Predictors of Adherence to a Strength Training Program for Older Women

By

Ryan Rhodes

BA, The University of British Columbia, 1996

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF ARTS

in

THE FACULTY OF GRADUATE STUDIES

SCHOOL OF HUMAN KINETICS

We accept this thesis as conforming to the required standard

The University of British Columbia
July, 1998

In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the head of my department or by his or her representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Department of (EDUCATION) SCHOOL OF HUMAN KINETICS

The University of British Columbia
Vancouver, Canada

Date JULY 31, 1998

ABSTRACT

The rate of regular physical activity in North America is very poor. Elderly females, the fastest rising portion of the population, report the lowest exercise frequency of all demographic groups. This is alarming given the physiological and psychological health benefits derived from regular moderate physical activity among older women. Therefore, it is important to understand what factors influence adherence to an exercise program in order to implement effective intervention strategies. Although an abundance of research literature regarding young and middle-aged adults has been conducted in exercise adherence, relatively few studies exist using elderly subjects. The present study utilized measures of social support, self-efficacy, enjoyment, age, education, and physiological strength as potential determinants to adherence. These measures were subsequently used to predict attendance to a strength training program for relatively healthy women aged 75 to 80 during the initial 6 months of adoption and adaptation. Results indicated that self-efficacy, and current peer and family support were significant to the adherence equation for the first 3 months. However, the 3-6 month period rendered self-efficacy and age significant, while only age predicted adherence over the full six months ($p<.05$). Further, self-efficacy was the only predictor variable to provide unique significant variance at 3 months while controlling for baseline scores. Results suggest that factors influencing physical activity vary throughout the exercise behaviour adherence process. Concepts such as reciprocal determinism and perception of health status may help account for these fluctuations.

CONTENTS

Abstract ii

Introduction 1
Purpose of the Study 4
Objectives & Research Questions 5
Significance of the Study 6

Literature Review 9
Introduction 9
Individual Factors 10
Exercise Experiences
1. Exercise History 10
Demographics
1. Age and Sex 11
2. Education and Income 12
Physical Factors
1. Physical Condition 13
Psychological Factors 14
1. Exercise Knowledge 17
2. *Theory of Reasoned Action* 18
2.1 Attitude 19
2.2 Subjective Norms 20
2.3 Intention 22
3. *The Stages of Change* 24
4. *Social Cognitive Theory* 26
5. *Personality* 30
6. *Perceived Barriers* 32
Social-Environmental Factors 33
Social Factors
1. Peer and Family Support 34
2. Physician Support 35
Program Factors
1. The Facility 37
2. Preference & Enjoyment 37
3. Intervention & Relapse Prevention 38
4. Leadership 41
5. Social Support 42
6. Convenience 43
Conclusion 44

Methodology 46
Introduction 46
Research & Design Perspective 46
The Study Population 47
Exclusionary Factors 48
Recruitment 50
The Exercise Program 50
Intervention Procedures 51
Measurement 52

CONTENTS CONTINUED

Adherence 53
Psychological Measures 53
1. Self-Efficacy 54
2. Stages of Change 54
3. Social Support 55
4. Enjoyment and Perceived Benefit 55
Demographic Measures
1. Age 56
2. Education 56
Strength Measures 57
1. Upper body 57
2. Lower Body 58
Statistical Analysis 58

Results 62
Introduction 62
Descriptive Statistics 62
Correlational Analysis 66
Multiple Regression Analysis 69
Multiple Regression Analysis (ANCOVA) 71
Causal Analysis 72

Discussion 74
Introduction 74
Research Question (1)
Predictors of Adherence at 0-3 Months 74
Predictors of Adherence at 3-6 Months 75
Predictors of Adherence at 0-6 Months 77
Predictor Variables Found Non-Significant 79
1. Education 79
2. Strength 79
3. Social Support 80
4. Enjoyment, Perceived Strength gain, & Benefit to Daily Lifestyle 81
Conclusions 81
Limitations & Future Research 82
1. Reliability and Validity of Measures 82
2. Generalizability 83
3. Type 1 Error 83
4. Length of the Study 84
Research Question (2) 84
Self-Efficacy at 3 Months 84
Conclusions & Future Research 86

CONTENTS CONTINUED

Research Question (3)	87
Causal Analysis of Adherence at 0-3 Months	87
Causal Analysis of Adherence at 3-6 Months	90
Causal Analysis of Adherence at 0-6 Months	91
Conclusions & Future Research	92
References	93
Appendix A (Self-Efficacy)	107
Appendix B (Stages of Change)	108
Appendix C (Social Support)	109
Appendix D (Program Self-Report)	110
Appendix E (Demographic Variables)	111

INTRODUCTION

Although the benefits of regular physical activity have been well documented (Bouchard et al., 1994), the majority of adults in developed countries do not exercise. Sample surveys conducted in Canada and the United States 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 (Stephens et al., 1985). Further, most exercise programs 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 six to twelve months of initiation (Carmody et al., 1980; Dishman, 1988). Unfortunately, those who could stand to gain the greatest health benefits from an exercise program tend to be the individuals who fail to realize their exercise intentions (Dishman, 1988).

In addition, many studies indicate that physical activity decreases with age (Stephens & Caspersen, 1994; Curtis & White, 1984; McPherson, 1983). The problem is even greater for females, as older women report the least amount of physical activity of all demographic groups (Baumann et al., 1990; Caspersen et al., 1986; Stephens & Craig, 1990; Casperson et al., 1994). This lack of physical activity among the elderly is of even greater concern when considering the changing demographics. Data from the U.S. 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 (Dishman, 1994b). Considering these demographics, it is important to understand what factors influence

physical activity among the older population in order to implement effective intervention strategies (Lee, 1991).

Factors associated with physical activity adherence are both complex and diverse, as Dishman's (1990) Life-Span Interaction model suggests (Figure 1). Potential determinants encompass psychological, physiological, and social-environmental characteristics from a range of disciplines. At present, little research has concentrated upon the factors that influence exercise adherence among elderly women, especially using prospective research designs. Therefore, the importance of various components has been inferred primarily from research using younger adults.

However, moderate regular exercise has been shown to improve the physical health (Shephard, 1998) and mental well-being (Bennett & Morgan, 1992; McAuley & Rudolph, 1995) of elderly individuals. Furthermore, no age limits to these positive health benefits have been observed (Fiatarone et al., 1994). Successful aging, characterized by minimal functional decline, is an achievable goal for many adults (Wagner et al., 1991). Therefore, exercise has been postulated as a resource for healthy aging among elderly women (O'Brien & Vertinsky, 1991). However, not all forms of physical activity may be as well suited for preventing the rapid deterioration of strength that accounts for functional disablement during the aging process (Taunton et al., 1997). Specifically, strength-training exercises among the free-living elderly have been successful in improving both functional mobility and preventing further sarcopenia (Evans, 1995). Importantly, these same benefits have not been as successfully attributed to exercise programs with a primary aerobic

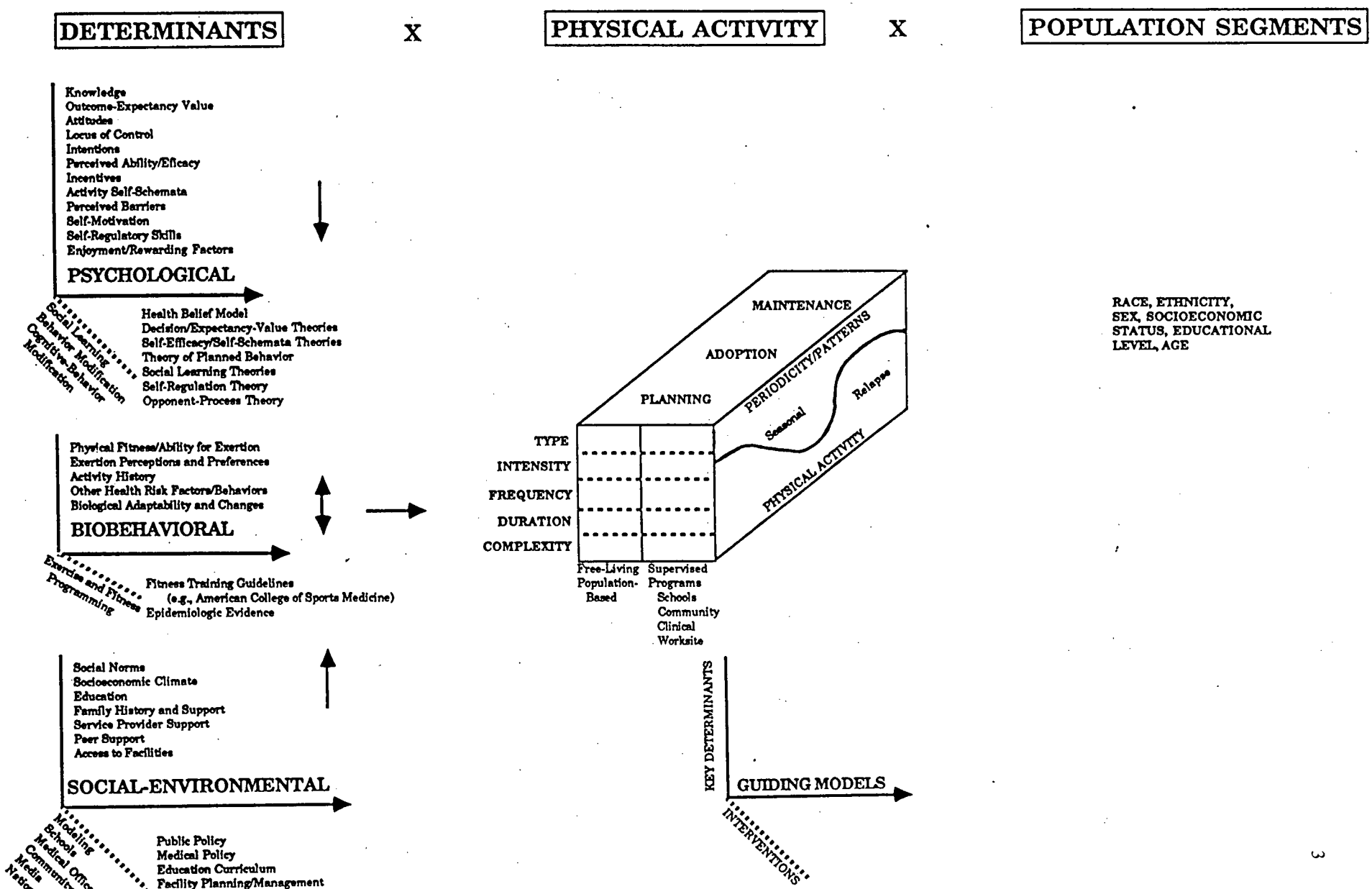


Figure 1. The Lifespan Interaction Model for Exercise Behaviour (Dishman 1990)

component (i.e. walking, dance, etc.), thereby indicating strength training as a necessary ingredient of elderly physical activity (Evans, 1995; Fiatarone & Evans, 1993).

In the following study, the researcher investigated how certain demographic, psychological, biological, and social-environmental factors explained and predicted adherence to a strength-training program for free-living elderly women over the initial six month period. Factors such as age, formalized education, self-efficacy, social support, enjoyment of participation, perceived improvement, and physiological strength were compared and regressed upon program attendance in order to ascertain their relative importance to exercise behaviour adherence. Further, the relationship between age, social support, self-efficacy and exercise adherence was explored within a hypothesized social-cognitive causal framework (Bandura, 1986). All the above mentioned factors have been strongly indicated as possible determinants associated with the continued participation of physical activity (King et al., 1992). However, none of these components has been previously assessed using a prospective design in an elderly female population.

Purpose of the Study

The purpose of this study was to investigate how certain psychological, social-environmental, and biological factors predict and explain exercise adherence among a group of elderly women participating in a six month strength training program; specifically, to identify how strongly age, self-efficacy, social support,

perceived improvement, enjoyment of the program, and increases in strength predict and explain program adherence.

Objectives & Research Questions

(1) **To identify variables that predict and explain adherence to a strength training program among elderly women during 0-3 months, 3-6 months, and the full 0-6 month adoption phase**. Exercise self-efficacy, kin, peer, physician, and program social support, perceived enjoyment of the activity, perceived improvement, education, age, and physical strength are all possible variables that influence program adherence. However, variables that influence physical activity have been hypothesized to vary in predictive and explanative importance across stages of behaviour adoption, adaptation, and maintenance (Marcus & Prochaska, 1994). Therefore different variables may predict or explain adherence with greater significance at differing time stages.

(Q1) **What variables predict adherence to a strength training program among elderly women at 0-3 months, 3-6 months, and the entire 0-6 month duration?**

(2) **To evaluate what variables, if any, are significant predictors of adherence 3-6 months and 0-6 months at measuring time 2 (3 months), while controlling for measuring time 1 (baseline)**. Social Cognitive Theory indicates a reciprocally determining nature between the environment, behaviour, and cognition (Bandura, 1986). Therefore, variables measured at 3 months may become more or less

significant to adherence when controlling for baseline scores based upon reciprocal determinism.

(Q2) **Do variables at time 2 (3 months) contribute significant variance towards predicting adherence 3-6 months and 0-6 months, while controlling for previous time 1 (baseline) scores?**

(3) **To investigate the indirect and direct effects upon adherence by age, social support, and self-efficacy.** As mentioned previously, Social Cognitive Theory's notion of reciprocal determinism indicates a mutual relationship between the social environment, cognition, and behaviour (Bandura, 1986). However, preliminary research (Duncan & McAuley, 1993) and Self-Efficacy Theory (Bandura, 1986) identify self-efficacy as a possible mediating factor between social support and exercise adherence. Further, the effects of age have been proposed to influence both efficacy cognitions and social support networks (O'Brien Cousins, 1995).

(Q3) **What is the causal relationship between age, social support, self-efficacy, and exercise adherence?**

Significance of the Study

The benefits of a strength training program purport to increase the quality of life for elderly women through a reduced chance of bone fracture and greater independent physical mobility (Farquahar, 1995; Evans, 1995). Either adjunct, or as a result of these benefits, an increase in self-esteem and self-concept is also a

common benefit, providing for better psychological well-being during the aging years (Ostrow, 1984). Understanding what factors influence continued participation or drop-out at various stages in a strength training program could significantly aid in tailoring intervention strategies to enhance adherence of similar programs. The following study investigates how the relationships of self-efficacy, social support, perceived enjoyment, perceived improvement, age, and strength affect continued participation in a strength program for older women in the initial six months of adoption. Self-efficacy, the central component of Social Cognitive Theory (Bandura, 1997), has been frequently associated with both exercise and other health behaviour adherence in research (Dishman, 1994a). Social support has been frequently cited as an important contributor to physical activity, especially among elderly women (O'Brien Cousins, 1995). Utilizing a Social-Cognitive framework, social support has been shown to exert influence on continued exercise participation through changes in self-efficacy (Duncan & McAuley, 1993). Therefore, self-efficacy is hypothesized to act as a mediator for social support's effects on physical activity (Bandura, 1986). Exploration of this relationship is preliminary at present, but the following study indicates how social support and self-efficacy relate in a population in which social support is deemed very important to exercise adherence (O'Brien-Cousins, 1995). Enjoyment of physical activity has frequently been cited as an important determinant of exercise adherence but has received a surprising lack of formal research (Kimiecik & Harris, 1996). This study is one of the first to investigate the perception of enjoyment on exercise attendance and strength gain. As well, since no studies to

date have specifically examined these variables associated with strength training adherence among elderly women, the proposed study will add a new parameter to the exercise adherence literature.

LITERATURE REVIEW

Introduction

Relatively few studies on adherence have been published about individuals above the age of sixty-five (Dishman, 1994a&b) and elderly females specifically (Williams & Lord, 1995). Therefore, it is difficult to discern how well findings observed in middle-aged adults generalize to the senior citizen community. However, the adoption and subsequent adherence to exercise behaviour are products of various physiological, psychological, and environmental variables (Dishman et al., 1985; Sallis et al., 1986). 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 (Dishman, 1988; Vanden Auweele et al., 1997). Since physical activity determinant research has traditionally relied on cross-sectional retrospective design (Dishman, 1994a), the direction of causality or even the intervention of a third factor has not been ascertained for many variables under study. Still, a relatively recent review reported fifteen prospective studies since 1988 (Dishman & Sallis, 1994), and more are being conducted every year. These should provide greater clarity to the causal and temporal relationships among variables associated with physical 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 (Dishman, 1994a). 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 the prominent factors currently associated with exercise adherence in the elderly population. These factors have been divided into two categories for the purpose of the present discussion based upon the components deemed important by Willis & Campbell (1992): 1) individual factors and 2) social-environmental factors associated with physical activity.

Individual Factors

Exercise Experiences

1. Exercise History

One of the most important factors associated with future behaviour is past behaviour (Triandis, 1977). Early exercise experiences and recent involvement in physical activity have been shown to predict adherence to a current exercise program (Schreyer et al., 1984; Valois et al., 1986). These studies show no significant age correlation differences, and therefore the relationship accounts for the elderly, middle-aged, and young alike. The research for measuring past exercise behaviour at this time, however, 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 (O'Brien & Vertinsky, 1991). 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 (Lee, 1993). 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.

Demographics

1. Age and Sex

Estimates ranging from 10% (Teague, 1989), to 90% (McPhillips et al., 1989) have been reported for elderly individuals' adherence rates to regular physical activity. However, more recent estimates from large scale surveys indicate differences in a senior citizens age and sex correlate with various regular physical activity rates. As well, 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 sex with physical activity less clear (Casperson et al., 1994). For example, although people over sixty-five have generally improved their rate of activity in the past fifteen years (for example Canada: 36% to 53%), sex disparities with males being more active than females still continue (Stephens & Casperson, 1994). As well, these disparities tend to differ by country, as Canada (36% men and 49% women) has a far greater gap between the sexes than the United

States (28.6% men and 32.3% women) among the sedentary population (Casperson et al., 1994). The age of senior citizens is also an important factor to consider for activity prevalence. Physical activity tends to increase slightly at retirement (age 60-65) but begins a downward slope a few years after, reaching the lowest activity rates of the population (Stephens & Casperson, 1994; Casperson et al., 1994).

2. Education and Income

Education and income have been positively correlated with physical activity (Dishman, 1994c; Dishman & Sallis, 1994). Higher rates of exercise behaviour have been correlated with increased socioeconomic standing (McMichael & Harlshorne, 1980), and frequency of exercise participation has also been related to years of education (Canada Fitness Survey, 1984a; Casperson et al., 1986; Stephens & Craig, 1990; Wolinsky & Stump, 1995). These relationships may possibly be misconstrued from volunteer bias and sampling error (Dishman, 1994a). Moreso, the relationships are correlational, providing causal inference for either direction, a synergism, or an unidentified third factor. As such, several reasons for these relationships have been proposed (Shephard, 1994). Greater education may indirectly raise awareness of health benefits and increase the subjective norms for physical activity among middle and upper class individuals. People with higher disposable incomes 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. Also, individuals of higher socio-economic 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 disposable income specifically, low cost leisure pursuit may be a crucial factor in exercise adherence (Stephens & Craig, 1990). Elderly individuals generally have reduced disposable income at retirement, with elderly women making up a large fraction of the poor in most developed countries (Shephard, 1994). Still, although lower socio-economic 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 shift to low cost exercise habits such as walking and gardening (Stephens & Craig, 1990).

Physical Factors

1. Physical Condition

Deteriorating health that often accompanies the aging process has been postulated as a potential explanation for the decrease in the physical activity among elderly individuals (Wolinsky & Stump, 1995). Further, of the two longitudinal controlled experimental studies that have examined adherence to exercise among women over the age of sixty-five, both found that the physical condition of the individual was the most important predictor of continued participation (Emery et al., 1992; Williams & Lord, 1995). Emery et al. (1992), in a study of exercise adherence in 101 men and women aged sixty to eighty-five participating in a ten to twelve week exercise program, 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 (1995) also found characteristics of physical condition such as reduced strength, slow reaction time and psychoactive drug use to explain most of the variance in their 12 month exercise (aerobics and balance 2x week) trial of 102 women aged sixty to eighty-five. Poor physical health and illness may especially be a hindrance for elderly women, as indicated by cross-sectional survey (Mobily, 1982; Mobily et al., 1987). In a large scale sample survey of the Canadian population, Stephens & Craig (1990) 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 twenty-five to forty-four, but this sharply rose to 19% of males and 34% of females aged sixty-five and over. Demographics suggest that women live longer and suffer a longer period of dependency than men (Canada Health Survey, 1982). 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 more than half of senior citizens are physically fit enough to exercise (McPherson, 1986).

