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Exercise Adherence in the Workplace: A Test of Self-Efficacy Theory

by

Patricia May Smith

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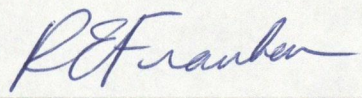

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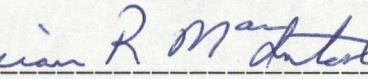

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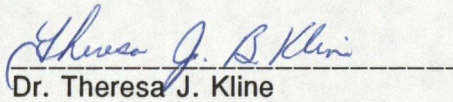

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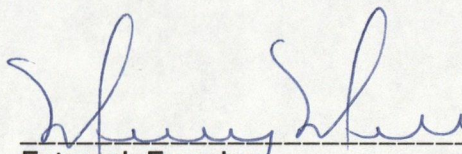

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Sciences 0714
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Social Sciences 0534
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- General 0679
- Ancient 0289
- Linguistics 0290
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- General 0401
- Classical 0294
- Comparative 0295
- Medieval 0297
- Modern 0298
- African 0316
- American 0591
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- Middle Eastern 0315
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PHILOSOPHY, RELIGION AND THEOLOGY

Philosophy 0422
Religion
- General 0318
- Biblical Studies 0321
- Clergy 0319
- History of 0320
- Philosophy of 0322

Theology 0469

SOCIAL SCIENCES

American Studies 0323
Anthropology
- Archaeology 0324
- Cultural 0326
- Physical 0327

Business Administration
- General 0310
- Accounting 0272
- Banking 0770
- Management 0454
- Marketing 0338

Canadian Studies 0385
Economics
- General 0501
- Agricultural 0503
- Commerce-Business 0505
- Finance 0508
- History 0509
- Labor 0510
- Theory 0511

Folklore 0358
Geography 0366
Gerontology 0351
History
- General 0578
- Ancient 0579
- Medieval 0581
- Modern 0582
- Black 0328
- African 0331
- Asia, Australia and Oceania 0332
- Canadian 0334
- European 0335
- Latin American 0336
- Middle Eastern 0333
- United States 0337

History of Science 0585
Law 0398
Political Science
- General 0615
- International Law and Relations 0616
- Public Administration 0617

Recreation 0814
Social Work 0452
Sociology
- General 0626
- Criminology and Penology ... 0627
- Demography 0938
- Ethnic and Racial Studies 0631
- Individual and Family Studies 0628
- Industrial and Labor Relations 0629
- Public and Social Welfare 0630
- Social Structure and Development 0700
- Theory and Methods 0344

Transportation 0709
Urban and Regional Planning 0999
Women's Studies 0453

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Agriculture
- General 0473
- Agronomy 0285
- Animal Culture and Nutrition 0475
- Animal Pathology 0476
- Food Science and Technology 0359
- Forestry and Wildlife 0478
- Plant Culture 0479
- Plant Pathology 0480
- Plant Physiology 0817
- Range Management 0777
- Wood Technology 0746

Biology
- General 0306
- Anatomy 0287
- Biostatistics 0308
- Botany 0309
- Cell 0379
- Ecology 0329
- Entomology 0353
- Genetics 0369
- Limnology 0793
- Microbiology 0410
- Molecular 0307
- Neuroscience 0317
- Oceanography 0416
- Physiology 0433
- Radiation 0821
- Veterinary Science 0778
- Zoology 0472

Biophysics
- General 0786
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Geochemistry 0996
Geodesy 0370
Geology 0372
Geophysics 0373
Hydrology 0388
Mineralogy 0411
Paleobotany 0345
Paleoecology 0426
Paleontology 0418
Paleozoology 0985
Palynology 0427
Physical Geography 0368
Physical Oceanography 0415

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Environmental Sciences 0768
Health Sciences
- General 0566
- Audiology 0300
- Chemotherapy 0992
- Dentistry 0567
- Education 0350
- Hospital Management 0769
- Human Development 0758
- Immunology 0982
- Medicine and Surgery 0564
- Mental Health 0347
- Nursing 0569
- Nutrition 0570
- Obstetrics and Gynecology .. 0380
- Occupational Health and Therapy 0354
- Ophthalmology 0381
- Pathology 0571
- Pharmacology 0419
- Pharmacy 0572
- Physical Therapy 0382
- Public Health 0573
- Radiology 0574
- Recreation 0575
- Speech Pathology 0460
- Toxicology 0383

Home Economics 0386

PHYSICAL SCIENCES

Pure Sciences

Chemistry
- General 0485
- Agricultural 0749
- Analytical 0486
- Biochemistry 0487
- Inorganic 0488
- Nuclear 0738
- Organic 0490
- Pharmaceutical 0491
- Physical 0494
- Polymer 0495
- Radiation 0754

Mathematics 0405
Physics
- General 0605
- Acoustics 0986
- Astronomy and Astrophysics 0606
- Atmospheric Science 0608
- Atomic 0748
- Electronics and Electricity 0607
- Elementary Particles and High Energy 0798
- Fluid and Plasma 0759
- Molecular 0609
- Nuclear 0610
- Optics 0752
- Radiation 0756
- Solid State 0611

Statistics 0463

Applied Sciences

Applied Mechanics 0346
Computer Science 0984
Engineering
- General 0537
- Aerospace 0538
- Agricultural 0539
- Automotive 0540
- Biomedical 0541
- Chemical 0542
- Civil 0543
- Electronics and Electrical 0544
- Heat and Thermodynamics ... 0348
- Hydraulic 0545
- Industrial 0546
- Marine 0547
- Materials Science 0794
- Mechanical 0548
- Metallurgy 0743
- Mining 0551
- Nuclear 0552
- Packaging 0549
- Petroleum 0765
- Sanitary and Municipal 0554
- System Science 0790

Geotechnology 0428
Operations Research 0796
Plastics Technology 0795
Textile Technology 0994

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General 0621
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Enseignement religieux 0527
Enseignement secondaire 0533
Enseignement spécial 0529
Enseignement supérieur 0745
Évaluation 0288
Finances 0277
Formation des enseignants 0530
Histoire de l'éducation 0520
Langues et littérature 0279
Lecture 0535
Mathématiques 0280
Musique 0522
Orientation et consultation 0519
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- Anciennes 0289
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- Généralités 0401
- Anciennes 0294
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- Médiévale 0297
- Moderne 0298
- Africaine 0316
- Américaine 0591
- Anglaise 0593
- Asiatique 0305
- Canadienne (Anglaise) 0352
- Canadienne (Française) 0355
- Germanique 0311
- Latino-américaine 0312
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- Slave et est-européenne 0314

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- Archéologie 0324
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Droit 0398
Économie
- Généralités 0501
- Commerce-Affaires 0505
- Économie agricole 0503
- Économie du travail 0510
- Finances 0508
- Histoire 0509
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Études canadiennes 0385
Études féministes 0453
Folklore 0358
Géographie 0366
Gérontologie 0351
Gestion des affaires
- Généralités 0310
- Administration 0454
- Banques 0770
- Comptabilité 0272
- Marketing 0338

Histoire
- Histoire générale 0578
- Ancienne 0579
- Médiévale 0581
- Moderne 0582
- Histoire des noirs 0328
- Africaine 0331
- Canadienne 0334
- États-Unis 0337
- Européenne 0335
- Moyen-orientale 0333
- Latino-américaine 0336
- Asie, Australie et Océanie 0332

Histoire des sciences 0585
Loisirs 0814
Planification urbaine et régionale 0999
Science politique
- Généralités 0615
- Administration publique 0617
- Droit et relations internationales 0616

Sociologie
- Généralités 0626
- Aide et bien-être social 0630
- Criminologie et établissements pénitentiaires 0627
- Démographie 0938
- Études de l' individu et de la famille 0628
- Études des relations interethniques et des relations raciales 0631
- Structure et développement social 0700
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Transports 0709
Travail social 0452

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- Agronomie. 0285
- Alimentation et technologie alimentaire 0359
- Culture 0479
- Élevage et alimentation 0475
- Exploitation des pâturages 0777
- Pathologie animale 0476
- Pathologie végétale 0480
- Physiologie végétale 0817
- Sylviculture et faune 0478
- Technologie du bois 0746

Biologie
- Généralités 0306
- Anatomie 0287
- Biologie (Statistiques) 0308
- Biologie moléculaire 0307
- Botanique 0309
- Cellule 0379
- Écologie 0329
- Entomologie 0353
- Génétique 0369
- Limnologie 0793
- Microbiologie 0410
- Neurologie 0317
- Océanographie 0416
- Physiologie 0433
- Radiation 0821
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- Zoologie 0472

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- Généralités 0786
- Medicale 0760

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Géochimie 0996
Géodésie 0370
Géographie physique 0368
Géologie 0372
Géophysique 0373
Hydrologie 0388
Minéralogie 0411
Océanographie physique 0415
Paléobotanique 0345
Paléoécologie 0426
Paléontologie 0418
Paléozoologie 0985
Palynologie 0427

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Sciences de l'environnement 0768
Sciences de la santé
- Généralités 0566
- Administration des hôpitaux 0769
- Alimentation et nutrition 0570
- Audiologie 0300
- Chimiothérapie 0992
- Dentisterie 0567
- Développement humain 0758
- Enseignement 0350
- Immunologie 0982
- Loisirs 0575
- Médecine du travail et thérapie 0354
- Médecine et chirurgie 0564
- Obstétrique et gynécologie 0380
- Ophtalmologie 0381
- Orthophonie 0460
- Pathologie 0571
- Pharmacie 0572
- Pharmacologie 0419
- Physiothérapie 0382
- Radiologie 0574
- Santé mentale 0347
- Santé publique 0573
- Soins infirmiers 0569
- Toxicologie 0383

SCIENCES PHYSIQUES
Sciences Pures

Chimie
- Généralités 0485
- Biochimie 487
- Chimie agricole 0749
- Chimie analytique 0486
- Chimie minérale 0488
- Chimie nucléaire 0738
- Chimie organique 0490
- Chimie pharmaceutique 0491
- Physique 0494
- PolymÇres 0495
- Radiation 0754

Mathématiques 0405
Physique
- Généralités 0605
- Acoustique 0986
- Astronomie et astrophysique 0606
- Électronique et électricité 0607
- Fluides et plasma 0759
- Météorologie 0608
- Optique 0752
- Particules (Physique nucléaire) 0798
- Physique atomique 0748
- Physique de l'état solide 0611
- Physique moléculaire 0609
- Physique nucléaire 0610
- Radiation 0756

Statistiques 0463

Sciences Appliqués Et Technologie

Informatique 0984
Ingénierie
- Généralités 0537
- Agricole 0539
- Automobile 0540
- Biomédicale 0541
- Chaleur et ther modynamique 0348
- Conditionnement (Emballage) 0549
- Génie aérospatial 0538
- Génie chimique 0542
- Génie civil 0543
- Génie électronique et électrique 0544
- Génie industriel 0546
- Génie mécanique 0548
- Génie nucléaire 0552
- Ingénierie des systèmes 0790
- Mécanique navale 0547
- Métallurgie 0743
- Science des matériaux 0794
- Technique du pétrole 0765
- Technique minière 0551
- Techniques sanitaires et municipales 0554
- Technologie hydraulique 0545

Mécanique appliquée 0346
Géotechnologie 0428
Matières plastiques (Technologie) 0795
Recherche opérationnelle 0796
Textiles et tissus (Technologie) 0794

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Généralités 0621
Personnalité 0625
Psychobiologie 0349
Psychologie clinique 0622
Psychologie du comportement 0384
Psychologie du développement 0620
Psychologie expérimentale 0623
Psychologie industrielle 0624
Psychologie physiologique 0989
Psychologie sociale 0451
Psychométrie 0632

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ABSTRACT

Regular exercise participation is a lifestyle behaviour recognized for its inverse relationship to the decreased risk of chronic disease, especially morbidity and mortality of coronary heart disease. However, it is estimated that only 20% of the adult population exercises regularly enough or at sufficient intensity to accrue the benefits. The problem of non-adherence to exercise has been studied by diverse groups of researchers across diverse disciplines, without much success. Most studies have remained atheoretical in nature, emanating from applied settings and focusing on sociodemographic, psychosocial, biomedical, and environmental factors.

The current study attempted to elucidate the determinants of exercise adherence within the framework of self-efficacy theory. Adherence to exercise was studied by designing an 8 week exercise program for sedentary adults in the workplace. A path model was formulated to test the tenability of the causal hypotheses of efficacy theory on adherence to exercise. The stability of efficacy constructs (self-efficacy, outcome efficacy, and motivation) over time was also explored using profile analysis, and the nature of the relationships of these variables to exercise adherence was tested with trend analysis and interactional analysis in multiple regression.

The results indicated that the path model did not fit the data: Self-efficacy, outcome efficacy, and motivation were evidenced to be dynamic constructs, although they were not significantly related to exercise adherence. Further, quadratic functions and interactional effects between efficacy, motivation, and outcome efficacy with adherence were not found. Plausible explanations of the data and possible future directions of research on exercise adherence were discussed.

ACKNOWLEDGMENTS

I would like to thank the many individuals who contributed to the successful completion of this study. First, I would like to thank my advisor, Dr. Bob Franken, for his insight over the last few years. Gratitude is extended to my committee members, Dr. Brian MacIntosh for giving generously of his time and knowledge, and Dr. Theresa Kline for her statistical guidance. A special thank-you is extended to my external examiner, Dr. Merry Miller, for her vision, understanding, and support.

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

EXERCISE ADHERENCE

Introduction

Attempts to elucidate the determinants of exercise adherence have involved diverse groups of researchers across diverse disciplines, without much success. Most studies have emanated from applied settings, and have remained correlational and atheoretical in nature. The current research project reflects the traditions of psychology, and was designed within the theoretical framework of Bandura's (1977) self-efficacy theory. Specifically, a causal model was formulated based on self-efficacy theory, in which the influence of social cognitive variables on adherence to exercise was examined. The underlying assumption of cognitive theory is that behaviours are ultimately determined by cognitive factors. As this study was designed to clarify specific cognitive mechanisms governing exercise adherence, it differs from the mainstream focus of the exercise adherence literature which attempts to describe exercisers by reliance on demographic, physical, and personality factors.

This study encompassed the exercise adherence literature as well as the self-efficacy literature, both of which will be reviewed in the first two chapters, respectively. The first chapter highlights business and industry involvement in health promotion, and the problem of non-participation in exercise in general. This is followed by a review of the literature on exercise adherence. The second chapter is devoted to the explanation of Bandura's (1977) self-efficacy theory, and includes selected health applications of self-efficacy. The third chapter provides an explanation of the study's design, a description of the causal model proposed, and a statement of the hypotheses which were tested. The methodology used in the study is explicated in chapter four, and the results of the hypotheses tested are detailed in chapter five. The final chapter focuses on a discussion of the results and potential future directions for research in exercise adherence.

Business and Industry Involvement in Health Promotion

Business and industry are currently putting more emphasis on the importance of the health and well-being of employees (Huhn & Volski, 1985). Since the mid 1970's, health promotion programs in the worksite have grown exponentially (Gebhardt & Crump, 1990). A major focus of company health promotion programs has been to encourage exercise by providing either on-site exercise facilities or company-paid memberships at public gyms and private health clubs (Levy, 1986). In Canada, exercise and fitness programs in the workplace are one of the fastest growing trends, with over 1,000 companies as early as 1987 involved to some degree in employee fitness (Falkenberg, 1987). Exercise as a health behaviour has received attention due to the strong inverse correlation of exercise and lifestyle-related diseases which tend to be chronic in nature (Siscovick, Laporte, & Newman, 1985). Chronic diseases are postulated to have a negative impact on business and industry in such areas as employee safety & effectiveness, turnover, absenteeism, productivity, and employee morale (Gebhardt & Crump, 1990).

Exercise is particularly recognized for its relationship to the decreased risk of morbidity and mortality of coronary heart disease (Paffenbarger & Hyde, 1984, 1988; Powell, Thompson, Caspersen & Kendrick, 1987; Siscovick, Weiss, Hallstrom, Inui, & Peterson, 1982;). Although a direct causal relationship between inactivity and coronary heart disease (CHD) has not been shown, research has demonstrated the positive effects of regular dynamic exercise on a number of risk factors that are known to be associated with increased incidence of CHD (Butler & Goldberg, 1989). Regular dynamic exercise has, for example, been found to increase high-density lipoprotein cholesterol and decrease low-density lipoprotein cholesterol and triglycerides (Runyan,

1989), decrease blood pressure especially in mild to moderate hypertensives (Kaplan, 1983), decrease the severity and/or incidence of diabetes mellitus (Pederson, Beck-Nielsen, & Heding, 1980), increase stamina or work capacity, and positively alter and improve the efficiency of the cardiovascular and musculoskeletal system (Haskell, 1984).

The Problem of Non-Adherence to Exercise

Exercise must be performed on a regular basis in order for health benefits to be obtained, and the benefits last only as long as the exercise is regularly maintained (American College of Sports Medicine, 1991). Unfortunately, a significant number of people do not exercise regularly enough to experience any truly lasting improvements in health. Statistics show that only approximately 20% of the Canadian and American adult populations exercise regularly enough and at sufficient intensity to meet the current 1991 guidelines for fitness set by the American College of Sports Medicine (3 times per week, 20-30 min per session, at an intensity of 60-75% of maximal heart rate) (Stephens, Jacobs, & White, 1985). Further, it is estimated that 40% of adults exercise but not frequently enough or with sufficient intensity to accrue the potential health benefits, and 40% are basically sedentary (Stephens et al., 1985). Even when businesses provide on-site health and fitness programs, it is estimated that only 15-30% of all white-collar employees take advantage of these offerings (Shephard & Cox, 1980). Although studies of blue collar workers are rare (Fielding, 1982), their participation rate is much lower than white collar workers.

The problem of non-participation lies with both initiation of a regular program of exercise and with subsequent adherence to the program. The problem of initiation is highlighted in a study by Wilhelmsen, Sanne, Elmfeldt, Grimby, Tibblin and Wedel

(1975). These researchers found that 29% of the post myocardial infarction patients referred to a supervised cardiac rehabilitation program centered on exercise did not attend the first exercise session. In other words, even when exercise was recommended by a physician to enhance recovery following a cardiac event, a large number of individuals did not attempt to change their activity level.

The second part of the non-participation problem is adherence to a program of regular exercise. Of those individuals who start some sort of exercise program, attrition is high. Typically, 50% of all participants in an exercise program discontinue regular exercise within the first 6 months, with the highest dropout rate being witnessed within the first few weeks (Oldridge, 1982). Dropout rates in apparently healthy or minimal risk individuals has ranged from 13-75%, and in clinical cardiac rehabilitation settings the dropout has ranged from 3-87% (Oldridge, 1982). Across time, the rate of drop-out follows a negative accelerating function (Dishman, Ickes, & Morgan, 1980) which closely resembles the elopement from long-term treatment programs such as outpatient and group psychotherapy, general psychiatric counselling, outpatient alcohol treatment, methadone maintenance programs for heroin addicts, detoxification, and medical regimens for internal conditions such as hypertension and tuberculoses (see Baekelund & Lundwall, 1975 for a review of the medical adherence literature).

Numerous researchers since the early 1970's have focused on the problem of exercise adherence using information gathered from population surveys, cardiac rehabilitation programs, and quasi-experimental and correlational studies. Investigation of exercise adherence has covered a myriad of variables under the rubric of sociodemographical, biomedical, psychosocial, and environmental. Additionally, some researchers have attempted to apply models or components of current theories of

behaviour-change to the problem of exercise adherence. This work on exercise adherence will be reviewed in the next section.

Review of the Exercise Adherence Literature

Sociodemographic Factors and Exercise Adherence

A review of the exercise adherence literature reveals that the most frequently studied sociodemographic variables have included age, gender, social economic status (SES), smoking behaviour, and past participation in sport or exercise. In general, the ability of these sociodemographic variables to predict or explain exercise adherence has been limited.

Age. Population surveys and supervised exercise programs generally report that activity declines with age (Lindsay-Reid & Morgan, 1979; Slenker, Price, Roberts & Jurs, 1984; Stephens et al., 1985; Teraslinna, Partanen, Kosela, & Oja, 1969). Whether this finding is a result of a cohort effect or actual aging is equivocal (Stephens et al., 1985). Other research has indicated that an absolute age-exercise relationship may not even exist. For instance, a tendency for younger men to have decreased activity levels was found in a community sample by Sallis, Haskell, Fortmann, Vranizan, Taylor and Solomon (1986) and in a cardiac rehabilitation program by Oldridge, Donner, Buck, Jones, Andrew, Parker, Cunningham, Kavanagh, Rechnitzer, and Sutton, (1983). Further, studies by Tirrell and Hart (1980) and Oldridge, Wicks, Hanley, Sutton, and Jones (1978) reported no age difference between adherers and dropouts.

Gender. Females have frequently been reported to evidence lower levels of regular exercise than males (Lindsay-Reid & Morgan, 1979; Slenker et al., 1984; Stephens et al., 1985; Teraslinna et al., 1969). It has been suggested that this finding may be a function of the operational definition of exercise or physical activity (Stephens et al.,

1985). In a recent population survey review, Stephens and his colleagues found that males were reported to be more active than females only if the frequency or intensity of the activity specified was high or if the activity was sports-related. When the activity included calisthenics, walking, jogging or biking, no gender differences were found. This finding is consistent with a study by Gale, Eckhoff, Mogel, and Rodnick (1984) which reported no gender difference in participation rates in a supervised exercise program with apparently healthy adults.

Socioeconomic status. Socioeconomic status, whether measured by income, education, or occupation, has consistently shown a direct positive relationship with exercise adherence (Andrew, Oldridge, Parker, Cunningham, Rechnitzer, Jones, Kavanagh, Shephard, & Sutton, 1981; Boothby, Tungatt & Townsend, 1981; Godin & Shephard, 1985; Harris, 1970; Oldridge, 1979; Oldridge, et al., 1983; Oldridge, et al., 1978; Stephens et al., 1985). Only one study has reported that education level does not affect adherence to supervised exercise (Gale et al., 1984).

A SES-related variable, income expectations, has also been found to be related to exercise adherence. Andrew et al. (1981) and Shephard and Cox (1980) found that the participants who dropped out of their exercise programs were either not satisfied with their current salary, or their projected income expectations had not been met.

Smoking. In addition to SES, another fairly consistent sociodemographic finding is an inverse relationship between smoking and exercise adherence (Massie & Shephard, 1971; Oldridge, et al., 1983; Oldridge, 1979; Oldridge, et al, 1978; Wilhelmsen, et al., 1975). In fact, Oldridge (1979) reported that smoking was the single most discriminating variable in terms of who would drop out of the Ontario Exercise-Heart Collaborative cardiac rehabilitation study, accounting for 59% of the dropouts.

Further, 95% of the total dropouts reported by Oldridge were profiled as blue-collar smokers who had inactive leisure time and low energy demands on the job.

