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Running head: PHYSICAL ACTIVITY AND AGING

A Study of the Relationships Between Physical Activity Levels, Experienced Bodily Changes, Age-Stereotyped Interpretations of Changes, and Motivation to Exercise in Older Adults

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Master's Thesis

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Abstract

In this study, the relationships between physical activity levels, experienced changes, interpretations of bodily states, and motivation towards physical exercise were examined in a sample of older adults (n = 151). Males who reported low levels of physical exercise, who experienced negative physical changes, and who attributed the changes to aging reported lower levels of self-determined motivation for physical exercise. However, there were no such effects for females. Surprisingly, additional findings indicated possible benefits of attributing negative physical changes to aging among more active individuals. It was also found that participants with low levels of physical exercise, but high levels of self-determined motivation, were more likely to intend to increase their level of physical exercise in the future. The implications for promoting physical exercise in older adults are discussed.

A Study of the Relationships Between Physical Activity Levels, Experienced Bodily Changes, Age-Stereotyped Interpretations of Changes, and Motivation to Exercise in Older Adults

Aging is an inevitable process accompanied by biological, psychological, and social changes (Birren & Fisher, 1992). Aging is often assumed to be associated with decline (Hulicka, 1992; Perlmutter & Hall, 1992), and gerontologists have long based their research on this assumption (Fry, 1990; Herrick, 1983; Neuhaus & Neuhaus, 1982; Rowe & Kahn, 1987, 1997). However, findings obtained over the last two decades have led researchers to conclude that people do not necessarily experience steep, pervasive declines as they age (Baltes & Baltes, 1990; Chodzko-Zajko, 1994; Tranel, Benton, & Olson, 1997). This "improved" perspective led researchers to classify older adults into two categories: (1) disabled/ill, or (2) healthy, but at risk for diseases or illnesses. However, this classification still did not provide a complete picture of aging, because it did not recognize that older adults could be both healthy, and at low risk for diseases or illnesses. In order to provide a more comprehensive understanding of aging, Rowe and Kahn (1987) described two specific types of aging: usual and successful. "Usual aging" describes what occurs when older adults are not currently experiencing any major diseases

and/or illnesses, but are nevertheless at risk due to lifestyle factors. Successful aging, on the other hand, describes what occurs when older adults are not only highly functioning, but are also at low risk for diseases and/or illnesses due to lifestyle factors (Rowe & Kahn, 1987).

Successful aging involves three main factors: (1) avoidance of disease and disability, (2) high cognitive and physical function, and (3) activity engagement with life. Extrinsic factors are viewed as having either no influence on the quality of the aging process, or as playing an important role in improving older adults' quality of life. For example, a nutritious diet, combined with regular physical exercise, may moderate the effects of aging, thereby increasing an individual's quality of life (Branch & Jette, 1984; Duffy & MacDonald, 1990; Quinn, Johnson, Poon, Martin, & Nickols-Richardson, 1997; Rosenberg, 1994). The main indicators of successful aging are: length of life, biological health, mental health, cognitive efficacy, social competence and productivity, personal control, and sense of autonomy or control (Baltes & Baltes, 1990, p. 5). Those indicators are not independent from each other (Abeles, 1991; Spirduso & Gilliam-MacRae, 1991; Svensson, 1991; Wetle, 1991). For example, general cognitive decline has been found to be associated with hypertension-related diseases (e.g., Hertzog, Schaie, & Gribbin, 1978; Launer, Dinkgreve, Jonker, Hooijer, & Lindeboom, 1993). Also, perceptions of good health are associated

with outcomes such as quality of life and mortality (Staats et al., 1993).

The distinction between usual and successful aging, and the extensive research on how lifestyle factors are responsible for a good portion of what was once thought to be "normal" aging decline, raises an important question for gerontologists: Why is "successful" aging so rare, and "usual" aging so common? The present study focuses on age-stereotyped interpretations of bodily states and motivation as variables that may be associated with low levels of physical activity in older adults.

Physical Activity and Experienced Changes

Physical decline has long been considered an inevitable consequence of normal aging. However, disuse is now recognized as an important cause of health problems and a moderating factor in the normal aging process (Spirduso & Gilliam-MacRae, 1991). Bortz (1982) was among the first researchers to report that many biological changes associated with aging were similar to the biological changes that result from physical inactivity. This finding led him to suggest that biological changes among different body systems (e.g., cardiovascular system, metabolic and regulatory function, and nervous system) could partly be explained by physical inactivity.

Bortz (1982) supported his argument by presenting a series of changes that are generally associated with aging, but that are also explainable by physical inactivity. For example, he pointed out that although studies showed that individuals' maximum oxygen consumption (VO_2 max) tends to decline with age, other studies have demonstrated that (1) bed rest deconditioning also results in a VO_2 max decrease, (2) exercise programs help increase VO_2 max, and (3) trained athletes have high VO_2 max levels. In other words, a decrease in VO_2 max in older adults may be partly caused by physical inactivity, and is thus at least partly reversible. Other examples of similar changes experienced by bed-ridden patients and inactive older adults include: loss of body weight, increase in body fat, increased tendency to faint, and symptoms of depression. These and other similarities between the changes associated with aging and the changes associated with physical inactivity led researchers to examine the role of physical activity on the aging process. Experiments conducted in laboratories showed that strength training programs could significantly increase older adults' muscle strength (Moritani & deVries, 1980). In one study, older adults who took part in a training program three times a week, for 12 weeks, saw their dynamic strength increase by 5% per training day, which represents a similar increase to the one found among younger participants in other studies (Frontera, Meredith,

O'Reilly, Knuttgen, & Evans, 1988). Strength training exercises were also found to increase muscle strength in a group of frail elderly who lived in a long-term care facility (Fiatarone et al., 1990).

Older adults do not necessarily need to take part in a specific strength training program to benefit from physical exercise. Studies have shown that moderate levels of physical activity are sufficient to increase muscle strength and joint flexibility, which may diminish the risk of falls in older adults (Deeg, Kardaun, & Fozard, 1996; Spirduso & Gilliam-MacRae, 1991; Stones & Kozma, 1996). A longitudinal study conducted over a period of five years showed that active participants' muscle strength did not decrease as much as it did for sedentary participants. Muscle strength and lean body mass were particularly stable among male participants (Rantanen & Heikkinen, 1998). Physical exercise may also be an important factor in reducing the risk of cardiovascular problems in older adults (Leon, Connett, Jacobs, & Rauramaa, 1987). In a 12-year longitudinal study, the rate of coronary heart disease for active older men (age 65 and above) was found to be less than half the rate of coronary heart disease for sedentary older men, even after controlling for factors such as cigarette smoking and alcohol intake (Donahue, Abbott, Reed, & Yano; 1988). A variety of such findings has led to the conclusion that regular practice of physical exercise such as walking, bicycling, swimming, or jogging may

prevent, or even reverse, physical decline (Fitzgerald et al., 1996; Leon et al., 1987; Ray, Gissal, & Smith, 1982; Spirduso, 1986; Spirduso & MacRae, 1990).

Physical exercise can also result in other benefits (Carron, Hausenblas, & Mack, 1996), such as an improvement in cognitive functions, like information-processing speed, fluid intelligence, and verbal memory (Diesfeldt & Diesfeldt-Groenendijk, 1977; Molloy, Beerschoten, Borrie, Crilly, & Cape, 1988; Spirduso, 1986; Spirduso & Gilliam-MacRae, 1990, 1991; Stones & Dawe, 1993; Stones & Kozma, 1996). In addition, regular practice of physical exercise is likely to improve individuals' emotional and mental health (Haug, Belgrave, & Gratton, 1984), because individuals who are physically active feel more in control of their environment, and consequently experience an increase in self-esteem (Ray et al., 1982). In summary, numerous studies have demonstrated that physical exercise results in physical, cognitive, and emotional benefits in older adults, and plays an important role in successful aging.

The associations between physical exercise and activity levels, and successful aging, are well documented and seem unquestionable. It also seems reasonable to assume that physically active older adults should experience (in the subjective sense) the beneficial effects of their active lifestyles, at least in contrast to the less active older adults who should experience and report more negative changes taking place in their bodies. The complete chain of

associations between levels of physical activity, objective bodily changes (e.g., muscle strength, joint stiffness) and subjective experiences of bodily changes have apparently not been fully examined in previous work. Establishing this chain of associations also requires longitudinal research that could not be conducted in the present study. It was nevertheless assumed that levels of physical activity should be associated with experienced changes in bodily states. We then decided to focus on age-stereotyped interpretations of bodily states as a possibly important factor in understanding motivation towards physical exercise.

Age Stereotypes

"Ageism represents a prejudicial orientation toward the elderly based on misconceptions, half truths, and ignorance" (Neuhaus & Neuhaus, 1982, p. 16). The most common myths about aging associate old age with (1) loss of physical and cognitive capacities, (2) difficulty at learning new skills, and (3) increased dependency and inactivity (Neuhaus & Neuhaus, 1982). Elders are particularly at risk of being influenced by age stereotypes, due to the numerous changes they experience (e.g., physical changes, new social roles) (Abeles, 1991; Hendricks, 1995; Rodin & Langer, 1980; Ryan, 1992). Recent research has shown that age stereotypes are not always negative (Harris, Page, & Begay, 1988; Hummert, 1994; Kite, Deaux, & Miele, 1991), and that their occurrence has decreased over

the last 15 years (Bell, 1992). However, attitudes toward older adults still tend to be more negative than attitudes toward younger adults (Kite & Johnson, 1988), and the predominant beliefs still revolve around declining competence.

Rosen and Jerdee (1976) suggested that the declining status of older adults could partly be explained by age stereotypes. Elders tend to internalize age stereotypes, and then act accordingly, which serves to reinforce the stereotypes (Beran, Ernst, & Kleinhauz, 1981; Kearl, 1981-82). Support for this type of argument was provided by Levy and Langer (1994) who demonstrated that at least part of the memory decline usually attributed to aging results from older adults' acceptance of society's expectations, rather than from real physiological changes.

A similar process may also explain why so many older adults are inactive. Age stereotypes are likely to have a negative impact on elders' sense of control and self-esteem (Abeles, 1991; Beran, Ernst, & Kleinhauz, 1981; Perry & Thomas, 1980). In turn, a decrease in self-esteem may lead to a decrease in the ability to feel control over the environment, which influences behaviour (Rodin, 1980; Wetle, 1991). Ferrini and Ferrini (1989) argued that age stereotypes may lead older adults to (1) exaggerate the risks associated with vigorous activity, (2) think that they do not need to exercise as much, and (3) underestimate their physical capacities to exercise. In other words, even though physical activity can

result in numerous benefits, a number of older adults may not exercise due to age stereotypes (Finnerty-Fried, 1982; Spirduso & Gilliam-MacRae, 1991).

While a low sense of control can result in diminished levels of participation in physical activities, a higher sense of self-efficacy and control has been associated with health-promoting behaviours, positive health outcomes, and increases in motivation (Abeles, 1991; McAvay, Seeman, & Rodin, 1996; Rodin, 1986). Rodin and Langer (1980) examined the influence of self-concepts in a sample of older adults newly arrived at a nursing home. Participants in the study all reported having physical problems that they attributed to aging. Three groups were randomly formed. Participants in the control group received no information. Participants in a second group were given information on the cause of their problems, based on medical reports and journal articles. The general message conveyed to these participants was that aging was not the true cause of their problems. Finally, participants in a third group were told that their problems were caused by their environment (reattribution intervention). For example, participants were told that the reason they sometimes slipped on the floor was not because they had motor difficulties or weak knees, but rather because the floors were tiled, and consequently slippery. Results showed that redirecting older adults' negative self-concepts (reattribution intervention) resulted in more positive outcomes, such as increased active participation and

sociability, compared to giving no information (group 1) or giving information based on medical reports (group 2).

