for guessing or other such estimation strategies was reduced by simplifying the instruction sets and the wording of the items.

Perhaps most important, the quality and accuracy of the MFES was improved because modifications were made to both its items and sub-scales to ensure that the appropriate information being captured and that the relevant aspects of motivation for exercise behaviour were being represented. This phase of the study provided preliminary evidence for the face validity of this instrument, increasing confidence that its content adequately represents important aspects of motivation for exercise behaviour.

8.0 OBJECTIVE 4 -- CONTENT VALIDITY

The objective for this phase of the study was:

- ◆ To determine whether the Motivational Factors for Exercise Scale (MFES) captures concepts that represent aspects of motivation for exercise behaviour.

8.1 Research Question

The research questions pertaining to this phase of the study were:

- ◆ Do the sub-scales, as defined, reflect factors of motivation for exercise behaviour?
- ◆ Do the items of the MFES adequately reflect the operational definitions of the constructs that they purport to measure?

These questions address what is generally referred to as *content validity*^{141,144}.

8.2 Procedure

The content (i.e. items and sub-scales) of the MFES was examined by two raters, whose expertise lay in the areas of the determinants of exercise behaviour and the measurement of health-related behaviours.

8.2.1 Selection of Raters

The areas of expertise required to examine the content of the MFES were exercise and psychology (e.g. motivation and behaviour change) and as such, two raters were chosen.

Two raters were deemed sufficient to assess the content of this instrument because its development was based on an extensive review of the literature, as well as utilized pre-testing and cognitive interviews to refine its content in an iterative manner.

8.2.2 Protocol

Each rater was provided with a package of materials that included the operational definitions adopted for motivation and the sub-scale factors represented within the MFES, as well as the items for each sub-scale. They were also provided with an instructional set describing how the content was to be assessed.

The raters reviewed the content of the MFES by answering the questions found in two different sections of the package they received. In the first section, each rater was asked to indicate using the “yes-no” rating scale provided whether:

- ⇒ Each factor represented in the MFES reflected an aspect of motivation for exercise behaviour.
- ⇒ The items within each sub-scale captured an aspect (i.e. reflected) of the concept it was proposed to represent.

In the second portion of the package, each rater was asked to answer for each sub-scale the open-ended question, “Is there an area within the sub-scale that has not been adequately addressed by its items?”. The purpose of this question was to ascertain whether the items from each sub-scale reflected all the relevant aspects of the motivational factors they were purported to be measuring.

8.2.3 Instrument(s)

Each rater received the items from each sub-scale, and the operational definitions for the fifteen presumed motivational factors represented in *Version 4* of the MFES (cf. [Figure 1](#), pg. 37).

8.2.4 Analyses Performed

To determine which items and factors were to be retained in the MFES, the answers that each rater provided were counted and the consistency between the raters

was ascertained. A factor was retained in the instrument only if there was 100% agreement between the raters, where both raters agreed that it represented an aspect of motivation for exercise behaviour. Similarly, an item was retained only if both raters believed (i.e. agreed) that it reflected an aspect of the concept its sub-scale was purporting to be measuring.

8.3 Results

8.3.1 The Content of the Motivational Factors for Exercise Scale (MFES)

Comparing the agreement between the raters to the pre-specified criteria (cf. Section 8.2.4) revealed that after reading each of the operational definitions of the sub-scales the raters agreed that each factor represented an aspect of motivation for exercise behaviour. Consequently, all the presumed motivational factors were retained in the MFES. A summary of the sub-scale specific results can be found in Table 16.

Table 16: Sub-scales Selected to Represent Aspects of Motivation in the Motivational Factors for Exercise Scale (MFES)

<i>Sub-scale</i>	<i>Criteria Satisfied *</i>	<i>Retained</i>	
		<i>Yes</i>	<i>No</i>
<i>Affect</i>	Yes	✓	---
<i>Affiliation</i>	Yes	✓	---
<i>Attitude</i>	Yes	✓	---
<i>Barrier</i>	Yes	✓	---
<i>Goals</i>	Yes	✓	---
<i>Outcome-expectancy</i>	Yes	✓	---
<i>PNB</i>	Yes	✓	---
<i>Rewards</i>	Yes	✓	---
<i>Self-determination</i>	Yes	✓	---
<i>Self-efficacy</i>	Yes	✓	---
<i>Self-evaluation</i>	Yes	✓	---
<i>Self-presentation</i>	Yes	✓	---
<i>Social comparison</i>	Yes	✓	---
<i>Social support</i>	Yes	✓	---
<i>Time</i>	Yes	✓	---

** Perfect Agreement between raters is that the factor, as defined by its operational definition, reflects an aspect of motivation for exercise behaviour.*

At the item level, the results revealed that two items had to be removed from the instrument because they did not satisfy the evaluation criteria. The first item that was eliminated was, *"My exercise is determined by what is going on in my life"* from the sub-scale *Self-determination*. Although this item had been added to the MFES, based on the results obtained from the cognitive interviews (cf. *Section 7.3.2.3*), it was removed in this phase of the study because both raters felt that it was not unique to the concept of self-determination. While this item was tapping into the individual's perception of the amount of control they have over their exercise participation, as it was written it was also capturing the perception of barriers that inhibit exercise participation. Consequently, this item was eliminated because it was tapping into two motivational concepts concurrently.

The second item that was removed was, *"I rate my abilities to exercise positively"* from the sub-scale *Self-evaluation*. For this item, both raters agreed that the concept this item was tapping into was irrelevant to, and inconsistent with the operational definition of this sub-scale.

Another modification was the identification of the need to add a new item to the sub-scale of *"Rewards"*. The item, *"People acknowledge my efforts to exercise"* was created because both raters thought that receiving rewards for the effort one puts forth to exercise was something that was not adequately addressed by the existing items of this sub-scale.

Although not the purpose of this phase of the study, the process of examining the content of the MFES also resulted in some modifications to the wording of the items. This provided another opportunity to re-visit the items in order to refine and/or simplify their wording.

A summary of the item-specific results from this phase of the study is provided in Table 17 (cf. pg. 102). Based on the changes described above, the modified version of the MFES (*Version 5*) consisted of 84-items (cf. Figure 1, pg. 37) that represented the

fifteen presumed motivational factors. A copy of the *Version 5* of the MFES can be found in [Appendix 5](#), while its response key can be found in [Appendix 6](#). Further, a description of the origin of the items from *Version 5* of the MFES can be found in [Appendices 7](#) and [8](#), respectively.

Table 17: Item-specific Results from the Examination of the Content of the Motivational Factors for Exercise Scale (MFES)

<i>Item</i>	<i>Criteria Satisfied *</i>	<i>Retained</i>	
		<i>Yes</i>	<i>No</i>
For me, engaging in exercise is rewarding.	Yes	✓	---
For me, engaging in exercise is unpleasant.	Yes	✓	---
For me, engaging in exercise is relaxing.	Yes	✓	---
For me, engaging in exercise makes my body feel uncomfortable.	Yes	✓	---
For me, engaging in exercise is too tiring.	Yes	✓	---
For me, engaging in exercise is difficult.	Yes	✓	---
I have a lot of control over whether or not I engage in exercise.	Yes	✓	---
I exercise because other people want me to.	Yes	✓	---
I have little control over the amount of time I have for engaging in exercise.	Yes	✓	---
My life circumstances make it hard for me to exercise.	Yes	✓	---
I can plan my schedule so that nothing interferes with me exercising.	Yes	✓	---
My exercise is determined by what is going on my life.	No	---	✓
Exercising will give me more energy.	Yes	✓	---
Exercising will improve my appearance.	Yes	✓	---
Exercising will help me feel better about myself.	Yes	✓	---
Exercising will allow me to maintain my athletic skills.	Yes	✓	---
Exercising will help reduce the stress of daily life.	Yes	✓	---
Exercising will help keep me be as healthy as I can be.	Yes	✓	---
I am in good enough physical condition to exercise.	Yes	✓	---
I am not coordinated enough to exercise.	Yes	✓	---
My body is strong enough to allow me to exercise.	Yes	✓	---
I rate my abilities to exercise positively.	No	---	✓

<i>Item</i>	<i>Criteria Satisfied *</i>	<i>Retained</i>	
		<i>Yes</i>	<i>No</i>
I do not have the skills required to exercise.	Yes	✓	---
Exercising makes me feel satisfied.	Yes	✓	---
Exercising makes me feel bored.	Yes	✓	---
Exercising leaves me feeling more energized.	Yes	✓	---
Exercising leaves me feeling refreshed.	Yes	✓	---
Exercising makes me feel good.	Yes	✓	---
I find exercising enjoyable.	Yes	✓	---
I do not find it fun to exercise.	Yes	✓	---
I like to exercise because it helps me meet with people.	Yes	✓	---
Exercise allows me to spend time with people I like.	Yes	✓	---
Exercise helps satisfy my need to spend time with family or friends.	Yes	✓	---
I look forward to exercising because of the people I do it with.	Yes	✓	---
Exercising is very important to me.	Yes	✓	---
I am the kind of person who believes it is worthwhile to exercise.	Yes	✓	---
Exercising is not a high priority for me.	Yes	✓	---
I would be achieving something meaningful to me if I exercised.	Yes	✓	---
I get praise from others for exercising.	Yes	✓	---
People acknowledge my efforts to exercise.	Yes	✓	---
When I meet a personal goal for exercise, I do something nice for myself.	Yes	✓	---
The feedback I get from others about my exercise helps me stay with it.	Yes	✓	---
When I meet a personal goal for exercise, I tell myself I have done well.	Yes	✓	---
How confident are you that you could exercise when you are a little tired.	Yes	✓	---
How confident are you that you could exercise when you have to do it yourself.	Yes	✓	---
How confident are you that you could exercise when you are in a bad mood.	Yes	✓	---
How confident are you that you could exercise when you have many other demands on your time.	Yes	✓	---
How confident are you that you could exercise when you feel a little stiff or sore.	Yes	✓	---
How confident are you that you could exercise when the weather is bad.	Yes	✓	---
That others will admire me for being in good physical condition.	Yes	✓	---
That I look good while exercising.	Yes	✓	---

<i>Item</i>	<i>Criteria Satisfied *</i>	<i>Retained</i>	
		<i>Yes</i>	<i>No</i>
That I look coordinated while exercising.	Yes	✓	---
That other people think I am performing an activity properly.	Yes	✓	---
Setting goals for what I would like to accomplish from exercising encourages me.	Yes	✓	---
I do not set goals for what I would like to accomplish from exercising.	Yes	✓	---
After I have reached an exercise goal I make a new one.	Yes	✓	---
When I set a goal for exercise, I base it on what I think I can reach.	Yes	✓	---
I consistently work towards achieving goals for exercise.	Yes	✓	---
I track my performance to see whether I am attaining my exercise goals.	Yes	✓	---
My goals for what I would like to accomplish from exercising tend to be too hard to reach.	Yes	✓	---
Due to other commitments, it is hard for me to fit exercise into my life.	Yes	✓	---
I do not find it difficult to exercise when the weather is bad.	Yes	✓	---
The places where I can exercise are easy to get to.	Yes	✓	---
Exercising costs too much money.	Yes	✓	---
I have an injury or illness that prevents me from exercising as much as I would like to.	Yes	✓	---
There is very little that can keep me from exercising on a regular basis.	Yes	✓	---
Engaging in exercise would be too time consuming.	Yes	✓	---
Most people who are important to me support my efforts to exercise.	Yes	✓	---
There are people who I can count on to help me exercise.	Yes	✓	---
There are people I can ask for advice about exercising.	Yes	✓	---
If I begin to lose interest in exercising, people I know encourage me to continue.	Yes	✓	---
There are people I can rely on to exercise with me.	Yes	✓	---
I feel less satisfied about my exercise when I see other people who are more athletic than I am.	Yes	✓	---
I feel more enthusiastic about exercise when I compare myself to people who have similar abilities as me.	Yes	✓	---

<i>Item</i>	<i>Criteria Satisfied *</i>	<i>Retained</i>	
		<i>Yes</i>	<i>No</i>
Comparing my exercise performance to people who are more physically fit than I am encourages me to exercise.	Yes	✓	---
Knowing that my exercise performance is at least as good as most people I know encourages me to keep on exercising.	Yes	✓	---
Exercise gives me time to my self.	Yes	✓	---
Exercise is important because it is something I am able to do on my own.	Yes	✓	---
Exercise gives me valuable time away from people.	Yes	✓	---
Exercising by myself allows me to satisfy my need to do something on my own.	Yes	✓	---

** Perfect agreement between raters is that the item reflects an aspect of the concept its sub-scale purports to be measuring.*

8.4 Discussion

The results of this phase of the study yielded useful information about the content of the MFES and afforded the opportunity to indirectly test the conceptual framework upon which this instrument was based.

The operational definitions of the sub-scales were all consistent with the definition of motivation adopted for the study, and each reflected an aspect of motivation that was relevant to exercise behaviour. The items accurately reflected the sub-scale definitions, and tap into aspects that are important to the concept they are proposed to be measuring. Collectively, this suggests that the current composition of the MFES is adequate, and that its items and the sub-scales could yield information reflecting motivational factors for exercise behaviour.

Although the raters found the content of the MFES to be acceptable at both the item and sub-scale levels, the process by which it was examined could have benefited from the addition of an examiner(s) with a complimentary area(s) of expertise. For

example, including experts from the fields of fitness promotion and sports psychology, or even individuals directly involved in the fitness industry could have enhanced this process. Their direct knowledge of, and experience in what motivates people to be active would have been an asset. Further, including raters external to the thesis would have provided the opportunity to confirm that the most relevant personal and environmental factors were represented in the MFES, as well as that the items within each sub-scale were appropriate.

Even though the inclusion of an additional raters might have been advantageous, the process that was employed likely did not compromise the study as the examiners possessed excellent knowledge of the domain of interest (i.e. motivation and exercise), and the MFES had already been tested and revised according to independent feedback.

The protocol described here represents only two of several possible methods by which content validity could have been assessed. The content validity of the MFES could have been addressed by determining whether the sub-scales of the MFES represented all of the possible factors of motivation for exercise behaviour. Raters could also have been asked to match each item from the MFES to one of the fifteen sub-scales represented in the MFES. This would have been a more rigorous test, as it would have demonstrated whether the raters could replicate the decisions made regarding the item-structure of the sub-scales.

Although the content validity of the MFES could have been examined using other methods, the results obtained addressing this objective indicate that at the item and sub-scale level, the current structure and composition of the MFES is at least adequate. This provides preliminary evidence for the content validity of the MFES.

9.0 OBJECTIVE 5 – INTERNAL CONSISTENCY

The objective for this phase of the study was:

- ◆ To determine if the sub-scales of the Motivational Factors for Exercise Scale (MFES) were characterized by an adequate level of internal consistency.

9.1 Research Question

The research question specific to this phase of the study was:

- ◆ Are the sub-scales of the Motivational Factors for Exercise Scale (MFES) homogeneous? In other words, to what degree are the items from each sub-scale interrelated, and do they appear to be measuring a similar motivational concept via their relationship to the sub-scale scores?

This question addressed one aspect of reliability commonly referred to as the internal consistency of an instrument ¹⁴¹⁻¹⁴⁵. The internal consistency of the MFES was determined by calculating the Cronbach α coefficient for each sub-scale. A sub-scale was considered homogeneous if its Cronbach α was ≥ 0.70 ¹⁴³.

9.2 Procedure

9.2.1 Sampling

Respondents were recruited at the RA Centre (Recreation Association of the Public Service of Canada) and its affiliated sites, as well as at worksites in the Regional Municipality of Ottawa-Carleton (RMOC) that were members of the Employee Lifestyle Management Alliance (ELMA).

A non-probability sample was accrued and participants were recruited or volunteered to participate in the study. They were informed that the purpose of the

study was to learn about their thoughts and feelings towards exercising. The following sections describe the recruitment process specific to these sites.

9.2.1.1 The RA Centre and Affiliated Sites

The RA Centre is a non-profit organization that provides a variety of fitness programs and hobby clubs. It also operates affiliated fitness centres in Federal Government buildings across the RMOC and Hull, as well as at external sites such as the Ottawa Regional Cancer Centre (ORCC).

At the RA Centre questionnaire packages were disseminated to members either via the massage therapy clinic, fitness activities, or hobby clubs. In addition, extra copies were left at the Member's Services Desks. However, at the affiliated sites of the RA Centre, the questionnaire packages were disseminated at their fitness centre, as well as through display booths that were set-up in their cafeteria and/or lobby.

Upon receiving the questionnaire package participants were given one week to complete it. At the RA Centre, members returned the completed questionnaires to drop-boxes set-up at the Member's Services Desks, while at the affiliated sites of the RA Centre, the completed questionnaires were returned via internal mail to the Fitness Centre. Additional information about the recruitment process at these sites is described in Appendix 9.

9.2.1.2 Employee Lifestyle Management Alliance (ELMA) Worksites

ELMA is a voluntary organization that consists of occupational health professionals that represent various corporations and agencies across the RMOC. It focuses on health promotion at the work place, as well as organizes and promotes various health-related events in the region. Several ELMA members were approached and agreed that the worksite they represented could participate in the study. Two

distinct methods were used to disseminate questionnaire packages at these worksites. The first was sending the packages directly to the ELMA representative at the specific worksite, who distributed them to their employees and/or colleagues. The second method was personally delivering the questionnaire packages, with the aid of the ELMA representative(s), directly to the employees of the worksite. Individuals were stationed at every entrance of the worksite and the questionnaire packages were disseminated to the employees as they arrived at work in the morning (i.e. between 7 am and 10 am).

Upon receiving the questionnaire, participants were given one week to complete it. The completed questionnaires were either returned to drop-boxes set up at various locations within each organization (e.g. cafeteria, reception desk, each floor), or via internal mail to the representative at the worksite. Additional information about the recruitment process at these worksites can be found in [Appendix 9](#).

9.2.2 Inclusion and Exclusion Criteria

At the RA Centre and the ELMA worksites, potential participants were included in the study if they were:

- ⇒ Proficient in English
- ⇒ Between the ages of 18 to 75

Amongst those initially selected, participants were excluded from the study if they:

- ⇒ Had an injury/illness that limited or prevented their current exercise participation.

However, owing to Federal language requirements, at the Federal Government sites of the RA Centre, potential participants were included if they were:

⇒ Proficient in English or French*

⇒ Between the ages of 18 to 75

At these sites, participants were excluded from the study if they:

⇒ Had an injury/illness that limited or prevented their current exercise participation

9.2.3 Instrument(s)

The analysis for this portion of the study utilized *Version 5* of the MFES (cf. Appendix 5, and Figure 1 – pg. 37). The other instrument used was the Demographic Questionnaire (cf. Appendix 11), which measured a variety of personal attributes such as age, height, and weight. It also included variables such as marital status, number of dependent children, level of education, employment status, and income. Given the exclusion criteria of this study was the presence of an injury/illness that limits/prevents exercise participation, a question was included in the Demographic Questionnaire to identify those who satisfied this criterion.

9.2.4 Analyses Performed

Before the analyses were performed the participants were randomly assigned to one of two groups. Fifty percent of respondents formed the group *Fall Sample A*, while the remaining half of the sample formed *Fall Sample B*. Preliminary assessment of the internal consistency of the sub-scales of the MFES was performed using *Fall Sample A*.

* Although the MFES (*Version 5*) (cf. Figure 1, pg. 37) was available in French, all participants from the Federal Government sites elected to complete the English version. The French version of the MFES can be found in Appendix 10.

After necessary refinements were made, the internal consistency of the MFES sub-scales was re-calculated using *Fall Sample B*. Splitting the sample provided an opportunity to confirm the appropriateness of the decisions made to modify the composition of the sub-scales and provided an additional test of internal consistency.

Given that the MFES is proposed to be a multi-factorial instrument and that its items are reported on a five-point Likert-type scale, sub-scale specific reliability coefficients were calculated using the Cronbach alpha (α) statistic. Most argue that the internal consistency of a test or sub-scale should be as high as possible ^{143,145}. However, in general, a Cronbach α level of ≥ 0.70 is considered acceptable ¹⁴³.

Prior to calculating the α coefficients, all the negatively worded items of the MFES were reverse scored (i.e. positively instead of negatively). The Cronbach α coefficients were calculated via SPSS 7.0 *Scale (Reliability Analysis)* (SPSS Inc., 1989-1995) with a listwise deletion strategy (cf. *Section 6.2.2.4.1*).

9.3 Results

9.3.1 Response Rates

A total of 3315 questionnaires were distributed at the RA Centre/Affiliated Government sites and the ELMA worksites. From these sites, 1160 questionnaires were completed and returned, yielding a 35% response rate.

9.3.2 Demographic Characteristics of Participants

Of the 1160 participants who completed and returned the questionnaire, 8 respondents (0.69%) were excluded because they did not satisfy the inclusion criteria (i.e. between ages of 18 and 65). This yielded a total of 1152 participants who were retained for the analysis. *Fall Samples A and B* each contained 576 participants. A

description of the demographic characteristics of these samples is provided in Tables 18 and 19 (cf. pg. 113-114). These tables indicate only minor differences between *Fall Samples A and B* with respect to the demographic characteristics ascertained in this study. It is highly unlikely given the similarity between these two samples that the demographic characteristics measured influenced the findings.

9.3.3 Internal Consistency of the Motivational Factors for Exercise Scale (MFES)

Examination of the Cronbach α coefficients for *Fall Sample A* revealed that the α coefficient for each sub-scale was ≥ 0.70 , and that they ranged between 0.70 and 0.90. The results also indicated that while the α coefficients for the sub-scales of *Self-determination* and *Goals* were adequate, they could be improved with the removal of an item.

Within the sub-scale of *Self-determination*, the results revealed that the inter-item correlations for the item "*I exercise because other people want me to*" was marginal and negative, with correlations ranging between -0.11 and 0.18. In order to increase the homogeneity of this sub-scale this item was eliminated. The modified sub-scale consisted of four items that represented the concept of *Self-determination*.

Similarly, for the sub-scale *Goals*, the results revealed that the α could be increased by eliminating the item "*My goals for what I would like to accomplish from exercising tend to be too hard to reach*". Inter-item correlations for this item were marginal and negative ranging between -0.009 and +0.107. To increase the internal consistency of this sub-scale the item was eliminated. Consequently, the reduced sub-scale of *Goals* was represented by six items instead of seven.