Psychological Factors

Numerous psychological theories have been utilized to explain exercise behaviour. Many of these theories have been reviewed and researched specifically for populations of older individuals (Herbert & Teague, 1989; Duda & Tappe,

1989a&b; Dzewaltowzky, 1989b; Courneya, 1995). From these theories, a myriad of psychological variables and constructs have been created and studied. So far, there is no clear answer as to which constructs are better than others, partly due to methodological flaws in early studies and the similarity in the operational definition of variables (Godin, 1994). For example, intention and self-efficacy, although conceptually distinct have been correlated at $r = 0.81$ (Godin, 1994). Likewise, perceived behavioural control and self-efficacy, although different variables, are very similar in concept (Ajzen, 1985).

The quality of the data obtained in researching psychological models may also be a problem. As mentioned previously, the majority of research consists of correlational retrospective self-report surveys among the general population or motivated volunteers in a clinical setting that may lack external validity (Baranowski, 1988; Perkins, & Epstein, 1988). Also, many psychological measures utilized for study purposes have been borrowed from other behaviour fields without the adaptation specificity of exercise (Perkins & Epstein, 1988). This may have deleterious effects upon generalizability of the measured construct. The motivation of volunteers used in adherence predictor research in longitudinal studies may also be problematic when attempting to identify significant psychological factors in regression analysis. For example, elderly individuals in these studies show perseverance and adherence rates far higher than the fifty percent attrition rate speculated for the population (Dishman, 1988). Emery and Blumenthal (1990), in their exercise adherence study of volunteer women and men 60-83 years old,

reported a mean attendance of 46 out of a possible 48 aerobic exercise classes. When subjected to regression analysis, the only psychological variable that predicted exercise behaviour was lower anxiety (Emery et al., 1992). Unfortunately, the lack of variability in motivation among the subjects may be providing for poor statistical discrimination between those who adhere to exercise and those who do not. Therefore the study most likely lacks generalizability to the senior citizen community at large. Further, gender was not a significant predictor of physical activity, perhaps indicating that the females in the study were unusually active and therefore not representative of their community. Even in prospective studies that use random community samples such as Williams and Lord's (1995) study of 102 elderly women, subjects that participate represent those either interested in or possessing the intention to exercise; a group that represents 50 percent of the general population at best (Dishman, 1994b; Stephens and Craig, 1990). Therefore, longitudinal studies, even when sampled from the community, may lack the variability to appropriately differentiate the psychological 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.

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 variables seem to be consistently associated with exercise behaviour or

robustly studied within the adherence literature in general (Dishman, 1994a), and some of these may have important implications for the elderly's decision to exercise. Finally, it is important to note that the majority of research has failed so far to find significant gender differences in psychological variables, even though the rates of exercise differ between the sexes in survey and demographics research. It has been speculated that either measuring difficulties with these psychological and social-cognitive variables, sample generalizability, or greater importance of females' exercise history and social-environmental barriers are responsible for this discrepancy (Lee, 1993).

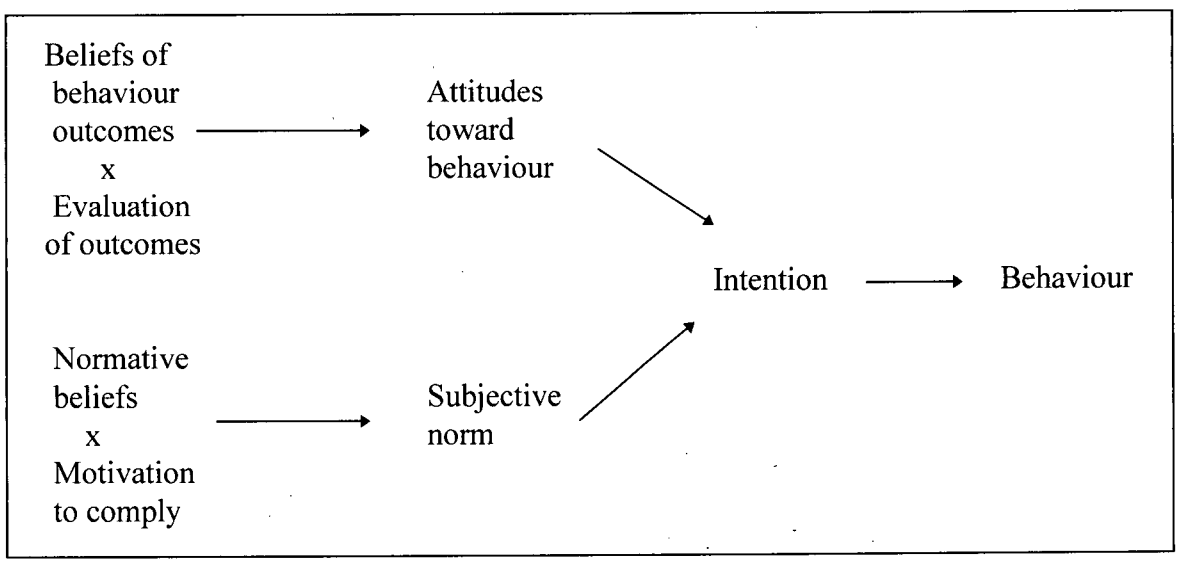
1. Knowledge About Exercise

Knowledge about health, fitness, and exercise behaviours has not been found to directly determine the adherence of physical activity (Dishman, 1994a). However, knowledge about exercise may be important in the initial adoption of exercise (Dishman, 1990; Sallis et al., 1986). Appropriate exercise behaviour such as correct technique, intensity, and equipment needed for specific activities, may conceivably be important for program continuation with the elderly. Safe and appropriate exercise would likely decrease the risk of injury and increase the potential for enjoyment of the activity (Sedgwick et al., 1988).

2. Exercise and The Theory of Reasoned Action

The intention to perform a behaviour is the most important factor to actually engaging in future behaviour, according to Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA). 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: 1) beliefs that the behaviour will lead to specific outcomes and 2) an evaluation of the desirability of such outcomes. This first factor is very similar to the concept of outcome expectancy in Bandura's (1986) Social Cognitive Theory. 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 Braskamp's (1986) Personal Investment Theory.

Figure 2: The Theory of Reasoned Action



(Adapted from Ajzen and Fishbein, 1980)

2.1 Attitude

Attitudes towards the value and importance of exercise are generally quite positive with older individuals in survey research (Mobily et al., 1987; Dishman, 1994b), and little difference in the overall attitude of physical activity exists in self-report between younger and older people (Dishman, 1994b; Wilcox & Storandt, 1996). The primary reason for exercise is almost always reported as health and fitness (Heitman, 1986; Gill & Overdorf, 1994; Emery et al., 1992). However, some differences among women, young and old, have been found that may have implications for differing intervention strategies. For example, Gill & Overdorf (1994) examined 272 regularly exercising (3x a week) women aged eighteen to sixty, 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 (Duda & Tappe, 1989b; Heitman, 1986; Mobily, 1981). However, differences between the genders in exercise attitudes (young and old) are relatively small (Stephens and Craig, 1990; King et al., 1990), and have not been reported in all studies (Emery et al., 1992). Elderly people also report less perception that exercise feels good than younger individuals (Shephard, 1994), and report an interest in less competitive, challenging, and vertigo seeking exercise with a preference to mastery

type activities (Stephens & Craig, 1990; Sidney & Shephard 1977). Exercise attitude has been credited to account for approximately 30% of the variance in the intention to exercise (Godin & Shephard, 1990a; Godin & Shephard, 1986b; Wilcox & Storandt, 1996). However, although many older individuals have positive attitudes towards exercise, they are not reflected in behaviour, as Mobily et al.'s (1987) survey of over 2000 older rural American men and women suggests. Different priorities such as diet and rest have been deemed more important than beginning and maintaining an exercise routine (Canada Fitness Survey, 1984b; Stephens and Craig, 1990).

2.2 Subjective Norms and Exercise Stereotypes

The TRA suggests subjective norms reflect the summed products of the following two factors: 1) the individual's beliefs that referents (such as family and friends) influence the behaviour in question and 2) his or her motivation to comply with these referents. Research support for the importance subjective norms in exercise behaviour intention has been insignificant (Godin, 1994). 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. However, societal stereotypes may also modify the subjective norm for behaviour without directly being measured by traditional TRA instrumentation. For example, the pattern of decline of exercise with increasing age may be partly due to the societal stereotypes regarding

the inappropriateness of physical activity for the elderly (Ostrow & Dzewaltoski, 1986; Ostrow et al., 1981). A common belief in Western society has been that retirement is a time to slow down and relax (Sidney & Shephard, 1977). Nevertheless, stereotypes regarding the inappropriateness of exercise for older adults have yet to be substantiated in research (McGuire, 1984). Still, social norms tend to have greater impact on less educated members of a community (Godin & Shephard, 1986a), and further survey research is needed to assess the impact of social norms on the geriatric population. Another stereotype proposed to hinder exercise intervention is that of the elderly being disinterested in changing their opinions and behaviour, as older people are "set in their ways" (Beningston et al., 1985). While the latter stereotype has not been supported by some research (Barke & Nicholas, 1990), it is indirectly supported by the elderly's lack of intention to adopt exercise behaviour (Dishman, 1994b; Stephens & Craig, 1990). Elderly women may especially find it difficult to overcome the norm which downplayed the appropriateness, or importance of leisure and physical activity in the past (O'Brien & Vertinsky, 1991). Also, the elderly may hold the belief that exercise must be strenuous and painful to be beneficial, which may act as a barrier to engaging in physical activity (Lee, 1993). This misinformation is unfortunate, as benefits can be achieved from very moderate exercise (Foster et al., 1989).

2.3 Intention

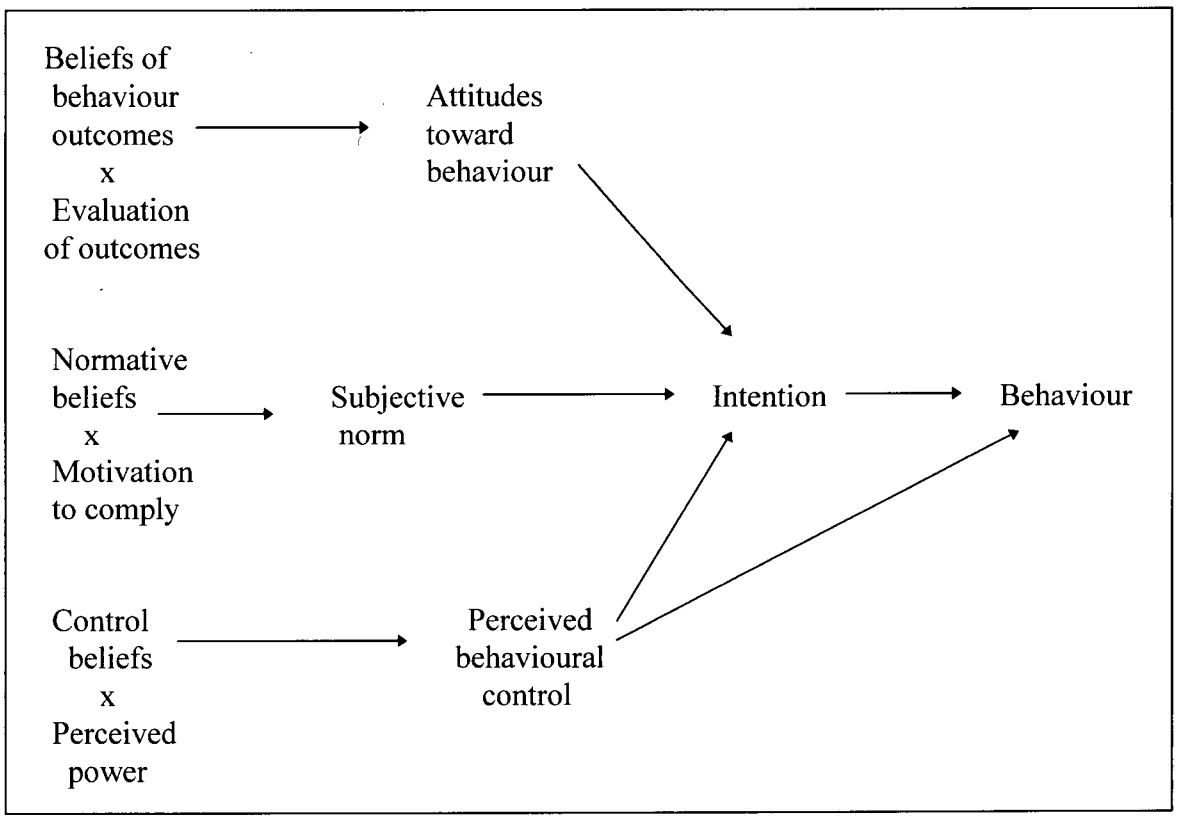
Although the elderly's attitudes are often favorable towards physical activity, exercise is usually reported as a low priority during leisure time (Stephens & Craig, 1990). One of the major differences between individuals young and old, is that over 50% of non-exercisers above sixty-five report they do not have any intention to start exercising (Dishman, 1994b). Further, in a survey of elderly individuals by Stephens and Craig (1990), 58% of those sixty-five and above 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. Godin and Shephard (1986b), in a cross sectional self report study of exercise beliefs among 45-74 year old men and women, found greater variance in exercise intentions among older men than women. It was theorized 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 an inconsistent predictor of behaviour (Shephard, 1994). Studies range from intention explaining anywhere from 30% to 5% of actual behaviour (Godin, 1994; Dzwaltowski, 1989a). As a result, some researchers have dismissed behavioural intention as being a relatively significant predictor of behaviour (King et al., 1992), while others continue to advocate its usefulness (Godin, 1994). However, exercise intention is definitely a necessary component for continued physical activity adherence, even if it sometimes fails to account for a significant proportion of explanative variance. 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. Factors such as exercise history, personality, and confidence and barriers in performance may provide more explanation as to why certain individuals exercise while others intend to do so, but fail to comply (Godin, 1994).

The TRA has generally now been replaced by the Theory of Planned Behaviour (TPB) in exercise adherence research (Ajzen, 1985; 1991). The TPB adds the construct of perceived behavioural control (similar to Bandura's self-efficacy) to Fishbein and Ajzen's original equation. Perceived behavioural control can be defined as a "person's belief of how easy or difficult the performance of the behaviour may be" and is influenced by skills, opportunities, and resources (Ajzen, 1985). Further, unlike attitude and social norms, perceived behavioural control is hypothesized to influence behaviour directly as well as behavioural intention (Ajzen, 1985). Research utilizing the TPB for exercise adherence has generally found that perceived behavioural control does add slightly more explained variance to behavioural intention (Godin, 1994). Attitude and perceived behavioural control tend to split this explained variance while subjective norms still provide no added significance (Courneya, 1995). However, perceived behavioural control has provided no extra variance towards actual behaviour when partialed from intention, thereby failing to establish the TPB as a better predictor of exercise behaviour than the TRA (Courneya, 1995; Godin, 1994).

Figure 3: The Theory of Planned Behaviour



(Adapted from Ajzen, 1991)

3. The Stages of Change

Relatively recently, the Transtheoretical Model of Behaviour Change (TMBC) (Prochaska, 1979; Prochaska & DiClemente, 1983), a model developed to explain and describe smoking behaviour, has been adapted to the study of exercise adherence. The TMBC argues that the process of behaviour change occurs in the following stages: pre-contemplation, contemplation, preparation, action, and maintenance. Individuals are hypothesized to move back and forth through these stages several times before developing a stable behaviour pattern. Therefore, the TMBC is both stable and dynamic (Prochaska, 1979). This model may have

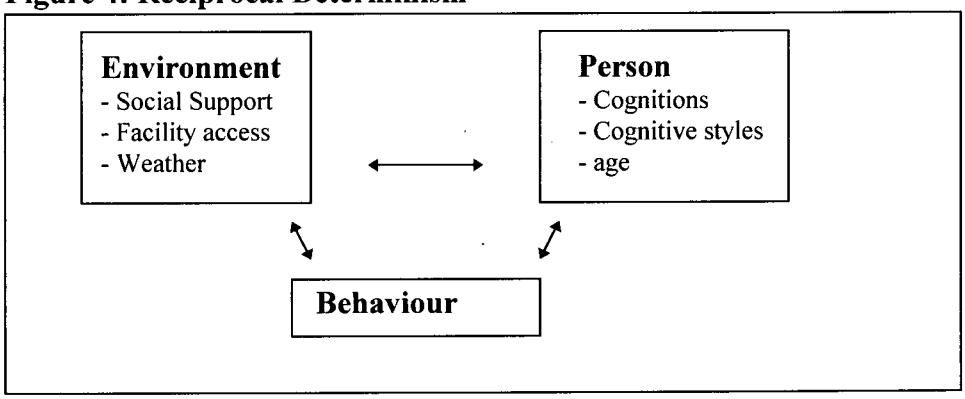
important implications for both the evaluation of exercise adoption and maintenance, as it allows for potential determinants and barriers to differ in relative importance amongst the various stages. Further, different interventions can be targeted to match the corresponding determinants at a particular stage. Cross-sectional research among older individuals has indicated that these stages occur just as they do among younger people (Barke & Nicholas, 1990; Courneya, 1995; Gorely & Gordon, 1995). However, the use of prospective studies is warranted to examine whether the population actually moves in a directional manner through the TMBC. The TMBC also appears to be able to compare other social-cognitive theories of exercise adherence within its stages. Although the TMBC is generally assessed using self-efficacy, processes of change, and the decision balance sheet (Prochaska & Marcus, 1994), the Theory of Planned Behaviour, and the Perceived Severity model has been successfully assessed within the stages of change, using older subjects (Courneya, 1995a & b) . Although further research and replication are needed, this nevertheless provides interesting information for model comparisons within the TMBC paradigm. Recently, the TMBC has aroused criticism for both its arbitrary stage analysis and lack of theoretical behaviour hypotheses (Ashworth, 1997). For example, stages are divided by arbitrary time intervals that probably do not reflect the nature of individual behaviour change processes. Further, the TMBC fails to utilize a theoretical framework for transitional progression through its stages, and therefore provides for little theorized intervention and examination of hypothesized constructs. In the future, the TMBC needs to be researched in a prospective manner to

investigate its usefulness for determinants and intervention implications beyond that of a primary descriptive and diagnostic tool.

4. Self-Efficacy and Social Cognitive Theory

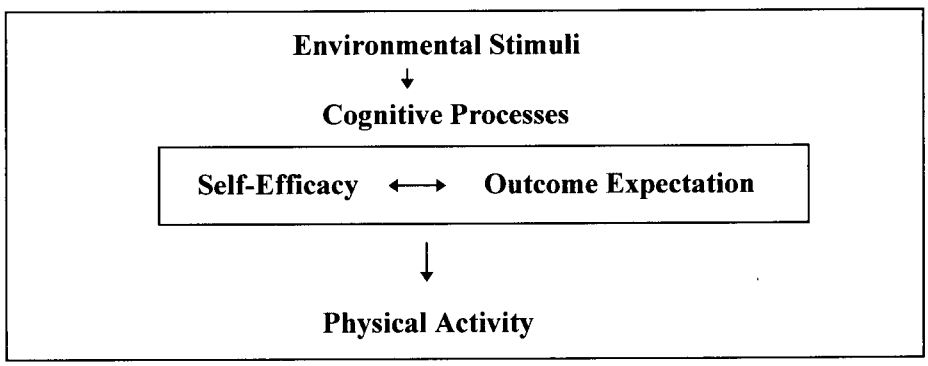
Bandura's Social Cognitive Theory (SCT)(1986, 1997) incorporates many concepts and constructs encompassed in other models by postulating that the person, behaviour and environmental events interact in a triadic reciprocal fashion (Figure 4).

Figure 4: Reciprocal Determinism



Through cognition, the capacity to represent future consequence serves as a motivator for the individual in each given behavior. Self-efficacy and outcome expectation are SCT's two important constructs regarding behaviour motivation (Figure 5).