There is indirect evidence that age stereotypes can decrease older adults' participation in physical exercises, thus contributing to the physical decline associated with aging. In light of the benefits associated with regular practice of physical exercise, it is important to get inactive older adults more involved in physical activity/exercise. However, doing so is a challenging task (Deeg, Kardun, & Fozard, 1996). A key factor in helping older adults become more active may be to increase older adults' motivation for physical activities (Brice, Gorey, Hall, & Angelino, 1996; Svensson, 1991). Self-determination theory, a theory of human motivation from personality and social psychology, has recently been applied to older adults (e.g., O'Connor & Vallerand, 1994a; Vallerand & O'Connor, 1989; Vallerand, O'Connor, & Blais, 1989), and may be useful in understanding the role of motivation in older adults' involvement in physical exercise.

Self-Determination Theory

Deci and Ryan (1985a) outlined different forms of motivation for performing a behaviour or an activity, as well as factors that are likely to influence motivation. According to Deci and Ryan, people have a need to feel

competent, self-initiating, and self-regulating in the activities they perform. People's motivation for an activity increases when these needs are satisfied, but it decreases if these needs are not fulfilled (Deci & Ryan, 1985a).

Types of Motivation

Four types of motivation are examined along a continuum of self-determination (O'Connor & Vallerand, 1994a). These forms of motivation, from high self-determination to low self-determination, are: intrinsic, self-determined extrinsic, non-self-determined extrinsic, and amotivation. People who are intrinsically motivated engage in an activity for the pleasure of doing so, as well as for the satisfaction they get out of their performance. In other words, intrinsic motivation is characterized by the absence of contingencies or rewards (e.g., "I exercise because I enjoy it").

In contrast to intrinsic motivation, extrinsic motivation involves the presence of contingencies; extrinsically motivated people perform an activity in order to receive or avoid something. In self-determined extrinsic motivation, the behaviour performed seems to result from an autonomous decision made by the person (e.g., "I exercise because it is a good way to stay healthy"). However, the reason for performing the behaviour is really based on a contingency (in this example, the person exercises in order to stay healthy, rather than for the

pleasure of exercising). The second type of extrinsic motivation, non-self-determined extrinsic motivation, implies that an individual is pressured, and feels obligated, to perform a behaviour (e.g., "I exercise because my physician wants me to"). The person does not have a feeling of freely deciding whether or not to perform the behaviour. Although extrinsic types of motivation are often believed to be externally caused, they can also be internally caused (Deci, Eghari, Patrick, & Leone, 1994). For example, people can pressure themselves to perform an activity by holding ideas about how they should behave. As a result of the pressure, their behaviour is not self-determined.

Amotivation, the fourth type of motivation, occurs when individuals do not perceive a contingency between their behaviours and outcomes (e.g., "I do not know why I exercise. I do not see what it does for me"). Amotivation is likely to result in behaviour termination.

Individuals who demonstrate more self-determined types of motivation (i.e., intrinsic motivation and self-determined extrinsic motivation) are said to possess an internal perceived locus of causality. On the other hand, people who demonstrate less self-determined types of motivation (i.e., non-self-determined extrinsic motivation and amotivation) are said to possess an external locus of causality (Deci & Ryan, 1985a, 1985b; O'Connor & Vallerand, 1994b). Locus of causality is not the same as locus of control. Locus of causality refers to the

reasons why a person initiates a behaviour, while locus of control refers to the beliefs about whether or not outcomes result from a person's behaviour (Deci & Ryan, 1985b; O'Connor & Vallerand, 1994b).

Influences on Motivational Orientations

Cognitive evaluation theory, a sub-theory of self-determination theory, describes how external events influence individuals' motivation (Deci & Ryan, 1985a; Frederick & Ryan, 1995). According to cognitive evaluation theory, events that increase individuals' perceived competence and perceived locus of causality, tend to increase individuals' intrinsic motivation. On the other hand, events that decrease individuals' perceived competence, and perceived locus of causality, tend to decrease individuals' intrinsic motivation (Deci & Ryan, 1985a; Frederick & Ryan, 1995). The subjective nature of an event (i.e., how individuals interpret an event) is more important than its objective nature in determining the event's impact on individuals' motivation. Thus, identical external events may influence people differently.

Studies have shown that different factors, such as avoidance of punishment, deadlines, surveillance, and money, can be used to decrease individuals' intrinsic motivation for a specific activity (Deci & Ryan, 1985a; Vallerand, 1997). For example, when participants are given money for

performing an activity they enjoy performing, their perceived locus of causality moves from internal to external. As a result, these individuals experience a decrease in intrinsic motivation, since the activity is perceived as being performed for an external reward, rather than being performed for sheer satisfaction and pleasure (Deci & Ryan, 1985a; 1991).

It is also possible to increase individuals' level of intrinsic motivation for an activity. Individuals are frequently faced with the necessity to perform essential, but uninteresting activities, such as marking exams (Deci & Ryan, 1985a). When external rewards are not sufficient to motivate people to engage in an essential activity, internal motivation may be used as a means to keep performing the activity (Sansone, Weir, Harpster, & Morgan, 1992). In self-determination theory, the concept of internalization is used to describe the process where an activity's external regulations become internalized by the individuals (Deci et al., 1994).

Internalization of regulations or values can be achieved through introjection, or integration. However, integration is the only type of internalization that represents self-determination. People who use introjection conform to a regulatory process, but do not accept the regulations as their own. For example, individuals who are uninterested in physical activity are likely to become active if they introject the regulations associated with physical activity;

however, they will feel obligated to exercise, instead of exercising for the pleasure of it. Introjection is thus a form of inner control.

On the other hand, people who use integration internalize a regulatory process, and identify themselves with the values associated with the behaviour or the activity. These people also take full responsibility for performing the behaviour (Deci et al., 1994). For example, people who integrate the values and regulations associated with physical activity are likely to be more active, because physical activity becomes important for the individuals' personal goals. Integration generally results in an increase in intrinsic motivation for the activity.

Self-determination theory has been supported with children and adult samples, and in a variety of situations, such as education (Deci, Vallerand, Pelletier, & Ryan, 1991; Vallerand, Gagné, Senécal, & Pelletier, 1994; Vallerand et al., 1992, 1993), interpersonal behaviours and relationships (Blais, Sabourin, Boucher, & Vallerand, 1990; Pelletier & Vallerand, 1996), proenvironmental behaviours (Pelletier, Legault, & Tuson, 1996), leisure (Pelletier, Vallerand, Green-Demers, Brière, & Blais, 1995), and sports (Pelletier et al., 1995).

Self-determination theory has also been applied to situations encountered by older adults (e.g., O'Connor & Vallerand, 1990, 1994a, 1994b). Vallerand and O'Connor (1989, 1991) developed the Motivation in the Elderly Scale (MES), based on self-determination theory. The MES was validated in English

(Vallerand, O'Connor, & Hamel, 1995). The purpose of the MES is to evaluate older adults' level of motivation across six important domains (health, religion, biological needs, interpersonal relations, current events, and recreation). Three questions were included for each domain. Participants must answer by selecting one of the four possible answers: (1) "I don't know, I don't see what it does for me" (amotivation); (2) "Because I am supposed to do it" (non-self-determined extrinsic motivation); (3) "I choose to do it for my own good" (self-determined extrinsic motivation); (4) "For the pleasure of doing it" (intrinsic motivation). Correlations obtained between the four MES motivation scales have been shown to be consistent with the general pattern predicted by Deci and Ryan (1985a).

In summary, past studies have repeatedly supported self-determination theory. The theory can be applied to different situations and to different populations, and has provided insight into the reasons why some individuals perform or do not perform certain activities. Consequently, self-determination seems appropriate to examine the role of motivation in older adults' participation in physical exercise.

The stereotypes about age suggest declining competence, which may prompt older adults to attribute the physical changes to aging. In turn, this may decrease their level of competence, and consequently decrease their level of motivation for physical exercise.

The Present Study

Many older adults experience changes that are associated with "usual" or "normal" aging, such as joint stiffness and loss of strength and flexibility. Yet, these experiences are relatively ambiguous, in the sense that older adults do not have access to a knowledge of the true causes of the experiences. The reasons older adults use to explain the physical changes they go through may be influenced by their own acceptance, or rejection, of age stereotypes. Older adults who are influenced by age stereotypes may be more likely to believe that the changes they experience result from aging, rather than from physical inactivity. In turn, they are likely to feel incompetent in improving their physical condition, their motivation for physical activity may decrease, and they may not get involved in physical activities. Why bother exercising if the changes are due to aging, and are therefore inevitable? Research has shown that feelings of incompetence are associated with lower levels of motivation (Deci & Ryan, 1985a). Consequently, age stereotypes, through their influence on motivation, may modify older adults' involvement in physical exercise. In light of the demonstrated importance of physical exercise in successful aging, it appears essential to look at the relationships between experienced changes, stereotyped interpretations of bodily states, motivation, and participation in physical

activity/exercise in older adults.

It seems reasonable to assume that there are reciprocal influences between some of these variables in everyday life. Physical activity levels presumably influence experienced changes; any stereotyped interpretations of these changes that are made at this point may influence motivation; and motivation influences subsequent activity levels. The selection of a dependent variable for the analyses is therefore arbitrary. Furthermore, despite initial appearances, the relationships between the variables are not all "causal", in the sense of A influencing B, and B influencing C, etc. Physical activity levels may not necessarily cause experienced changes; and experienced changes do not cause stereotyped interpretations. Thus, instead of a causal or "mediated" model, the associations between the variables should take the form of "moderated" relationships. In moderated relationships, the association between two or more variables varies or depends on scores on other variables, and there is no assumption of causal influence. In this study, it was hypothesized that elderly participants who experienced changes associated with low activity levels, and who attributed the changes to aging would experience lower levels of motivation to exercise. This hypothesis is thus a three-way interaction between physical activity level, experienced changes, and attributions in the prediction of motivation.

Frequency of Behaviour as a Predictor of Future Performance

We were also interested in examining the factors that are most important in predicting participants' engagement in physical activity. According to self-determination theory, people who are more motivated to perform a behaviour are also more likely to perform the behaviour in the future. In other words, motivation can be used to predict a person's future behaviour (e.g., engaging into physical activity/exercise). However, participants' current level of physical exercise may also be an important predictor, because people who exercise on a regular basis may be more likely to exercise in the future, regardless of their level of motivation. Although behaviour frequency has been measured in past studies (e.g., Coleman & Iso-Ahola, 1993; Goudas, Biddle, & Fox, 1994; Losier, Bourque, and Vallerand, 1993; Vallerand & Bissonette, 1992), the separate and combined effects of motivation and current behaviour frequency have not been simultaneously compared in their prediction of future intentions. The issue deserves attention because motivational factors, if important, should contribute to the prediction of future behaviour alone and beyond the base rate prediction that is achieved by simply asking participants about their current behaviour frequencies. Yet this issue has not been examined in previous work. Two relevant hypotheses were made in the present study. First, there should be a

significant effect for motivation in the prediction of behavioural intentions, beyond any effects for current behavioural frequencies. This will be tested using hierarchical regression. Second, there should also be an interaction between motivation and behaviour frequency in the prediction of behavioural intentions. This interaction should occur, because if the two factors are not redundant, then their combined effect should be higher than that of two main effects.