Table 18: The Demographic Characteristics of Fall Sample A*

		N (%)	$\bar{x}$ (σ)	Range (Minimum/Maximum)
Age		566 (98.3%)	40.2 (9.32)	56 (18/74)
Sex:	Male	254 (44.1%)	----	----
	Female	319 (55.9%)		
	Total	571 (99.1%)		
Height (cm)		569 (98.8%)	166.8 (9.13)	47.5 (147.5/195)
Weight (lbs)		559 (97%)	159.8 (31.45)	193 (92/285)
Marital Status:	Single	106 (18.7%)	----	----
	Married/Commonlaw	396 (69.7%)		
	Divorced/Separated	64 (11.3%)		
	Widowed	2 (0.4%)		
	Total	568 (98.6%)		
Dependent Children ≤ 16:	Yes	251 (44%)	----	----
	No	319 (56%)		
	Total	570 (99%)		
Highest Level of Education:	Elementary	9 (1.6%)	----	----
	High School/Cegep	116 (20.5%)		
	Technical Trades	139 (24.5%)		
	University UG ¹	202 (35.6%)		
	University PG ²	101 (17.8%)		
Total		567 (98.4%)		
Employment Status:	Full-time	513 (90%)	----	----
	Part-time	36 (6.3%)		
	Seasonal	5 (0.9%)		
	Not Employed OH ³	0 (0%)		
	Unemployed NL ⁴	5 (0.9%)		
	Unemployed L ⁵	1 (0.2%)		
	Retired	10 (1.8%)		
Total		570 (99%)		
Household Income Meeting Needs:	Very Well	108 (19%)	----	----
	Adequately	359 (63.3%)		
	Inadequately	75 (13.2%)		
	Very Inadequately	9 (1.6%)		
	No Answer	15 (2.8%)		
Total		567 (98.4%)		
Illness/Injury Limiting Exercise:	Yes	101 (17.7%)	----	----
	No	470 (82.3%)		
	Total	571 (99.1%)		

* Participants from the RA Centre, Affiliated Sites, and ELMA Worksites

1. University Undergraduate Degree

2. University Post-graduate Degree

3. Not employed Outside the Home

4. Unemployed Not Looking

5. Unemployed Looking

Table 19: The Demographic Characteristics of Fall Sample B*

		N (%)	$\bar{x}$ (σ)	Range (Minimum/Maximum)
Age		570 (99%)	39.4 (9.41)	56 (19/75)
Sex:	Male	239 (41.9%)	---	---
	Female	331 (58.1%)		
	Total	570 (99%)		
Height (cm)		569 (98.8%)	167.0 (9.87)	97.5 (100/197.5)
Weight (lbs)		564 (97.9%)	158.6 (33.16)	185 (90/275)
Marital Status:	Single	107 (18.7%)	---	---
	Married/Commonlaw	408 (71.5%)		
	Divorced/Separated	53 (9.3%)		
	Widowed	3 (0.5%)		
	Total	571 (99.1%)		
Dependent Children ≤16:	Yes	225 (39.4%)	---	---
	No	346 (60.6%)		
	Total	571 (99.1%)		
Highest Level of Education:	Elementary	3 (0.5%)	---	---
	High School/Cegep	147 (25.8%)		
	Technical Trades	138 (24.3%)		
	University UG ¹	192 (33.7%)		
	University PG ²	89 (15.6%)		
Total		569 (98.8%)		
Employment Status:	Full-time	515 (90%)	---	---
	Part-time	41 (7.2%)		
	Seasonal	2 (0.3%)		
	Not Employed OH ³	2 (0.3%)		
	Unemployed NL ⁴	2 (0.3%)		
	Unemployed L ⁵	4 (0.7%)		
	Retired	6 (1%)		
Total		572 (99.3%)		
Household Income Meets Needs:	Very Well	134 (23.6%)	---	---
	Adequately	310 (54.6%)		
	Inadequately	84 (14.8%)		
	Very Inadequately	11 (1.9%)		
	No Answer	29 (5.1%)		
Total		569 (98.8%)		
Illness/Injury Limiting Exercise:	Yes	98 (17.1%)	---	---
	No	474 (82.9%)		
	Total	572 (99.3%)		

* Participants from the RA Centre, Affiliated Sites, and ELMA Worksites

1. University Undergraduate Degree

2. University Post-graduate Degree

3. Not employed Outside the Home

4. Unemployed Not Looking

5. Unemployed Looking

With the deletion of these two items, the modified version of the MFES (*Version 6*) consisted of 82 items (cf. [Figure 1](#), pg. 37). Cronbach α 's were then re-calculated on *Fall Sample B* using *Version 6* of the MFES (cf. [Figure 1](#), pg. 37). In these analyses, the α 's ranged from 0.70 to 0.90. The sub-scale specific Cronbach α coefficients from *Fall Samples A and B* can be found in [Table 20](#).

Table 20: Sub-scale Specific Cronbach α Coefficients from Fall Samples A and B

Sub-scale	Fall Sample A *			Fall Sample B **		
	N	# of items	α Coefficient	N	# of items	α Coefficient
<i>Affect</i>	559	7	0.90	567	7	0.90
<i>Affiliation</i>	561	4	0.83	563	4	0.84
<i>Attitude</i>	558	6	0.86	558	6	0.88
<i>Barrier</i>	562	6	0.76	568	6	0.72
<i>Goals</i>	552	7	0.79	558	6	0.87
<i>Intention</i>	559	4	0.87	572	4	0.88
<i>Outcome-expectancy</i>	560	7	0.79	562	7	0.80
<i>PNB</i>	564	4	0.78	560	4	0.83
<i>Rewards</i>	565	6	0.81	562	6	0.84
<i>Self-determination</i>	554	5	0.75	563	4	0.79
<i>Self-efficacy</i>	566	6	0.88	567	6	0.88
<i>Self-evaluation</i>	559	4	0.72	565	4	0.70
<i>Self-presentation</i>	569	4	0.85	573	4	0.86
<i>Social comparison</i>	559	4	0.70	564	4	0.73
<i>Social support</i>	564	6	0.75	567	6	0.77
<i>Time</i>	559	4	0.84	569	4	0.82

* Calculation based on *Version 5* of the MFES (cf. [Figure 1](#), pg. 37)

** Calculation based on *Version 6* of the MFES (cf. [Figure 1](#), pg. 37)

9.4 Discussion

The results described above reveal that all the items within each sub-scale were positively inter-correlated, suggesting that they were measuring similar characteristics. Further, the observation that the α coefficient for each sub-scale met or exceeded the

pre-specified cut-point (i.e. $\alpha \geq 0.70$) indicates that the items comprising the sub-scales in *Version 6* of the MFES are characterized by an adequate degree of homogeneity, and that no other items need to be removed.

Although the internal consistency of each sub-scale appears to be satisfactory (i.e. $\alpha \geq 0.70$), there were a few sub-scales that did not perform as well as the others. Specifically, across both *Fall Samples A and B*, the α coefficients for the sub-scales of *Social comparison* and *Self-evaluation* were ≤ 0.73 . This indicates that these sub-scales were not as homogeneous as the other sub-scales, where their items were not as strongly inter-correlated as the items within the other sub-scales. This suggests that while the α 's for these sub-scales exceeded the pre-specified cut-point, their items could be made more consistent and that there is room for improvement.

Further examination of the results obtained for the sub-scale *Social comparison* revealed that the item "*I feel less satisfied about my exercise when I see others who are more athletic than I am*" was not as highly correlated with the other items in this sub-scale ($r = 0.16 - 0.25$). Despite the poorer performance of this particular item, it was not eliminated from the sub-scale for two reasons. First, eliminating this item would have only marginally increased the internal consistency of this sub-scale. Second, it was decided a-priori that each sub-scale of the instrument would consist of at least three items (cf. *Section 6.2.1*). Since the elimination of this item would have reduced the number of items within this sub-scale to the minimally acceptable level, coupled with the marginal gain associated with its removal, it was decided that this item should be retained in the instrument.

As for the sub-scale of *Self-evaluation*, there does not appear to be one item in particular that was performing poorly. It is possible that this sub-scale did not perform as well as others because collectively its items were not very good. Although the inter-

correlation between the items in this sub-scale was modest to moderate, ranging from 0.23 to 0.60, they were quite dispersed. Although each item appears to be consistent with the operational definition of *Self-evaluation*, the range of inter-correlations observed suggests that perhaps altogether the items were not very similar. Consequently, future work on the MFES could benefit from conducting qualitative research on this sub-scale to determine how, or if the items within this sub-scale need to be modified.

Despite a few sub-scales performing less well than others, the observation that the sub-scales demonstrated adequate Cronbach α 's across both *Fall Samples A* and *B* supports the current sub-scale structure of the MFES. These findings provide initial evidence for one aspect of reliability, specifically the internal consistency of the MFES.

10.0 OBJECTIVE 6 – CRITERION-RELATED VALIDITY

The objective for this phase of the study was:

- ◆ To determine the criterion-related validity of the sub-scales of the Motivational Factors for Exercise Scale (MFES) by examining the manner in which its sub-scales were related to participants' level of energy expenditure and intention to exercise.

10.1 Research Question

The research questions for this phase of the study were:

- ◆ What is the magnitude and the pattern of the correlations between the sub-scales of the Motivational Factors for Exercise Scale (MFES) and respondents' current level of energy expenditure?
- ◆ What is the magnitude and the pattern of the correlations between the sub-scales of the Motivational Factors for Exercise Scale (MFES) and the degree of respondents' intention to exercise?

These questions address the predictive validity of the MFES^{141,144,147}. Two variables of practical importance were identified to represent concepts that the sub-scales of the MFES should be related to. The first variable was the respondents' current level of energy expenditure. Since the MFES should represent motivational factors that influence exercise participation, its sub-scales should be significantly related to energy expenditure. The second variable of interest was the intention to exercise. This variable was selected because it is believed to occupy an intermediate position between motivational factors and actual exercise behaviour^{1,116,120,248,256,258,269}. If the sub-scales reflect motivational concepts then they should also be related to the intention to exercise.

Examining the nature and magnitude of the correlations between the sub-scales and the key variables of interest (i.e. energy expenditure and intention) was expected to provide initial evidence concerning this one aspect of validity of the MFES.

10.2 Procedure

10.2.1 Sampling

Data used to address these research questions were obtained from the sample described in the previous research question (cf. *Section 9.2.1*, Appendix 9).

10.2.2 Inclusion and Exclusion Criteria

The inclusion and exclusion criteria pertaining to the sample used for this analysis were the same as described in the previous research question (cf. *Section 9.2.2*).

10.2.3 Instrument(s)

This portion of the study utilized *Version 6* of the MFES (cf. Figure 1, pg. 37) and the Demographic Questionnaire (cf. *Section 9.2.3*, Appendix 11). The other instrument used was the Physical Activities Questionnaire (PAQ). The PAQ is an instrument that measures the current level of exercise participation. It ascertains the frequency and duration with which an individual has participated in a variety of activities over a one-month period. Twenty-six potential activities are listed in the PAQ and additional space is provided to indicate up to two other activities that are not listed. The information obtained from this questionnaire is summarized into a daily energy expenditure score. A description of the PAQ and its pre-testing is described in Appendix 12, while a copy of the PAQ used in this study can be found in Appendix 13.

10.2.4 Evaluating the Relationship between the MFES and Variables of Interest

10.2.4.1 The Sub-scales of the MFES and Current Energy Expenditure

10.2.4.1.1 Scoring the Questionnaires

10.2.4.1.1.1 The Sub-scales of the MFES

Sub-scale scores were derived by reverse scoring all negatively worded items (i.e. positively instead of negatively) and calculating a mean score. The following equation was used to derive a mean score for each sub-scale:

$$D_n = \Sigma x_i / y_n$$

Where:

D_n = The mean score for a sub-scale of the MFES

x_i = The value for each item within the sub-scale, ranging from 1 through 5

y_n = The number of admissible items within the sub-scale

* Note – The sum is over admissible items only

An item was considered inadmissible if it was represented by a missing value. Mean scores were only calculated if $\geq$ two-thirds of the items in the sub-scale had valid responses. The minimum number of admissible items required to calculate a mean score for each sub-scale is described in [Appendix 14](#), while a sample calculation of a mean score is provided in [Appendix 15](#).

10.2.4.1.1.2 The Current Level of Energy Expenditure

The current level of energy expenditure through exercise was determined using the Physical Activities Questionnaire (PAQ). The PAQ is based on the structure and format of the Ontario Health Survey (OHS) Questionnaire and asks participants to identify the activities they have participated in over the past month ³¹². It also inquires about the frequency and duration of participation in each activity ³¹². To summarize the data obtained from the PAQ, respondents' energy expenditure was estimated.

Energy expenditure is an approximation of the kilocalories (kcal) of energy expended that is relative to a person's body weight ³¹³. Energy expenditure is expressed in kilocalories expended per kilogram of body weight per day (kcal/kg/day) ^{312,313}. It was calculated using the formula below, which transforms respondents' participation across individual activities into an index (i.e. score) that represents and summarizes their overall participation (e.g. their total energy expenditure across all activities) ³¹². This approach is consistent with other studies, such as the Campbell's Survey of Well-being (1988) and the OHS (1990), as well as the study by Plotnikoff et al., (1997) ^{72,305,312}. The formula used was:

$$\begin{aligned} \text{Energy Expenditure} &= \Sigma (N \times D / 60 \text{ minutes per hour} \times \text{METS} / 30 \text{ days per month}) \\ &= \Sigma (N \times D \times \text{METS} / 1800) \end{aligned}$$

Where:

N = the number of times the activity was performed in the past month

D = the average duration, in minutes, of the activity

METS = the energy cost of activity, expressed as kilocalories expended per kilogram of body weight per hour of activity (kcal/kg/hr)

The MET value is a numerical score assigned to an activity which reflects the metabolic energy cost of participating in it ³¹². The intensity level of an activity is classified as a multiple of one MET, which is the energy expenditure for sitting quietly ³¹³. For the average adult, the amount of energy required to sit quietly is approximately 3.5 ml of oxygen X kg body weight ⁻¹ X minutes ⁻¹ or 1 kcal X kg ⁻¹ body weight X hour ⁻¹ ³¹³. Hence, the MET value of an activity is the ratio of the associated metabolic rate for the activity divided by the resting metabolic rate (RMR) ³¹³, or in other words, it is a multiple of the RMR ³¹². For example, an activity with a MET value of 4 requires four times as much metabolic energy expenditure as when the body is at rest (e.g. sitting quietly)

^{312,313}

For those activities listed in the original version of the PAQ, the activity specific MET values were obtained from the OHS ³¹², while the MET values for the new activities listed in the modified version of the PAQ were obtained from the study by Plotnikoff et al. (cf. [Appendix 12](#)) ³⁰⁵. The MET values for the activities that were added as part of this study were derived from the Physical Activity Compendium ³¹³. This compendium has derived the intensity level for activities by taking the mean energy expenditure value from published energy expenditure lists (i.e. Tecumseh Occupational Questionnaire, the Minnesota Leisure Time Physical Activity Questionnaire (LTPA), Katch's Physical Activity Lists, the 7-day Recall Physical Activity Questionnaire, the American Health Foundation's physical activity list) ³¹³.

There were three inherent assumptions used in calculating participants' energy expenditure scores. These assumptions were:

- ⇒ Generally, a MET value for an activity is expressed at one of three intensity levels: low, medium, or high. For this study, the MET value corresponding to the lowest intensity level for each activity was used in the calculation of the energy expenditure scores. This practice is consistent with the Canadian Fitness and Lifestyle Research Institute (CFLRI) methodology and was adopted for two reasons ³¹². First, participants were not asked to specify the intensity level of their activities. Second, according to the CFLRI, people tend to overestimate the intensity, frequency, and duration of their activities. For these reasons, taking the lowest intensity level was believed to yield a conservative estimate of the MET value for each activity ³¹².
- ⇒ In order to obtain the "average" duration for each activity, the following modifications were made to the duration indicated by respondents:
 - Duration of ≤ 15 minutes → Assigned average duration of 13 minutes

- Duration of 16 - 30 minutes → Assigned average duration of 23 minutes
- Duration of 31 - 60 minutes → Assigned average duration of 45 minutes
- Duration of ≥ 60 minutes → Assigned average duration of 60 minutes

This method of assigning an average duration is consistent with the methodology used in the OHS ³¹².

⇒ Although space was provided for respondents to indicate activities “other” than those listed that they had participated in, it is difficult to ascertain precisely what respondents may consider as “other” activities. The MET value for all “other” activities was taken as the average of the MET values for the listed activities. This yielded a MET value of 4.3 that was assigned to the “other activities” that were reported in the PAQ. Although some of the “other” activities participants listed may have had a MET value higher or lower than the average of 4.3, this approach is consistent with other studies, such as the Campbell’s Survey of Well-being (1988) and the OHS (1990) ^{72,312}.

An example of how the energy expenditure scores were calculated, as well as how the MET value was derived for the “other activities” of the PAQ is provided in Appendix 16.

10.2.4.1.2 Analysis Performed

Pearson correlation was used to determine the association between the subscales of the MFES and the current level of energy expenditure because both are continuous variables. In this case the Pearson correlation coefficient was used as a *coefficient of validity* because it is an index of the test’s validity when it measures the

correlation between the instrument and a variable of practical importance (i.e. energy expenditure score) ¹⁴⁷.

Pearson correlations were calculated via SPSS 7.0 *Correlate (Bivariate)* (SPSS Inc., 1989-1995) with a pairwise deletion strategy, where any participant(s) with a missing value(s) on either pair of variables being correlated was excluded from the analysis.

10.2.4.1.3 Criteria for Sub-scale Evaluation

The sub-scales of the MFES were evaluated against one criterion: each sub-scale had to be positively correlated with the current level of energy expenditure. To interpret the magnitude of the association between the sub-scales and current energy expenditure, the following classification scheme was employed. Correlations from 0 to 0.25 indicate little (i.e. marginal) or no association, those from 0.25 to 0.50 indicate a fair (i.e. modest) degree of relationship, correlations from 0.50 to 0.75 suggest a moderate to good relationship, and those above 0.75 reflect a very good to excellent relationship ³¹⁴. Although these cut-points are roughly estimated and somewhat arbitrary, they were used only to interpret the sub-scale specific correlations and identify the weakest correlates of energy expenditure and intention.

10.2.4.2 The Sub-scales of the MFES and Intention to Exercise

10.2.4.2.1 Scoring the Questionnaires

10.2.4.2.1.1 The Sub-scales of the MFES

Prior to estimating the association between the sub-scales and intention, all negatively worded items were reverse scored and participants' responses were converted into a mean sub-scale score (cf. *Section 10.2.4.1.1.1* and Appendix 14).

10.2.4.2.1.2 The Intention to Exercise

The intention to exercise was represented by four-items. Similar to the sub-scales of the MFES, its negatively worded items were reverse scored and participants' responses were transformed into a mean score (cf. *Section 10.2.4.1.1.1* and Appendix 14).

10.2.4.2.2 Analysis Performed

Pearson correlation was used to determine the degree of correlation between the sub-scales of the MFES and intention. Correlations were calculated via SPSS 7.0 *Correlate (Bivariate)* (SPSS Inc., 1989-1995) with a pairwise deletion strategy (cf. *Section 10.2.4.1.2*).

10.2.4.2.3 Criteria for Sub-scale Evaluation

The sub-scales of the MFES were evaluated against one criterion: each sub-scale had to be positively correlated with intention to exercise. The magnitude of the association between the sub-scales and the intention to exercise was interpreted using the same classification scheme described in *Section 10.2.4.1.3*. Conclusions about poorly functioning sub-scales were made after examining their overall performance in the study.

10.3 Results

10.3.1 Response Rates

A total of 3315 questionnaire were disseminated to the sites described in the previous research question (cf. *Section 9.2.1*), while 1160 questionnaires were completed and returned, yielding a 35% response rate.

10.3.2 Demographic Characteristics of Participants

Of the 1160 respondents who completed the questionnaire, 8 were excluded (0.69%) because they did not satisfy the inclusion criteria (i.e. being between the ages of 18 and 75). Further, since so few participants were over 60 years of age (in relation to the age distribution of the entire sample) the decision was made to exclude 19 (1.6%) participants from this analysis. An additional 199 (17.2%) were eliminated because they satisfied the exclusion criteria (i.e. presence of injury/illness), while 9 (0.78%) more were eliminated because their injury/illness status could not be determined (i.e. missing value). Thus, a total of 925 respondents were retained in the analysis. A summary of the demographic characteristics of those included in the analysis can be found in Table 21 (cf. pg. 127).

10.3.3 Correlational Analyses *

10.3.3.1 The Sub-scales of the MFES and Current Energy Expenditure

All of the sub-scales of the MFES were significantly and positively related to the current level of energy expenditure. The correlations between the sub-scales of the MFES and the current level of energy expenditure ranged from 0.11 to 0.47 ($p < 0.01$).

With respect to the sub-scale specific correlations, the sub-scales that were fairly (i.e. modestly) associated with the current level of energy expenditure were those of *Affect*, *Attitude*, *Barrier*, *Goals*, *Intention*, *PNB*, *Self-efficacy*, *Outcome-expectancy*, *Self-determination*, *Self-evaluation*, and *Time*. Conversely, the sub-scales of *Affiliation*, *Rewards*, *Self-presentation*, *Social comparison*, and *Social support* demonstrated little or no association (i.e. marginal) with energy expenditure. The sub-scale specific validity coefficients are provided in Table 22 (cf. pg. 128).

* ANOVA models were performed which largely supported the results reported here.

