

Factors Associated with Exercise Adherence Among Older Adults

An Individual Perspective

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Abstract

This paper reviews the literature concerning factors at the individual level associated with regular exercise among older adults. Twenty-seven cross-sectional and 14 prospective/longitudinal studies met the inclusion criteria of a mean participant age of 65 years or older. The findings are summarised by demographics, exercise experience, exercise knowledge, physiological factors, psychological factors, activity preferences and perceived social influences. In general, education and exercise history correlate positively with regular exercise, while perceived physical frailty and poor health may provide the greatest barrier to exercise adoption and adherence in the elderly. Social-cognitive theories identify several constructs that correlate with the regular exercise behaviour of older adults, such as

exercise attitude, perceived behavioural control/self-efficacy, perceived social support and perceived benefits/barriers to continued activity. As well, stage modelling may provide additional information about the readiness for regular exercise behaviour among older adults. However, relatively few studies among older adults exist compared with middle-aged and younger adults. Further, the majority of current research consists of cross-sectional designs or short prospective exercise trials among motivated volunteers that may lack external validity. Future research utilising longitudinal and prospective designs with representative samples of older adults will provide a better understanding of significant causal associations between individual factors and regular exercise behaviour.

Although the benefits of regular physical activity have been well documented,^[1] the majority of adults in developed countries do not exercise. Sample surveys conducted in Canada and the US have indicated that 40% of the adult population are sedentary and another 40% exercise with a frequency and intensity too low to derive any substantial health benefits.^[2] Further, most exercise programmes typically suffer high attrition in their early stages. It is estimated that over 50% of people will drop out of their attempted exercise routine within 6 to 12 months of initiation.^[3] Unfortunately, those who could stand to gain the greatest health benefits from an exercise programme tend to be the individuals who fail to realise their exercise intentions.^[3]

In addition, epidemiological research indicates that physical activity decreases with age.^[4] This problem is even greater for females, as older women report the least amount of regular physical activity of all demographic age groups.^[5-8] This lack of physical activity among the elderly is of even greater concern when considering the changing demographics. Data from the US National Center for Health Statistics indicate that the most rapidly growing segment of the population is that of individuals aged 85 and older, with a women to men ratio of 2.36 : 1 by the year 2000.^[9] Moderate regular exercise has been shown to improve the physical health^[10-12] and mental wellbeing^[13-16] of elderly individuals. Furthermore, no age limits to these positive health benefits have been observed.^[17] Therefore, successful aging, characterised by minimal functional decline, is an achievable goal for

many adults.^[18,19] Considering the benefits of regular exercise and the current trend in demographics, it is important to understand what factors influence physical activity among the older population in order to implement effective intervention strategies.^[20]

1. Factors Influencing Exercise Adherence Among Older Adults

Relatively few studies on exercise adherence have been published about individuals over the age of 65 years in comparison to middle-aged and younger adults.^[9,21] Further, factors associated with adherence are both complex and diverse. Potential determinants encompass psychological, physiological and social-environmental characteristics from a range of disciplines, and elements associated with regular adherence to an exercise programme can be influenced by both individual and environmental components. Factors at the individual level comprise demographics, personality, skills, history, social cognitive variables and perceived barriers and influences, while environmental factors reflect social-environmental situations that exert influence external to the individual.^[22,23] However, interactions between individual and environmental factors are likely to be reciprocal.^[24] Further, when examining what variables are important in the determination of the exercise adoption and maintenance process, it is equally important to discover which variables contribute to non-adherence and the intention not to exercise in order to clarify directional relationships among variables.^[3,25] Since exercise determinant research has traditionally relied on cross-sectional

retrospective design,^[21] the direction of causality or even the intervention of a third factor has not been ascertained for many variables under study. Fortunately, more prospective exercise adherence studies are being conducted every year.^[23] These should provide greater clarity to the causal and temporal relationships among variables associated with regular activity. Unfortunately, with the majority of determinant research also based on self-report, their validity, compounded with the concurrent validity of various report scales, is difficult to establish.^[21] Nevertheless, some variables have been rather consistently associated with exercise behaviour. Therefore, a congruous association of certain factors and exercise adherence can be surmised.