Method

Participants and Procedures

Participants were 151 older adults recruited from nursing homes (n = 20) and seniors' clubs (n = 131) in Ottawa and Thunder Bay. There were 91 women and 60 men, whose ages ranged from 56 to 95 (M = 72.2). Participants received a questionnaire, a postage-paid return envelope, and a cover letter explaining the purpose of the study and reminding them that all their answers would be anonymous and that their participation was voluntary (the cover letter can be found in Appendix A, and the questionnaire can be found in Appendix B). Participants from the nursing homes were contacted by the events coordinators, whereas participants from the seniors' clubs were contacted directly by two research assistants.

Measures

The questionnaire consisted of items concerning participants' self-reported experiences of physical changes, their attributions for these changes, their level of physical activity and physical exercise, as well as their motivation and behavioural intentions towards physical activity/exercise. Eight types of physical changes were assessed: energy level, stiffness of joints, strength of arms and legs, feeling out of breath, flexibility, reflexes and reaction times, body weight, and physical appearance (sample item: "Over the past year, my energy level has been:"). The experiences chosen were ambiguous ones that participants could attribute to normal aging and/or level of physical activity. Participants rated their experienced physical changes on an 11-point Likert scale ranging from decreasing (-5) to increasing (+5) change. Participants' attributions for each experienced change were measured using two 11-point Likert scales, ranging from disagree (-5) to agree (+5): e.g., "My energy level is due to my level of physical activity" (Attributions of Changes to Activity); "My energy level is due to aging" (Attributions of Changes to Aging).

A physical activity index (PAI) was obtained by asking each participant to indicate, on average, how many hours a day they spent in each of the five following levels of activities: (1) basal activity (e.g., sleeping, lying down); (2)

sedentary activity (e.g., sitting, standing, reading); (3) slight activity (e.g., light walking); (4) moderate activity (e.g., golf, gardening, dancing); and (5) heavy activity (e.g., swimming laps, chopping wood). Transformation of some responses was performed to ensure that the physical activity index of each participant was based on a total of 24 hours. Participants' reported number of hours spent in each type of activity was multiplied by 24, and then divided by the number of hours spent in all five types of activities. Each type of activity was then weighted by an intensity factor (Abbott, Rodriguez, Burchfiel, & Curb, 1994), and then multiplied by the number of hours spent in each activity. The values were then summed to form a PAI.

A physical exercise index (PEI) was also obtained for each participant. Participants were asked to indicate the types of exercises they engaged in. For each exercise, they were asked to indicate the number of days per week they engaged in the exercise, as well as the number of minutes per occasion. Each type of exercise was multiplied by an intensity factor expressed in metabolic equivalents (MET) based on published tables (Ainsworth et al., 1993). The results were then multiplied by the number of days and the number of minutes, and then summed to form a PEI.

The four kinds of motivation for exercise were measured by adapting items from the MES (Vallerand & O'Connor, 1989; 1991; Vallerand, O'Connor,

& Hamel, 1995). Participants rated their motivation on twelve 11-point Likert scales ranging from disagree (-5) to agree (+5). Three items were used to measure each type of motivation. Sample items: "I don't know why I exercise" (amotivation); "I exercise because I am supposed to" (non-self-determined extrinsic motivation); "I choose to exercise because I feel like it's a good way to help myself" (self-determined extrinsic motivation); and "I exercise because it is an interesting thing to do" (intrinsic motivation).

Two types of measures were used to examine participants' intentions to exercise. "Intentions to Exercise More" measured participants' intentions to increase both their amount of exercise, and their level of physical activity. "Intentions to Sweat" measured participants' intentions to engage in vigorous physical activity long enough to work up a sweat at least three days a week, for the four weeks following the time they filled-out the questionnaire.

Finally, participants rated their present physical health (1) in general, (2) compared to other people their age, and (3) according to their doctors, on 11-point Likert scales.

Special attention was given to some aspects of the questionnaire (e.g., reading level, typeface, adequate space to answer, and length of the questionnaire), because the participants were older adults (McHorney, 1996).

Statistical Analyses

Bivariate and partial correlations were first computed to examine the basic relationships between the variables. The interactive effects of the variables were examined by performing hierarchical regression analyses, with the interactions being represented as product terms. A significant increase in the variance accounted for by a product term indicates a significant interaction (Aiken & West, 1991; Cohen & Cohen, 1983). The nature of the interactions were discovered using the SIMPLE programs (O'Connor, 1998), which perform the computations recommended by Cohen and Cohen (1983) and Aiken and West (1991). The decision to use multiple regression analyses was guided by the fact that the independent variables of interest were continuously scored. All significance levels reported in the present study are two-tailed.

Results

The main purpose of this study was to examine the relationships among five key variables: physical activity/exercise, experienced physical changes, attributions for these changes, motivation, and intentions towards physical activity/exercise. The means, standard deviations, and internal consistency values for all measures are reported in Table 1. (Participants with missing values

were not included, thus explaining why data from only 112 participants were used in Table 1, although data from slightly more cases were used in some of the analyses when there were no missing values). Analyses were conducted to determine whether the various experienced changes could be collapsed into a composite variable in order to simplify the analyses. A series of reliability analyses, examinations of item-total correlations, and factor analyses revealed that five of the expected changes (energy level, strength in arms and legs, breathing, flexibility, and reflexes and reaction times) were both homogeneous and unidimensional, and were therefore used to create an Experienced Changes composite variable ($\alpha = .82$). Three other measured variables (i.e., body weight, physical activity, and stiffness of joints) either loaded on separate factors, had low item-total correlations, or were theoretically different from the others (especially body weight). A composite variable was created for Attributions of Changes to Activity ($\alpha = .63$), and Attributions of Changes to Aging ($\alpha = .84$), using the same five "changes" used to create the Experienced Changes composite variable.

The intercorrelations among the four kinds of motivational styles (see Table 2) were generally consistent with the simplex structure proposed by Deci and Ryan (1985a). The correlations indicate that motivational types located on the higher end of the self-determination continuum (i.e., intrinsic and self-

determined extrinsic motivation) were positively intercorrelated, and were negatively associated with motivational types falling on the lower end of the self-determination continuum (i.e., amotivation and non-self-determined extrinsic motivation). In addition, adjacent scales on the continuum tended to be more closely associated with one another than scales farther apart.

Analyses were conducted using a composite motivation scale to simplify the presentation of the results. Specifically, the four motivation scales were assigned weights according to their relative position on the self-determination continuum, and then summated to form a Self-Determined Motivation Index (see Blais, Sabourin, Boucher, & Vallerand, 1990; O'Connor & Vallerand, 1994a). Less self-determined forms of motivation were assigned negative weights, while more self-determined forms of motivation were assigned positive weights. Amotivation and non-self-determined extrinsic motivation received a weight of -2 and -1, respectively, while self-determined extrinsic motivation and intrinsic motivation received a weight of +1 and +2, respectively. The internal consistency of the Self-Determined Motivation Index was .83.

Independent t-tests were performed on the variables of interest to assess possible differences between nursing home participants and community-living participants. Results showed that nursing home participants were older, t (149) = 5.19, $p < .001$, and less physically active, t (145) = -2.80, $p < .01$, than

community-living participants. In addition, nursing home participants reported lower levels of self-determined motivation than community-living participants, t (18.86) = -2.20, $p < .05$. Both groups reported similar levels of physical exercise, t (140) = .91, p = n.s.

Physical Changes

Numerous studies indicate that physical decline, which is generally associated with aging, is often due to physical inactivity. This relationship is an assumption upon which our more specific hypotheses were based. The relationships between the variables were therefore examined to determine if the effect also existed in our data. Bivariate correlations showed that there was a positive association between PEI and Experienced Changes ($r = .21$, $p < .05$), indicating that participants who exercised more reported more positive changes. There was also a negative association between Experienced Changes and Age ($r = -.37$, $p < .01$), indicating that older respondents reported experiencing more negative changes than younger respondents. However, there was no relationship between PEI and Age ($r = -.02$, n.s.), and the relationship between age and experienced changes remained significant after controlling for PEI (partial $r = -.40$, $p < .01$), and after controlling for PAI (partial $r = -.36$, $p < .01$).

It was also expected, on the basis of previous work, that there should be an interaction between age and level of physical exercise in the prediction of experienced changes. Specifically, (1) younger adults should report experiencing more positive changes than older adults; (2) older adults with higher levels of physical exercise should report slightly less positive changes than younger adults; and (3) older adults with lower levels of physical exercise should report more negative changes than all other participants. Moderated regression analyses revealed that there was a significant interaction between Age and PEI predicting Experienced Changes, R^2 change = .03, $F(1, 141) = 4.34$, $p = .04$. A plot of this interaction (see Figure 1) revealed that younger adults with higher levels of physical exercise reported experiencing more positive changes than younger adults with lower levels of physical exercise. However, in contrast to predictions, older adults reported experiencing relatively negative physical changes, regardless of their level of exercise.

Main Hypotheses

The main purpose of the present study was to examine the relationships among participants' levels of physical exercise, experienced changes, attributions for these changes, and motivation. A series of bivariate correlations were first conducted for these variables. As mentioned above, it was found that

participants who exercised more reported more positive changes ($r = .21$, $p < .05$). There was a negative association between Experienced Changes and Attributions of Changes to Aging ($r = -.44$, $p < .01$), and a positive association between Experienced Changes and Attributions of Changes to Activity ($r = .24$, $p < .05$). These correlations indicate that older adults who experienced negative changes tended to attribute those changes to aging, while older adults who experienced positive changes tended to attribute those changes to their level of physical activity. There was also a positive association between Attributions of Changes to Activity and Motivation ($r = .29$, $p < .01$), indicating that participants who attributed their experienced changes to their level of physical activity reported higher levels of self-determined motivation for physical exercise.

The following results were expected for participants with lower levels of physical exercise: (1) participants who experienced negative changes, and who attributed those changes to aging, would report lower levels of self-determined motivation, and (2) participants who did not attribute their changes to aging would report higher levels of self-determined motivation. No specific predictions were made for participants with high levels of physical exercise, although they were expected to report higher levels of self-determined motivation. Hierarchical regression was used to test this hypothesized three-way

interaction between Experienced Changes, Attributions of Changes to Aging, and PEI on Motivation. There was a significant effect for the interaction term among men, R^2 change = .07, $F(1, 43) = 4.46$, $p = .04$, but not among women, R^2 change = .00, $F(1, 61) = .003$, $p = .96$. The interaction for men is plotted in Figure 2. The hypothesis was supported among male participants who reported lower levels of physical exercise. However, unexpected findings emerged for male participants with higher levels of physical exercise. Males who attributed their experienced changes to aging reported higher levels of self-determined motivation than males who did not attribute their experienced changes to aging. This difference was strongest among participants who reported experiencing negative changes.