Figure 5: Self-Efficacy, Outcome Expectation, and Physical Activity



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 (Bandura, 1997). According to SCT (Bandura, 1977;1986), self-efficacy determines: 1) whether an individual attempts a given task; 2) the degree of persistence when the individual encounters difficulties; and 3) ultimate success or failure. This construct has been indicated to be a factor associated with exercise adherence in numerous cross-sectional retrospective studies (McAuley & Jacobson, 1991; Stanley & Maddux, 1986; Sallis et al., 1989; Sallis et al., 1986; Dzewatowski, 1989a). However, self-efficacy still lacks prospective studies to attempt to account for a causal relationship with exercise adherence (Dishman, 1994a), and is yet to be thoroughly tested as a predictor of adherence among the elderly. Nevertheless, self-efficacy has received the most support of any psychological factor in exercise adherence research (Mazzeo et al., 1998), explaining anywhere from 10 to 30 percent of the variance in exercise behaviour (Dishman, 1994a).

Self-efficacy appears to be very important in the initial adoption of exercise (McAuley, 1993). A five-month exercise program on previously sedentary older adults aged 45-65 indicated that self-efficacy was a significant predictor over the first three months of the program, but less so in five months (McAuley, 1992). This is in agreement with self-efficacy theory (Bandura, 1986). As individuals progress with a chronic behaviour and exercise becomes routine and masterful, self-efficacy is less of

a salient cognition. However, when McAuley (1993) collected data from the original sample four months after termination of the five-month program, 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.

So far, no gender differences have been significant in self-efficacy research; however, age differences have been indicated. In a random phone survey of women aged 20 to 85 of both exercisers (aerobics 3x week for 4 months) and non-exercisers, age was negatively related to exercise self-efficacy and accounted for 27 % of its variance (Wilcox & Storandt, 1996). Compared to younger individuals, older people do not perceive as much control in exercise behaviour (Dishman, 1994b), as well as facing a greater fear of injury from engaging in physical activity (Dishman, 1989; Stephens & Craig, 1990). 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.

Self-efficacy has also been examined and compared with other factors associated with exercise adherence. A comparison of self-efficacy and behavioural intention to exercise among college-aged adults found that self-efficacy explained slightly more variance (unique $R^2 = .07$) than intention when each of the constructs were regressed against attendance (Dzewaltowski et al., 1990). However, both constructs correlated very highly ($r = .81$), and were significant predictors, indicating the similarity of variance to exercise that both self-efficacy and intention share.

Another recent study has examined the relationship of self-efficacy and social support appreciation of an exercise program (Duncan & McAuley, 1993). Bandura (1986) hypothesized that self-efficacy plays a mediating role for social support in health behaviours. This was in agreement with the findings of Duncan & McAuley's (1993) study of the social support and self-efficacy relationship among 85 men and women aged 45-64. Self-efficacy was found to mediate the relationship between attendance and social support in these previously sedentary subjects after ten weeks of aerobic exercise using growth curve analysis. However, the social support measure was not adapted for exercise behaviour, and purported to measure group support only. The relationship between self-efficacy and multiple other sources of exercise social support (i.e. Physician, past and current family and friend, etc.) has not been measured at present.

SCT provides four 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 (Bandura, 1986). 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 program nor adequate exploratory research among the sources of self efficacy and actual efficacy and behavior change have been conducted with the elderly at this time. However, the

only randomized trial attempting to influence exercise adherence utilizing an efficacy enhancing treatment produced a 12% improvement among middle-aged adults (McAuley & Courneya, 1994).

The second important variable in SCT is outcome expectation, defined as the "expected outcome any given behavior will provide" (Bandura, 1986). This construct is conceptually similar to the Theory of Reasoned Action's (Ajzen and Fishbein, 1975) 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 using regression analysis (Dzewaltowski et al., 1990).

5. Personality

Personality variables have received mixed results as factors associated with exercise adherence. Moreover, much of the research focuses on either myocardial infarction patients or college-aged students, making effective generalization to senior citizens unknown. Some research has found no support for a relationship between personality and physical activity adherence (Valois et al., 1986), while most results indicate varied findings (Willis & Campbell, 1992). For example, middle-aged adult myocardial patients researched using the MMPI were reported to have higher anxiety scores among those who dropped out of the exercise program (Stern & Cleary, 1981; Blumenthal et al., 1982), however, research using the Taylor Manifest

Anxiety Scale has found no relationships to exercise adherence (Massie & Shephard, 1971; Shephard & Cox, 1980). Conflicting or ineffective evidence has also been reported for self-concept (Wilfly & Kance, 1986), self-motivation (Knapp et al., 1984; Gale et al., 1984; Wankel et al., 1985), and type A versus B personality (Shephard & Cox, 1980; Oldridge, 1978).

Locus of control (Rotter, 1966) has been found to be related to exercise behaviour among young males, with those individuals with an internal locus of control more likely to become active (Sonstroem & Walker, 1973). However, locus of control was not found to be a significant predictor of adherence in a 12 month exercise trial among women aged 60-85 years (Williams & Lord, 1995). 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 and certainly it has yet to be demonstrated as a predictor of exercise adherence among the elderly (King et al., 1992).

As well, an elderly individual's position on the introversion / extraversion continuum (Eysenck, 1981) may have implications for exercise behaviour. Extraverted people respond well to group programs while introverted individuals respond to private or solitary exercise programs (Massie & Shephard, 1971). It has been theorized that elderly introverted individuals have a greater chance of adherence to exercise, as solitary programs may have fewer potential external barriers than exercise groups

(Shephard, 1994; Davis et al., 1995). However, extraverts may have advantages such as socializing incentives and social support that may act as reinforcement for exercise behaviour. This may especially aid in adherence for extraverted elderly women, as the social aspects of exercise seem to be an important reason for adopting physical activity. Certainly personality could conceivably influence the development and evaluation of efficacy cognitions, beliefs, confidence, perceived norms, and the reaction to barriers (real or perceived); however, further research is needed to examine the relationship between various personality characteristics and continued exercise behaviour among the elderly.

6. The Perception of Barriers to Exercise Adherence

Physical and environmental barriers to exercise participation are commonly reported in North American survey (Canada Fitness Survey, 1983; Dishman et al., 1985). However, evidence suggests that many reported obstacles to regular exercise can be explained through individual priorities and perception (Stephens, 1994). 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 (Canada Fitness Survey, 1983). Therefore, the notion that perceived social-environmental factors act as barriers to physical activity is an important issue to address (Dishman & Sallis, 1994). Moreover, the perception of barriers, or costs to exercise, reduces the probability of performing the behaviour even when attitudes towards exercise are favorable (Lee, 1993). Gettman et al. (1983) 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 (Lee, 1993). Large scale Canadian survey suggests that women tend to report more barriers than men, many of which could be perceived rather than actual (Stephens and Craig, 1990), perhaps a factor that could explain gender differences in adherence. However, the elderly population specifically, may be hindered from exercise adherence by perceived physical limitations (Mobily, 1982; Mobily et al., 1987; Canada Fitness Survey, 1984b; Dishman et al., 1985). The perception of physical frailty and consequent fear of injury may be responsible in part for the poor exercise adoption rate among senior citizens (Sidney and Shephard, 1977). For example, perceived health was reported a significant antecedent for physical activity for 6,780 respondents aged seventy or greater in a longitudinal study of aging. This potential factor needs to be researched and addressed in order to firmly establish its role in exercise adherence.

Social-Environmental Factors

Though social-environmental factors associated with physical activity have not been studied adequately for causal explanation because of the over-use of correlational and retrospective report, many variables have been suggested as possible determinants or barriers in exercise adoption and maintenance (Dishman, 1994c; Dishman & Sallis, 1994). This section concentrates on research findings of potential social and societal or environmental factors that may either assist or bar an

elderly individual's adherence to regular exercise. For this purpose, social-environmental variables have been divided into two categories: social and program factors.

Social Factors

1. Peer and Family Social Support

Social support has been consistently reported as a significant factor associated with exercise adherence among the elderly in retrospective self-report (Chogahara et al., 1998), and lack of social support and loneliness have been cited as major barriers to their initiation of physical activity (King et al., 1990). Unfortunately, survey estimates suggest the social support network within the geriatric population is very weak in relation to younger individuals (Stephens & Craig, 1990). 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 an important antecedent to physical activity among a survey of 6,780 senior citizens aged seventy or greater (Wolinsky & Stump, 1995). 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 (Shephard, 1994). Stephens and Craig (1990) indicated this to be a barrier for 19% of women over sixty-five 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 seventy, social support to exercise from active friends was reported in 50% of the cases and correlated significantly with exercise frequency (O'Brien-Cousins, 1995). This sample was notably biased towards healthy and physically fit subjects, perhaps accounting for the high response towards social support. As well, positive reinforcement from social support seems to decrease with age (O'Brien-Cousins, 1995). For example, female individuals aged twenty to twenty-four reported 64% positive reinforcement to exercise while those aged over sixty-five reported only 41% (Stephens and Craig, 1990). Perhaps linking social interest with physical activity is the most successful approach to combat the relationship between lack of social support and poor exercise adherence. Certainly family and peer encouragement to exercise with an emphasis on either couple or group activity would aid the elderly in overcoming this barrier.

2. Physician Support

As the aging process continues, individuals increase the frequency with which they interact with the health care system and especially with their general practitioners. Therefore, physicians are in an excellent position to encourage active behaviour (Mulder, 1981). More so, survey research indicates that the opinions of physicians tend to have significant influence over the elderly (Weinstein, 1988; Canada Fitness Survey, 1983), especially in comparison to younger individuals (Canada Fitness Survey, 1984a). Unfortunately, many doctors do not seem to be

informed about the benefits of geriatric exercise (Weinstein, 1988). Iverson et al (1985) reported that doctors offered an exercise prescription to only 3.4% of ambulatory patients. Further, two other studies have found that 80% of patients had never been given advice to exercise by their doctors (Wechsler et al., 1983; Wyshak et al., 1980). 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 the patients' immediate illness (Valente et al., 1986; Wechsler et al., 1983). Even among physicians who do prescribe exercise, few spend more than three to five minutes to counsel (Lewis et al., 1991; Wells, et al., 1984) 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 (Lewis et al., 1991).

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 favorable impression towards their physicians' attitudes regarding exercise (Godin & Shephard, 1990b), and Stephens & Craig (1990) found 56% of those above sixty-five were being encouraged to exercise by their doctors. However, only 30% of elderly women reported support in a more recent Canadian survey (O'Brien-Cousins, 1995). Physicians' exercise support has yet to be analyzed for gender differences, and perhaps this factor could have an explanatory impact on the gender discrepancy in physical activity (Lee, 1993).

Program Factors

1. The Facility

The physical characteristics of the exercise facility may provide important factors for continued participation. Aspects such as ambiance, floor space, exercise equipment availability, music, ventilation, and lighting could influence adherence or decisions to participate among the population (Willis & Campbell, 1992). Certainly, an atmosphere deemed suitable and pleasing for a majority of senior citizens would be a likely successful intervention effort. Lack of opportunities for senior citizen fitness programs have also been proposed as a potential reason for the elderly's low rate of physical activity (Sidney & Shephard, 1977), especially perhaps for elderly women (Henderson, 1990). Shephard (1988) has argued contrary to the luxury of the facility providing an important basis for exercise adherence, but at this time, both propositions are merely speculative, as no research exists to resolve the issue. Although factors associated with the exercise facility may not be as important as many other variables in exercise adherence research, studies need to explore and define this potential relationship.

2. Activity Preference and Enjoyment of the Program

As individuals grow older, the nature and type of physical activity tends to change. Survey indicates that an activity such as walking increases in preference, while more vigorous exercise, such as swimming and cycling decreases (Montoye, 1975; Stephens & Craig, 1990). For example, Stephens & Craig (1990) reported less than 20% of men and women participated in swimming and cycling over the age of sixty-five, compared to nearly 50% of men and women ages twenty-five to forty-five.

Walking, however, tends to increase as an activity with the onset of age, especially with elderly females (Stephens & Craig 1990; Hovell et al., 1989). Similarly, gardening is a popular activity that remains relatively stable among young and elderly females, but increases significantly in preference among aging males (Stephens & Craig, 1990). 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 (Thompson & Wankel, 1980). Moreover, enjoyment of the exercise program has also been reported an important determinant of short and long term adherence (King et al., 1988; Godin, 1987). Therefore a great diversity of activities based on relatively moderate to low exertion and maximum enjoyment should be provided to increase adherence for elderly adults (Dishman, 1991).

3. Program Intervention and Relapse Prevention

It has been speculated that poor self-regulation and cognitive-behavioral skills for overcoming barriers are a main reason why many people who intend to be active fail to do so, and remain sedentary (Weber & Wertheim, 1989). Therefore, behavioural strategies, cognitive-behavioral strategies, and self-regulatory strategies rooted in the traditions of behavior modification and cognitive-behavior modification have been implemented with exercise . Studies using these strategies have generally reported increases in participation frequency ranging from 10 to 25%, however increases in exercise intensity and duration are less clear (Dishman, 1991). Examples of these strategies include: decision making utilizing the decision balance sheet (Wankel et al., 1985), stimulus control cues such as prompts and diaries (Keefe & Blumenthal, 1980; Owen et al., 1987), goal setting for directing behaviour towards achievement (Strecher et al., 1996), self-monitoring for positive reinforcement and

re-evaluation (Rejeske & Kennedy, 1988; Zimmeman & Schunk, 1989; Owen et al., 1987), attention control strategies as a form of distraction from the unpleasantness of exercise fatigue (Martin et al., 1984; Johnson & Siegal, 1992), and positive thinking or cognitive restructuring (Gauvin, 1990; Atkins et al., 1984; King, 1988).

Leith and Taylor (1992), in a review of behavior modification research in exercise adherence, concluded that these strategies generally increase the frequency of exercise behaviour. However, several pertinent criticisms of the research literature were cited including low sample sizes, a variety of settings and experimental designs, and different types of physical activity. Incidentally, no intervention strategy has been deemed superior, since many are used in concert with each other, or perhaps because of the lack of standardization of adherence measures. These measures range from maximum oxygen uptake, to self-efficacy scores, to the number of attended exercise sessions. Also, a sample bias (motivated volunteers) and a possible Hawthorne effect could be potential prejudice to the current research. However, most important is the poor generalizability of the current literature. Since the majority of studies have been conducted using college aged students, it is currently unclear which populations respond best to the different adherence strategies, or even whether various populations respond with increases in adherence at all (Leith & Taylor, 1992). With respect to older individuals' exercise adherence behaviour, subjects in some intervention studies have shown very similar increases to younger subjects from various behavioral strategies (Atkins et al., 1984; Perkins et al., 1986). For example, a behavioural strategy such as a token economy system has been shown to be effective in promoting exercise behaviour in the elderly (Wiggam et al., 1986), while positive reinforcement, a more cognitive-behavioural intervention strategy has been ineffective (Mattesen, 1989). All of these studies had very small samples and used different intervention strategies. Therefore, further study is needed

before any conclusions can be drawn about the efficacy of behavioural and cognitive-behavioural strategies in exercise adherence among the elderly.

The relapse prevention model (Marlatt & Gordon, 1985) is an example of self-regulation training and utilizes cognitive-behavioural and behavioural strategies. This model is based on the premise of acquiring coping strategies to compensate for unexpected disruptions which could interrupt or end the behaviour change process. Relapse prevention, however, was developed in an effort to explain lack of adherence to abstinence in addictive behaviours (eg. smoking, drugs, alcohol) and may not generalize very well to acquiring positive health behaviours such as exercise (Knapp, 1988). Nevertheless, many studies suggest this approach has been beneficial to exercise adherence, especially when combined with other intervention strategies (King et al., 1988; Belisle, 1987). The best tool for relapse assessment has been the decision balance sheet (King, 1988) in which an individual assessment of costs and benefits for exercise can be examined. Using this tool, appropriate intervention strategies can be implemented to reinforce an individual's positive aspects regarding exercise while diminishing negative ones. Unfortunately, elderly individuals, neither male nor female, have been adequately studied using relapse prevention training, so only generalizations from other populations' success can be speculated. As well, Marcus and Stanton (1993) did not support any difference between relapse prevention training and controls, and called for further research to be conducted before conclusions on the efficacy of the relapse prevention model for exercise adherence can be reached.

The environment and social-context in which we live is certainly a most important determinant for our physical activity. This is often underscored by cognitive-behavioural strategies of behavior change that focus attention on the individual's thought processes about exercise behaviour, rather than the myriad of environmental obstacles that may act as barriers to regular physical activity

(Kendzierski & Johnson, 1993). Further, face-to-face personal and interpersonal intervention approaches only conceivably reach a small segment of the population, and since people prefer moderate activities, often outside of a structured setting (Stephens et al., 1985; Stephens & Craig, 1990), the generalizability of face to face or small interpersonal interventions may be poor. Community-wide intervention campaigns utilizing multiple disciplines of health promotion (exercise physiology, psychology , education, etc.) and using many channels of information delivery (i.e. telephone, mail, brochures etc.) may be the most cost effective strategy required to reach the general population (King, 1991). As well, these campaigns can approach health behaviour from multiple levels of intervention including personal, interpersonal, and organizational / environmental strategies (King, 1994). Considering the elderly specifically, an emphasis on hospital-, community- or population-based agencies, and geriatric institutes represent the key social influences for intervention to take place at this community level (Dishman, 1994b). However, currently a paucity of data exists to reflect both the efficacy and cost effectiveness of the community-wide intervention approach (King, 1992). Therefore, although community intervention strategies towards physical activity promotion should in theory result in greater exercise behaviour outcomes, research is needed for this claim to be substantiated.

4. Program Leadership

Program leadership has been suggested as the most important variable to continued exercise participation, providing a deliberate effect on the behaviour of a participant (Presbie & Brown, 1977). As well, leadership has been identified by participants as the most important factor in continued participation of physical activity (Heinzelmann & Bagley, 1970). In a controlled study of the effects of bland

versus enthusiastic leadership upon the self-efficacy and mood states of two groups of 23 college-aged women, the enthusiastic leadership group reported significantly higher self-efficacy and enjoyment than the bland leadership group (Turner et al., 1997). Unfortunately, this study was performed using one exercise trial, therefore negating the generalizability of leadership upon exercise adherence. The role of a leader can be enormously important and variable, serving as educator, counselor, cheerleader, and taskmaster (Willis & Campbell, 1992). Beneficial leadership has been reported to include influencing feelings of safety, psychological comfort, expertise, and other personal qualities (Gillet, 1988). Regrettably, although frequently addressed in exercise adherence literature, leadership has received little formal research (Cox, 1984; Franklin, 1988; Oldridge, 1984). Research concerning leadership and exercise adherence among the elderly has yet to be conducted in an experimental setting. Certainly studies involving various aspects of leadership and support among elderly populations need to be conducted.

5. Program Social Support

Program social support may provide a number of important factors towards adherence and certainly aids in the enjoyment and reinforcement of the activity, especially if group cohesiveness is strong (King, 1984). As with leadership, relatively little research has been conducted to assess program social support exclusively as a variable and incentive associated with continued physical activity (Dishman, 1994). Further, social support could be underscored by existing behavioural, and cognitive-behavioural intervention strategies. For example, McAuley and Courneya (1994) identified that program social support may have been significantly responsible for exercise participation increases in conjunction with self-

efficacy in their study of 125 middle-aged men and women. Other studies have also attributed the exercise frequency increases in intervention studies to group support (King et al., 1988; Martin et al., 1984). Thow and Newton (1990) indicated that social support can be fostered through class meetings for exercise planning, while Faulkner & Stewart (1978) found social support to improve adherence through group discussion rather than seminars and brochures. Group exercise classes, buddy systems, and post-exercise social activities for the elderly may provide effective strategies to foster positive reinforcement and enjoyment of the activity, thereby increasing adherence. Further study of these aspects is certainly required.

6. Convenience and Group Vs Individual Programs

Exercise behaviour is a habit that takes energy, as well as time, and therefore often acts as an inconvenience. Lack of time for exercise is a very commonly reported barrier (Lee & Owen, 1986; McGuire, 1984; Stephens & Craig, 1990; Canada Fitness Survey, 1984a). Fortunately, the elderly usually have more time to dedicate to activities, as older individuals generally have less work and family commitment (Shephard, 1994). This may account for the extremely high compliance rate in the few longitudinal studies that have involved women over sixty-five (Williams, & Lord, 1995; Emery & Blumenthal, 1990). However, elderly women are still more likely to have more domestic activities than elderly men (Lee, 1993; Geerken & Gove, 1983), which could act as a time barrier, and may help explain the gender differences in exercise participation.