The following is a review of the literature concerning factors associated with regular exercise among older adults at the individual level. This review utilised the databases of Psychinfo, Heracles, ERIC and Medline for searches in the English language, as well as bibliographic searches yielding 27 cross-sectional and 14 prospective/longitudinal studies. Index words were all possible combinations of elderly, elderly women/men, older adults, older women/men with both exercise and physical activity. Inclusion criteria for this review consisted of a mean participant sample age of 65 years or older (or comparison segment within a larger population study), and regular exercise defined by moderate intensity of twice weekly for at least 20 minutes duration (just slightly below the American College of Sports Medicine guidelines^[26]). As such, studies investigating the efficacy of intervention strategies upon changes in regular exercise were not reviewed. Further, given the limited research among age ranges of older adults at present, samples were not systematically evaluated by geriatric age divisions of young old,^[27-36] middle old^[37-46] and very old (85 years and over). However, for the purposes of comparison, some research utilising samples of middle-aged and younger adults has been included in the discussion. What follows is a summary of the findings from the 41 studies examined, organised by demographics, experience, knowledge,

physiological factors, psychological factors, perceived social influences and activity preferences.

2. Demographics

2.1 Age and Gender

Recent estimates from large scale surveys indicate that differences in age and gender correlate with various regular exercise rates in senior citizens. Discrepancies in the operational definition of adherence used, the type of exercise and the country of origin for the sample population also make the relationship of age and gender with physical activity less clear.^[7] For example, although people over 65 years have generally improved their rate of activity in the past 15 years (for example Canada: 36 to 53%;^[4] gender disparities with males being more active than females still continue,^[8,47-50] even though the differences are not significant in all research.^[51,52] These disparities also tend to differ by country, as Canada (36% men and 49% women) has a far greater reported gap between the genders than the US (28.6% men and 32.3% women) among the sedentary population.^[7] The age of senior citizens is also an important factor to consider for activity prevalence. Physical activity tends to increase slightly at retirement (age 60 to 65 years) but begins a downward slope a few years after, reaching the lowest activity rates of the population.^[4,7,53,54]

2.2 Education and Income

Education and income have been positively correlated with regular exercise among middle-aged adults.^[55,56] Higher rates of exercise behaviour have been correlated with increased socioeconomic standing,^[57] and frequency of exercise participation has also been related to years of education.^[6,8,58] Among adults over 65 years of age, education has not been found to be a significant predictor of adherence in prospective exercise trials,^[52-54] yet larger longitudinal survey samples have indicated significant associations.^[49,50] Further, the association of income with physical activity was found to be spurious when education was entered into the regression equation.^[49] The discrepancy of findings

in these studies requires further research. However, the insignificant differences found in prospective exercise trials may reflect poor sample generalisability. Several reasons for the relationship between education and regular exercise have been proposed.^[59] Greater education may indirectly raise awareness of health benefits and increase the subjective norms for physical activity among middle and upper class individuals. Also, these individuals are likely to possess greater disposable incomes and therefore may have easier access with transportation to physical activity areas such as gyms, and allow for memberships and equipment to be purchased with less restraint. As well, individuals of higher socioeconomic status may live in an environment where physical activity is a very popular pursuit of one's leisure time. At present, no studies have provided support for such plausible explanations.

When considering the effect that education may have on disposable income specifically, low cost leisure pursuit may be a crucial factor in exercise adherence.^[8] Elderly individuals generally have reduced disposable income at retirement, with elderly women making up a large fraction of the poor in most developed countries.^[59] Still, although lower socioeconomic status may be an important barrier to the adoption and maintenance of activity, it is fortunate that the survey information indicates that the elderly often choose low cost exercise habits such as walking and gardening.^[8]

3. Exercise Experiences

3.1 Exercise History

One of the most important factors associated with future behaviour is past behaviour.^[60] Early exercise experiences and recent involvement in physical activity have often been shown to predict adherence to a current exercise programme.^[61,62] These studies show no significant age correlation differences, and therefore the relationship accounts for the elderly, middle-aged and young alike. However, the only study that has examined the relationship with a sample mean of adults over 65 years of age did not indicate previous history to be a signif-

icant predictor of post-cardiac rehabilitation stage of exercise behaviour change.^[63] Further, the research for measuring past exercise behaviour at this time is correlational, retrospective and acquired through subjective self-report, thereby preventing causal explanation. Nevertheless, this factor may also be inferred as a leading reason to explain the proposed gender differences in exercise adherence among the elderly.^[19] Elderly women may have developed poorer exercise habits than men because of fewer experiences in physical activity during childhood, adolescence and young adulthood. Women in western societies have traditionally been discouraged from physical activities, especially activities that involve competition and aggression.^[64] Elderly women who grew up with a traditional background may never have acquired the experience of regular exercise and therefore have very little prior exercise skill or knowledge, making current exercise behaviour more difficult to adopt. However, the role of exercise experience in adherence requires future study in prospective research before any conclusions can be drawn.