There was also a significant three-way interaction between PAI, Experienced Changes, and Attributions of Changes to Activity in the prediction of Motivation among women, R^2 change = .05, $F(1, 67) = 4.31$, $p = .04$, but not among men, R^2 change = .002, $F(1, 43) = .12$, $p = .74$. Examination of the plots (see Figure 3) reveals that self-determined motivation levels for females who attributed their changes to their level of physical activity were stable and high. However, levels of self-determined motivation for participants who did not attribute their changes to activity varied depending on participants' levels of physical activity. Participants with lower levels of physical activity reported

higher levels of self-determined motivation when they experienced negative changes than when they experienced positive changes. Participants with higher levels of physical activity reported higher levels of self-determined motivation when they experienced positive changes than when they experienced negative changes.

Motivation

Research on self-determination theory has consistently demonstrated the benefits associated with higher levels of self-determined motivation. In the present study, there was a negative association between age and Motivation (r = -.33, $p < .01$), indicating that younger adults reported higher levels of self-determined motivation for physical exercise than older adults. After controlling for participants' age, there was a positive association between Motivation and PEI (partial $r = .37$, $p < .01$), and between Motivation and Experienced Changes (partial $r = .22$, $p < .01$). These correlations indicate that participants who reported higher levels of self-determined motivation for physical exercise also reported higher levels of physical exercise, regardless of their age. In addition, they also reported experiencing positive changes. As predicted by self-determination theory, self-determined motivation styles seem to be associated with both healthier behaviours and positive outcomes.

Prediction of Future Behaviour

It was hypothesized that participants' intentions about their future performance would be better predicted if both motivation and present behaviour frequency (i.e., PEI) were examined, instead of looking at either of these variables alone. Separate analyses were conducted for Intentions to Sweat (i.e., participants' intentions to engage in vigorous physical activity), and for Intentions to Exercise More (i.e., participants' intentions to increase their physical activity/exercise level).

There was a negative association between Intentions to Sweat and age ($r = -.23$, $p < .05$), indicating that older respondents reported lower levels of intentions to engage in vigorous physical activity, compared to younger respondents. There was a positive association between Intentions to Sweat and Experienced Changes ($r = .27$, $p < .01$), PEI ($r = .28$, $p < .01$), and PAI ($r = .25$, $p < .01$). These results indicate that participants who reported higher levels of intentions to engage in vigorous physical activity reported experiencing positive changes, and also reported higher levels of physical exercise and higher levels of physical activity.

Intentions to Exercise More was negatively associated with age ($r = -.36$, $p < .01$), indicating that older respondents reported lower levels of intentions to

increase their amount of physical activity/exercise than younger respondents. There was also a negative association between Intentions to Exercise More and Attributions of Changes to Aging ($r = -.27$, $p < .01$), indicating that participants who did not attribute their experienced physical changes to aging reported higher levels of intentions to increase their amount of physical activity/exercise. Finally, there was a positive association between Intentions to Exercise More and Motivation ($r = .19$, $p < .05$), indicating that participants with higher levels of self-determined motivation reported higher levels of intentions to increase their amount of physical activity/exercise.

Contrary to our hypothesis, there was no significant association between Motivation and Intentions to Sweat, after controlling for current behaviour frequency (PEI). After controlling for participants' PEI, there was a positive partial correlation between Motivation and Intentions to Exercise More (partial $r = .17$, $p = .08$). This association was stronger among men (partial $r = .34$, $p = .02$). These two associations indicate that participants who reported higher levels of self-determined motivation for physical exercise also reported higher levels of intentions to increase their amount of physical activity/exercise.

Hierarchical regressions revealed that PEI significantly contributed to the prediction of Intentions to Sweat, R^2 change = .06, $F(1, 116) = 7.06$, $p < .01$, but not to Intentions to Exercise More R^2 change = .004, $F(1, 116) = .50$, $p =$

.48. Motivation significantly contributed to the prediction of Intentions to Exercise More, R^2 change = .03, $F(1, 116) = 3.23$, $p = .08$, but not to Intentions to Sweat, R^2 change = .001, $F(1, 116) = .08$, $p = .78$.

Hierarchical regression was used to test the interactive effects of current level of physical exercise (PEI) and Motivation on participants' behavioural intentions. It was hypothesized that participants with higher levels of physical exercise and higher levels of self-determined motivation would report the highest levels of intentions to engage into vigorous physical activity. This hypothesis was supported among men and women together, R^2 change = .02, $F(1, 115) = 2.75$, $p = .10$ (see Figure 4), and among women only, R^2 change = .04, $F(1, 68) = 2.99$, $p = .09$ (see Figure 5). Results also revealed a significant interaction between PEI and Motivation in the prediction of Intentions to Exercise More, R^2 change = .08, $F(1, 67) = 6.08$, $p = .02$ (see Figure 6). Women with higher levels of physical exercise and higher levels of self-determined motivation reported the lowest levels of intentions to increase their amount of physical activity/exercise.

Supplementary Analyses

The above findings provided only partial support for the hypotheses, and so supplementary analyses were conducted in an attempt to discover patterns in the data that might account for the findings. Our suspicion was that some of the

interactions may not have emerged as clearly as expected due to the distribution of the elderly participants across the multivariate space that is defined by the central variables of interest (experienced changes, exercise and activity levels, and attributions).

The emergence of significant interactions requires that there be substantial and balanced numbers of cases across the variable continuums (or at least at the poles of the continuums) and this may not have been the case in our sample. The most informative picture of the data emerged from cluster analyses, which is a procedure that searches for groups in multivariate space that display high within-group similarities and low between-group similarities. The variables were first standardized, and then entered into the Hierarchical Cluster and Quick Cluster routines in SPSS. Examinations of icicle plots, agglomeration coefficients, and the numbers of cases per group suggested that three clusters of adequate size could be identified. The clusters centers are reported in Table 3, and are similar to mean $\underline{z}$ scores of the identified groups on the variables. The cluster centers revealed that Group 1 (the largest) consisted of people who were somewhat inactive, who exercised less than average, who experienced slightly negative changes, and yet who did not attribute the experienced changes to either aging or their activity levels. Group 2 was perhaps the most interesting and peculiar, consisting of individuals who were the most active and who

reported relatively high levels of physical exercise. Yet they experienced slightly negative changes and attributed the changes to both aging and activity levels. Being exercise- and activity-conscious may have made these people more sensitive to small changes taking place inside their bodies with age. Group 3 was also peculiar, consisting of individuals who displayed only average levels of physical exercise and activity, yet who reported the most positive experienced changes and who attributed the changes to activity levels and not to aging. Pairwise comparisons using the Scheffé test indicated that individuals in cluster 1 reported lower levels of self-determined motivation than individuals in clusters 2 and 3.

Supplementary analyses were also conducted on participants' reported Physical Health. Physical Health was positively associated with Experienced Changes ($r = .35$, $p < .01$), Attributions of Changes to Activity ($r = .29$, $p < .01$), PAI ($r = .25$, $p < .01$), PEI ($r = .23$, $p < .01$), Motivation ($r = .30$, $p < .01$), and Intentions to Sweat ($r = .27$, $p < .01$). These results indicate that participants who evaluated their physical health positively reported experiencing more positive physical changes, and attributed these changes to their level of physical activity. They also reported higher levels of physical activity and physical exercise, as well as higher levels of self-determined motivation for physical exercise. Finally, these participants reported higher levels of intentions to

engage in vigorous physical activities.

Discussion

Studies show that physical decline in older adults can be slowed down, or even reversed, through physical activity/exercise. Unfortunately, elders who internalize age stereotypes such as, "it is dangerous for older adults to engage in physical exercise", may demonstrate lower levels of motivation for physical exercise. The main purpose of this study was to examine the relationships among physical activity/exercise, experienced changes, attributions for the physical changes, and motivation.

The findings provide partial support for the importance of physical exercise in successful aging (Rowe & Kahn, 1997). Participants who reported higher levels of physical exercise rated their physical health as better compared to other people their age, and reported experiencing more positive physical changes, such as increased flexibility, and improved reflexes and reaction times. They also reported higher levels of self-determined motivation for physical exercise, and higher intentions to engage in vigorous physical activities. These findings are in line with findings from other studies that demonstrate the beneficial effects of physical exercise (e.g., Deeg, Kardaun, & Fozard, 1996; Donahue, Abbott, Reed, & Yano, 1988; Haug, Belgrave, & Gratton, 1984; Ray

et al., 1982; Spirduso & Gilliam-MacRae, 1991; Stones & Dawe, 1993; Stones & Kozma, 1996).

However, further analyses indicated some evidence of an "aging" effect among older respondents, who reported experiencing negative changes, regardless of their level of physical exercise (re: Figure 1). Thus, the role of lifestyle on successful aging was weaker than we expected among older respondents. This finding may have occurred for several reasons. First, there could be a true aging effect among older respondents. Second, there could be a cohort effect, due to the cross-sectional design of this study. Third, this finding could be due to the low number of respondents who reported high levels of physical exercise. Although this was also true for younger respondents, the role of physical exercise may be particularly important in older age, and the lack of very active older respondents may have weakened the influence of physical exercise on physical changes. In contrast to the recommended wisdom of representative sampling, a proper test of our hypothesis may require extensively unrepresentative sampling in order to obtain more active participants in research investigations.

This study also provides further support for self-determination theory, and demonstrates that self-determination theory can be applied to the motivation behind older adults' participation in physical exercise. Results revealed (1) the

existence of a continuum of self-determination similar to the one proposed by Deci and Ryan (1985a), and (2) an association between more self-determined types of motivation (i.e., intrinsic and self-determined extrinsic motivation) and positive outcomes (i.e., higher levels of physical exercise, positive experienced physical changes, and good current physical health).

In accordance with the main hypothesis, the results revealed that participants who reported low levels of physical exercise, who experienced negative physical changes, and who attributed the changes to aging, tended to report lower levels of self-determined motivation for physical exercise, although the effect occurred only among men. From the perspective of self-determination theory, by attributing the changes to aging, these participants presumably felt incompetent in their capacities to exercise, and as a result, experienced lower levels of self-determined motivation for physical exercise. (Some participants may have reported lower levels of self-determined motivation due to a lack of opportunities to exercise, or simply due to a history of physical inactivity). Interestingly, women who attributed their physical changes to their level of physical activity reported high, stable levels of self-determined motivation for physical exercise, regardless of the type of physical changes they experienced (negative or positive), and regardless of their level of physical activity. From the perspective of self-determination theory, these women may have felt competent

in their capacities to exercise, which led them to experience higher levels of self-determined motivation for physical exercise. These two findings are in line with self-determination theory, and suggest that older adults' acceptance or rejection of age stereotypes may result in a decrease, or an increase, of older adults' levels of self-determined motivation for physical exercise.

Motivation plays an important role in physical exercise participation (Deci & Ryan, 1985a; Frederick & Ryan, 1993, 1995; Thompson & Wankel, 1980), and the present results suggest a tentative explanation for part of the physical decline associated with aging. Older adults who exercise little, who experience negative changes, and who internalize negative age stereotypes, may feel incompetent in engaging in physical exercise, and may remain or become inactive. This inactivity is likely to contribute to their physical decline, thus "confirming" in their minds that physical decline is caused by aging. While past research has shown that age stereotypes could partly explain the cognitive decline often associated with aging (Levy & Langer, 1994), the present results indicate that age stereotypes, through their effect on stereotyped interpretations of bodily states, may also be involved in the physical decline often associated with aging.

