# The Self-Management of Type 2 Diabetes: changing exercise behaviours for better health

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# TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## Acknowledgments

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# Abstract

New Zealand is currently in the midst of a diabetes epidemic and it has become clear that the increasing prevalence of obesity and a sedentary lifestyle are inextricably linked to this escalating health crisis. Extensive research has long made clear that people of all ages can enhance their health by incorporating moderate levels of physical activity as part of their normal daily routine and physical activity is now recognised as a major therapeutic modality for type 2 diabetes. Despite such evidence, most people in the western world *do not* engage in sufficient regular physical activity and there remains a paucity of evidence that elucidates effective methods of achieving the required behaviour change *over time*. This study set out to demonstrate meaningful correlations between the psychosocial constructs optimism, exercise self-efficacy, goal-directness, stage of change, anxiety and depression, the biochemical measures HbA1c and BMI and also the behavioural outcomes of *general physical activity* and *physical exercise* participation, all within a newly diagnosed type 2 diabetic population.

Participants (n=30, newly diagnosed adults with type 2 diabetes; mean age 61.46 years; BMI 31.43 Kg/m²[range 18.8-50.95 Kg/m²]) were recruited from attendees of the Christchurch Diabetes Centre's education seminars. The recruitment strategy was designed to search out diabetic patients as near as practicable to the point in time when they first became *cognisant* of their disease state. A battery of instruments was assembled into a researcher-administered retrospective questionnaire and this was completed with all subjects at baseline and again at six month follow-up. Additional data comprised subject's demographics and selected bio-chemical measures (subject height, weight, and blood Haemoglobin A1c). Descriptive, correlational and qualitative statistics were evaluated.

The level of physical activity reported was significantly less than is required to facilitate the biochemical and psychological changes that are generally considered necessary to support optimal health. On average, study participants did not perform their planned physical activity tasks as well as they might have, despite being relatively optimistic and goal-directed at baseline. Many participants clearly indicated an inadequate understanding of exercise modalities and the intensity, duration and frequency of physical activity required to support optimal health. Generally, participants tended to *overestimate* their physical activity levels. Exercise self-efficacy emerged as an especially important psychological construct, and one that appeared to be among those central to the participants' relationships with physical activity and exercise. The study group demonstrated a relatively high prevalence of low level anxiety and depression, and even at these sub-clinical levels, anxiety and depression were significantly inversely related to optimism, goal-directness, goal-attainment, exercise self-efficacy and stage of change.

The study findings illuminate the wide contextual variability among patients who are suffering from the same chronic condition. Further, the implications of conducting detailed pre-assessments of patients' personal characteristics and their psychological profiles, in order to guide intervention tailoring, are also outlined and discussed. Areas for future research are highlighted. In conclusion, meso and macro-level policy implications are discussed, with reference to an array of the broader determinants of health.

## Glossary of Terms

**Age:** The subjects' ages at baseline.

**Alcohol:** Subjects' typical alcohol consumption per week as assessed by the Alcohol Use Disorders Identification Test-C (AUDIT-C) (1998).

**Anxiety**: a state of intense apprehension or fear of real or imagined danger, manifested physiologically as increased heart rate, sweating, trembling, weakness and stomach or intestinal discomfort. Subjects' anxiety levels were assessed by the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983).

**Atherogenic:** Tending to cause atherosclerosis

**Atherosclerosis:** is a disease affecting the arterial blood vessel. It is commonly referred to as a "hardening" or "furring" of the arteries. It is caused by the formation of multiple plaques within the arteries.

**Biofeedback:** A treatment technique in which people are trained to improve their health by using signals from their own bodies (for example galvanic skin response).

**Blood glucose**: the main sugar that the body makes, mostly from carbohydrates, as well as from the other two elements of food – proteins and fats. Glucose is the major source of energy for living cells and is carried to each cell through the bloodstream.

**BMI:** Body Mass Index (BMI) describes a particular relationship between an individual's body weight and their height, and this relationship is defined by the formula: BMI = body mass (in Kilograms) / height$^2$ (in metres). In lay terms, BMI denotes the leanness (low BMI values) or fatness (high BMI values) of an individual (true of the general population, however not necessarily true for an athletically trained individual). A BMI of 20–25 is considered normal, >25 is overweight and >30 is obese (>40 is often termed clinically or morbidly obese).

**Cardiovascular disease (CVD)**: disease of the heart or vessels of the circulation.

**Coronary heart disease**: also known as ischaemic heart disease.

**Depression**: a psychiatric disorder showing symptoms such as persistent feelings of hopelessness, dejection, poor concentration, lack of energy, inability to sleep, and sometimes, suicidal tendencies. Subjects' levels of depression were assessed by the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983).

**DHB**: District Health Board.

**Diabetes mellitus**: a disease involving a disturbance of metabolism, the underlying cause of which being the defective production or action of the hormone insulin. There are several manifestations of the disease, the most common being type 1 and type 2 (see below).

**Dietician**: an expert in nutrition who helps people with special health needs to plan the kind and amount of foods to eat.

**Education:** Subjects' highest level of school and/or higher education, as assessed by questions 279-280 from the Life in New Zealand Questionnaire (1991).

**End-stage renal failure**: The final phase of kidney disease; treated by dialysis or kidney transplantation.

**Energy expenditure:** Individuals' total energy expenditure per kilogram, per day, (kcal/kg/day), as assessed by the Stanford 7-day Physical Activity Recall Questionnaire (Sallis et al., 1985). Note: energy expenditure differs from exercise minutes in that it factors in subject's hours of sleep per day and their hours of moderate physical activity (including occupational tasks and housework) that is *additional* to exercise.

**Epidemiological transition:** refers to a change in the pattern of disease in a country away from infectious diseases towards degenerative diseases. This transition is evident as a country completes the process of modernization or economic development.

**Epidemiology**: The study of the distribution and determinants of health-related states or events in specified populations.

**Exercise goal-directed:** During the baseline interviews, subjects were asked the question, "To what extent do you have physical activity goals with respect to your health, in particular the self-management of your type 2 diabetes?" (Question Iq1). and respondents answered on a 5-point Likert Scale ranging from: (1) I have no health goals; (2) I know what I perhaps should be doing; (3) I intend to make some changes; (4) I have some general health goals; (5) I have some specific health goals that I am working toward.

**Exercise minutes:** Subjects' self-reported average minutes of moderate intensity (or equivalent) physical exercise per day. Exercise in this context was defined as "a regular and structured subset of physical activity, performed deliberately and with special purpose such as preparation for athletic competition or the improvement of some aspect of health" (Shephard, 2003, p.197).

**Exercise self-efficacy:** Subjects' levels of exercise self-efficacy, as assessed by the Exercise Self-Efficacy Questionnaire, Short-Form (Benisovich, Rossi, Norman, & Nigg, 1998)

**Exercise stage of change:** Subject's *exercise stage of change* as assessed by the Exercise Stages of Change, Short-Form Questionnaire (Marcus, Selby, Niaura, & Rossi, 1992). The stages of change are: 5= Maintenance, 4= Action, 3= Preparation, 2= Contemplation, 1= pre-contemplation. Note therefore, a 'more advanced' stage of change refers to a stage of change that is behaviourally (and numerically) closer 'Maintenance' (5).