4. Physical Factors

4.1 Physical Condition

Deteriorating health that often accompanies the aging process has been associated with a decrease in physical activity among elderly individuals.^[50] Four controlled, prospective studies that have examined adherence to exercise in adults over the age of 65 found that the physical condition of the individual was an important predictor of continued participation.^[51-54] In a study of exercise adherence in 101 men and women aged 60 to 85 years, participating in a 10- to 12-week programme, Emery et al.^[51] found that physical health measures such as greater cardiorespiratory endurance and faster psychomotor speed were the most significant predictors of adherence using regression analysis. Williams and Lord^[54] also found characteristics of physical condition such as reduced strength and slow reaction time to explain most of the variance in their 12-month exercise (aerobics and balance twice a

week) trial of 102 women aged 60 to 85 years. Further, lower body limitations was a significant factor explaining self-reported exercise behaviour among 6780 older adults in a longitudinal study of aging.^[50] Functional mobility was a significant factor associated with participation among 102 adults aged over 60 years in a 26-week home-based prospective exercise programme,^[52] while illness was an important factor associated with a similar prospective study.^[53] Poor physical health, movement confidence and illness may especially be a hindrance for elderly women, as indicated by cross-sectional survey.^[65] In a large scale sample survey of the Canadian population, Stephens and Craig^[8] reported this to be exactly the case, as illness and injury were self-reported barriers to only 8% of males and 9% of females aged 25 to 44 years, but this sharply rose to 19% of males and 34% of females aged 65 years and over. Demographics suggest that women live longer and experience a longer period of dependency than men.^[66] This may account for the substantially higher subjective reporting of physical health as a barrier to exercise in elderly females. However, the lack of physical activity for both older females and males certainly cannot be fully explained by deteriorating health and injury, as it is estimated that more than half of senior citizens are physically fit enough to exercise.^[67]

5. Knowledge About Exercise

Knowledge about health, fitness and exercise behaviours has not been found to directly determine the adherence of physical activity among middle-aged and younger adults.^[21] However, knowledge about exercise has been associated with predicting participation and adherence to a structured exercise programme among older adults.^[53] Knowledge may be important in the initial adoption of exercise.^[68,69] Appropriate exercise behaviour such as correct technique, intensity and equipment needed for specific activities may be important for programme continuation with the elderly. Safe and appropriate exercise would likely decrease the risk of injury

and increase the potential for enjoyment of the activity.^[70]

6. Psychological Factors

Numerous psychological theories have been utilised to explain exercise behaviour. Many of these theories have been revised specifically for populations of older individuals.^[71-73] From these theories, a myriad of psychological variables and constructs have been created and studied.

Since only a few prospective experimental studies regarding exercise adherence and the elderly exist, most psychological variables have yet to be tested adequately as possible predictors of exercise behaviour, especially in reference to the theoretical model from which they were derived. However, a few psychological theories and/or variables seem to be consistently associated with exercise behaviour or robustly studied within the adherence literature in general,^[21] and some of these may have important implications for the decision of elderly people to exercise. Finally, it is important to note that the majority of research has presently failed to find significant gender differences in psychological variables, even though the rates of exercise differ between the genders in survey and demographics research. It has been speculated that either measuring difficulties with these psychological and social-cognitive variables, sample generalisability or greater importance of females' exercise history and social-environmental barriers are responsible for this discrepancy.^[64]

6.1 Exercise and The Theory of Reasoned Action/Planned Behaviour

The intention to perform a behaviour is the most important factor to actually engaging in future behaviour, according to Fishbein and Ajzens^[74] Theory of Reasoned Action (TRA) and Ajzens^[75] extended Theory of Planned Behaviour (TPB) model. The TRA states that an intention is formed through a weighted appraisal of attitudes towards a behaviour and the subjective norms for this behaviour. An attitude toward a given behaviour depends on the summed product of the following: (i) beliefs that

the behaviour will lead to specific outcomes; and (ii) an evaluation of the desirability of such outcomes. This first factor is very similar to the concept of outcome expectancy in Bandura's Social Cognitive Theory.^[76] The second premise supports that one must perceive desirable consequences of such an outcome and its value in order to produce a positive attitude. The use of this value construct seems necessary to account for individual differences in the perception of outcomes, and consequently represents the central factor in Maehr and Braskamps Personal Investment Theory.^[77]