Table 21: The Demographic Characteristics of Participants Included in the Correlational Analyses

		N (%)	$\bar{x}$ (σ)	Range (Minimum/Maximum)
Age (in years)		925 (100%)	39.3 (8.8)	41 (18/59)
Sex:	Male	529 (57.2%)	---	---
	Female	395 (42.7%)		
	Total	924 (99.9%)		
Height (cm)		920 (99.5%)	166.8 (9.44)	90 (100/190)
Weight (lbs)		909 (98.3%)	158.4 (32.16)	193 (92/285)
Marital Status:	Single	169 (18.3%)	---	---
	Married/Commonlaw	655 (70.8%)		
	Divorced/Separated	97 (10.5%)		
	Widowed	1 (0.1%)		
	Total	922 (99.7%)		
Dependent Children ≤ 16:	Yes	393 (42.5%)	---	---
	No	532 (57.5%)		
	Total	925 (100%)		
Highest Level of Education:	Elementary	10 (1.1%)	---	---
	High School/Cegep	216 (23.4%)		
	Technical Trades	235 (25.4%)		
	University UG ¹	314 (33.9%)		
	University PG ²	146 (15.8%)		
	Total	921 (99.6%)		
Employment Status:	Full-time	832 (89.9%)	---	---
	Part-time	69 (7.5%)		
	Seasonal	7 (0.8%)		
	Not Employed OH ³	2 (0.2%)		
	Unemployed NL ⁴	7 (0.8%)		
	Unemployed L ⁵	2 (0.2%)		
	Retired	5 (0.5%)		
	Total	924 (99.9%)		
Household Income Meeting Needs:	Very Well	208 (22.5%)	---	---
	Adequately	529 (57.2%)		
	Inadequately	131 (14.2%)		
	Very Inadequately	17 (1.8%)		
	No answer	36 (3.9%)		
	Total	921 (99.6%)		

Legend:

- ^{1.} University Undergraduate Degree
- ^{2.} University Post-graduate Degree
- ^{3.} Not employed Outside the Home
- ^{4.} Unemployed Not Looking
- ^{5.} Unemployed Looking

Table 22: Coefficients of Validity – The Sub-scales of the Motivational Factors for Exercise Scale (MFES) with Energy Expenditure and Intention

Sub-scale	Energy Expenditure Scores		Intention	
	N	Validity Coefficient	N	Validity Coefficient
<i>Affect</i>	844	0.37*	904	0.64*
<i>Affiliation</i>	855	0.18*	916	0.25*
<i>Attitude</i>	850	0.38*	913	0.69*
<i>Barrier</i>	846	0.40*	908	0.68*
<i>Goals</i>	847	0.33*	913	0.49*
<i>Intention</i>	850	0.47*	—	—
<i>Outcome-expectancy</i>	843	0.26*	903	0.43*
<i>PNB</i>	852	0.40*	913	0.70*
<i>Rewards</i>	842	0.16*	902	0.27*
<i>Self-determination</i>	853	0.27*	914	0.46*
<i>Self-efficacy</i>	843	0.46*	903	0.76*
<i>Self-evaluation</i>	854	0.29*	915	0.49*
<i>Self-presentation</i>	850	0.11*	915	0.14*
<i>Social comparison</i>	841	0.19*	907	0.31*
<i>Social support</i>	843	0.23*	906	0.25*
<i>Time</i>	850	0.47*	907	0.47*

* $p \leq 0.01$ (2-tail)

10.3.3.2 The Sub-scales of the MFES and Intention

The results obtained have demonstrated that all of the sub-scales of the MFES were positively and significantly related to the intention to exercise. The magnitude of the correlation between the sub-scales and intention ranged from 0.14 to 0.76 ($p < 0.01$).

The sub-scale of *Self-efficacy* was found to be a very good (i.e. excellent) correlate of intention, while the sub-scales of *Affect*, *Attitude*, *Barrier*, and *PNB* demonstrated a moderate to good correlation. The sub-scales of *Goals*, *Outcome-expectancy*, *Rewards*, *Self-determination*, *Self-evaluation*, *Social Comparison*, and *Time* demonstrated a fair to modest association to intention. However, the sub-scales of *Affiliation*, *Self-presentation*, and *Social support* demonstrated little to no (i.e. marginal) association to intention.

Interestingly, the correlation between the sub-scales and intention was greater than that of the sub-scales and energy expenditure. The sub-scale specific coefficients of validity are provided in Table 22 (cf. pg. 128).

10.4 Discussion

10.4.1 The Sub-scales of the MFES and Current Energy Expenditure

The purpose of this analysis was to gather initial evidence concerning the validity of the MFES. Examining the magnitude and pattern of the correlations between the sub-scales of the MFES and energy expenditure enabled an appraisal of whether the sub-scales were sufficiently related to motivation for exercise.

The results revealed that all of the sub-scales of the MFES were positively correlated with respondents' current level of energy expenditure. The direction and magnitude of the correlations obtained were consistent with other studies in the field 1,8,24,25,34,46,69,70,95,98-100,111-114,116,127,131-132,134,137-139,159,163,177,230-232,234-236,241,242,246,258,263,266,274,278,285,286, 288,291,295. For example, the relationships between energy expenditure and the sub-scales of *Affect*, *Barriers*, and *Social support* ($r = 0.37, 0.40, 0.33$, respectively) were similar to, or exceeded the values reported in the literature for these concepts ($r = -0.27-0.29, r = 0.22, r = 0.23-0.44$, respectively)*⁶⁹. The similarity of the relationships observed in this study with the research to date suggests that the MFES is tapping into concepts that other investigators have observed with a reasonable degree of precision.

Since all of the sub-scales of the MFES were related to energy expenditure in the expected direction, it is possible that they represent factors of motivation. However, examining the magnitude of correlations, according to the classification scheme

* In the present study the sub-scales of *Affect* and *Barrier* were coded opposite to the direction cited in the literature (i.e. positively instead of negatively). However, the results could be compared to the existing literature because the absolute value of the Pearson correlation coefficient is not influenced by changes in the direction of the scale³¹⁵.

employed in this study, it is evident that *Affect*, *Attitude*, *Barriers*, *Goals*, *PNB*, *Self-efficacy*, *Outcome expectancy*, *Self-evaluation*, and *Time* were modestly correlated with energy expenditure (i.e. $r \geq 0.26$). In contrast, the sub-scales of *Affiliation*, *Rewards*, *Self-presentation*, *Social Comparison*, and *Social support* had less association with energy expenditure ($r < 0.25$). This suggests that the sub-scales of the MFES vary in their relevance to energy expenditure.

However, it is possible that the weaker correlations, particularly for *Affiliation*, *Rewards*, *Self-presentation*, *Social Comparison*, and *Social support* are related to the nature of the concepts they were proposed to represent. For example, studies have demonstrated that the need to be favourably perceived by others (i.e. *Self-presentation*), to be involved with others during exercise (i.e. *Affiliation*), and to receive support and encouragement from others (i.e. *Social support*) exerts a greater effect on female exercise participation than on male participation^{8,25,72,75,131,151,163,177,219,220,268,285,289}. *Post hoc* analyses using the data from this study did not find any evidence to indicate that the relationship between the sub-scales of *Affiliation*, *Self-presentation*, and *Social support* was gender-specific as none of the sub-scales showed stronger correlations for female exercise participation than for male participation*.

Beyond gender-differences, it is possible that the relationship observed between energy expenditure and the sub-scales of *Affiliation*, *Self-presentation*, and *Social Comparison* varies by age. Research has found that the need to be involved with others during exercise (i.e. *Affiliation*) was more important for older than for younger adults^{151,163,220}. Conversely, the tendency to compare one's exercise performance to others (i.e. *Social comparison*) and the need to be perceived favourably during exercise (i.e. *Self-presentation*) may become less relevant with advancing age. *Post hoc* analyses

* *Affiliation*, females ($r = 0.15$) & males ($r = 0.22$); *Self-presentation*, females ($r = 0.10$) & males ($r = 0.13$); *Social support*, females ($r = 0.10$) & males ($r = 0.17$).

revealed that there may be some influence of age on the relationship between these sub-scales and energy expenditure. Specifically, the sub-scale of *Affiliation* was found to be a stronger correlate of energy expenditure for older than for younger adults ($r = 0.20$ vs. $r = 0.09$). As for *Self-presentation* and *Social Comparison*, both were stronger correlates of, and accounted for slightly more variance in energy expenditure for younger than for older adults ($r = 0.14$ vs. 0.09 ; $r = 0.23$ vs. 0.18 , respectively). Despite the evidence to suggest that the relationship between these sub-scales and energy expenditure is age-dependent, the relationships obtained were still marginal according to the classification scheme used in this study to interpret the correlations.

Given the preliminary nature of the MFES, perhaps a fundamental reason for the low correlations observed may be that the response options provided were not optimal. The anchors for the response options for *Self-presentation*, *Social comparison*, and *Social support* were not problematic, yet the anchors for *Affiliation* were not appropriate. Specifically, the current response option for *Affiliation* did not lend itself well to either its items, or the concept under study and as such, more suitable anchors would have been “very untrue for me (1)” to “very true for me (5)”. However, since there is no way of determining how, or if this affected the results, this is something that should be examined in greater detail in future studies of the MFES.

Although there have been some plausible explanations put forth to understand the functioning of these sub-scales, they still appear to have relatively weak associations with energy expenditure (i.e. $r < 0.25$). This suggests that it is unlikely that in their current form, they reflect motivational factors for energy expenditure.

As for the relationship between *Rewards* and energy expenditure, it is possible that the salience of this sub-scale may increase when it operates in conjunction with the sub-scale *Goals*. Some research has shown that different types of rewards, such as feedback, praise, and reinforcement, rarely occur on their own, but rather in conjunction

with the attainment of a goal ^{18,254}. Future work on the MFES may consider examining whether the relationship between *Rewards* and energy expenditure is enhanced with the inclusion of *Goals*.

It is also plausible that the performance of *Rewards* reflects a shortcoming in the anchor used in the response option. Perhaps more fitting response option would have been “very untrue for me (1)” to “very true for me (5)”. Examining how this may have affected the results is beyond the scope of the current study, but future research endeavors using the MFES may wish to look into this matter in greater detail.

Despite this, the relationship observed between *Rewards* and energy expenditure indicates that, in its current form, it does not represent a factor that is very relevant to energy expenditure. As for the remaining sub-scales, the results obtained have provided some evidence to suggest that they may represent factors of motivation that are relevant to energy expenditure. This suggests that it is possible that the sub-scales measure multi-dimensional factors of motivation, supporting the conceptualization that was used to guide the development of the MFES.

10.4.2 The Sub-scales of the MFES and the Intention to Exercise

Intention is believed to occupy an intermediate position between motivational factors and actual behaviour, where its strength is modified directly by the motivational factors that influence behaviour ^{1,116,248,256,258,269}. It is also believed to be involved in the process by which motivation is transformed into action ^{1,116,248,258}. For these reasons, it was proposed that if the sub-scales of the MFES reflected aspects of motivation then they should demonstrate association with intention to exercise, and that such results would support their predictive validity.

All of the sub-scales of the MFES were positively correlated with the intention to exercise. The nature and magnitude of the relationships observed in this study were

consistent with previous research in this field ^{1,27,46,58,70,99,111,114-116,164,165,241,246,256,258,260,262,266,271,290}. For example the correlations in this study between intention and the sub-scales of *Attitude* and *Self-efficacy* ($r = 0.69$, $r = 0.76$, respectively) were consistent with the ranges cited in the literature for these concepts ($r = 0.18 - 0.76$; $r \geq 0.42$, respectively) ^{111,115,116,241,260,261,271}. The comparability of the relationships and the magnitude of the associations observed in this study with the previous literature provide some evidence to suggest that the MFES is capturing motivational factors that other investigators have observed in the field with a degree of precision. Further, since all the sub-scales were associated with intention in the expected direction, it suggests these sub-scales are relevant to motivational factors.

The sub-scales that demonstrated the strongest relationship with energy expenditure also had the strongest relationship with intention. Conversely, the sub-scales that had the poorest relationship with energy expenditure also exhibited a poor relationship with intention. Researchers in this field contend that the strength of the factors that motivate exercise behaviour also correspond to the magnitude with which they influence the intention to exercise ^{1,20,116,251,252,258}. The similarity of the pattern observed in this study with the theory in the field demonstrates that the MFES is sensitive enough to capture the relationships between the factors of motivation, intention, and energy expenditure. Further, the sub-scales were related to both intention and energy expenditure, suggesting that they may be implicated in the process by which exercise behaviour occurs.

However, the relevance of the sub-scales to motivation appears to vary. The results revealed that the sub-scales of *Affiliation*, *Rewards*, *Self-presentation*, *Social comparison*, and *Social support*, were the weakest correlates of intention and energy expenditure, and may therefore not be significant motivating factors. Perhaps an argument can be made that these sub-scales are in need of further refinement.

As for the remaining sub-scales of the MFES, the relationship and the patterns observed suggest that they are operating in a manner that would be expected of motivational factors. These findings also provide support for the multi-dimensional conceptualization of motivation for exercise behaviour.

11.0 OBJECTIVE 7 – CONSTRUCT VALIDITY

The objective for this phase of the study was:

- ◆ To obtain preliminary evidence bearing on the construct validity of the MFES by examining whether the nature and magnitude of the direct and indirect relationships between the sub-scales, level of energy expenditure, and intention to exercise suggests that the MFES sub-scales reflect motivational factors.

11.1 Research Question

The research question specific to this objective was:

- ◆ Do the sub-scales of the MFES exert their influence on current exercise behaviour more directly or more indirectly via intentions?

This question addresses construct validity, as it attempts to examine an aspect of the nature of the sub-scales of the MFES. Specifically, it helps address the issue whether the MFES sub-scales function simply as predictors of exercise behaviour or can be construed as factors of motivation. Motivational factors are believed to influence exercise behaviour by virtue of their effects on people's intention to exercise ^{1,116,248,256,258,269}. Consequently, if the sub-scales represent factors that are truly motivational in nature and effect, the following hypothesis should be supported:

- ◆ The sub-scales of the MFES will have stronger effects on the level of energy expenditure "*indirectly*" through intention than directly. A direct relationship is one where the sub-scales operate to influence energy expenditure without the presence of any intervening variables to mediate the relationship. In contrast, an indirect relationship is one where an intervening variable, such as intention, mediates the effect that the sub-scales are able to exert on energy expenditure ²⁰.

11.2 Procedure

11.2.1 Sampling

Data used to address this research question were obtained from the same sample described in the previous research question (cf. *Section 9.2.1, Appendix 9*).

11.2.2 Inclusion and Exclusion Criteria

The inclusion and exclusion criteria pertaining to the sample used for this analysis were the same as described in the previous research question (cf. *Section 9.2.2*).

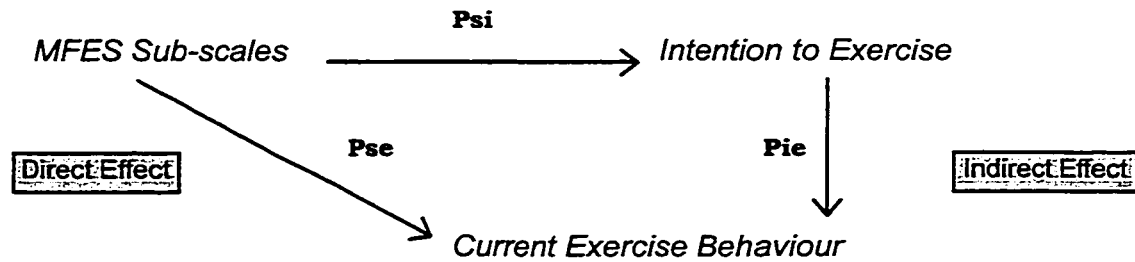
11.2.3 Instrument(s)

This portion of the study used *Version 6* of the MFES (cf. *Figure 1*, pg. 37). The other instruments used (i.e. Demographic Questionnaire, PAQ) were those described in the previous research question (cf. *Sections 9.2.3 and 10.2.3, Appendix 11, Appendix 13*).

11.2.4 Analyses Performed

To determine whether the relationship between the sub-scales of the MFES and the level of energy expenditure was more direct or indirect, a path analytic approach was employed. This procedure was felt to be one way of addressing this research question because it considers all the variables of interest simultaneously and provides a plausible interpretation of the causal relationship between them. Specifically, it allows for the examination of the direct effects of one set of variables (i.e. sub-scales) on another (i.e. energy expenditure), as well as their indirect relationship through other intervening variables (i.e. intention) ³¹⁶. An illustration of the path model that was tested can be found in *Figure 6* (cf. pg. 137).

Figure 6: Path Model Examining the Relationship between the Sub-scales of the Motivational Factors for Exercise Scale (MFES) and Current Exercise Behaviour



The diagram above is a representation of the set of structural equations relating the variables under study, where all paths represent linear equations ³¹⁶. The path coefficients provided in this diagram represent:

Psi = Zero-order correlation of each “sub-scale” and “intention”

Pie = Standardized regression coefficient of “intention” (i.e. independent variable) and “current exercise” (i.e. dependent variable)

Pse = Standardized regression coefficient of each “sub-scale” (i.e. independent variable) and “current exercise” (i.e. dependent variable)

Direct effect = Pse value (i.e. link of sub-scale and current exercise)

Indirect effect = $Psi \times Pie$ (i.e. link of sub-scale and current exercise through intention)

Prior to calculating the path coefficients, each sub-scale was transformed into a mean score and the amount of exercise participation was summarized by estimating respondents' total energy expenditure. These transformations were carried out using the same procedures described in an earlier research question (cf. *Sections 10.2.4.1.1.1, 10.2.4.1.1.2 and Appendix 14*).

The path coefficients of Pie , Pse , and Psi were calculated via SPSS 7.0 *Statistics (Linear Regression)*, with a pairwise deletion strategy (SPSS Inc., 1989-1995). For this analysis, the dependent variable was the total energy expenditure, the

independent variables were each of the sub-scales of the MFES, and the intervening variable was the intention to exercise.

Path coefficients were also calculated for the effect of the *age* of participants, which was treated as an independent variable. The purpose of examining the relationship between *age* and current energy expenditure was to confirm that *age* operated more directly on exercise behaviour rather than indirectly through intentions because it is a well established predictor of exercise behaviour and could not be considered an aspect of motivation ^{26,57,96,150,187,249,272}. Demonstrating that *age* has a stronger direct effect would not only provide evidence for the sensitivity and utility of the path analytic approach to this research question, but it would also support the interpretations made from the path coefficients regarding the nature of the sub-scales' relationship to energy expenditure. If the sub-scales proved to have stronger direct effects, as in the case of *age*, then they too could be viewed as predictors of energy expenditure. However, if their influence was more indirect through their effect on intention, it would be plausible that the sub-scales represent factors of motivation.

11.3 Results

11.3.1 Response Rates

The response rate and sample size for this analysis was the same as described in the previous research question (cf. *Section 10.3.1*).

11.3.2 Demographic Characteristics of Participants

The number and type of respondents excluded for this analysis were the same as described in the previous research question (cf. *Section 10.3.2*). The demographic characteristics of the participants retained for this analysis are described in Table 21 (cf. pg. 127).

11.3.3 Path Analysis

The indirect path (i.e. via intentions) between the sub-scales of the MFES and the current level of energy expenditure yielded path coefficients that ranged between 0.07 to 0.28. The path coefficients for the direct effect of these sub-scales on the current level of energy expenditure ranged from 0.004 to 0.212.

Overall, for each of the sub-scales of the MFES, except *Self-efficacy*, the indirect effect was much stronger than the direct effect. However, for the sub-scale of *Self-efficacy*, the direct and indirect effects were both similar.

This results obtained for all the sub-scales, with the exception of *Self-efficacy*, indicates that they influence the current level of energy expenditure by operating through intentions, suggesting that intention mediates the pathway between the sub-scales and the current level of energy expenditure. One would expect intention to channel together the multiple sources of motivation because it is the proximal determinant of behaviour. The motivational factors then function to influence and interact with the intention to exercise, and collectively this triggers action (i.e. exercise). Based on this, intention can be said to guide the effect motivational factors have on energy expenditure, where without intention, the sources of motivation would not have as strong an effect on energy expenditure.

The results also demonstrated that the direct effect of *age* was greater than its indirect effect. The *age* variable yielded a “*direct*” path coefficient of -0.065 and an indirect path coefficient of -0.00472. This indicates that *age* exerts its influence more directly than indirectly.

The direct and indirect effects of each sub-scale on the current level of energy expenditure are summarized in Table 23 (cf. pg. 140).

Table 23: The “Indirect” and “Direct” Paths between the Sub-scales of the Motivational Factors for Exercise Scale (MFES) and the Current Level of Energy Expenditure

Sub-scale	Psi	Pie	Pse	Direct Effect	Indirect Effect
<i>Affect</i>	0.649	0.404	0.106	0.106	0.262
<i>Affiliation</i>	0.250	0.456	0.065	0.065	0.141
<i>Attitude</i>	0.694	0.407	0.095	0.095	0.282
<i>Barrier</i>	0.695	0.374	0.142	0.142	0.260
<i>Goals</i>	0.489	0.407	0.133	0.133	0.200
<i>Outcome-expectancy</i>	0.437	0.443	0.069	0.069	0.194
<i>PNB</i>	0.719	0.337	0.133	0.133	0.271
<i>Rewards</i>	0.265	0.464	0.034	0.034	0.123
<i>Self-determination</i>	0.466	0.441	0.069	0.069	0.210
<i>Self-efficacy</i>	0.775	0.293	0.212	0.212	0.230
<i>Self-evaluation</i>	0.499	0.439	0.068	0.068	0.220
<i>Self-presentation</i>	0.143	0.467	0.040	0.040	0.070
<i>Social comparison</i>	0.310	0.457	0.051	0.051	0.141
<i>Social support</i>	0.254	0.472	0.004	0.004	0.120
<i>Time</i>	0.375	0.451	0.057	0.057	0.170
<i>Age</i>	- 0.10	0.472	- 0.065	- 0.065	- 0.00472

Legend:

Psi = Zero-order correlation of each “sub-scale” and “intention”

Pie = Standardized regression coefficient of “intention” and “current exercise”

Pse = Standardized regression coefficient of each “sub-scale” and “current exercise”

Direct effect = *Pse* value (i.e. link between sub-scale and current exercise)

Indirect effect = *Psi* x *Pie* (i.e. link between sub-scale and current exercise through intention)

11.4 Discussion

An important step in assessing the validity of the MFES was to gather information concerning whether the sub-scales represent factors of motivation. This analysis was performed to examine the manner in which the sub-scales of the MFES operated to influence energy expenditure, in order to determine if they functioned as would be expected if they were motivational factors.

Although the construct validity of the MFES cannot be equivocally established from this analysis alone, the results obtained here will begin to clarify the manner in

which the sub-scales operate. It was reasoned that if the sub-scales were merely predictors of energy expenditure, then they would exert their effect directly on exercise behaviour, and that would be reflected in the path analysis by a stronger direct than indirect effect on energy expenditure. However, if the sub-scales represented motivational factors then they would exert their effect on energy expenditure indirectly via intentions because the intention to exercise is believed to occupy an intermediate position between motivational factors and overt behaviour, and is affected by the factors that motivate behaviour^{1,116,248,256,258,269}. If this were true, then it would be manifested in the path analysis by the sub-scales having a stronger indirect than direct effect on energy expenditure. Further, since age functions as a predictor of energy expenditure^{26,57,96,150,242,249,317}, it was hypothesized that it would exert its effect directly on energy expenditure, and that this would be demonstrated in the path analysis by a stronger direct than indirect effect on energy expenditure.

As expected, all of the sub-scales except *Self-efficacy* demonstrated stronger path coefficients through intention (i.e. indirectly), and that in comparison their direct path coefficients were negligible. The relationship observed between the sub-scales and energy expenditure indicates that intention is a proximal determinant of exercise behaviour, and that it mediates the effects the concepts measured by the sub-scales have on exercise behaviour. In other words, the concepts represented in the sub-scales exert their effect on energy expenditure by virtue of their influence on the intention to exercise.