Cluster analyses were performed to examine the main types of participants included in our sample. One of the findings that emerged from the

cluster analyses was that the most active participants reported slightly negative changes. This counterintuitive finding can be explained by a conceptual and methodological strategy used in research on cognitive aging, called "testing-the-limits". The idea behind this strategy is that "true" cognitive changes due to aging can be detected when participants' cognitive capacities are pushed to their limits. Research has shown that when younger and older adults are tested within their normal range of functioning (i.e., without cognitive training), there is relatively little evidence of cognitive decline in old age. However, when participants are tested after intensive cognitive training (i.e., testing-the-limits practice), significant age differences emerge more clearly. More specifically, younger adults clearly outperform older adults on cognitive tasks (Baltes, 1993; Baltes & Baltes, 1990). Similarly, the active elders in the present study may have pushed their physical capacities further than less active participants. As a result, active participants may have been more likely to notice negative physical changes occurring inside their body. Thus, ironically, active older adults reported experiencing more negative changes than inactive individuals. However, active participants reported being in better general physical health than inactive participants.

Two unexpected results may be explainable by adapting the concept of testing-the-limits to physical exercise. First, male participants who reported

higher levels of physical exercise, and who experienced negative changes, reported the highest levels of self-determined motivation amongst all participants when they attributed the changes to aging. The fact that these participants were active, and reported experiencing negative changes, indicates that those changes were probably due to participants reaching the limits of their physical capacities. Active participants who attributed the changes to aging may have believed that they could prevent further losses if they exercised, thus explaining why they reported high levels of self-determined motivation for physical exercise. Surprisingly, it seems that internalizing age stereotypes may sometimes allow participants to preserve their motivation for physical exercise.

The second unexpected finding was that active male participants who reported high levels of physical exercise, who experienced negative changes, and who did not attribute the changes to aging, reported lower levels of self-determined motivation for physical exercise. Active participants who did not attribute the negative changes they experienced to aging may have felt helpless about their capacities to prevent their physical "decline". As a result, they reported lower levels of self-determined motivation for physical exercise.

Similarly, female participants who reported high levels of physical activity, who experienced negative changes, and who attributed the changes to their level of physical activity, also reported low levels of self-determined

motivation for physical exercise. These people may think: "I am active, but I am nevertheless experiencing negative changes. Therefore, being active is unlikely to be helpful." These findings indicate that active older adults may misinterpret small physical changes as signs of an inevitable physical decline. Unfortunately, as a result of this wrong interpretation, they may diminish their amount of physical activity/exercise, which could lead to further physical decline.

Finally, it should also be mentioned that female participants who reported low levels of physical activity, who experienced positive changes, and who did not attribute the changes to their levels of physical activity, reported low levels of self-determined motivation for physical activity. It seems unlikely that these individuals will become active on their own if they experience negative physical changes. After all, they are currently sedentary and unmotivated for physical activity/exercise. In addition, they do not seem to realize the importance of an active lifestyle, since they do not attribute their positive changes to their level of activity.

Prediction of Future Behaviour

A second purpose of this study was to examine how participants' future behavioural intentions could best be predicted. It was expected that motivation would contribute to the prediction of future behavioural intentions above and

beyond the base rate prediction of current levels of physical exercise. In addition, it was also expected that future behavioural intentions would be better predicted if both motivation and current behaviour frequency were examined together, instead of looking at either of the above separately. To our knowledge, this issue has not been examined before.

Results revealed that motivation was an important factor in the prediction of participants' intentions to increase their amount of physical exercise. However, current levels of physical exercise was a more important factor in the prediction of participants' intentions to engage in vigorous physical activity. Not surprisingly, the results revealed that participants with higher levels of physical exercise and higher levels of self-determined motivation reported higher levels of intentions to engage in vigorous physical activity. It was also found that women who reported higher levels of physical exercise and higher levels of self-determined motivation reported lower levels of intentions to increase their amount of physical exercise. These participants probably see no reason for increasing their amount of physical activity/exercise, because they are already active.

Other findings indicated that participants with lower levels of physical exercise and lower levels of self-determined motivation reported surprisingly high levels of intentions to engage in vigorous physical activity, compared to

participants with lower levels of physical exercise and higher levels of self-determined motivation. Participants with lower levels of self-determined motivation may feel pressured to exercise, and consequently report wanting to engage in vigorous physical activity more than participants with higher levels of self-determined motivation. These latter may feel highly motivated for physical exercise, but simply do not wish to modify their sedentary lifestyle.

The fact that current behaviour frequency seemed to be the most important factor in the prediction of older adults' intentions to engage in vigorous physical activity raises an important issue: if participants' intentions to engage in vigorous physical activity can be predicted simply by asking participants about their current behaviour frequencies, then why should researchers go through the time-consuming process of evaluating participants' motivation? It may be the case that, until now, researchers have used a more complicated way of predicting participants' future behaviours, when an easier solution was available. However, the presence of significant interactions between current level of physical exercise and motivation in the prediction of participants' behaviour intentions indicate that both factors may provide a more accurate prediction of participants' future behaviours if examined together. Future studies should examine this issue further in order to determine the exact role of motivation and current levels of physical exercise on participants' future

behaviours.

Implications

A central practical issue underlying the present study is the question "how can we get inactive older adults to engage in physical activity/exercise?" We were interested in trying to answer this question because physical exercise has been associated with numerous benefits in past research, but only a small number of elders exercise on a regular basis (Nieman & Haddock, 1995). Not surprisingly, results in the present study revealed that inactive individuals with high levels of self-determined motivation for physical exercise reported higher levels of intentions to increase their amount of physical activity/exercise, while inactive participants with low levels of self-determined motivation reported the lowest levels of intentions to increase their amount of physical activity/exercise.

Several solutions to help inactive elders become more active have been proposed in the literature. Examples include: facilitating older adults' access to existing facilities, putting in place structured activities (e.g., mall walking programs), and creating individualized programs that are adapted to participants' needs and capacities (Duncan, Travis, & McAuley, 1995; Jensen & Lorish, 1994; Travis, Duncan, & McAuley, 1996).

In addition to those interventions, the present study indicates that psychological interventions, with educational and applied components, could also help older adults become more active. More specifically, this study provided two main findings that researchers could consider in their search for ways to increase older adults' participation in physical exercise. First, internalization of age stereotypes may decrease inactive older adults' levels of motivation for physical exercise. Second, self-determination theory may help account for older adults' motivation for physical exercise. In light of these findings, programs targeted to inactive elders could aim at informing these individuals about (1) the different myths concerning aging and physical decline, and (2) the benefits of physical exercise. Research has shown that older adults who are aware of the benefits associated with physical exercise are more likely to engage in physical exercise (Schuster, Petosa, & Petosa, 1995; Stones & Kozma, 1996). We recognize that this type of intervention represents an instance of external motivation, and that intrinsic motivation may be preferable to ensure participants' adherence to the exercise programs (Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997). However, it is not unusual for people to engage in a new activity as a result of contingencies. In fact, there are indications that the satisfaction derived from practicing an activity [intrinsic

motivation] tends to develop over time (Simons, 1985). Moreover, contingencies may be the only way to get inactive older adults with low levels of motivation active in the first place.

As older adults become more involved in physical activity, different approaches can be used to help them feel more self-determined. For example, Deci et al. (1994) demonstrated that it is possible to facilitate the integrated internalization of an uninteresting activity in individuals by (1) providing the participants with a meaningful rationale for performing the activity, (2) acknowledging any conflicting feeling they may have with the idea of performing the activity, and (3) minimizing the feeling of pressure to perform the activity. This type of approach could be adapted to encourage older adults to become more active.

Finally, another type of intervention to facilitate the engagement of inactive older adults in physical exercise would be to help older adults set challenging, yet reachable goals for themselves. This type of approach would allow elders to develop feelings of competence and autonomy, thus resulting in an increase in motivation (Bandura, 1982; Deci & Ryan, 1985a). The effectiveness of these interventions could be increased by combining them with social and family support, as well as with the encouragement from health professionals (e.g., physicians and nurses) (Travis et al., 1996; Turjanica, 1996).

Limitations and Further Research

The present study was limited in that we did not use an experimental design or a longitudinal design. Consequently, the results cannot be interpreted in terms of causality. Also, the lack of active respondents may have weakened the expected effect between physical exercise and successful aging, especially among older respondents. Sampling restrictions also probably reduced the strength of the interaction for the main hypothesis, thus explaining the lack of support for the main hypothesis among women. For the main hypothesis to be properly tested, there had to be a substantial and balanced numbers of cases across the variables continuums (or at least at the poles of the continuums) (i.e., participants with low levels of physical exercise and participants with high levels of physical exercise; participants experiencing negative changes and participants experiencing positive changes; participants attributing the changes to aging and participants not attributing the changes to aging). Unfortunately, this may not have been the case in the present study.

This study provides a number of avenues for future research. First, future research should include a longitudinal research design, which would allow researchers to (1) examine how stereotyped interpretations of bodily states, involvement in physical exercises, and motivation, influence each other and

change over time, and (2) make causal interpretations. For example, future research could include a manipulation where some older adults receive information about the myths associated with aging and physical decline, while other older adults receive no information. Both groups could then be followed over a number of years to determine the role of age stereotypes in older adults' participation in physical exercise.

The potential benefits of attributing physical changes to aging indicate that acceptance of age stereotypes may sometimes result in positive consequences. Future research should try to replicate the present findings not only in the domain of physical exercise, but in other domains as well, such as cognitive aging. Also, a variety of findings from self-determination theory may be relevant to the motivation factor behind older adults' participation in physical exercise. For example, research has shown that it is sometimes preferable for individuals with less self-determined types of motivation to be in a controlling environment, rather than to be in an environment that promotes autonomy and opportunity for decisions (O'Connor & Vallerand, 1994a). This type of finding could have an important influence on the way exercise programs are designed.

Future research should also determine what types of interventions could be used to educate older adults about the myths concerning aging and physical decline. Rodin and Langer (1980) showed that reattribution intervention was

helpful in increasing nursing home residents' participation in social activities. However, it may be more complicated to implement this type of intervention with community-living seniors.

Finally, additional research could be conducted on the role of participants' self-rated physical health, as a predictor of intentions to exercise. In the present study, preliminary analyses demonstrated that participants who rated their physical health better, compared to other people their age, also reported (1) more positive changes, (2) higher levels of physical activity/exercise, (3) higher levels of self-determined motivation for physical exercise, and (4) higher intentions to engage in vigorous physical activity. These results are consistent with the results of Patterson (1996), who argued that perceived physical health was associated with future participation in leisure activities. It would be interesting to compare the importance of perceived physical health, motivation, and current level of physical exercise, in the prediction of future behaviour.

Despite the limitations of this study, there seems to be some evidence for a relationship between stereotyped interpretations of bodily states, motivation for physical exercise, and participation in physical exercise. The influence of age-stereotyped interpretations of bodily states and motivation may be responsible for low levels of physical activity in older adults, and consequently, for the low

number of older adults who age successfully.