However, even the smoking relationship is equivocal. Gale et al. (1984) and Sallis et al. (1986) failed to find a correlation between smoking and exercise adherence or dropout in a supervised exercise program with healthy adults and a community study, respectively.

Past participation in sport or exercise. The last sociodemographic variable to be reviewed is past participation in exercise or sport. Although past participation as a predictor of future participation has intuitive appeal, only one study has found support for this tenet. Harris (1970) profiled volitionally active males as those who had formed a positive attitude toward physical activity early in life, had parents who encouraged participation in sports, were members of high school and college athletic teams, had always participated in vigorous activity, and had always enjoyed competition and feeling of the fatigue following strenuous exercise. As a result of this early exposure, physical activity had become a meaningful part of their lifestyle. No other study has been able to show any relationship, positive or negative, between former participation in athletics or exercise and exercise adherence as an adult (Brunner, 1969; Dishman, 1981; Dishman & Gettman, 1980; Gale et al., 1984; Godin &Shephard, 1985).

In summary, sociodemographic factors have not been consistently capable of predicting or describing who will adhere and who will drop out of an exercise program. Oldridge (1979) has profiled the potential dropout as a blue-collar smoker with inactive leisure time. However, since very few studies have included blue-collar workers, it is difficult to arrive at any definite conclusions. Even if sociodemographic factors were strongly associated with exercise dropout and adherence, these types of

variables are basically descriptive and do not elucidate the underlying cognitive processes involved in deciding whether to exercise or not. Additionally, sociodemographic variables are generally not modifiable, and therefore do not provide much information in terms of enhancing adherence interventions.

Psychosocial Factors and Exercise Adherence

The psychosocial factors which have been most frequently studied in the attempt to elucidate the best predictors of exercise adherence are: exercise attitudes, health beliefs and knowledge, self-perceptions of physical ability, perceived health status, various personality traits, exercise goals and outcome expectations, and self-motivation. These variables will be reviewed in the following section.

Exercise attitudes, health beliefs and knowledge, and self-perceptions of physical ability. Although these variables seem intuitively important in predicting who will initiate and adhere to regular exercise, the results are not only mixed, but tend to discount this proposition. Whereas some studies have found a positive correlation between exercise behaviour and positive attitudes toward exercise or physical activity (Harris, 1970; Sallis et al., 1986; Sonstroem & Walker, 1973), self-perceptions of ability (Harris, 1970; Spreitzer & Snyder, 1983), and health beliefs or knowledge of the benefits of exercise (Slenker et al., 1984), the majority of studies have shown either no relationship between these variables and exercise adherence (Dishman & Gettman, 1980; Dishman & Ickes, 1981; Shephard & Cox, 1980; Sonstroem & Kampper, 1980) or an inverse relationship (Andrew & Parker, 1979; Andrew et al., 1981; Lindsay-Reid & Osborn, 1980). In fact, some researchers have found it surprising that adherers and dropouts alike tend to have a generally positive attitude and perception toward exercise and the exercise program being offered (Andrew & Parker,

1979). Further, the studies that have shown a positive correlation between cognitions and exercise behaviour tend to share the commonality of being survey designs, either surveying community samples regarding activity levels (Sallis et al., 1986) or surveying current regular exercisers (Harris, 1970; Spreitzer & Snyder, 1983). Unfortunately, this methodology may be measuring ex post facto justifications and rationalizations for exercise behaviour as opposed to providing predictive validity for these variables.

Perceived health status. Another paradox appears when it is found that one's perception of personal health status is not a good predictor of exercise behaviour. It has frequently been hypothesized that individuals who perceive themselves at risk for diseases such as CHD, will tend to exercise more in an attempt to diminish that risk. Shephard and Cox (1980) reported that neither self-reported health nor perceived body image was correlated with exercise adherence, and Lindsay-Reid and Osborn (1980) found that perception of susceptibility both to CHD and general illness was negatively associated with exercise. In other words, individuals at greater risk for CHD were not the ones adhering to exercise. It was concluded in the Lindsay-Reid and Osborn study that these high risk individuals either did not perceive exercise as potentially beneficial in reducing their risk profile, or that they did not actually perceive themselves to be at risk. This latter supposition may highlight the possibility that many cognitive processing variables such as denial may prohibit the unbiased use of the health belief variable in exercise adherence literature. Consistent with this postulation, Tirrell and Hart (1980) found that in a population of older (age range 46-75 years, M = 59), post-coronary bi-pass surgery patients, most saw their present condition as not serious, they had no concern about possible continuation of the advancement of arteriosclerosis, perceived themselves as healthier than they had previously been, and

there was no need to worry about their condition since they were in the care of competent physicians.

Personality traits and psychological profiles. The prediction of exercise adherence using personality traits and psychological profiles has been attempted by numerous researchers, with limited success. Using a sample of healthy adult male runners, Pargman and Green (1990) found that scores on self-motivation was the only difference found between Type A and Type B Behaviour Pattern runners, with Type A's reporting significantly higher self-motivation than the Type B runners. However, Type A's and B's did not differ on intrinsic motivation, average miles run per week, average minutes run per mile, or concern with time or distance ran.

Type A Behavior Pattern was found to correlate with dropout in the Ontario Exercise-Heart Collaborative Study (Oldridge; et al., 1978), but was only associated with low-adherence, not dropout, in a supervised exercise program with healthy male adults (Shephard & Cox, 1980). The authors of the latter study concluded that since most of the Type A individuals were upper management males who typically had numerous appointments in and out-of-town that restricted attendance at exercise class, it was possible that the low adherence was a function of a real or perceived time conflict and not a personality trait, per se.

Other psychological traits, which have been used infrequently but have been considered to be predictive of adherence, have included higher intraception, defensiveness, achievement, dominance, and self-confidence (Brunner, 1969), confidence and emotional stability (Young & Ismail, 1977), and internal locus of control using a sample children (Sonstroem & Walker, 1973). Conversely, individuals who are profiled as depressed, hypochondriacal, anxious, introverted, and have lower ego strength have been shown to drop out of cardiac rehabilitation (Blumenthal, Williams,

Wallace, Williams, & Needles, 1982). Social adjustment, manifest anxiety, and life satisfaction (Shephard & Cox, 1980) have not been found to be associated with adherence to exercise. As well, health locus of control in adults has not met with success in predicting dropout or adherence to exercise (Dishman & Gettman, 1980; Dishman et al., 1980).

Exercise goals and outcome expectations. Exercise goals and outcome expectations have also been used in an attempt to predict exercise adherence. Although limited research has been completed in this area, the findings are interesting. In studies of healthy adults, Wankel (1985) and Siegel, Johnson and Newhof (1988) found that pre-activity health-related goals and outcome expectations did not differ between those who adhered to a program of regular exercise and those who dropped out. These health-related goals and expectations included the desire to improve physical fitness, prevent CHD, lose weight, and reduce tension and anxiety. The adherers, however, scored significantly higher on a number of non-health-related goals such as developing recreational skills, social rewards, release of competitive drive, satisfy curiosity, develop and utilize personal skills, and use their minds in physical activity (Siegel et al., 1988; Wankel, 1985).

Self-motivation. The last psychosocial variable that will be reviewed is self-motivation. Dishman and his colleagues have been successful at predicting adherers to exercise programs with the Self-Motivation Inventory (SMI) in a limited number of studies (Dishman & Ickes, 1981). Self-motivation as measured by the SMI is viewed as a stable and general disposition to persevere, and is believed to operate somewhat independently of factors that typically have been conceptualized in terms of achievement motive or locus of causality/control (Dishman et al., 1980). The SMI has predicted adherence to a competitive rowing training program in undergraduate women (Dishman

& Ickes, 1981), and exercise adherence with adult males involved in medically supervised adult fitness classes (Dishman & Gettman, 1980).

Other researchers have not been as successful with the SMI. For example, Gale, et al. (1984) found that early dropout females (those who completed less than 10% of the program) had higher motivation scores than the adherers. Further, self-motivation scores did not differentiate between adherers (those who completed more than 50% of the program) and non-adherers (those who completed 10-50% of the program).

Biomedical Factors and Exercise Adherence

The most common and practical biomedical factors studied in the exercise adherence literature can be categorized into weight/body fat, fitness/strength, and risk for CHD. All three categories of variables have had some success, albeit varied, in describing and predicting who will adhere to exercise programs.

Weight and body fat. A number of researchers have found that leaner (percent body fat), lighter (weight) individuals are more likely to adhere to a program of regular exercise (Dishman, 1981; Dishman & Gettman, 1980; Massie & Shephard, 1971; Young & Ismail, 1977). This finding, however, has not gone unchallenged. Gale et al. (1984) found that early dropout females were lighter and leaner but that no differences were found between males who adhered or who dropped out of a supervised exercise program. Similarly, Shephard and Cox (1980) and Oldridge et al. (1978) found that physique was not related to adherence, and Sallis et al. (1986) found that although lower body mass index ([BMI] = weight/height^2) predicted adoption of moderate activity in males, it did not predict maintenance of activity. Further BMI was not associated with adoption or maintenance of activity in females.

It is important to note that "lighter" in most studies is a relative term, simply referring to average body weight of the participants, which in the above studies involving males, has ranged from 78 to 94 kg, very normal weights. One study which reported that leaner individuals exercised significantly more than less lean individuals (Young & Ismail, 1977), compared males who were current exercisers with those who had been sedentary prior to the study. It should come as no surprise that regular exercisers would have leaner body mass than sedentary individuals, and that regular exercisers would exercise more than non-regular exercisers.

Following from the exercise literature on body fat and weight, Dishman and his colleagues have proposed a psychobiological model involving weight, body fat, and SMI scores to enhance prediction of adherence to exercise. Although this model has been successful in predicting adherence thus far (Dishman et al., 1980), more studies are required in order to validate its effectiveness.

Physical fitness and strength. Physical fitness and strength have also been used as predictor variables in the exercise adherence literature. Again, the results of these studies are equivocal. Whereas Young and Ismail (1977), and Teraslinna, Partanen, Kosela, and Oja (1969) have found a tendency for more fit individuals (higher estimated maximal oxygen uptake [VO_2max]) to adhere to exercise programs, Dishman (1981) has found that individuals with a low metabolic capacity were more likely to exercise, and Shephard and Cox (1980), Andrew and Parker (1979), and Oldridge et al. (1978) have found no difference in fitness between dropouts and adherers. Further, Gale et al. (1984) found that females who adhered to an exercise program were more fit than the dropouts, but there were no functional capacity differences between male adherers and dropouts.

Risk for CHD. Mixed findings have also resulted from the attempt to use risk for CHD as a predictor of exercise adherence. It has been suggested that individuals who are more symptomatic in terms of health risks for CHD are more likely to adhere to exercise because the presenting symptoms serve as cues to better one's physical disposition. This finding has been reported only by Dishman (1981). For the most part, it would appear that healthier individuals (healthier is a relative term based on the population used) are more likely to adhere to regular exercise (Blumenthal et al., 1982; Dishman & Gettman, 1980; Oldridge et al., 1983; Oldridge et al., 1978; Wilhelmsen et al., 1975). This latter finding is very practical. From a physical comfort perspective, individuals who are actually suffering from CHD risks or symptoms such as angina, would simply find exercise too uncomfortable to perform.

Environmental Factors and Adherence to Exercise

The most commonly studied environmental factors in the exercise adherence literature fall under the rubric of social support, convenience, and characteristics of the exercise program. It is important to note that many of the studies that have reported environmental factors actually involved questioning the participants of their reasons for dropping out, ex post facto. Therefore, these results should be interpreted with caution as they may represent personal justification and traces of social desirability as opposed to valid predictors of dropout.

Social support. It would appear that for male participants, spousal support of the exercise program is a very important factor related to adherence, regardless of the type of population studied. Specifically, positive spousal support has been found to have a direct relationship to exercise adherence (Andrew et al., 1981; Andrew & Parker, 1979; Godin & Shephard, 1985; Heinzelmann & Bagley, 1970). As well, Wankel

(1985) found that both male and female exercise adherers scored higher on four social support measures (friendship within the program, encouragement from work friends, encouragement from non-worker friends, and encouragement from work supervisor) than did those who dropped out. However, this positive association between social support and exercise is not unequivocal. Desharnais, Bouillon, and Godin (1987) did not find a significant relationship between perceived support from family and friends and adherence to exercise.

Convenience. Convenience factors including lack of facilities, location of facilities, and time or scheduling difficulties, are the most commonly given reasons for dropout that surface ex post facto during interviews with individuals who have dropped out of a given program (Boothby et al., 1981; Desharnais et al., 1987; Andrew & Parker, 1979; Andrew et al., 1981; Fielding, 1982; Heinzelmann & Bagley, 1970; Slenker et al., 1984; Teraslinna et al., 1969; Tirrell & Hart, 1980; Wankel, 1985). Although self-report of reasons for dropping out can be accurate and valid, this type of methodology can also produce rationalizations or excuses in terms of what constitutes a perceived barrier (Dishman, 1986). Surveys show, for example, that the inactive have just as much weekly leisure time as the exercisers. And in one study, dropouts who perceived distance to the facility and lack of time as the main barriers to adherence actually lived closer to the exercise facility than did compliers (Gettman, Pollock & Ward, 1983).

Characteristics of the exercise program. Research in the last category of environmental factors, characteristics of the program, is limited. Whereas Andrew et al. (1981) reported that lack of attention by the staff predicted dropout in a cardiac rehabilitation program, Desharnais and his colleagues (1987) found that satisfaction or dissatisfaction with the attention received from a fitness leader in an exercise program

for healthy adults was non-significant. In response to the question of whether group or individual exercise programs were better for adherence, Massie and Shephard (1971) reported that middle-aged businessmen responded better to group programs than to solitary exercise. This finding, however, may be confounded by the fact that the supervised group in Massie and Shephard's study invested $60 to join the Y.M.C.A. in order to participate in the program. The solitary group experienced no financial cost. Further, a high percentage of dropout in the solitary group was due to injury, mostly incurred from jogging. This latter point is consistent with the findings from high intensity running programs which often lose a significant number of their participants to athletic injury (Pollock, Gettman, Milesis, Bah, Durstine & Johnson, 1976). This finding serves to highlight the fact that adherence to exercise may depend on the mode and dose of exercise prescribed. High intensity programs, in other words, could potentially result in extraneous variables such as injury accounting for a high proportion of variance in dropout.

One final important program factor that should be described was identified in a review of eight American and Canadian population studies. Stephens et al. (1985) reported that out of the top six most popular physical activities, five are inexpensive, can be done close to home, and are typically flexible in their schedule. These five activities include walking, swimming, calisthenics, bicycling, and jogging. These activities, in other words, are convenient in terms of cost, facilities, and time.

Summary of the Sociodemographic, Psychosocial, Biomedical and Environmental Factors

Attempts to characterize who will adhere and who will drop out of exercise programs have been only marginally successful. Although significant differences have been found within the various categories of sociodemographical, biomedical,

psychosocial, and environmental variables, none are sufficient predictors across studies. Basically, no single overwhelming factor has been found to consistently correlate with dropout or adherence. Moreover, a variety of seemingly relevant psychological and biological variables such as attitude toward physical activity, health beliefs and knowledge, self-percepts of physical ability, body weight, and functional capacity, while significant in some studies, have failed to be consistently or reliably linked to exercise adherence.

In short, the determinants of exercise adherence basically remain elusive. This may partially be reflective of the inconsistency of study designs employed. Because researchers are interested in exercise for very different reasons (e.g., improved productivity in the workplace versus cardiac rehabilitation) using very different populations (e.g., CHD patients versus adolescents) and very different designs (e.g., retrospective versus predictive) and underlying premises (theoretical versus atheoretical), it becomes difficult, if not impossible, to compare and synthesize findings across exercise adherence studies.

Further, inconsistent operational definitions of adherence and drop-out, varying study time frames, and lack of dose identification (intensity, frequency and duration of exercise) have added to the difficulty of arriving at any firm conclusions regarding the determinants of exercise adherence (Dishman et al., 1985). Methodological problems such as the consistent misuse of statistical methods (reporting numerous significant t-test results within a single study but failing to control experiment-wise alpha levels) and single administration of psychological questionnaires have also contributed to the elusiveness of the elucidation of the determinants of exercise adherence. In short, the research on exercise adherence thus far has been descriptive not explanatory (Dishman, 1988).

Dishman (1988) has suggested that if physical activity and exercise, along with their accompanying benefits, are to be understood as complex health behaviours, a more theoretical approach into the underlying determinants must be taken. A theory that not only can help explain what is happening with adherence or non-adherence to exercise, but will also yield methods that are capable of affecting significant change in affect, cognition, and behaviour is needed. A few researchers have attempted to rise to this challenge using models or components of theories that have been successful in predicting health behaviour change in areas other than exercise, and in one case, physical activity in adolescents. The most prominent models and theories have included the Psychological Model for Physical Activity Participation (Sonstroem, 1978), and the Health Belief Model ([HBM], Rosenstock, 1974).

Models of Exercise Adherence

Psychological Model for Physical Activity Participation. The first model developed specifically for the prediction of exercise involvement was the Psychological Model for Physical Activity Participation (Sonstroem, 1978). This model predicts that one's self-perception of physical ability (Estimation) influences one's interest in physical activity (Attraction), and that attraction provides the greater influence on exercise participation (Sonstroem, 1988). Estimation of one's physical ability and attraction to physical activity are measured using the Physical Estimation and Attraction Scales ([PEAS], Sonstroem, 1974).

The Psychological Model for Physical Activity Participation has been successful in predicting self-reports of physical activity and initiation of interscholastic athletic participation in adolescent boys (Sonstroem, 1978; Sonstroem & Kampper, 1980). However, The Psychological Model for Physical Activity Participation has not been

successful in predicting adherence to activity over time with either adolescent populations (Sonstroem & Kampper, 1980) or with adult populations (Dishman & Gettman, 1980). Sonstroem (1988) has suggested that failure to predict adherence could be related to the nature of the PEAS items. The PEAS was developed for adolescent males and some of the items are inappropriate for adults or for long-term participation. Examples of such items include "wishing to belong to a white-water canoe club" and "preferring softball to poker". It would seem unlikely that these items would have much success in predicting adherence to exercise with special populations such as patients in cardiac rehabilitation.

Health Belief Model. The Health Belief Model (HBM) grew out of research which attempted to elucidate the reasons why people failed to utilize screening tests for the detection of asymptomatic disease (Rosenstock, 1974). The major components of the model include: (a) susceptibility (perception of the likelihood of contracting a particular disease); (b) severity (evaluation of the consequences of developing the given disease); (c) benefits (beliefs regarding the effectiveness of taking a specific health action); and, (d) barriers (beliefs regarding the potentially negative aspects such as cost, pain, and inconvenience of adopting the particular health behaviour). These variables, in turn, are influenced by demographic (e.g., age, sex, race, ethnicity) and sociopsychological variables (e.g., personality, social class, peer and reference group pressure). Additionally, if action or a given health behaviour is to be initiated, a cue to action must be present. A cue to action can include such events as perceived physical symptoms (e.g., angina), media communication or campaigns (e.g., Canada's Participaction campaign), or interpersonal communication (e.g., annual check-up reminder-postcard from the dentist).

Janz and Becker (1984) have critically reviewed 46 studies and report outstanding success of the model to predict behaviour in areas such as breast examination and medication compliance. Although certain of HBM components, most notably barriers, have been associated with exercise adherence or lack thereof, the HBM in exercise settings has generally failed to replicate the positive results found with health behaviours other than exercise (Lindsay-Reid & Osborn, 1980; Slenker et al., 1984; Tirrell & Hart, 1980).

Sonstroem (1988) has offered one possible reason that the HBM has not been successful in predicting exercise adherence. He notes that the HBM was originally developed to predict a single instance of one specific behaviour. However, exercise adherence is a complex behaviour encompassing a variety of behaviours carried on over time that require large amounts of time and energy. Further, the motivation orientation within HBM emphasizes a desire to avoid illness which may be inappropriate for many individuals who are motivated to exercise for reasons other than illness avoidance (Lindsay-Reid & Osborne, 1980).

Additionally, work with the HBM has derived mainly from retrospective studies measuring belief and behaviour concurrently, which may account for the limited predictability in prospective exercise studies (Sonstroem, 1988). Specifically, HBM variables which differentiate among individuals who are currently involved on a regular basis (e.g., Slenker et al., 1984), may be ineffectual in anticipating later, ongoing compliant behaviours in traditionally sedentary healthy adults.

CHAPTER 2

SELF-EFFICACY THEORY

Framework of Self-Efficacy Theory

Social learning theory ([SLT] or Social Cognitive Theory [SCT] to which it is often now referred) is a cognitive-oriented theory concerned with the acquisition and determination of cognitive and behavioural competencies (Bandura, 1978). Self-efficacy theory emanates from the larger, more encompassing social learning theory (Bandura, 1977).

The self-efficacy component of social learning theory centers on the role of self-referent thought in psychosocial functioning (Bandura, 1986). Specifically, Bandura posits that self-referent thought mediates the relationship between knowledge and action, and this relationship is reciprocally determined. The issues addressed in self-efficacy theory focus on how people judge their capabilities (self-perceptions of efficacy), and how self-perceptions of efficacy affect motivation and behaviour. Among the key measurable concepts of self-efficacy theory are outcome expectations or efficacy, and self-efficacy expectations.

Outcome expectation or efficacy is defined as "a person's estimate that a given behaviour will lead to certain outcomes". In comparison, an efficacy expectation or self-efficacy "is the conviction that one can successfully execute the behaviour required to produce the outcomes" (Bandura, 1977, p. 193). In the conceptual scheme of self-efficacy theory, "successfully execute" refers to carrying out or completing a specified behaviour pattern but does not imply success in terms of its effects, outcomes or emotional consequences (Bandura, 1978).

Outcome and self-efficacy are necessarily differentiated (Bandura, 1977). An individual can believe that a given behaviour will produce desirable outcomes. If, however, the individual lacks confidence regarding his or her personal ability to perform the behaviour necessary to accrue the outcomes, he or she will not engage in the

required behaviours and resultantly, knowledge of the potential outcomes alone will not influence his or her behaviour. For example, a chronic smoker may believe that quitting smoking will have beneficial effects on his health in terms of reduced risk of CHD or lung cancer, but he may also doubt his ability to stop smoking. In such a case, information regarding the beneficial effects of smoking cessation may not influence his behaviour toward smoking cessation because he lacks the confidence (self-efficacy) to initiate the required behaviours.

Perceived self-efficacy predicts performance much better than expected outcomes, and is central to efficacy theory. Bandura (1986) has suggested that an individual's performance judgements for a given task will statistically account for much of the variance in the kinds of outcomes they expect from behaviour performance. As a result, expected outcomes may not add much on their own to the prediction of behaviour (Bandura, 1986).

Self-efficacy does not refer to a personality characteristic or a global trait that operates independent of contextual factors (Bandura, 1978). The concept of self-efficacy relates to personal judgments and beliefs about capabilities of performing a specified behaviour in a particular situation. As such, efficacy expectations will not remain stable across tasks and situations. Rather, self-efficacy is hypothesized to vary greatly depending on the task and context in which the task is expected to be performed. Therefore, a person should never be characterized as having high or low self-efficacy without reference to a specific behaviour and circumstance.