**Exercise**: Exercise is a regular and structured subset of physical activity, performed deliberately and with special purpose, for example, in preparation for athletic competition or the improvement of some aspect of health

**Gangrene**: the death of body tissue. It is most often caused by a loss of blood flow, especially in the legs and feet.

**Goal-attainment (self-rated):** Subjects self-rated their progress towards achieving their 'Physical activity-Health goals set'. Self-rated goal-attainment was scored on a 0-10 scale, and goal scores were averaged across all goals set. Goals that subjects reported they no longer held current were rated 'not applicable' and were excluded.

**Goal-directness (or self-regulation)**: "the capacity to plan, guide, and monitor one's behaviour flexibly in the face of changing circumstances" (1998, p. 63). This may involve a number of processes including: informational input, self-evaluation, instigation to change triggered by perceptions of discrepancy, search for ways to reduce discrepancy, planning for change, implementation of behaviour change and evaluation of progress toward a goal (Miller & Brown, 1991).

**Goal**: a general aim for which to strive.

**Goal-directed:** Subjects' levels of goal-directness, as assessed by the SSRQ-GS (Neal & Carey, 2005).

**Hawthorne Effect**: an experimental effect in the direction expected but not for the reason expected; i.e., a significant positive effect that turns out to have no causal basis in the theoretical motivation for the intervention but is apparently due to the effect on the participants of knowing themselves to be studied in connection with the outcomes measured.

**HbA1c**: a blood test used to measure glycosylated haemoglobin levels which indicate glycaemic control.

**HDL/LDL**: high-density lipoprotein and low-density lipoprotein make up cholesterol. The levels and ratios of HDL and LDL are predictors of cardiovascular disease.

**Health status**: a set of measurements that reflect the health of populations. The measurements may include physical function, emotional wellbeing, activities of daily

living.

**Hyperglycaemia**: elevation of blood glucose. Over an extended duration it is associated with the development of diabetes complications.

**Hyperinsulinemic euglycemic clamp:** A laboratory test procedure for investigating and quantifying insulin resistance. The hyperinsulinemic euglycemic clamp measures the amount of glucose necessary to compensate for an increased insulin level without causing hypoglycaemia.

**Hypoglycaemia**: a low level of blood glucose. Associated with an elevated level of insulin in insulin-dependent diabetics, it can lead to performance changes, but is not always symptomatic.

**Ideal physical activity (perceived):** Subject's self-rated attainment of their perceived 'ideal' level of physical activity for health. Using a 0-10 scale, subjects self-rated their *actual* level of physical activity as compared to the physical activity level that they themselves perceived would be '*ideal*' and individually appropriate.

**Incidence**: the number of new cases or deaths in a given period in a specified population.

**Income:** Subjects' annual family (household) incomes, as assessed by question 293 from the Life in New Zealand Questionnaire (1991).

**Insulin**: a hormone that helps the body use glucose (sugar) for energy. The beta cells in the pancreas (in areas called the Islets of Langerhans) make the insulin. When the body cannot make enough insulin on its own, a person with diabetes can inject insulin made from other sources.

**Intersectoral**: between sectors.

**Intervention**: a specific prevention measure or activity designed to meet a programme objective.

**Intrasectoral**: within a sector.

**Ketoacidosis**: A serious condition caused by an accumulation of ketoacids in the blood resulting from the body deriving energy from non-glucose sources during hyperglycaemia. Usually seen in type 1 diabetes, ketoacidosis can lead to coma if not immediately treated with insulin.

**Likert scaling:** Likert scaling is a bipolar scaling method, measuring either positive or negative response to a statement. Likert scales may be subject to distortion, for

example *central tendency* bias and *social desirability* bias.

**Lipid**: a term for some forms of fat.

**Macrovascular** complications: diabetes complications from large blood vessel disease. Includes coronary heart disease, stroke, peripheral vascular disease, hypertension.

Māori: indigenous people of New Zealand.

**Microvascular** complications: diabetes complications from small blood vessel disease; includes retinopathy (damage to eye), nephropathy (damage to kidneys), neuropathy (damage to nerves)

**Moderate activity:** Types of muscular activity that increase a person's energy expenditure to a level of 3.0-4.9 times his/her resting metabolic rate (MET). Moderate activity may be considered to average 4 METs.

**Morbidity**: illness.

**Mortality**: death.

**Nephropathy**: disease of the kidneys caused by damage to the small blood vessels or to the units in the kidneys that clean the blood. People who have had diabetes for a long time may have kidney damage.

**Neuropathy**: disease of the nervous system. Many people who have had diabetes for a while have nerve damage. The most common form is peripheral neuropathy, which mainly affects the feet and legs. Nerve damage in the feet and legs causes diabetic gangrene.

**Obesity**: when people have 20 percent (or more) extra body fat for their age, height, sex and bone structure, fat works against the action of insulin. BMI > 30 (see BMI).

**Objective**: the end result a programme seeks to achieve.

**Ophthalmologist**: a doctor who sees and treats people with eye problems or diseases.

**Optimism**: A person's tendency to explain bad events in circumscribed ways; with reference to external, unstable and specific causes. Optimists display a dispositional tendency to rely on active, problem-focused coping and being planful. Subjects' levels of optimism were assessed by the Life Orientation Test-Revised (Scheier, Carver, & Bridges, 1994).

**Ottawa Charter**: the Charter developed and adopted by the first International Conference on Health Promotion held in Ottawa, Canada in November 1986. This Charter defines health promotion as the process of enabling people to increase control over, and to improve, their health. Health promotion action means building healthy public policy, creating supportive environments, strengthening community action, developing personal skills, and reorienting health services.

**Overweight**: body weight that is above the recommended level, due to increased body fat. 25 < BMI > 30 (see BMI).

**Pacific peoples**: the population of Pacific Island ethnic origin (eg, Tongan, Niuean, Fijian, Samoan, Cook Islands, Māori and Tokelauan), incorporating people born in New Zealand as well as overseas.

**Pessimism**: A person's tendency to explain bad events with specific reference to internal, stable, 'trait-like' causes. Pessimists display a dispositional tendency to expect bad things to happen to them, and are often 'avoidant copers'.

**Physical activity**: Types of muscular activity that increase energy expenditure substantially.

**Physical activity-Health goals set:** During the baseline interviews, subjects were asked the question "Can you please describe to me as much as you can about your physical activity goals with respect to your health, in particular the self-management of your type 2 diabetes?" (Question Iq2) and the subjects' goal descriptions were recorded.

**Podiatrist**: a health professional who treats and takes care of people's feet.

**Prevalence**: the number of instances of a given disease or other condition in a population at a designated time. Prevalence includes both new (incidence) and existing instances of a disease.

**Psychosocial**: Relating to both the psychological and the social aspects of something, or relating to something that has both of these aspects.

**Quality of life:** An individual's perception of their position in life in the context of the culture in which they live, and in relation to their goals, expectations and standards. The term incorporates concepts of physical and psychological wellbeing, levels of independence and autonomy, social relationships and support, and spirituality.