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Table 1

Means, Standard Deviations, and Reliabilities

Scale	M	SD	α
Age	72.16	7.73	--
Experienced Changes	-0.65	1.53	.82
AC to Activity	1.58	1.51	.63
AC to Aging	0.84	1.83	.84
PAI	35.17	6.83	--
PEI	985.06	1369.70	--
AM	-2.55	2.29	.85
NSDEM	-.28	2.65	.78
SDEM	2.80	1.72	.77
IM	1.53	2.42	.85
SDM	11.23	10.01	.83
Intentions to Exercise	0.88	2.41	.93
Intentions to Sweat	-1.14	3.16	--
Physical Health	2.52	2.13	.91

Note. All means are on a -5 to +5 scale (except for age, PAI, PEI, and SDM).

n = 112 (Participants with missing values were not included)

AC = Attributions of changes

PAI = Physical activity index

PEI = Physical exercise index

AM = Amotivation

NSDEM = Non-self-determined extrinsic motivation

SDEM= Self-determined extrinsic motivation

IM = Intrinsic motivation

SDM = Self-determined motivation index

Table 2

Pearson Correlation Coefficients Among the Variables Measured

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age													
2. Experienced Changes	-.37**												
3. AC to Activity	-.16	.24*											
4. AC to Aging	.16	-.44**	.15										
5. PAI	-.29**	.13	.11	.14									
6. PEI	-.02	.21*	.09	-.00	.18								
7. AM	.39**	-.31**	-.22*	.18	-.04	-.30**							
8. NSDEM	.22*	-.11	.01	.10	.04	.00	.17						
9. SDEM	-.20*	.27**	.36**	-.14	.15	.32**	-.72**	-.02					
10. IM	-.12	.29**	.26**	.09	.29**	.33**	-.46**	-.03	.54**				
11. SDM	-.33**	.36**	.29**	-.09	.17	.35**	-.85**	-.36**	.77**	.79**			
12. Intentions to Exercise More	-.36**	.18	.08	-.27**	.05	.00	-.26**	-.03	.23*	.05	.19*		
13. Intentions to Sweat	-.23*	.27**	.06	-.16	.25**	.28**	-.11	.11	.12	.25**	.16	.14	
14. Physical Health	-.03	.35**	.29**	-.04	.25**	.23*	-.20*	-.00	.24*	.34**	.30**	.08	.27**

Note. n = 112 (Participants with missing values were not included) ** p < .01 * p < .05

AC = Attributions of Changes PAI = Physical Activity Index PEI = Physical Exercise index AM = Amotivation

NSDEM = Non-self-determined Extrinsic Motivation SDEM = Self-determined Extrinsic Motivation IM = Intrinsic Motivation

SDM = Self-determined Motivation

Table 3

Final Cluster Centers

Cluster	n	Experienced Changes	PEI	PAI	AC to Aging	AC to Activity
1	62	-.3984	-.3329	-.4529	-.1327	-.5216
2	32	-.2077	.5358	.8416	.9162	.5374
3	24	1.3062	.1454	.0479	-.8787	.6310

Note. PEI = Physical exercise index PAI = Physical activity index

AC = Attributions of changes

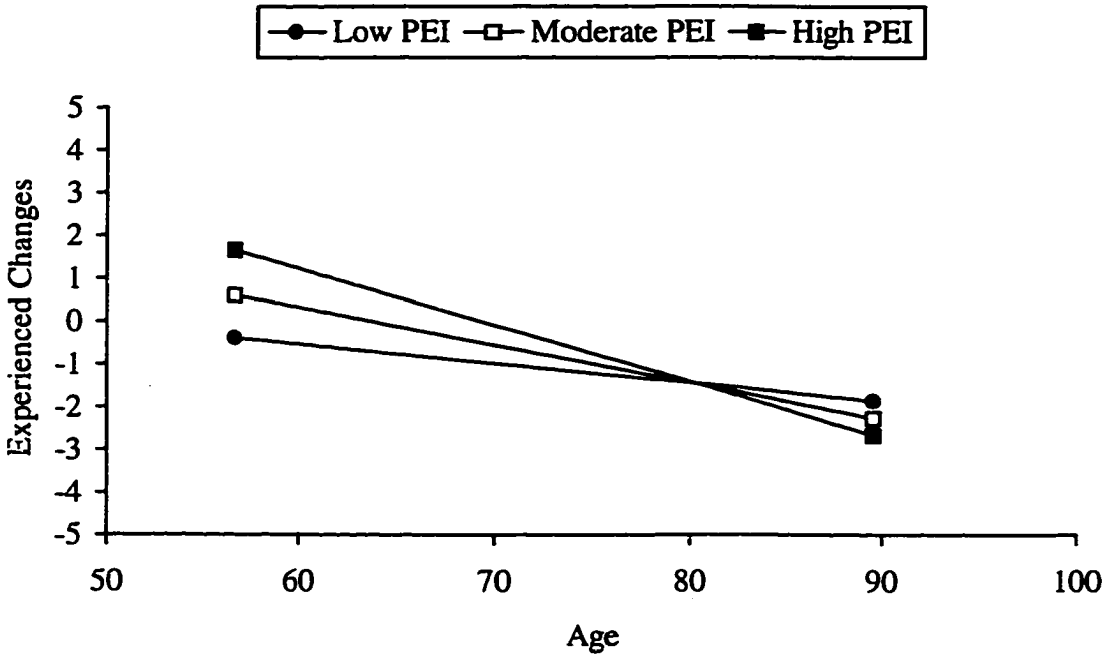

Figure 1. Regression lines for experienced changes on age for different levels of participation in physical exercise (PEI).

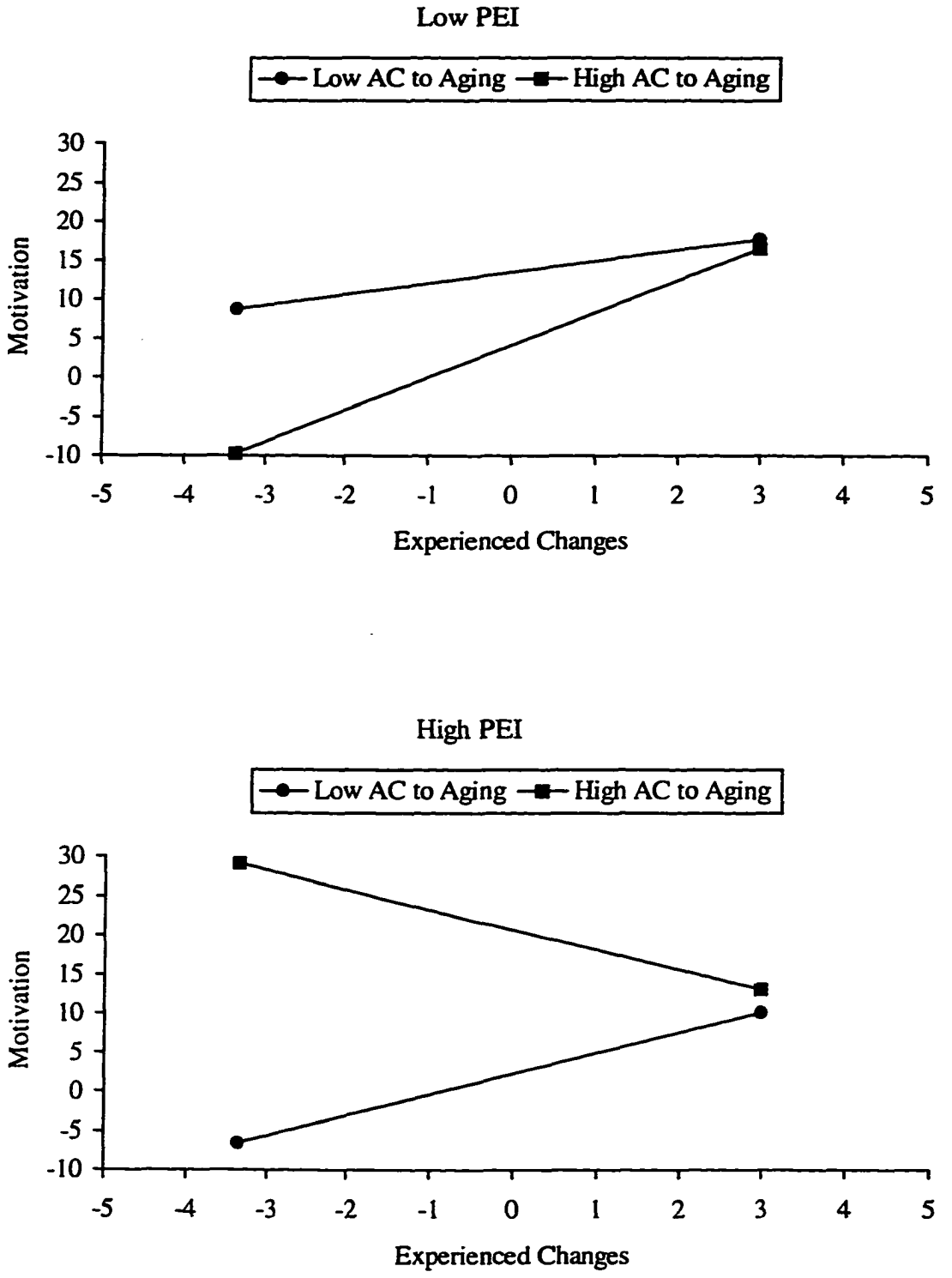

Figure 2. Regression lines for motivation on experienced changes for different levels of attributions of changes (AC) to aging, and different levels of participation in physical exercises (PEI), among men.