Self-efficacy is posited to be central in human agency (Bandura, 1986). In the conceptual scheme, self-efficacy judgments affect both the initiation and persistence of behaviour. Perceived capabilities are also hypothesized to determine the effort expended and the amount of time an individual will persist in the face of obstacles and aversive

experiences; the stronger the perceived self-efficacy, the greater the persistence and the amount of effort expended.

Expectation is not to be understood as the sole determinant of behaviour (Bandura, 1977). Regardless of level of expectancy, a recommended behaviour will not be performed if the skills required to produce the behaviour are lacking. Further, high expectations alone will not lead to action if an individual lacks the incentive or motivation to perform the given behaviour. However, given that appropriate skills and sufficient motivation are present, efficacy expectations are a major determinant of activity choice, effort expenditure, and persistence of effort (Bandura, 1977).

Dimensions of Efficacy Expectations

Efficacy expectations vary along three basic dimensions: magnitude, strength, and generality. Measurement of perceived self-efficacy requires assessment of these three dimensions commensurate with a detailed description of the expected behaviours in order to achieve a complete understanding of the relationship between efficacy and behaviour (Bandura, 1986).

Magnitude. Efficacy magnitude refers to the extent of related behaviours or tasks in a graded series, usually ordered by difficulty, that an individual feels capable of performing (Bandura & Adams, 1977). Low-magnitude expectations reflect judgments that one is capable of performing only the simpler of tasks in a given difficulty hierarchy, while those with high-magnitude expectations judge themselves very confident in their abilities to perform even the most difficult tasks in the proposed hierarchy.

Strength. Strength of efficacy refers to probabilistic judgements of confidence or certitude regarding one's ability to perform a specific task identified as "do-able" on the

magnitude hierarchy (Bandura, 1977). Although strength of efficacy for a given behaviour in a graded series of tasks is hypothesized to predict whether or not the behaviour will be performed, strength is not necessarily linearly related to behaviour (Bandura, 1986). "A certain threshold of self-assurance is needed to attempt a course of action, but higher strengths of self-efficacy will result in the same attempt" (p. 397).

Generality. Generality is the third dimension of efficacy expectations. Generality measures the extent to which efficacy expectations regarding a given behaviour or action generalizes to other situations (Bandura, 1977). Although efficacy theory stipulates that efficacy is task and situation specific, it is possible for efficacy generated in therapy to generalize to different situations. For example, newly acquired approach behaviours that enhance an ophidiophobic's efficacy toward handling a boa constrictor in the laboratory may or may not generalize to a situation in which a garden snake is encountered on a nature walk (Bandura & Adams, 1977).

Measurement of Self-Efficacy

Measurement of efficacy magnitude and strength generally involves a two-step measurement procedure (Bandura & Adams, 1977). First, individuals are asked to identify the tasks they believe they can accomplish at a given time from a list of tasks hierarchically-ordered to reflect various difficulty levels. Then, for each task individuals judge they can perform, they rate the strength of their certitude or confidence on a probability interval scale ranging from 10-100 (Bandura & Adams, 1977).

As previously noted, the exact behaviour to be performed must be specified in the efficacy assessment instrument. It is in relation to the exact specified behaviour that

efficacy is measured; poorly-defined general measures of perceived self-efficacy will not yield valid predictive information (Bandura, 1977). Therefore, efficacy instruments are not standardized, but rather are tailored to specific behaviours in specific situations. Further, inappropriate assessment of performance behaviour will result in meaningless analyses (Bandura, 1986).

Sources of Efficacy Information

Bandura has postulated that psychotherapeutic change relies on the creation and enhancement of personal efficacy (1977). The sources of efficacy creation and enhancement include enactive, vicarious, exhortative, and emotive experiences. Any given intervention may draw to a lesser extent on one or more sources of efficacy information.

Enactive information. Performance accomplishments or personal mastery experiences are especially influential sources of efficacy information. Successes tend to raise mastery expectations, and repeated failures lower them (Bandura, 1977).

Although occasional failures are often a natural occurrence in the enactment of behavioural events, the potential negative impact of these experiences on efficacy judgments tends to depend on the timing and the total pattern of experiences in which failures occur (Bandura, 1977). Failure is likely to have a greater negative impact if mishaps occur early in the course of events, or if they occur prior to the development of strong efficacy expectations through previous repeated successes (Bandura & Adams, 1977).

Vicarious experience. Personal performance expectations can be derived from vicarious experiences (Bandura, 1977). Watching others successfully perform a

particular behaviour can positively alter one's judgment of personal abilities to perform the same behaviour.

Since vicarious experience relies on inferences from social comparison as opposed to enactive experience, it is considered to be a less dependable source of information about one's capabilities than is direct evidence of personal accomplishment. Resultantly, efficacy expectations derived from vicarious experiences alone are likely to be weaker and more vulnerable to change (Bandura, 1977).

Verbal persuasion. Through verbal suggestion from others, individuals can be convinced to believe they can cope successfully with tasks and situations which have left them feeling inefficacious in the past (Bandura, 1977). As with vicarious experiences, verbal persuasion does not provide an opportunity for personal achievement. Therefore, efficacy expectations induced by verbal persuasion are likely to be weaker than those arising from performance accomplishments, and tend to be easily extinguished by disconfirming experiences.

Although changes to self-efficacy rather than outcome efficacy are most relevant to efficacy theory, interventions also commonly try to enhance outcome expectations using verbal persuasion. For example, in smoking cessation programs therapy often highlights the detrimental health effects or consequences of smoking. The same limitations that exist in the attempt to verbally enhance self-efficacy expectations applies to verbal persuasion attempts to enhance outcome expectations. Simply telling people what to expect will not necessarily increase outcome efficacy, nor can verbal persuasion be expected to enhance self-efficacy via increases in outcome expectations.

Another caveat with verbal persuasion should be noted. Focusing any given intervention on outcome expectations without arranging conditions to facilitate effective performances and consequences when the recommended behaviour is attempted, may set

the participant up for failure. Failure, in turn, may result in discrediting the persuaders as well as evidence major decreases in the recipients' perceived self-efficacy.

Emotive information. Emotional or physiological arousal may provide information concerning personal competency (Bandura, 1977). In attempting to cope with novel or threatening situations, individuals commonly use their state of physiological arousal to judge their performance capabilities. As extreme arousal is often associated with poor performance, a tendency may exist for individuals to have lower expectations of success when high physiologic arousal is experienced.

In summary, it is conceptually important to understand that self-efficacy is multi-determined from enactive, vicarious, exhortive, and emotive experiences. As such, the impact of any single source of efficacy information on personal efficacy will partly depend on the total configuration of efficacy experiences in which it occurs (Bandura, 1977). Additionally, not everyone in a given intervention program will have met with the same types and amounts of efficacy-relevant experiences. Therefore, any single new source of efficacy information provided should not be expected to affect everyone uniformly (Bandura & Adams, 1977).

Cognitive Processing and Appraisal of Efficacy Information

According to the conceptual scheme of efficacy theory, the impact of enactive, vicarious, exhortive, and emotive information on efficacy expectations will depend on how it is cognitively appraised (Bandura, 1977). Information available from the environment and information that is processed, transformed and integrated by the individual does not necessarily represent the same thing. As such, even success experiences do not necessarily create strong generalized expectations of efficacy.

Efficacy judgements formed from behavioural enactments will depend on causal attributions of success (Bandura, 1986). If people attribute their performance accomplishments to luck or situational factors rather than skill, efficacy is unlikely to increase. Perceptions of ability and effort will also affect the enhancement of efficacy. Specifically, minimum effort is more likely to result in a high ability attribution for success and would be expected to positively influence efficacy judgments. Whereas, a high effort expenditure may be interpreted to reflect a lesser ability and, in this case, efficacy would be unlikely to increase. Additionally, the more varied the circumstances in which a given task is measured, as well as the more challenging the task, the more likely efficacy is to increase (Bandura & Adams, 1977). In summary, the influence of enactive sources of efficacy will vary to some degree depending on how the performance information is processed (Bandura & Adams, 1977).

The influence of exhortive sources of efficacy also depends on cognitive appraisal. The impact of verbal persuasion on self-efficacy judgments may vary depending on the perceived credibility of the persuaders, as well as the persuader's prestige, trustworthiness, expertise, and assuredness (Bandura, 1977). The more believable the source, the more likely efficacy expectations are to change.

The influence of vicarious experiences on efficacy also depends on a number of factors. The model performing a given behaviour must show determined effort in his or her performance achievement, as simple performances by competent models is not likely to lead to enhanced efficacy (Bandura, 1977). The modeled behaviour must also have clear, as opposed to ambiguous, outcomes. Additionally, either a variety of models (diversified modeling) must be seen performing the recommended behaviour, or if a single model is used, the model must share some similar characteristics with the

observer in order to increase the personal relevance of vicariously-derived information.

The effects of physiological arousal on self-efficacy will similarly depend on how it is cognitively processed. Cognitive appraisal of emotive experiences is posited to depend on a number of factors, including causal attribution of the source of arousal (e.g., situational events versus personal inability), the situational circumstance which elicits the arousal, and past experiences on how level of arousal affects one's performances (Bandura, 1977). Some individuals, for instance, find moderate levels of arousal facilatory rather than debilitating. The informative value of arousal for these people will differ from those for whom arousal usually foreshadows failure performances. Bandura (1977) uses the example of pre-performance anxiety in seasoned actors; those who become anxious before a performance but lose their apprehensiveness once the play gets under way, are likely to ascribe their arousal to common situation factors rather than to personal deficiencies. As such, their efficacy will not be altered.

Criticisms of Self-Efficacy Theory

Bandura (1977) originally proposed the concept of self-efficacy as a unifying cognitive construct for explaining the effectiveness of various intervention procedures in the treatment of anxiety. Since Bandura's theory was first introduced during a time when the dual-process theory of arousal was preeminent in the treatment area of arousal and phobias, most of the original criticism of self-efficacy theory emanated from the postulation of an alternative explanation for the effectiveness of anxiety treatment.

Bandura's self-efficacy theory was challenged most adamantly by traditional operant and conditioning theorists such as Borkovec (1978) and Wolpe (1978). Wolpe

(1978) maintained that the posttreatment approach behaviour of ophidiophobics in Bandura's experiments was not due to an increase of self-efficacy, but simply an extinction of arousal. As such, there was no need (nor room according to Ockham's razor) for a causal relationship between efficacy and treatment outcome. It was further argued by Borkovec (1978) that self-efficacy simply reflected performance accomplishments and was therefore redundant in the explanation of future approach behaviours with previously anxious individuals.

Bandura's (1978) reply to the criticisms was extremely instrumental in the further elucidation of the conceptual scheme of self-efficacy theory. First, self-efficacy is not a measure of arousal but rather it represents an individual's judgment of personal capabilities of performing a particular task in a given situation. The theory does not suggest that behaviour will be performed in the absence of anxiety. In fact, many approach behaviours in Bandura's laboratory were performed with a great deal of anxiety, thereby eliminating the explanation of anxiety extinction as the catalyst to behaviour performance (Bandura, 1978).

Bandura has also been successful in defending the premise that self-efficacy is not simply a reflection of past behaviour. In Bandura and Adam's (1977) seminal study, ophidiophobics increased their personal efficacy for a variety of approach behaviours after symbolic desensitization. Efficacy increased, in other words, without actual performance of the recommended approach behaviours. Further, this enhanced efficacy, based solely on imagery processes and not actual performances, later predicted actual performance. Additionally, even after subjects had successfully performed all tasks in a guided participant intervention, self-efficacy remained a better predictor of future behaviour accomplishments than did actual performance from the guided mastery.

Bandura's (1978) rebuttals highlight a caveat to Wolpe's (1978) extinction argument and enhance the validity and strength of self-efficacy theory. The extinction hypothesis cannot explain the fact that although all subjects emerged from systematic desensitization therapy with complete anxiety extinction in Bandura and Adam's (1977) study, varying levels of self-efficacy and behavioural performance were evidenced. Bandura's concept of efficacy construct was highly predictive of behavioural performances after systematic desensitization, whereas Wolpe's dual-process failed to explain how subjects emerging from systematic desensitization, not only evidenced anxiety during behavioural performance and performed in spite of this anxiety, but also how individuals with the same level of anxiety extinction went on to perform the required task at varying levels of competencies.

Selected Health Applications of Self-Efficacy

As previously noted, self-efficacy was originally conceptualized as central in the analysis of changes achieved in fearful and avoidant behaviour. In the seminal study of self-efficacy, Bandura and Adams (1977) reported a microanalytic congruency between task-specific self-efficacy and behavioural improvement following complete desensitization toward a boa constrictor by ophidiophobics. The generalizability of self-efficacy theory to diverse behavioural tasks examined by other researchers soon strengthened the validity of the theory. Research in self-efficacy spread out from the confines of anxiety arousal with phobic threats to include the predictive effects of self-efficacy on such diverse activities as performance motivation in physical strength tasks (Bandura & Cervone, 1983; Weinberg, 1985), pain tolerance (Williams & Watson, 1985), and sport performance (Feltz, 1988; Weiss, Wiese, & Klint, 1989).

Self-efficacy theory has also gained substantial support from health-related studies. Specifically, the theory has been consistently successful in the prediction of health performances in such diverse areas as oral hygiene (Beck & Lund, 1981), preventative cancer behaviours (Seydel, Taal, & Wiegman, 1990), smoking cessation (Coelho, 1984; Devins & Edwards, 1988; DiClemente, 1981), weight control (Bernier & Avard, 1986; Weinberg, Hughes, Critelli, England, & Jackson, 1984), and exercise performance and activity (e.g., Dzewaltowski, 1989; Ewart, Stewart, Gillilan, & Kelemen, 1986; Kaplan, Atkins, & Reinsch, 1984).

As self-efficacy was originally conceptualized as a predictor of behaviour immediately following judgment of perceived capabilities, health behaviour studies provide extreme and stringent tests of the strength, validity and robustness of self-efficacy theory. Health behaviours, for the most part, are habitual behaviours or addictive responses in need of correction, that require long-term change and adherence to strict regimes. Health behaviours are more complex in nature, requiring substantially more time and energy than tasks such as laboratory demonstration of leg or arm strength which require one-time, immediate performances. As long-term performance and adherence are central to this study, only those studies focusing on these requirements will be reviewed in this next section.

Smoking cessation. In a pioneering self-efficacy and smoking cessation study, DiClemente (1981) found that self-efficacy of formerly heavy, chronic smokers, measured at the end of treatment was a strong predictor of 5-month follow-up smoking status. These findings are similar to those of Coelho (1984), Godding and Glasgow (1985), Devins and Edwards (1988), DiClemente, Prochaska, and Gibertini (1985), and Baer, Holt, and Lichtenstein (1986), who also found that posttreatment efficacy judgments were predictive of follow-up smoking status. Pretreatment efficacy scores,

however, were not predictive of posttreatment status or maintenance in any of these studies.

Coelho (1984) also reported that those subjects classified as abstinent at the end of treatment had significantly higher self-efficacy scores than smokers at all assessment periods except pretreatment. Additionally, abstainers' level of efficacy remained relatively constant from treatment cessation to 3-month posttreatment compared with smokers who significantly decreased in efficacy over the same period, and their mean 3-month score was not significantly different from their pretreatment score. These latter findings at least partially support Bandura's (1977) contention that efficacy is influenced by enactive experiences, with differing experiences of success and failure having varying effects on efficacy.

Godding and Glasgow (1985) provided a more stringent test of the ability of efficacy scores to predict smoking cessation maintenance by employing several different dependent variables (nicotine content, amount of each cigarette smoked, number of cigarettes smoked, and carbon monoxide levels). Additionally, the ability of self-efficacy to predict an objective biochemical dependent measure (carbon monoxide levels) suggests there is more to the self-efficacy concept than simply response bias on self-report of behaviour. However, in this same study, outcome efficacy failed to significantly correlate with the dependent variables, nor was it able to significantly increment the proportion of variance explained when combined with self-efficacy.

Conversely, Strecher, Becker, Kirscht, Eraker, and Graham-Tamasi (1985) reported that only the treatment itself (versus a no-treatment control) was predictive of smoking status. Although a main effect of self-efficacy was not found, a susceptibility by self-efficacy interaction was significantly related to changes in the amount smoked. Specifically, individuals with high-susceptibility, high self-efficacy scores showed the

greatest decrease in smoking behaviour, whereas those with high-susceptibility, low self-efficacy showed the least amount of change.

Possible measurement error in the Strecher et al. (1985) study, however, may have violated the assumptions of multiple regression analysis (Pedhazur, 1982) and obscured the findings. Self-efficacy was not assessed as a measure of confidence but rather subjects were asked to rate their difficulty resisting the urge to smoke in various situations. Perceived difficulty and perceived confidence are two different constructs. For instance, a subject could rate the urge to resist smoking in the presence of alcohol as very difficult but still be very confident of her or his ability to abstain.

Kirscht, Janz, Becker, Eraker, Billi, and Woolliscroft (1987), who also measured one's perceived difficulty to resist the urge to smoke rather than one's perceived confidence in the capability not to smoke, found mixed results in terms of the ability of self-efficacy to predict smoking status across groups. A number of design problems were apparent in this study and may account, in part, for the mixed findings. First, as just noted, the construct of perceived difficulty as opposed to perceived confidence was used as a measure of efficacy. Although levels and strength of difficulty were measured, these measures were not used in a microanalysis of the data, as suggested by Bandura. Therefore, the summation of items was equivalent to a general index of difficulty perception. Second, the study was not designed to measure individuals who had specifically signed up for a smoking cessation program (the treatment program was not specified; it merely suggested that physicians and nurses counselled smokers who appeared for medical care to stop smoking.). As such, sufficient motivation to quit smoking, a necessary mediating variable of self-efficacy (Bandura, 1977), may have been lacking (it was not measured). Third, subjects consisted of individuals attending a general medical clinic, and patients at a Veterans Administration (VA) hospital. The VA

patients were relatively disadvantaged compared to the other subject sample (Kirscht et al., 1987), and this may have confounded the results which showed significant relationships between both general and specific indices of efficacy at both cessation and reduction at one month for the general medical clinic only. No significant relationships were found for the VA group. Further, although a greater change in smoking was seen at 6 months, few belief measures remained predictive.

Wojcik (1988) also reported a group by efficacy interaction effect in the attempt to predict smoking status. Specifically, self-efficacy was the strongest predictor of abstinence versus relapse for self-treatment individuals rather than for program treatment groups. It is interesting to note that the program treatment relapsers who were highly efficacious that they could quit smoking, also claimed high health value and great faith in the health professionals. In comparison, the self-treatment abstainers who had high self-efficacy seemed to value other things more than health and gave little credence to professional ability to help them stop smoking or protect their health. This could be interpreted to mean that since those who were less successful in reaching abstinence put more faith in health professionals than those who were most successful, it is possible that the greater power attributed to health professionals artificially enhanced self-efficacy.

In a survey study, Brod and Hall (1984) reported that joiners to a smoking treatment program had higher self-efficacy than non-joiners. The efficacy instrument used, however, was not situation specific. An item example from the instrument is "In general, do you consider yourself a person who succeeds at at what you try to do?". Obviously, this does not comply with the measurement and conceptual framework of self-efficacy theory.

Finally, Devins and Edwards (1988) are the only researchers to-date, who have applied self-efficacy theory in its entirety to smoking cessation. Devins and Edwards included not only measures of self-efficacy, but also "nonefficacy" variables of outcome efficacy, motivation, and behavioural repertoire in their study. Controlling for age, sex, initial smoking levels, and number of years as a smoker, multiple regression indicated that perceived self-efficacy was the only significant SLT variable predictor of reduced smoking at the 1- and 3-month post-test. Also as predicted, each of the nonefficacy SLT variables contributed to smoking reductions via their interactions with self-efficacy but not independently of it.

Summary of the smoking cessation studies. Self-efficacy has generally been successful in predicting smoking behaviour following smoking cessation treatment. Many researchers have used the efficacy instrument (or a related version thereof) designed by DiClemente (1981). The items on the efficacy questionnaires usually reflect situations identified as difficult to sustain abstention from smoking. Subjects respond to these questions by either indicating their perceived temptation or perceived difficulty in resisting the urge to smoke in these situations, or more correctly in some studies, their perceived confidence to remain abstinent in the mentioned situations. It was noted that only the study by Devins and Edwards (1985) tested efficacy theory in totality, using the constructs of outcome efficacy, motivation, and behavioural repertoire in concert with self-efficacy.

Weight reduction. Studies on self-efficacy and weight reduction are less plentiful than those conducted on smoking cessation. However, the limited studies examined in this area are promising. In weight reduction studies, two different dependent variables are used to assess performance behaviour: absolute weight and adherence to a program.

The only study on weight to use adherence to the program as the dependent measure, was performed by Mitchell and Stuart (1984). They reported that dropouts from a Weight Watchers program were significantly more likely than adherers to the program to report low self-efficacy at the beginning of their memberships. Dropouts were also significantly less likely to feel successful in weight control and behaviour change, even though their rates of weight loss did not differ significantly from adherers.

Glynn and Ruderman (1986) found that increases in self-efficacy scores were significantly related to weight losses among weight loss program participants. They also showed that weight decreased and self-efficacy increased significantly over the study. Self-efficacy at any specific point in treatment was not, however, significantly related to previous or subsequent weight loss during treatment. This lends support to Bandura's argument that efficacy is not simply a reflection of past behavioural accomplishments.

One group of researchers studied the effects of both preexisting and manipulated self-efficacy on weight loss (Weinberg et al., 1984). Weinberg and his colleagues found that subjects with high preexisting self-efficacy lost more weight over time than those with low preexisting self-efficacy. In addition, a significant manipulated self-efficacy by trials interaction was found, with subjects in the high manipulated self-efficacy condition losing more weight over time than subjects in the non-manipulated self-efficacy condition.

Slater (1989) found that self-efficacy mediated the effects of social influences and cognitive control on subjects' eating behaviour. Additionally, efficacy was found to account for variance in eating behaviour not explained by health knowledge, demographics, and social influences, even when these latter variables were used as covariates.

Results from a weight reduction study by Bernier and Avard (1986) indicated that pretreatment level of personal efficacy was significantly related to weight loss during treatment, and posttreatment level of personal efficacy was significantly related to weight loss at a 6-week follow-up but not at a 6-month follow-up. Further, whereas posttreatment efficacy was a significant predictor of follow-up weight loss, end-of-treatment weight loss was not. This latter finding supports Bandura's contentions that self-efficacy is a better predictor of future behaviour than is past behaviour.