A review of the literature among older adults and exercise attitudes revealed 13 studies with 8 volunteer samples.^[8,27-30,47,52,78-83] Attitudes towards the value and importance of exercise are significantly associated with exercise behaviour among elderly individuals in survey research,^[47,78,79] and exercise status explained 26% of the variance in attitudes among 121 surveyed young and older females.^[80] Further, exercise attitude has statistically discriminated between the stages of behaviour change with the marked exception of action from maintenance.^[81] In a 3-year follow-up, Courneya et al.^[82,83] found that attitude significantly discriminated those individuals who had maintained their current exercise stage from those who had relapsed to a lesser behaviour stage. As well, recent prospective research has identified attitude as a significant predictor of adherence to a 26-week home-based seniors exercise programme.^[52] Unfortunately, as individuals age, positive exercise attitudes tend to decrease.^[27,47,80,81] Although some cross-sectional research has found gender differences, with males presenting significantly stronger exercise attitudes,^[47] most research has found no significant difference.^[27,28] Further, a marked gap between attitude and behaviour has been identified in prospective research.^[29] As hypothesised by the TRA/TPB, attitude is mediated by exercise intention. In support of this hypothesis, Gravelle et al.^[30] found that 73.3% of the variance in exercise intention among active older adults was explained by attitude and 69% of the variance was explained by the single indicator of 'good/beneficial'. Therefore, identify-

ing and introducing interventions to strengthen the underlying beliefs that contribute to positive attitude formation seems a beneficial strategy for increasing exercise intentions.

The TRA/TPB suggests subjective norms reflect the summed products of the following 2 factors: (i) the individuals beliefs that referents (such as family and friends) influence the behaviour in question; and (ii) his or her motivation to comply with these referents. Research support for the importance of subjective norms in exercise intention has generally been insignificant among older^[78,82,83] and younger adults.^[31,32] Unlike attitude, which tends to consistently account for approximately 30% of behavioural intention, social norms are rarely even significant and always account for a very small percentage towards the variance of exercise intentions. Still, social norms tend to have greater impact on less educated members of a community,^[78] and further survey research is needed to assess the impact of social norms on the geriatric population.

Both the TRA and the extended TPB identify behavioural intention as the central predictor of behaviour. In support of this hypothesis, intention has shown significant association with reported exercise behaviour in the 6 studies among older adults.^[27,53,78,79,81-83] In cross-sectional research, significant associations were identified between intention and self-reported regular exercise^[27,78,79] and pre-contemplation, contemplation and preparation stages of exercise behaviour.^[81] Further, a 3-year longitudinal follow-up identified intention with significant discriminant ability between individuals who had maintained their exercise stage versus those who had relapsed.^[82] However, the same study failed to discriminate those who did not change stages from those who moved to a latter stage.

Unfortunately, age differences in behavioural intention significantly differ between older and younger adults,^[27] although not all research has found this association.^[78] Even though elderly people often have favourable attitudes towards exercise, activity is usually reported as a low priority during leisure time.^[8] Further, in a survey of elderly individuals by Stephens and Craig,^[8] 58% of those aged

65 and over could think of nothing which would induce them to increase their exercise behaviour. No gender differences were present in the survey, although minor gender discrepancies in intention to exercise have been reported. In a cross-sectional, self-report study of exercise beliefs among men and women aged 45 to 74 years, Godin and Shephard^[78] found greater variance in exercise intentions among older men than women. It was theorised that women's intentions were more closely linked to social purpose, which were less directly related to exercise than the intentions of men.

In general, exercise intention is a consistent predictor of behaviour, with an average explained variance of 30%.^[31,32] The enormous percentage of both elderly men and women that do not even intend to adopt exercise behaviour is a serious concern, and must be considered a crucial factor to change using intervention strategies.

The TRA has generally now been replaced by the TPB in exercise adherence research.^[33,75] The TPB adds the construct of perceived behavioural control (similar to Banduras self-efficacy) to Fishbein and Ajzens original equation. Perceived behavioural control can be defined as a 'persons belief of how easy or difficult the performance of the behaviour may be' and is influenced by skills, opportunities and resources.^[75] Further, unlike attitude and social norms, perceived behavioural control is hypothesised to influence behaviour directly as well as behavioural intention.^[75] Research utilising the TPB for exercise adherence has generally found that perceived behavioural control does add slightly more explained variance to behavioural intention.^[31,32] Research investigating the TPB among older adults indicates that attitude and perceived behavioural control tend to split this explained variance, while subjective norms still provide no added significance.^[27,79,81-83] Future research among older adults and the TPB requires investigation in both applied and theoretical directions. Application of interventions to change underlying beliefs of both attitudes and perceived behavioural control would greatly strengthen the prospective effectiveness of the TPB. Changes in beliefs should increase

feelings of control and positive attitudes, which in turn should increase exercise intention and behaviour. From a theoretical perspective, extending the TPB to incorporate other factors associated with exercise behaviour may prove advantageous.^[34] Factors such as exercise history, personality, self-efficacy, affect and barriers in performance may provide more explanation as to why certain individuals exercise while others intend to do so but fail to comply.