Furthermore, the results obtained for all the sub-scales, except *Self-efficacy*, converged well with the theory in this field, which is that the factors that motivate a person to engage in exercise behaviour influences their intention to exercise^{20,70,258,266}. The results were also consistent in that the intention to exercise occupied an

intermediate position between the concepts that influence energy expenditure and the actual behaviour^{1,116,248,256,258,269}.

The similarity between the results obtained in this study and theory indicates that the sub-scales demonstrated the hypothesized relationship with intention and energy expenditure. This also suggests that the sub-scales were tapping into motivational concepts that are implicated in the process by which exercise behaviour occurs. Collectively, this provides some evidence to support the notion that these sub-scales represent factors of motivation that are relevant to exercise behaviour.

However, regarding *Self-efficacy*, its direct and indirect effects on energy expenditure were comparable. While the previous research questions in this study have demonstrated that *Self-efficacy* is clearly strongly related to energy expenditure (cf. *Sections 10.3.3*), the present finding indicates that it may be operating outside the system of motivation-producing factors to influence energy expenditure. Although clarifying the role of *Self-efficacy* is beyond the scope of the present study, it is plausible that while it is relevant to both intention and energy expenditure, it functions to augment the process by which motivation is transformed into action. Researchers contend that after the motivational factors have influenced the intention to exercise, it is further processed and elaborated before the behaviour occurs^{20,70,258,266}. Perhaps *Self-efficacy* becomes relevant once the individual has the intention to exercise and is motivated to do so, whereby it is part of the processing phase that transforms intention into actual behaviour. This is conceivable given that in this study *Self-efficacy* has been shown to be related to the magnitude of the intention to exercise, as well as the level of participation (cf. *Sections 10.3.3*). While *Self-efficacy* may not have operated as would be expected of a truly motivational factor it may still be central to the process by which exercise behaviour occurs.

The results obtained from this analysis also revealed that not all the sub-scales of the MFES appear to have an equally strong indirect effect on energy expenditure. The observation that the indirect path coefficients varied, where some were greater than the others, suggests that the influence the sub-scales exert, and their relative importance is different. The sub-scales that yielded the largest indirect path coefficient (i.e. *Affect, Attitude, Barrier, Goals, Outcome-expectancy, PNB, Self-determination, Self-evaluation, Time*), were those that demonstrated the strongest relationship with both intention and energy expenditure (cf. *Section 10.3.3*). As for the sub-scales that yielded the smallest indirect path coefficients (i.e. *Affiliation, Rewards, Self-presentation, Social comparison, Social support*), they also demonstrated a weak relationship with intention and energy expenditure (cf. *Section 10.3.3*).

In addition to the sub-scale specific results, as hypothesized, the direct path between *age* and energy expenditure was greater than the indirect path. This confirms that the *age* of an individual exerts its influence on energy expenditure directly rather than operating through intentions. This finding is important because it supports the interpretations that were made of the path coefficients. Specifically, not only did *age*, a well-known predictor of exercise behaviour, operate as expected, but it also operated in a manner that was opposite to the sub-scales of the MFES. This is suggestive of the sub-scales being factors of motivation because if they were in fact solely predictors of exercise behaviour then they would have influenced energy expenditure the same way that *age* did (i.e. directly instead of indirectly).

The results obtained here also bear on the correlations obtained in *Section 10.3.3* which demonstrated that the correlations between the sub-scales and intention were greater than between the sub-scales and current energy expenditure. Given that intention occupies an intermediate position between the sub-scales and energy

expenditure, it is not surprising that the sub-scales were more strongly related to intention.

Overall, demonstrating how the sub-scales operated (i.e. indirectly vs. directly) was of practical importance because it provided insight into the inter-relationship between the sub-scales, intention, and energy expenditure. The results suggest that they may be relevant to the process by which exercise behaviour is motivated. As well, these findings provide some support for the conceptual basis for this instrument, that motivation to exercise is multiply determined. Thus, altogether these findings provide some preliminary evidence for the construct validity of the MFES.

12.0 OBJECTIVE 8 – TEST-RETEST RELIABILITY

The last objective for this phase of the study was:

- ◆ To determine whether each sub-scale within the Motivational Factors for Exercise Scale (MFES) was characterized by an adequate degree of test-retest reliability.

12.1 Research Question

The research question specific to this phase of the study was:

- ◆ In the absence of an intervention to change participants' level of exercise participation, how consistent were their scores on the sub-scales of the MFES over the two-weeks between the test-and-retest periods?

12.2 Procedure

12.2.1 Sampling

A non-probability sample was accrued from the National Research Council (NRC) *. A directory containing contact information for 2802 NRC employees in the RMOC was used to generate and select the initial pool of participants. From the total number (2802) of NRC employees listed in the directory, 50% (1401) were selected and contacted via electronic mail. Potential participants were informed that purpose of the study was to learn about their thoughts and feelings towards exercising.

Those who agreed to participate were electronically sent a standard introductory letter with instructions, as well as the questionnaire package as an attachment. The test and retest phases were separated by a two-week interval. During both these phases,

* Although it would have been ideal to examine the test-retest reliability of the MFES using the same sample that had been used in the previous analyses (i.e. internal consistency, validity tests), due to the techniques available at the time for disseminating the questionnaires (i.e. no unique identifiers or list of participants), this was unfeasible. Consequently the stability of the MFES was assessed using the sample collected from NRC.

participants were instructed to print a hard copy of the questionnaire and return it within five working days via internal mail to the mailroom. Additional information about the recruitment process at the NRC is described in [Appendix 17](#).

12.2.2 Inclusion and Exclusion Criteria

Due to Federal government language policy, potential respondents were included if they were:

- ⇒ Proficient in English or French *
- ⇒ Between the ages of 18 to 75

Of those initially eligible, respondents were excluded from the study if they:

- ⇒ Had a disability/injury that prevented/limited their current level of exercise participation

12.2.3 Instrument(s)

For this analysis, *Version 6* of the MFES (cf. [Figure 1](#), pg. 37) was used.

12.2.4 Analyses Performed

Given that the MFES is meant to be a multi-factorial instrument, sub-scale specific estimates of stability were calculated. Prior to estimating the test-retest reliability, all the negatively worded items were reverse scored (i.e. positively instead of negatively) and participants' responses were converted to a mean score for each sub-scale (cf. [Section 10.2.4.1.1.1](#) and [Appendix 14](#)).

* Although the MFES (*Version 5*) (cf. [Figure 1](#), pg. 37) was available in French, all participants from NRC elected to complete the English version. The French version of the MFES can be found in [Appendix 10](#).

Pearson correlation was selected as the statistic by which to determine the stability between the test- and re-test phases because the mean scores were considered to represent a set of continuous variables. The Pearson correlation coefficient is also referred to as the coefficient of reliability, when it is used to measure the constancy of scores over a test- and re-test phase ^{141,143,144}. A correlation coefficient of ≥ 0.70 was viewed as the minimum acceptable value to justify inclusion in the instrument ¹⁴³. Pearson correlations were calculated via SPSS 7.0 *Correlate (Bivariate)* (SPSS Inc., 1989-1995) with a pairwise deletion strategy (cf. *Section 10.2.4.1.2*).

12.3 Results

12.3.1 Response Rates

Of the 1401 employees contacted, 365 agreed to participate in the study, yielding a response rate of 26%. From this group of employees, 300 (82.2%) participants completed and returned the first questionnaire (i.e. test-phase), while 60 (16.4%) did not respond, and 5 (1.4%) were unable to continue participating in the study due to their business-related travel schedule.

Of the 300 employees who completed the questionnaire from the test-phase, 62 (20.7%) did not complete and return the re-test questionnaire, leaving a usable sample of 238 (79.3%) participants.

Overall, of the 365 employees who had initially agreed to participate in the study, 238 (65.2%) participants completed both the test- and retest phases of the study.

12.3.2 Demographic Characteristics of Participants

Of the 238 participants who completed both phases of the study, 4 respondents (1.7%) were eliminated from the study because they did not satisfy the inclusion criteria (i.e. between the ages of 18 and 75). This yielded a sample of 234 who were retained

for the analysis. A description of the demographic characteristics of participants is provided in Table 24.

Table 24: The Demographic Characteristics of Participants from NRC

		N (%)	$\bar{x}$ (σ)	Range (Minimum/Maximum)
Age		234 (100%)	41.8 (9.49)	43 (22/65)
Sex:	Male	134 (57.3%)	---	---
	Female	100 (42.7%)		
	Total	234 (100%)		
Height (cm)		234 (100%)	169.6 (9.81)	45 (150/195)
Weight (lbs)		234 (100%)	164.5 (32.77)	236 (104/340)
Marital Status:	Single	45 (19.2%)	---	---
	Married/Commonlaw	174 (74.4%)		
	Divorced/Separated	14 (6%)		
	Widowed	1 (0.4%)		
	Total	234 (100%)		
Dependent Children ≤16:	Yes	85 (36.3%)	---	---
	No	149 (63.7%)		
	Total	234 (100%)		
Highest Level of Education:	Elementary	0 (0%)	---	---
	High School/Cegep	48 (20.5%)		
	Technical Trades	45 (19.2%)		
	University UG ¹	50 (21.4%)		
	University PG ²	91 (38.9%)		
	Total	234 (100%)		
Employment Status:	Full-time	227 (97.9%)	---	---
	Part-time	5 (2.1%)		
	Seasonal	0 (0%)		
	Not Employed OH ³	0 (0%)		
	Unemployed NL ⁴	0 (0%)		
	Unemployed L ⁵	0 (0%)		
	Retired	0 (0%)		
	Total	233 (99.6%)		
Household Income Meets Needs:	Very Well	53 (22.7%)	---	---
	Adequately	130 (55.8%)		
	Inadequately	38 (16.3%)		
	Very Inadequately	4 (1.7%)		
	No Answer	8 (3.4%)		
	Total	233 (99.6%)		
Illness/Injury Limits Exercise:	Yes	48 (20.6%)	---	---
	No	185 (79.4%)		
	Total	233 (99.6%)		

Legend:

- ^{1.} University Undergraduate Degree
- ^{2.} University Post-graduate Degree
- ^{3.} Not employed Outside the Home
- ^{4.} Unemployed Not Looking
- ^{5.} Unemployed Looking

12.3.3 Test-retest Reliability of the MFES

The estimates of stability obtained revealed that the correlation between the test and retest phases was acceptable (i.e. $r \geq 0.70$) for all the sub-scales. The correlations ranged from 0.694 to 0.90 ($p < 0.01$), indicating that they were all stable over the two-week period. The sub-scale specific correlation coefficients (i.e. coefficients of reliability) are provided in Table 25.

Table 25: The Test-retest Reliability of the Sub-scales of the Motivational Factors for Exercise Scale (MFES)

Sub-scale	N	Correlation Coefficient ¹
<i>Affect</i>	234	$r = 0.90^*$
<i>Affiliation</i>	233	$r = 0.74^*$
<i>Attitude</i>	234	$r = 0.88^*$
<i>Barrier</i>	232	$r = 0.87^*$
<i>Goals</i>	232	$r = 0.85^*$
<i>Intention</i>	232	$r = 0.90^*$
<i>Outcome-expectancy</i>	234	$r = 0.80^*$
<i>PNB</i>	234	$r = 0.86^*$
<i>Rewards</i>	234	$r = 0.76^*$
<i>Self-determination</i>	234	$r = 0.84^*$
<i>Self-efficacy</i>	233	$r = 0.90^*$
<i>Self-evaluation</i>	234	$r = 0.75^*$
<i>Self-presentation</i>	233	$r = 0.78^*$
<i>Social Comparison</i>	231	$r = 0.694^*$
<i>Social support</i>	232	$r = 0.80^*$
<i>Time</i>	232	$r = 0.78^*$

* $p \leq 0.01$ (2-tail)

¹. Calculated via Pearson Coefficient

12.4 Discussion

This research question addressed a key psychometric property of the MFES, its test-retest reliability. The purpose of this analysis was to determine if the items comprising the concepts represented in the sub-scales of the MFES operated with a

reasonable degree of stability. This is an important quality since the utility of an instrument greatly depends on its ability to measure with a degree of constancy.

The results obtained from this analysis revealed the sub-scales of the MFES were characterized by varying degrees of stability, but that they all demonstrated adequate stability. The ability of each sub-scale of the MFES to measure in a stable manner indicates that the concepts their respective items are tapping into are not adversely affected by extraneous factors through the passage of time. This lends greater confidence that the MFES scores are capturing information in a stable, consistent manner and that respondent scores are not likely to change, without intervention, significantly over time.

The observation that the MFES measures with a degree of stability is an essential attribute given its purpose and intended application. Specifically, the MFES attempts to capture motivational factors that are inherent to exercise behaviour, and is intended to be used to guide the creation of interventions to increase the level of activity in the population. From a measurement perspective, confidence in its stability is necessary for making inferences concerning the effects of interventions.

Although the results obtained for this objective have demonstrated that the MFES sub-scales possess adequate stability over a 2-week period, the Pearson correlation, which is considered an estimate of relatedness or association ³¹⁸⁻³²¹, represents only one method by which this aspect of reliability could have been assessed. Another widely used measure of test-retest reliability is the intra-class correlation (ICC), which is considered an estimate of concordance or agreement ³¹⁹⁻³²¹. There are a number of forms of ICC, which differ according to the assumptions that are made. Some examples include 1- or 2-way ANOVA and Spearman-Brown ^{319,320,322-326}. The Bland and Altman method is considered comparable to the ICC in that it retains the underlying assumptions and principles of the ICC ³²⁰.

The fundamental advantage of ICC over Pearson correlation is that it takes into account, and dissociates between systematic biases and random errors, while the Pearson correlation does not ^{319,320}. For instance, it is possible for test scores between time 1 and 2 to change due to an additive or multiplicative bias, thereby causing a change in scores over the test-retest periods ^{319,321,322}. In instances where such biases are present, the Pearson method can still yield a perfect correlation when in fact test scores have systematically changed and there is no agreement. However, agreement statistics, such as ICC are not altered by this because they focus on the variance and co-variance between scores and will therefore only yield a value of 1.0 (i.e. perfect agreement) when all the observations on each subject are identical ³¹⁹⁻³²². For this reason, correlation is not necessarily indicative of good agreement ³¹⁹⁻³²¹.

Despite the relative advantages of the ICC method, the use of Pearson correlation was considered to be appropriate and acceptable for three reasons. First, the underlying assumption of this objective was that there was no reason to believe that there would be systematic differences between time 1 and 2 scores. This was a reasonable and safe assumption to make because according to Streiner and Norman (1995), in general, the predominant source of error in instruments is due to random variation, and under the assumption that it represents the most significant source of error, the Pearson correlation and ICC are very close estimates of reliability ³²⁰. Second, with large samples, the relative advantages of ICC over Pearson correlation is negligible in that both provide consistent estimates of reliability. Specifically, as the sample size increases both estimators of stability converge to the population value ^{319,320}. However, although the magnitude of the Pearson correlation will still be greater than that of ICC, for large samples this difference is marginal, if any at all ^{319,320}. As such, considering that this test was conducted on a sample of > 200 subject, it was felt that the Pearson correlation would yield an accurate estimate of the stability of the MFES sub-scales.

Lastly, not only is Pearson correlation considered a standard method for assessing the retest reliability of instruments, but it also represents one of the more commonly used estimate of retest reliability ³¹⁸⁻³²⁰. Collectively, these reasons provide confidence in the application of Pearson correlation as a measure of the stability between test scores.

Although the test-retest reliability could have been assessed using other methods, the results obtained from this analysis demonstrate that, in their present form, the sub-scales of the MFES are stable over a two-week period. These findings provide initial evidence for another aspect of reliability, specifically the test-retest reliability of the MFES.

13.0 CONCLUSION

Motivation is not a uni-factorial concept. The purpose of developing the Motivation for Exercise Scale (MFES) was to create a measure that assessed the multiple factors of motivation in a manner consistent with current theory. In addition to supporting further basic research on exercise motivation, it was hoped that the MFES would find useful applications in population health as a survey instrument for health promotion, yielding data to support interventions to increase exercise participation in the population.

Since these intended uses require that the instrument possess sound psychometric properties, the purpose of this thesis was to develop and then conduct preliminary testing of the reliability and validity of the MFES by examining the performance of its sub-scales. It was anticipated that, in relation to a series of specific research questions, patterns of results would emerge illustrating the strengths and weaknesses of the sub-scales with respect to aspects of reliability and validity. This would distinguish those sub-scales that appeared to perform well from those that did not perform consistently indicating a need for further refinement.

This study was organized so that each research question addressed a specific aspect of the reliability and validity of the MFES. Reliability was assessed by examining the internal consistency and stability of its sub-scales and was addressed in *Objectives* 5 and 8, respectively. Content, criterion-related, and construct validity were evaluated in *Objectives* 4, 6, and 7, respectively. Content validity was examined by assessing the extent to which expert raters agreed that the fifteen concepts represented in the MFES sub-scales reflected factors of motivation for exercise, as well as the relevance of the items to the definition of the concepts they were intended to measure.

Criterion-related validity was addressed by examining the magnitude and nature of the associations between the sub-scales and two variables believed to be central to motivation: energy expenditure (as a manifestation of the effects of motivation), and intention to exercise (as an indicator of a proximal determinant of exercise). If it were true that the sub-scales comprising the MFES were capturing motivational factors, it would be necessary for these sub-scales to be related to both energy expenditure and intention.

The last aspect of validity addressed in this study was construct validity. Although construct validity cannot be definitively established from the results of this study alone, it was a necessary first step in determining whether the sub-scales could be interpreted as representing factors of motivation. It was believed that this would provide a basis for future investigations into its construct validity. To conduct a preliminary assessment of its construct validity, a path analytic approach was employed to examine how the sub-scales exerted their influence on exercise behaviour.

The breadth of tests that were performed in this study allowed for a range of sub-scale specific characteristics to be examined. Altogether, the results obtained suggest that the sub-scales of the MFES can be grouped into two clusters based on their overall performance. The first cluster includes *Goals*, *PNB*, *Self-efficacy*, *Affect*, *Attitude*, *Outcome-expectancy*, *Barrier*, *Self-evaluation*, *Self-determination*, and *Time*, all of which exhibited a consistent pattern, performing reasonably well across the tests. The second cluster contained *Affiliation*, *Rewards*, *Self-presentation*, *Social comparison*, and *Social support*, and were found not to have performed consistently across the analyses. This raises some questions about the reasons for the differences and suggests a need to revisit the conceptualization of these sub-scales and/or their item structure.

13.1 Sub-scales Performing Consistently – Cluster # 1

13.1.1 Tests of Validity

With respect to the sub-scales of *Goals*, *PNB*, *Self-efficacy*, *Attitude*, *Affect*, *Outcome-expectancy*, *Barrier*, *Self-evaluation*, *Self-determination*, and *Time*, the results obtained suggest that they are characterized by a reasonable degree of content, criterion-related, and construct validity, as defined in the present investigation. Specifically, in terms of their content validity, the raters agreed that each of these concepts reflected a factor of motivation for exercise, and that the sub-scales consisted of items that tapped into the concepts appropriately.

As for the criterion-related validity, these sub-scales were modestly to strongly correlated with the intention to exercise and energy expenditure. The pattern of correlations observed between these sub-scales and energy expenditure, as well as with intention was consistent with the theory driven expectations. Collectively, these findings are significant because they demonstrate that the sub-scales of *Goals*, *PNB*, *Self-efficacy*, *Attitude*, *Affect*, *Outcome-expectancy*, *Barrier*, *Self-evaluation*, and *Self-determination* are measuring concepts that are appropriately related to the target behaviour of interest (i.e. energy expenditure) and the proximal determinant of exercise behaviour, thereby providing some evidence for their criterion-related validity.

Regarding the construct validity of these sub-scales, with the exception of *Self-efficacy*, they all operated more indirectly via intention to influence energy expenditure than directly. This preliminary assessment suggests that it is reasonable to construe them as factors of motivation for exercise behaviour.

As for *Self-efficacy*, although the results for this sub-scale were not as clear as the other sub-scales of the MFES (e.g. the relative magnitude of indirect and direct paths being similar), its failure to operate as expected does not, at this stage, undermine its role in the MFES. While some researchers contend that *Self-efficacy* is motivational

by nature, *Self-efficacy* may be auto-correlated with exercise behaviour. For example, having confidence in one's ability to perform a behaviour under varying circumstances may be a function of performing the behaviour. To clarify this issue and determine the role of *Self-efficacy* as a motivational factor for exercise behaviour, longitudinal research is required. This will assist in establishing whether increases in self-efficacy precede changes in the activity level of an individual, as they move from being inactive to active.

Despite the observation that *Self-efficacy* did not perform clearly on a particular test of validity, there is sufficient evidence to suggest that these sub-scales are characterized by content and criterion-related validity, and there is preliminary evidence for their construct validity.

13.1.2 Tests of Reliability

Beyond the attributes of validity described above for *Goals*, *PNB*, *Self-efficacy*, *Affect*, *Attitude*, *Outcome-expectancy*, *Barrier*, *Self-evaluation*, *Self-determination*, and *Time*, the results obtained in this study indicate that these sub-scales also performed in a reliable manner, characterized by adequate stability and internal consistency. This observation lends confidence in their structure and composition at the item level, as well as how the items function collectively in the sub-scales and indicates that the information these sub-scales are providing is reproducible. The tests conducted to examine their reliability demonstrate that each of these sub-scales were related to a single concept and were stable. The information they yield is not likely subject to appreciable distortions by extraneous variables over time.

13.1.3 Implications of the Results

The overall performance of *Goals*, *PNB*, *Self-efficacy*, *Affect*, *Attitude*, *Outcome-expectancy*, *Barrier*, *Self-evaluation*, *Self-determination*, and *Time* across the tests of

validity and reliability performed in this study was quite reasonable. Altogether, this lends confidence in the measurement sensitivity and accuracy of these sub-scales. The nature and quality of the relationships observed between these sub-scales and both intention and actual behaviour supports the interpretation that they represent factors of motivation. These findings lend some promise that the data these sub-scales yield could be of some use to identify intervention needs and support programs to increase the level of exercise participation.

Establishing the validity and reliability of *Goals*, *PNB*, *Self-efficacy*, *Affect*, *Attitude*, *Outcome-expectancy*, *Barrier*, *Self-evaluation*, *Self-determination*, and *Time* indicates that their current conceptualization and item structure is acceptable. However, although the results from this study indicate *Time* is adequately operationalized, it is plausible that the performance of this sub-scale could be enhanced by broadening its conceptualization and making it less contingent upon performing exercise behaviour.