Summary of the weight reduction studies. Efficacy studies with weight reduction have supported Bandura's theory. Since measurement errors also surface in these studies, results should be interpreted with caution. Self-efficacy is usually measured using a self-report scale on which subjects are instructed to indicate the extent to which they feel capable of executing each of the specified cognitive-behavioural strategies in the treatment package. A situational measure of self-efficacy is also commonly used, where subjects are instructed to indicate, using a Lickert-scale, the extent to which they feel capable of coping with risk situations associated with eating. It should be noted that these two types of scales measure behaviours other than absolute weight loss, yet these scales are most commonly used as predictors of weight loss.

Exercise. Self-efficacy has been found to be an important mediator in participation of physical activity across diverse populations. Efficacy has been used successfully to predict physical activity in two very different conceptual areas: adherence efficacy, and perceived physical ability efficacy in post-myocardial infarction (MI) patients. The effects of efficacy in the prediction of exercise participation in post-MI patients, and exercise adherence in healthy populations will be dealt with separately as they involve different issues.

Self-efficacy has proven to be an especially powerful predictor of exercise participation in cardiac rehabilitation. Recovery from myocardial infarction involves a reappraisal of physical abilities in terms of how robust patients perceive their hearts to be (Ewart, Taylor, Reese, & DeBusk, 1983). Unfortunately, individuals recovering from MI often focus on declining abilities rather than current capabilities. A declining sense of perceived physical efficacy for activities such as walking, jogging, lifting, and sex often results in a curtailment of all physical activity (Lemanski, 1990). Since behaviour is partly governed by self-referent thought, perceived inefficacy for physical activity can give rise to inactivity.

In a study of post-myocardial infarction patients, Ewart, Taylor, Reese, and DeBusk (1983) found that pre-exercise test self-efficacy assessments of physical ability were related to treadmill performance (r = .36) measured as peak treadmill heart rate. Correlations between peak treadmill heart rate and post-treadmill self-efficacy (r = .50) were even higher, suggesting that efficacy changed as a result of exposure to the exercise test. Specifically, among those who evidenced low self-efficacy scores prior to treadmill testing, self-efficacy for activities similar to treadmill exercise (walking, stair climbing, and running) changed following treadmill results, especially among those who performed well on the treadmill test (efficacy scores for running 1 block increased 285%, $p < .005$) compared with those who performed less well (efficacy for running increased 130%, $p > .05$). Patients with high self-efficacy scores prior to treadmill testing, maintained high values of self-efficacy (+58%) if they performed well, compared to a decrease (-33%) in patients who performed less well. Additionally, post-treadmill counselling sessions by a physician and nurse resulted in significantly increased self-efficacy scores from pre-treadmill testing for dissimilar activities (sexual activity, lifting, and general exertion). Further, the

modified self-efficacy scores due to the effects of treadmill testing and counselling were more accurate predictors of the duration and intensity of subsequent physical activity in the home environment than were peak treadmill heart rates from the exercise test. Therefore, self-efficacy perceptions supplied information about probable physical exercise performance that ability measures alone did not provide.

In another study of CHD patients, Ewart et al., (1986) found that strength gains at the end of training were predicted by self-efficacy assessed prior to and during training. Ewart and his colleagues examined the specificity hypothesis of self-efficacy in three ways. First, they found evidence to support the postulation that the relationship between self-efficacy judgments for various tasks will be a function of the perceived similarity between the tasks being assessed (efficacy scores for jogging and running were more highly related to each other than were efficacy scores between lifting and climbing). The second test of the specificity of self-efficacy revealed that the strength of prediction between self-efficacy and behaviour increased substantially when self-efficacy assessments more closely matched the measured tasks (lifting efficacy and arm strength, $r = .73$, $p < .0001$; jogging efficacy and treadmill endurance, $r = .54$, $p < .001$), and the weakest relationships obtained were those relating self-efficacy for one type of task (lifting) to a high dissimilar performance (jogging, $r = -.16$, $p > .05$).

Finally, self-perceived abilities in a given task were found to change only after the patients acquired relevant new ability information by performing a task of that type, whether the new ability information hailed from the performance test or enactive experience with the exercise program. This last finding enabled Ewart et al. (1986) to perform the third test of the specificity hypothesis which revealed that self-efficacy gains during training or testing were correlated with performance improvements on similar but not dissimilar tasks.

Consistent with the Ewart et al. (1983; 1986) studies, Taylor, Bandura, Ewart, Miller, and DeBusk (1985) found that the personal efficacy judgments of physical and cardiac ability made by the male CHD patients they studied predicted treadmill performance. Perceived physical self-efficacy and cardiac efficacy also increased significantly following both treadmill testing and counselling. Wives' doubts about their husband's capacity for physical exertion were reflected in their low efficacy ratings of their husband's physical and cardiac abilities. The wives' efficacy judgments regarding their husband's physical and cardiac capabilities, however, increased significantly when they were allowed to both witness their husband's performance on the treadmill test, as well as walk on the treadmill themselves and experience the same intensity of physical exertion that their husband's had performed. Wives who increased their physical efficacy judgments of their husband's abilities were much more likely to encourage them to resume an active life.

In addition to successfully predicting treadmill performance with efficacy scores, Kaplan et al. (1984) were able to show that perceived self-efficacy was related to compliance with exercise prescription (target behaviour was walking) in a sample of chronic obstructive pulmonary disease patients. Groups given specific training for compliance with walking (groups received training in one of behaviour modification, cognitive modification, or cognitive-behaviour modification techniques) significantly increased their activity in comparison to the attention control group. Kaplan and his colleagues found that the changes in activity level were mediated by changes in perceived efficacy for walking. Congruent with the specificity hypothesis of efficacy theory, efficacy expectations for other physical tasks such as lifting and climbing changed as a function of their similarity to walking.

In a prospective study of young healthy adults enrolled in a university physical fitness program, Desharnais, Bouillon, and Godin (1986) showed that both self-efficacy and outcome efficacy proved to significantly discriminate adherers from dropouts, although self-efficacy was a more central determinant. In contrast to efficacy measures used in exercise performance studies which assess subjects' judgments of their perceived capabilities to physically perform a broad spectrum of tasks such as lifting, climbing, and running, Desharnais and his colleagues used a one item test of self-efficacy expectations that asked participants "to what extent they expected to be capable of attending the program regularly until its completion" (pp. 1157). Potential dropouts were not only less certain about their capacity to regularly attend the fitness classes until completion of the program, but they also expected more benefits from participation in the program than did adherers.

Using a sample of undergraduate physical education students, Dzewaltowski (1989) tested the ability of efficacy theory to predict exercise behaviour in a variety of required classes including jogging, life-saving, soccer, softball, volleyball, weight training, flexibility, advanced fitness, and relaxation techniques over an 8 week period. Two SLT variables, self-efficacy and self-evaluated dissatisfaction, significantly predicted exercise behaviour. Specifically, individuals who were high in self-efficacy and those who were more satisfied with the outcomes of exercise (e.g., present body weight) were more likely to exercise than those who had lower self-efficacy, and were less satisfied or dissatisfied. Additionally, those who had both high levels of outcome efficacy and high satisfaction with their actual personal health effects achieved from exercise, were more likely to participate in exercise. When compared with the two other primary SLT variables (satisfaction and outcome beliefs) assessed in this study, the standardized regression coefficients supported the hypothesis that the strongest

predictor of behaviour was self-efficacy. For completion of presentation, it is important to note that when all the SLT variables were force-entered into a multiple regression equation, they accounted for 12% of the variance in the average number of days exercised per week (F (1, 326) = 43.31, $p < .001$). However, only self-efficacy and self-evaluated dissatisfaction demonstrated a significant additive effect on behaviour. Further, when SLT variables were entered into the equation following the forced entry of behavioural intention, attitude toward exercise, and subjective norms of exercise variables, SLT variables uniquely accounted for 10.8% ($p < .05$) of the variation in exercise behaviour. It is important to note that although total days exercised was originally defined as the dependent measure of exercise behaviour in this study, the average number of days exercised per week was used in the analyses with no explanation for the change in criterion provided.

Although two other notable studies have been performed on self-efficacy and exercise adherence, problems with the methodology or statistical analyses leaves one to interpret the statistical significance of these studies with caution. In one of these studies, Wurtele and Maddux (1987) reported that both perceived vulnerability to heart disease and self-efficacy variables, in a sample of undergraduate women, enhanced intentions to exercise as well as actual self-reported exercise behaviour. Intentions, in turn, were predictive of self-reported changes in behaviour. Although this was designed as a multivariate study, all variables were analyzed individually with ANOVA and main effects were reported when interactions were statistically significant.

In the other study that is difficult to interpret, Sallis, Pinski, Grossman, Patterson, and Nader (1988) developed self-efficacy scales specifically for health-related eating and exercise behaviours. Although self-efficacy was significantly associated with exercise behaviours, efficacy was measured with regular exercisers and

was hypothesized to reflect their current exercise habits, and not predict future exercise. Consequently, respondents merely reported the behaviours in which they already engaged rather than predicting future behaviours. As well, although the exercise adherence efficacy scale was designed to be an objective instrument to be used across studies, a few problems with the items are apparent. For instance, some of the items were population specific (e.g., "read or study less in order to exercise more"). Other items reflected only limited scheduling possibilities in which individuals had to judge whether they could make time for exercise (e.g., "get up early, even on weekends, to exercise" or "get up earlier to exercise"). Since the instrument only allowed one to judge whether or not they could get up earlier in order to exercise, the questionnaire could not tap accurate efficacy assessments in individuals who had decided to exercise at other times in the day.

Summary of the exercise and efficacy studies. A good deal of research has indicated that self-efficacy mediates behaviour. Further, self-efficacy, is to some degree, related to health behaviour. Unless people believe they can master and adhere to health-promoting habits, they are unlikely to devote the effort necessary to succeed. A number of studies of cardiac patients undergoing aerobic exercise and strength testing support the hypotheses posited by self-efficacy theory that strength of efficacy predicts performance. Further, studies have shown that self-efficacy is enhanced by exposure to the recommended activity, modeling, persuasion, and arousal. Ewart et al. (1983, 1986) have found that self-efficacy is valuable in predicting and enhancing patient response to cardiac rehabilitation programs. The most important practical and theoretical finding was the discovery that changes in self-efficacy scores after treadmill testing are better predictors of patients' subsequent home activity levels than is the maximum heart rate achieved during treadmill exercise testing. These findings

suggested that patients' perceptions of personal efficacy influenced which physical activities they attempted, how hard they exerted themselves, and how long they were likely to persevere.

CHAPTER 3

DESIGN OF THE STUDY, DESCRIPTION OF THE CAUSAL MODEL, STATEMENT OF HYPOTHESES, AND ASSUMPTIONS AND LIMITATIONS OF THE STUDY

Research from the exercise adherence literature has been equivocal. Atheoretical, predictive designs have done little to elucidate the determinants of adherence to exercise. Although self-efficacy has emerged as the most consistent predictor of exercise adherence, the tests of its strength have tended to rely on exploratory step-wise multiple regression analyses rather than theory-based confirmatory analyses such as hierarchical regression or path modeling. The primary purpose of this study was to clarify the role of the cognitive mechanisms specified in self-efficacy theory in terms of their ability to govern behaviour, specifically adherence to a program of regular exercise. Applied to the behaviour of exercise adherence, self-efficacy theory asserts that perceptions of personal efficacy to carry out a program of regular exercise should mediate exercise adherence by determining how hard and how long an individual will work to keep to the program.

Design of the Study

The design of the current study involved a number of improvements over the research currently available in the exercise adherence literature. These design improvements included clear guidelines for the dose of exercise, the inclusion of outcome efficacy and motivation measures commensurate with the theory, the measurement of social learning variables over time, and an attempt to maximize the range of self-efficacy scores by exposing participants to differential sources of efficacy. These improvements will be subsequently described.

Exercise dose. The exercise prescribed in the current study was specifically designed according to the guidelines set by the American College of Sports Medicine (1991) to enhance cardiovascular functioning. Mode and dose specifications allow

future replications of the exercise program central to this study, and the results are therefore more conducive to cross-study comparisons.

The inclusion of outcome efficacy and motivation. In order to provide a more complete test of self-efficacy theory, outcome efficacy and motivation were measured in addition to self-efficacy. Behavioural repertoire, another variable specified in self-efficacy theory (Bandura, 1977), was not measured as the exercise prescribed in the current study did not require any special skills.

The measurement of SLT variables over time. Social learning variables are postulated to be dynamic constructs, not static characteristics. As such, in the current study these variables were measured repeatedly over time, after exposure to the various sources of efficacy provided naturally in the environment as a result of exercise participation. Specifically, self-efficacy, outcome efficacy, and motivation were measured at four different times in the study. Time 1 measurements (the point in time in which efficacy is usually measured in other studies) were interpreted to represent naive assessments of perceived efficacy to exercise prior to actual experience with the exercise program.

Time 2 measurements were analogous to a realistic job preview with participants being exposed to the education and testing components of the program, but not actual experience with the exercise program. Time 3 measurements (following 4 weeks of exercise) were designed to represent a more informed assessment of ability and motivation to participate fully in the program as participants were exposed to the inherent problems of adhering to regular exercise. Time 4 measurements (following the second exercise test and counselling, but prior to the final 4 weeks of exercise) were designed to tap changes in SLT variables following covert and overt performance feedback.

Attempts to maximize the range of self-efficacy. Participants were arbitrarily divided into two groups in an attempt to maximize the range of self-efficacy scores over time. Group 1 was provided with a greater opportunity for a mastery experience with exercise than Group 2 as their exercise intensity was dependent upon self-monitoring of heart rate as opposed to machine controlled (revolutions per minute) for Group 2. Group 1 also received anthropometric and physiological performance feedback following each of the three exercise tests, whereas Group 2 received this feedback only at the end of the program. This intervention follows from studies in which researchers (Ewart et al., 1983) have found that exercise testing and performance feedback increases self-efficacy.

The First Set of General Hypotheses

In the first set of hypotheses of this study, the difference between groups in the change of self-efficacy, outcome efficacy, and motivation over time was examined. Since the three social learning variables were tested over time (repeated measures design), profile analysis was the selected statistical procedure. Profile analysis provides a test of parallelism (group by dependent variable interaction), levels (group main effect) and flatness (dependent variable main effect) in one analysis. No attempts were made to delineate the sources of changes in the efficacy variables as it has been stipulated that self-efficacy predicts level of performance regardless of whether self-efficacy is changed through enactive mastery, vicarious learning, or exhortive and emotional experience (Bandura & Adams, 1977). It is also difficult to tease apart the sources of efficacy as individuals are exposed to variations of the sources (Bandura, 1977).

Description of the Causal Model

Causal modeling was employed as a test of the applicability of Bandura's self-efficacy theory to exercise adherence. Causal modeling is a method which examines the plausibility of causal hypotheses put forward in a theory. It is a statistical method that permits causal inferences to be made with naturally occurring events in non-experimental studies (Ferketich & Verran, 1990).

Conceptualization of a causal model. Conceptually, a causal model represents a set of interrelated hypotheses that attempt to explain the occurrence of a given phenomenon. The goal of causal modeling is to attempt to synthesize the literature into a unified whole by deriving a model that is both parsimonious and powerful in terms of its explanatory power (Ferketich & Verran, 1990). Two underlying assumptions must be met in order to test a causal model (Ferketich & Verran, 1990). First, as causal modeling is explanatory as opposed to exploratory, the model to be tested must be based on a well-supported theory with appropriate causal connections and temporal ordering among variables. Second, the assumptions underlying the statistical techniques used must be met in order to test the specified model. Given that these two assumptions are met, causal modeling reduces to a series of multiple regression analyses using the least squares criterion (Pedhazur, 1982).

Interpretation of a causal model. In causal modeling, the path coefficient for the effect of an independent variable on a dependent variable is equivalent to the standardized regression coefficient (Pedhazur, 1982). The regression coefficient test of significance indicates whether the path coefficient is significantly different from zero. A model link is nonexistent when the significance of a coefficient does not meet the pre-specified alpha level. Although tests of significance are the primary method used to examine the existence of a path, Pedhazur (1982) has suggested that for large samples, standardized

regression coefficients lesser than, or equal to .05 should be considered substantively nonsignificant. A model is confirmed and the causal hypotheses supported when the theoretical model is statistically shown to have a good fit with the empirical data being examined.

Testing a causal model for significance. In a multistage causal model where more than one regression equation is calculated, testing regression coefficients within each equation does not constitute a test of the model (Pedhazur, 1982). Rather, the validity of a causal model is assessed by the efficiency of its path coefficients to reproduce or closely approximate the original correlation matrix used in the model (Pedhazur, 1982). However, reproduction of the correlation matrix in a just-identified model is always possible regardless of whether the model is tenable or reasonable on logical and/or theoretical grounds. Since just-identified models may always be shown to fit the data perfectly, they cannot be tested (Pedhazur, 1982).

Building a causal model for efficacy and exercise adherence. In order to explain the phenomena in question, causal models do not necessarily have to be elaborate. As previously noted, parsimony is central to causal modeling, and as such, only those agents that are postulated to be the most powerful (well-supported from previous studies) are included. In efficacy theory, the most powerful agent is self-efficacy. Bandura hypothesizes that "given appropriate skills and adequate incentives, . . . efficacy expectations are a major determinant of people's choice of activities, how much effort they will expend, and of how long they will sustain effort" (1977, pp. 194). The theory also hypothesizes that: (a) self-efficacy is not necessarily linearly related to behaviour, but rather a threshold exists, above which efficacy scores will predict behaviour; (b) self-efficacy, outcome efficacy, and motivation may interact in their effects on behaviour; (c) self-efficacy is a better predictor of behaviour than outcome

efficacy or motivation; and, (d) outcome efficacy has both direct and indirect effects (mediated by self-efficacy) on behaviour.

The hypotheses suggesting a quadratic function (hypothesis a) and an interactional relationship between the SLT variables and behaviour (hypothesis b) were not part of the actual causal model tested in this study, but rather served as preliminary tests of the statistical assumptions of linearity and additivity required by path analysis. These preliminary tests were performed under the heading of The Second Set of General Hypotheses. The tenability of the focal hypothesis of efficacy theory (self-efficacy predicts behaviour given adequate incentives) and the more peripheral hypotheses alluding to the power of outcome efficacy to predict behaviour (hypotheses c and d) were examined in a causal model under The Third Set of General Hypotheses.

The Second Set of General Hypotheses

The second set of hypotheses were used to test the underlying statistical assumptions necessary for path analysis. As path analysis requires that the assumption of linearity be met, Bandura's (1977) postulation of a quadratic function between efficacy and behaviour was tested with trend analysis in an attempt to find the potential threshold of efficacy, above which scores are hypothesized to equally predict behaviour. Additionally, the joint effects of self-efficacy, outcome efficacy, and motivation were assessed using a test of interactions in multiple regression. In the event that the interactions were found to be significant, the conventional follow-up tests of simple main effects (Pedhazur, 1982) were planned.

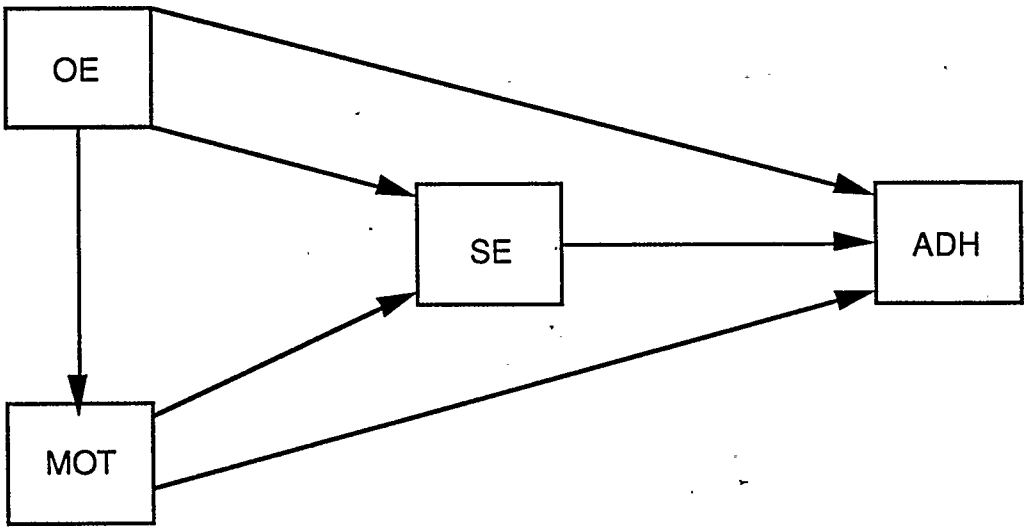
The Third Set of General Hypotheses

The third set of hypotheses tested the tenability of the aforementioned hypotheses proposed in Bandura's self-efficacy theory (1977). A just-identified recursive path model was used for this purpose. In a just-identified model the number of path coefficients to be estimated equals the number of known bivariate correlations between the model variables (Ferketich & Verran, 1990). Recursive refers to an asymmetrical causal flow; the specified paths move solely in one direction and are not reciprocal or reversible.

The general path model is outlined in Figure 1. Arrows indicate that a given observed variable is influencing another in the direction of the arrowhead (as this is a fully-recursive model, path directions are not interchangeable). Following from self-efficacy theory, outcome efficacy (OE) was hypothesized to directly influence motivation (MOT), self-efficacy (SE), and adherence (ADH). Motivation was hypothesized to directly effect SE, and SE was postulated to directly influence ADH. Additionally, motivation and outcome efficacy were hypothesized to have indirect effects on adherence through self-efficacy. Only the OE to MOT and MOT to SE paths were exploratory. Although Bandura (1977) has stated that self-efficacy is predictive of behaviour given 'adequate levels' of motivation (adequate is not defined), a direct path from either OE to MOT or from MOT to SE is not actually specified in the theory.

Figure 1

Proposed Path Model for the Effects of Self-efficacy, Outcome Efficacy, and Motivation on Exercise Adherence



Three path models were examined in this study. The first one most closely followed the format currently used in the literature; an initial naive measure of efficacy administered prior to the experimental program was used to predict the recommended behaviour at the end of the program. For this path model, Time 1 measures of self-efficacy, motivation, and outcome efficacy were used, reflecting participants' judgments of their ability to adhere to the full 8-week program. This model tested the degree to which naive perceptions of efficacy and motivation were capable of predicting exercise adherence 8 weeks into the future.

In the analyses for the first path model, raw score strength levels of self-efficacy, outcome efficacy, and motivation were represented by a percentage from 1-100%, and adherence was measured as a continuous variable reflecting total days of exercise. A

maximum of 24 days of exercise, commensurate with the prescribed program, was imposed on the adherence measure. Individuals who did not report their activity levels were coded as missing data and were subsequently deleted from the study.

Standardized path coefficients (equivalent to standardized regression coefficients, β) and unstandardized path regression coefficients (equivalent to unstandardized regression coefficients, b) are both presented in the results to provide a deeper understanding of the meaning of the path models relative to the theory. Only direct effects and total effects (effect coefficients) are presented in the completed models. No attempt was made to explain the noncausal parts of the correlation coefficients (spurious correlations due to common causes).