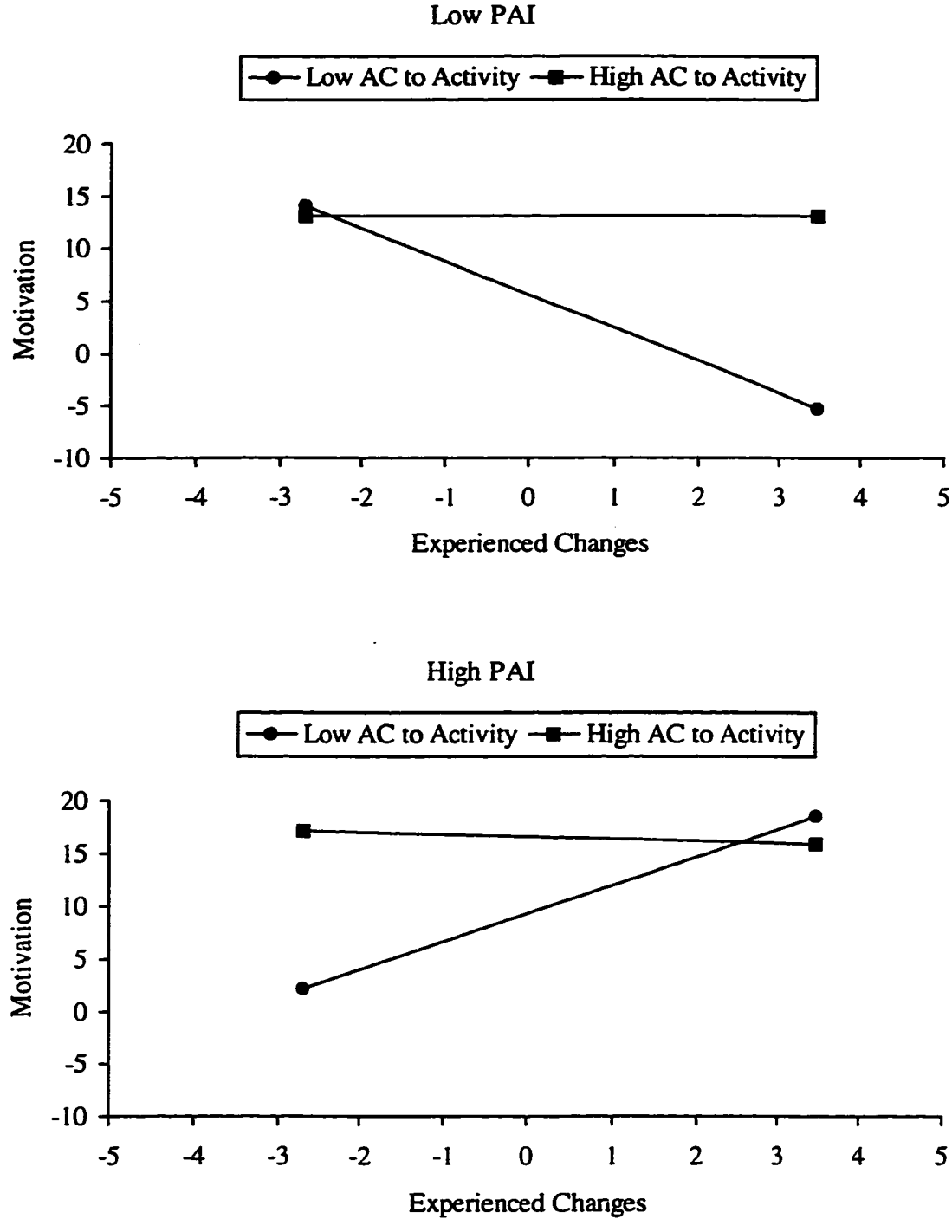

Figure 3. Regression lines for motivation on experienced changes for different levels of attributions of changes (AC) to activity and different levels of participation in physical activities (PAI).

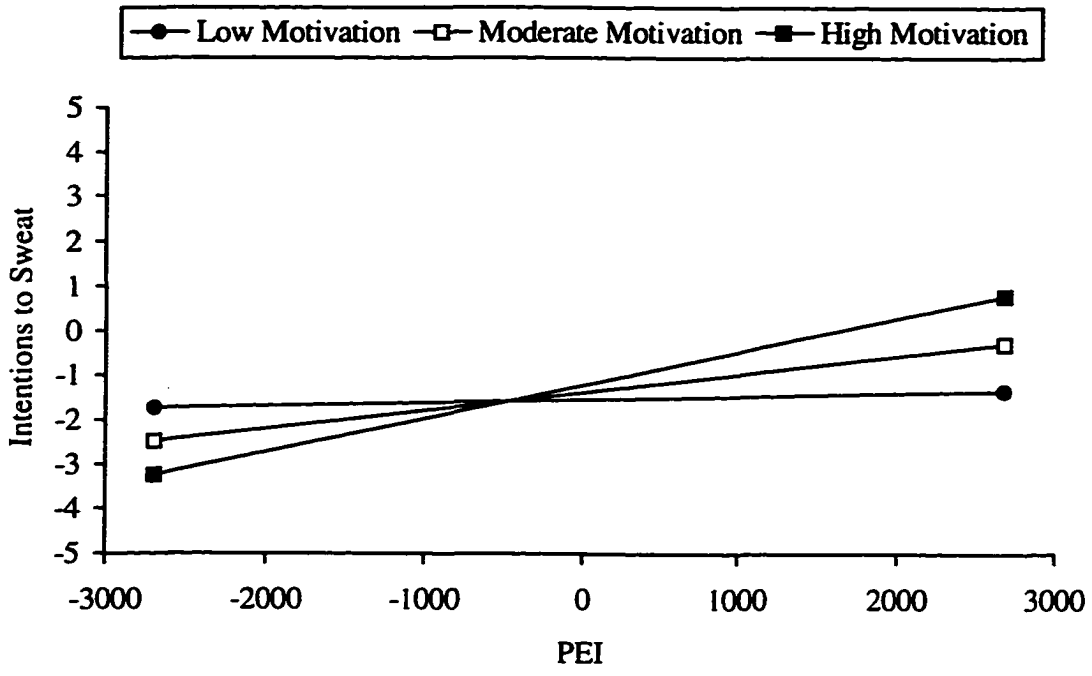

Figure 4. Regression lines for intentions to sweat on participation in physical exercises (PEI) for different levels of motivation.

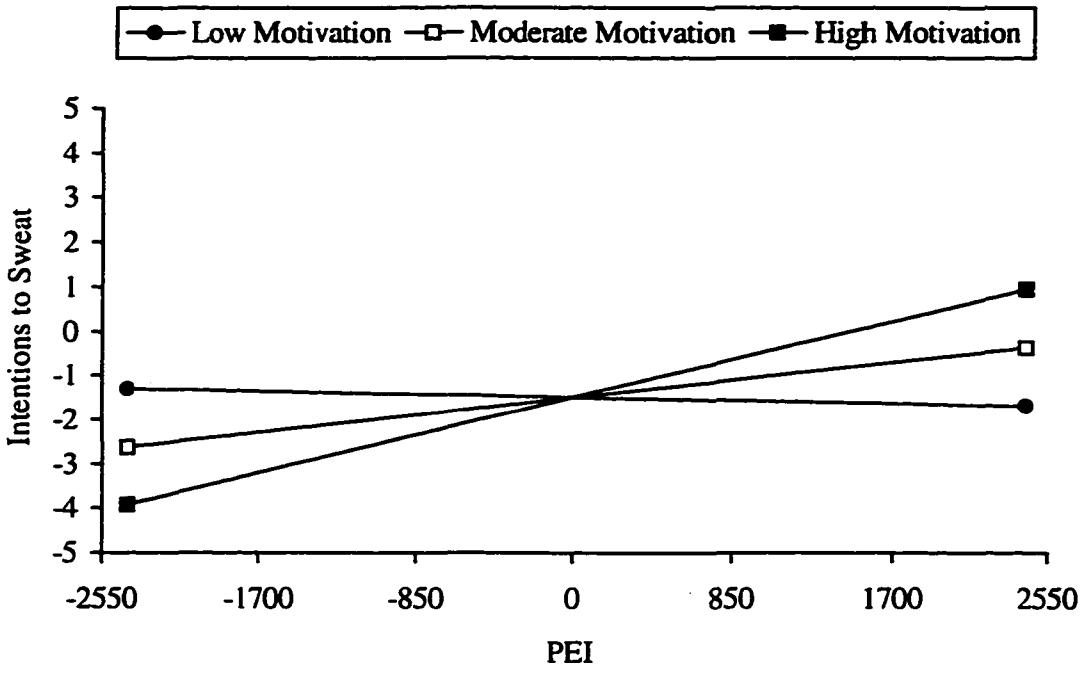

Figure 5. Regression lines for intentions to sweat on participation in physical exercises (PEI) for different levels of motivation, among women.

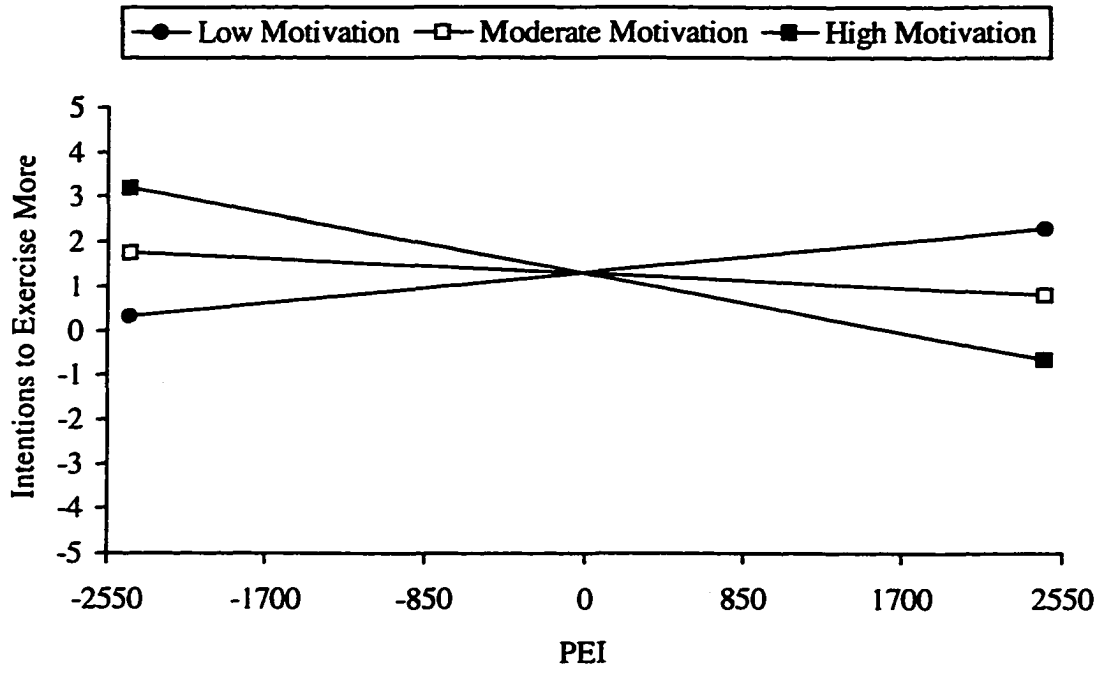

Figure 6. Regression lines for intentions to exercise more on participation in physical exercises (PEI) for different levels of motivation, among women.

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Appendix A

I am a student at Lakehead University and I am looking for people to help me with a study I am conducting. The purpose of the study is to understand health perceptions and behaviors. The study involves filling out a questionnaire and should require about 20 minutes of your time. There are no direct benefits to you for participating in the study, and there are no risks. Your responses will remain completely anonymous and confidential. There are no right or wrong, or good or bad answers. Your participation in the study is completely voluntary and you may withdraw at any time. The data from all participants will be pooled and analyzed as a group, as the responses of any single individual are meaningful only in relation to the responses of others. The completed questionnaires will also be safely stored for seven years at Lakehead University. You may obtain a copy of the final results of the study by writing or calling me at the address below.

If you would like to participate, just complete the questionnaire. To guarantee anonymity, please do not put your name on the questionnaire.

Thank you very much for your help.

Sincerely,

François Rousseau
Department of Psychology
Lakehead University
Thunder Bay, Ontario
P7B 5E1

Appendix B

QUESTIONNAIRE

There are no right or wrong, or good or bad, answers to any of the questions below. Please just give the most accurate, truthful response for you. If you find any of the questions too personal, you do not have to respond, although it would be most helpful to us if you answered every question. To ensure anonymity, please do not sign your name on this questionnaire. In answering the questions your first impressions are probably correct. For each question you are asked to make a rating on a scale of numbers. Answer each question by circling the appropriate number. Please do not circle the words. The following statements have to do with how you have been feeling over the past year compared to preceding years.