**Retinopathy**: a disease of the small blood vessels in the retina of the eye.

**Risk factor**: an aspect of personal behaviour or lifestyle, an environmental exposure, or an inborn or intended characteristic that is associated with an increased risk of a

person developing a disease.

**Routine medical care:** A generic term to describe a broad range of routine medical services, from prevention through treatment and recovery.

**Self Management**: Self-management is now an accepted and popular term to describe both healthful behaviours and behavioural interventions, particularly for the management of chronic diseases. In self-management, the patient is an active participant in treatment.

**Self-efficacy**: A Self-efficacy belief is a self-belief that one can perform the required behaviour that produces a specific (and desired) outcome.

**Self-tailoring**: the tailoring of an intervention or programme by the patient, after learning the required principles of behaviour change and self-management.

**Stage progression:** Stage progression describes changes in 'exercise stage of change' between baseline and follow-up, as assessed by the Exercise Stages of Change, Short-Form Questionnaire (Marcus, Selby, Niaura, & Rossi, 1992). Note that stage progression may be *positive* to indicate advancement from a previous stage, or *negative* to indicate regression from a previous stage.

**Stages of change**: The central organizing construct of the Transtheoretical Model of behaviour change. The Stages of Change construct is important because it represents a temporal dimension and implies phenomena occurring over time.

**Tailoring (of interventions)**: Health providers modifying and/or delivering appropriately matched interventions, after using a series of tests to determine the patient's readiness to learn; based on the patient's 'stage of change' and health beliefs.

**Target**: An intermediate result towards the objective that a programme seeks to achieve.

**Treaty of Waitangi:** the founding document of New Zealand.

**Type 1 diabetes**: Otherwise known as insulin-dependent diabetes mellitus (IDDM), type 1 diabetes is found most often in childhood, with secondary peaks in early and late adulthood. It is characterised by rapid onset of clinical symptoms and requires prompt medical treatment and regular use of insulin for survival. It is also termed juvenile-onset diabetes.

**Type 2 diabetes**: Otherwise known as non-insulin-dependent diabetes mellitus (NIDDM), type 2 diabetes is found primarily in adults and which accounts for most

cases of diabetes. It is characterised by a gradual onset of symptoms. It is also termed mature-onset or adult diabetes.

**Urologist**: a doctor who sees people for treatment of the urinary tract and for treatment of the (male) genital organs.

**Vigorous physical exercise**: deliberate exercise that is sufficient to induce moderate sweating and/or causing sufficient breathlessness to limit conversation.

# 1 INTRODUCTION

## *1.1 Overview*

Extensive research has long made clear that people of all ages can enhance their health by incorporating moderate levels of physical activity as part of their normal daily routine (Morris, Heady, Raffle, Roberts, & Parks, 1953; Paffenbarger & Hale, 1975). There is a great volume of empirical evidence that links appropriate amounts of physical activity to a wide array of mental and physical health benefits, for example reduced anxiety and depression (Camacho, Roberts, & Lazarus, 1991; Carver et al., 2005; Lawlor & Hopker, 2001; Paffenbarger, Lee, & Leung, 1994), and reduced cardiovascular risk (Morris, Heady, Raffle, Roberts, & Parks, 1953; Morris, Kagan, & Pattison, 1966; Powell, 1987). However, despite such evidence, most people in the western world are not engaging in sufficient regular physical activity to induce such health benefits (International Obesity Task Force (IOTF), 1998; World Health Organisation, 1998b; World Health Organisation & Food and Agriculture Organization of the United Nations, 2003) There remains a paucity of evidence that elucidates methods of achieving the required behaviour change (i.e. appropriate physical activity) *over time*. Most health professionals would agree that individual behaviour change over time is at best difficult, and some researchers have considered targeting individual behaviour change to be largely ineffectual (McKinlay, 1993). Contemporary thought is perhaps more optimistic and progressive, and recognises that behaviour does not occur in a vacuum. Change outcomes may be influenced by social interactions and supportive environments (Egger & Swinburn, 1997). Further, the increasing application of social psychology, positive psychology, and the application of health behaviour change theories and models has facilitated a significant rise in

the effectiveness of individual behaviour modification interventions (Burke, Arkowits, & Menchola, 2003; Burke, Dunn, Atkins, & Phelps, 2004; Dunn, Deroo, & Rivara, 2001; Miller & Rollnick, 2002; Prochaska & Di Clemente, 1984; Seligman, 1991). Education and brief psychological interventions have been shown to be efficacious in many areas of health behaviour change including changes in exercise and nutrition and exercise patterns and compliance with monitoring and medication protocols (Burke, Arkowits, & Menchola, 2003; Gonder-Frederick, Cox, & Ritterband, 2002). A large body of evidence suggests however, that such behaviour change is both extremely challenging and often not maintained over time, with a tendency for individuals to regress to pre-intervention or baseline behaviours and/or progress toward more unfavourable health outcomes (Gonder-Frederick, Cox, & Ritterband, 2002; McKinlay, 1993).

Epidemiological studies have shown that sedentary lifestyles are associated with significantly increased all-cause mortality rates (Morris, Heady, Raffle, Roberts, & Parks, 1953; Morris, Kagan, & Pattison, 1966; Paffenbarger, Blair, & Lee, 2001; Paffenbarger & Hale, 1975; Paffenbarger et al., 1986), and sedentary lifestyles can be considered to be among the most serious contemporary public health concerns. Chronic diseases disproportionately affect older adults and the effects on health spending are related to the interaction between trends of mortality and morbidity (Cornwall & Davey, 2004). Specifically, it has been suggested that in recent years, increasing trends in life expectancy in New Zealand are not paralleled by improvements in morbidity (Koopman-Boyden, 1986); due largely to the progression of non-communicable diseases, particularly coronary heart disease, obesity and diabetes (New Zealand Ministry of Health, 2004e). For all people, the process of ageing is associated with

some 'normal' decline in functional capacity, for many however, the process of ageing is overlaid with 'morbidity' or the presence of disease and/or disability, and an increased reliance on health care and support services (Davis & Ashton, 2001). Thus morbidity, for many people, underpins their concept and their reality of quality of life.

### *1.2 Statement of the issue: Diabetes epidemic*

New Zealand is currently in the midst of a diabetes epidemic and diabetes mellitus presents a serious challenge to New Zealand's health care system (New Zealand Ministry of Health, 2004e). Diabetes mellitus is a significant cause of ill health and premature death, and disproportionately so for Māori and Pacific Island Peoples (New Zealand Ministry of Health, 2004a). Diabetes mellitus is a disease involving a disturbance of metabolism, the underlying cause being the defective production or action of the hormone insulin. There are several manifestations of the disease, the most common being type 1 and type 2. Type 1 diabetes, otherwise known as insulin-dependent diabetes mellitus (IDDM), is found most often in childhood. It is characterised by rapid onset of clinical symptoms and requires prompt medical treatment and regular use of insulin for survival. Type 2 diabetes, otherwise known as non-insulin-dependent diabetes mellitus (NIDDM), is found primarily in adults and accounts for most cases of diabetes. The onset of type 2 diabetes is commonly asymptomatic for several years before being diagnosed and the incidence of type 2 diabetes increases with increasing age. Obesity is highly correlated with type 2 diabetes, and is the most salient risk factor (approximately 80% of type 2 diabetics are clinically obese [BMI > 30]) (Gonder-Frederick, Cox, & Ritterband, 2002). Management of diabetes often involves modifying diet and physical

activity behaviours, along with oral medications and sometimes insulin (Gimenez-Perez, Gonzalez-Clemente, & Mauricio, 2005).