Although the hypothesized paths remain unchanged from the full 8-week model (see Figure 1), the second and third models provided a finer analysis of efficacy theory variables and adherence by examining assessment of efficacy and adherence 4 weeks at a time. These models were more exploratory in nature, and were designed to test the boundaries of self-efficacy theory in terms of stability across time. The relationships in a stable model should remain the same during several time periods. If the relationships are found to be stable only within a very short period of time, in this case 4 weeks at a time, the generalizability of the model becomes limited (Ferketich & Verran, 1990).

The design of the second and third path models remain identical to the first. However, the measures used to assess the SLT variables and adherence for these models are different. In the second path model, the relationship between Time 2 SLT assessments and the first 4 weeks of exercise adherence was examined. The SLT measures in the third path model were taken at Time 4 and were used to predict the last 4 weeks of exercise adherence.

Statement of Specific Hypotheses

Three general hypotheses have been presented. Each of the three general hypotheses contain two to four testable specific hypotheses which are specified below.

The First Set of Hypotheses: The Change in SLT Variables Over Time

Hypothesis 1a: Self-efficacy strength will increase over the course of the study.

Hypothesis 1b: The increase in self-efficacy over time will be greater for Group 1 than for Group 2.

Hypothesis 1c: Outcome efficacy will increase over the course of the study as a result of noticeable physiological changes due to exercise. Because regular exercise should lead to the same physiological changes in all participants, no differences were hypothesized between groups.

Hypothesis 1d: The change in motivation over time will be significantly different than zero. As this was an exploratory hypothesis, a direction of change in motivation was not specified.

The Second Set of Hypotheses: Self-efficacy, Outcome Efficacy, and Motivation and Their Relationship to Exercise Adherence

A null hypothesis approach was taken to present the second set of hypotheses.

Hypothesis 2a. Self-efficacy, outcome efficacy, and motivation will be linearly related to adherence (the trend analysis for adherence regressed on each of these variables is expected to be nonsignificant.)

Hypothesis 2b. Self-efficacy, outcome efficacy, and motivation will not interact in their effects on exercise adherence.

The Third Set of Hypotheses: Path Model of SLT Variable Effects on Exercise Adherence

Hypothesis 3a: For path models 1, 2, and 3, the path from self-efficacy to adherence will be positive, and larger than the paths from outcome efficacy and motivation to adherence.

Hypothesis 3b: For path models 1, 2, and 3, the paths from outcome efficacy to motivation, self-efficacy, and adherence will be positive.

Hypothesis 3c: For path models 1, 2, and 3, the paths from motivation to self-efficacy and adherence will be positive.

Assumptions of the Study

For the purpose of this investigation it was assumed that:

1. The exercise program employed herein effectively simulated a conventional unsupervised exercise program.

2. Participants would be capable of using the self-report scales to accurately judge their personal perceptions of self-efficacy, outcome efficacy, and motivation with regard to participation in the 8-week exercise program.

3. The scales used to measure the efficacy theory variables were accurate assessments of the constructs of self-efficacy, outcome efficacy, and motivation.

4. Self-reports of exercise activity were accurate assessments for the purpose of examining exercise adherence.

5. Subjects were free of contraindications to exercise. Specifically the female participants were not pregnant, and everyone was free of metabolic disease, cardiopulmonary disease, and CHD.

Limitations of the Study

The following limitations of the current study are acknowledged:

1. The sample of subjects consisted of self-selected volunteers to an exercise program, and as such, the subsequent generalizability of the findings to other populations is restricted.

2. The analyses performed in the study probably constituted a conservative test of self-efficacy hypotheses in that subjects were apparently healthy and were relatively highly motivated.

3. Because the present study was designed to examine the relationships between perception (self-efficacy) and exercise adherence in one's natural environment, no formal attempt was made to influence participants' physical activity. The study, therefore differed from intervention studies designed to enhance adherence.

CHAPTER 4

METHOD

Recruitment

Subjects were recruited via company-wide employee memos from four Calgary oil and gas exploration/production companies. In order to control for the availability and convenience of exercise facilities, only companies with in-house exercise facilities were approached. The recruitment memo stated that only sedentary individuals (people who had not engaged in regular physical activity more than 2 times per week for the last 2 years), who were free of coronary heart disease, cardiopulmonary disease, metabolic disease (diabetes mellitus, thyroid disorders, renal disease, and liver disease), and who were not pregnant would be considered. It was explained that these special populations require special exercise prescriptions and that this was beyond the scope of the study. The memo included an application form on which interested potential participants filled out a brief synopsis of their physical activities over the past 6 months, as well as their reasons for wanting to participate in the study. Since the training effects of exercise are typically lost within 6 months of inactivity, an individual's activity over the past 6 months was assumed to give a good indication of whether or not they met the criteria of being sedentary and in an untrained physical condition.

Participants

One hundred and ten individuals were initially invited to attend one of the two orientation and education meetings. Since this first meeting was an integral part of the study, only those individuals who attended were included in the study. A total of 84 adults (38 females, 46 males), ranging from 23-61 years of age (M = 39.8, SD = 7.9) participated in the study.

Questionnaires

Physical Activity Readiness Questionnaire

To ensure that only apparently healthy individuals participated, volunteers were screened pre-activity with the Physical Activity Readiness Questionnaire ([PAR-Q], see Appendix A). The PAR-Q was developed by the British Columbia Ministry of Health, and has been used as a pretest screening instrument prior to administration of the Canadian Aerobic Fitness Test for over 1 million people, none of whom have experienced any serious cardiovascular problems. It is essentially 100% sensitive for the detection of medical contraindications to exercise and approximately 80% specific (American College of Sports Medicine, 1991).

Demographics

Basic demographic information was collected (see Appendix B). Demographic data of interest included date of birth, occupation, years of schooling, past participation in exercise and sport, smoking habits, percentage of friends that exercise, and whether one's spouse exercised.

Social Learning Theory Variables

The social learning theory variables were measured using The Exercise Personal Efficacy Scale, The Exercise Outcome Efficacy Scale, and The Exercise Motivation Scale self-report instruments, designed by the researcher. Since Bandura (1977) has emphasized the importance of assessing expectations specific to the activity one wants to encourage, the Exercise Personal Efficacy Scale was a measure of the participants' perceived confidence in their personal ability to complete the 8-week exercise program. This scale involved two questions; the first pertained to the belief that one could

complete the whole 8-week program, and the second reflected one's confidence in the ability to complete only 4 weeks of the program at a time. Subjects rated their confidence for each question on a 100-point probability scale. The scale used 1-unit intervals that represented the full range of confidence, from 1 indicating no confidence to 100 representing totally confident (see Appendix C).

The Exercise Outcome Efficacy Scale followed the same self-report format as the Exercise Personal Efficacy Scale. This questionnaire asked subjects to rate their belief that the specific 8-week exercise program designed for the study would improve their own personal health. Subjects rated their belief on a 100-point probability scale that used 1-unit intervals representing the full range of belief, from 1 indicating no belief to 100 representing total belief (see Appendix C).

Motivation was also assessed with a self-report scale, the Exercise Motivation Scale. This scale followed the same format as the Exercise Personal Efficacy and the Exercise Outcome Efficacy Scales. Subjects rated their motivation to participate in the 8-week exercise program designed for the study on a 100-point probability scale. The scale used 1-unit intervals that represented the full range of motivation, from 1 indicating no motivation to 100 representing totally motivated (see Appendix C).

The structure of the efficacy instruments followed that of the efficacy strength scales suggested by Miller (1989). This format followed the scales originally created by Bandura (1977). Although, an initial attempt to validate the scales with 250 undergraduate psychology students was made, it proved unhelpful as the questions were designed for sedentary adults who had volunteered for a specific 8-week exercise program, and the questions tended to create confusion.

As reported by Kaplan et al. (1984), it is difficult to evaluate the reliability of self-efficacy scales in traditional psychometric terms. First, each specific efficacy

scale is a single item, and internal consistency estimates of reliability are based upon average intercorrelations between items. Second, test-retest reliability is not considered appropriate as efficacy is considered to be a dynamic characteristic that fluctuates over the course of time. Bandura (1982), however, has provided some indirect evidence for the reliability of self-efficacy scales by demonstrating their substantial correlation with external variables. These validity correlations would be expected to be low if efficacy scores represented only random error.

Open-ended questionnaire

The subjects also completed an open-ended format questionnaire 4 weeks into the program. This questionnaire was designed to find out where individuals were exercising (at work, home, or facility other than that offered by the company), whether the prescribed program was being strictly followed or altered (e.g., altered by adding a muscular strength component), what psychological or physical changes (positive or negative) the participant had noticed over the 4 week period, and any problems the participants might be experiencing. This latter question allowed the experimenters to address any concerns or problems that may have occurred (e.g., muscle soreness which may indicate an overly enthusiastic approach to the program).

Anthropometric and Physiological Testing

Assessment of various morphologic and physiologic variables was conducted. These included height with a Magnetometre Stadeometer to the nearest 10th of a centimeter (cm); body weight with a standard physician's beam scale to the nearest 10th of a kilogram (kg); skin-folds in millimeters (mm) by Harpenden calipers; and hip and waist girths with a Lufkin metal measuring tape in mm. Resting heart rate was

measured in beats per minute using a heart rate monitor (PE 3000 Sport Tester), and resting blood pressure was taken in mm Hg using the standard inflatable cuff, stethoscope and sphygmomanometer.

Exercise Testing Protocol

Aerobic capacity (VO_2max) was estimated using a submaximal cycle ergometer test. The exercise test was submaximal because of the discomfort (especially for sedentary individuals) and possible dangers (heart failure in individuals with undiagnosed CHD) of direct measurement of oxygen uptake. Additionally, physician supervision is not required during submaximal testing (up to 40-60% VO_2max or 75% of age-predicted maximal heart rate) regardless of age, providing subjects are asymptomatic of CHD, cardiopulmonary disease, metabolic disease, and are not pregnant (ACSM, 1991). As previously mentioned, subjects were screened pre-activity for these possible contraindications to exercise by the PAR-Q questionnaire.

The submaximal exercise testing followed the guidelines set by the American College of Sports Medicine (1991). Three exercise tests were performed over the course of the program and the same protocol was used for every test. The exercise tests were performed on a Monarch cycle ergometer in the Human Performance Laboratory at the University of Calgary. The cycle ergometer was regularly calibrated with a known free-weight not less than 3 kg.

The submaximal protocol used in the current study began with a minimum 2 minute warm-up phase followed by progressive power increases of 25-50 watts every 2 minutes. The appropriate initial power level was selected according to each subject's weight and activity status (initial assumption was that all participants were inactive). Heart rate, monitored during the test by a Sport Tester, was recorded during the last 15

seconds of each test stage. The test was terminated when the subject's HR reached 70% of their predicted age-adjusted maximum heart rate (MHR = 220 - age). Other end-points for termination of the test include muscle fatigue, and hyperpnea, although it was not necessary to use any of these. Recovery consisted of 2 to 4 minutes of minimum cycling with no resistance until the subject's heart rate fell below 100 beats/minute and the subject felt comfortable. The ACSM suggests that recovery HR values should be stable but not necessarily at pre-exercise levels before discontinuation of monitoring. Based on the linear relationships between HR, workload, and VO_2, an estimated VO_2max was calculated by extrapolation using the predicted age-adjusted MHR as the end-point.

Exercise Prescription.

In general, all participants were prescribed an exercise program that consisted of 3 independently-scheduled sessions per week for 8 weeks. These sessions included a 5-10 minute warm-up, 30 minutes on the stationary bicycle, and 5-10 minutes of cool-down exercise .

Subjects were arbitrarily assigned to Group 1 or Group 2 based on whether they attended the first education/orientation session or the second, respectively. According to Bandura, a control group was not necessary as efficacy strength, regardless of whether it is preexisting or manipulated, is hypothesized to predict behaviour (personal communication, August 24, 1991). Group 1 monitored the intensity of their exercise using the heart rate palpation technique. They were instructed to exercise at an intensity of 60-75% of their estimated MHR. In addition to monitoring exercise intensity heart rate, Group 1 was required to record their resting heart rate upon waking each morning (see Appendix D for Group 1's exercise program). Group 2 participants were instructed to exercise at 60-90 revolutions per minute. This method

of regulating exercise intensity was similar to that used at the various exercise facilities of the companies that participated. Group 2 was not instructed to monitor their heart rates either during exercise or in the morning upon waking (see Appendix D for Group 2's exercise program).

Both groups were responsible for recording the intensity, duration, and dates of each exercise session they performed. Participants were free to exercise at the venue of their choice (at a public or private exercise facility or at home).

Regardless of group, each program began with a 'starter' phase consisting of 2-4 weeks of gradual increases in duration and intensity of exercise. By week 3 of the prescribed program, subjects were at the program goal of 30 minutes a session (plus warm-up and cool-down), 3 times/week, at an intensity of 60-75% of estimated MHR or 60-90 revolutions per minute, depending on group assignment.

Procedure

The procedure in this study was conducted in four phases: (1) participant orientation and education; (2) participant exercise testing; (3) exercise program; and (4) debriefing. Prior to any exercise involvement, subjects received an orientation and education session. Exercise testing took place pre-activity, 4 weeks into the exercise program, and at the end of the 8-week exercise program. The exercise component of the study was completed on an individual basis by the subjects on their own time. Measurement of SLT variables (self-efficacy, outcome efficacy, and motivation) took place four times throughout the study, and self-reports of exercise adherence were collected twice. The debriefing session took place approximately 3 months after the last exercise test.

Participant Orientation and Education

The study began with participants attending one of two general orientation and education meetings in the Physical Education Building at the University of Calgary. At these sessions, the nature of the program was explained to all volunteers and subsequent questions were answered, except those pertaining directly to the hypotheses of the research. Subjects were informed that they were free to withdraw from the study at any time. Subsequently, participants received an informed consent form (see Appendix E) and copies of the three efficacy questionnaires: The Exercise Personal Efficacy Scale, The Exercise Outcome Efficacy Scale, and The Exercise Motivation Scale. To eliminate any ambiguity in the wording and ensure that all participants completed the scales correctly, each efficacy scale was discussed by the researcher.

The educational component included a slide presentation on the benefits of exercise and the dose of exercise required to achieve health benefits. A film followed which provided a variety of human models, representing average working people, who have taken up exercise and have had positive experiences. The purpose of the film was to provide a strong vicarious experience for the participants in terms of exercise initiation. This film also attempted to enhance participants' outcome efficacy and motivation. The only difference in the education classes between Group 1 and Group 2 involved heart rate monitoring. Although both groups were exposed to the same information on RHR, MHR, and target zone, only Group 1 was given the opportunity in class to calculate these values and to practice the palpation technique of heart rate monitoring.

The orientation session ended with a thorough demonstration of the pre-activity anthropometric assessment and exercise test. Questions were encouraged and answered. Subjects then registered for their first exercise test. A tour of the Human Performance

Laboratory was subsequently given to help orient the subjects with where to go for their test and to decrease anticipatory anxiety by familiarizing them with the lab. Subjects also received an information sheet that included instructions regarding shoe and clothing requirements for the test, the location and personal time of the test, and the protocol for abstention from eating, drinking, and smoking prior to the test (minimum 3 hour abstention).

Prior to their first exercise test, subjects were sent the demographic questionnaire via inter-office mail. The delay of the completion of this questionnaire from the orientation session was to prevent questionnaire overload.

Participant Exercise Testing

All three exercise testing sessions followed the same basic procedure. Testing was conducted on an individual basis, and complete testing took 1 hour per participant, broken up into 15 minute segments. Upon arrival at the Human Performance Laboratory, participants were fitted with a heart rate monitor and seated in a quiet place for 15 minutes. During this 15 minute period, participants completed the efficacy and motivation scales. (However, at the first testing session these questionnaires were not administered upon arrival at the laboratory since the participants had already filled out Time 1 questionnaires at the orientation session.) Participants also recorded their own resting heart rate (RHR) every 2 minutes using the heart rate monitor. This self-monitoring was an attempt to get a more accurate reading, as any type of stimuli such as an experimenter entering the room can artificially inflate RHR. After the 15 minute rest period, resting blood pressure was measured. Any participant with a resting blood pressure consistently over 145/95 was not allowed to participate in the exercise test and was excluded from the study.

The next 15 minute segment involved anthropometric assessment. Height, weight, waist and hip girths, and skinfolds were assessed. To ensure consistency of measurement over time, the same trained technician conducted all anthropometric assessments.

The third 15 minute segment involved the submaximal cycle ergometer test. Each time the participants came for testing, the cycle test was explained in detail, and they were re-assured that the test was not of a pass/fail nature.

The final 15 minute segment, or post-exercise test briefing, involved a personal consultation with an exercise physiologist. The information given by the exercise physiologist in the post-exercise test counselling depended upon whether the subject was in Group 1 or Group 2. Group 1 received complete feedback after all three exercise tests regarding their anthropometric and submaximal capacity assessments, along with the significance of their results. Group 2 participants only received their assessment results following Test 3 (the final test). Both groups were given their exercise prescription sheets and any questions the subjects had were answered.

At the end of the first and second exercise testing sessions, each participant completed the efficacy and motivation questionnaires. At the completion of the second exercise test and counselling session (week 4), the open-ended questionnaire (see Appendix F) was completed, and at the second (week 4) and third (week 8) exercise tests, adherence charts for the 4 weeks prior to the test were collected.

Exercise Program

Subjects were given an exercise program to follow after completion of their first exercise test and assessment. Subjects were given the freedom to choose their location of exercise. For subjects' convenience and economic considerations, it was decided that the experimenters could not ask subjects to purchase memberships at a club. The company

health clubs did not offer any special discounts for the study participants. Depending on the employer, health club subsidized rates ranged from $16-24 per month, payable by payroll deduction. Membership contracts varied from no restrictions to a minimum of a 12 month purchase. All clubs were run by an outside exercise consultant and were not exclusive to the employees of the companies involved in the study.

The exercise programs were designed to be simple to follow, required no great expense, and would optimize cardiovascular training benefits. Based on the prescribed program, increases in aerobic capacity were expected to be between 10-25% within 4-6 weeks (ACSM, 1991).

Debriefing

A debriefing session involving a slide presentation reviewing the modifying effects of exercise on CHD risk factors, and the results found in the study was given 3 months following the last exercise test. No further physical testing or analyses occurred at this point in the study.

CHAPTER 5

RESULTS

The data were analyzed in a variety of ways in order to answer the multiple hypotheses proposed in this study. The results presented in this section begin with a description of the sample population used, followed by analyses for each of the specific hypotheses. As previously noted, a number of important anthropometric and physiological variables were measured in the study. As the purpose of these variables was to provide feedback to the participants and was not part of the research question, the results of these measurements are tabled in Appendix G. The only results presented in this section are ones pertinent to assessing the hypothesized specificity of efficacy perceptions and their presumed influence as mediators of exercise behaviour. The sample number varied across the results section as only those participants who had complete data files were used for any given analysis.

Sample Description

Thirty-eight women and 46 men with an average age of 39.83 years (SD = 7.93; range 23-61 years) participated in the study. Seventy percent of the sample was married, 58.3% had children that lived with them, 73.8% were non-smokers, 79.8% had been active in sport or exercise in the past, 19% had spouses who exercised, and 23.8% reported that over 50% of their friends exercised on a regular basis.

The First Set of Hypotheses: The Change in SLT Variables Over Time

The first set of hypotheses examined the postulated change of efficacy over time, following exposure to the previously noted sources of efficacy (enactive, exhortive, vicarious, and emotive). The SPSSx (1986) profile analysis programme in MANOVA was run to obtain the simultaneous tests of parallelism, flatness, and levels for the repeated measures tests of self-efficacy, outcome efficacy, and motivation. As three

separate profile analyses were run, the results for each will be reported separately. Zero-order correlations within the SLT variables and among the adherence variables across time can be found in Table 1.

Table 1

Original Correlations between the SLT Variables and Adherence Across Time

Variable	1	2	3
(1) SE-Time 1	1.00	.656***	.621***
(2) SE-Time 2		1.00	.655***
(3) SE-Time 4			1.00
Variable	**4**	**5**	**6**
(4) OE-Time 1	1.00	.805***	.744***
(5) OE-Time 2		1.00	.868***
(6) OE-Time 4			1.00
Variable	**7**	**8**	**9**
(7) MOT-Time 1	1.00	.747***	.503***
(8) MOT-Time 2		1.00	.691***
(9) MOT-Time 4			1.00
Variable	**10**	**11**	**12**
(10) Total Adherence	1.00	.728***	.864***
(11) Adherence-1st 4 weeks		1.00	.284*
(12) Adherence-2nd 4 weeks			1.00

*p < .05; **p < .01; ***p < .001

Figure 2 presents a graphic representation of the changes in self-efficacy over time and between groups. Since the parallelism test was non-significant using an exact F statistic for Wilk's lambda ($F(3, 62) = 1.13$, $p > .05$), it was appropriate to interpret the levels and flatness tests. The levels test also yielded non-significant results ($F(1, 64) = .16$, $p > .05$), suggesting that the two groups did not differ in their average level of self-efficacy over time. The only significant results were produced by the flatness test (test of the constant) using an exact F statistic for Wilk's lambda ($F(3, 62) = 7.39$, $p < .001$). Univariate F statistics for the test of the constant revealed that the differences between the scale profiles were due to all three slopes since all were statistically different than zero. Specifically, self-efficacy significantly increased from Time 1 to Time 2 ($F(3, 63) = 14.81$, $p < .001$), significantly decreased from Time 2 to Time 3 ($F(3, 62) = 13.16$, $p < .001$), and then significantly increased again from Time 3 to Time 4 ($F(3, 62) = 6.37$, $p < .01$).

Figure 2.

Graphic Representation of Profile Analysis of Self-efficacy Between Groups and Over Time.