Despite this, the current conceptualizations of the concepts upon which these sub-scales are based appears to capture factors that energize and direct exercise behaviour.

13.2 Sub-scales Performing Inconsistently – Cluster # 2

In contrast to the sub-scales described above, *Affiliation*, *Rewards*, *Self-presentation*, *Social comparison*, and *Social support* did not perform consistently across the tests conducted in this study. Each of these sub-scales demonstrated a weakness on the same test of validity, but performed reasonably well on the tests of reliability.

The performance of these sub-scales raise questions about the reasons for the weakness observed and suggests a need to re-visit their conceptualization and item structure.

13.2.1 Self-presentation

13.2.1.1 Tests of Reliability and Validity

Reviewing the results obtained for *Self-presentation* across the tests conducted in this study, it became apparent that while there was sufficient evidence to establish its reliability (i.e. internally consistent and stable), however, the evidence pertaining to its validity was less clear.

It appears that *Self-presentation* is characterized by adequate content validity. There is also preliminary evidence for the construct validity of *Self-presentation*, since the path analysis demonstrated that it exerted its influence on energy expenditure more indirectly via intention than directly.

However, the results obtained for its criterion-related validity suggest a weakness. It demonstrated little or no association with both intention and energy expenditure. Although the magnitude of the association between *Self-presentation* and energy expenditure obtained in this study was comparable to the previous literature^{137,177,242,285,286,288}, according to the rule of thumb employed in this study (cf. Section 10.2.4.1.3), the observed association was in fact quite poor.

Post hoc analysis also did not suggest that the relationship between this sub-scale and energy expenditure was gender specific. This is contrary to the literature in this field which has shown that not only do females have more self-presentational concerns than males, but that it also has a greater effect on their exercise participation (i.e. frequency)^{162,175,177,285-289}. Collectively, these findings suggest that there may be a problem with the operationalization and/or items of *Self-presentation*.

Revisiting the conceptualization and composition of this sub-scale, it became evident that the operational definition was not problematic since it captured the theme of self-presentational concerns energizing and directing exercise behaviour. The

deficiency of this sub-scale appears to be that its items do not adequately reflect the conceptualization.

The items within *Self-presentation* were capturing self-presentational concerns representing social identity, which are generally more relevant to males than to females. The items failed to include concerns relevant to females that are related to issues of body image. Several studies have shown that, for females, their perception of their physique, as well as their desire to improve or maintain a desired appearance exerts an effect on their exercise participation^{177,285-288}.

13.2.1.2 Implications of the Results

The items of *Self-presentation* must be refined to adequately reflect the concept. Some examples of the types of items that pertain to body image and structure concerns that could be incorporated into this sub-scale are summarized in Table 26 (cf. pg. 160).

With the addition of items that specifically reflect physical appearance concerns, this sub-scale should become more relevant to females, and its overall performance should also improve.

13.2.2 The sub-scales of Affiliation and Rewards

Affiliation and *Rewards* demonstrated an inconsistent performance across the tests in this study. These sub-scales are being considered concurrently because the results they yielded that contributed to their weakness were comparable and the examination of the reasons for their poor performance revealed that they likely suffered from the same limitation.

Table 26: A Comparison of the Original and Revised Items within the Sub-scales of the Motivational Factors for Exercise Scale (MFES).

Sub-scale	Original	Revised *
<i>Affiliation</i>	→ I like to exercise because it helps me meet people. → Exercise allows me to spend time with people I like. → I look forward to exercising because of the people I do it with.	→ Exercise would be a way for me to meet new people. → Exercise would be a nice way for me to spend time with people I like (family or friends). → If I liked the people I exercise with, I would look more forward to exercising.
<i>Rewards</i>	→ When I have met a goal for exercise people acknowledge my success. → I get praise from others for exercising. → People acknowledge my efforts to exercise.	→ Knowing that people would acknowledge my success if I were to reach an exercise goal I had set would encourage me to continue. → Performing exercise would be a way for me to get praise from others. → Having people acknowledge my efforts to exercise would influence my participation.
<i>Self-presentation</i>	<i>How important is each of the following to you:</i> → That other people will admire me for being in good physical condition. → That I look good while exercising. → That I look coordinated while exercising. → That other people think I am performing an exercise properly.	<i>How important is each of the following to you:</i> → That my body shape appears attractive to other people. → That I appear slim to other people. → That I am not drawing too much attention to the unattractive areas of my body during exercise. → That other people will perceive my physique positively. → That other people are evaluating my appearance positively.
<i>Social comparison</i>	→ I feel less satisfied about my exercise when I see other people who are more athletic than I am. → I feel more enthusiastic about exercise when I compare myself to people who have similar physical abilities as me. → Knowing that my exercise performance is at least as good as most people I know encourages me to keep on exercising.	→ Comparing my performance to people who are more athletic than me renews my spirit to exercise. → Comparing myself to people with similar physical abilities as me while exercising helps me stay with it. → Knowing that I am not performing as well as others makes me try harder.
<i>Social support</i>	→ Most people who are important to me support my efforts to exercise. → There are people I can count on to help me get exercise. → If I begin to lose interest in exercising, people I know encourage me to continue.	→ I would feel more inclined to exercise when people support my efforts. → Having friends and/or spouse to exercise with helps maintain my desire to exercise. → Having people who encourage me to be active helps me continue exercising.

★ These items reflect potential items that could be included in each sub-scale.

13.2.2.1 Tests of Reliability and Validity

Similar to *Self-presentation*, although there was sufficient evidence for their reliability, the evidence for their validity was weaker. Although the content validity was not problematic for these sub-scales, and that there was preliminary evidence for construct validity, the evidence for their criterion-related validity was less clear.

Regarding the test of criterion-related validity, their association with energy expenditure and intention was comparable to the values cited in the research to date ^{25,130,134-139,151,216-218}, however, according to the classification scheme employed in this study (cf. *Section 10.2.4.1.3*), their relationship was interpreted to be quite weak. Although some plausible explanations were put forth in *Section 10.4.1* to account for the performance of these sub-scales (e.g. inappropriate response option, age/gender-specific), they were only still marginally related to, and did not demonstrate the appropriate relationship with either energy expenditure or intention.

The difficulty with establishing the criterion-related validity of these sub-scales may reflect problems with their conceptualization and/or item structure. Upon re-examining their operationalization it became apparent that they were conceptualized too narrowly – being contingent upon performing exercise behaviour – and were likely only relevant to those who were active at some level. Further, since *Affiliation* and *Rewards* consisted of only 4 and 5 items, respectively, it is possible that the weak relationship observed between these sub-scales and the target variables of interest may be due to an insufficient number of items to represent the intended concepts.

13.2.2.2 Implications of the Results

In light of the limitations identified above with respect to the conceptualization and item structure, these sub-scales appear to require further refinement. Their

operational definition must be widened to increase their relevance to people of all activity levels.

This can be achieved by defining the concepts as being less contingent upon performing exercise. Rather, they should reflect beliefs about the extent to which an individual thinks that exercise could serve as a means of satisfying their need for affiliation and receiving rewards. The changes to the conceptualization of *Affiliation*, *Rewards* are summarized in Table 27.

Table 27: Sub-scales within the Motivational Factors for Exercise Scale (MFES) – Comparison of Original Definition and Revised Definition

Sub-scale	Operational Definition	
	Original	Revised
<i>Affiliation</i>	The extent to which exercise satisfies one's need for, or desire to be emotionally connected and interpersonally involved with others.	The individual's belief about the value of being interpersonally involved with, and connected to people during exercise.
<i>Rewards</i>	Internally or externally produced reinforcements that are contingent upon performing exercise behaviour.	The individual's belief that internal or external reinforcements could be available through exercise.
<i>Social comparison</i>	The result of individuals making certain types of comparisons with other people in relation to their exercise performance.	The effect that the comparisons an individual makes with other people in relation to their exercise performance or physical abilities, and the effect it has on their performance.
<i>Social support</i>	Provisions of social relations, such as attachment, spousal integration, guidance, buddy system, spousal participation, encouragement, or feedback.	The personal relevance of social relations to the individual and the effect it has on their exercise participation

Given the new operationalization of these sub-scales, the existing items comprising these sub-scales must also be accordingly revised to reflect this modification. Examples of the refined items that capture the new operationalization of these concepts and which could be included in the sub-scales of *Affiliation* and *Rewards* are provided in Table 26 (cf. pg. 160).

Beyond refining the existing items within the sub-scales of *Affiliation* and *Rewards*, the results pertaining to their criterion-related validity suggest that these sub-scales may not contain a sufficient number of items to adequately represent these concepts. Consequently, in addition to refining the existing items within these sub-scales, new items should also be crafted to ensure a broad and satisfactory coverage of the concepts under study.

It is anticipated that with the re-conceptualization of these sub-scales, coupled with the inclusion of additional items, that the performance of these sub-scales should improve.

13.2.3 Social comparison

13.2.3.1 Tests of Reliability and Validity

Although the performance of *Social comparison* was comparable to *Affiliation* and *Rewards*, it is described separately because the reasons for its poor performance are somewhat different.

The pattern of results obtained for this sub-scale demonstrate that it performed in a reliable manner. It is also characterized by content validity, as well as there being preliminary evidence for its construct validity. However, in terms of its criterion-related validity, *Social comparison* had little to no association with either intention or energy expenditure, demonstrating that it was not very relevant to the target variables of interest. Further, despite the *post hoc* evidence to suggest that the relationship between this sub-scale and energy expenditure was age-dependent, the association obtained was still marginal (cf. *Section 10.4.1*). In its present form, this sub-scale is not showing the expected relationship with the target behaviour of interest and may require further refinement.

Revisiting the operationalization of this sub-scale, it became evident that it was conceptualized narrowly and was too contingent upon performing exercise behaviour and as such, would only have been applicable to people who were doing some amount of activity. Also, the conceptualization did not capture how the comparisons an individual makes with other people energize and direct their exercise participation and performance. For this variable to exert a motivational influence on exercise behaviour, it is not the comparisons per se that are important, but rather it is the result and value of the comparisons that are made which exert an effect on exercise behaviour.

In addition to the limitation of the operationalization, the poor relationships observed could be attributed to an inadequate coverage of the domain by the items.

13.2.3.2 Implications of the Results

To improve the functioning of this sub-scale two changes should be implemented. First, the conceptualization must be broadened to increase its relevance to people of all activity levels and refined to capture the results and value of the comparisons that are made. A comparison of the original operational definition of this sub-scale to the refined one is provided in Table 27 (cf. pg. 162).

Second, the existing items must be revised to reflect the new conceptualization. Examples of how the existing items could be modified to capture the change in the operational definition of this sub-scale are provided in Table 26 (cf. pg. 160).

However, there may also be some merit, based on the results obtained for the criterion-related validity of this sub-scale, to including additional items (i.e. beyond the existing ones) in this sub-scale. This may result in a more adequate coverage of this concept by its items.

13.2.4 Social support

13.2.4.1 Tests of Reliability and Validity

The last sub-scale whose results were inconsistent across the tests conducted in this study was *Social support*. Similar to the other sub-scales comprising this cluster, it performed in a reliable manner, was characterized by content and construct validity (based on preliminary evidence), and did less well on the test of criterion-related validity.

The observation that *Social support* was not demonstrating the appropriate relationships is surprising given that it represents one of the strongest environmental factors that has been shown to be related to exercise participation^{80,120,300-302}. This suggests that this sub-scale is in need of further refinement.

The operational definition of *Social support* adopted for this study was imprecise in that it failed to capture how social support serves to energize and direct exercise behaviour. Rather, it captured the attributes of the social environment that create an enabling environment and make it conducive to exercise. Instead, this sub-scale should tap into how the presence of social support serves to influence exercise behaviour. Specifically, it should be capturing the personal relevance of the support an individual receives and the effect this has on their exercise participation.

13.2.4.2 Implications of the Results

The original definition of this sub-scale was “*Provisions of social relations, such as attachment, spousal integration, guidance, buddy system, spousal participation, encouragement, or feedback*”. To modify this operationalization to capture how social support motivates exercise behaviour, a more accurate definition would be “*The personal relevance of social relations to the individual and the effect it has on their exercise participation*”. The original and revised operational definitions of this sub-scale are provided in Table 27 (cf. pg. 162).

Because the conceptualization of this sub-scale was refined, its items also need to be revised accordingly. A summary of the refined items that could be included in the revised version of this sub-scale is provided in Table 26 (cf. pg. 160).

13.2.5 Summary

The results obtained for *Social support*, as well as the sub-scales of *Affiliation*, *Rewards*, *Self-presentation*, and *Social comparison* collectively indicate that further work is required to refine these sub-scales before they are re-tested. Although the modifications described above to both the operational definitions and items of these respective sub-scales are proposed to improve their functioning, at this stage this is purely speculative. Future research endeavors using the MFES should consider implementing the recommended changes and re-examining the psychometric properties of these sub-scales to establish whether their quality and performance has improved.

13.3 Future Areas of Research and Outstanding Questions

According to the results obtained for the sub-scales that performed well in this study (i.e. cluster # 1), an individual who is highly motivated for exercise, in comparison to their less motivated counterpart would be characterized by:

- ⇒ *More positive thoughts and feelings about exercising.*
- ⇒ *Perception of fewer barriers to their exercise participation.*
- ⇒ *Greater tendencies to set goals for their exercise and arrange behaviour accordingly.*
- ⇒ *A stronger belief that exercise is personally important.*
- ⇒ *Anticipating more outcomes from exercising.*
- ⇒ *Greater confidence in their ability to exercise in a variety of circumstances.*

⇒ *More positive appraisals of their physical abilities.*

⇒ *More realistic perceptions of the amount of personal control required to be active.*

⇒ *A greater need to have time to themselves.*

Based on the results obtained in this study (via cluster # 1) it is interesting that of the attributes that characterize a motivated individual, the majority reflect concepts that are intrinsic to the person. Researchers contend that although exercise can be initially adopted for the external reasons (e.g. improving appearance), as time progresses and physical conditioning and skill improve, the internal reasons for exercise (e.g. enjoyment) become more salient ¹⁷⁹.

Given the relationship between internal-external components of motivation and the stage of exercise participation, the patterns observed in this study raise some questions about the relative importance of the concepts from the MFES to those initiating versus those maintaining exercise. In particular, it would be interesting to examine what differences exist, if any, between initiators and maintainers of exercise behaviour across the sub-scales of the MFES. To examine this, future studies using the MFES should consider including an item that ascertains the exercise history of participants who are active at that time. Identifying motivational factors that are specific to, and relevant for each stage of exercise behaviour (i.e. adopters versus maintainers) could have a tremendous application in health promotion endeavors, as it would yield information to support tailored interventions created specifically for the purpose of initiating or maintaining exercise behaviour.

Although establishing the relevance of the sub-scales of the MFES for the stage of participation would be useful, the cross-sectional nature of such an undertaking would not provide any insight into how these sub-scales perform over time. Future research endeavors using the MFES should consider longitudinal designs that examine how the

sub-scales of the MFES change over time, in particular as an individual progresses from being inactive to active. Conducting a study such as this has the potential of providing insight into the motivational factors that influence an individual to become more active.

In addition, there still remains some work to further examine the psychometric properties of the MFES. Although this study examined some of the aspects of the validity of the MFES, this thesis could not address all the questions pertaining to its validity. Beyond the analyses conducted as a part of this study, the validity of the MFES could be further examined through factor analytic studies and structural equation modeling (SEM). Both of these analyses can address additional psychometric questions.

Factor analysis would assist in answering research questions such as, “what is the underlying factor structure of the MFES and what is its most parsimonious structure?” Factor analytic approaches would be helpful in summarizing the relationship among the items from each sub-scale of the MFES in a concise manner, and minimizing the number of factors and items in the MFES while maximizing the information it yields³²⁷. It would also provide information about, and help test the structure of the MFES^{307,328}. Given that factor analysis aids in conceptualizing the underlying structure of an instrument^{307,237}, it would provide additional evidence for the construct validity of the MFES.

A SEM approach would be an ideal analytic procedure to perform because it includes theoretical constructs, such as motivation, that cannot be observed directly (i.e. latent variables)³²⁹. As well, since SEM pictorially represents the structural relations among the variables under study simultaneously³²⁹, it allows for a clear conceptualization of the framework underlying the instrument.

The utility of SEM is that it examines the plausibility of the postulated relations among variables. This modeling technique will assist in answering a series of

outstanding questions which include: how are the sub-scales of the MFES related to the latent construct of motivation; are there any differences between the sub-scales of the MFES, in terms of how central they are to motivation; and do the sub-scales (i.e. measured scores) represent the underlying motivational concept they are presumed to be measuring.

The results from SEM would assist in clarifying whether the concepts represented in the MFES reflect factors of motivation by elucidating their relationship with the latent construct of motivation. This procedure would make a significant contribution to clarifying the underlying framework of the MFES, thereby providing additional evidence bearing on its construct validity.

13.4 Limitations and Strengths of the Current Study

It is quite plausible that the design of this study may have introduced some biases. One such bias is misclassification bias. This type of bias is common with any self-report measure, where there is the potential for error in the recollection process of participants. Regarding the Physical Activities Questionnaire (PAQ) (cf. *Section 10.2.3*), since respondents were asked to indicate their exercise participation over a one-month period, it is possible that their responses reflect estimation and guessing. Therefore, it is conceivable that the frequency and duration of participation reported by those sampled is an overestimation of their true activity level. This was anticipated and its potential effect(s) were minimized by utilizing MET values that corresponded to the lowest intensity level in the calculation of the energy expenditure scores (cf. *Section 10.2.4.1.1.2*). This technique has been employed by studies such as the Ontario Health Survey and the Campbell's Survey of Well-being, and is believed to yield a conservative estimate of the MET value for each activity^{72,312}, thereby reducing the likelihood of misclassifying participants based on overestimated energy expenditure scores.

Another potential shortcoming of the design of this study is that some proportion of the sample was self-selected and as such, may not be representative of the general population. Generally, volunteers are more positive towards the concept being studied than are non-volunteers³³⁰. It is possible that the data collected from these individuals were biased in that those who participated in the study were more interested in exercise and were more motivated compared to those who chose not to participate, thereby potentially resulting in higher scores across the sub-scales of the MFES.

However, this was not viewed as being problematic for two reasons. First, the data from this study was not used to derive population estimates for the parameters of motivation under study, but rather to examine the psychometric properties of the MFES. Second, to counter this, at many of the organizations and worksites, participants were directly approached. Potential participants were accrued from clubs and/or organizations that were less likely to be active (i.e. photography, bridge clubs, worksites without an in-house fitness centre) and may have been less motivated for exercise. This helped ensure variability in the sample.

Despite these potential limitations, this study possesses several strengths. In terms of the overall design of the present investigation, a comprehensive and iterative process was employed to develop and refine both the structure and content of the MFES. Further, the MFES is based upon a very extensive review of the literature and its development incorporated both cognitive interviews and pilot testing. This entire process provided several opportunities to refine the content of the MFES, as well as to evaluate how various aspects of the instrument functioned. The advantage of such an iterative process is that it led to the identification and correction of problems or shortcomings inherent to the design and content of the MFES early on in the process, thereby improving the quality of the sub-scales.

The examination of the psychometric properties of the MFES was also quite extensive. In particular, the current study attempted to gather insight into the extent to which the sub-scales could be construed as representing aspects of motivation, by examining how they operated to influence exercise behaviour. Since these analyses were conducted on a fairly large sample, this serves to lend greater confidence that accurate inferences can be made about the performance of the sub-scales.

13.5 Potential Application of the MFES to Population Health

The MFES possesses several important attributes. It is comprehensive and addresses several weaknesses of existing instruments measuring motivation for exercise behaviour/physical activity. The MFES also captures concepts both internal to, and external to the person.

Given sub-optimal levels of exercise adoption and maintenance considerable emphasis has been placed on health promotion interventions to increase the prevalence of exercise participation. Without the ability to measure the process by which exercise behaviour is motivated, it will be harder to make progress towards enhancing the effectiveness of public health interventions in this area.

The observation that many of the sub-scales of the MFES demonstrated the appropriate relationship with both intention and exercise behaviour indicates that the MFES holds some promise as an instrument that may have useful applications in population health. It could yield information to support the creation of interventions to increase the exercise participation in the population.

As a survey instrument, the MFES could assist those conducting needs assessment in measuring the motivational level of the population. In particular, the sub-scale scores obtained from this could be used to identify those in the population that are in the greatest need, by virtue of being the least motivated to exercise. Further, the data

obtained from the MFES would be useful since it could assist in characterizing the motivational factors that may be low or deficient in a given sub-population, thereby identifying the areas that should be targeted. This would support the creation of tailored interventions to increase exercise participation. Those establishing interventions could create unique techniques targeting specific motivational factors, and simultaneously implement them. The advantage of this is that it would broaden the scope and content of health promotion initiatives.

13.6 Conclusion

Although the MFES is only in its preliminary stages of development, it represents a means of supporting population health initiatives. With further development, the MFES would be of benefit to those conducting needs assessments, interventions, and evaluations which concern health promotion. Further, given that the MFES builds upon the weaknesses of existing instruments in the field, and conceptualizes motivation as a broad, multiple-determined construct, it holds some promise for enhancing our understanding of how exercise behaviour is motivated.