Diabetes mellitus per se, if poorly controlled, may result in many complications. These complications include an increased risk of heart attack and stroke (Solomon, 1996), kidney damage, eye problems that may lead to blindness (retinopathy), skin disorders and diabetic neuropathy (nerve damage) (Swidan & Montgomery, 1998; Turner, Cull, & Holman, 1996). In addition, people with diabetes can develop many different foot problems; generally when there is nerve damage and/or poor blood flow in the feet and minor infections and/or minor lesions/abrasions go undetected, possibly culminating in amputation (Swidan & Montgomery, 1998; Turner, Cull, & Holman, 1996). Type 2 diabetes is a chronic condition and has been associated with depression and compromised mental health and wellbeing (Black, Markides, & Ray, 2003; Talbot & Nouwen, 2000). The use of physical exercise is considered beneficial, in that it increases glucose utilization, decreases insulin requirements, and can help to decrease body fat (Ross et al., 2000). Thus, type 2 diabetes is a substantially preventable condition, at least in theory, given sustained reduction of modifiable risk factors such as obesity, physical inactivity and smoking (NZGG & Ministry of Health, 2003).

While there are no *definitive* diabetes prevalence data for the New Zealand general population, it is estimated that the overall prevalence of *diagnosed* diabetes is 3-4%. However, estimates equating data from the recent Australian "AusDiab Study" (Cameron et al., 2003) indicate that this 3-4% is likely to represent as little as <u>half</u> of the actual burden of diabetes in New Zealand (NZGG & Ministry of Health, 2003). Thus, current estimates of the prevalence and incidence

of diabetes in New Zealand depict a complex and serious epidemic. Currently, there are more than 142,000 people with *diagnosed* diabetes in New Zealand (PriceWaterhouseCoopers., 2007), 7,500 people are *newly diagnosed* every year, it is estimated that approximately 200,000 people are currently *un-diagnosed,* and *e*ach year approximately 4,500 people die from diabetes in New Zealand (Diabetes New Zealand, 2006b; PricewaterhouseCoopers, 2001). Further, within the New Zealand population, the prevalence of diabetes in Māori adults is likely to be in the range of 15 to 20 percent and Māori mortality for diabetes is over ten times that of non- Māori in the same age group (Ministry of Health, 2002; New Zealand Ministry of Health, 2001). Diabetes is one of the major causes of death and hospitalisation among Pacific men and women, especially those in the 44-64 year age group (New Zealand Ministry of Health, 2004a).

There are significant costs associated with the management of diabetes per se, and in addition, the many associated diabetic complications that an individual may develop over time. In New Zealand, the Health Funding Authority (2000) estimated that hospital admissions for individuals with diabetes cost approximately $168 million during 1998/1999, and the more recent PriceWaterhouseCooper's report up-date (2001) predicted that these costs could rise to over $1.4 billion by 2021. Currently, it is estimated that diabetes related costs already exceed 250 million per year (Diabetes New Zealand, 2006b). While New Zealand's ability to fund spiralling health care services is reason enough for concern, the ability of the health care system to practicably deliver appropriate and effective services and interventions is of concern (Ministry of Health, 2002; New Zealand Ministry of Health, 2001; New Zealand Public Health Advisory Committee, 2004).

Arguably, health care systems in western countries have evolved such that they are not particularly well adapted for optimal treatment of high prevalence chronic diseases (Lorig & Holman, 2003). Historically, during the first half of the 20th century, the predominant reason for individuals to seek health care services was for the treatment of acute illness and disability. Thus, health care systems evolved and adapted primarily to ameliorate acute illness and disability. During the second half of the 20th century, particularly in western countries, and increasingly in developing countries, the profile of disease has changed ('epidemiological transition'). Chronic disease now prevails. Such epidemiological transition is now well progressed in New Zealand, and the progressive and serious negative health consequences of high fat/high calorie diets and a lack of physical activity have been evident in New Zealand's population for well over three decades (Beaven, 1970, , 1974). Over thirty years ago, it was postulated that approximately 30% of New Zealand's population already displayed a measurable and progressive deviation from normal health, which in all likelihood would result in symptomatic disease (Beaven, 1974).

Thus, as predicted, a high prevalence of diabetes and other chronic diseases, now poses significant challenges for contemporary health care systems. The predominant western 'medical model' of health and health care is founded in the 'acute disease paradigm' or the notion that modern medicine can 'cure people' or 'fix' acute illness, disease and disability (Lorig & Holman, 2003). While it is true that modern medicine has evolved to ameliorate many acute illnesses and injuries, it performs rather less well when faced with the increasing prevalence of chronic disease (Hiss, 1996; McKinlay, 1993), and the multi-faceted determinants of health that lie outside of individuals' human biology (for example, the

physical environment, psychosocial and socioeconomic influences) (Fuchs, 1998; Lorig & Holman, 2003).

### *1.3 Management of the problem and future directions*

Reducing the incidence and impact of diabetes is currently one of the 13 immediate action priority objectives for population health as stipulated in the New Zealand Health Strategy (New Zealand Ministry of Health, 2004c). The New Zealand Ministry of Health's strategy (with respect to diabetes), and the resultant treatment guidelines, are grounded in the concept of *self-management*. The guideline document 'Best Practice Evidence-based Guideline for the Management of Type 2 Diabetes' (NZGG & Ministry of Health, 2003) details best practice recommendations in the areas of dietary intervention, weight management, physical activity, smoking cessation, depression, glycaemic control, cardiovascular disease, foot care, eye disease, renal disease and includes Māori and Pacific perspectives.

> "Lifestyle change is central to the management of all people with diabetes and requires advice on energy intake and dietary pattern, physical activity, and smoking cessation, where appropriate" (NZGG & Ministry of Health, 2003, p. xiii).

Implementation of such treatment guidelines, particularly the provision of support, advice and education, are functions that are salient to Diabetes New Zealand Inc. Diabetes New Zealand is *the* nationwide, non-governmental, non-profit organization which provides support to its 14,000 members, the 39 diabetes societies throughout New Zealand, and the many health professionals who are involved with diabetes treatment and care. Established in 1962, Diabetes New Zealand has a long history of encouraging local support for people affected by diabetes,

acting as an advocate for people affected by diabetes, supporting diabetes research, raising awareness of diabetes and, of great importance, educating and informing people about diabetes and its treatment and self-management (Diabetes New Zealand, 2006a).