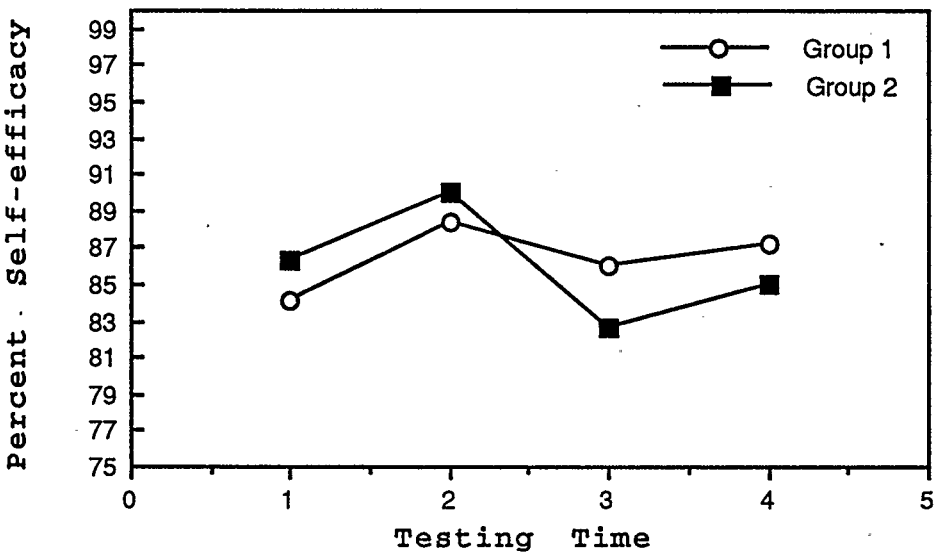
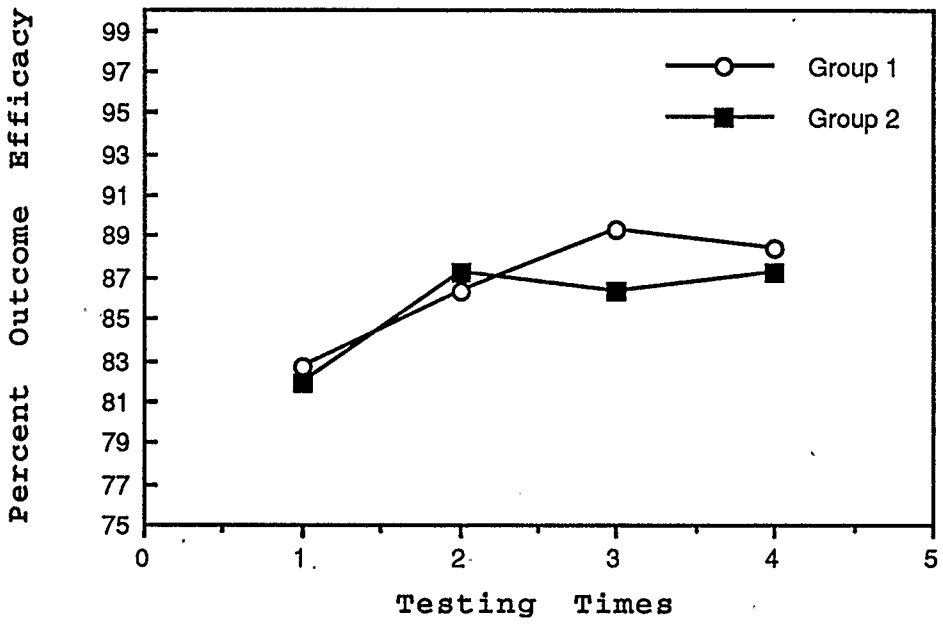


Figure 3 graphically depicts the profile analysis on outcome efficacy between groups over time. The exact F statistic for Wilk's lambda ($E(3, 63) = .32$, $p > .05$) revealed no significant differences in the test of parallelism. The levels test of outcome efficacy was also non-significant ($E(1, 65) = .65$, $p > .05$). Collapsing across groups, the overall test of flatness was significant using an exact F statistic for Wilk's lambda ($E(3, 63) = 4.49$, $p < .001$). Although outcome efficacy increased slightly overtime, univariate F statistics revealed that only the difference between Time 1 and Time 2 was significant ($E(3, 63) = 10.41$, $p < .01$).

Figure 3.

Graphic Representation of Profile Analysis on Outcome Efficacy Between Groups and Over Time.

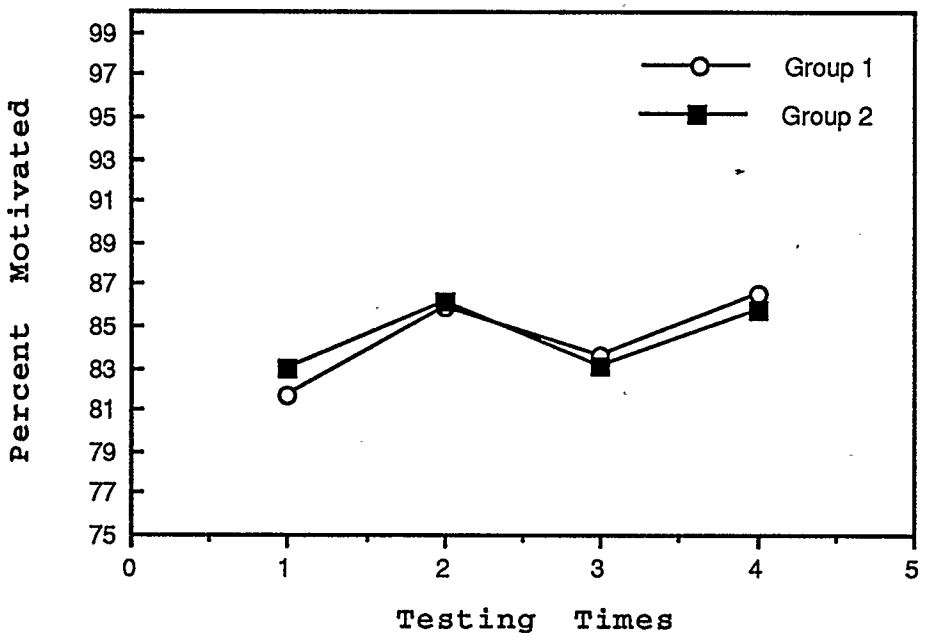


The graphic representation of motivation over time and between groups is presented in Figure 4. Results were non-significant for the test of parallelism

($E(3, 63) = .50$, $p > .05$) and levels ($E(1, 65) = .01$, $p > .05$), and significant for flatness ($E(3, 63) = 6.34$, $p < .001$). Collapsing across groups, motivation followed a pattern similar to self-efficacy. Univariate F statistics revealed that motivation increased significantly from Time 1 to Time 2 ($E(1, 65) = 11.68$, $p < .001$), decreased significantly from Time 2 to Time 3 ($E(1, 65) = 5.05$, $p < .05$), and then increased significantly again from Time 3 to Time 4 ($E(1, 65) = 7.31$, $p < .01$).

Figure 4.

Graphic Representation of Profile Analysis on Motivation Between Groups and Over Time.



The Second Set of Hypotheses: Self-efficacy, Outcome Efficacy, and Motivation and Their Relationship to Exercise Adherence

As previously noted, prior to running the path analyses, a trend analysis was performed to test the assumption of linearity between the SLT variables and adherence. Bandura (1977) has suggested that the effect of efficacy on performance is not

necessarily linear but rather a threshold of efficacy exists, scores above which are equally likely to predict the recommended behaviour to be performed. The trend analysis in the current study was designed to determine whether in fact a quadratic function between efficacy and adherence existed, and if it did, identify the threshold of efficacy strength.

The SPSSx (1986) multiple regression programme was used to examine the data for significant trends. Since the profile analyses tests of parallelism and levels revealed no significant differences between Groups 1 and 2 on self-efficacy, outcome efficacy, or motivation, self-selection was not evident and the groups were collapsed for the rest of the multiple regression analyses in the study to increase statistical power.

Separate trend analyses were performed on adherence regressed on self-efficacy, outcome efficacy, and motivation. All analyses used Time 1 measures and total adherence for 8 weeks, and therefore included only those individuals on whom complete data sets were available (N = 58 [31% of the participants dropped out]).

Table 2 presents the separate results of the trend analyses for adherence regressed on self-efficacy, outcome efficacy, and motivation, respectively. The quadratic function for self-efficacy was non-significant (Fchange (2, 55) = .48, $p > .05$), and the cubic function was not entered into the equation as tolerance limits (.01) were reached. Similar to self-efficacy, the quadratic function for outcome efficacy (Fchange (2, 55) = .04, $p > .05$), and motivation (Fchange (2, 55) = .56, $p > .05$) were non-significant, and the cubic function did not enter their respective equations as tolerance limits (.01) were reached.

Table 2

Trend Analysis Results for Adherence Regressed on the Linear, Quadratic, and Cubic Terms of Self-efficacy, Outcome Efficacy, and Motivation

Variable	Term	Mult R	R^2	R^2_{chg}	F_{chg}	Beta
SELF-EFFICACY	Linear	.074	.006	.006	.307	-.738
	Quadratic	.118	.014	.008	.476	0.625
	Cubic	n/a				
OUTCOME	Linear	.114	.013	.013	.734	-.114
	Quadratic	.116	.014	.001	.035	0.155
	Cubic	n/a				
MOTIVATION	Linear	.001	.000	.000	.000	.001
	Quadratic	.100	.010	.010	.558	.910
	Cubic	n/a				

* $p < .05$

A test of the possible interactional effects of the SLT variables on exercise adherence was performed next to test the hypothesis that the SLT variables may interact in their effects on behaviour. Multiple regression analysis in the SPSSx (1986) programme was used for this test of interactions. Again, Time 1 measures and total adherence for 8 weeks were used, and therefore included only those individuals on whom

complete data sets were available.

Table 3 presents the results of the interactional analysis for adherence regressed on self-efficacy, outcome efficacy, and motivation. All interactions were non-significant. The two-way interaction of outcome efficacy by motivation, and the three-way interaction of self-efficacy by outcome efficacy by motivation were not entered into the equation as tolerance limits (.01) were reached. Only 2% of the variance in adherence was accounted for by the forced entry of the main effects, self-efficacy, outcome efficacy, and motivation (R^2 = .020).

Table 3

Interactional Analysis Results for Adherence Regressed on Self-efficacy, Outcome Efficacy, and Motivation

Term	Variable	Mult R	R^2	R^2_{chg}	F_{chg}	Beta
MAIN EFFECTS		.141	.020	.020	.365	
	SE					-.065
	OE					-.149
	MOT					+.001
2-WAY INTERACTIONS		.160	.026	.006	.149	
	SEXOE					+.063
	SEXMOT					+.694
	OEXMOT					n/a
3-WAY INTERACTION		.160	.025	.005	.149	
	SEXOEXMOT					n/a

The Third Set of Hypotheses: Path Model of SLT Variable Effects on Exercise Adherence

A causal path model was formulated to test the hypotheses described earlier from Bandura's (1977) self-efficacy theory. Multiple regression analyses in the SPSSx (1986) programme were used to derive the path coefficients.

The sample sizes (n), means (M), standard deviations (SD), and ranges for the variables used in the path analyses are presented in Table 4. The data were analyzed for three path models. The focal one represented adherence for the whole program, and the other two path models represented the first 4 weeks of adherence, and the last 4 weeks of adherence. These latter two models were more exploratory in nature, and were designed to examine the temporal stability of efficacy measures to predict the criterion behaviour over varying time periods.

The path regression coefficients for the proposed model of total adherence predicted by the initial efficacy and motivation measures (Time 1) revealed that the proposed model did not fit the data well. Figure 5 shows both the standardized path coefficients (ß), and the unstandardized path regression coefficients (b). The direct paths in the figure are presented without brackets, and the total effects (direct plus indirect, but not spurious effects) are presented within brackets. The direct paths from motivation (b = -.0151) and outcome efficacy (b = -.0168) to total adherence were both non-significant. The direct path from self-efficacy to adherence was zero (b = .000, p > .05). The path from outcome efficacy to motivation was significant (b = .4518, p < .0001), as were the paths from outcome efficacy (b = .0750, p < .05) and motivation (b = .7151, p < .01) to self-efficacy. The original correlations among SLT variables for the full 8-week model are presented in Table 5, and the results from the multiple regression analyses used to derive the path coefficients are in Table 6.

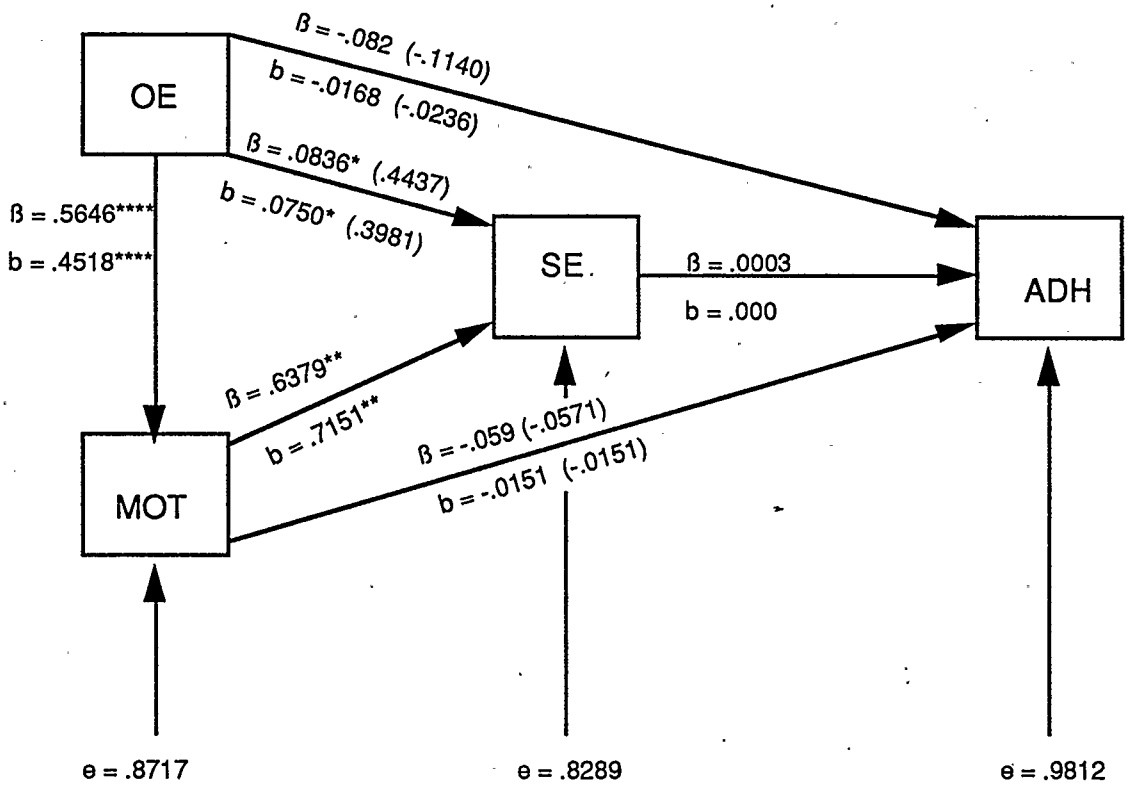
Table 4

Means, Standard Deviations, and Ranges for the Social Learning Theory Variables and Adherence

Variable	n	Mean	SD	Range
SELF-EFFICACY				
Time 1	58	79.98%	16.29%	30-100%
Time 2	71	90.16%	10.78%	50-100%
Time 4	58	86.61%	14.52%	50-100%
OUTCOME EFFICACY				
Time 1	58	82.31%	18.16%	20-100%
Time 2	71	85.73%	17.05%	10-100%
Time 4	58	87.95%	14.64%	40-100%
MOTIVATION				
Time 1	58	86.03%	14.53%	41-100%
Time 2	71	86.24%	13.67%	41-100%
Time 4	58	86.19%	14.56%	50-100%
ADHERENCE				
Weeks 1-4	71	10.27 days	2.43 days	3 - 12 days
Weeks 5-8	58	10.15 days	2.71 days	1 - 12 days
Total	58	20.98 days	3.74 days	9 - 24 days

Figure 5

Path Model of SLT Variables on Adherence for the Total Exercise Program



* p < .05
** p < .01
*** p < .001
**** p < .0001

Table 5

Original Correlations for the Four Variables in the Full 8-Week Program

	1	2	3	4
(1) Total Adherence	1.00	-.074	-.114	-.103
(2) SE-Time 1		1.00	+.444***	+.685***
(3) OE-Time 1			1.00	+.565***
(4) MOT-Time 1				1.00

*** $p < .001$

Table 6

Multiple Regression Analyses for Path Coefficients for Total Exercise Adherence Using Time 1 Measures of SLT Variables

Dependent Variable	Term	Mult R	R^2	F	SignF	Beta
TOTAL ADHERENCE		.123	.015	.277	.842	
	SE-Time 1					+.003
	OE-Time 1					-.082
	MOT-Time 1					-.059
SELF-EFFICACY - Time 1		.689	.474	24.802	.000	
	OE-Time 1					.084
	MOT-Time 1					.638***
MOTIVATION - Time 1		.565	.319	26.212	.000	
	OE-Time 1					.565***

*** $p < .001$

Figure 6 depicts the results of the path analysis for the first 4 weeks of exercise adherence. The results of this model revealed that the direct path from self-efficacy to adherence was zero (b = -.0019, p > .05). Similar to the full 8-week model, the path regression coefficients from outcome efficacy and motivation to adherence were zero (b = -.0022, p > .05, and b = .0211, p > .05, respectively). Congruent with the 8-week model, the strongest paths were from outcome efficacy to motivation (b = .4335, p < .0001), motivation to self-efficacy (b = .4275, p < .0001), and outcome efficacy to self-efficacy (b = .2253, p < .001), with motivation being a more important determinant of self-efficacy (ß = .5391) than was outcome efficacy (ß = .355). The the zero-order correlations among the variables can be found in Table 7 and results from the multiple regression analyses used to derive the path coefficients are presented in Table 8.

Figure 6
Path Model of SLT Variables on Adherence for the First Four Weeks of the Exercise Program

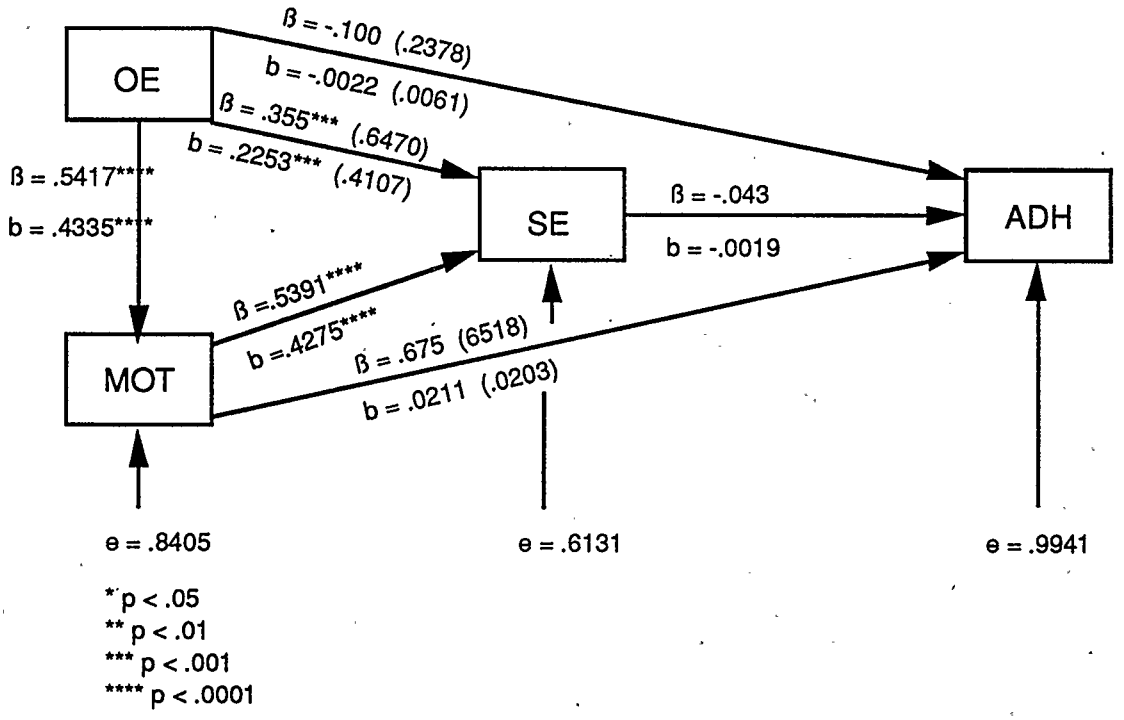


Table 7

Original Correlations for the First 4-Week Path Model

	1	2	3	4
(1) Adherence-1st 4	1.00	.070	.044	.107
(2) SE-Time 2		1.00	.647***	.731***
(3) OE-Time 2			1.00	.542***
(4) MOT-Time 2				1.00

*** $p < .001$

Table 8

Multiple Regression Analyses for Path Coefficients for the First Four Week Path Model

Dependent Variable	Term	Mult R	R^2	F	SignF	Beta
ADHERENCE--1st 4 Weeks		.108	.012	.262	.853	
	SE-Time 2					-.043
	OE-Time 2					-.100
	MOT-Time 2					.675
SELF-EFFICACY - Time 2		.790	.624	55.63	.000	
	OE-Time 2					.355***
	MOT-Time 2					.539***
MOTIVATION - Time 2		.542	.294	28.24	.000	
	OE-Time 2					.542***

*** $p < .001$

Figure 7 presents the graphic representation of the standardized path coefficients and the unstandardized path regression coefficients for the path model examining the relationship of the SLT variables on the second 4 weeks of exercise adherence. As with the previous 2 models, this model for the second 4 weeks of the exercise program did not fit the data. Self-efficacy, outcome efficacy, and motivation were not related to exercise adherence (b = .0686, p > .05, b = -.0041, p > .05, and b = .0804, p > .05, respectively). Again, the strongest paths were those from outcome efficacy to motivation (b = .6414, p < .0001), and from motivation to self-efficacy (b = .8173, p < .0001). The direct relationship from outcome efficacy to self-efficacy was nonsignificant. The original correlations among the variables can be found in Table 9, and the results from the multiple regression analyses used to derive the path coefficients are presented in Table 10.