Over the past year, my **energy level** has been:

Decreasing -5 -4 -3 -2 -1 0 1 2 3 4 5 Increasing

My energy level is due to my level of physical activity.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

My energy level is due to aging.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

My energy level is due to my general lifestyle.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

Over the past year, the degree of **stiffness in my joints** has been:

Decreasing -5 -4 -3 -2 -1 0 1 2 3 4 5 Increasing

The degree of stiffness in my joints is due to my level of physical activity.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

The degree of stiffness in my joints is due to aging.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

The degree of stiffness in my joints is due to my general lifestyle.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Over the past year, the **strength in my arms and legs** has been:

Decreasing	-5	-4	-3	-2	-1	0	1	2	3	4	5	Increasing

The strength in my arms and legs is due to my level of physical activity.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

The strength in my arms and legs is due to aging.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

The strength in my arms and legs is due to my general lifestyle.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Over the past year, I **feel out of breath**:

More Quickly	-5	-4	-3	-2	-1	0	1	2	3	4	5	Less Quickly

How fast I feel out of breath is due to my level of physical activity.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

How fast I feel out of breath is due to aging.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

How fast I feel out of breath is due to my general lifestyle.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Over the past year, my **flexibility** has been:

Decreasing	-5	-4	-3	-2	-1	0	1	2	3	4	5	Increasing

My flexibility is due to my level of physical activity.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

My flexibility is due to aging.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

My flexibility is due to my general lifestyle.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Over the past year, my **reflexes and reaction times** have been:

Slowing	-5	-4	-3	-2	-1	0	1	2	3	4	5	Improving

My reflexes and reaction times are due to my level of physical activity.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

My reflexes and reaction times are due to aging.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

My reflexes and reaction times are due to my general lifestyle.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Over the past year, my **body weight** has been:

Decreasing	-5	-4	-3	-2	-1	0	1	2	3	4	5	Increasing

My body weight is due to my level of physical activity.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

My body weight is due to aging.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

My body weight is due to my general lifestyle.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Over the past year, the **physical appearance of my body** has been:

Getting Worse -5 -4 -3 -2 -1 0 1 2 3 4 5 Getting Better

The physical appearance of my body is due to my level of physical activity.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

The physical appearance of my body is due to aging.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

The physical appearance of my body is due to my general lifestyle.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

Do you exercise on a regular basis? yes no

If "yes," please indicate the kinds of physical exercises do you do and how often you do them.

Type of Exercise	# of Days per Week	# of Minutes per Occasion	# of Weeks in the Last 12 months
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____

If you do not exercise on a regular basis, what are the reasons?

____ I don't want to ____ Lack of time ____ No facilities nearby

____ Costs too much ____ Lack of energy ____ No leaders available

____ Ill health ____ Injury or handicap ____ I lack the necessary skills

____ Requires too much self-discipline ____ I'm too old

____ Other reasons (please specify) _____

Now please think about your average day and indicate how much time you spend in each of the following categories of physical activity (the total should add up to 24 hours):

_____ sleeping or lying down

_____ sedentary activity (e.g., sitting, standing, reading, listening to music, watching TV)

_____ slight activity (e.g., light walking, window shopping)

_____ moderate activity (e.g., sweeping or mopping, raking or mowing the lawn, gardening, carpentry, baseball, golf, slow jogging, brisk walking or dancing)

_____ heavy activity (e.g., shoveling, digging, chopping wood, carrying heavy loads, swimming laps, racquet sports, running, hockey)

I am a physically active person.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I am more physically active than most other people my age.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I get enough exercise to stay healthy and fit.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

The need for exercise diminishes with age.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

Exercising is increasingly risky after middle age.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

Light, occasional exercise is sufficient to stay healthy and fit.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I intend to increase the amount of exercise I get.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I intend to increase my level of physical activity.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I intend to participate in vigorous physical activity long enough to work up a sweat at least three days a week during the next four weeks.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

Now think about your current physical exercise habits. If you do not exercise on a regular basis, then answer the questions on the basis of how you felt when you exercised in the past.

I don't know why I exercise.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I don't really see what exercising does for me.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

Personally, I feel like I have no real reason to exercise.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I exercise because I am supposed to.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I exercise because I would feel bad about myself if I didn't.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I exercise because I feel obligated to.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I choose to exercise because it is a good challenge for me.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I choose to exercise for my own good.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I choose to exercise because I feel like it's a good way to help myself.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I exercise for the pleasure of doing it.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I exercise because it is an interesting thing to do.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I exercise for the enjoyment I feel when exercising.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

Now please indicate how you feel when you exercise. Place the appropriate number from the following 1-to-7 scale on the dash beside each item.

Very Much -5 -4 -3 -2 -1 0 1 2 3 4 5 Very Little

When I exercise I feel:

____ distressed ____ alert ____ excited ____ ashamed ____ upset

____ irritable ____ strong ____ proud ____ hostile ____ enthusiastic

I would not be able to engage in vigorous physical activity or exercise even if I tried to.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I have little control over whether I can engage in vigorous physical activity or exercise.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I was more competent at exercising when I was younger.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I know many other people my age who are unable to exercise regularly.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

Other people seem to think that I am unable to exercise regularly.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

My body feels lousy when I exercise.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Most people who are important to me think I should engage in regular physical activity.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Physical aging is a programmed, internal process.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Physical aging is a process that can be altered by one's lifestyle.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

Physical aging is a general process that affects many aspects of one's physical being.

Disagree	-5	-4	-3	-2	-1	0	1	2	3	4	5	Agree

In general, how would you rate your health at the present time?

Very poor	-5	-4	-3	-2	-1	0	1	2	3	4	5	Very Good

How would you describe your health compared to people your age?

Much Worse	-5	-4	-3	-2	-1	0	1	2	3	4	5	Much Better

According to the doctors I've seen, my health is now:

Very poor	-5	-4	-3	-2	-1	0	1	2	3	4	5	Very Good

Do you require assistance with some of the activities of daily living (e.g., transportation, personal care, cooking)?

Never	-5	-4	-3	-2	-1	0	1	2	3	4	5	Often

Do you now have, or have you ever had, any of the following? Check the appropriate items:

____ a heart condition	____ stroke	____ cancer
____ diabetes	____ liver disease	____ hip fracture
____ broken bones	____ arthritis	____ Parkinson's disease
____ amputation of a limb		

Do you have any other condition that limits your physical activity? yes no

If "yes," please specify: _____

In most ways my life is close to my ideal.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

The conditions of my life are excellent.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I am satisfied with my life.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

So far I've gotten the important things I want in life.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

If I could live my life over, I would change almost nothing.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

On the whole, I am satisfied with myself.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I feel that I have a number of good qualities.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I am able to do things as well as most other people my age.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I feel that I'm a person of worth, at least on an equal plane with others.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

I take a positive attitude toward myself.

Disagree -5 -4 -3 -2 -1 0 1 2 3 4 5 Agree

Most of the time, I <u>feel</u> as though I am about age ____ years.

Most of the time, I <u>look</u> as though I am about age ____ years.

What is your gender? (circle the answer) Male Female

How do you live? (circle the answer): alone with someone else

What is your marital status? (circle the answer):

single married widowed divorced or separated

How old are you? _____ years

What is your height? _____ What is your weight? _____

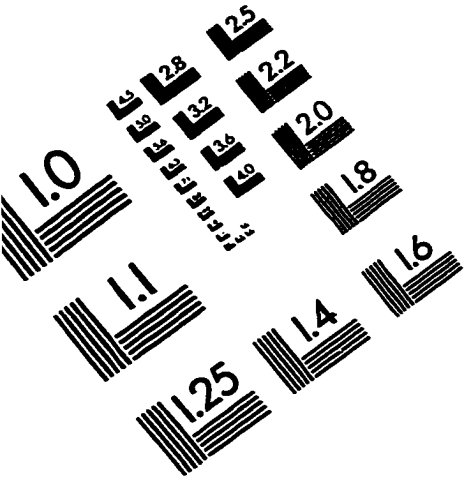
What was the highest level of education that you completed? _____

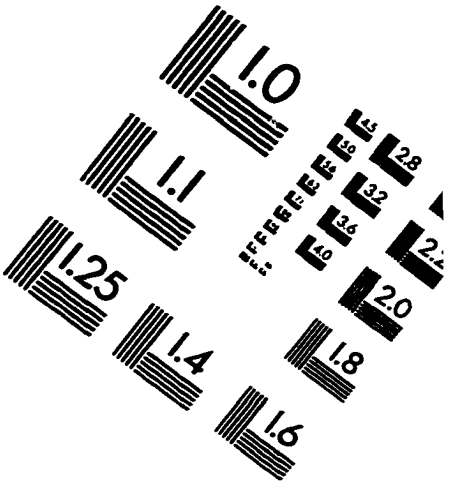
What is (or was) your job? _____

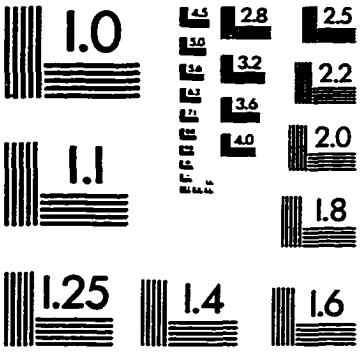
If you are retired, how long have you been retired? _____ years

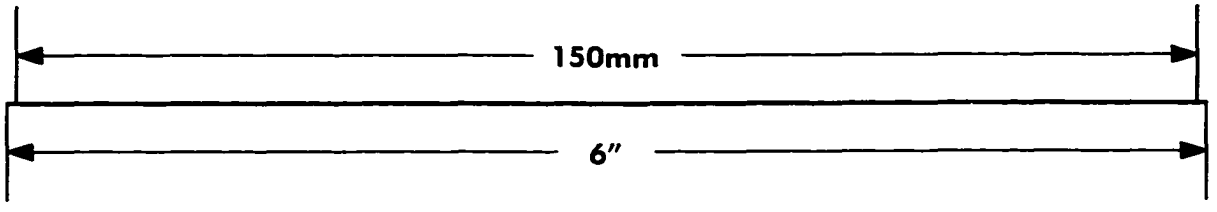
Thank You Very Much For Your Help

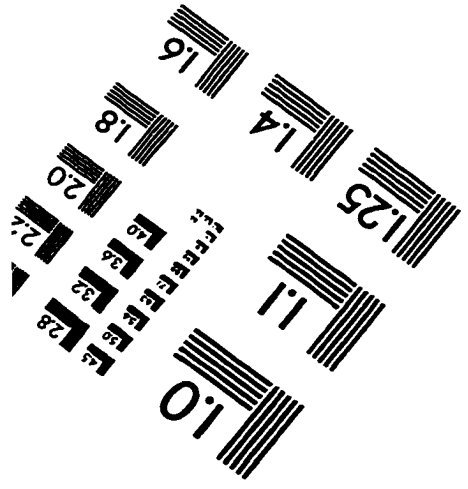
IMAGE EVALUATION TEST TARGET (QA-3)

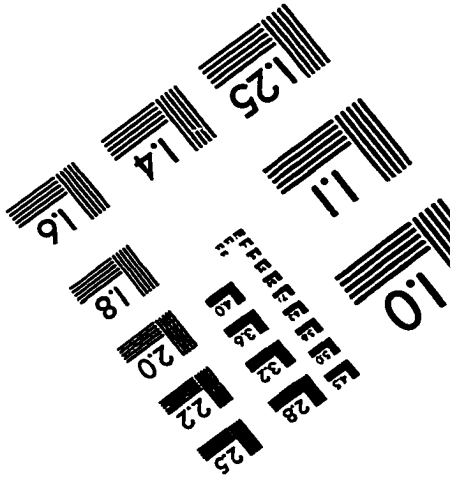












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