6.2 The Stages of Change

The Transtheoretical Model of Behaviour Change (TM),^[35,36] a model developed to explain and describe smoking behaviour, has been adapted relatively recently to the study of exercise adherence.^[37] The TM postulates that the process of behaviour change occurs in the following stages: pre-contemplation, contemplation, preparation, action and maintenance. Individuals are hypothesised to move back and forth through these stages several times before developing a stable behaviour pattern. Therefore, the TM is both stable and dynamic.^[35] This model may have important implications for both the evaluation of exercise adoption and maintenance, as it allows for potential determinants and barriers to differ in relative importance amongst the various stages. Further, different interventions can be targeted to match the corresponding determinants of behaviour at a particular stage. Five cross-sectional and 2 follow-up longitudinal studies have investigated the discriminant ability of the TM and exercise behaviour among older adults.^[38-40,63,81-83] However, 4 of these 7 studies utilise the same sample.^[39,81-83] The results indicate that these stages can be statistically discriminated with various social-cognitive constructs just as they can among younger people, and the largest difference tends to occur between pre-contemplation and contemplation. Although the TM is generally assessed using self-efficacy, processes of change and the decision balance sheet,^[37] the TPB,^[81-83] beliefs about the benefits and barriers of exercise,^[38,63] interpersonal support^[63] and the Perceived Severity construct from the Health Be-

lief Model/Protection Motivation Theory^[39] have been successfully assessed within the stages of change utilising older individuals.^[39,81] Although further research and replication is needed, this nevertheless provides interesting information for model comparisons within the TM paradigm. However, the use of prospective studies is warranted to examine whether individuals actually move in a directional manner through the TM. Only 1 longitudinal study has examined change in behaviour stage over time among older adults.^[82] This 3-year follow-up found only the construct of perceptions of behavioural control from an investigation of the TPB to be significant for forward movement through behaviour stages. In contrast, backward movement (relapse) was significantly discriminated between those who maintained their previous exercise behaviour stage with intention, attitudes and perceptions of behavioural control.^[82] Although a promising paradigm for understanding exercise behaviour, a paucity of prospective research exists to investigate the TMs usefulness for intervention implications beyond that of a primary descriptive and diagnostic tool among older adults.

6.3 Self-Efficacy and Social Cognitive Theory

Bandura's Social Cognitive Theory (SCT)^[24,41,76] incorporates many concepts and constructs encompassed in other models by postulating that the person, behaviour and environmental events interact in a triadic, reciprocal fashion.

Through cognition, the capacity to represent future consequence serves as a motivator for the individual in each given behaviour. Self-efficacy and outcome expectation are the 2 important constructs of the SCT regarding behaviour motivation.

Self-efficacy is defined as 'the belief that one can successfully perform a desired behaviour given various instrumental barriers' and is considered the situation specific mechanism in which all behaviour changes are mediated.^[24] According to SCT, self-efficacy determines: (i) whether an individual attempts a given task; (ii) the degree of persistence when the individual encounters difficulties; and (iii) ultimate success or failure.^[41,76] This construct

has been associated with exercise behaviour in 5 cross-sectional studies among older adults.^[42,43,63,80] Prospective research examining the predictive capabilities of self-efficacy towards exercise adherence among older adults has been significant in some,^[44,53] but not all,^[52] studies. Further, self-efficacy has received the most support of any psychological factor in exercise adherence research.^[45]

Self-efficacy appears to be very important in the initial adoption of exercise.^[46] A 5-month exercise programme on previously sedentary adults aged 45 to 65 years indicated that self-efficacy was a significant predictor over the first 3 months of the programme, but less so in 5 months.^[46] This is in agreement with self-efficacy theory.^[76] As individuals progress with a chronic behaviour and exercise becomes routine and masterful, self-efficacy is less of a salient cognition. However, when McAuley^[84] collected data from the original sample 4 months after termination of the 5-month programme, exercise self-efficacy still accounted for a significant proportion of the variance in adherence, indicating its underlying importance in maintenance when a behaviour becomes more difficult to continue. Based upon these findings, the temporal relationship between self-efficacy and exercise adherence among the elderly requires future investigation.