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Appendix 1

Application of the Theories of Reasoned Action and Planned Behaviour to Physical Activity and Exercise Behaviour: Empirical Evidence

Study Description	Investigators	Intentions	Variables		
			Attitude	Subjective Norm	Behavioural Control
Predicting Exercise Behaviour	Riddle (1980) ¹¹⁵	$R^2 = 0.67$, $p < 0.05$	---	---	---
	Wurtele & Maddux (1987) ²⁴¹	$R^2 = 0.09$, $p < 0.05$	---	---	---
	Godin et al. (1986) ²⁶¹	$R^2 = 0.23$, $p < 0.05$	---	---	---
	Godin & Shephard (1986) ¹¹⁴	$R^2 = 0.12$, $p < 0.05$	---	---	---
	Godin & Shephard (1986) ²⁶¹	$R^2 = 0.17$, $p < 0.05$	---	---	---
	Godin et al. (1987) ²⁶³	$R^2 = 0.31$, $p < 0.05$	---	---	---
	Kimiecik (1992) ¹¹¹	$R^2 = 0.46$, $p < 0.05$	---	---	---
Predicting Exercise Behaviour	Dzewaltowski (1989) ²⁶⁶	---	$R^2 = 0.05$, $p < 0.05$	---	---
	Riddle (1980) ¹¹⁵	---	$R^2 = 0.67$, $p < 0.05$	---	---
Additional Variance Explained in Predicting Exercise Behaviour	Ajzen & Driver (1992) ²⁶⁷	---	---	---	$R^2 = 0.09$, $p < 0.05$
	Dzewaltowski et al (1990) ⁷⁰	---	---	---	$R^2 = 0.27$, $p < 0.05$
	Gatch & Kendzierski (1990) ¹¹²	---	---	---	$R^2 = 0.05$, $p < 0.05$
	Godin & Gionet (1991) ¹¹³	---	---	---	$R^2 = 0.10$, $p < 0.05$
	Godin (1993) ²⁶⁰	---	---	---	$R^2 = 0.20$, $p < 0.05$
	Kimiecik (1992) ¹¹¹	---	---	---	$R^2 = 0.06$, $p < 0.05$
	Madden et al (1992) ²⁶⁸	---	---	---	$R^2 = 0.04$, $p < 0.05$

Appendix 2

Application of the Social Cognitive Theory to Physical Activity and Exercise Behaviour: Empirical Evidence

Study Description	Investigators	Entire Model	Variables Self-efficacy	Outcome expectancy
Predicting Exercise Behaviour	Dzewaltowski (1989) ²⁶⁶	$R^2 = 0.16$, $p < 0.05$	---	---
	Dzewaltowski et al. (1990) ⁷⁰	$R^2 = 0.46$, $p < 0.05$	---	---
Predicting Frequency of Exercise Participation	Dzewaltowski (1989) ²⁶⁶	$R^2 = 0.16$, $p < 0.05$	---	---
Predicting Intention to Exercise	Wurtele & Maddux (1987) ²⁴¹	---	$R^2 = 0.16$, $p < 0.05$	$R^2 = 0.26$, $p < 0.05$
Differentiating between Ability to Begin & Not Begin Exercise Program	Wurtele & Maddux (1987) ²⁴¹	---	$F_{1,144} = 6.27$, $p < 0.02$	
Predicting Exercise Behaviour for Beginners	Poag-DuCharme & Brawley (1993) ²⁷⁴	---	$R^2 = 0.25$, $p < 0.02$	---
Predicting Maintenance of Exercise Behaviour	Poag-DuCharme & Brawley (1993) ²⁷⁴	---	$R^2 = 0.42$, $p < 0.02$	---
Differentiating between Ability to Continue & Not Continue Exercise Program	Wurtele & Maddux (1987) ²⁴¹	---	$F_{1,144} = 4.87$, $p < 0.02$	---
Predicting Attendance at: • Onset of Exercise Program • End of Exercise Program	McAuley (1992) ⁹⁹	---	$R^2 = 0.06$, $p < 0.05$ $R^2 = 0.04$, $p < 0.05$	---

Appendix 3

Application of the Theory of Interpersonal Behaviour to Physical Activity and Exercise Behaviour: Empirical Evidence

<i>Study Description</i>	<i>Investigators</i>	<i>Full Model *</i>
<i>Predicting Intention to Exercise</i>	<i>Valois et al. (1986)²⁸³</i>	$R^2 = 0.25, p < 0.0001$
<i>Predicting Frequency of Exercise Participation</i>	<i>Valois et al. (1986)²⁸³</i>	$R^2 = 0.33, p < 0.0001$

** Full model includes the cognitive, affective, and social components, as well as personal normative beliefs (PNB).*

Appendix 4

Item-Specific Results from the Pilot Testing Phase of Version 1 of the Motivational Factors for Physical Activity Scale (MFPAS)

<i>Item</i>	<i>Criteria Satisfied</i>		<i>Retained</i>	
	<i>Presence of a Floor/Ceiling Effect</i>	<i>Moderate Inter-Item Correlation</i>	<i>Yes</i>	<i>No</i>
How confident are you that you could quickly learn the skills required to do new physical activities.	Yes	No	—	✓
How confident are you that you could participate in regular physical activity when you are a little tired.	No	Yes	✓	—
How confident are you that you could participate in regular physical activity when you have to do it yourself.	No	Yes	✓	—
How confident are you that you could participate in regular physical activity when you are in a bad mood.	No	Yes	✓	—
How confident are you that you could have enough physical coordination to enable you to get regular physical activity.	Yes	No	—	✓
How confident are you that you could participate in regular physical activity when it becomes boring.	No	No	—	✓
How confident are you that you could participate in regular physical activity when you can not notice any improvements in your fitness.	No	No	—	✓
How confident are you that you could participate in regular physical activity when you have many other demands on your time.	No	Yes	✓	—
How confident are you that you could participate in regular physical activity when you feel a little stiff or sore.	No	Yes	✓	—
How confident are you that you could participate in regular physical activity when the weather is bad.	No	Yes	✓	—
How confident are you that you could put forth the effort to perform a type of physical activity that is difficult.	No	No	—	✓
How confident are you that you could try new types of physical activities if you lost interest in your usual activity.	No	No	—	✓
For me, getting regular physical activity is unpleasant.	No	Yes	✓	—
For me, getting regular physical activity is interesting.	Yes	No	—	✓
For me, getting regular physical activity is harmful.	No	Yes	✓	—

<i>Item</i>	<i>Criteria Satisfied</i>		<i>Retained</i>	
	<i>Presence of a Floor/Ceiling Effect</i>	<i>Moderate Inter-Item Correlation</i>	<i>Yes</i>	<i>No</i>
For me, getting regular physical activity is relaxing.	No	Yes	✓	---
For me, getting regular physical activity is rewarding.	No	Yes	✓	---
For me, getting regular physical activity is tiring.	No	Yes	✓	---
For me, getting regular physical activity is important.	Yes	No	---	✓
For me, getting regular physical activity is difficult.	No	Yes	✓	---
I have a lot of control over whether or not I get regular physical activity.	No	Yes	✓	---
I have little control over the amount of time I have for physical activity.	No	Yes	✓	---
I choose my own goals for getting regular physical activity.	No	Yes	✓	---
While exercising, I set my own pace.	Yes	No	---	✓
I am physically active only because other people push me to be.	No	Yes	✓	---
I depend on other people rewarding me for being physically active.	No	Yes	✓	---
I can usually plan my schedule in advance so that nothing interferes with me being physically active.	No	Yes	✓	---
Regular physical activity will improve my health.	Yes	No	---	✓
Regular physical activity will give me more energy.	No	Yes	✓	---
Regular physical activity will improve my appearance.	No	Yes	✓	---
Regular physical activity will help me feel better about myself.	No	Yes	✓	---
Regular physical activity will allow me to keep up my skills.	No	Yes	✓	---
Regular physical activity will let me spend time with other people.	No	No	---	✓
Regular physical activity will give me some time to myself.	No	Yes	✓	---
Regular physical activity will reduce the stress of daily life.	No	Yes	✓	---
I am in better physical condition than most people my age.	No	Yes	✓	---
I am less coordinated than most people I know.	No	Yes	✓	---
My body is stronger compared to other men/women my age.	No	Yes	✓	---
I have high expectations for my performance when it comes to the activity I participate in.	No	Yes	✓	---
I compare myself to others when I rate my own progress in being physically active.	No	Yes	✓	---

<i>Item</i>	<i>Criteria Satisfied</i>		<i>Retained</i>	
	<i>Presence of a Floor/Ceiling Effect</i>	<i>Moderate Inter-Item Correlation</i>	<i>Yes</i>	<i>No</i>
I am rarely satisfied with my performance while doing physical activity.	No	No	—	✓
My continuing to participate in an activity depends on how well I think I have performed.	No	No	—	✓
Performing less well than other people discourages me from continuing a physical activity.	No	No	—	✓
Performing less well than other people discourages me from continuing a physical activity.	Yes	No	—	✓
Getting regular physical activity makes me feel satisfied.	No	Yes	✓	—
Getting regular physical activity makes me feel content.	Yes	No	—	✓
Getting regular physical activity makes me feel bored.	No	Yes	✓	—
Getting regular physical activity makes me feel anxious.	No	Yes	✓	—
Getting regular physical activity makes me feel confident.	No	Yes	✓	—
Getting regular physical activity makes me feel discouraged.	No	No	—	✓
I enjoy doing regular vigorous physical activity.	No	Yes	✓	—
I like the excitement being physically active.	No	Yes	✓	—
I do not enjoy physical activity because it makes me sweaty and dirty.	No	No	—	✓
I do not find physical activity to be fun.	No	Yes	✓	—
I enjoy the time I get being physically active.	No	Yes	✓	—
I love the sense of accomplishment I feel after being physically active.	Yes	No	—	✓
I have difficulty making physical activity a priority on my list of weekly activities.	No	No	—	✓
Setting goals for myself encourages me to be physically active.	No	Yes	✓	—
I set physical activity goals for myself.	No	Yes	✓	—
I tend to forget about the physical activity goals that I set for myself.	No	No	—	✓
After I have attained the physical activity goals that I have set for myself, I set new ones.	No	Yes	✓	—
Getting regular physical activity is not a high priority for me.	No	Yes	✓	—
When it comes to setting a goal for physical activity, I base it on what I think I can reach.	No	Yes	✓	—
I choose goals for physical activity that are “small steps” toward what I want to accomplish.	No	No	—	✓
Setting goals for myself helps me make some progress.	No	No	—	✓

<i>Item</i>	<i>Criteria Satisfied</i>		<i>Retained</i>	
	<i>Presence of a Floor/Ceiling Effect</i>	<i>Moderate Inter-Item Correlation</i>	<i>Yes</i>	<i>No</i>
When things get in the way of getting physical activity, I will still continue to work towards my goal.	No	Yes	✓	—
After exercising, I think about how much closer I am to achieving the goal(s) that I have set for myself.	No	No	✓	—
I track my performance to see whether I am attaining my physical activity goals.	No	Yes	✓	—
I get discouraged easily because my goals for physical activity tend to be too hard to reach.	No	Yes	✓	—
I really want to do vigorous physical activity on a regular basis.	No	No	—	✓
I have the will power required to get vigorous physical activity on a regular basis.	No	Yes	✓	—
I have a hard time following through on my intentions to get vigorous physical activity on a regular basis.	No	Yes	✓	—
I have made a commitment to get vigorous physical activity on a regular basis.	No	Yes	✓	—
I have little desire to do vigorous physical activity on a regular basis.	No	Yes	✓	—
Other people will respect me more if I am in shape.	No	No	—	✓
Others will admire me if I am in good physical condition.	No	Yes	✓	—
I feel self-conscious about my physical appearance when participating in an activity.	No	Yes	✓	—
Looking uncoordinated when I am doing physical activity.	No	Yes	✓	—
Other people thinking that I am not performing an activity properly.	No	Yes	✓	—
I cannot overcome the things that prevent me from being active.	No	No	—	✓
Due to the commitments I have, I cannot fit physical activity into my life.	No	Yes	✓	—
If something comes up that prevents me from exercising then I can find an alternate way of fitting physical activity into my life.	No	No	—	✓
I find it difficult to be active when the weather is bad.	No	Yes	✓	—
The places where I can be physically active are easy to get to.	No	Yes	✓	—
Being physically active costs too much money.	No	Yes	✓	—
I would like to be more active, but other people prevent me.	Yes	Yes	—	✓
Getting regular physical activity would leave too little time for my family and friends.	Yes	Yes	—	✓

<i>Item</i>	<i>Criteria Satisfied</i>		<i>Retained</i>	
	<i>Approximately Normally Distributed</i>	<i>Moderate Inter-Item Correlation</i>	<i>Yes</i>	<i>No</i>
Regular physical activity would put me at risk for getting an injury.	No	Yes	✓	—
At the end of the day I am too tired to be active.	No	Yes	✓	—
I have an injury or illness that prevents me from being as physically active as I should be.	No	Yes	✓	—
There is very little that can keep me from being physically active on a regular basis.	No	Yes	✓	—
Getting regular physical activity would be too time consuming.	No	Yes	✓	—
Most people who are important to me support me in being physically active.	No	Yes	✓	—
There are people who I can count on to help me be physically active.	No	Yes	✓	—
There are people I can ask for advice about being physically active.	No	Yes	✓	—
There is no one I feel comfortable talking to about the problems I experience with physical activity.	No	Yes	✓	—
I know people who enjoy being physically active.	Yes	No	—	✓
I have friends who take part in regular physical activity with me.	Yes	No	—	✓
If I begin to lose interest in being active, people I know can convince me to continue.	No	Yes	✓	—
If I doubt my physical abilities there are people I can rely on to boost my morale.	No	Yes	✓	—
I like to do physical activity because it helps me meet more people.	No	Yes	✓	—
Being physically active allows me to spend time with people I like.	No	Yes	✓	—
I participate in physical activity because it helps me spend time with my friends or family.	No	Yes	✓	—
I find it hard to be physically active unless I am doing it with people I like.	Yes	No	—	✓
I participate in physical activity mainly for social reasons.	Yes	No	—	✓
I look forward to being active because of the people I exercise with.	No	Yes	✓	—
To me it is important to get regular physical activity.	Yes	Yes	—	✓
I am the kind of person who wants to keep themselves in good physical shape.	No	Yes	✓	—
I am the kind of person who believes it is very important to get enough regular physical activity.	No	Yes	✓	—
Staying healthy by being physically active is very important to me.	No	Yes	✓	—

<i>Item</i>	<i>Criteria Satisfied</i>		<i>Retained</i>	
	<i>Presence of a Floor/Ceiling Effect</i>	<i>Moderate Inter-Item Correlation</i>	<i>Yes</i>	<i>No</i>
I would be achieving an important personal goal if I was physically active.	No	Yes	✓	—
I find it rewarding to engage in activities that physically challenge me.	Yes	No	—	✓
I would find it difficult to continue participating without positive feedback from people I know.	Yes	No	—	✓
I get encouragement from others to be physically active.	No	Yes	✓	—
When I meet a personal goal for physical activity, I do something nice for myself.	No	Yes	✓	—
I get helpful feedback on my performance from people who are interested in me being physically active.	No	Yes	✓	—
It is important for me to receive some form of feedback on my performance.	No	Yes	✓	—
When I meet a personal goal for physical activity, I tell myself I have done well.	No	Yes	✓	—
TOTAL	—	—	81	36

THE EXERCISE STUDY

***For People
Who Do & Do Not
Get Exercise***

This project is being conducted by Gauri Junnarkar who is a graduate student at the University of Ottawa, and is being supervised by Dr. S. Hotz (Faculty of Medicine, University of Ottawa).

The purpose of this project is to find out what people think and feel about doing exercise. If you choose to participate, simply complete this questionnaire and return it by (INSERT DATE HERE) to:

INSERT RETURN ADDRESS WITHIN THE SITE HERE

The questionnaire does not ask you to provide any identifying information. Any information you provide will remain anonymous and confidential. There is no obligation to participate in this project, and you are free to stop at any time. If you choose to participate, the information you will provide will assist in developing programs to help more people get exercise.

Your time and co-operation in participating in this project is greatly appreciated. For more information, please feel free to call Gauri Junnarkar at 562-5800, extension 8290.

Thank you for your help.

SECTION A

The following questions are about **regular vigorous exercise**. Whenever you read the words **exercise** or **exercising** in this questionnaire, they refer to activities that are vigorous *and* that are done on a regular basis.

Vigorous exercise refers to those activities that are done hard enough to *make your heart rate and breathing increase by a large amount*. For vigorous exercise to be **regular**, it must occur **at least 3 times per week, for at least 20 minutes each time without stopping**.

Please answer each question by **circling** the response that *most* accurately represents what you think, feel, or do.

Your answer options are:

- 1 = Strongly disagree
- 2 = Disagree
- 3 = Neither disagree nor agree
- 4 = Agree
- 5 = Strongly agree

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
1. For me, exercise is rewarding.	1	2	3	4	5
2. I have a lot of control over whether or not I exercise.	1	2	3	4	5
3. For me, exercise is unpleasant.	1	2	3	4	5
4. I exercise because other people want me to.	1	2	3	4	5
5. For me, exercise is relaxing.	1	2	3	4	5
6. I have little control over the amount of time I have for exercise.	1	2	3	4	5
7. For me, exercise makes my body feel uncomfortable.	1	2	3	4	5
8. My life circumstances make it hard for me to exercise.	1	2	3	4	5
9. For me, exercise is too tiring.	1	2	3	4	5
10. I can plan my schedule so that nothing interferes with me exercising.	1	2	3	4	5

		<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither disagree nor agree</i>	<i>Agree</i>	<i>Strongly agree</i>
11.	For me, exercising is difficult.	1	2	3	4	5
12.	Exercising will give me more energy.	1	2	3	4	5
13.	I am in good enough physical condition to exercise.	1	2	3	4	5
14.	Exercising makes me feel satisfied.	1	2	3	4	5
15.	I do not find it fun to exercise.	1	2	3	4	5
16.	I like to exercise because it helps me meet with people.	1	2	3	4	5
17.	Exercising is very important to me.	1	2	3	4	5
18.	I get praise from others for exercising.	1	2	3	4	5
19.	Exercising will improve my appearance.	1	2	3	4	5
20.	I am not coordinated enough to exercise.	1	2	3	4	5
21.	Exercising makes me feel bored.	1	2	3	4	5
22.	Exercise allows me to spend time with people I like.	1	2	3	4	5
23.	I am the kind of person who believes it is worthwhile to exercise.	1	2	3	4	5
24.	When I have met a goal for exercise, people acknowledge my success.	1	2	3	4	5
25.	Exercising will help me feel better about myself.	1	2	3	4	5
26.	My body is physically strong enough to allow me to exercise.	1	2	3	4	5
27.	Exercise helps satisfy my need to spend time with family or friends.	1	2	3	4	5
28.	Exercising is not a high priority for me.	1	2	3	4	5
29.	When I meet a personal goal for exercise, I do something nice for myself.	1	2	3	4	5

Remember, the words exercise or exercising, refer to activities that are *vigorous* and are done on a *regular* basis.

Your response options are:

1 = Strongly disagree

2 = Disagree

3 = Neither disagree nor agree

4 = Agree

5 = Strongly agree

		Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
30.	Exercising will allow me to maintain my athletic skills.	1	2	3	4	5
31.	I look forward to exercising because of the people I do it with.	1	2	3	4	5
32.	I would be achieving something meaningful to me if I exercised.	1	2	3	4	5
33.	The feedback I get from others about my exercise helps me stay with it.	1	2	3	4	5
34.	Exercising will help reduce the stress of daily life.	1	2	3	4	5
35.	I do not have the skills required to exercise.	1	2	3	4	5
36.	Exercising leaves me feeling more energized.	1	2	3	4	5
37.	When I meet a goal for exercise, I tell myself I have done well.	1	2	3	4	5
38.	Exercising will help me maintain a desirable weight.	1	2	3	4	5
39.	Exercising leaves me feeling refreshed.	1	2	3	4	5
40.	Exercising will help keep me as healthy as I can be.	1	2	3	4	5
41.	Exercising makes me feel good.	1	2	3	4	5
42.	People acknowledge my efforts to exercise.	1	2	3	4	5
43.	I find exercising to be enjoyable.	1	2	3	4	5

SECTION B

These questions ask *how confident you are* about being able to *exercise in different circumstances*. Remember **vigorous exercise** refers to those activities that are *done hard enough to make your heart rate and breathing increase by a large amount*. For vigorous exercise to be **regular**, it must occur **at least 3 times per week**, for **at least 20 minutes** each time **without stopping**.

Your answer options are:

- 1 = Not at all confident
- 2 = Not very confident
- 3 = Moderately confident
- 4 = Very confident
- 5 = Extremely confident

How confident are you that you would exercise when

	Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1. You are a little tired.	1	2	3	4	5
2. You have to do it by yourself.	1	2	3	4	5
3. You are in a bad mood.	1	2	3	4	5

How confident are you that you would exercise when

4. You have many other demands on your time.	1	2	3	4	5
5. You feel a little stiff or sore.	1	2	3	4	5
6. The weather is bad.	1	2	3	4	5

SECTION C

People can have *different thoughts* about *exercising*. Please indicate *how important* each of the following is to you.

Your response options are:

1 = Very unimportant to me

2 = Unimportant to me

3 = Neither unimportant nor important to me

4 = Important to me

5 = Very important to me

How important is each of the following thoughts to you?

	Very unimportant to me	Unimportant To me	Neither unimportant nor important to me	Important to me	Very important to me
1. That other people will admire me for being in good physical condition.	1	2	3	4	5
2. That I look good while exercising.	1	2	3	4	5
3. That I look coordinated while exercising.	1	2	3	4	5
4. That other people think I am performing an exercise properly.	1	2	3	4	5

SECTION D

Please read the following statements and indicate *how much they describe you*.

Your response options are:

1 = Very unlike me

2 = Unlike me

3 = Neither unlike nor like me

4 = Like me

5 = Very like me

		Very unlike Me	Unlike me	Neither unlike nor like me	Like me	Very like me
1.	Setting goals for what I would like to accomplish from exercising encourages me.	1	2	3	4	5
2.	I have the willpower required to regularly exercise.	1	2	3	4	5
3.	I feel less satisfied about my exercise when I see other people who are more athletic than I am.	1	2	3	4	5
4.	I do not set goals for what I would like to accomplish from exercising.	1	2	3	4	5
5.	I have a hard time following through on my intentions to exercise.	1	2	3	4	5
6.	After I have reached an exercise goal, I make a new one.	1	2	3	4	5
7.	I have made a commitment to exercise on a regular basis.	1	2	3	4	5
8.	I feel more enthusiastic about exercise when I compare myself to people who have similar physical abilities as me.	1	2	3	4	5
9.	When I set a goal for exercise, I base it on what I think I can reach.	1	2	3	4	5
10.	I have little desire to exercise on a regular basis.	1	2	3	4	5
11.	Exercise gives me time to myself.	1	2	3	4	5
12.	I consistently work to achieve specific goals for exercise.	1	2	3	4	5

We are *still asking* you to indicate *how much* each of the following statements *describes you*.

		Very unlike me	Unlike me	Neither unlike nor like me	Like me	Very like me
13.	Comparing my exercise performance to people who are more physically fit than I am encourages me to exercise.	1	2	3	4	5
14.	Exercise is important to me because it is something I get to do on my own.	1	2	3	4	5
15.	I track my performance to see whether I am attaining my exercise goals.	1	2	3	4	5
16.	Exercise gives me valuable time away from people.	1	2	3	4	5
17.	Knowing that my exercise performance is at least as good as most people I know encourages me to keep on exercising.	1	2	3	4	5
18.	My goals for what I would like to accomplish from exercising tend to be too hard to reach.	1	2	3	4	5
19.	Exercising by myself satisfies a need I have to do something on my own.	1	2	3	4	5

SECTION E

Please read the following statements carefully and indicate how *accurately each statement describes you* at the *present time*. Remember **vigorous exercise** refers to those activities that are *done hard enough to make your heart rate and breathing increase by a large amount*. For vigorous exercise to be **regular**, it must occur **at least 3 times per week**, for **at least 20 minutes** each time without stopping.