Lack of access to facilities, or the time it takes to go to and from the facility are also frequently reported barriers (Lee & Owen, 1986; McGuire, 1984; Stephens & Craig, 1990). Therefore, convenience oriented home programs that can be more time and cost efficient have been implemented with success. Many home-based programs have shown improvements in physical activity equal to group-based interventions (King 1991; Jeneau et al., 1987). For example, 160 women and 197 men aged fifty to sixty-five improved fitness in a home-based exercise program more than a group-based program and control subjects (King, 1991). Standard procedure is to equip subjects with cognitive-behavioural strategies for behaviour change and then monitor progress with follow-up phone calls or mail-ins. Monitoring by telephone, however, has been shown to be more effective than mail (King et al., 1989; King et al., 1988). Although this intervention method may not be the most effective for the elderly, as the efficacy of cognitive-behavioural strategies for this population is unclear and social support is unused, older individuals who wish to exercise alone or find groups inconvenient may derive benefits from a home-based exercise program.

Conclusion

In summary, a paucity of research exists to adequately explain factors that determine exercise adherence among the elderly (Dishman, 1994a&b; Williams & Lord, 1995). Therefore, at present, research findings from younger and middle-aged populations often have to be generalized to the senior citizen community. An over-emphasis on retrospective, correlational design, compounded by homogenous volunteer samples, and variable self-report measurement systems further convolutes the understanding of validity, causality and control of variables in adherence research

(Dishman, 1994a). However, several variables have been rather consistently cited and associated with continued physical activity among the elderly, even though more sophisticated and standardized research parameters are required in future research. For example, self-efficacy, social support, and perceived barriers to continued activity may provide considerable influence over an elderly individuals decision to adhere to a regular exercise routine. Education and socio-economic standing continues to positively correlate with physical activity among all age groups, while perceived physical frailty and poor health may provide the elderly's greatest barrier to exercise adherence. As well, program factors, such as the exercise setting, and leadership are cited as influential factors for physical activity but supportive research is scarce for any population (Willis & Campbell, 1992). Finally, intervention efforts, although indicative to increase continued physical activity (Dishman, 1991), require more systematic attempts to reflect theory- and research-based constructs in order to understand how individual variables and techniques influence exercise behaviour among the elderly. Therefore, future research should investigate prospectively, the predictive significance of variables such as social support, self-efficacy, education, and strength 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 can be surmised.

METHODOLOGY

Introduction

This chapter describes the research design perspective, implementation process, and methodology used to study factors associated with adherence to a strength-training program among older women. The chapter begins by presenting a rationale for the research perspective and design utilized for investigative application. The subject population is then described together with the procedures and instrumentation used in the study. The chapter closes by describing the processes by which data were analyzed.

Research and Design Perspective

Research is typically situated in a larger theoretical and conceptual paradigm, which in turn provides the lens from which all phases are guided. Exercise adherence research has traditionally relied upon an empirical, positivist, or experimental approach to research design. As common among other social sciences, exercise psychology often attempts to utilize quantitative data collection and analysis procedures (Perkins & Epstein, 1988). The present study also continues to utilize an experimental design and quantitative focus. A single group prospective multiple regression / correlation analysis (MRC) framework was chosen as the primary design, based upon the general and flexible nature of such a data-analytic system. The MRC frame-work is very applicable to the exploratory nature of exercise adherence research and has consequently been utilized for the central design in many

studies (McAuley, 1993; Williams and Lord, 1995; Emery et al., 1992). Adherence, identified as the dependent variable, has been studied as a function of, and in relationship to factors of interest, identified as independent variables. According to Cohen and Cohen (1983) MRC also provides the following advantages:
1) relationships can be simple or complex; 2) independent variables are not constrained (quantitative or qualitative, correlated or uncorrelated, single or groups); 3) both the measure of the "whole" relationship of a factor to the dependent variable, as well as partial and unique proportions of variables can be investigated; and
4) MRC is equipped with necessary statistical hypothesis testing and power analysis requirements.

The Study Population

The following design included a sample size of 30 subjects (3 Asian, 27 Caucasian), composed of elderly women aged 75 to 80. According to age categorization by gerontologist data, this population is considered among the middle old, whereby the typical classification range of age is as follows: young old = 65 - 74 years, middle old = 75 - 84 years, and very old = 85 years and up (Shephard, 1994). The inclusion of 30 subjects was considered to provide an adequate power of .80 at an alpha of .05 while considering a medium to large hypothesized effect size (based on previous findings such as Williams & Lord, 1995; McAuley, 1993). This number was investigated for Pearson product-moment correlational analysis, and up to 5 predictor variables at any given regression calculation (Cohen, 1988). The

subjects were free-living, volunteer based, and self-selected from various locales around the Vancouver community area. A population diagnostic using the trantheoretical stages of behaviour change for exercise indicated all subjects could be identified as in either the contemplation (not currently active but currently considering physical activity), preparation (engaging in irregular or informal activity for the past six months), or maintenance (engaging in regular physical activity for the past six months or longer) stage. In addition, all subjects that responded in both the contemplation and preparation stage of behaviour change indicated previous experience with regular physical activity. Consequently, this group represents a resumption of physical activity from relapse, rather than an adoption of exercise as a novel experience. Therefore the study population can be largely regarded as those with previous regular physical activity patterns interested in attempting a weight training program to increase their muscular strength (Figure 6).

Exclusionary Factors

Medical approval by family physician to rule out significant disease of the cardiovascular, neuromuscular, neurological, and skeletal systems was a mandatory requirement before subjects were accepted into the study. Consent forms signed by their physician acted as necessary documentation for study approval (Table 1). This was performed in order to attempt to control for obvious health risks the program may present as well as premature drop-out from the study due to these ailments.

Figure 6: The Sample Population Assessed Using The Stages of Exercise Behaviour Change Paradigm

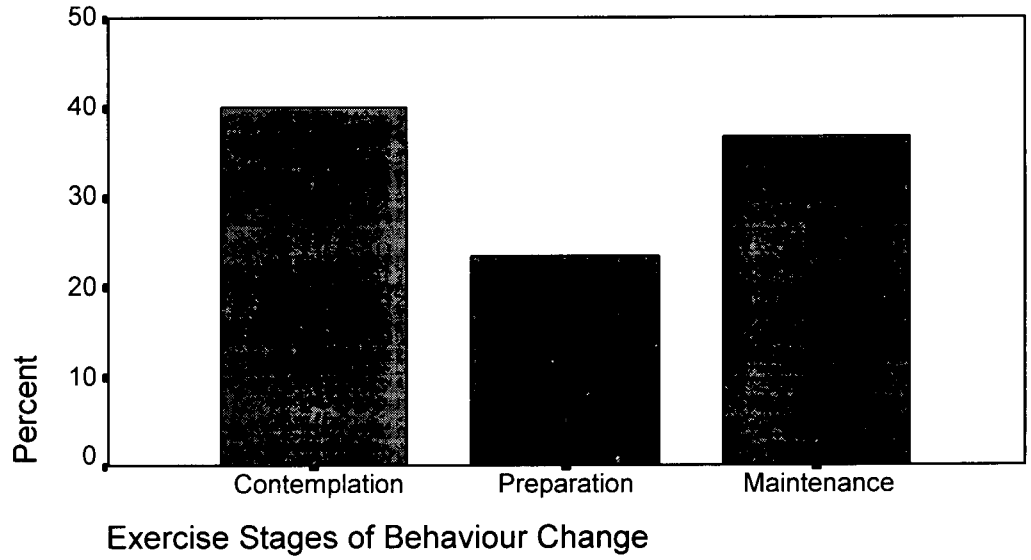


Table 1: Exclusion Criteria:

1. Restricted limb or trunk movement
2. Medical Contraindications to maximize strength training
3. Uncontrolled hypertension or diabetes
4. Symptomatic cardiorespiratory disease
5. Severe renal or hepatic disease
6. Uncontrolled epilepsy
7. Progressive neurological disease
8. Dementia
9. Marked anemia (hemoglobin less than 100G/L)
10. Marked obesity with inability to exercise
11. Medication with betablockers, wafarin, or CNS stimulants
12. Subjects will also be excluded if they are already performing intense cardiovascular exercise for more than 30 minutes, 3 times a week.

As it is the requirement in research using human subjects, informed consent was also obtained from all participants allowing for full understanding of the proposed study and refusal of testing or drop-out without repercussion at any time. Finally, investigation into past physical activity patterns and habits was also performed through interview at the time of subject recruitment. All subjects engaging in strenuous cardiovascular or strength activities over three times a week were excluded from being study participants. Further, any proposed participants that acknowledged engaging in any form of organized and formal exercise regimen were also excluded. Therefore, the physical activity status of all study participants could be considered those engaging in light or moderate exercise no more than three times a week and not participating in any formal or organized program.

Recruitment

Recruitment of subjects consisted of an intensive multi-modal advertising campaign for 8 months prior to the study start date. Methods of advertising included weekly newspaper ads, radio and television ads, community and senior center brochures and posters, as well as word of mouth promotion from individuals that were among the first to commit to the study.

The Exercise Program

The exercise program consisted of 3 times weekly hour long sessions of progressive resistance training using a combination of free-weights, Kaiser, and

universal gym machines with a priority emphasis upon strength gain and a minimum of 48 hours between sessions. Exercises focused on all upper and lower body major muscle groups with an emphasis on safety and correct procedures. The following eight resistance exercises were utilized: lateral pull-down, chest press, leg press, leg curl, seated row, shoulder press, bicep curl, and an abdominal stabilization exercise. Participants performed two sets of 12-15 repetitions. In addition, a five minute cardiovascular system warm-up (60% of max. heart rate), and a ten minute stretching cool-down were provided as part of the sixty minute session. This program continued for 3 months at set facilities on the UBC campus and North Shore Recreation center where both bus transportation and automobile parking are accessible and available. Monitoring and instructional aid was provided during the first three months of the program but the second half of the study primarily consisted of supervision only and the taking of attendance. The sample was divided into manageable groups for 2 exercise sessions at the UBC facility and 1 on the North Shore. Selection to these groups was self-selected based on time preference and accessibility. This grouping procedure was for improved flexibility of the program only and not for measuring or control purposes. The ratio of instructors averaged 1 to five participants at all exercise times during the first 3 months.

Intervention Procedures

The intervention procedures utilized in the 3 month program consisted of enthusiastic leadership from supervisors, self-monitoring of progress skills,

promotion of group social support, and 3 organized socials. Instructors promoted a friendly, supportive environment by answering or demonstrating all questions in a courteous yet informal manner, and providing encouragement and positive feedback to all participants. Self-monitoring of progress was achieved through work-out checklist cards, whereby subjects could monitor their respective improvements and adherence to the various exercises. Group social support was promoted by instructors through encouragement of exercise circuit buddy systems, car pooling, and varying participant led cool-down stretches. The first organized social was held during the testing and orientating week of the study, the second during the 6 week mark, and the third concluded the formalized 3 month program. Socials included food and beverages, as well as educational lectures on topics such as cancer, bone density, and the contributions that the subjects are making to the physiological research topics.

Measurement

Measurements were taken at baseline (pre-program), and 3 months (mid-program). The pre-program results reflect baseline levels while 3 month measurements are expected to be more representative of program adoption adherence: a critical phase in attrition (Dishman, 1988). The measurements at 3 months also reflect maintenance measurement and assimilation of the strength training activity into regular habit, especially since that phase of adherence was

primarily up to the individuals in the study as monitoring and instructional aid were not provided.

Adherence

Adherence in determinant research has been traditionally measured via attendance (Perkins & Epstein, 1988). The number of program sessions attended also represented adherence in this study, controlling only for planned vacations among participants. Adherence measurements consisted of 0-3 month, 3-6 month, and 0-6 month intervals. Also, the definition for those who drop-out has also been variable throughout exercise determinant research (Dishman, 1988). In this study drop-out was defined as 3 weeks consecutive absence from the program facility without prior arrangement (Williams & Lord, 1995). Consequently, participants who dropped out of the program were not entered into the analysis of the next measurement phase.

Psychological Measures

Psychological and self-report measures were administered and tested before strength measures. This procedure attempted to control for the self-observation that strength measures' success or relative failure may affect psychological self-perception. Also, all self-report questionnaires were administered at the exercise site to increase psychological applicability and memory cueing of the activity during the response period.

1. Self-Efficacy

Self-efficacy was measured with the Self-Efficacy Questionnaire developed by Marcus et al. (1992). This questionnaire was developed using the guidelines suggested by Bandura (1977). It is composed of five items that reflect the respondent's beliefs in his or her capability to continue exercising when faced with potential barriers (1. fatigue, 2. bad mood, 3. lack of time, 4. vacation, 5. bad weather). A seven point Likert scale, from 1 (not at all) to 7 (very confident) is used to rate each of the five items. A score of 0 (does not apply) is also available for each question. This questionnaire was used in the study by Marcus et al. (1992) and the test-retest (product moment) reliability was reported to be 0.9 ($n=20$, $p < 0.001$). The items on the scale were validated by Sallis et al. (1988) as those factors most meaningful to exercise self-efficacy (see Appendix A).

2. Stages of Exercise Behaviour Change Scale

This scale was developed along the guidelines suggested by Prochaska and DiClemente (1985) and adapted for exercise participation by Marcus et al. (1992). This is a five item questionnaire (of stages Precontemplation, Contemplation, Preparation, Action, and Maintenance) where one rates each item on a five point Likert scale, with 1 indicating strongly disagree and 5 strongly agree. This scale has received a Kappa index of two week reliability at 0.78, which indicates strong agreement (Fleiss, 1981). (See Appendix B)

3. Social Support

Social support, defined as perceived encouragement for exercise, was measured using a four item questionnaire developed specifically for elderly women by O'Brien Cousins (1995). This measure represents a composite of four sources of social reinforcement deemed important to the physical activity of elderly women: 1) previous family sport involvement, 2) current encouragement by at least one person to maintain physical fitness, 3) support from the family physician, and 4) peer or significant referent group interest and support in physical activity. The four items are to be answered using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) with question 1 and 4 reversed scored. Total scores can range from 4 (low support) to 20 (high support) and the instrument has demonstrated adequate test re-test reliability ($r=0.79$ $p<0.001$). In addition, a fifth item to investigate the role of program social support has been created for the current study. This item has been utilized in conjunction with the other four items on the 3 month testing period in order to investigate the influence of program social support specifically. (See Appendix C).

4. Enjoyment and Perceived Benefit of the Program

Although enjoyment and perceived gain from physical activity are frequently cited predictors of adherence, no formal constructs have been agreed upon and validated for use in this domain (Kimiecik & Harris, 1996). Further, complicated multi-scale questionnaires from other disciplines are likely to be inappropriate for the

elderly (Lee, 1993). Therefore, three simple questions regarding program enjoyment, perceived increase in physical strength from the program, and benefit to daily lifestyle have been developed for the current study. These questions have been posed in Likert scale format ranging from 1 (strongly disagree) to 5 (strongly agree) in order to create a parsimony with the previous constructs (See Appendix D).

Demographic Measurements

1. Age

Age was also measured as a possible predictor variable in the adherence equation. Age related declines in physical activity are prominent in epidemiological studies (Stephens & Casperson, 1994). As well, increasing age has been associated with both lower scores of exercise self-efficacy and perceived social support (O'Brien Cousins, 1995).(Appendix E).

2. Education

Formal education was divided into 7 groups for increased simplicity and less dependence on memory recall for the respondent. Groups ranging from 1 (less than seventh grade), to 7 (graduate professional training) were utilized (Hollingshead, 1957). The grouping of formalized education were as follows: 1. less than 7th grade, 2. junior high (8-9th grade), 3. partial high school (10-11th grade), 4. high school graduation, 5. partial college or specialized training (at least one year), 6. standard

university or college graduation, 7. graduate professional training (graduate degree) (Appendix E).

Strength Measurements

Strength measurements were assessed using the one repetition maximum format (1 RM). This format has been frequently utilized for strength testing procedures among the elderly (Mazzeo et al., 1998; Rhodes et al., 1998; Taunton et al., 1997; Rogers & Evans, 1993). For the purpose of the present study, two exercises were used as representative measures of overall upper body and lower body strength, based upon their utilization of large muscle groups: the leg press (lower body) and the chest press (upper body). These tests began with a five repetition warm-up and practice at the lowest set weight increment, followed by a two minute rest. A 1 RM was then attempted with a heavier weight followed by a three minute rest. This sequence was repeated until the 1 RM maximum was achieved. Repetition speed was controlled by the testers to a cadence of two seconds concentric contraction and two seconds eccentric contraction.

1. Chest Press

The chest press was completed using dumbbells for successive weight increment. The starting weight represented 2x5 pounds, followed by the following increments if needed: 2x8, 2x10, 1x12, 2x15, 2x20, and 2x25. On a flat bench, the

press was achieved by lowering the upper arms until parallel with the floor and then raising the arms to full extension.

2. Leg Press

A Universal Gym apparatus served to facilitate the leg press exercise. The starting weight represented 50 kilograms, followed by equally increasing increments of 7.5 kilograms until failure of a successful press. The leg press seat was positioned to place the participant's knees at a 90 degree angle when in the starting position. The subjects were then instructed to press their legs to full extension.

Statistical Analysis

(1) **Analysis / inspection of means, frequencies, and proportions among respondents.** An investigation of the means, frequencies, and proportions among participants allowed for explanation and inference of variable skewness, and description of response. These procedures were useful to describe variables that suffered from either obvious restriction of range or significant outliers and therefore would not be deemed significant in MRC analysis.

(2) **Pearson product moment or Spearman rank order correlations of variables with attendance at the different measuring times 0-3 months, 3-6 months and 0-6 months**. This procedure allowed for an observation of the strength of relationship between the independent variables and the dependent adherence measure at the three

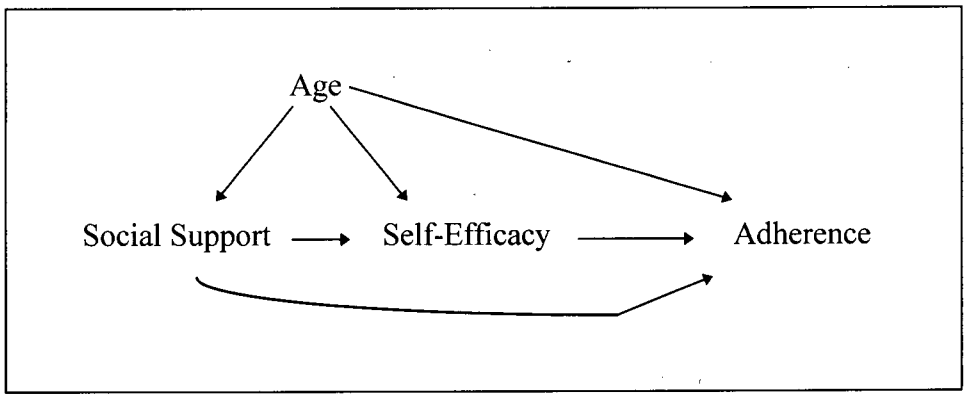
time periods. In conjunction of inspection of these correlation coefficients, variables were graphed using a scatter plot in order to further understand their relationship.

(3) **Hierarchical multiple regression analysis from stage to stage to determine predictors as well as total variance accountability of attendance**. With this analysis, significant predictors to the adherence regression equation were identified for both a total (6 month) significance and a stage by stage significance. First, the individual sources of social support were explored as predictors to adherence. This procedure was utilized in order to identify the best social support predictor(s) of adherence while reducing possible suppression by the composite score or multicolinearity by entering all sources into the regression equation. Regression equations involving physiological (e.g. strength), psychological (e.g. self-efficacy), social (e.g. social support) and demographic factors (e.g. age, education) at baseline and three months were then examined to attain the independent predictor variables that share the highest variance with the dependent adherence variable (attendance) at either 0-3, 3-6, or 0-6 month intervals. Age was entered first into the equations based upon the possible theoretical causation of the other independent variables. The stepwise procedure was then utilized for the remaining independent variables in order to maximize predictive parsimony. From these equations, scores of total significance (F ratio), multiple R^2, unique r^2 and betas for independent variables were reported.