So far, no gender differences have been significant in self-efficacy research among older adults.^[85] However, age differences have been indicated. In a random phone survey of women aged 20 to 85 years, both exercisers (aerobics 3 times a week for 4 months) and non-exercisers, age was negatively related to exercise self-efficacy and accounted for 27% of its variance.^[80] Similarly, McAuley et al.^[86] identified age as significant between self-efficacy scores before commencement of exercise, yet insignificant after the bout of activity. Compared to younger individuals, older people do not perceive as much control in exercise behaviour,^[9] as well as facing a greater fear of injury from engaging in physical activity.^[8] These factors could certainly affect self-efficacy in exercise behaviour among the elderly, and although further research is required,

may need to be considered in intervention. Exercise self-efficacy among older women has also been associated with social support,^[87] perceived health and childhood movement confidence.^[88] As well, the stages of behaviour change paradigm identified self-efficacy as the most important factor to discriminate a sample of 347 older adults between stages.^[63]

Another study has examined the relationship of self-efficacy and social support appreciation of an exercise programme among middle-aged adults.^[89] Bandura^[76] hypothesised that self-efficacy plays a mediating role for social support in health behaviours. This was in agreement with the findings of Duncan and McAuleys^[89] study of the social support and self-efficacy relationship among 85 men and women aged 45 to 64 years. Self-efficacy was found to mediate the relationship between attendance and social support in these previously sedentary volunteers after 10 weeks of aerobic exercise using growth curve analysis. However, the relationship between self-efficacy and exercise social support has not been measured among adults aged 65 years and older at present.

SCT provides 4 priority sources for the attainment of self-efficacy, in order of importance: personal experience, vicarious experience, social and verbal persuasion, and emotional and physiological states.^[76] Obviously, these sources encompass a wide range of factors that may influence behaviour, indicating the pervasive depth of individual cognition and the environment that self-efficacy represents. These sources of efficacy also provide for specific intervention goals that can be tested against both self-efficacy improvement and behaviour change. Unfortunately, neither a specified self-efficacy intervention programme nor adequate exploratory research among the sources of self efficacy and actual efficacy and behaviour change have been conducted with the elderly at this time. However, the only randomised trial attempting to influence exercise adherence utilising an efficacy enhancing treatment produced a 12% improvement among middle-aged adults.^[90]

The second important variable in SCT is outcome expectation, defined as the 'expected outcome any given behaviour will provide'.^[76] This construct is conceptually similar to the Theory of Reasoned Actions^[74] definition of an attitude, but excludes the value of the expectation provided in the TRA. At this time, very little research has been conducted with outcome expectations and exercise adherence, but so far, outcome expectations have not provided for any explained variance over self-efficacy in research among older adults.^[42,43]

6.4 Locus of Control

Locus of control,^[91] a construct within social learning theory, posits that a behaviour such as exercise should be more likely to persist if individuals have a belief that they possess some personal control over their health. Conceptually, adoption of exercise would be easier for those with an internal locus of control because of their perception of control over their environment. Individuals with an internal locus of control would, in theory, experience fewer perceived external barriers to physical activity. However, research into this variable has yielded mixed results. Early correlational research among elderly men and women indicated internal locus of control was significantly positively related to hours of recreational exercise.^[92] Recent cross-sectional research among older women found this same relationship in extreme scores on locus of control, but the relationship was nonlinear and nonsignificant for most participants except the noted outliers.^[87] Further, locus of control was not found to be a significant predictor of adherence in a prospective, 12-month exercise trial among women aged 60 to 85 years.^[54] Only 3 studies have investigated locus of control and exercise adherence among adults over 65. Certainly the construct requires more research to be demonstrated as a predictor of exercise adherence among the elderly.

6.5 The Perception of Benefits and Barriers to Exercise Adherence

Physical and environmental barriers to exercise participation are commonly reported in North

American surveys.^[93,94] However, evidence suggests that many reported obstacles to regular exercise can be explained through individual priorities and perception.^[59] For example, barriers such as lack of time, laziness and work or social responsibilities are equally reported among those who exercise and those who do not.^[93] Therefore, the notion that perceived social-environmental factors act as barriers to physical activity is an important issue to address.^[56] Moreover, the perception of barriers, or costs to exercise, reduces the probability of performing the behaviour even when attitudes towards exercise are favourable.^[64] Gettman et al.^[95] argued that perceived barriers may not even reflect actual external barriers in reality but, nevertheless, will still influence behaviour. Therefore, identifying external barriers to exercise may be a strategy for avoiding personal responsibility.^[64]

Although evaluation of perceived barriers are central to the constructs of perceived behavioural control and self-efficacy, an understanding of what comprises the most common barriers for senior citizens is critical for appropriate measurement of these variables and successful intervention. Further, an analysis of the benefits to barriers ratio is an instrumentive construct in both the Health Belief Model and Protection Motivation Theory.^[96,97] Four prospective^[29,50,53,98] and 5 cross-sectional studies^[63,87,99-101] have examined the contribution of exercise benefits and barriers towards exercise behaviour among older adults.