Table 9

Original Correlations for the Second 4-Week Path Model

	1	2	3	4
(1) Adherence-2nd 4 weeks	1.00	-.026	-.077	-.129
(2) SE-Time 4		1.00	+.616***	+.877***
(3) OE-Time 4			1.00	+.645***
(4) MOT-Time 4				1.00

*** p < .001

Table 10

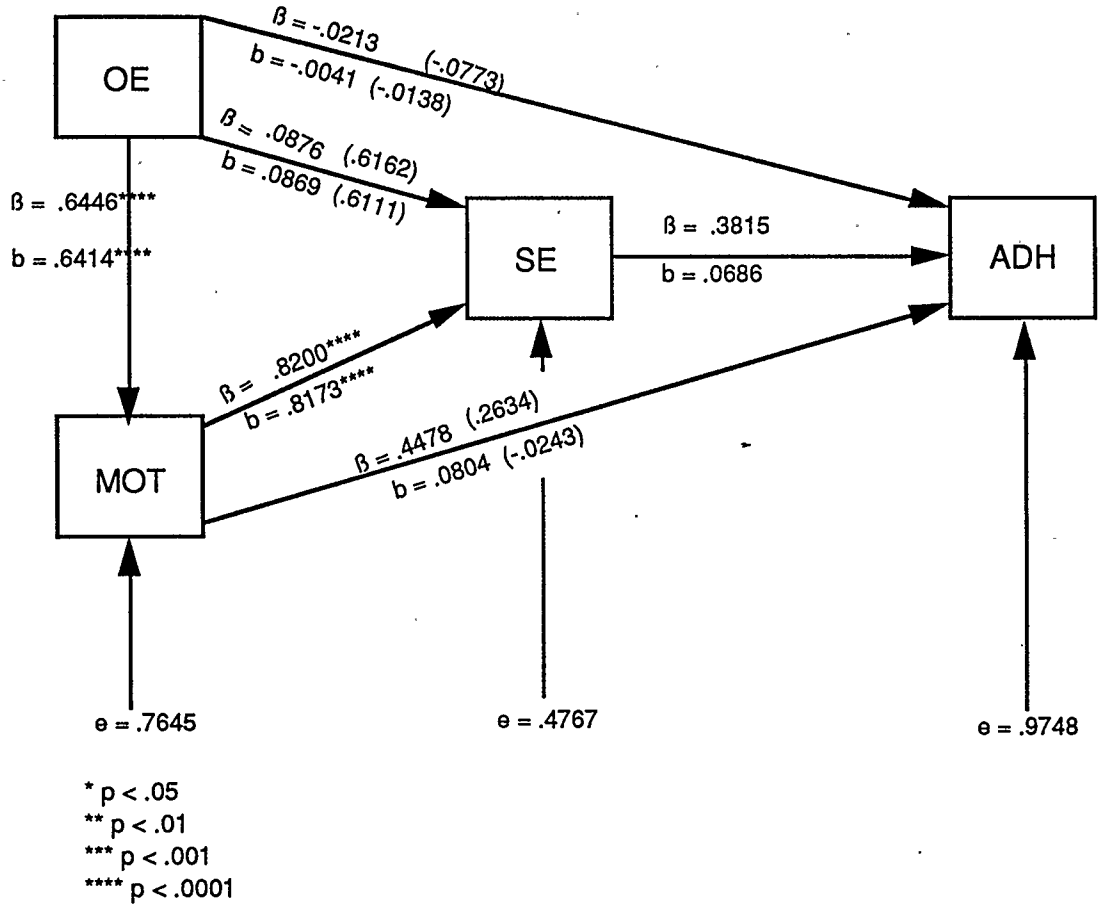
Multiple Regression Analyses for Path Coefficients for the Second 4-Week Path Model

Dependent Variable	Term	Mult R	R^2	F	SignF	Beta
ADHERENCE--2nd 4 Weeks		.223	.050	.927	.434	
	SE-Time 4					.382
	OE-Time 4					-.021
	MOT-Time 4					.448
SELF-EFFICACY - Time 4		.879	.773	91.82	.000	
	OE-Time 4					.088
	MOT-Time 4					.820***
MOTIVATION - Time 4		.645	.420	39.10	.000	
	OE-Time 4					.645***

*** $p < .001$

Figure 7

Path Model of SLT Variables on Adherence for the Second Four Weeks of the Exercise Program



Description of the Distribution of Data

The distribution of data for all measures was negatively skewed (not normally distributed) for all analyses completed in this study. The skewness for all distributions is presented in Table 11. A skewness measure of -1.15 is considered substantial

skewness, -1.76 is extreme skewness, and -1.88 is very extreme skewness (Hopkins & Weeks, 1990). The table was divided into three time segments based on the three path models to assist in the comprehension of the data used in each analysis.

Table 11

Description of the Distribution of Data

Path Model	Variable	Skewness
FULL 8-WEEK MODEL		
	Adherence	-1.361
	SE - Time 1	-1.446
	OE - Time 1	-1.290
	MOT - Time 1	-1.289
FIRST 4-WEEK MODEL		
	Adherence	-1.453
	SE - Time 2	-1.439
	OE - Time 2	-1.994
	MOT - Time 2	-1.303
SECOND 4-WEEK MODEL		
	Adherence	-1.714
	SE - Time 4	-1.416
	OE - Time 4	-1.617
	MOT - Time 4	-1.218

CHAPTER 6

DISCUSSION AND FUTURE DIRECTIONS

The First Set of Hypotheses: The Change in SLT Variables Over Time

The first set of hypotheses tested Bandura's (1977) postulation from self-efficacy theory that self-efficacy changes over time due to enactive, vicarious, emotive, and exhortive influences. In this study it was also hypothesized that motivation and outcome efficacy would change over time. Although self-efficacy, outcome efficacy, and motivation proved to be dynamic constructs, the hypotheses were only partially supported.

Change in self-efficacy over time. Individuals' assessments of self-efficacy were hypothesized to increase over time regardless of group membership. Additionally, individuals in Group 1 were hypothesized to evidence the greatest increases in efficacy over time because their exercise prescription involved a more mastery-type experience than did Group 2's (monitoring exercise intensity by heart palpation versus odometer observation), and performance feedback was given after each of the three exercise tests. Results from the profile analysis for this hypothesis were mixed.

Self-efficacy followed the same pattern of change in both groups, and no differences in the average level of efficacy between groups over time was apparent. This finding suggests that the treatment designed to enhance self-efficacy over and above the natural exposure to enactive, emotive, exhortive, and vicarious experiences present during an exercise program was not effective. This finding is congruent with a study by Lindsay-Reid and Morgan (1979), who found that compliance with exercise adherence was not enhanced by adding heart rate monitoring as a means of gauging exercise intensity.

Furthermore, when collapsing across groups, the change in self-efficacy over time was significant at each measurement of the construct, although not consistently in the hypothesized direction. The pattern of change in self-efficacy was shown to first increase, then decrease, and finally increase again. It was previously noted that the

change in self-efficacy depends on information available in the environment as well as on an individual's cognitive processing of the information. The drop in efficacy from Time 2 to Time 3 may reflect the difficulty experienced and the amount of effort that went into adhering to the program.

The current study was the first to measure adherence self-efficacy across time, and the first to show inconsistent fluctuations in the strength of self-efficacy. Although Ewart et al. (1983, 1986) measured the change in physical efficacy over time and related this efficacy to treadmill performance and adherence to exercise, the sample used, (cardiac rehabilitation patients), differs qualitatively from apparently healthy adults. Therefore, physical capability was probably not an issue in the current study, and the efficacy that was measured (adherence efficacy) may be a more elusive construct to capture.

Change in motivation across time. Although it was hypothesized that motivation would change, this was an exploratory hypothesis because Bandura does not make any specific statements in efficacy theory regarding change in this construct. As such, a direction of change in the current study was not specified. Profile analysis revealed that both groups followed the same pattern of change, and no group differences in average motivation over time were found. However, collapsing across groups resulted in a significant test of flatness.

The pattern of change in motivation and self-efficacy was identical, and is of interest. Specifically, self-efficacy and motivation were lowest at the initial 'naive' assessment (prior to exposure to the program orientation, education, and the pre-activity exercise test), and at measurement Time 3 (after 4 weeks of independent exercise, and prior to the second exercise testing and counselling session). Conversely, self-efficacy and motivation were highest following exercise tests and counselling

sessions 1 and 2. Since Group 1 received feedback after all three exercise tests, and motivation did not differ significantly between groups post-exercise test on any occasion, it would appear that actual feedback of performance may not serve to motivate (or conversely de-motivate) individuals to adhere to an exercise program.

However, attention (the Hawthorne Effect) may be an important variable. Both self-efficacy and motivation were shown to increase significantly after exercise tests and counselling, regardless of amount or quality of information imparted in the counselling session. Further, these higher assessments were significantly different from efficacy and motivation assessments made even as close as 1 hour prior to the exercise tests and counselling. In fact, some subjects mentioned how personally important it was for them to be assessed on a regular basis. Therefore, exercise testing served as an impetus for some participants to continue with the program. Some participants also expressed a desire to perform the actual exercise program under supervision at the Human Performance Lab as it would ensure they would adhere on a more regular basis with someone watching over them.

This highlights a potentially important issue in the exercise adherence literature. Massie and Shephard (1971) studied exercise adherence in sedentary middle-aged businessmen divided into two groups: one that exercised on their own at home and one that was required to join a supervised gym program at the Y.M.C.A. The gym group showed significantly less dropout (18.2%) than did the group that exercised on their own (53%). The authors concluded that middle-aged businessmen respond better to a group program than to solitary exercise. An equally plausible explanation is that attention was the determining factor rather than the postulated group versus individual exercise, as all exercise at the gym was lead by an instructor.

Lack of supervised exercise may also be found to have a bearing on the dismal follow-up exercise adherence rates after the cessation of an exercise study. This may be especially true of studies in which participants exercised in a laboratory or hospital setting where attention was given and 'attendance' was recorded. In other words, the actual effects in a number of studies reported in the literature may have been masked by an extraneous attention-related variable. In terms of real world application, if individuals are more prone to exercise while under supervision, then perhaps exercise programs intended to enhance adherence could adopt such a strategy. Programs such as Weight Watchers have adopted this technique with mandatory weekly weigh-ins.

Change in outcome efficacy over time. Outcome efficacy was predicted to increase over the time course of the study as individuals were hypothesized to notice personal physiological changes due to exercise (decreased perceived exertion during exercise and/or other physical activities such as stair climbing), as well as anthropometric changes (slight weight or fat loss noticeable by looser-fitting clothing). As the greatest and most noticeable changes in functional capacity occur within the first 4-6 weeks of an aerobic exercise program (ACSM, 1991), and this was an 8-week program, ample opportunity was provided for the participants to experience physiological change and thereby increase their confidence that the exercise program would lead to health-related improvements. This hypothesis was supported; outcome efficacy increased steadily, albeit slightly, over time.

The outcome efficacy change profiles between groups were parallel, and no significant level differences between groups were evidenced. The test of the constant revealed that the only slope that was significantly different than zero was the change from Time 1 measurement ('naive assessment') to Time 2 measurement (post-education and post-exercise test and counselling). The education program was designed to ensure

that all individuals began the actual program with a similar amount of knowledge of the beneficial effects of exercise on health, and how and when these benefits accrue. The results would suggest that overall, the education program was successful in enhancing individuals' perceptions of the health consequences of exercise, as outcome efficacy increased post-education but prior to the actual exercise program. Again, this is consistent with the findings of Lindsay-Reid and Morgan (1979) who found that a 1 hour education presentation initially motivated twice as many firefighters to initiate an exercise program.

The pattern of change in outcome efficacy between groups is of interest. The finding of no significant differences in outcome efficacy between groups suggests that perhaps overt performance feedback is not a necessary component in an exercise program, as Group 2 did not receive feedback and their outcome efficacy scores were undifferentiated from Group 1 who did receive performance feedback.

In summary, self-efficacy, outcome efficacy, and motivation were all dynamic constructs, changing over the course of the study. Self-efficacy and motivation followed the same pattern of change. This pattern may have been due to the fact that the same sources of information influence both self-efficacy and motivation. The pattern of change suggests both cognitive processing of efficacy information when one is left on one's own to exercise as well as an attention variable affects personal efficacy and motivation assessment. Although the effect of enhanced personal judgments of efficacy and motivation on adherence is not clear from this set of analyses, the possibility of attention affecting adherence is likely. A study by Massie and Shephard (1971) indicated that individuals who exercised on their own evidenced close to three times the amount of dropout found in a supervised program.

It would appear that the treatment (heart rate monitoring and performance feedback) employed to enhance efficacy and maximize the range of efficacy and motivation scores was ineffective. Group differences were not apparent on any variable, and the profiles for both groups on every variable were parallel. In comparison, the education program appeared successful in enhancing outcome efficacy. These two conclusions are consistent with the findings in a similarly-designed study by Lindsay-Reid and Morgan (1979).

Furthermore, overt physical performance feedback may not be an essential component of an exercise program as no differences in outcome efficacy over time between feedback and no-feedback groups were found. In comparison with the Ewart et al. (1983, 1986) cardiac rehabilitation studies, in which performance feedback provided an indication of what the subjects were truly capable of physically performing, feedback in apparently healthy individuals in the current study did not seem to play an important role in exercise adherence. Rather, based on feedback from the participants in the current study regarding their own experiences with exercise adherence, it would appear, that in apparently healthy adults, time management and scheduling issues may be more central than physical abilities.

The preceding conclusions are limited by the possibility that self-efficacy, outcome efficacy, and motivation scores might have increased significantly in participants completing the questionnaires on four occasions within a 4 week period without undergoing exercise testing, counselling, or physical activity. Significant increases in self-efficacy resulting from repeated administration of the self-efficacy questionnaire have not, however, been noted in previous studies (Bandura & Shunk, 1981). It is also important to acknowledge that although perceived outcomes may include consequences of exercise that are more intrinsic, such as exhilaration or

accomplishment, the current study focused on the more extrinsic long-term effects of exercise (reduced risk of CHD). Outcome efficacy assessment of a broader range of possible exercise outcomes may have resulted in findings different than those in the current study. As well, the raw scores for self-efficacy, outcome efficacy, and motivation were skewed. This issue will be addressed subsequently.

The Second Set of Hypotheses: Self-efficacy, Outcome Efficacy, and Motivation and Their Relationship to Exercise Adherence

The second set of hypotheses tested the relationships between the SLT variables used in this study and adherence to exercise. Bandura has suggested that self-efficacy may not be linearly related to behaviour. Rather, a threshold may exist, and scores above this threshold will all equally predict behaviour. Bandura further mentions that outcome efficacy and self-efficacy may interact in their effects on behaviour. Although an interactive effect of motivation with the other two efficacy variables is not explicitly stated, Bandura does posit that a behaviour will be performed given a 'sufficient level' of motivation. This would seem to imply a possible interactive effect between motivation and self-efficacy on behaviour.

The analyses revealed that the quadratic and cubic functions were not significant for any of the SLT variables. Therefore, the postulated threshold of efficacy was not evidenced. Further, interactions among the SLT variables were not found. A significant linear component was also not found between any of the SLT variables and adherence to exercise. A possible reason may be due to the limited variability of the SLT variables and adherence. This matter will be discussed in conjunction with the path models. As path analysis, the central focus of this study, requires that the data be linear and additive, and not curvilinear and interactional, the nonsignificant multiple regression

tests in the second set of hypotheses provided a sufficient test of the underlying assumptions necessary to perform the next set of analyses.

The Third Set of Hypotheses: Path Model of SLT Variable Effects on Exercise Adherence

The last set of analyses tested the tenability of hypotheses stated in Bandura's (1977) self-efficacy theory in relation to exercise behaviour. Specifically, efficacy theory hypothesizes that self-efficacy and outcome efficacy determine behaviour, given sufficient motivation and skill. Self-efficacy is hypothesized to be a more important determinant of behaviour than outcome efficacy, with a large proportion of the effects of the latter on behaviour mediated through self-efficacy. In the current study, the paths from outcome efficacy, motivation, and self-efficacy to adherence were hypothesized to be positive, with the path from self-efficacy to adherence being the strongest. In general, the proposed path model did not fit the data, and the hypotheses were not supported.

Outcome efficacy and adherence. The unstandardized path regression coefficients for all three models revealed that the direct paths from outcome efficacy to adherence were zero. This finding is consistent with a number of exercise adherence studies outside the theoretical framework of self-efficacy that have found no relationship between health belief outcomes of exercise and activity (Dishman & Gettman, 1980; Dishman & Ickes, 1981; Lindsay-Reid & Osborn, 1980). What these research findings concomitant with the current study suggest, is that belief in positive health consequences alone, may not provide enough incentive to maintain a program of regular exercise. Perhaps high outcome efficacy is sufficient for one to initiate exercise as most participants in the current study evidenced high scores on outcome efficacy, and by volunteering to participate in the study they were expressing a desire to at least start

exercising. This is in fact, what Morgan, Shephard, Finucane, Schimmelfing, and Jazmaji (1984) concluded in a study of employees at the General Foods fitness centre.

Motivation and adherence. The direct relationship of motivation with adherence in all three models was also zero. However, motivation was the most important predictor of level of self-efficacy in every path model, contributing significantly more to the variance in self-efficacy than did beliefs in the outcome of exercise. The meaning of this relationship is not clear in terms of the hypotheses being tested. Although motivation was an important determinant of self-efficacy, self-efficacy was not related to the criterion behaviour.

Self-efficacy and adherence. The strong positive direct path from self-efficacy to behaviour (adherence) hypothesized from Bandura's theory was not supported. The direct path from self-efficacy to adherence in all three models was zero, indicating that self-efficacy was not at all related to adherence. These findings may have been due to a number of factors, but were most likely a result of the lack of variability in the dependent measure. A discussion of the data distribution is subsequently presented.

Interrelationships among the SLT variables. For completeness of presentation, the remaining interrelationships between the SLT variables are discussed. As previously noted, in all three models, motivation was a better predictor of self-efficacy than was outcome efficacy. However, outcome efficacy evidenced a substantial and significant relationship with motivation. Again, the interpretation of these interrelationships between the SLT variables is not clear. Although outcome efficacy had strong positive effects on motivation, and motivation was highly related to self-efficacy, none of these variables were related to exercise adherence. In other words, adherence in the current study was determined by factors other than motivation to exercise, perceived capability

of adhering to regular exercise, and belief in the potential positive benefits of regular exercise.

Summary of the path models. The proposed path models did not fit the data. Most importantly, no relationship between any of the SLT variables and adherence was found in any of the three models. The most stable, and significant paths were those between the SLT variables. The interrelationships can be interpreted to mean that although beliefs in the health benefits of exercise strongly affect motivation, and motivation strongly affects one's perceived judgment of ability to complete the program, something other than this personal assessment of ability to complete the exercise program determines adherence. In fact, personal assessment of ability to complete the program remains totally unrelated to adherence.

The lack of significant findings in this set of hypotheses may have been due to a number of factors such as ceiling effects, measurement problems, and/or statistical issues. Each one of these possibilities will be addressed in the next section.

Potential Explanations of the Data

Ceiling Effects. One possible reason why positive relationships between the SLT variables and exercise adherence were not found may have been due to a ceiling effect in all relevant variables. All SLT variables may have lacked a sufficient floor to give individual differences an opportunity to be expressed; individuals whose self-efficacy, outcome efficacy, and motivation was low enough to cause underachievement probably did not volunteer to participate in the exercise program. Or conversely, those who did score low enough to cause underachievement dropped out of the program, and therefore their scores were not used in the analysis as they were lacking complete data sets. However, this cannot explain the fact that other adherence studies within the theoretical

framework of self-efficacy have had success with self-efficacy and outcome efficacy as predictors of adherence in exercise volunteers (e.g., Desharnais et al., 1986).

The difference in findings between the current study and others may be due to the fact that either the actual measurement of adherence in the other studies differed than the current one, or that individuals that did not report their adherence were defined as dropouts and their data were used in the subsequent analyses. It is also possible that the statistical tests in these other studies were not as stringent as those employed in the current study, tending to be more exploratory than confirmatory.

Further, the dependent measure (adherence) in the current study had a built-in restriction of a maximum of 24 days of exercise that could be recorded. A potential 24 days of exercise does not leave much room for variability, and most likely only those individuals who were sufficiently pleased with their exercise attendance for the program bothered to submit their adherence charts as evidenced by the unusually high mean attendance ($\underline{M}$ = 20.98).

The high adherence may have been a function of the method of data collection itself. Exercise adherence was measured with individuals' self-reports of exercise. Adherence could only be calculated for those individuals who turned in their adherence charts. Every reasonable effort was made to collect the adherence data. All subjects who did not schedule their 4-week test and/or 8-week test (adherence was collected at testing sessions), were called at least three times and a message was always left as all participants had either a voice-mail system or a secretary to receive their messages when they were not in the office. The phone calls were followed up by a note requesting the participant to turn in his or her exercise record sheet. Even those who had decided to quit the program were encouraged to send in their adherence charts, usually to no avail. As the participants were volunteers, and were informed that they could withdraw from

the study at any time, the experimenters could not ethically pester these individuals incessantly. It would appear that only those who were relatively pleased with their adherence submitted their forms, and as a result, spuriously high adherence data was collected. Incomplete data cases were not used as it could not be assumed that individuals who did not return their adherence records were not in fact exercising.

It would seem reasonable to suggest that social desirability may have prevented the non-adherers from sending in less than perfect record sheets. Therefore, the lack of variability in adherence values may reflect social desirability characteristics. Through other participants it was learned that some of those who did not respond to our pleas, were actually embarrassed because they had not complied with the exercise prescription and were not, in fact, exercising at all. This is a major problem in the real world, and one that is encountered in other areas of behaviour change, such as recovery from substance abuse (Peele, 1989).

Measurement problems. Bandura (1986) has suggested that individuals may assess hopefulness to complete a behaviour rather than confidence in their judgment of abilities to perform a given behaviour. Adherence to regular exercise would seem a likely candidate for this type of assessment error. Individuals volunteered to participate in the study as they had a desire to start a regular exercise program. Many participants had indicated that they had experienced difficulty adhering to regular exercise in the past and had hoped that the exercise program in the current study would prove an impetus or jumping off point for a life of regular exercise. As such, it is plausible that assessments of self-efficacy reflected a desire or hopefulness to follow and complete the prescribed exercise, rather than a realistic assessment of what they truly felt capable of performing. If hopefulness rather than self-efficacy was being measured, and most participants' desire to complete the program was high, not only would little variability

in the independent measures be evidenced, but hopefulness would not be expected to predict adherence with the same precision as an accurate assessment of ability to complete the program.

In retrospect, one may be inclined to argue that the simple one item questionnaire designed for this study to measure self-efficacy might have not been sufficient and a list of potentially high-risk situations for non-exercise adherence may have enhanced the ability of the instrument to measure the construct. Questionnaires used in other studies (e.g., Sallis et al., 1988), however, have listed limited situations such as making time for exercise by getting up earlier, or judging one's ability to stick to an exercise program even when one's family is demanding more time. The rational for not using this type of questionnaire followed from the fact that all possible situations for all individuals could not possibly be identified. Therefore, some items would be relevant only to some individuals and enhance or decrease any given subject's judgment of performing the prescribed exercise. For instance, a participant who decided that morning would be a good time to schedule exercise, would answer with high confidence to the question of whether they could get up early, even on weekends to exercise. Conversely, this item would be totally irrelevant for the individual who decided to exercise at noon, and would therefore, most likely be answered with zero confidence that he/she could get up earlier to exercise. The person in the latter case would evidence lower self-efficacy than the former person, and as a result, efficacy would not likely be a good predictor of adherence to exercise for the latter person.

Further, items such as family demanding more time may be irrelevant for some individuals and not for others. A good example from the study highlights this fact. A close relative of one of the participants in the current study was extremely ill, and the participant judged her efficacy quite low in terms of believing that she could finish the

whole program as she was anticipating her relative's death and subsequently a trip to Europe for the funeral. As it turned out, she did travel to Europe for the funeral, but during her time there, in opposition to her perceived assessment of exercise adherence, she exercised on a regular basis to relieve her stress. Conversely, another participant in the study had judged his efficacy to complete the program as quite high. This participant experienced an unexpected death in the family and was left with a number of extra family responsibilities, and as a result did not exercise at all. These examples point to the limitations of the 'situation-based' questionnaire, and also highlight the problems of applied research which involve variables over which researchers have no control or subjects have no accurate way of judging their long-term behaviour a priori. This problem is more relevant to exercise adherence than to other behaviours because exercise involves adding a time-consuming activity to one's schedule, as opposed to maintaining an already habitual schedule and merely altering one's behaviour within various situations.