(4) **Hierarchical regression analysis to examine independent variable prediction efficacy and relative predictive significance (MRC analysis of covariance) from baseline to 3 months and 0 - 6 months upon adherence.** Regression equations for significant predictor variables (found in the step-wise procedure) at previous time periods were entered into the regression equation at later time periods, thus testing for any significant increases across the second 3 month or entire six month time period. This procedure was accomplished by partialing the variance of a given predictor and adherence at baseline and testing for further predictive significance from the same predictor at 3 months while controlling for age.

(5) **Path analysis to examine theoretically proposed hypotheses identified in findings from the hierarchical multiple regression analysis at 0-3 months, 3-6 months, and 0-6 months.** Social Cognitive Theory's notion of reciprocal determinism indicates a mutual relationship between the social environment, cognition, and behaviour (Bandura, 1977). However, research (Duncan & McAuley, 1993) and Self-Efficacy Theory (Bandura, 1986) identify self-efficacy as a possible mediating factor between social support and exercise adherence. Further, the effects of age have been proposed to influence both efficacy cognitions and social support networks (O'Brien Cousins, 1995). Therefore, the following causal path hypothesis (Figure 7) was investigated utilizing multiple regression analysis and its generated path coefficients when social support, self-efficacy, and / or age were found significant to adherence:

Figure 7: Causal Hypothesis of Social Support, Age, and Self-Efficacy to Adherence



RESULTS

Introduction

This chapter details the results found from quantitative analysis, divided into sections of descriptive statistics, correlational findings, multiple regression procedures, and causal analysis. All statistical procedures were calculated utilizing the SPSS computer package. Adherence to the program was varied, but drop- out remained low over the program and similar to other prospective designs consisting of elderly subjects (Emery et al., 1992). Two drop-outs at the end of the first 3 months and 1 drop-out at the end of the 6 month trial comprised the drop-outs for the duration of the study. As such, 27 out of the original 30 were still regularly exercising at 6 months into the trial.

Descriptive Statistics

Descriptive statistics for all variables of interest are detailed in tables 2-4. Table 2 details the dependent variable adherence in the 3 ranges utilized for assessment: 0-3 months, 3-6 months, and the full 0-6 month period. Adherence has been transformed into an attendance percentage score to control for planned vacations among participants. Therefore, many subjects had different raw scores of attendance.

Table 2: Descriptive Statistics for Adherence

Variable (Dependent)	Mean	Std. Dev.	Min.	Max.	N
Adherence 0-3 Months	85.9	14.9	42	100	30
Adherence 3-6 Months	69.0	21.0	11	93	28
Adherence 0-6 Months	78.8	14.1	34	95	28

Table 3: Descriptive Statistics for Baseline Measurements

Variable (Independent)	Mean	Std. Dev.	Min.	Max.	N
Weight (kg)	70.5	16.9	47	128	30
Height (cm)	158.67	6.22	147.50	174.10	30
Age	76.4	1.6	74	80	30
Education	5	1.4	1	7	30
Strength (lb.) (Upper Body)	24.8	7.6	10	40	29
Strength (kg) (Lower Body)	97.2	26.8	65	157	30
Self-Efficacy	26.8	4.1	20	35	30
Social Support (Composite)	13.8	2.6	7	19	30
Support Since Middle-Age	3.0	1.3	1	5	30
Past Family Support	3.5	1.2	1	5	30
Physician Support	3.5	0.8	2	5	30
Current Peer & Family Support	3.6	1.2	1	5	30

Table 3 lists descriptive statistics for all independent variables at baseline measurement values. The mean for formalized education represented at least one year of university schooling with a large proportion of the sample consisting of some form of post-secondary education (see Figure 8). Consequently, the education level is above national norms for this age group (O'Brien Cousins, 1995). Self-efficacy scores ranged from moderately confident (20) to total confidence (35) with a mean score of slightly above moderate confidence (26.8). This level of self-efficacy falls

within the range from contemplation to maintenance behaviour stages in previous studies (Marcus et al., 1992). Therefore, the subjects indicate appropriate response norms for reported baseline physical activity levels. All four sources of social support showed means of similar magnitude (3-3.5) but proportions differed between sources (Figure 9). Most notable in figure 9 is the relatively low perceived support received since middle-age in comparison to past family support.

Figure 8: Level of Formalized Education

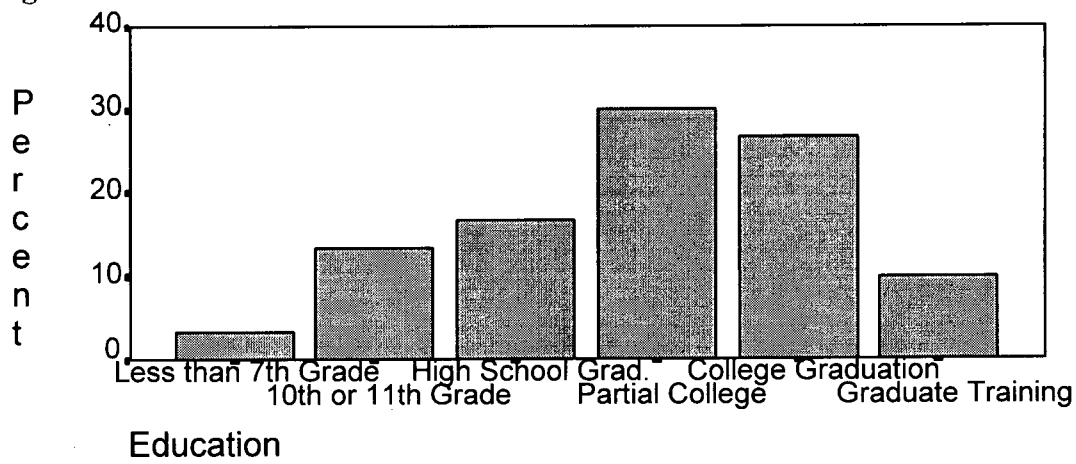
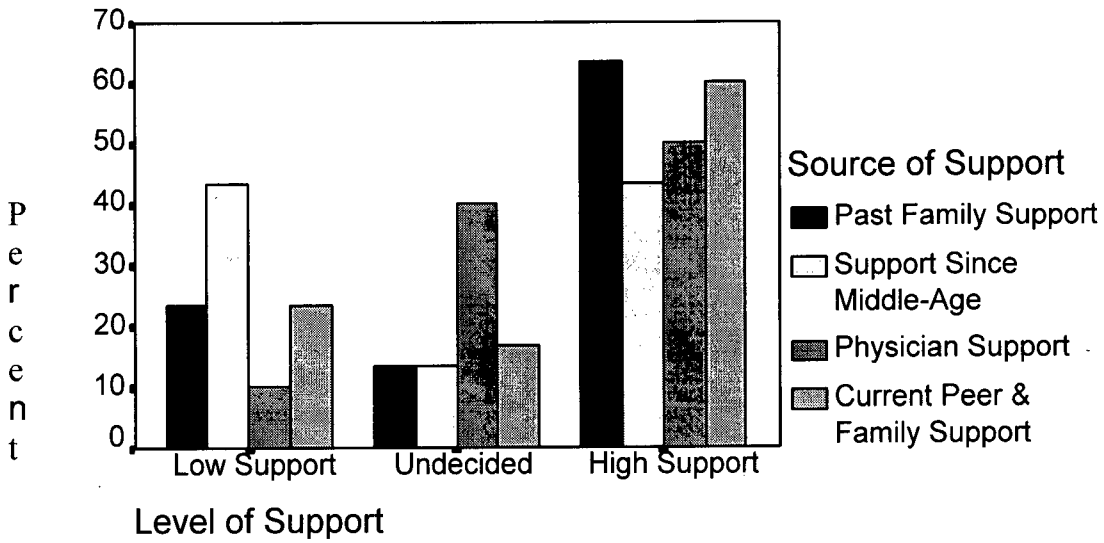


Figure 9: Sources of Social Support (at Baseline) Frequencies



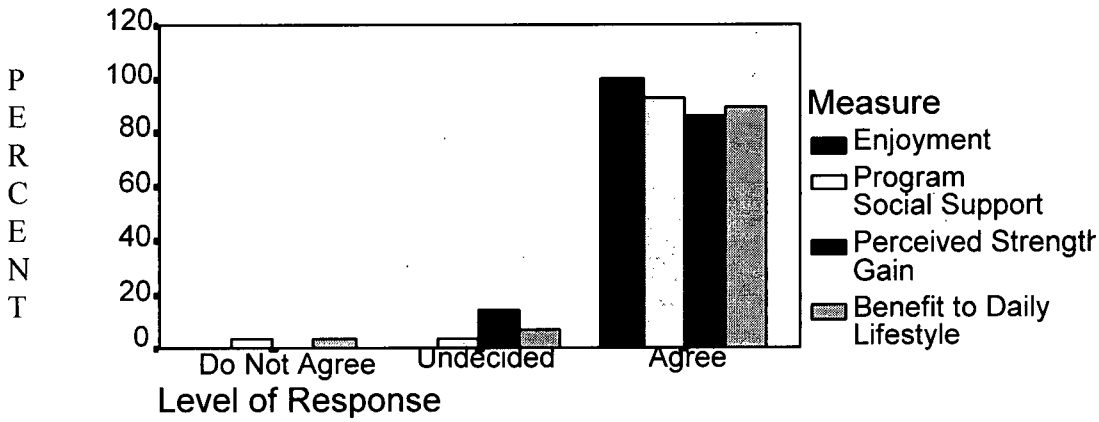
Note: The range of 5 point Likert scores pertaining to low support (1 & 2) and high support (4 & 5) have been combined for the purpose of graphical display. However, the full range of scores were utilized during correlational and multiple regression calculation.

Table 4 lists descriptives for the 3 month measurement time period of the study. Scores in self-efficacy, and social support indicate similar values as in table 3. However, the addition of self-report scores for perceived program social support, enjoyment, benefit to daily lifestyle, and strength gain were noticeably restricted in range (Figure 10).

Table 4: Descriptive Statistics For 3 Month Measurements

Variable (Independent)	Mean	Std. Dev.	Min.	Max.	N
Strength (lb.) (Upper Body)	37.6	10.3	20	60	26
Strength (kg) (Lower Body)	105.3	23.6	65	162.5	27
Self-Efficacy	27.6	3.8	18	35	28
Social Support (Composite)	14.6	2.7	8	19	28
Support Since Middle-Age	3.8	1.2	1	5	28
Past Family Support	3.7	1.1	1	5	28
Physician Support	3.8	0.8	2	5	28
Current Peer & Family Support	3.6	1.1	2	5	28
Program Support	4.4	0.7	2	5	28
Enjoyment	4.6	0.5	4	5	28
Benefit to Daily Lifestyle	4.3	0.8	2	5	28
Perceived Strength Gain	4.3	0.7	3	5	28

Figure 10: Examples of Restricted Range: Enjoyment, Program Support, Perceived Strength Gain, & Benefit to Daily Lifestyle Measurements at 3 Months



Note: The range of 5 point Likert scores pertaining to low (1 & 2) and high (4 & 5) have been combined for the purpose of graphical display. However, the full range of scores was utilized during correlational and multiple regression calculation.

Correlational Analysis

Tables 5 and 6 detail the correlations among the independent variables of interest with respect to adherence. Baseline measures with adherence for the first 3 months and their parallel correlation coefficients for overall 6 months are represented in table 5. Likewise, independent variable measurements at 3 months and their correlation with adherence during the second half of the six month trial are indicated in table 6.

Table 5: Correlations For Baseline Measures & Adherence

Variable (Independent)	Adherence 0-3 Months	Adherence 0-6 Months
Age	-0.35	-0.46**
Education	-0.21(Rho)	-0.14(Rho)
Strength (Upper Body)	0.03	-0.14
Strength (Lower Body)	-0.01(Rho)	0.13(Rho)
Self-Efficacy	0.49**	0.38*
Social Support (Composite)	0.19	0.18
Support Since Middle-Age	-0.17(Rho)	0.01(Rho)
Past Family Support	0.11	0.17
Current Peer & Family Support	0.44**	0.18
Physician Support	0.09	0.01

(* = P < .05, ** = P< .01) Rho = Spearman Rank Order Correlation

Table 6: Correlations For 3 Month Measurements & Adherence

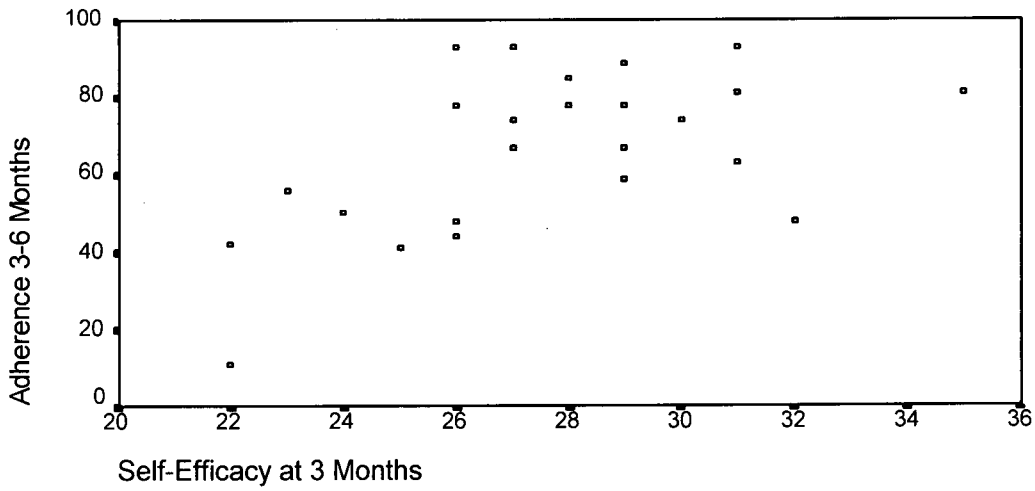
Variable (Independent)	Adherence 3-6 Months
Strength (Upper Body)	0.07
Strength (Lower Body)	-0.25
Self-Efficacy	0.51**
Social Support (Composite)	0.08
Support Since Middle- Age	0.06 (Rho)
Past Family Support	-0.05
Current Family & Peer Support	0.00
Physician Support	0.00
Program Social Support	0.15(Rho)
Enjoyment	0.26(Rho)
Perceived Strength Gain	0.15(Rho)
Benefit To Daily Lifestyle	0.15(Rho)

(* = P < .05, ** = P< .01) Rho = Spearman Rank Order Correlation

Independent variables with skewed or non-normal distribution were calculated using Spearman Rank Order correlations and have been identified with the notation of Rho. Otherwise, all correlation coefficients were calculated using the Pearson R Product Moment formulation. As mentioned previously, variables such as

program support, enjoyment, perceived strength gain, and benefit to daily lifestyle were distributed with a restricted range, thereby negating the possibility of demonstrating a strong association with adherence. Significant correlations for self-efficacy and adherence (0-3 months = 0.49, $p<.01$; 0-6 months = 0.38, $p<.05$; 3-6 Months = 0.51, $p<.01$) were found at all time periods, with the 3-6 month coefficient representing the strongest association in the study (see Figure 11). Other significant associations with adherence included age at 0-6 months (-0.46, $p<.01$), and current peer and family exercise social support at 0-3 months (0.44, $p<.01$). No other independent variables approached a significant linear relationship with adherence except for age at 0-3 months (-0.35, $p=.06$).

Figure 11: The Relationship Between Self-Efficacy (3 Months) and Adherence at 3-6 Months (r = 0.51, P<.01)



Multiple Regression Analysis

Based upon the preceding patterns of correlations among adherence and the demographic, social, psychological, and physiological variables above, 3 separate hierarchical regression equations were developed. Each equation represented the most parsimonious predictors of adherence at 0-3 months, 3-6 months, and 0-6 months. These expressions were derived by forcing age into the equation first in order to control for any causal influence upon possible variables to follow. Education, also a static variable, was not forced into the equation because of its poor association with adherence and other variables of noted interest (i.e. self-efficacy, and social support). Therefore, the obligatory forcing of this variable into the multiple regression calculation was hypothesized to only reduce the power of the expression. After age had been forced into the equation, the stepwise procedure was employed to enter variables into the formulation until further statistical significance was unavailable. To reduce multicolinearity and type 2 error, all sources of social support were tested first utilizing this stepwise procedure. Then, based upon any significant findings, the source(s) of support were placed among other independent variables for possible utilization in the final equation.

From the hierarchical format, the contribution of unique variance (sr^2) of independent variables to adherence could be ascertained. As well, total regression equation fit (F ratio) and variance explained have been reported. Results of all three regression analysis are provided in table 7.

Table 7: Hierarchical Multiple Regression Analysis

Part 1: Adherence 0-3 Months (* = P < .05, ** = P< .01)

Variable (Independent)	Beta	Unique R^2
1. Age	0.01	
2. Current Family & Peer Support	0.37*	0.12
3. Self-Efficacy	0.47*	0.12

Total Variance = 0.36; F(3,26) = 4.88 P<.01

Part II: Adherence 3-6 Months (* = P < .05, ** = P< .01)

Variable (Independent)	Beta	Unique R^2
1. Age	-0.37*	
2. Self-Efficacy (3 Months)	.42*	0.17

Total Variance = 0.39; F(2, 21) = 6.86 P<.01

Part III: Adherence 0-6 Months (* = P < .05, ** = P< .01)

Variable (Independent)	Beta	Unique R^2
1. Age	-0.46**	0.21

Total Variance = 0.21; F(1, 26) = 7.04 P<.01

Adherence for the first 3 months yielded two significant predictors while controlling for age. Current peer and family social support (Beta = 0.37, p<.05), along with self-efficacy (Beta = 0.47, p<.05) each contributed 12 % of unique variance to the total prediction equation. Total explained variance for the equation reached 36 percent (p<.01).

The next set of multiple regression analyses was investigated utilizing independent variables measured at time 2 (3 months) upon adherence from 3-6 months. Both age (Beta = -0.37, p<.05) and self-efficacy (Beta = 0.42, p<.05) were found significant to the prediction equation. However, no forms of social support or any other independent variables were deemed significant in the stepwise procedure. Total explained variance for the equation reached 39 percent (p<.01), while self-efficacy contributed 17 percent of unique variance.

In predicting overall adherence to the 0-6 month weight training program, only age (Beta = -0.46, $p<.01$) was found to contribute significant variance ($R^2 = 0.21$). Subsequently, no variables were entered during the stepwise procedure.

Multiple Regression Analysis Using Repeated Measures (ANCOVA)

Table 8 details an investigation of the significance of adherence with measurements at time 2 (3 months) while controlling for previous time 1 (baseline) scores and age. Self-efficacy proved to be the only variable significant at both measurement periods and therefore constitutes the sole investigative focus for 3-6 months and 0-6 months MRC ANCOVA adherence analysis. As such, self-efficacy was found to contribute significant unique variance to both 3-6 month (Beta = 0.47, $p<.05$; unique $r^2 = 0.17$), and 0-6 month (Beta = 0.45, $p<.05$; unique $r^2 = 0.16$) adherence.

Table 8: Multiple Regression Analysis Using ANCOVA

Part I: Adherence 3-6 Months (Controlling for Age & Self-Efficacy at Baseline)

Variable (Independent)	Beta	Unique R^2
Self-Efficacy (3 Months)	0.47*	0.17

(* = P < .05, ** = P< .01)

Part II: Adherence 0-6 Months (Controlling for Age & Self-Efficacy at Baseline)

Variable (Independent)	Beta	Unique R^2
Self-Efficacy (3 Months)	0.45*	0.16

(* = P < .05, ** = P< .01)

Causal Analysis

Causal analysis in figures 12-14 represents the findings of each previous hierarchical multiple regression analysis using the hypothesized path routes outlined in the statistical procedures section of the methods chapter. Path coefficients, however, have been reinterpreted using regression analysis equations specified for causal analysis in the hypothesized direct and indirect effects of the variables under study (Cohen & Cohen, 1983).