A strong belief in the benefits of exercise has been associated with exercise behaviour among older adults in several studies.^[53,63,99-101] In contrast, frequent reporting of barriers to regular exercise has shown a negative relationship towards exercise adherence.^[63,101] The primary benefit of exercise for older adults is almost always reported as health and fitness.^[99-101] However, the elderly population specifically may be hindered from exercise adherence by perceived physical limitations.^[47,94] The perception of physical frailty and consequent fear of injury may be responsible in part for the poor exercise adoption rate among senior citizens.^[29,88] For example, perceived health was reported a signifi-

cant antecedent for physical activity for 6780 respondents aged 70 years or greater in a longitudinal study of aging.^[50] Further, this factor has been indicated a predictor of prospective research as well.^[53] A large scale Canadian survey suggests that women tend to report more barriers than men, many of which could be perceived rather than actual,^[8] perhaps a factor that could explain gender differences in adherence. However, some differences among women, young and old, have been found that may have implications for differing intervention strategies. For example, Gill and Overdorf^[100] examined 272 regularly exercising (3 times a week) women aged 18 to 60 years, through cross-sectional self-report, to compare their values towards exercise ranked in order of importance. Although health and physical activity were a priority for all ages, older women placed greater importance on the social aspects of exercise, while young females found exercise as a means of weight control more important. The social aspects of exercise have been found to be of greater importance to older women in comparison with younger women and men, and to older men in other studies.^[99,101] Further, significant reported barriers among older African American women include availability of exercise equipment, exertion, embarrassment and safety.^[101] Elderly people also report less perception that exercise feels good than younger individuals,^[59] and report an interest in less competitive, challenging and vertigo-seeking exercise with a preference to less challenging activities.^[8,29] Understanding the most frequently reported barriers and benefits to regular exercise among the elderly is an important consideration for successful intervention. With greater emphasis placed upon exercise benefits and attempts to reduce the perception of barriers, older adults will be more likely to either adopt or continue a regular exercise regime.

7. Perceived Social Influence Factors

Seven studies and 5 separate participant samples have attempted to measure the relationship between social influences and regular exercise among adults over 65 years of age.^[27,50,53,63,65,85,87] Except

for one 10-week prospective exercise trial,^[53] all studies utilised cross-sectional designs, thereby negating causal inference about the effectiveness of social support as a predictor of exercise behaviour among older adults. At the individual level, social influences have been studied most frequently within the context of 2 primary sources: perceived peer and family support, or perceived physician support for exercise.

7.1 Perceived Peer and Family Social Support

Perceived social support has been consistently reported as a significant factor associated with exercise adherence among the elderly in retrospective self-report.^[27,102] Unfortunately, survey estimates suggest the social support network within the geriatric population is very weak in relation to younger individuals.^[8] Families perhaps identify with societal stereotypes and norms, or fear injury, thereby providing little encouragement to exercise. Furthermore, older individuals likely require more than just family support, as non-kin social support was reported as an important antecedent to exercise among a survey of 6780 senior citizens aged 70 years or greater.^[50,85] The social requirements of leisure time are often even less available for very elderly women, many of whom live alone and progressively become more isolated from family and friends.^[59] Stephens and Craig^[8] indicated this to be a barrier for 19% of women over 65 years and less than 50% of men the same age. Peer support may also be inadequate since friends have probably become less active themselves, or are perhaps even ill or deceased. However, among a community sample of 550 elderly women over the age of 70 years, social support to exercise from active friends was reported in 50% of the cases and correlated significantly with exercise frequency.^[65,87] This sample was notably biased towards healthy and physically fit volunteers, perhaps accounting for the high response towards social support. Nonetheless, perceived interpersonal support has also been identified as a significant variable to discriminate between the stages of exercise behaviour

change.^[63] Unfortunately, positive reinforcement from social support seems to decrease with age.^[65] For example, females aged 20 to 24 years reported 64% positive reinforcement to exercise, while those aged over 65 years reported only 41%.^[8] However, social influences may also hinder exercise involvement, especially among the elderly. Factors such as ailing spouses and friends have been a reported barrier for regular exercise adherence.^[53] Further attention is required to examine the positive and negative impact of perceived social influences.^[102] In the only prospective study examining perceived social support and older adults to date, Howze et al.^[53] found that social support was not significantly associated with adherence. It was suggested that social support was an expectation within the programme and the restriction of range in measurement was likely a direct indication of this possible implication. As such, perhaps linking social interest with physical activity is the most successful approach to combat the negative association between lack of social support and regular exercise. Certainly family and peer encouragement to exercise with an emphasis on either couple or group activity would aid the elderly in overcoming this potential barrier.