Self-management is a term that is now commonly associated with many health promotion interventions and patient education programmes (Lorig & Holman, 2003). The term self-management, as it is used throughout this document, attributes the patient with an 'active participant' role in treatment. Self-management has been defined as comprising three distinct management tasks; (1) medical management (such as taking medication, adhering to a specific diet or exercise programme), (2) role management (creating new meaningful behaviours or life roles), and (3) emotional management (learning to adapt emotionally to a chronic condition which may alter the individual's view of the future) (Corbin & Strauss, 1988). Whether self-management is a useful concept however, may depend on an individual's values and their perception and concept of 'good' or 'bad' health. It has been argued that it is impossible for individuals not to self-manage, in some way or other, their own health (Lorig & Holman, 2003). However, as they self-manage, their behaviours may or may not conform with, or be deemed to contribute toward, what others may define as 'good' or 'bad' health. Whether one is engaging in a health promoting activity such as exercise, or is living with a chronic disease such as diabetes, it can be argued that ultimately he or she is responsible for day-to-day management (Lorig & Holman, 2003).

There is now an extensive and continually advancing body of evidence that demonstrates the efficacy of many individual and complementary interventions in the management of type 2

diabetes (DCCT Research Group, 1993; Gonder-Frederick, Cox, & Ritterband, 2002; Griffin, Kinmouth, Skinner, & Kelly, 1999; Grifn, 1998; Padgett, Mumford, Hynes, & Carter, 1988; Paternostro-Bayles, Wing, & Robertson, 1989; Schneider, Khachadurian, Amorosa, Clemow, & Ruderman, 1992). However, the exact magnitude of the gap between recommended best practice and current practice in diabetes management in New Zealand is unknown (NZGG & Ministry of Health, 2003). It has been shown that self-care, monitoring, retinal screening and other treatment interventions are frequently not fully implemented in New Zealand and/or the up-take is variable and/or low (Dawson & Andrews, 2003). It therefore appears that diabetes management could be improved significantly and that a substantial number of individuals with diabetes are still unnecessarily enduring diminished quality of life and/or premature death.

### *1.4 Research purpose*

The purpose of this research is to investigate the role that physical activity plays (or may play) in the self-management of type 2 diabetes, within a group of newly diagnosed diabetic patients in a metropolitan New Zealand health care setting/community. Further, the research seeks to elucidate how selected psychosocial constructs may influence a newly diagnosed type 2 diabetic patient's adaptation to this significant life event. The purpose of such an investigation is to generate recommendations that may facilitate individuals, communities, health professionals, health promoters and policy analysts in the task of matching resources and interventions optimally: specifically, within a metropolitan New Zealand diabetic population, with specific emphasis on the integration of *daily physical exercise* in the context of a modern urban environment. Such optimal matching (or tailoring) of resources and interventions will

potentially enhance the quality of such interventions, provide for enhanced cost-effectiveness of interventions, and assist people to form stronger commitments to being physically active over a lifetime, thus enhancing their quality of life.

### *1.5 Research hypothesis*

"Greater optimism, exercise efficacy and goal-directedness, and lower life stress and anxiety/depression, measured at the time of an individual's diagnosis with type 2 diabetes, will be associated with higher levels of physical activity, and more clinically normal scores on biochemical measures, at 6 months follow-up".

### *1.6 Implications*

Traditionally, within the 'medical model' of health care, there has been a tendency to apply a 'one size fits all' approach to interventions at the micro-level; particularly, within what might be termed 'routine medical care' (Fuchs, 1974, , 1998; McKinlay, 1993; Minkler, 1999). For example, the provision of hospital based services tends to assume that all individuals will have equitable opportunity, access, understanding, motivation and perceptions of the services available. Often, traditional 'medical model' health care fails to accommodate individual differences in readiness to change, willingness to change, cultural appropriateness, barriers to equitable access to health care, and a myriad of other socioeconomic, cognitive and psychological antecedents to health behaviour change (Fuchs, 1998; New Zealand Ministry of Health, 2002b; New Zealand National Advisory Committee on Health and Disability, 1998; New Zealand Public Health Advisory Committee, 2004). A challenge the health sector *is* now beginning to address, is the *range* of implications for service delivery, which are generated by

wide contextual variability among patients suffering from the same chronic condition (New Zealand Ministry of Health, 2001, , 2002b, , 2004c). The implication of the above hypothesis is that appropriate and sufficiently detailed pre-assessment of individuals' likely engagement with and adaptation to the challenges of the change process will allow resources to be customized or tailored to better meet individual needs. Moreover, patients will be more likely to attain the skills required to self-tailor resources to suit their own individual needs.

## *1.7 Research aims*

### *1.7.1 General*

The study, being of prospective cohort design, aims broadly to demonstrate correlations between certain psychosocial, behavioural and biological determinants of health and the self-management of one's health: as measured at baseline and again at six month follow-up, and within a newly diagnosed type 2 diabetes population. Specifically, the psychosocial constructs comprise optimism/pessimism; life stress; self-efficacy; readiness for change; goal-directness; and anxiety/depression. The biochemical measures are HbA1c (as a measure of average blood glucose control) and BMI (as a measure of subject's body composition, broadly; normal, overweight, obese) and the salient behavioural measure being subjects' physical activity levels.

For the purpose of definition, baseline refers to the time when the subject/patient first attends the Christchurch Diabetes Centre - patient education seminar *or* within one month of diagnosis. 'Follow-up' refers to a point in time as near as possible to a subject's 'baseline' interview, plus six months.

### *1.7.2 Specific aims*

(1) To investigate and illuminate subject's individual differences in psychosocial, physical (biochemical) and behavioural profiles; at the time of the patient's initial diagnosis of type 2 diabetes.

(2) To investigate and demonstrate how any such individual differences in psychosocial, physical (biochemical) and behavioural profiles may change over time (specifically, between baseline and follow-up) and within the context of 'routine medical care'.

(3) To investigate and demonstrate how any such baseline differences, and/or changes in individuals' psychosocial profiles, relate to differing behavioural and physical (biological) outcomes, over time. Specifically, the conscious and purposeful integration of physical activity into subject's daily life, as an element of their diabetes self-management.

These aims, collectively, seek to elucidate any predispositions, variations, and differences in individuals' adaptation to, and experience of living with type 2 diabetes over time.

### *1.7.3 Expected outcome*

To generate recommendations for the future development of behaviour change interventions that facilitate the adoption of physical exercise over time. Specifically, exercise behaviour as an integral component of effective type 2 diabetes prevention and self-management in New Zealand adults.

### *1.8 Summary/Conclusion*

There would appear to be little argument that increasing the average activity levels of New Zealanders would contribute to increased individual and collective physical and psychological health and a reduction in New Zealand's burden of disease. Diabetes related health care costs alone are predicted to rise to over $1 billion by the year 2021 (PWC, 2003). New Zealand is experiencing the burden of spiralling non-communicable disease prevalence, and the ability of the health care system to practicably deliver appropriate and efficacious services and interventions is questionable. With respect to type 2 diabetes in particular, it has been shown that self-care and other treatment interventions and services are frequently not fully implemented in New Zealand, and/or the up-take is variable and tends to be low (Dawson & Andrews, 2003).

The purpose of this research was to investigate but a small facet of type 2 diabetes management in New Zealand, specifically, the role that physical activity and a selection of associated psychosocial constructs play in the self-management of type 2 diabetes, within a group of newly diagnosed diabetic patients in a metropolitan New Zealand health care setting/community. Further, the findings, as reported here, seek to illuminate how a newly diagnosed cohort of patients with type 2 diabetes adapted to this significant life event.