In support of the one item self-efficacy questionnaire, Desharnais et al. (1986) was successful in discriminating who would adhere to the exercise program in their study with a one item self-efficacy questionnaire. The one item asked participants to what extent they expected to be capable of attending the exercise program regularly until its completion.

Statistical issues. All the data collected in the current study were skewed. Multivariate statistics are based on the assumption of multivariate normality. Two alternatives are available if the empirical data do not support normal distribution. The data can either be transformed to normalize the distribution, or the raw-score distribution properties can be used as they appear under the assumption that the

statistical tests employed are robust to violations of normality (Ghiselli, Campbell & Zedeck, 1981).

The current study adopted the latter alternative, using the raw scores as they appeared. This decision was based on two factors. First, potential disadvantages to transforming data exist, the least of which is the difficulty in interpreting the results. For example, it may prove difficult, if not impossible, to comprehend the meaning of the average value of the square root of the original scores (Maxwell & Delaney, 1990). Second, many of the statistical tests that are based on a normal distribution are robust to the assumption of normality and yield equivalent results regardless of whether or not the assumptions of normality are violated (Ghiselli et al., 1981). Analysis of variance (ANOVA) is robust to violations of normality (Maxwell & Delaney, 1990; Hopkins & Weeks, 1990), and since ANOVA can be treated as a special case of multiple regression (Pedhazur, 1982), the regression analyses used in the current study for the path models, trend analyses, and interaction analyses were also assumed to be reasonably robust. Further, profile analysis, which was employed in the first set of hypotheses to examine the change in the SLT variables over time, is even more robust than ANOVA to violations of assumptions, and in fact, is the analysis of choice when the assumptions for ANOVA are violated (Harris, 1985).

Another plausible statistical problem in the current study is the existence of multicollinearity (absence of orthogonality) among the SLT variables. High intercorrelations among the independent variables can lead to both a reduction in the magnitudes of their ß's (as shared variance is partialled out of each variable on which the dependent variable is regressed), as well as an increase in their standard errors (Pedhazur, 1982). The higher the standard error is for any given variable, the less likely the regression coefficient is to be statistically significant. Although the zero-

order correlations among the SLT variables in the current study were considerably high, zero-order correlations do not elucidate the multivariate relationships and are not a reliable check of multicollinearity. Further, an inspection of the standard errors for the various regression analyses (a check for high multicollinearity) performed in the current study remained inconclusive. The standard errors for the ß's for self-efficacy, outcome efficacy, and motivation were almost identical in all equations; had any of the errors been substantially higher than the others, multicollinearity would be suspect.

Even if multicollinearity existed in the current study, it is important to note that location of the source of multicollinearity does not necessarily solve the problem as the logical and often recommended solution involves eliminating one of the intercorrelated variables (Pedhazur, 1982). The variables chosen for the path analyses in the current study were initially selected based on theory, and therefore exclusion of any variable specified in the theory may lead to specification errors, another violation of multiple regression (Ferketich & Verran, 1990). While multicollinearity may represent a possible problem in the current study, as it is for most applied behavioural studies, it is not fatal and should be considered a necessary trade-off for being able to make causal inferences with non-experimental data (Ferketich & Verran, 1990).

Summary of the path model discussion. The proposed path models did not fit the empirical data in the current study. A number of possible reasons for this poor fit were presented. Ceiling effects in the SLT variables and in adherence, as well as the possible reasons for these skewed distributions was explored. It was suggested that an insufficient floor on the SLT variables and adherence may have prevented individual differences from being expressed. Measurement issues involving the potential problematic assessment of hopefulness rather than perceived self-efficacy, and the merits of the one-item efficacy questionnaire used in the current study were also

examined. Finally, statistical concerns that may have affected the fit of the model to the data were addressed. Although all distributions of raw data were skewed, it was argued that multiple regression (a statistical test related to ANOVA) and profile analysis were robust to violations of normality, and therefore the analyses should not have suffered any major consequences. Further, it was decided that multicollinearity in the current study was likely, as it is in most correlational studies, and potentially problematic, but not fatal. Any elimination of variables would theoretically and possibly, statistically result in model specification errors. It is far more important to have all the key variables specified in the theory included in the model.

Conclusions and Potential Future Research Directions

Resorting to statistical explanations of the data is not only equivocal, but meaningfully unsatisfactory. What has become excruciatingly clear during the course of the current study, is the complexity and yet elusiveness of exercise behaviour. The analyses revealed that self-efficacy, outcome efficacy, and motivation are not static, but rather dynamic constructs that change over time after exposure to various sources of information and/or stimuli. These SLT variables did not seem to interact in their effects on adherence, and were not even related to exercise adherence. In other words, exercise adherence in the current study was not determined by motivation to exercise, belief in the beneficial health consequences of exercise, or perceived confidence in the ability to adhere to a program of regular exercise.

On an intuitive level, these findings are not as paradoxical as they may first appear. Deciding to incorporate regular exercise into one's life requires nothing less than a basic lifestyle change. Unlike other lifestyle changes such as smoking cessation, exercise adherence requires actual concrete time changes to an already busy schedule.

While breaking the smoking habit means altering a habit within a habit, (e.g., substituting gum for cigarettes while watching television), initiating exercise involves the actual elimination or rescheduling of potentially numerous other habits to a greater or lesser degree, depending upon how tightly scheduled any given individual may be. For example, the decision to exercise during lunch hour, a time frequently set aside in some individuals' days for socializing with friends, errand-running, and shopping, would require the rescheduling of these other activities. Rescheduling these other activities, in turn, may mean changing other time commitments or habits such as family time or television viewing, all in an attempt to find time for the activities that were dropped in order to include exercise into one's schedule. In light of this analogy, it becomes increasingly easier to comprehend the somewhat paradoxical results of the path analyses. That is, adherence is determined by factors other than motivation to exercise, perceived capability of adhering to regular exercise, and belief in the potential positive benefits of regular exercise.

Based on this simple analogy, it starts to become apparent that self-efficacy theory, as currently used in behaviour change research, may not necessarily be all-encompassing enough to account for lifestyle decisions in which numerous factors remain either ambiguous or elusive. Remaining within the theoretical framework of self-efficacy, however, a number of potential future studies into the depths of exercise adherence can be suggested. Although many suggestions may seem to stray to varying degrees from the construct of efficacy, the main thread through all the suggestions remains the elucidation of the reciprocal relationship between cognitive processing and action.

One experimental design suggestion involves the inclusion of skill or behaviour repertoire in the study of exercise adherence. Bandura (1977) has stated that self-

efficacy is a major determinant of behaviour given sufficient skill level or behaviour repertoire. Skill in this context would not refer to physical or athletic skill, but rather ability to self-discipline, time-manage, and prevent relapse. In a smoking cessation study, Devins and Edwards (1988) had subjects identify every smoking cessation technique of which they were aware, and then smoking efficacy magnitude and strength was measured using this list. The same type of method could be used for exercise adherence and time-management skills.

The fluctuating changes in self-efficacy and motivation raise some important questions concerning the antecedents to these cognitive mechanisms. Future studies could be designed to tap the personal cognitive experiences of the participants during their efforts to adhere to a program of regular exercise to help elucidate the possible mechanisms for fluctuations in efficacy and motivation across time. Subjects could daily record their personal efficacy to exercise concomitant with the reasons and cognitions behind their assessments. Such an exercise would serve to highlight individual problem areas, and a relapse prevention program could be tailored to help circumvent high risk situations.

A longitudinal study to examine the effects of attention (the Hawthorne Effect) and testing on adherence is also in order. It is curious that only one past study compared adherence in a supervised program of exercise with that in an individualized independent program (Massie & Shepherd, 1971), and the researchers in that study did not seemingly appear cognizant of what they were actually comparing. A study designed to vary the amount of attention in the form of supervision, testing, and counselling could help to determine whether a time threshold exists before which motivation to exercise is extrinsic, and after which motivation becomes intrinsic and not dependent on outside stimuli. This type of study could also examine what happens to self-efficacy when

individuals are left on their own to exercise compared to those who continue with a supervised program. In concert with this type of study, a method to accurately measure exercise adherence outside the laboratory is in order. Perhaps a longitudinal study in which the exercise facility staff collects the adherence data for the experimenter would eliminate demand characteristics and attention confounds.

As belief in positive health outcomes as a consequence of regular behaviour seems important in the initiation, but not maintenance of exercise, further exploration into the personal meaningfulness of health outcomes to an individual would also appear helpful. A blanket statement such as decreasing risk of CHD, for example, tends to be rather elusive and would therefore understandably carry little weight as an impetus for maintaining regular exercise. Other outcome efficacy inquiry could include the differences in outcome beliefs between regular exercisers and those who are attempting to initiate a program of regular exercise. Does the focus and meaningfulness of the consequences of exercise change over time? Can this change be charted? For example, do uninitiated individuals look to the long-term health benefits as impetus to exercise, whereas regular exercisers focus on the intrinsic sensations and satisfactions? It would also be important to examine whether failure to reach realistic or unrealistic expected outcomes over time leads to discouragement, and ultimately dropout from exercise.

In conclusion, the current study has not challenged the basic theoretical underpinnings of self-efficacy theory which has gathered much support in the literature. Rather it has challenged the ability of efficacy to predict an extremely complex and elusive behaviour. The suggestions for future research are attempts to help further elucidate the components of exercise behaviour as well as the cognitive mechanisms contributing to efficacy and exercise behaviour. Although the current study has brought understanding of the problem of exercise adherence within a theoretical

framework a step closer, the question remains, why do some individuals exercise regularly and why do most adults remain basically sedentary by ACSM standards?

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APPENDICES

APPENDIX A

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

Physical Activity Readiness
Questionnaire (PAR-Q)*

PARTICIPANT IDENTIFICATION

PAR Q & YOU

PAR-Q is designed to help you help yourself. Many health benefits are associated with regular exercise, and the completion of PAR-Q is a sensible first step to take if you are planning to increase the amount of physical activity in your life.

For most people physical activity should not pose any problem or hazard. PAR-Q has been designed to identify the small number of adults for whom physical activity might be inappropriate or those who should have medical advice concerning the type of activity most suitable for them.

Commonsense is your best guide in answering these few questions. Please read them carefully and check the ☐ YES or NO opposite the question if it applies to you.

YES	NO		
☐	☐	1.	Has your doctor ever said you have heart trouble?
☐	☐	2.	Do you frequently have pains in your heart and chest?
☐	☐	3.	Do you often feel faint or have spells or severe dizziness?
☐	☐	4.	Has a doctor ever said your blood pressure was too high?
☐	☐	5.	Has you doctor ever told you that you have a bone or joint problem such as arthritis that has been aggravated by exercise, or might be made worse with exercise?
☐	☐	6.	Is there a good physical reason not mentioned here why you should not follow an activity program even if you wanted to?
☐	☐	7.	Are you over age 65 and not accustomed to vigorous exercise?

If You Answered

YES to one or more questions

If you have not recently done so, consult with your personal physician by telephone or in person BEFORE increasing your physical activity and/or taking a fitness test. Tell him what questions you answered YES or PAR-Q, or show him your copy.

programs

After medical evaluation, seek advice from your physician as to your suitability for:

- unrestricted physical activity, probably on a gradually increasing basis.
- restricted or supervised activity to meet your specific needs, at least on an initial basis. Check in your community for special programs or services.

NO to all questions

If you answered PAR-Q accurately, you have reasonable assurance of your present suitability for:

- A GRADUATED EXERCISE PROGRAM - A gradual increase of proper exercise promotes good fitness development while minimizing or eliminating discomfort.
- AN EXERCISE TEST - Simple tests of fitness (such as the Canadian Home Fitness Test) or more complex types may be undertaken if you so desire.

postpone

If you have a temporary minor illness, such as a common cold.

APPENDIX B

DEMOGRAPHIC QUESTIONNAIRE

APPENDIX B

DEMOGRAPHIC QUESTIONNAIRE

Name:_____

Male:_____Female:_____ Date of Birth:_____

Job Title:_____

Please check highest level of education attained:

High School____ Community College_____ Bachelor's Degree__

Graduate or Professional Degree_____

Marital status: Single_____ Common Law:___ Married:____

Divorced_____Separated:_____ Widowed:___

Number of children who live with you:_____

Number of children who live with the other parent:_____

What percentage of your friends exercise on a regular basis?_____

Does your spouse or 'significant other' exercise regularly?_____

Have you ever played competitive sports?_____

If yes, name your sports and the years that you participated._____

_____

_____

_____

On average, how many cigarettes do you smoke per week?_____

APPENDIX C

THE EXERCISE PERSONAL EFFICACY SCALE

THE EXERCISE MOTIVATION SCALE

THE EXERCISE OUTCOME EFFICACY SCALE

APPENDIX C

THE EXERCISE PERSONAL EFFICACY SCALE

Instructions:

The following two questions ask you to evaluate the amount of confidence you have in your ability to adhere to the prescribed exercise program. Answer the questions by selecting a single number from 1 to 100. Use the information provided in the chart below to help you determine the numerical value that best represents your level of confidence. When you answer each question please consider the many factors that could make regular exercise difficult, such as business or vacation travel, family responsibilities, social commitments, daily fatigue, the nature of the exercise, Christmas holidays, etc.

General Category	Specific Guidelines	
Limited Confidence	1-5.....	No Confidence
	6-15.....	Very Low Confidence
	16-25.....	Low Confidence
Some Confidence	26-40.....	Below Average Confidence
	41-60.....	Average Confidence
	61-75.....	Above Average Confidence
Much Confidence	76-85.....	High Confidence
	86-95.....	Very High Confidence
	96-100...	Totally Confident

Questions:

1. How confident are you in your ability to complete the entire 8 week exercise program (riding a stationary bike for 30 minutes, 3 times per week) designed for this research study?

   Numerical Rating:_____

2. How confident are you in your ability to complete the first 4 weeks of this exercise program?

   Numerical Rating:_____

Name: _____
Company: _____
Date: _____

APPENDIX C
THE EXERCISE MOTIVATION SCALE

Instructions:

The following question asks you to evaluate the amount of motivation you have to exercise. Answer the question by selecting a single number from 1 to 100. Use the information provided in the chart below to help you determine the numerical value that best represents your level of motivation.

General Category	Specific Guidelines	
Limited Motivation	1-5.....	No Motivation
	6-15.....	Very Low Motivation
	16-25.....	Low Motivation
Some Motivation	26-40.....	Below Average Motivation
	41-60.....	Average Motivation
	61-75.....	Above Average Motivation
Much Motivation	76-85.....	High Motivation
	86-95.....	Very High Motivation
	96-100...	Totally Motivated

Question:

1. How motivated are you to participate in the 8 week exercise program designed for this research study?

Numerical Rating:_____

Name: _____
Company: _____
Date: _____

APPENDIX C
THE EXERCISE OUTCOME EFFICACY SCALE

Instructions:

The following question asks you to evaluate the degree to which you believe exercise will improve health. Answer each question by selecting a single number from 1 to 100. Use the information provided in the chart below to help you determine the numerical value that best represents your level of belief.

General Category	Specific Guidelines	
Limited Belief	1-5.....	No Belief
	6-15.....	Very Low Belief
	16-25.....	Low Belief
Some Belief	26-40.....	Below Average Belief
	41-60.....	Average Belief
	61-75.....	Above Average Belief
Much Belief	76-85.....	High Belief
	86-95.....	Very High Belief
	96-100...	Totally Believe

Question:

1. Do you believe that your personal health will improve as a result of exercising on a regular basis (regular meaning 3 times a week, 30 minutes a session)?

   Numerical Rating:_____

Name: _____
Company: _____
Date: _____

APPENDIX D

GROUP 1 EXERCISE PRESCRIPTION

GROUP 2 EXERCISE PRESCRIPTION

APPENDIX D

GROUP 1 EXERCISE PRESCRIPTION

Name: _____

Maximum Heart Rate _____Resting Heart Rate _____

Target Heart Rates: 60% _____75% _____

EXERCISE PROGRAM

Goal: To increase your cardiovascular fitness by maintaining your heart rate within your target zone for 30 minutes, 3 times a week by riding the stationary bicycle.

Warm-up - 5-10 minutes of low intensity riding at less than 50% of MHR

* Begin your exercise session with a warm-up period of 5-10 minutes so that your heart and circulation are not suddenly taxed. This warm-up is also beneficial for your joints and muscles, and helps to prevent injuries and soreness.

* For the warm-up, ride the stationary bicycle at a very low intensity (less than 50% of your maximum heart rate _____). Pedal slowly and keep the tension setting on the bicycle very low.

Target zone-30 continuous minutes of exercise at an intensity of 60-75% of MHR

* Move into your target zone by increasing the tension setting on the bicycle and by increasing your rate of pedaling.

* Count your heart beat 3-5 minutes after you increase your effort to determine whether you are doing enough to be on target.

* If you are below 60% of your maximum heart rate, exercise more strenuously by either pedaling faster or more strenuously.

* If you are above 75% of your maximum heart rate, exercise less vigorously either by slowing down your rate of pedaling or by decreasing the tension setting on the bicycle.

* Continue taking your heart rate at five minute intervals until you have determined just how much exercise is necessary to put you in the target zone.

* Keep your heart rate in the target zone for 30 minutes. You will soon be able to recognize how much effort it takes to get you into your target zone and will no longer need to take your pulse as often.

Cool-down - 5-10 minutes of low intensity riding:

* Before you stop exercising, slow down your rate of pedaling, decrease the tension setting on the bicycle, and enjoy a 5-10 minute cool-down.

* Abruptly stopping exercise when you have been working hard, may slow the return of blood to the heart, brain or intestines, potentially resulting in dizziness, or nausea.

APPENDIX D

GROUP 2 EXERCISE PRESCRIPTION

Name: _____

Maximum Heart Rate _____Resting Heart Rate _____

EXERCISE PROGRAM

Goal: To increase your cardiovascular fitness by maintaining your heart rate within your target zone for 30 minutes, 3 times a week by riding the stationary bicycle.

Warm-up - 5-10 minutes of low intensity riding:

* Begin your exercise session with a warm-up period of 5-10 minutes so that your heart and circulation are not suddenly taxed. This warm-up is also beneficial for your joints and muscles, and helps to prevent injuries and soreness.

* For the warm-up, ride the stationary bicycle at a very low intensity. Pedal slowly (less than 50 revolutions per minute) and keep the tension setting on the bicycle very low.

Target zone-30 continuous minutes of exercise at an intensity of 60-90 pedal revolutions/minute:

* Move into your target zone by increasing the tension setting on the bicycle and by increasing your rate of pedaling to 60-90 revolutions per minute.

* If the exercise seems too easy (i.e., you are not beginning to perspire, breathe harder or your heart rate has not seemed to increase much), exercise more strenuously

by either by pedaling faster (i.e., increasing your pedal revolutions per minute) or by increasing the tension setting on the bicycle.

* If the exercise seems really hard, exercise less vigorously either by slowing down your rate of pedaling or by decreasing the tension setting on the bicycle.

Cool-down - 5-10 minutes of low intensity riding:

* Before you stop exercising, slow down your rate of pedaling, decrease the tension setting on the bicycle, and enjoy a 5-10 minute cool-down.

* Abruptly stopping exercise when you have been working hard, may slow the return of blood to the heart, brain or intestines, potentially resulting in dizziness, or nausea.

APPENDIX E

INFORMED CONSENT

APPENDIX E

INFORMED CONSENT

Title of Study: Exercise as a health behaviour change in a worksite setting.

Investigators: Patricia Smith, Dr. Bob Franken, Dr. Brian MacIntosh, Dr. Merry Miller, Dr. Theresa Kline

This is to certify that I, _____, hereby agree to participate as a volunteer in an exercise program as an authorized part of the research undertakings within the Department of Psychology at the University of Calgary under the supervision of Dr. Bob Franken.

The study and my part in the exercise program have been fully explained to me by Patricia Smith and I understand her explanation. The procedures of this investigation and their risks and discomforts have been fully described and discussed in detail with me.

I have been given an opportunity to ask whatever questions I may have had and all such questions and inquiries have been answered to my satisfaction.

I understand that I am free not to answer specific items or questions in interviews or on questionnaires.

I understand that any data or answers to questions will remain confidential with regard to my identity.

I understand that I am free to withdraw my consent and terminate my participation at any time without penalty.

I understand that I may request a summary of the results of this study.

_____ _____

Participant's Signature Date

APPENDIX F
OPEN-ENDED QUESTIONNAIRE

APPENDIX F

OPEN-ENDED QUESTIONNAIRE

Please answer the following questions by circling the appropriate answer, YES or NO. Where applicable, please elaborate on your answer.

1. For this study, are you exercising in the health club provided by your company?
A. If YES,

(1) Did you have to buy a membership, or did you already have one?_____

(2) How many months do you have left on your membership? _____
B. If NO, where are you exercising, and please give reasons for your choice:

_____
_____

2. Are you:
(a) following the exercise program you were prescribed by Dr. MacIntosh? YES NO
(b) supplementing the stationary bicycle with other exercise? YES NO If YES, please specify (include all other activities you are currently engaged in including non-program activities such as curling, walking to the C-Train or bus, taking the stairs at work, etc.)

_____
_____
_____

(c) following an alternate program? YES NO If YES, please specify:

_____
_____

3. Are you currently involved in any other health changes such as dieting, quitting smoking, etc. that may be causing you to lose or gain weight? YES NO If YES, please elaborate:

_____
_____

4. Are you having any problems with your exercise program? (For example, not sure you are doing it correctly, finding time to do it, etc)

_____
_____
_____

5. Have you noticed any personal changes since you started your program? (For example, more stamina during exercise, more energy overall, improved mood, etc)

_____
_____

6. Comments:

APPENDIX G
ANTHROPOMETRIC AND PHYSIOLOGICAL VARIABLES

APPENDIX G

Anthropometric and Physiological Variables

Variable	Test	N	Mean	SD	Range
VO_2max					
	Time 1	84	33.16	7.991	15.77-53.45
	Time 2	67	35.30	8.651	18.34-58.28
	Time 3	57	37.10	7.783	19.52-53.92
BMI (weight/height2)					
	Time 1	84	27.3	4.6	18.4-38.5
	Time 2	67	27.6	4.6	18.2-39.2
	Time 3	57	27.3	4.4	18.7-40.0
Resting heart rate					
	Time 1	84	70.64	9.738	53-96
	Time 2	67	69.84	9.727	51-97
	Time 3	57	71.37	9.768	47-99
Resting blood pressure					
Systolic					
	Time 1	84	120	11.9	92-145
	Time 2	67	118	12.6	90-150
	Time 3	57	115	11.4	92-146
Diastolic					
	Time 1	84	83	7.9	68-100
	Time 2	67	83	8.9	60-100
	Time 3	57	81	9.5	60-100
Sum of skin folds					
	Time 1	84	97	38.6	27-200
	Time 2	67	93	35.9	27-190
	Time 3	57	88	30.4	29-159

Note: All measurements reflect males and females from Groups 1 and 2 combined. The number of cases differed across time due to incomplete data on some subjects.