7.2 Perceived Physician Support

As the aging process continues, individuals increase the frequency with which they interact with the healthcare system, and especially with their general practitioners. Therefore, physicians are in an excellent position to encourage active behaviour.^[103] More so, survey research indicates that the opinions of physicians tend to have significant influence over the elderly,^[93] especially in comparison to younger individuals.^[58] Unfortunately, many doctors do not seem to be informed about the benefits of geriatric exercise.^[104] It seems that most physicians do not view the importance of exercise as critical to discuss with their patients, as it is not perceived as a treatment to patients immediate illness.^[105,106] Even among physicians who do prescribe exercise, few spend more than 3 to 5 minutes to counsel.^[107] This is certainly not enough time

given the complexity of exercise prescription, maintenance and possible questions. Therefore, the time taken to discuss exercise prescription should be increased.^[107]

Evidence is mixed as to whether physicians' exercise support among the elderly has improved in the last few years. The adult population overall tends to hold a favourable impression towards their physicians' attitudes regarding exercise,^[108] and Stephens and Craig^[8] found that 56% of those over 65 years of age were being encouraged to exercise by their doctors. However, only 30% of elderly women reported support in a more recent Canadian survey.^[65,87] Additionally, physician support has not significantly predicted exercise adherence among older adults in prospective research, most likely due to restricted range in scoring from an expectation within the programme.^[53] Still, physician support for geriatric exercise requires further study, as this factor may be an important intervention strategy for exercise adoption and maintenance.

8. Activity Preference and Enjoyment of the Programme

As individuals grow older, the nature and type of exercise tends to change. Surveys indicate that activities such as walking increase in preference, while more vigorous exercise, such as swimming and cycling, decrease.^[8,109] For example, Stephens and Craig^[8] reported less than 20% of men and women participated in swimming and cycling over the age of 65 years, compared to nearly 50% of men and women aged 25 to 45. However, walking tends to increase as an activity with the onset of age, especially with elderly females.^[8,110] Similarly, gardening is a popular activity that remains relatively stable among young and elderly females, but increases significantly in preference among aging males.^[8] Therefore, change in the nature and type of exercise is important to consider, since perceived choice over the type of activity, enjoyment and the level of exertion committed has been shown to improve adherence and continued activity.^[111] Moreover, enjoyment of the exercise programme has also been reported an important determinant of short

and long term adherence among younger and middle-aged adults.^[112,113] Therefore, although more research is required, a great diversity of activities based on relatively moderate to low exertion and maximum enjoyment should be provided to increase adherence for elderly adults.

9. Conclusion

In summary, limited research exists to adequately explain factors that influence exercise adherence among the elderly at the individual level. Therefore, at present, research findings from younger and middle-aged populations often have to be generalised to the senior citizen community. Further, the quality of the data obtained in researching exercise adherence among older adults may also be a problem. The majority of research consists of correlational, retrospective, self-report surveys among the general population or motivated volunteers in a clinical setting and may lack external validity.^[114,115] The motivation of volunteers used in adherence predictor research in prospective studies may especially be problematic when attempting to identify significant psychological factors in regression analysis because of restriction of range in measures. Similarly, elderly individuals in these studies show perseverance and adherence rates often higher than the 50% attrition rate speculated for the population.^[3] Unfortunately, the lack of variability in motivation among the participants may be providing for poor statistical discrimination between those who adhere to exercise and those who do not. Therefore, even when sampled from the community, prospective studies may lack the variability to appropriately differentiate the determinants responsible for those who adhere to exercise and those who do not, as only those who intend to exercise are included in the study.

However, several variables have been consistently cited and associated with continued physical activity among the elderly, even though more future research is required. For example, attitude, perceived behavioural control/self-efficacy, perceived social support and perceived benefits of and barriers to continued activity may provide consider-

able influence over an elderly individual's decision to adhere to a regular exercise routine. Education and exercise history continues to positively correlate with physical activity among all age groups, while perceived physical frailty and poor health may provide the greatest barrier to exercise adherence for an elderly person. Therefore, future research should investigate prospectively the predictive significance of these variables among the elderly within a chosen theoretical paradigm. Further, the indirect relationship between predictors needs to be understood through causal analytic structuring. Using these procedures, a better understanding of causal significance between factors influencing physical activity and their relationship to adherence among older adults can be surmised.

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