It is hoped that the recommendations generated here will facilitate individuals, communities, health professionals, health promoters and policy analysts in the task of matching resources and interventions optimally: specifically, within a metropolitan New Zealand diabetic population, with specific emphasis on the integration of daily physical exercise in the context

of a modern urban environment.

Type 2 diabetes is a substantially preventable condition, at least in theory, given sustained reduction of modifiable risk factors such as obesity, physical inactivity and smoking. The challenge to health systems in New Zealand and around the world is to develop programmes that achieve a sustained reduction of risk across the population.

### *1.9 Limitations*

A salient limitation of this study is the relatively short time interval between administering the questionnaire/collecting baseline data, and the collection of data at follow-up. Due to the time constraints of the one year full time academic programme, it was decided that six months was the maximum time interval practicable between time 1 and time 2. It is acknowledged here that this relatively short time interval may not wholly reflect the concept of 'over time', that is, day-to-day management of a chronic disease for the person's remaining life-span. However, the sample cohort could be re-surveyed at appropriate intervals in the future (for example at 12,18,24,36 months) to examine further the correlations investigated here.

The scope and resources of the study did not allow for a randomised control trial. The inclusion of a 'wait list' control group would have evoked the ethical obligation to, in due course, extend the study to such a control group, and this was considered not practicable within the time constraints of the researcher's Master of Health Science programme academic year.

With regard to the generalisability of findings, it is acknowledged the sample may not be

wholly representative of the general diabetic population. Specifically, the sample was drawn from participants who chose to participate in a patient education seminar; a behaviour that, in itself, could be argued to represent some elevated motivation toward change. Nevertheless, as the Christchurch Diabetes Centre is the centralised diabetes service for the region's public health services it is likely that the sample reflects the wider population.

Further, dietary changes and total calorific intake are not controlled for, therefore changes in BMI are only indicative of an individual's change in behaviour in general, however the individual levels of physical activity are reported, and form a useful part of the 'energy-in-equals-energy-out' body mass equation. The measurement of dietary changes was considered to be outside the scope and resources of this study, and outside the specific focus on physical activity.

Finally, the 'Hawthorn Effect' (Mayo, 1933) may account for some of the total variance in individual behaviours and medical outcomes. Improvements or changes in subject behaviour may have resulted from the mere fact that subjects knew they were being studied. Subjects may have adopted 'pleasing the experimenter' as a goal, and this may have resulted in changes in their motivation.

Note: The above limitations are acknowledged here for the purpose of delineating the context of the study and are not a full account of the study limitations (see 5.2.10 for further discussion).

# 2 REVIEW OF THE LITERATURE

## *2.1 Introduction and guide to the reader*

There is now an extensive and continually advancing body of evidence that demonstrates the *efficacy* of many individual and complementary interventions in the management of type 2 diabetes. However, in practice, the implementation of *effective* chronic disease management is still in its infancy. There are now many reviews that substantiate the view that appropriate diabetes management has the *potential* to improve long-term outcomes and health status, however, to date, the overall effect on glycemic control, in actuality, appears modest (Knight et al., 2005).

The following literature review presents firstly, an overview of the pathophysiology of type 2 diabetes (section 2.2) and aspects of traditional and contemporary type 2 diabetes management (section 2.3). Additionally, the relationships between physical activity, health and the prevention and/or self-management of type 2 diabetes are examined in detail (section 2.4). Further, the psychological constructs of optimism and pessimism are elucidated, and the literature relating optimism-pessimism and a range of health outcomes and contexts is reviewed (section 2.8). Still further, goal theory is reviewed: its origins from within the educational and industrial/organisational psychology fields, and its subsequent and evolving application within health and health behaviour change contexts (section 2.9). Within the review of goal theory, the constructs of anxiety; depression; and self-efficacy (section 2.9.5) are also reviewed, to illuminate their potential relevance to the evolving treatment paradigms with respect to type 2 diabetes management.

Overall, this chapter is intended to investigate factors that may facilitate future health promotion and treatment interventions to target more precisely high risk diabetic populations, and importantly, any sub-groups therein. However, this chapter also draws on literature from related health fields, as well as the fields of organisational, educational, social and positive psychology. It is suggested here that many of the concepts, principles, and mechanisms of behaviour change elucidated herein may usefully be applied to other problem behaviours and populations. This is particularly true of weight management, smoking, alcohol, and substance abuse; however in each case, the specific integration of theory and practice is likely to be idiosyncratic.

## *2.2 Type 2 Diabetes Mellitus*

### *2.2.1 Definition*

Type 2 diabetes mellitus is a progressive disorder characterised by chronic hyperglycaemia (elevation of blood glucose levels), with disturbances of carbohydrate, fat and protein metabolism. Type 2 diabetes mellitus results from a defect in the secretion of the hormone insulin by the pancreas (relative insulin deficiency), or the decreased sensitivity of peripheral tissue to the action of insulin (insulin resistance), or both. Either insulin resistance or an insulin secretion defect can predominate (NZGG & Ministry of Health, 2003; W.H.O., 1999).

### *2.2.2 Pathology/physiology*

The exact cause of type 2 diabetes is not completely understood, but it is known that the disease has a strong hereditary component. Individuals who have a parent or sibling with type

2 diabetes have 10% to 15% chance of developing the disease (Rewers & Hamman, 1995). Environmental factors such as an inactive lifestyle or poor diet may act as a trigger for someone with a genetic tendency towards type 2 diabetes. The adoption of a more affluent and westernized lifestyle (characterised by decreased physical activity, greater fat consumption and subsequent obesity) is contributing to an increase in prevalence of type 2 diabetes. Obesity is highly correlated with type 2 diabetes, and is a serious risk factor (approximately 80% of type 2 diabetics are clinically obese [BMI > 30]) (Gonder-Frederick, Cox, & Ritterband, 2002).

Diabetes mellitus is classified into two main sub-types; type 1 diabetes mellitus and type 2 diabetes mellitus. Type 1 diabetes, otherwise known as insulin-dependent diabetes mellitus (IDDM), is an auto-immune disease in which the insulin-producing pancreatic beta cells are destroyed. It typically has an acute symptomatic onset and requires prompt medical treatment and regular use of insulin for survival. Type 1 diabetes typically presents in children and young adults aged less than 30 years, and type 1 diabetes is comparatively rare, accounting for only approximately 10% of all cases of diabetes (Harris, Nagy, & Vardaxis, 2006; W.H.O., 1999).

Type 2 diabetes, otherwise known as non-insulin-dependent diabetes mellitus (NIDDM), results from insulin resistance (resistance by body tissues to the action of insulin), and/or an insulin secretion defect. The onset of type 2 diabetes is commonly asymptomatic for several years before diagnosis, and the incidence of type 2 diabetes increases with increasing age. Type 2 diabetes usually presents in adults, but is now becoming more common in adolescents and children (Harris, Nagy, & Vardaxis, 2006; W.H.O., 1999).