Figure 12: Causal Analysis of Adherence 0-3 Months Using Path / Partial Correlation Coefficients (* = P < .05, ** = P< .01)

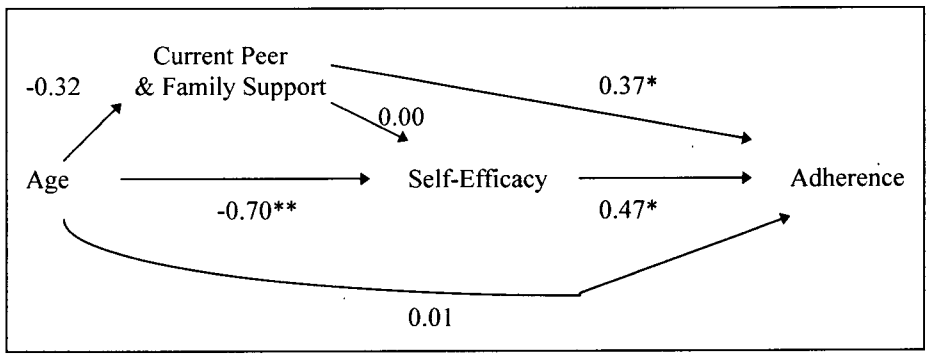
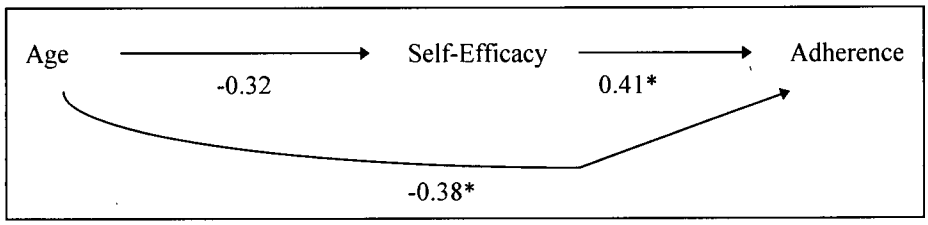


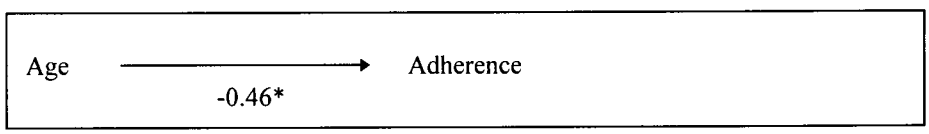
Figure 12 shows the hypothesized causal paths of current peer and family social support, self-efficacy, and age to adherence 0-3 months. Current peer and family support does not appear to carry an indirect effect through self-efficacy (Path = 0.00) in the sample, but does provide a significant direct effect upon adherence (Path = 0.37, p<.05). Likewise, self-efficacy provides a direct effect on adherence (Path = 0.47, p<.05). Age, although not directly significant to adherence (Path = 0.01), may be mediated through efficacy cognitions (Path = -0.70, p<.01) and to a large but non significant degree through current peer and family support (Path= -.32).

Figure 13: Causal Analysis of Adherence 3-6 Months Using Path / Partial Correlation Coefficients (* = P < .05, ** = P< .01)



Unlike the 0-3 month adherence period, figure 13 investigates the causal effects of age and self-efficacy upon adherence 3-6 months. Like the preceding hierarchical regression analyses, social support is no longer a significant cause of adherence. Self-efficacy (3 months) continues to provide a direct effect upon adherence (Path = 0.41, p<.05). However, age now also carries a significant causal effect on adherence (Path = -.38, p<.05), while still providing a large but non significant indirect effect through self-efficacy (Path = -0.32)

Figure 14: Causal Analysis of Adherence 0-6 Months Using Path / Partial Correlation Coefficients (* = P < .05, ** = P< .01)



Path analysis for the entire 6 month program adherence indicates only age (Path = -0.46, p<.05) as a significant causal variable (see Figure 14). No other independent variables under study were found significant in the hierarchical analysis.

DISCUSSION

Introduction

This chapter provides a discussion of the findings presented in this study. Results have been compared and contrasted to the present body of literature regarding exercise adherence and the elderly. Moreover, limitations of results, variability of possible conclusions, and future research directions have been suggested in reference to the conclusions of this study.

Discussion: (1) **Variables that predict and explain adherence to a strength training program among elderly women.**

Predictors of Adherence at 0-3 Months

Two prediction variables at baseline measurement were found to account for significant unique variance in the first three months of adherence to a strength training program for elderly women. Both self-efficacy, and current peer and family social support contributed 12 percent of unique variance towards the total prediction variance of 36 percent. Although age was not significant to adherence 0-3 months in either the previously mentioned regression equation, or in Pearson product-moment correlational analysis, important factors were observed that demonstrated its necessary inclusion as a first order variable in the hierarchical analysis.

Age has been inversely associated with scores of both exercise social support and self-efficacy in previous cross-sectional research of older females (O'Brien Cousins, 1995). Further, in the present study, age was found to correlate with baseline levels of self-efficacy (-0.70, $p<.01$) and current peer and family social

support (-0.32, p=.08). Therefore, age was entered into the regression equation first, in order to partial any causal variance that might be otherwise misinterpreted towards adherence by the two predictor variables

The significance of current peer and family support towards exercise has also been found in previous research as the most important source of social support for late life activity among females (Sallis et al., 1989; O'Brien Cousins, 1995). As well, self-efficacy has shown similar explained unique variance and correlational magnitude with adherence within the first 3 months of exercise adoption in a prospective study of women aged 45-64 (McAuley, 1992). Finally, the equal contributions towards adherence that both self-efficacy and social support provide has been previously reported in research among older women (O'Brien Cousins, 1995).

Predictors of Adherence at 3-6 Months

Following in the same procedural format as the hierarchical regression equation for prediction of adherence 0-3 months, a new equation was generated for adherence 3-6 months. At this time period, only age and self-efficacy were found significant to the adherence of strength training. Total explained variance for the equation reached a significant 39 percent, while self-efficacy contributed a unique 17 percent of that variance when controlling for the effect of age.

Contrasting the findings from adherence 0-3 months, current peer or family exercise social support or any other source of support was not statistically significant at this time period. One plausible reason for this finding surrounds the strong

consensus of support within the training group. Perhaps group social support removed the effect of peer and family support found in the first 3 month segment of adherence. Group support within the program seemed very strong from observation. Unfortunately, the restricted positive range found from the measurement of program support negates the ability to test this hypothesis.

Also in contrast to the 0-3 month findings is the inclusion of age as a significant variable within the prediction equation. This finding, however, does not conflict with the previous analysis. Age was not statistically significant ($P<.05$) in regression of adherence 0-3 months but did provide a rather strong correlation (-0.35, $p=.06$). Therefore, the trend towards age and lower strength training adherence has merely been further amplified in the second half of the trial.

Self-efficacy increased its unique explained variance by 5 percent in the second 3 months of the exercise trial. This is in agreement with the findings of McAuley (1993) and the concept of self-efficacy and increased demand. McAuley (1993) states:

> It is argued that regular participation during a structured program and participation following termination of the program place different demands on the individual. Participation in a leader supportive, consistent, and convenient exercise program might be considered a low demand situation beyond the adoption and adaptation phase. Conversely termination of such a program places the onus for continued participation entirely on the participants, a high demand

situation. As the desired behaviour becomes more demanding of the individual , self efficacy is hypothesized to play a more important role in the behaviour (Bandura, 1986).

The exercise program in this present study involved an organized leader oriented situation for the first 3 months of adoption and adaptation. However, the second 3 month period was essentially unsupervised and not organized by date, time, or location. Therefore, adherence to the program was independent for each participant from the support of trainers and commitment.

Predictors of Adherence at 0-6 Months

An amalgamation of the attendance for both 3 month time periods provided the entire adherence 0-6 months variable for analysis. Only age was found to be statistically significant in this regression equation, accounting for 21 percent of the explained variance in adherence. Upon inspection of scatterplot data, an outlier representing the oldest of the group and the lowest of adherence percent was identified. It was suspected that this outlier may have produced the strong prediction scores of age and adherence. Therefore, it was temporarily removed from analysis in order to investigate the subsequent effect of age upon adherence. However, even with this outlier removed, the equation was still significant ($p<.05$), albeit less so, and no variables other than age were entered into the stepwise prediction formulation. The same procedure was completed for both adherence 0-3 months and 3-6 months, with similar results. Therefore, age did remain a significant predictor of adherence even when a noticeably extreme outlier was removed.

Age was not a significant predictor of adherence to an aerobic program among elderly women in a previous study that included similar methodology (Williams & Lord, 1995). However, this previously mentioned study included a mean age (71.6 +/- 5 yrs.) almost five years younger than the present investigation. Age may unfortunately become an important determinant for lower continued exercise behavior among individuals 75 and older. Nevertheless, other factors known to correlate with age such as physiological or perceived health and bio-medical status (King et al., 1992) may be responsible for the age effect found in this study.

The disappearance of self-efficacy as a significant predictor of adherence for the full 0-6 month strength training trial may reflect Social Cognitive Theory's concept of reciprocal causation (Bandura, 1986). Self-efficacy measurement was significant for both short term 3 month prediction periods, however baseline scores failed to predict the aggregation of the second 3 month term. Bandura (1986) postulates that cognition, the environment, and behaviour interact in a reciprocal fashion. Therefore, exercise behaviour over the relative short term may be significantly predicted by efficacy cognitions. However, long term behaviour also may influence self-efficacy, thereby lowering the predictive power of baseline measurements.

Predictor Variables Found Non-Significant

1. Education

Formal education has been consistently associated with lower exercise behaviour (King et al., 1992). However, most physical activity studies that have examined this relationship have been cross-sectional and epidemiologically based, rather than prospective designs and exercise trials. Therefore, naturally occuring rates of physical activity rather than exercise adherence may be responsible for these findings. It has been proposed that education effects upon adherence may disappear when participation is the outcome of interest (Brill et al., 1991). This statement is in agreement with the findings of this study. However, the sample was noticeably biased in distribution towards many years of formal education (Figure 8) and did not control for other known correlates such as income, accessibility, and availability of resources (Shephard, 1994). Therefore, more study is required to examine the direct effect of education upon exercise adherence.

2. Strength

Neither lower nor upper body strength were found to predict adherence at any time point from 0-6 months. This is in agreement with the findings of Williams and Lord's (1995) similar study of older women at the 0-6 month time range. Their study, however, did indicate strength to become a predictor of adherence over the full year of the aerobic-based program. It is unknown whether strength would produce similar or exaggerated effects in the present study since strength should be the outcome result of exercise adherence to a progressive resistance training program.

3. Social Support

The composite score for four sources of social support: 1) support since middle-age, 2) current peer and family support, 3) physician support, and 4) past family support was not a significant predictor of adherence at any measurement time during the study. Moreover, only baseline current peer and family support significantly predicted adherence at 0-3 months. At no other time was social support found significant. This is in disagreement with cross-sectional research using the same instrumentation (O'Brien Cousins, 1995), however, several studies of prospective manner have indicated similar findings to this study (Chogahara et al., 1998) One factor of difference between prospective and cross-sectional research is the identification of program social support, as those who do not exercise cannot respond to this variable. Strong perceived social support from participants in the exercise program may remove or minimize the effects of other non-supportive sources. Current research needs to examine various influences that are activated across the full range of social relationships rather than a simple additive model (Chogahara et al., 1998). As mentioned previously, perceived program social support for this study was exceedingly high but restricted in range. Therefore, its predictive effect upon adherence was essentially untestable. Program social support may be an instrumental force towards continued elderly female exercise participation, however, the current measure of response unfortunately lacked the precision to explore this hypothesis.

4. Enjoyment, Perceived Strength Gain, and Benefit to Daily Lifestyle

As with program social support, enjoyment, perceived strength gain, and benefit to daily lifestyle were severely restricted in range of response. Although individuals who reported lower scores on these measurements tended to adhere slightly less, the restricted range of scores rendered investigation statistically insignificant. Therefore, activity enjoyment, and perceived gains and benefits may be important factors towards even engaging in a strength training program, but do not significantly discriminate attendance.

Conclusions

Three hierarchical regression analysis equations for prediction of adherence to a strength training program for elderly women at 0-3 months, 3-6 months, and the full 0-6 months yielded a total of three significant predictor variables. At time 0-3 months both self-efficacy and current peer and family social support were significant ($p<.05$) when controlling for the causal effects of age. However, by the second half of the program (3-6 months) both age and self-efficacy were significant ($p<.05$), while the social support variable dropped-out of the regression equation. Finally, upon investigation of the entire 6 month trial, only age contributed significant variance towards the prediction of adherence. Several independent variables under study were not found to associate with adherence in any statistically significant fashion such as: strength (lower and upper body), formalized education, enjoyment, perceived strength gain and benefit to daily lifestyle, as well as various sources of social support.

Limitations & Future Research

1. Reliability and Validity of Measures

Reliability and validity issues surrounding the use of exercise self-report questionnaires indicate several points of caution when interpreting findings (Lamb & Brodie, 1990). For example, these methods are likely to suffer from social desirability bias, whereby participants overestimate questionnaire scoring in order to satisfy the experimenter. Although questions for current peer and family support, past family support, and benefit to daily lifestyle were reverse scored in order to attempt to counter this form of acquiescence, several questions and questionnaires (such as self-efficacy) may have been unduly influenced by this bias.

Further, the accuracy of recall can suffer if respondents have poor memory or lack motivation. Memory and motivation issues may have been a factor influencing this aged population, however no formal screening or testing was utilized to control for this possibility.

Also, due to weekly fluctuations in exercise behaviour, self-report questionnaires can lack the sensitivity to measure changes accurately. Three month measurement increments could certainly be influenced by poor sensitivity to capture the average of the three month period. However, contrary to this sensitivity issue surrounds the learning effect that can occur from repeated testing in short duration. Therefore this limitation remains difficult to rectify.

Finally, the reliability and validity of the strength testing procedure is also a possible limitation to the results of this study. Aspects such as fluctuations in effort

perception, fear of injury, precision of the weight increments, and fatigue before reaching a true 1 RM may have confounded these results. The elderly population is likely influenced by these factors more than younger and middle-aged adults. Therefore, future studies need to attempt to control for these possible confounders.

2. Generalizability

As with other prospective studies of the exercise adherence nature, the generalizability of the findings may not reflect the total female senior citizen community. Volunteers for this type of research tend to be of higher education and motivation levels than the community norm, and the present study continues to reflect this feature. However, these findings can be generalized to females between the age of 75-80 that are interested and plan to engage in a strength training program with a similar intervention effort. Therefore this research is beneficial for developing strategies to increase adherence in programs similar to the study.

3. Type 1 Error

When multiple variables are analyzed and many statistical procedures performed, there becomes a greater probability that some findings may occur by chance. This limitation, known as experiment-wise error, could have been present in this study. However, attempts were made to reduce the total number of multiple comparisons by only performing statistical procedures that addressed the specific research questions. Further, variables that showed low and insignificant correlation

with the dependent and independent variables of interest (i.e. adherence, self-efficacy, and age) were not added to the stepwise procedure. This method was attempted in order to reduce the comparison-wise error rate for any given regression equation.

4. Length of the Study

Although six months is a long enough duration to appropriately investigate the adoption process of the program, the long term adherence rate cannot be assessed. Prospective adherence research beyond the first six months of adoption and adaptation is scarce for any age group (Dishman, 1994a). Therefore, future research is needed to investigate what variables predict and explain adherence years after initiation.

Discussion: (2) **Variables that vary in predictive importance to adherence during the six months of the trial.**

Self-Efficacy at 3 Months

As self-efficacy proved to be the only variable measured at time 1 (baseline) and time 2 (3 months) that remained a significant predictor of adherence, an analysis of covariance using hierarchical regression was performed. This procedure was utilized to identify whether self-efficacy at time 2 (3 months) still contributed unique significant variance to adherence 0-6 months and 3-6 months, when controlling for its baseline measurement. As with the regression analysis reported earlier, age was also partialled from these equations in order to control for any shared variance with

adherence. Self-efficacy at 3 months was found to contribute substantial significant unique variance towards adherence 0-6 months (0.16, $p<.05$) and 3-6 months (0.17, $p<.05$) even when age and self-efficacy at baseline were partialled from the equation.

Consequently, baseline measurement of self-efficacy failed to significantly predict adherence 0-6 months, while the 3 month measurement was significant. This finding has been supported in previous research, as the strength of relationship between self-efficacy and physical activity can be weak and varies widely (McAuley, 1992). Therefore, the research question raised by Dzwaltowski (1994), "not 'if' but 'when' does self-efficacy influence physical activity?" seems appropriate to pursue.

Fazio (1990) outlines that cognitions relate to behaviour in two ways: 1) theory driven, and 2) data driven. Theory driven cognitions towards a behaviour focus upon retrieval of previously stored information, while data driven cognitions are retrieved from immediate salient environmental cues to the specified behaviour. Data driven cognitions towards a behaviour tend to provide better prediction capability than their theory driven counterparts when time for thought is available (Fazio, 1990). Participants in this program , may have produced stronger associations between adherence behaviour and self-efficacy at time 2 (3 months) because of data driven exercise efficacy cognition availability. Self-efficacy responses at baseline would likely reflect theory driven exercise adherence capability. Even though all participants had been previous regular exercisers at one time, strength training was a salient experience for most. Therefore, the participation of

strength training may have altered efficacy cognitions at 3 months and increased its overall predictive ability towards adherence.

The time 2 self-efficacy scores may have also been increased in significant predictive importance in comparison to baseline levels because of the reciprocal relationships of self-efficacy and physical activity. As mentioned previously, Bandura's (1986) concept of reciprocal determinism hypothesizes that behaviour influences cognition as well as cognition influencing behaviour. Therefore, although the focus of this study relied upon prediction of behaviour, this reciprocal relationship certainly needs to be addressed. Perhaps attendance behaviour from the first three months produced a reinterpretation of exercise adherence efficacy cognitions. This seems a possibility, especially among those participants that were in the contemplation and preparation stages of behaviour change at baseline. These individuals may be utilizing theory driven efficacy cognitions regarding exercise adherence at a younger age. Therefore, predictive capabilities of baseline self-efficacy scores would be less significant over longer duration than 3 month scores, as indicated in the present study.

Conclusions & Future Research

In summary, Self-efficacy at time 2 (3 months) was found to significantly ($p<.05$) predict adherence 3-6 months and 0-6 months, while controlling for the effects of both self-efficacy at baseline and age. Future research needs to continue to examine the influence of self -efficacy upon physical activity at various stages in continued exercise behaviour. As well, the predictive influence upon other dynamic

variables of interest (e.g. perceived barriers, social support, mood states) should be investigated upon their relative contribution throughout the exercise adherence process.

Discussion: (3) **The indirect and direct effects upon adherence by age, social support, and self-efficacy.**

Causal analysis was utilized to identify the relative direct and indirect contributions of variables found significant to adherence in the previous hierarchical regression analyses. Rather than using a data driven theory trimming technique, the hypothesized causal routes of age, self-efficacy, and social support presented in the methods section were examined. However, one possible limitation to this analysis procedure involves the exclusion of indirect effects regarding several variables under study not found significant to adherence. As mentioned in the hierarchical regression analysis discussion, these variables did not correlate strongly with any significant predictors. Therefore, it was unlikely these variables provided any significant indirect causal effect through age, self-efficacy, or social support.

Causal Analysis of Adherence at 0-3 Months

Causal analysis of self-efficacy, and current peer and family social support indicated significant direct effects upon adherence 0-3 months ($p<.05$). Moreover, age may provide indirect effects through self-efficacy ($p<.01$) and current peer and family social support ($p=.08$).

One important factor for consideration before further interpretation of these results involves reciprocal determinism (Bandura, 1986). Personal, environmental,

and behavioural factors operate as reciprocal interacting determinants of each other as hypothesized by Social Cognitive Theory. The focus of this research is rather one sided, however, primarily investigating causal analysis of cognition and social forces upon behaviour. Nevertheless, path analysis still provides interesting information by investigating direct and indirect effects of age upon self-efficacy and social support, and social support on self-efficacy.

This latter relationship of social support on self-efficacy was a research question of interest. Previous research has found that self-efficacy mediates the relationship of social support upon adherence (Duncan & McAuley, 1993). However, in contrast to these findings, social support had no mediating effect through self-efficacy (Path=.00) in the present study. Three important differences between these studies may explain the discrepancies of the findings.

First, Duncan and McAuley (1993) used a more comprehensive measure of program social support 3 months into an exercise trial, whereas this support measure reflected baseline levels of current peer or family activity levels. Therefore, both the source of social support and the temporal relationship between studies differed.

Second, the age spread between both studies was markedly different. In the present study, females recruited were aged between 75-80 years, while Duncan and McAuley (1993) utilized a sample of 45-64 year old subjects. Perhaps social support importance to both adherence and self-efficacy varies throughout the aging process.