Your answer options are: 1 = *Very untrue for me*

2 = *Untrue for me*

3 = *Neither untrue nor true for me*

4 = *True for me*

5 = *Very true for me*

		Very untrue For me	Untrue for me	Neither untrue nor true for me	True for me	Very true for me
1.	Due to other commitments, it is hard for me to fit exercise into my life.	1	2	3	4	5
2.	Most people who are important to me support my efforts to exercise.	1	2	3	4	5
3.	I do not find it difficult to exercise when the weather is bad.	1	2	3	4	5
4.	There are people who I can count on to help me get exercise.	1	2	3	4	5
5.	The places where I can exercise are easy to get to.	1	2	3	4	5
6.	There are people I can ask for advice about exercising.	1	2	3	4	5
7.	Exercising costs too much money.	1	2	3	4	5
8.	If I begin to lose interest in exercising, people I know encourage me to continue.	1	2	3	4	5
9.	I have an injury or illness that prevents me from exercising as much as I would like to.	1	2	3	4	5
10.	There are people I can rely on to exercise with me.	1	2	3	4	5
11.	There is very little that can keep me from exercising on a regular basis.	1	2	3	4	5
12.	Engaging in exercise would be too time consuming.	1	2	3	4	5

Appendix 6

Response Key for Version 5 of the Motivational Factors for Exercise Scale (MFES)

<i>Sub-scale</i>	<i>Location of Items</i>	
	<i>Section</i>	<i>Item Numbers</i>
Affect	C	14, 15, 21, 36, 39, 41, 43
Affiliation	C	16, 22, 27, 31
Attitude	C	1, 3, 5, 7, 9, 11
Barriers	G	1, 3, 5, 7, 9, 11, 12
Goals	F	1, 4, 6, 9, 12, 15, 18
Intention	F	2, 5, 7, 10
Outcome-expectancy	C	12, 19, 25, 30, 34, 38, 40
PNB	C	17, 23, 28, 32
Rewards	C	18, 24, 29, 33, 37, 42
Self-determination	C	2, 4, 6, 8, 10
Self-efficacy	D	1-6
Self-evaluation	C	13, 20, 26, 35
Self-presentation	E	1-4
Social Comparison	F	3, 8, 13, 17
Social support	G	2, 4, 6, 8, 10
Time	F	11, 14, 16, 19

Appendix 7

Origin of the Items in Version 5 of the Motivational Factors for Exercise Scale (MFES)

Sub-scale	# of Items	ORIGIN OF ITEM						# Culled from Existing Scale(s)	% of Total Items	% of Total Items
		# Newly Created	% of Total Items	Culled from Supervisor	% of Total Items	% of Total Items				
Affect	7	6	86%	0	---	1	14%			
Affiliation	4	1	25%	0	---	3	75%			
Attitude	6	6	100%	0	---	0	---			
Barriers	7	6	86%	0	---	1	14%			
Goals	7	7	100%	0	---	0	---			
Intention	4	4	100%	0	---	0	---			
Outcome-expectancy	7	4	57%	0	---	3	43%			
PNB	4	3	75%	1	25%	0	---			
Rewards	6	6	100%	0	---	0	---			
Self-determination	5	3	60%	1	20%	1	20%			
Self-efficacy	6	0	---	6	100%	0	---			
Self-evaluation	4	3	75%	0	---	1	25%			
Self-presentation	4	4	100%	0	---	0	---			
Social Comparison	4	4	100%	0	---	0	---			
Social support	5	2	40%	0	---	3	60%			
Time	4	4	100%	0	---	0	---			
TOTAL:	84	63	75%	8	10%	13	15%			

Appendix 8

A Comparison of the Items Culled from Existing Instruments to those Adopted in Version 5 of the Motivational Factors for Exercise Scale (MFES)

<i>Sub-scale</i>	<i>Wording of Item</i>	
	<i>Item from Original Instrument</i>	<i>Item from the MFES</i>
<i>Affiliation</i>	I would like to meet people by engaging in various types of physical activities (Steinhardt & Young, 1992) ¹⁵⁰ .	I like to exercise because it helps me meet with people.
	Joining various physical activities would allow me to spend time with different people (Bagozzi & Kimmel, 1995) ²⁰ .	Exercise allows me to spend time with people I like.
	I participate in physical activity because I want to be with my friends (Frederick & Ryan, 1993) ¹³¹ .	Exercise helps satisfy my need to spend time with family or friends.
<i>Affect</i>	I think physical activity is fun (Frederick & Ryan, 1993) ¹³¹ .	I do not find it fun to exercise.
<i>Barriers</i>	Due to the commitments I have, I cannot fit physical activity into my life (DuCharm & Brawley, 1995) ²⁴⁴ .	Due to my other commitments, it is hard for me to fit exercise into my life.
<i>Outcome-expectancy</i>	I believe that regular vigorous physical activity will give me more energy (Bagozzi & Kimmel, 1995) ²⁰ .	Exercising will give me more energy.
	The activity I participate in will improve my appearance (Bagozzi & Kimmel, 1995) ²⁰ .	Exercising will improve my appearance.
	Physical activity will make me feel better about myself (Bagozzi & Kimmel, 1995) ²⁰ .	Exercising will help me feel better about myself.
<i>PNB</i>	I would be achieving an important personal goal if I was physically active (Plotnikoff et al., 1997) ³⁰⁵ .	I would be achieving something meaningful to me if I exercised.
<i>Self-determination</i>	I have a lot of control over whether or not I engage in planned physical activity (Plotnikoff et al., 1997) ³⁰⁵ .	I have a lot of control over whether or not I exercise.
	I can usually plan my schedule in advance so that nothing interferes with me being active (DuCharm & Brawley, 1995) ²⁴⁴ .	I can plan my schedule so that nothing interferes with me exercising.

Sub-scale	Wording of Item	
	Item from Original Instrument	Item from the MFES
Self-efficacy	How confident are you that you could...	How confident are you that you would exercise when ...
	→ Participate in regular physical activity when you are a little tired (Plotnikoff et al., 1997) ³⁰⁵ .	→ You are a little tired.
	→ Participate in regular physical activity when you have to do it by yourself (Plotnikoff et al., 1997) ³⁰⁵ .	→ You have to do it by yourself.
	→ Participate in regular physical activity when you are in a bad mood (Plotnikoff et al., 1997) ³⁰⁵ .	→ You are in a bad mood.
	→ Participate in regular physical activity when you have other demands on your time (Plotnikoff et al., 1997) ³⁰⁵ .	→ You have many other demands on your time.
	→ Participate in regular physical activity when you are stiff or sore (Plotnikoff et al., 1997) ³⁰⁵ .	→ You feel a little stiff or sore.
	→ Participate in regular physical activity when the weather is bad (Plotnikoff et al., 1997) ³⁰⁵ .	→ The weather is bad.
Self-evaluation	I am in better physical condition than most people my age (Steinhardt & Young, 1992) ¹⁵⁰ .	I am in good enough physical condition to exercise.
Social support	Most people who are important to me approve of my decision to be active (Bagozzi & Kimmel, 1995) ²⁰ .	Most people who are important to me support my efforts to exercise.
	If I find it difficult to be active, there are people who I can count on to help me (Duncan & McAuley, 1993) ³⁰⁶ .	There are people who I can count on to help me get exercise.
	There are people I can ask for advice about being physically active (Duncan & McAuley, 1993) ³⁰⁶ .	There are people I can ask for advice about exercising.

Appendix 9

Sampling Techniques at the RA Centre, Affiliated Sites, and the ELMA Worksites

i) The Affiliated Sites of the RA Centre

The affiliated sites of the RA Centre that were included in this study were Natural Resources Canada (NRCan), Agriculture and Agri-food Canada (Agrifit), Terrasse de la Chaudière, Human Resources Development Canada (HRDC), International Development Research Centre (IDRC), Department of Foreign Affairs and International Trade (DFAIT), and the Ontario Regional Cancer Centre (ORCC).

Internal email and newsletters were used to describe the nature of the study and when it would occur. They were also used as a forum from which to generate interest in the study, as well as to demonstrate organizational support for it.

Questionnaires were disseminated at the fitness centre and at display booths. The latter method of accrual was important because solely relying on subjects from the fitness centre would have yielded a highly active sample. Further, given that the goal of the study was to capture a range of activity levels, members of the fitness centres were also encouraged to take additional copies to their colleagues, friends, or family who were not as active.

ii) The RA Centre

At this site, monthly newsletters were used as the forum to describe the nature of the study and when it would occur, as well as to demonstrate organizational support. At the RA Centre, members were either approached directly and asked to participate, or indirectly through their instructors/leaders. Members were accrued from the message therapy clinic and fitness-related activities, as well as hobby clubs. The specific fitness-

related activities included in this study were: weight training, badminton, squash, archery, fencing, curling, aikido, twaikando, bowling, yoga, and aerobics. As for the hobby clubs, the groups that were approached were photography, bridge, darts, and rifle/handgun. The purpose of approaching these types of members was to ensure that a range of activity levels was captured. Moreover, in order to obtain a heterogeneous sample, members were encouraged to take additional copies to family and friends, regardless of their activity level.

iii) Worksites of ELMA

The ELMA worksites that were approached and agreed to participate in the study were the Ottawa Civic Hospital, Regional Health Department, Omnimark Technology, RMOC Public Works (Water Division, Signals and Communication, Water Treatment, Transportation), MDS Nordion, Digital Equipment, Canada Post Corp., Mitel Corp., and the City of Nepean. At all these sites the representative(s) had advertised the study through their intra-email system and encouraged employees to participate and complete the questionnaire.

Upon verbally agreeing to participate in the study, meetings were scheduled with the representative from each site to determine the optimal dissemination strategy. At the sites where the dissemination was the responsibility of the representative, a variety of techniques were employed, such as: inserting questionnaires into employee mailboxes; offering incentives for picking up and returning questionnaires; personally visiting employees and distributing questionnaires; and giving the questionnaires to departmental managers to distribute to their employees. At other sites, the questionnaires were personally distributed to employees.

Appendix 10

French Version of the *Motivational Factors for Exercise Scale (MFES)*

L'ÉTUDE SUR L'EXERCICE

*Pour les gens
qui font et ne font pas
d'exercice*

Ce projet est réalisé par Gauri Junnarkar, étudiante de 3^e cycle à l'Université d'Ottawa, sous la supervision du Dr Hotz (Faculté de médecine, Université d'Ottawa).

Il a pour but de découvrir ce que les gens pensent et ressentent à propos de l'exercice. Si vous choisissez de participer à cette étude, remplissez simplement ce questionnaire et renvoyez-le **d'ici une semaine** à :

BOITE L'ÉTUDE SUR L'EXERCICE

L'address ici

Le questionnaire ne vous demande aucun renseignement d'identification. Toute information fournie demeurera anonyme et confidentielle. Il n'y a aucune obligation à participer à ce projet et vous êtes libre de vous arrêter en tout temps. Si vous choisissez d'y participer, les renseignements que vous fournirez aideront à élaborer des programmes pour inciter davantage de gens à faire de l'exercice.

Nous apprécions énormément votre temps et votre collaboration pour participer à ce projet. Pour obtenir de plus amples renseignements, n'hésitez pas me téléphoner au 562-5800, poste 8290, ou par courrier électronique à gaurig@zeus.med.uottawa.ca

Merci pour votre aide.

Ne sautez pas de page et répondez à toutes les questions.

SECTION A

Veillez nous donner quelques renseignements sur vous-même.

1. Quel est votre âge? ____ ans

2. Quel est votre sexe?
Féminin ☐
Masculin ☐

3. Quelle est votre taille?
pieds ____ pouces
OU
centimètres

4. Quel est votre poids?
livres ____ **OU** kilogrammes

5. Quel est votre état civil?
☐ Célibataire sans avoir jamais été marié(e)
☐ Marié(e) ou conjoint(e) de fait
☐ Divorcé(e)/séparé(e)
☐ Veuf(veuve)

6. Avez-vous la charge d'enfants de moins de 16 ans?
☐ Oui
☐ Non

7. Quel est le niveau de scolarité le plus élevé que vous avez achevé?

<i>École élémentaire/ primaire (1^{ère} à 8^e année)</i>	<i>École secondaire ou CEGEP</i>	<i>École de métiers</i>	<i>Études universitaires de premier cycle</i>	<i>Études supérieures</i>
1	2	3	4	5

8. Quelle est votre situation professionnelle?

<i>À plein temps</i>	<i>À temps partiel</i>	<i>Emploi saisonnier</i>	<i>Pas d'emploi en dehors de la maison</i>	<i>Au chômage et à la recherche d'un emploi</i>	<i>Au chômage et <u>pas</u> à la recherche d'un emploi</i>	<i>En retraite</i>
1	2	3	4	5	6	7

9. Quel énoncé décrit le mieux dans quelle mesure votre revenu familial satisfait vos besoins?

- ☐ Mon revenu satisfait mes besoins très bien.
- ☐ Mon revenu satisfait mes besoins convenablement.
- ☐ Mon revenu n'est pas suffisant pour satisfaire mes besoins.
- ☐ Mon revenu est très insuffisant pour satisfaire mes besoins.
- ☐ Je choisis de ne pas répondre à cette question.

10. Votre aptitude à faire de l'exercice au cours du dernier mois a-t-elle été entravée par un problème de santé ou une blessure?

- ☐ Oui
- ☐ Non

Si oui :

Dans quelle mesure cet état de santé ou cette blessure a-t-il entravé votre exercice?

<i>Légèrement</i>	<i>Un peu</i>	<i>Quelque peu</i>	<i>Beaucoup</i>	<i>Totalement</i>
1	2	3	4	5

SECTION B

Les questions suivantes concernent les *types* d'activités physiques que *vous faites*. Pour chaque activité énumérée ci-après, veuillez mentionner le ***nombre de fois*** que vous l'avez faite au cours du ***dernier mois***. Pour chaque activité que vous avez faite, **cochez** la case qui indique pendant ***combien de temps*** vous l'avez faite.

	<i>Nombre de fois que vous avez fait cette activité au cours du dernier mois?</i>	<i>Chaque fois que vous avez fait cette activité, elle a duré combien de minutes en moyenne?</i>			
		<i>Moins de 15 min.</i>	<i>16-30 min.</i>	<i>31-60 min.</i>	<i>Plus de 60 min.</i>
1. Marche-exercice	□ □ □	☐	☐	☐	☐
2. Jogging / Tapis roulant	□ □ □	☐	☐	☐	☐
3. Cours d'exercice structurés ou cours d'aérobic en dehors de la maison	□ □ □	☐	☐	☐	☐
4. Machines à la maison (par exemple ergocycle, tapis roulant, machine à ramer)	□ □ □	☐	☐	☐	☐
5. Exercice sans machines à la maison (par exemple aérobic)	□ □ □	☐	☐	☐	☐
6. Golf	□ □ □	☐	☐	☐	☐
7. Canoë / Kayak	□ □ □	☐	☐	☐	☐
8. Patinage sur glace	□ □ □	☐	☐	☐	☐
9. Hockey sur glace	□ □ □	☐	☐	☐	☐
10. Natation	□ □ □	☐	☐	☐	☐
11. Tennis	□ □ □	☐	☐	☐	☐
12. Squash / Racquetball	□ □ □	☐	☐	☐	☐
13. Cyclisme (en salle ou en plein air)	□ □ □	☐	☐	☐	☐

	Nombre de fois que vous avez fait cette activité au cours du dernier mois?	Chaque fois que vous avez fait cette activité, elle a duré combien de minutes en moyenne?			
		<u>Moins de 15 min.</u>	<u>16-30 min.</u>	<u>31-60 min.</u>	<u>Plus de 60 min.</u>
14. Quilles		☐	☐	☐	☐
15. Patins à roues alignées		☐	☐	☐	☐
16. Basket-ball		☐	☐	☐	☐
17. Soccer		☐	☐	☐	☐
18. Curling		☐	☐	☐	☐
19. Yoga		☐	☐	☐	☐
20. Haltérophilie		☐	☐	☐	☐
21. Badminton		☐	☐	☐	☐
22. Volley-ball		☐	☐	☐	☐
23. Arts martiaux		☐	☐	☐	☐
24. Corvées ménagères ardues ou fatigantes / Pelletage de la neige		☐	☐	☐	☐
25. Danse aérobique (par exemple jazz, ballet, danse moderne)		☐	☐	☐	☐
26. Activité physique tout en jouant avec les enfants (activités distinctes de celles déjà		☐	☐	☐	☐
27. Autre (veuillez préciser) :					
		☐	☐	☐	☐
		☐	☐	☐	☐

SECTION C

Les questions suivantes concernent l'**exercice régulier vigoureux**. Lorsque vous lisez les expressions **exercice** ou **faire de l'exercice** dans ce questionnaire, elles désignent des activités qui sont vigoureuses *et* pratiquées sur une base régulière.

Exercice vigoureux désigne les activités qui sont effectuées avec une intensité suffisante pour *faire augmenter considérablement votre pouls et votre respiration*. Pour que des exercices soient **réguliers**, ils doivent se dérouler **au moins 3 fois par semaine pendant au moins 20 minutes** chaque fois **sans arrêter**.

Veuillez répondre à chaque question qui suit en **encerclant** la réponse qui décrit *le mieux* ce que vous pensez, ressentez ou faites.

Vos choix de réponses sont :

1 = *Fortement en désaccord*

2 = *En désaccord*

3 = *Ni en désaccord ni en accord*

4 = *En accord*

5 = *Fortement en accord*

		<i>Fortement En Désaccord</i>	<i>En désaccord</i>	<i>Ni en désaccord ni en accord</i>	<i>En accord</i>	<i>Fortement en accord</i>
1.	Pour moi, l'exercice est gratifiant.	1	2	3	4	5
2.	J'exerce beaucoup de contrôle sur ma décision de faire ou non de l'exercice.	1	2	3	4	5
3.	Pour moi, l'exercice est désagréable.	1	2	3	4	5
4.	Je fais des exercices parce que d'autres personnes le souhaitent.	1	2	3	4	5
5.	Pour moi, l'exercice est relaxant.	1	2	3	4	5
6.	J'exerce très peu de contrôle sur le temps dont je dispose pour faire de l'exercice.	1	2	3	4	5
7.	Pour moi, l'exercice met mon corps mal à l'aise.	1	2	3	4	5
8.	Les circonstances de mon existence me posent des problèmes pour faire de l'exercice.	1	2	3	4	5

		Fortement En Désaccord	En désaccord	Ni en désaccord ni en accord	En accord	Fortement en accord
9.	Pour moi, l'exercice est trop fatiguant.	1	2	3	4	5
10.	Je peux modifier mon horaire afin que rien n'entrave mes exercices.	1	2	3	4	5
11.	Pour moi, il est difficile de faire de l'exercice.	1	2	3	4	5
12.	L'exercice me donne plus d'énergie.	1	2	3	4	5
13.	Je suis en assez bonne condition physique pour faire de l'exercice.	1	2	3	4	5
14.	Après l'exercice, je me sens satisfait(e).	1	2	3	4	5
15.	Je ne trouve pas amusant de faire de l'exercice.	1	2	3	4	5
16.	J'aime faire de l'exercice car cela m'aide à rencontrer des gens.	1	2	3	4	5
17.	L'exercice est très important pour moi.	1	2	3	4	5
18.	Les autres me félicitent parce que je fais de l'exercice.	1	2	3	4	5
19.	L'exercice améliorera mon apparence.	1	2	3	4	5
20.	Je ne suis pas assez coordonné(e) pour faire de l'exercice.	1	2	3	4	5
21.	L'exercice m'ennuie.	1	2	3	4	5
22.	L'exercice me permet de passer du temps avec des gens que j'aime.	1	2	3	4	5
23.	Je suis le genre de personne qui estime qu'il vaut la peine de faire de l'exercice.	1	2	3	4	5
24.	Lorsque j'ai atteint un objectif d'exercice, les gens reconnaissent mon succès.	1	2	3	4	5
25.	L'exercice me permettra de me sentir mieux dans ma peau.	1	2	3	4	5

N'oubliez pas que les expressions **exercice** ou **faire de l'exercice** désignent des activités qui sont *vigoureuses* et effectuées sur une base *régulière*.

Vos choix de réponses sont :

1 = *Fortement en désaccord*

2 = *En désaccord*

3 = *Ni en désaccord ni en accord*

4 = *En accord*

5 = *Fortement en accord*

		Fortement En Désaccord	En désaccord	Ni en désaccord ni en accord	En accord	Fortement en accord
26.	Mon corps est assez fort physiquement pour me permettre de faire de l'exercice.	1	2	3	4	5
27.	L'exercice m'aide à satisfaire mon besoin de passer du temps avec ma famille ou mes ami(e)s.	1	2	3	4	5
28.	L'exercice n'est pas une grande priorité pour moi.	1	2	3	4	5
29.	Lorsque j'atteins un objectif personnel d'exercice, je fais quelque chose de bien pour moi.	1	2	3	4	5
30.	L'exercice me permettra de conserver mes habiletés sportives.	1	2	3	4	5
31.	J'ai hâte de faire de l'exercice en raison des gens qui m'accompagnent.	1	2	3	4	5
32.	Je réaliserais quelque chose de valable pour moi si je faisais de l'exercice.	1	2	3	4	5
33.	La rétroaction de mon entourage au sujet de mes exercices m'aide à continuer.	1	2	3	4	5
34.	L'exercice m'aidera à réduire le stress de la vie quotidienne.	1	2	3	4	5
35.	Je n'ai pas les habiletés nécessaires pour faire de l'exercice.	1	2	3	4	5
36.	Après l'exercice, je me sens plus débordant(e) d'énergie.	1	2	3	4	5

		Fortement En Désaccord	En désaccord	Ni en désaccord ni en accord	En accord	Fortement en accord
37.	Lorsque j'atteins un objectif d'exercice, je me dis que j'ai bien fait.	1	2	3	4	5
38.	L'exercice m'aidera à maintenir un poids souhaitable.	1	2	3	4	5
39.	Après l'exercice, je me sens revigoré(e).	1	2	3	4	5
40.	L'exercice me permettra de rester en aussi bonne santé que possible.	1	2	3	4	5
41.	L'exercice me permet de me sentir bien dans ma peau.	1	2	3	4	5
42.	Les gens reconnaissent les efforts que je déploie pour faire de l'exercice.	1	2	3	4	5
43.	Je trouve l'exercice agréable.	1	2	3	4	5

SECTION D

Ces questions demandent *dans quelle mesure vous avez confiance* d'être capable de *faire des exercices dans des circonstances différentes*. N'oubliez pas que l'**exercice vigoureux** désigne les activités qui sont effectuées avec une intensité suffisante pour *faire augmenter considérablement votre pouls et votre respiration*. Pour que des exercices soient **réguliers**, ils doivent se dérouler **au moins 3 fois par semaine pendant au moins 20 minutes** chaque fois **sans arrêter**.