There are also at least three related metabolic abnormalities or 'pre-diabetes' conditions recognised, namely *insulin resistance, impaired glucose tolerance* (IGT) and *impaired fasting glucose* (IFG) (W.H.O., 1999). These three conditions all refer to metabolic stages intermediate between normal carbohydrate metabolism and diabetes. While IFG and IGT both represent similar states of abnormal metabolism, the terms are not synonymous, as IFG represents abnormality of glucose regulation in the fasting state, and IGT represents abnormality of glucose regulation postprandial (occurring after a meal). IFG refers to fasting glucose concentrations which are lower than those required to diagnose diabetes mellitus but higher than the "normal" reference range (if an OGTT is performed, some individuals with IFG will return a positive test result for diabetes)(W.H.O., 1999).

Insulin resistance is thought to underpin type 2 diabetes, and insulin resistance represents a decreased sensitivity of target cells (particularly skeletal muscle, adipose and liver cells) to the action of insulin. Excess body fat is strongly implicated in the occurrence of insulin resistance (and thus type 2 diabetes), as adipose cell membranes have fewer insulin receptors, and defects in intra-cellular processes also appear to play a large role in the development of insulin resistance (McGarry, 2002). The inability of the pancreas to produce additional insulin in a condition of hyperinsulinaemia is what characterizes the transition from insulin resistance to type 2 diabetes and insulin resistance is often found in people with central upper body obesity, hypertension, hyperglycaemia and dyslipideamia (also referred to as 'Metabolic Syndrome' or 'Syndrome x') (McGarry, 2002). While the W.H.O. states that there is no internationally recognised definition of insulin resistance, the W.H.O. suggests that insulin resistance is indicated if the glucose uptake is below the lowest quartile for the background population

under investigation (under laboratory 'hyperinsulinaemic, euglycaemic' test conditions [see below])(W.H.O., 1999).

### *2.2.3 Risk factors*

People with IGT or IFG are at risk of progressing to diabetes (W.H.O., 1999). In the United States, approximately 40% of individuals aged 65-75 years and 50% of individuals aged over 80 years have IGT that may lead to type 2 diabetes, however the exact prevalence of IGT or IFG in New Zealand is unknown (New Zealand Ministry of Health, 2001). With the exception of the ageing process itself, and any genetic predisposition, much of the increasing prevalence of type 2 diabetes is due to largely controllable factors including poor diet, physical inactivity and increased body fat (ACSM, 2000).

#### *2.2.3.1 Ageing*

Type 2 diabetes affects mainly middle aged and elderly people. Further, certain ethnic groups have disproportionably high rates, for example Māori and people of Pacific origin. The average age of the diagnosed diabetic population is forecast to be 59.9 years for both males and females by 2011 (Ministry of Health, 2002). Age is a significant un-modifiable risk factor for type 2 diabetes (Rewers & Hamman, 1995), and the incidence of type 2 diabetes can be expected to rise significantly in New Zealand due to New Zealand's changing demographic profile.

In New Zealand (and elsewhere in the Western World), a period of heightened fertility occurred between (approximately) 1945 and 1975. This cohort of so called 'baby boomers'

produces a 'wave' in the population pyramid (Koopman-Boyden, 1986). Thus, from approximately 2011 to 2037, the population aged above 65 years in New Zealand will increase the most rapidly. Statistics New Zealand's current population projections indicate that New Zealand's population will increase to 5.05 million people by 2051, and the total number of people aged 65 and over will increase dramatically to an estimated 1.33 million people by 2051, this being 2.7 times the 2004 total (Pink, 2004; Statistics New Zealand, 2006). Further, the percentage increase in the number of older people in the Māori, Pacific and Asian ethnic groups is projected to be even greater (Pink, 2004; Statistics New Zealand, 2006). Ageing significantly affects the demand for health and disability services. While ageing itself does not *cause* ill health, ageing is strongly related to both the risk of dying, and to the prevalence of chronic disease and disability which increases exponentially with age (New Zealand Ministry of Health, 2004d). Hospitalisation statistics indicate that older people accounted for just over half of all bed days, and nine of the main diseases and conditions affecting older people (including diabetes) accounted for nearly two-thirds of all bed days in the population as a whole (NZIER, 2004).

#### *2.2.3.2 Ethnicity*

Diagnosed diabetes causes about 20 percent of all deaths among Māori and 17 percent of all deaths among Pacific peoples, but only 4 percent of deaths among New Zealand Europeans. Furthermore, it is estimated that the proportion of all deaths correctly attributed to diabetes is likely to be an underestimate, with less than half of all deaths attributable to diabetes being correctly reported. Almost two-thirds of Māori and Pacific peoples with diabetes will probably die from their diabetes, compared to one-third of New Zealand Europeans with diabetes

(Ministry of Health, 2002; NZIER, 2004). For the total population, diabetes incidence and prevalence are forecast to increase at an average rate of approximately 5.8 percent and 3.9 percent per year respectively. However, annual growth rates for Māori and Pacific people are forecast to be 30 to 40 percent greater than European ethnic groups for incidence, double for prevalence, and nearly treble for diabetes-attributable mortality (Ministry of Health, 2002). Thus, by the year 2011, the number of people aged between 25 and 89 years with diagnosed (mainly type 2) diabetes will increase by approximately 78 percent compared to 1996 levels, and the relative increase will be greater for Māori and Pacific peoples at approximately 130 to 150 percent (Ministry of Health, 2002).

#### *2.2.3.3 Obesity*

Obesity is highly correlated with type 2 diabetes, and is a serious risk factor as approximately 80% of type 2 diabetics are clinically obese (BMI > 30 for New Zealand European and BMI>32 for Māori and Pacific People) (Gonder-Frederick, Cox, & Ritterband, 2002).While slightly less than two-thirds of the projected increase in the number of people with diabetes results from anticipated non-modifiable demographic trends, slightly more than one-third results from the projected increase in the prevalence of obesity (Ministry of Health, 2002; New Zealand Ministry of Health, 2004e).

Data from the 1997 National Nutrition Survey (Russell, Parnell, & Wilson, 1999) indicate that the prevalence of obesity in New Zealand will increase overall from 17 percent in 1996 to 29 percent in 2011 and for every 1 percent absolute increase in the prevalence of obesity, it was estimated that an additional 2,300 people will develop diabetes. Further, the 1997 National

Nutrition Survey found considerable variation in the prevalence of obesity between different ethnic groups within the New Zealand population. Specifically, 27.0 percent of Māori and 26.2 percent of Pacific males were classified as obese, compared with 12.6 percent of New Zealand European and other males. Further, almost half of Pacific females (47.2%) were classified as obese compared with 27.9 percent of Māori females and 16.7 percent of New Zealand European and other females (Russell, Parnell, & Wilson, 1999)

#### *2.2.3.4 Socioeconomic status*

Socioeconomic status is an important determinant of health and generally, people with low incomes who live in socio-economically deprived neighbourhoods have poorer health and shorter life expectancy than people with professional occupations and higher incomes, who live in less deprived neighbourhoods (Ministry of Health, 2002; New Zealand Ministry of Health, 2002b). Type 2 diabetes is no exception, and people with diabetes living in more deprived socioeconomic circumstances tend to have higher morbidity and mortality rates, compared to people with diabetes who live in better socioeconomic circumstances (Ministry of Health, 2002).