Finally, the lack of any relationship between social support and self-efficacy in the present study may be an anomalous finding explained by either this source of

support, or the sample group in the present study. Self-efficacy and social support are commonly interactive in virtually all aspects of health promotion (Bandura, 1997). Therefore, perhaps this measurement of current peer and family support level is not a valid indication of social support. Likewise, self-efficacy may not have correlated strongly with current peer and family social support because of inflated responses from currently sedentary participants at baseline, utilizing theory driven efficacy schemas.

For example, current peer and family support correlated significantly with a participants baseline stage of behaviour change ($r = .50$, $p<.01$), indicating that those who are frequently associated with active peers or family are likely to be active themselves. However, contrary to normal strong associations between level of self-efficacy and stage of behaviour change (Marcus et al., 1992; Marcus and Prochaska, 1994), the current sample did not correlate to any significant degree ($r = 0.17$). This finding has probably occurred because all participants have engaged in regular exercise at some time in their lives. Since previous experience with a behaviour is the most important source of increasing efficacy (Bandura, 1997), perceived capabilities towards exercise adherence are likely to be quite high, even among those who are currently sedentary. Further, theory driven exercise efficacy responses at baseline may be over-exaggerated, due to utilizing cognitions towards adherence at a younger age. Therefore, the lack of relationship between current peer and family social support and self-efficacy may be explained by these confounding factors

Causal Analysis of Adherence at 3-6 Months

Path analysis for adherence 3-6 months identified significant direct effects for both self-efficacy and age ($p<.05$). Current peer and family social support was no longer found to provide a significant direct or indirect effect upon adherence and therefore dropped from the causal analysis. As mentioned in the regression analysis discussion, it was hypothesized that program social support may have reduced the causal effect of current peer and family support by three months into the exercise classes.

Age continued to be indirectly influenced through self-efficacy, though statistically insignificant, but also provided a direct effect upon adherence. Perhaps efficacy cognitions mediate the relationship between age and adherence among older participants in the short term, but are less temporally stable than younger adults. This could possibly occur because of perceived and actual health fluctuations from the elderly. A criticism of the self-efficacy instrument used in this study is the absence of perceived health barriers to exercise adherence. Research indicates that the prediction magnitude of self-efficacy can be largely amplified if the measure resembles the types of sub-skills required to successfully execute the behaviour (McAuley, 1992). Perhaps self-efficacy, with inclusion of this barrier may have been a significant predictor over adherence 0-6 months. Simply controlling for illness and injury among adherence scores was deemed inappropriate, since most participants complained of multiple aches and pains but continued to adhere.

Unfortunately, program social support was restricted in range. Therefore, investigating a mediation effect of self-efficacy upon program support and adherence was not possible. However, the one subject who dropped-out at 6 months responded with low self-efficacy and was the only participant to not perceive encouragement from the exercise group. Other than this participant, self-efficacy scores may have lacked the variability to mediate the program social support and adherence relationship. Self-efficacy scores at three months averaged approximately 80 percent confidence to adhere, while no scores were below moderate confidence. Perhaps lower scores of adherence efficacy are required to begin removing the appreciation of group support.

Causal Analysis of Adherence at 0-6 Months

Causal analysis for the total six month adherence variable indicated only age as significant ($p<.05$). As discussed in the previous section, several factors could have contributed to this finding. Physical activity decreases and age is complicated by biomedical factors (King et al., 1992). Self-efficacy may have provided direct causal significance to adherence 0-6 months if perceived heath barriers were included in the instrumentation. Still, predictors in the psychological domain are not static and vary from stage to stage of activity, supporting the reciprocally determining nature of Social Cognitive Theory (Bandura, 1986), or what Sallis et al. (1989) refer to as "the natural history of exercise".

Conclusions & Future Research

In summary, causal analysis indicated significant indirect effects for age through self-efficacy, and direct effects of self-efficacy and current peer and family social support upon adherence 0-3 months. Adherence 3-6 months was significantly caused by the direct effects of both age and self-efficacy, while only age significantly caused adherence for the full 6 month program. Perhaps biomedical conditions, such as illness and aches or pains contributed to the age effect over the 6 months of the program. Further, the inclusion of perceived health to self-efficacy instrumentation was warranted to possibly increase the long term significance of efficacy cognitions and exercise adherence in elderly subjects.

Future research using causal analysis to understand the direct and indirect effects of determinants on adherence would benefit from including a variety of variables and a larger, more diverse sample population. This procedure would increase generalizability of the complexities surrounding possible psychological, social, physiological, and demographic determinants of adherence to the community setting.

REFERENCES

Ajzen, I. & Fishbein , M. (1980). *Understanding Attitudes and Predicting Social Behaviour*. Englewood Cliffs, Prentice Hall: NJ

Ajzen, I. (1985). From intentions to actions: A theory of planned behaviour. In Kuhl, J., & Beckman, J. (Eds.), *Action Control: From Cognition to Behavior*. Springer: Heidelberg.

Ajzen, I., (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.

Ashworth, P. (1997). Breakthrough or bandwagon? Are interventions tailored to stage of change more effective than non-staged interventions? *Health Education Journal*, 56, 166-174.

Atkins, C.J., Kaplan, R.M., Timms, R.M., Reinsch, S., Lofback, K. (1984). Behavioral exercise programs in the management of chronic obstructive pulmonary disease. *Journal of Consulting and Clinical Psychology*, 52, 591-603.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavior. *Psychological Review, 84, 191-215.*

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology*, 4(3), 359-373.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control.* W.H. Freeman & Co: New York.

Baranowski, T. (1988). Validity and reliabilityof self report measures of physical activity: An information-processing perspective. *Research Quarterly for Exercise and Sport*, 59, 314-327.

Barke, C.R., & Nicholas, D.R. (1990). Physical activity in older adults: The stages of change. *Journal of applied gerontology*, 9(2), 216-223.

Bauman, A., Owen, N., & Rushworth, R.L. (1990). Recent trends and sociodemographic determinants of exercise participation in Australia. *Community Health Studies*, 14, 19-26.

Belisle, M., Roskies, E., & Levesque, J.M. (1987). Improving adherence to physical activity. *Health Psychology*, 6, 159-172.

Beningston, V., Reddy, M., & Gordon, C. (1985). Aging and self conceptions: Personality processes and social contexts. In Birren, J.E., Schaie, K.W. (Eds.), *Handbook of the Psychology of Aging*. Van Nostrand Reinhold: New York, NY.

Bennett, K., & Morgan, K. (1992). Activity and morale in later life: Preliminary analysis from the Nottingham Longitudinal Study of Activity and Aging. In Norgan, N. (Ed.), Physical Activity and Health. Cambridge University Press: Cambridge, UK.

Blumenthal, J.A., Williams, R.S., Wallace, A.G., Williams, R.B., & Needles, T.L. (1982). Physiological and psychological variables predict compliance to prescribed exercise therapy in patients recovering from myocardial infarction. *Psychosomatic Medicine*, 44(6), 519-527

Bouchard, C., Shephard, R.J., & Stephens, T. (Eds.) (1994). *Physical Activity Fitness and Health.* Human Kinetics: Champaign, IL

Brill, P.A., Kohl, H.W., Rogers, T., Collingwood, T.R., Sterling, C.L., & Blair, S.N. (1991). Recruitment, retention, and success in worksite health promotion: Association with demographic characteristics. *American Lournal of Health Promotion*, 5, 215-221.

Canada Health Survey (1982). Health & Welfare Canada: Ottawa, ON.

Canada Fitness Survey (1983). *Fitness and Lifestyle in Canada.* Directorate of Fitness and Amateur Sport: Ottawa, ON.

Canada Fitness Survey (1984a). *Fitness and Aging.* Government of Canada.

Canada Fitness Survey (1984b). *Changing Times: Women and Physical Activity.* Government of Canada

Carmody, T.P., Senner, J.W., Manilow, M.R., & Mattarazzo, J.D. (1980). Physical exercise rehabilitation: Long term drop out rate in cardiac patients. *Journal of Behavioral Medicine*, 3, 163-168.

Caspersen, C.J., Christenson, G.M., & Pollard, R.A. (1986). Status of the 1990 physical fitness and exercise objectives-evidence from NHIS 1985. *Public Health Reports*, 101, 587-592.

Casperson, C.J., Merritt, R.K., & Stephens, T. (1994). International Physical Activity Patterns: A Methodological Perspective. In Dishman, R.K.(Ed.), *Advances in Exercise Adherence.* Human Kinetics: Champaign, IL.

Chogahara, M., O'Brien Cousins, S., Wankel, L.M. (1998). Social influences on physical activity in older adults: A review. *Journal of Aging and Physical Activity*, 6(1), 1-17.

Cohen, J. & Cohen, P. (1983). *Applied Multiple Regression / Correlation Analysis for the Behavioral Sciences.* Lawrence Erlbaum: New Jersey.

Cohen, J.(1988). *Statistical Power Analysis for the Behavioral Sciences.* Academic:New York, NY.

Courneya, K.S. (1995). Understanding readiness for regular physical activity in older individuals: An application of the theory of planned behavior. *Health Psychology*, 17(1), 80-87.

Courneya, K.S. (1995). Perceived severity of the Consequences of physical inactivity across the stages of change in older adults. *Journal of Sport and Exercise Psychology*, 17, 447-457.

Cox, M.H. (1984). Fitness and lifestyle programs for buisiness and industry: Problems in recruitment and retention. *Journal of Cardiac Rehabilitation*, 4, 136-142.

Curtis, J., & White, P. (1984). Age and Sport Participation: Decline in participation with age or increased specialization with age. In Theberge, N., & Donnely, P. (Eds.), *Sport and the Sociological Imagination*. Texas Christian University Press: Fort Worth, Texas.

Davis, C., Fox, J., Brewer, H. & Ratusny, D. (1995). Motivations to exercise as a function of personality characteristics, age, and gender. *Personality and individual Differences*, 19(2), 165-174.

Dishman, R.K., Sallis, J.F., & Orenstein, D.O. (1985). The determinants of physical activity and exercise. *Public Health Reports*, 100, 158-171.

Dishman, R.K. (1988). Overview. In Dishman, R.K. (Ed.), *Exercise Adherence: Its Impact on Public Health*. Human Kinetics: Champaign, IL., 1-9.

Dishman, R.K. (1989). Determinants of physical activity and exercise for persons 65 years and older. In Spirduso, W.W., & Eckert, H.M. (Eds.), *Physical Activity and Aging*. Human Kinetics: Champaign, IL, 140-162.

Dishman, R.K. (1990). Determinants of participation in physical activity. In Bouchard, C.J., Shephard, R.J., Stephens, T., Sutton, J.R., & McPherson, B.D. (Eds.), *Exercise, Fitness, and Health: A Consensus of Current Knowledge*. Human Kinetics: Champaign, IL, 75-101.

Dishman, R.K. (1991). Increasing and maintaining exercise and physical activity. *Behavior Therapy*, 22(3), 345-378.

Dishman, R.K. (1994a). Introduction: Consensus, problems, and prospects. In Dishman, R.K. (ed.), *Advances in Exercise Adherence*. Human Kinetics: Champaign, IL., 1-27.

Dishman, R.K. (1994b). Motivating older adults to exercise. *Southern Medical Journal*, 87, 79-82.

Dishman, R.K. (1994c). Predicting and changing exercise and physical activity: What's practical and whats not. In Quinney, H.A., Gauvin, L., & Wall, A.E.T. (Eds.), *Toward Active Living*. Human Kinetics: Champaign, IL.

Dishman, R.K., & Sallis, J.F. (1994). Determinants and interventions for physical activity and exercise. In Bouchard, C., Shephard, R., & Stephens, T. (Eds.), *Physical Activity, Fitness, and Health: International Proceedings and Consensus Statement*. Human Kinetics: Champaign, IL., 214-256.

Duda, J.L., & Tappe, M.K. (1989a). Personal investment in exercise among middle aged and older adults. In Ostrow, A. (Ed.), *Aging and Motor Behavior*. Benchmark Press: Indianapolis, IN, 219-238.

Duda, J.L. & Tappe, M.K. (1989b). Personal investment in exercise among older adults: The examination of age and gender-related differences in motivational orientation. In Ostrow, A. (Ed.), *Aging and Motor Behavior*. Benchmark Press: Indianapolis, IN, 239-256.

Duncan, T.E., & McAuley, E. (1993). Social support and efficacy cognitions in exercise adherence: A latent growth curve analysis. *Journal of Behavioural Medicine*, 16, 199-218.

Dzewaltowski, D.A. (1989a). Toward a model of exercise motivation. *Journal of Sport and Exercise Psychology*, 11, 251-269.

Dzewaltowski, D.A. (1989b). A social cognitive theory of older adult exercise motivation. In Ostrow, A. (Ed.), *Aging and Motor Behavior*. Benchmark Press: Indianapolis, IN, 257-281.

Dzewaltowski, D.A., Noble, J.M., Shaw, J.M. (1990). Physical activity participation: Social cognitive theory versus the theories of reasoned action and planned behavior. *Journal of Sport and Exercise Psychology*, 12, 388-405.

Dzewaltowski, D.A. (1994). Physical activity determinants: A social Cognitive approach. *Medicine and Science in Sports and Exercise*, 26(11), 1395-1399.

Emery, C.F., & Blumenthal, J.A. (1990). Perceived change among participants in an exercise program for older adults. *Gerontologist*, 30(4), 516-521.

Emery, C.F., Hauck, E.R., & Blumenthal, J.A. (1992). Exercise adherence or maintenance among older adults: 1-Year follow-up study. *Psychology and Aging*, 7, 466-470.

Evans, W.J. (1995). Reversing sarcopenia: How weight training can build strength and vitality. *Geriatrics*, 51(5), 46-53.

Eysenck, H.J. (1981). *A Model For Personality*. Heidelberg: Springer.

Farquhar, M. (1995). Elderly people's definitions of quality of life. *Social Science and Medicine*, 41(10), 1439-1446.

Fazio, R.H. (1990). Multiple processes by which attitudes guide behaviour: the mode model as an integrative framework. In *Advances in Experimental Social Psychology*, 23, Zanna, M. (Ed.). Academic Press: New York, 75-109.

Fiatarone, M.A. & Evans, W.J. (1993). The etiology and reversibility of muscle dysfunction in the aged. *Journal of Gerontology*, 48, 77-83.

Fiatarone, M.A., O'Neill, E.F., Ryan, N.D. (1994). Exercise training and nutritional supplementation for physical frailty in very elderly people. *New England Journal of Medicine*, 320(25), 1769-75.

Fishbein, M. & Ajzen, I. (1975). *Beliefs, Attitude, Intention, and Behavior: An Introduction to Theory and Research.* Addison-Wesley: Reading, MA.

Fleiss, J.L. (1981). Statistical Methods for Rates and Proportions (2nd ed.). Wiley: New York.

Foster, V.L., Hume, G.J.E., Byrnes, W.C., Dickenson, A.L., & Chatfield, S.J. (1989). Endurance training for elderly women: Moderate versus low intensity. *Journal of Gerontol: Medicine and Science*, 44, 184-188.

Franklin, B.A. (1988). Program factors that influence exercise adherence: Practical adherence skills for the clinical staff. In Dishman, R.K. (Ed.), *Exercise Adherence: Its Impact on Public Health.* Human Kinetics: Champaign, IL.

Gale, J.B., Eckhoff, W.T., Mogel, S.F., & Rodnick, J.E. (1984). Factors related to adherence to an exercise program for healthy adults. *Medicine and Science in Sports and Exercise*, 16(6), 544-549.

Gauvin, L. (1990). An experimental perspective on the motivational features of exercise and lifestyle. *Canadian Journal of Sport Sciences*, 15(1), 51-58.

Geerken, M. & Gove, W.R. (1983). *At Home and at Work.* Sage: Beverly Hills, CA.

Gettman, L.R., Pollock, M.L., & Ward, A. (1983). Adherence to unsupervised exercise. *Physician Sports Medicine*, 11(10), 56-66.

Gill, K., & Overdorf, V. (1994). Incentives for exercise in younger and older women. *Journal of Sport Behavior*, 17(2), 87-97.

Gillet, P.A. (1988). Self-reported factors influencing exercise adherence in overweight women. *Nursing Research*, 37(1), 25-29.

Godin, G., & Shephard, R.J. (1986a). The importance of type of attitude to the study of exercise behavior. *Psychological Reports*, 58, 991-1000.

Godin, G. & Shephard, R.J. (1986b). Psychosocial factors influencing intentions to exercise in a group of individuals ranging from 45 to 75 years of age. In Berridge, M., & Ward, G. (Eds.), *International Perspectives on Adapted Physical Activity.* Human Kinetics: Champaign, IL, 243-249.

Godin, G., Desharnais, R., Jobin, J., & Cook, J. (1987). The impact of physical fitness and health-age appraisal upon exercise intentions and behavior. *Journal of Behavioral Medicine*, 10, 241-250.

Godin, G., & Shephard, R.J. (1990a). Use of attitude-behavior models in exercise promotion. *Sports Medicine*, 10, 103-121.

Godin, G., & Shephard, R.J. (1990b). An evaluation of the potential role of the physician in influencing community exercise behavior. *American Journal of Health Promotion*, 4, 255-259.

Godin, G. (1994). Social-cognitive models. In Dishman, R.K. (Ed.), *Advances in Exercise Adherence*. Human Kinetics: Champaign, IL, 113-136.

Gorely, T., & Gordon, S. (1995). An examination of the transtheoretical model and exercise behavior in older adults. *Journal of Sport and Exercise Psychology*, 17, 312-324.

Heinzelmann, F., & Bagley, R.W. (1970). Response to physical activity programs and their effects on health behavior. *Public Health Reports*, 85(10), 905-911

Heitmann, H.M. (1986). Motives of older adults for participating in physical activity programs. In McPherson, B. (Ed.), *Sport and Aging*. Human Kinetics: Champaign, IL, 199-204.

Henderson, K.A. (1990). The meaning of leisure for women: An integrative review of the research. *Journal of LeisureResearch*, 22, 23-38.

Herbert, L., & Teague, M.L. (1989). Exercise adherence and older adults: A theoretical perspective. *Activities, Adaptation, & Aging*, 13, 91-105.

Hollingshead, A.B. (1957). *Two Factor Index of Social Position*. Privately Printed: New Haven.

Hovell, M.F., Sallis, J.F., Hofstetter, C.R., Spry, V.M., Elder, J.P., Faucher, P., & Caspersen, C.J. (1989). Identifying correlates of walking for exercise: An epidemmiologic prerequesite for physical activity promotion. *Preventive Medicine*, 18, 856-866.

Iverson, D., Fielding, J., Crow, R., & Christenson, G. (1985). The promotion of physical activity in the United States population: The status of programs in medical, worksite, community, and school settings. *Public Health Reports*, 100, 212-224.

Juneau, M., Rogers, F., DeSantos, V., Yee, M. et al. (1987). Effectiveness of self-monitored, home-based moderate intensity exercise training in middle aged men and women. *American Journal of Cardiology*, 60, 66-70.

Johnson, J.H., & Siegel, P.S. (1992). The effects of association and dissociationon on effort perception. *Journal of Sport Behavior*, 15(2), 119-128.

Keefe, F.J. & Blumenthal, J. A. (1980). The life fitness program: A behavioral approach to making exercise a habit. *Journal of Behavior Therapy and Experimental Psychiatry*, 11, 31-34.

Kendzierski, D., & Johnson, W. (1993). Excuses, excuses, excuses: A cognitive behavioral approach to exercise implementation. *Journal of Sport and Exercise Psychology*, 15(2), 207-219.

Kimiecik, J.C., & Harris, A.T. (1996). What is enjoyment? A conceptual / definitional analysis with implications for sport and exercise psychology. *Journal of Sport & Exercise Psychology*, 18, 247-263.

King, A.C., & Frederiksen, L.W. (1984). Low-cost strategies for increasing exercise behavior. *Behavior Modification*, 8, 3-21.

King, A.C., Taylor, B., Haskell, W., Debusk, R.F. (1988). Strategies for increasing early adherence to and long term maintenance of home-based exercise training in healthy middle-aged men and women. *American Journal of Cardiology*, 61, 628-632.

King, A.C., Frey-Hewitt, B., Dreon, D., & Wood, P. (1989). Diet versus exercise in weight maintenance: The effects of minimal intervention strategies on long term outcomes in men. *Archives of Internal Medicine*, 149, 2741-2746.