Vos choix de réponses sont :

- 1 = Pas du tout confiant(e)
- 2 = Pas très confiant(e)
- 3 = Modérément confiant(e)
- 4 = Très confiant(e)
- 5 = Extrêmement confiant(e)

Dans quelle mesure êtes-vous confiant(e) de faire de l'exercice lorsque...

		<i>Pas du tout confiant(e)</i>	<i>Pas très confiant(e)</i>	<i>Modérément confiant(e)</i>	<i>Très Confiant(e)</i>	<i>Extrêmement confiant(e)</i>
1.	Vous êtes un peu fatigué(e).	1	2	3	4	5
2.	Vous devez le faire par vous-même.	1	2	3	4	5
3.	Vous êtes de mauvaise humeur.	1	2	3	4	5

Dans quelle mesure êtes-vous confiant(e) de faire de l'exercice lorsque...

4.	Votre emploi du temps est très surchargé.	1	2	3	4	5
5.	Vous vous sentez un peu ankylosé(e) ou endolori(e).	1	2	3	4	5
6.	Le temps est mauvais.	1	2	3	4	5

SECTION E

Les gens peuvent avoir des *pensées différentes* au sujet de l'*exercice*. Veuillez indiquer *quelle importance* a pour vous chacun des énoncés suivants.

Vos choix de réponses sont :

1 = *Très insignifiante pour moi*

2 = *Insignifiante pour moi*

3 = *Neutre*

4 = *Importante pour moi*

5 = *Très importante pour moi*

Quelle importance a pour moi chacune des pensées suivantes?

	<i>Très insignifiante pour moi</i>	<i>Insignifiante pour moi</i>	<i>Neutre</i>	<i>Importante pour moi</i>	<i>Très importante pour moi</i>
1. Que les autres m'admirent parce que je suis en bonne condition physique.	1	2	3	4	5
2. Que je paraisse bien pendant mes exercices.	1	2	3	4	5
3. Que je paraisse coordonné(e) pendant mes exercices.	1	2	3	4	5
4. Que les autres pensent que j'exécute un exercice convenablement.	1	2	3	4	5

SECTION F

Veuillez lire les énoncés suivants et mentionner *dans quelle mesure ils vous décrivent*.

Vos choix de réponses sont :

1 = *Ne me ressemble pas du tout*

2 = *Ne me ressemble pas*

3 = *Neutre*

4 = *Me ressemble*

5 = *Me ressemble beaucoup*

	<i>Ne me ressemble pas du tout</i>	<i>Ne me ressemble pas</i>	<i>Neutre</i>	<i>Me ressemble</i>	<i>Me ressemble beaucoup</i>
1. Il est encourageant pour moi de me fixer des objectifs pour les résultats que j'aimerais obtenir de l'exercice.	1	2	3	4	5
2. J'ai la volonté nécessaire pour faire de l'exercice régulièrement.	1	2	3	4	5
3. J'éprouve moins de satisfaction à propos de mes exercices lorsque je vois d'autres personnes qui sont plus sportives que moi.	1	2	3	4	5
4. Je ne me fixe pas d'objectifs pour ce que j'aimerais obtenir de l'exercice.	1	2	3	4	5
5. J'ai beaucoup de mal à donner suite à mes intentions de faire de l'exercice.	1	2	3	4	5
6. Après avoir atteint un objectif d'exercice, j'en fixe un nouveau.	1	2	3	4	5
7. J'ai pris l'engagement de faire de l'exercice régulièrement.	1	2	3	4	5
8. Je me sens plus enthousiaste pour faire de l'exercice lorsque je me compare à des gens qui ont les mêmes habiletés physiques que moi.	1	2	3	4	5
9. Lorsque je me fixe un objectif d'exercice, je le fonde sur ce que je crois pouvoir atteindre.	1	2	3	4	5
10. J'ai très peu envie de faire de l'exercice régulièrement.	1	2	3	4	5

Nous vous **demandons toujours** de nous indiquer **dans quelle mesure** chacun des énoncés suivants **vous décrit**.

	<i>Ne me ressemble pas du tout</i>	<i>Ne me ressemble pas</i>	<i>Neutre</i>	<i>Me ressemble</i>	<i>Me ressemble beaucoup</i>
11. L'exercice me donne du temps pour moi-même.	1	2	3	4	5
12. Je m'efforce régulièrement d'atteindre des objectifs d'exercice précis.	1	2	3	4	5
13. Comparer mes résultats d'exercice à ceux de personnes qui sont plus en forme que moi physiquement m'encourage à faire de	1	2	3	4	5
14. L'exercice est important pour moi parce que c'est quelque chose que je dois faire par moi-même.	1	2	3	4	5
15. Je suis mes résultats pour savoir si j'atteins mes objectifs d'exercice.	1	2	3	4	5
16. L'exercice m'accorde du temps précieux loin des gens.	1	2	3	4	5
17. Savoir que mes résultats d'exercice sont au moins aussi bons que ceux de la plupart des gens que je connais m'encourage à poursuivre mes exercices.	1	2	3	4	5
18. Les objectifs que je vise en faisant de l'exercice ont tendance à être trop difficiles à atteindre.	1	2	3	4	5
19. Faire de l'exercice par moi-même satisfait un besoin que j'ai de faire quelque chose personnellement.	1	2	3	4	5

SECTION G

Veillez lire soigneusement les énoncés suivants et indiquer *avec quelle précision chaque énoncé vous décrit* à l'heure actuelle. N'oubliez pas que l'exercice vigoureux désigne les activités qui sont effectuées avec une intensité suffisante pour *faire augmenter considérablement votre pouls et votre respiration*. Pour que des exercices soient réguliers, ils doivent se dérouler **au moins 3 fois par semaine pendant au moins 20 minutes** chaque fois sans arrêter.

Vos choix de réponses sont :

- 1 = Tout à fait faux pour moi
- 2 = Faux pour moi
- 3 = Ni vrai ni faux pour moi
- 4 = Vrai pour moi
- 5 = Tout à fait vrai pour moi

		<i>Tout à fait faux pour moi</i>	<i>Faux pour moi</i>	<i>Ni vrai ni faux pour moi</i>	<i>Vrai pour moi</i>	<i>Tout à fait vrai pour moi</i>
1.	En raison d'autres engagements, il est difficile pour moi d'inclure des exercices dans ma vie.	1	2	3	4	5
2.	La plupart des gens qui sont importants pour moi appuient mes efforts en vue de faire de l'exercice.	1	2	3	4	5
3.	Je ne trouve pas difficile de faire de l'exercice lorsque le temps est mauvais.	1	2	3	4	5
4.	Je peux compter sur des gens pour m'aider à faire de l'exercice.	1	2	3	4	5
5.	Les endroits où je peux faire de l'exercice sont facilement accessibles.	1	2	3	4	5
6.	Il y a des gens auxquels je peux demander des conseils sur l'exercice.	1	2	3	4	5
7.	Faire de l'exercice coûte trop cher.	1	2	3	4	5
8.	Si je commence à me désintéresser de l'exercice, les personnes que je connais m'encouragent à continuer.	1	2	3	4	5

		<i>Tout à fait faux pour moi</i>	<i>Faux pour moi</i>	<i>Ni vrai ni faux pour moi</i>	<i>Vrai pour moi</i>	<i>Tout à fait vrai pour moi</i>
9.	J'ai une blessure ou une maladie qui m'empêche de faire autant d'exercice que j'aimerais.	1	2	3	4	5
10.	Je peux compter sur des gens pour faire de l'exercice avec moi.	1	2	3	4	5
11.	Il y a très peu de choses qui peuvent m'empêcher de faire régulièrement de l'exercice.	1	2	3	4	5
12.	Commencer à faire de l'exercice me prendrait trop de temps.	1	2	3	4	5

Merci pour votre aide.

Appendix 11

The Demographic Questionnaire

Please tell us about yourself.

1. What is your age? _____ years
2. What is your sex?
Female ☐
Male ☐
3. What is your height?
feet _____ inches _____
OR
centimeters _____
4. What is your weight?
pounds _____ **OR** kilograms _____
5. What is your marital status?
☐ Single and have never been married
☐ Married or living common-law
☐ Divorced/Separated
☐ Widowed
6. Are you responsible for the care of children under the age of 16?
☐ Yes
☐ No

7. What is the highest level of schooling you have completed?

<i>Elementary/ Primary School (Grade 1 - 8)</i>	<i>Completed High School / CEGEP</i>	<i>Completed Technical Trades Program</i>	<i>Completed University Undergraduate Degree</i>	<i>Completed University Post- Graduate Degree</i>
1	2	3	4	5

8. What is your employment status?

<i>Full Time</i>	<i>Part Time</i>	<i>Seasonal Employment</i>	<i>Not Employed Outside Home</i>	<i>Unemployed and Looking for Work</i>	<i>Unemployed and <u>not</u> Looking for Work</i>	<i>Retired</i>
1	2	3	4	5	6	7

9. What best describes how well your household income meets your needs?

- ☐ Income meets my needs very well.
- ☐ Income meets my needs adequately.
- ☐ Income is not adequate for my needs.
- ☐ Income is very inadequate for my needs.
- ☐ I choose not to answer this question.

10. Was your ability to exercise during the last month limited by a health problem, or injury?

- ☐ Yes
- ☐ No

If yes:

How much did this health condition or injury limit your exercise?

<i>Slightly</i>	<i>A little</i>	<i>Somewhat</i>	<i>Quite a lot</i>	<i>Completely</i>
1	2	3	4	5

Appendix 12

The Development and Pilot Testing of the Physical Activities Questionnaire (PAQ)

1.0 Development of Physical Activities Questionnaire (PAQ)

The original version of the Physical Activities Questionnaire (PAQ) was used in the Ontario Health Survey (1990) ³¹². This version was modified and used in another recent study on exercise behaviour (Plotnikoff, 1997) ³⁰⁵. Both the original and the modified versions of the PAQ served as the template for the development of the questionnaire used in the present study.

The PAQ measures the frequency and duration of participation for a variety of activities over a given period of time, and can be used to derive estimates of energy expenditure. The modified version of the PAQ used in the study by Plotnikoff et al. ³⁰⁵, added new activities, such as machine exercises at home, canoeing/kayaking, yoga, badminton, hard/strenuous housework/snow shoveling, and playing with children to the original structure of the PAQ ³⁰⁵.

For this thesis, the modified version of the PAQ was altered further to ensure that seasonal activities were included, and that current trends in exercise and sports for younger and older adults were considered. The activities of martial arts and roller-blading were added to the scale. Thus, the PAQ used in this study lists twenty-six activities that people could have participated in over the past month.

2.0 Pilot Testing of the Physical Activities Questionnaire (PAQ)

2.1 Procedure

2.1.1 Protocol and Collection Period

The pilot work on the PAQ was conducted on a non-probability sample. Participants consisted of students and employees of the University of Ottawa who had

been verbally recruited. This method of accrual was believed to be both appropriate and sufficient for preliminary testing such as this, because the results obtained were to be used solely for the purpose of modifying the questionnaire, not to derive population estimates. Further, this method of collection was selected due to the ease and speed with which it could be implemented.

Participants were requested to complete the PAQ immediately upon receiving it. Completed questionnaires were personally collected at which point participants were fully disclosed about the purpose of the pilot work. Following this, participants were given the opportunity to provide feedback about the content and structure of the PAQ by answering structured and standard questions.

2.1.2 Inclusion and Exclusion Criteria

Potential participants were included in the pilot phase of this study if they were :

- ⇒ Proficient in English.
- ⇒ Between the ages of 18 to 75

Among those initially selected, participants were excluded if they:

- ⇒ Had a disability/injury that prevented/limited their current level of participation in physical activities.

2.1.3 Instrument(s)

The version of the PAQ that participants in the pilot phase completed listed 26 possible activities. They also had the opportunity to list two additional activities that had not been cited. For each activity, space was provided for the frequency of participation, as well as the duration, which ranged from < 15 minutes to > 1 hour.

2.2 Results & Modifications

2.2.1 Demographic Characteristics of Participants

A total of ten participants were accrued for the pre-testing of the PAQ. However, three participants were excluded due to incomplete questionnaires. Of the seven participants who remained, they consisted of 5 females (71%) and 2 males (29%). The average age of participants was 34.4 years ($\sigma = 12.1$ years), with age ranging between 24 and 55 years.

2.2.2 Item Level Modifications

The feedback obtained from participants indicated that the content, structure and organization of the PAQ was satisfactory. As such, no changes were made to the PAQ. The final version of the PAQ is provided in Appendix 13.

Appendix 13

The Physical Activities Questionnaire (PAQ): Final Version

The following questions are about the *types* of physical activities *you do*. For each activity listed below, please indicate the ***number of times*** you have done it in the ***past month***. For each activity that you have done, **check** the box which indicates ***how long*** you did it for.

	Number of times you have done this in the past month?	Each time you did this activity, on average, how many minutes did you do it for?			
		<u>Less than 15 min.</u>	<u>16-30 min.</u>	<u>31-60 min.</u>	<u>More than 60 min.</u>
1. Walking for Exercise	□ □ □	☐	☐	☐	☐
2. Jogging / Treadmill	□ □ □	☐	☐	☐	☐
3. Structured exercise classes or aerobics classes outside the home	□ □ □	☐	☐	☐	☐
4. Machines at home (for example, stationary bike, treadmill, rower)	□ □ □	☐	☐	☐	☐
5. Non-machine exercise at home (for example, aerobics)	□ □ □	☐	☐	☐	☐
6. Golf	□ □ □	☐	☐	☐	☐
7. Canoeing / Kayaking	□ □ □	☐	☐	☐	☐
8. Ice skating	□ □ □	☐	☐	☐	☐
9. Ice hockey	□ □ □	☐	☐	☐	☐
10. Swimming	□ □ □	☐	☐	☐	☐
11. Tennis	□ □ □	☐	☐	☐	☐
12. Squash / Racquetball	□ □ □	☐	☐	☐	☐
13. Cycling (indoor or outdoor)	□ □ □	☐	☐	☐	☐

	Number of times you have done this in the past month?	Each time you did this activity, on average, how many minutes did you do it for?			
		<u>Less than 15 min.</u>	<u>16-30 min.</u>	<u>31-60 min.</u>	<u>More than 60 min.</u>
14. Bowling	□ □ □	☐	☐	☐	☐
15. Roller-blading	□ □ □	☐	☐	☐	☐
16. Basketball	□ □ □	☐	☐	☐	☐
17. Soccer	□ □ □	☐	☐	☐	☐
18. Curling	□ □ □	☐	☐	☐	☐
19. Yoga	□ □ □	☐	☐	☐	☐
20. Weight Training	□ □ □	☐	☐	☐	☐
21. Badminton	□ □ □	☐	☐	☐	☐
22. Volleyball	□ □ □	☐	☐	☐	☐
23. Martial Arts	□ □ □	☐	☐	☐	☐
24. Hard or strenuous housework/ Shoveling Snow	□ □ □	☐	☐	☐	☐
25. Aerobic Dance (for example, jazz, ballet, modern)	□ □ □	☐	☐	☐	☐
26. Being physically active while playing with children (separate from the activities already	□ □ □	☐	☐	☐	☐
27. Other, please specify:					
_____	□ □ □	☐	☐	☐	☐
_____	□ □ □	☐	☐	☐	☐

Appendix 14
Calculating Mean Scores for the Sub-scales of the
Motivational Factors for Exercise Scale (MFES):
The Minimum Number of Admissible Items within each Sub-scale

The table below indicates the minimum number of admissible items (i.e. valid) that were required in order for a mean score to be calculated for each sub-scale of the MFES.

Sub-scale	# of Items in Sub-scale	Minimum # of Admissible Items (Maximum # of Inadmissible Items)
<i>Affect</i>	7	5 (2 missing)
<i>Affiliation</i>	4	3 (1 missing)
<i>Attitude</i>	6	4 (2 missing)
<i>Barrier</i>	7	5 (2 missing)
<i>Goals</i>	6	4 (2 missing)
<i>Intention</i>	4	3 (1 missing)
<i>Outcome-expectancy</i>	7	5 (2 missing)
<i>PNB</i>	4	3 (1 missing)
<i>Reward</i>	6	4 (2 missing)
<i>Self-determination</i>	4	3 (1 missing)
<i>Self-efficacy</i>	6	4 (2 missing)
<i>Self-evaluation</i>	4	3 (1 missing)
<i>Self-presentation</i>	4	3 (1 missing)
<i>Social comparison</i>	4	3 (1 missing)
<i>Social support</i>	5	3 (2 missing)
<i>Time</i>	4	3 (1 missing)

Appendix 15
Sample Calculation used to Derive a Mean Score for each Sub-scale of the
Motivational Factors for Exercise Scale (MFES)

The following calculation was used to derive a mean score for each sub-scale:

$$D_n = \sum x_i / y_n$$

Where:

D_n = A sub-scale from the MFES

x_i = The value for each item within the sub-scale, ranging from 1 through 5

y_n = The number of admissible items within the sub-scale

The sample calculation below is for the sub-scale of *Rewards*. This sub-scale consists of six items and as such, a maximum of two invalid (i.e. inadmissible) responses are permitted. If a participant had greater than 2 invalid responses for this sub-scale, then a mean score was not calculated.

In calculating a mean score for this sub-scale, one of three possible scenarios could occur:

Scenario 1:

The participant has a valid response for all six items. Their mean score would be:

$$D_{\text{Reward}} = \sum x_i / y_n$$

$$D_{\text{Reward}} = (x_1 + x_2 + x_3 + x_4 + x_5 + x_6) / 6$$

$$D_{\text{Reward}} = (4 + 3 + 5 + 3 + 5 + 5) / 6$$

$$D_{\text{Reward}} = 4.17$$

Therefore, this individual's mean score for the sub-scale of *Rewards* would be 4.16.

Scenario 2:

The participant has a valid response for five items, but an invalid response for the sixth. Hence, their mean score would be:

$$D_{\text{Reward}} = \sum x_i / y_n$$

$$D_{\text{Reward}} = (x_1 + x_2 + x_3 + x_4 + x_5) / 5$$

$$D_{\text{Reward}} = (3 + 5 + 3 + 5 + 5) / 5$$

$$D_{\text{Reward}} = 4.2$$

Therefore, this individual's mean score for the sub-scale of *Rewards* would be 4.2

Scenario 3:

The participant has a valid response for four items, but an invalid response for two items. Their mean score would be:

$$D_{\text{Reward}} = \Sigma x_i / y_n$$

$$D_{\text{Reward}} = (x_1 + x_2 + x_3 + x_4) / 4$$

$$D_{\text{Reward}} = (3 + 5 + 3 + 5) / 4$$

$$D_{\text{Reward}} = (16 / 4)$$

$$D_{\text{Reward}} = 4.0$$

Therefore, this individual's mean score for the sub-scale of *Rewards* would be 4.0.

Appendix 16
Sample Calculations:
Calculating the MET Value for the “Other” Activities Listed in the Physical Activities Questionnaire (PAQ) and Deriving an Energy Expenditure Score

i) Calculating MET Value for “Other” Activities

The MET value for the activities “other” than those listed in the Physical Activities Questionnaire (PAQ) was derived by taking the average of the MET values for the listed activities. The following equation was used:

$$\begin{aligned} \text{MET}_{\text{Other Activities}} &= \Sigma \text{ MET values for listed activities} / \# \text{ of listed activities} \\ &= (2+8+4+4+3+4+5+4+6+3+4+6+4+2+7+5+5+4+2+3+4+5+10+3+3+3) / 26 \\ &= 4.3 \end{aligned}$$

Therefore, the MET value for the activities “other” than those listed was 4.3

ii) Calculating Energy Expenditure Scores

Participants responses for the individual activities listed in the PAQ were transformed into a score that described their overall participation (e.g. their total energy expenditure across all activities). The equation used to derive the total energy expenditure for participants was obtained from the Ontario Health Survey (1990) ³¹². The equation was:

$$\begin{aligned} \text{Energy Expenditure} &= \Sigma (N \times D / 60 \text{ minutes per hour} \times \text{METS} / 30 \text{ days per month}) \\ &= \Sigma (N \times D \times \text{METS} / 1800) \end{aligned}$$

Where:

N = the number of times the activity was performed in the past month

D = the average duration, in minutes, of the activity

METS = the energy cost of activity, expressed as kilocalories expended per kilogram of body weight per hour of activity (kcal/kg/hr)

As per the OHS (1990) in order to obtain the “average” duration of activities, the following modifications were made to the duration indicated by respondents ³¹²:

- Duration of ≤ 15 minutes → Assigned average duration of 13 minutes
- Duration of 16 to 30 minutes → Assigned average duration of 23 minutes
- Duration of 31 to 60 minutes → Assigned average duration of 45 minutes
- Duration of ≥ 60 minutes → Assigned average duration of 60 minutes

Thus, for a participant who walked fifteen times in a month for a total of thirty minutes each time, as well as swam eight times over the month, for between thirty-one and forty-five minutes each time, their total energy expenditure score would be:

$$\begin{aligned}
 \text{Energy Expenditure} &= \Sigma (N \times D / 60 \text{ minutes per hour} \times \text{METS} / 30 \text{ days per month}) \\
 &= (N \times D \times \text{METS} / 1800) \\
 &= [(15 \times 23 \times 2) + (8 \times 45 \times 3)] / 1800 \\
 &= 0.9833
 \end{aligned}$$

Therefore, this individual's total energy expenditure would be 0.98 kcal/kg/day.

Appendix 17

Sampling Techniques Employed at the National Research Council (NRC)

The National Research Council (NRC) was used to assess the test-retest reliability of the Motivational Factors for Exercise Scale (MFES) for two reasons. First, it is a large institution that would yield a diverse sample and capture a wide range of activity levels. Second, the electronic correspondence system not only facilitated the dissemination of questionnaires, but also enabled the monitoring of participants over both phases of the study.

At NRC, internal email and newsletters were used as the forum to describe the nature of the study, as well as demonstrate the organizations support of this research endeavor. The contact person at NRC provided a list of all the employees in the Regional Municipality of Ottawa-Carleton (RMOC). This list provided 2802 employee names, phone numbers, and email addresses. However, since the study had been electronically advertised to all employees, those who were not selected but were interested in the study also had the opportunity to participate. Each participant who agreed to participate in the study was provided with a unique identifier to monitor the dissemination of questionnaires.