King, A.C., Taylor, C.B., Haskell, W.L., & DeBusk, R.F. (1990). Identifying strategies for increasing employee physical activity levels: Findings from the Stanford / Lockheed exercise survey. *Health Education Quarterly*, 17, 269-285.

King, A.C. (1991). Community Intervention for promotion of physical activity and fitness. *Exercise and Sport Science Review*, 19, 211-259.

King, A.C., Haskell, W.L., Taylor, C.B., Kraemer, H.C. & Debusk, R.F. (1991). Group- vs. home-based exercise training in healthy older men and women: A community based clinical trial. *Journal of the American Medical Association*, 266, 1535-1542.

King, A.C., Blair, S.N., Bild, D.E., Dishman, R.K., Dubbert, P.M., Marcus, B.E., Oldridge, N.B., Paffenbarger, J.R., Powell, K.E., & Yeager, K.K. (1992). Determinants of physical activity and interventions in adults. *Medicine and Science in Sports and Exercise*, 24(6 Supp), S221-S236.

King, A.C. (1994). Clinical and community interventions to promote and support physical activity. In Dishman, R.K. (Ed.) *Advances in Exercise adherence*. Human Kinetics: Champaign, IL. (183-212).

Knapp, D., Gutman, M., Foster, C., & Pollock, M. (1984). Self-motivation among 1984 olympic speedskating hopefuls and emotional response and adherence to training. *Medicine and Science in Sports and Exercise*, 16, 114-115.

Knapp, D.N. (1988). Behavioral management techniques and exercise promotion. In Dishman, R.K. (Ed.) *Exercise Adherence: Its Impact on Public Health*. (203-235). Human Kinetics: Champaign, IL.

Lamb, L.K., & Brodie, D.A. (1990). The measurement of physical activity by leisure-time physical activity questionnaires. *Sports Medicine*, 10(3), 159-186.

Lee, C. & Owen, N. (1986). Uses of psychological theories in understanding the adoption and maintenance of exercising. *Australian Journal of Science and Medicine in Sport*, 18(2), 22-25.

Lee, C. (1991). Women and aerobic exercise: Directions for research development. *Annual of Behavioral Medicine*, 13, 133-140.

Lee, C. (1993). Factors related to the adoption of exercise among older women. *Journal of Behavioral Medicine*, 16, 323-334.

Leith, L.M., & Taylor, A.H. (1992). Behavior modification and exercise adherence: A literature review. *Journal of Sport Behavior*, 15(1), 60-74.

Lewis, C.E., Clancy, C., Leake, B., & Schwartz, T.S. (1991). The counseling practices of internests. *Annals of Internal Medicine*, 114, 54-58.

Maehr, R.L., & Braskamp, L.A. (1986). *The Motivation Factor: A Theory of Personal Investment*. Lexington Press: Lexington, MA.

Marcus, B.H., Selby, V.C., Niaura, R.S., & Rossi, J.S. (1992). Self-efficacy and the stages of exercise behavior change. *Research Quarterly for Exercise and Sport*, 63, 60-66

Marcus, B.H., & Stanton, A.L., (1993). Evaluation of relapse prevention and reinforcement interventions to promote exercise aadherence in sedentary females. *Research Quarterly for Research and Sport*, 64(4), 447-452.

Marlatt, G.A., & Gordon, J.R. (1985). *Relapse Prevention.* The Guilford Press: New York.

Martin, J.E., Dubbert, P.M., Katell, A.D., Thompson, J.K., Raczynski, J.R., Lake, M., Smith, P.O., Webster, J.S., Sikova, T., & Cohen, R.E. (1984). The behavioral control of exercise in sedentary adults: Studies 1 through 6. *Journal of Consulting and Clinical Psychology*, 52, 795-811.

Matteson, M.A. (1989). Effects of a cognitive behavioral approach and positive reinforcement on exercise for older adults. *Educational Gerontology*, 15, 497-513.

Massie, J., & Shephard, R.J. (1971). Physiological and psychological effects of training. *Medicine and Science in Sports*, 3, 110-117.

Mazzeo, R.S., Cavanagh, P., Evans, W.J., Fiatarone, M., Hagberg, J., McAuley, E., Startzell, J. (1998). American College of Sports Medicine Position Stand: Exercise and physical activity for older adults. *Medicine and Science in Sports and Exercise*, 30(6), 992-1008.

McAuley, E. & Jacobson, L. (1991). Self-efficacy and exercise participation in sedentary adult females. *American Journal of Health Promotion*, 5, 185-207.

McAuley, E. (1992). The role of efficacy cognitions in the prediction of exercise behaviour in middle aged adults. *Journal of Behavioural Medicine*, 15, 65-88.

McAuley, E. (1993). Self-efficacy and the maintenance of exercise participation in older adults. *Journal of Behavioral Medicine*, 16(1), 103-113.

McAuley, E., Courneya, K.S. (1994). Enhancing exercise adherence in middle aged males and females. *Preventive Medicine: An International Journal Devoted to Practice and Theory*, 23(4), 498-506

McAuley, E. & Rudolph, D. (1995). Physical activity, aging, and psychological well-being. *Journal of Aging and Physical Activity*, 3, 67-96.

McGuire, F.A. (1984). A factor analytic study of leisure constraints in advanced adulthood. *Leisure Science*, 6, 313-326.

McMicheal, A.J., & Hartshorne, J.M. (1980). Cardiovascular disease and cancer mortality in Australia, by occupation, in relation to drinking, smoking, and eating. *Community Health Studies*, 4, 76-84.

McPherson, B.D. (1983). Aging as a social process. *An Introduction to individual and population aging*. Butterworths: Toronto.

McPherson, B.D. (1986). Sport, health, well being, and aging: Some conceptual and methodological issues and questions for sport scientists. In McPherson, B.D. (Ed), *Sport and Aging*. Human Kinetics: Champaign, IL., 3-23.

McPhillips, J.B., Pellettera, K.M., Barrett-Connor, E., Wingard, D.L., & Criqui, M. (1989). Exercise patterns in a population of older adults. *American Journal of Preventive Medicine*, 5, 65-72.

Mobily, K.E. (1981). Attitudes of institutionalized elderly Iowans toward physical activity. *Therapeutic Recreation Journal*, 15, 30-40.

Mobily, K.E. (1982). Motivational aspects of exercise for the elderly: Barriers and solutions. *Physical and Occupational Therapy in Geriatrics*, 1(4), 43-54.

Mobily, K.E., Lemke, J.H., Drube, G.A., Wallace, R.B., Leslie, D.K., & Weissinger, E. (1987). Relationship between exercise attitudes and participation among the rural elderly. *Adaptation and Physical Activity Quarterly*, 4, 38-50

Montoye, H.J. (1975). *Physical activity and health: An epidemiological study of an entire community*. Prentice Hall: Eaglewood Cliffs, NJ.

Mulder, J.A. (1981). Prescription home exercise therapy for cardiovascular fitness. *Journal of Family Practice*, 13, 345-348.

O'Brien, S.J., & Vertinsky, P.A. (1991). Unfit survivors: Exercise as a resource for aging women. *Gerontologist*, 31, 347-357.

O'Brien Cousins, S. (1995). Social support for exercise among elderly women in Canada. *Health Promotion International*, 10(4), 273-282.

Oldridge, N.B., Wicks, J.R., Hanley, C., Sutton, J.R., & Jones N.L. (1978). Non-compliance in an exercise rehabilitation program for men who have suffered a myocardial infarction. *Canadian Medical Association Journal*, 118, 361-364.

Oldridge, N.B. (1982). Compliance and exercise in primary and secondary prevention of coronary heart disease: A review. *Preventive Medicine*, 11, 56-70.

Ostrow, A., Jones, D., & Spiker, D. (1981). Age-role expectations and sex-role expectations for selected sport activities. *Research Quarterly for Exercise and Sport*, 52, 216-227.

Ostrow, A. (1984). *Physical activity and the older adult: Psychological Perspectives.* Princeton Book Company: Princeton, NJ.

Ostrow, A., & Dzewaltowski, D. (1986). Older adults' perceptions of physical activity participation based on age-role and sex-role appropriateness. *Research Quarterly for Exercise and Sport*, 57, 167-169.

Owen, N., Lee, C., & Sedgwick, A.W. (1987). Exercise maintenance: Developing self management guidelines for community fitness courses. *Australian Journal of Science and Medicine in Sport*, 1, 8-12.

Perkins, K.A., Rapp, S.R., Carlson, C.R., & Wallace, C.E. (1986). A behavioral intervention to increase exercise among nursing home residents. *The Gerontologist*, 26, 479-481.

Perkins, A., & Epstein, L.H. (1988). Methodology in exercise adherence research. In Dishman, R.K. (Ed.), *Exercise Adherence: Its Impact on Public Health.* Human Kinetics: Champaign, IL, 399-416.

Presbie, R.J., & Brown, P.L. (1977). *Physical Education: The Behavior Modification Approach.* National Education Association: Washington, DC.

Prochaska, J.O. (1979). *Systems of Psychotherapy: A Transtheoretical Analysis.* Dorsey Press: Homewood, IL.

Prochaska, J.O., DiClemente, C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51, 390-395.

Prochaska, J.O., DiClemente, C. (1985). Common processes of self-change in smoking, weight control, and psychological distress. In Shiffman, S., & Willis, T. (Eds.), *Coping and Substance Use* (pp. 345-363). Academic Press: New York.

Prochaska, J.O., & Marcus, B. H. (1994). The transtheoretical model:Applications to Exercise. In Dishman, R.K. (Ed.), *Advances in Exercise Adherence.* Human Kinetics: Champaign, IL., 161-180.

Rejeski, W.J., & Kennedy E.A. (1988). *Fitness Motivation: Preventing Participant Drop-Out.*Life Enhancement: Champaign IL.

Rhodes, E.C., Martin, A.D., Taunton, J.E., Donnely, M., & Elliot, J. (1998). The effects of one year of resistance training on the relationship between muscle strength and bone density in elderly women. *Journal of Orthopedic and Sport Physiotherapy*, (In Press).

Rogers, M.A. & Evans, W.J. (1993). Changes in skeletal muscle with age: Effects of exercise training. *Exercise & Sport Science Reviews*, 21, 65-102.

Rotter, J.B. (1966). Generalized expectancies for internal vs external control of reinforcement. *Psychological Monographs: General and Applied*, 80, 1-28

Sallis, J.F., Haskell, W.L., Fortnam, S.P., Vranizan, M.S., Taylor, C.B., & Solomon, D.S. (1986). Predictors of adoption and maintenance of physical activity in a community sample. *Preventitive Medicine*, 15, 331-341.

Sallis, J.F., Pinski, R.B., Patterson, T.L., & Nader, P.R. (1988). The Development of self-efficacy scales for health related diet and exercise behaviours. *Health Education Research*, 3, 283-292.

Sallis, J.F., Hovell, M.F., Hofstetter, C.R., Faucher, P., Elder, J.P., Blanchard, J., Casperson, C.J., Powell, K.E., & Christenson, G.H. (1989). A multivariate study of determinants of vigorous exercise in a community sample. *Preventative Medicine*, 18, 20-34.

Schreyer, R., Lime, D.W., & Williams, D.R. (1984). Characterizing the influence of past experience on recreational behavior. *Journal of Leisure Research*, 16, 34-50.

Sedgwick, A.W., Smith, D.S., & Davies, M.J. (1988). Musculoskeletal status of men and women who entered a fitness programme. *Medical Journal of Australia*, 148, 385-391.

Shephard, R.J., Morgan, P., Finucane, R., & Schimmelfing, L. (1980). Factors influencing recruitment to an occupational fitness program. *Journal of Occupational Medicine*, 22, 389-398.

Shephard, R.J., & Cox, M. (1980). Some charactaristics of participants in an industrial fitness programme. *Canadian Journal of Applied Sport Science*, 5(2), 69-76.

Shephard, R.J. (1987). *Physical Activity and Aging* (2nd ed.). Croom Helm: London.

Shephard, R.J. (1988). Exercise adherence in corperate settings: Personal traits and program barriers. In Dishman, R.K. (Ed.), *Exercise Adherence: Its Impact on Public Health.* Human Kinetics: Champaign, IL.

Shephard, R.J. (1994). Determinants of exercise in people aged 65 years and older. In Dishman, R.K. (ed.), *Advances in Exercise Adherence*. Human Kinetics: Champaign, IL, 343-360.

Shephard, R.J. (1998). Physical Activity and Aging (3rd ed.). Human Kinetics: Champaign, IL.

Sidney, K.H., & Shephard, R.J. (1977). Attitudes towards health and physical activity in the elderly: Effects of a physical training program. *Medicine and Science in Sports*, 8, 246-252.

Sonstroem, R.J., & Walker, M.I. (1973). Relationship of attitudes and locus of control to exercise and physical fitness. *Perceptual and Motor Skills*, 36, 1031-1034.

Stanley, M.A. & Maddux, J.E. (1986). Cognitive processes in health enhancement: Investigation of a combined protection motivation and self-efficacy model. *Basic and Applied Social Psychology*, 7, 101-113.

Stephens, T., Jacobs, D.R., & White, C.C. (1985). A descriptive epidemiology of leisure-time physical activity. *Public Health Reports*, 100, 147-158.

Stephens, T., & Craig, C.L. (1990). *The well-being of Canadians: Highlights of the 1988 Cambell's Soup Survey.* Canadian Fitness and Lifestyle Research Institute: Ottawa.

Stephens, T., Caspersen, C.J. (1994). The demography of physical activity. In Bouchard, C., Shephard, R.J., & Stephens, T. (eds.), *Physical Activity, Fitness, and Health.* Human Kinetics: Champaign, IL.

Stern, M.J., & Cleary, P. (1981). National exercise and heart disease project: Psychosocial changes observed during a low-level exercise Program. *Archives of Internal Medicine*, 141, 1463-1467.

Stretcher, V.J., Seijts, G.H., Kok, G.J., Latham, G.P., Glasgow, R., Devellis, B.M., Meertens, R.M., & Bulger, D.W. (1996). Goal setting as a strategy for health behavior change. *Health Education Quarterly*, 13, 73-91.

Taunton, J.E., Rhodes, E.C., Martin, A., & Donnely, M. (1997). Exercise for the older woman: Choosing the right prescription. *British Journal of Sports Medicine*, 31, 1-6.

Teague, M.L. (1989). 1990 Exercise objectives for older adults; public health service (PHS). *Activities, Adaptation, and Aging*, 13, 107-116.

Thompson, C.E., & Wankel, L.M. (1980). The effects of perceived activity choice upon frequency of exercise behavior. *Journal of Applied Social Psychology*, 10, 436-443.

Triandis, H.C. (1977). *Interpersonal Behavior*. Brooks / Cole: Pacific Grove, CA.

Turner, E.E., Rejeski, W.J., & Brawley, L.R. (1997). Psychological Benefits of Physical Activity Are Influenced by the Social Environment. *Journal of Sport and Exercise Psychology*, 19, 119-130.

Valente, C., Sobal, J., Muncie, H., Levine, D., & Antlitz, A. (1986). Health promotion: Physicians' beliefs, attitudes, an practices. *American Journal of Preventive Medicine*, 2, 82-88.

Valois, P., Shephard, R.J., & Godin, G. (1986). Relationship of habit and percieved physical ability to exercise behavior. *Perceptual and Motor Skills*, 62, 811-817.

Vanden Auweele, Y., Rzewnicki, R., Van Mele, V. (1997). Reasons for not exercising and exercise intentions: A study of middle-aged sedentary adults. *Journal of Sports Sciences*, 15, 151-165.

Wagner, E.H., Grothaus, L.C., Hecht, J.A., & LaCroix, A.Z. (1991). Factors associated with participation in a senior health promotion program. *Gerontologist*, 31(5), 598-602.

Wankel, L. M., Yardley, J.K., & Graham, J. (1985). The effects of motivational interventions upon the exercise adherence of high and low self-motivated adults. *Canadian Journal of Applied Sport Sciences*, 10, 147-156.

Weber, J., & Wertheim, E. (1989). Relationship of self monitoring, special attention, body fat percent, and self-motivation to a community gymnasium. *Journal of Sport and Exercise Psychology*, 11, 105-114.

Wechsler, H., Levine, S., Idelson, R.K., Rohman, M., & Taylor, J.O. (1983). The physicians role in health promotion: A survey of primary care practitioners. *New England Medical Journal*, 308, 97-100.

Weinstein, L.B. (1988). Exercise: A benificial activity for older adults. *Activities, Adaptation, and Aging*, 11(1), 85-94.

Wells, K.B., Lewis, C.E., Leake, B., Ware, J.E. (1984). Do physicians preach what they practice? A study of physicians' health habbits and counseling practices. *Journal of the American Medical Association*, 252, 2846-2848.

Wiggam, J., French, R., Henderson, H. (1986). The effects of a token economy on distance walked by senior citezens in a retirement center. *American Corrective Therapy Journal*, 40, 6-12.

Wilcox, S., & Storandt, M. (1996). Relations among age, exercise, and psychological variables in a community sample of women. *Health Psychology*, 15(2), 110-113.

Wilfley, D., & Kunce, J. (1986). Differential physical and psychological effects of exercise. *Journal of Counseling Psychology*, 33(3), 337-342.

Williams, P. & Lord, S.R. (1995). Predictors of Adherence to a structured exercise program for older women. *Psychology and aging*, 10, 617-624.

Willis, J.D., & Campbell, L.F. (1992). *Exercise Psychology*. Human Kinetics: Champaign, IL.

Wolinsky, F.D., & Stump, T.E. (1995). Antecedents and consequences of physical activity and exercise among older adults. *Gerontologist*, 35(4), 451-462.

Wyshak, G., Lamb, G.A., Lawrence, R.S., & Curran, W.J. (1980). A profile of the health promoting behavior of physicians and lawyers. *New England Journal of Medicine*, 303, 104-107.

Zimmerman, B.J., & Schunk, D.H. (Eds.) (1989). *Models of Self-Regulated Learning and Academic Achievement: Theory, Research, and Practice*. Springer-Verlag: New York.

APPENDIX A

Exercise Self-Efficacy

Using the following scale as a yardstick, please answer the questions below.

0	1	2	3	4	5	6	7
Does not apply to me	Not at all confident			Moderately confident			Very confident

I am confident I can participate in regular exercise when:

a. I am tired. ----

b. I am in a bad mood. ----

c. I feel I don't have time. ----

d. I am on vacation. ----

e. It is bad weather. ----

*Regular exercise = 3 or more times per week for 20 minutes or more each time.

APPENDIX B

Stages of Exercise Behaviour Change

Please respond to the following questions by placing the appropriate number in the boxes which describes your feelings about physical activity.

(1) Strongly Disagree
(2) Disagree
(3) Uncertain
(4) Agree
(5) Strongly Agree

(a) I currently do not exercise, and I do not intend to start exercising in the next 6 months .....

(b) I currently do not exercise, but I am thinking about starting to exercise in the next 6 months. .....

(c) I currently exercise some, but not regularly. .....

(d) I currently exercise regularly, but I have only begun doing so within the last 6 months. .....

(e) I currently exercise regularly, and have done so for longer than 6 months. .....

(f) I have exercised regularly in the past, but I am not doing so currently. .....

*** Regular exercise = 3 or more times per week for 20 minutes or more each time.**

APPENDIX C

Social Support for Exercise Questionnaire

Please respond using the number that best represents your answer.

1	2	3	4	5
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

1. When I was 20-50, my own family (husband and children) was not athletic. .....

2. Since middle age, I have been encouraged by at least one person to develop or maintain my physical abilities beyond what was normally expected for the average woman. .....

3. My physician is in favour of me participating in vigorous (sweat inducing) physical activity. .....

4. The people I spend most of my time with now are NOT interested in physical fitness activities. .....

5. I have received support and encouragement to continue participating in this program from other participants in the program. .....

APPENDIX D

Current Program Self-Report

Please respond using the number that best represents your answer.

1	2	3	4	5
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

1. I am enjoying the experience of participating in this exercise program. .....

2. I have increased my physical strength because of participating in this exercise program. .....

3. This program has NOT provided any benefit to my daily lifestyle. .....

APPENDIX E

1. Date of Birth: Month ..... Day..... Year.....

2. Education Level: (please circle the appropriate answer)

Level of school completed	Score
Less than seventh grade	1
Junior high school (9th grade)	2
Partial high school (10th or 11th grade)	3
High school graduate	4
Partial college (at least one year), or specialized training	5
Standard college or university graduation	6
Graduate professional training (graduate degree)	7