### *2.2.4 Clinical findings*

Diabetes mellitus may present with characteristic symptoms such as tiredness, polydipsia (great thirst), polyuria (excessive urination, a common symptom of type 2 diabetes), repeated and persistent infections (including oral or vaginal thrush, urinary tract infections, genital thrush in men), erectile dysfunction, changes in sensation in the feet, persistent coughs and colds, sores that are slow to heal, blurred vision and unexplained weight loss (due possibly to

dehydration and/or muscle breakdown). Often, symptoms are not severe or may be absent, and consequently, hyperglycaemia sufficient to cause functional changes in some tissues may be present for a long time before a diagnosis is made. In its most severe form, undiagnosed chronic extreme hyperglycaemia may lead to a non-ketotic hyperosmolar state, which may lead to stupor and coma, and in absence of effective treatment, death (Harris, Nagy, & Vardaxis, 2006; W.H.O., 1999).

#### *2.2.4.1 Tiredness*

While the body normally utilises a number of substrates for energy, the preferred source of energy is glucose, as derived from the breakdown of carbohydrate foods. In the diabetic person, a defect in the secretion of insulin (relative insulin deficiency), or the decreased sensitivity of peripheral tissues to the action of insulin (insulin resistance), or both, results in the reduced capacity to utilise glucose such that a 'metabolic' tiredness (or general 'un-wellness') may be experienced (Harris, Nagy, & Vardaxis, 2006; W.H.O., 1999).

#### *2.2.4.2 Polyuria*

Excessive blood glucose is ultimately filtered through the kidneys causing an osmotic effect which diminishes water re-absorption in the kidneys leading to polyuria (excessive urination)(Harris, Nagy, & Vardaxis, 2006; W.H.O., 1999).

#### *2.2.4.3 Ketoacidosis*

Decreased cellular uptake of glucose results in the diabetic person obtaining an increased proportion of energy from metabolising fat, and this produces an excess of keotoacids (by-products of fat metabolism) and a tendency towards acidosis (abnormal blood plasma pH). The

person may present with 'sweet-smelling' breath due to the production of ketone bodies (for example acetone) during the metabolism of lipids (Harris, Nagy, & Vardaxis, 2006; W.H.O., 1999).

### *2.2.5 Diagnosis*

The New Zealand Guidelines for Type 2 Diabetes management (NZGG & Ministry of Health, 2003) state the current World Health Organisation's (W.H.O., 1999) diagnostic criteria for the different recognised categories of hyperglycaemia: impaired glucose tolerance (IGT), impaired fasting glycaemia (IFG), and type 2 diabetes mellitus (summarised below). The W.H.O. classification is based on a venous plasma sample. Traditionally, the recognised method of diagnosing type 2 diabetes has been via the fasting blood glucose test, however in the late 1990s the World Health Organisation (W.H.O.) revised the classification and diagnostic criteria for diabetes, and the W.H.O. recommended the additional use of the oral glucose tolerance test (OGTT) to avoid the possibility of some cases of diabetes being missed when the fasting plasma glucose test is the only diagnostic test undertaken (NZGG & Ministry of Health, 2003). The OGTT is a laboratory test whereby the person presents at the laboratory after having had nothing to eat or drink (except water) for the past 8-10 hrs. An initial fasting blood glucose level is taken, and the person then consumes a drink containing 75grams of glucose. Blood glucose levels taken one and two hours later are used to form a diagnosis (W.H.O., 1999).

### *2.2.6 Diagnostic criteria*

- Two fasting venous plasma glucose results greater than, or equal to, 7 mmol/l on two different days are diagnostic of diabetes and an oral glucose tolerance test (OGTT) is not required. A fasting venous plasma glucose result of less than 5.5 mmol/l is normal. Note: For clinical purposes, the diagnosis of diabetes should always be confirmed by repeating the test on two different days, unless the first positive test is reinforced by indisputable hyperglycaemia with acute metabolic de-compensation, or other obvious symptoms (e.g. thirst/polyuria).

- A random venous plasma glucose result of greater than 11 mmol/l on two different days is diagnostic of diabetes.

- A fasting venous plasma glucose of 6.1 to 6.9 mmol/l indicates impaired fasting glucose (IFG) and an OGTT is recommended to assess for diabetes or IGT. Some people with a fasting venous plasma glucose of 5.5 to 6.0 mmol/l show diabetes or impaired glucose tolerance with an OGTT.

- An OGTT is recommended in people with a fasting venous plasma glucose of 5.5 to 6.0 mmol/l who are not of European ethnicity or who have a family history of diabetes, a past history of gestational diabetes or other features of the metabolic syndrome. A positive result for diabetes is confirmed if the person is not pregnant and the blood plasma glucose level two hours after the ingestion of 75grams of glucose is equal or greater than 11.1 mmol/l (W.H.O., 1999).

#### *2.2.6.1 Other tests and measures*

*HbA1c:* Glycosylated haemoglobin (HbA1c) is a laboratory measure that reflects a person's average blood glucose level over the previous 2-3 months. In general terms, the goal of treatment is to achieve an HbA1c as close to physiologically normal as possible, preferably less than 7.0%. The target HbA1c for an individual should, however, take into account any individualised differences including; the person's BMI, blood pressure, lipid status, the presence of any diabetic complications and/or co-morbidities, the risk of severe hypoglycaemia, individual choice and psychosocial circumstances. Note that HbA1c should not be used for the diagnosis of diabetes (NZGG & Ministry of Health, 2003).

*Hyperinsulinaemic euglycaemic clamp:* The laboratory test procedure for investigating and quantifying insulin resistance is the "hyperinsulinaemic euglycaemic clamp". This procedure involves measuring the amount of glucose necessary to compensate for an experimentally increased insulin level, without causing hypoglycaemia. The test is mainly used in a medical research context. The test takes approximately 2 hours and the subject has a small dose of insulin infused via a peripheral vein, and blood glucose is also infused such that his/her blood glucose levels are held within the normal range during the test. The rate of glucose infusion required (to maintain blood glucose levels within the normal range) during the last 30 minutes of the test determines the person's insulin sensitivity. If very low levels of glucose are required during the test then this indicates a resistance to the action of insulin (DeFronzo, Tobin, & Andres, 1979).

*Blood Pressure:* Raised blood pressure is 1½ to 2 times more prevalent in people with

diabetes. Research has shown that lowering blood pressure in people with diabetes lowers cardiovascular risk (UK Prospective Diabetes Study Group, 1998). The UKPDS study demonstrated that each 10 mm Hg reduction in systolic blood pressure is associated with a 15% reduction in risk of cardiovascular death over 10 years. Appropriate blood pressure control is recommended for everyone with diabetes to achieve the reduction of both cardiovascular disease outcomes and renal complications (NZGG & Ministry of Health, 2003).

*Lipid abnormalities:* Abnormal lipid profiles are common in people with type 2 diabetes. The most common type of abnormality in type 2 diabetes is a combination of reduced HDL cholesterol, and elevated triglycerides and LDL (LDL being more atherogenic). Randomized controlled trial evidence shows that intensive lipid management in people with diabetes lowers cardiovascular risk (Mensink, Zock, & Kester, 2003). Dietary restriction of saturated fatty acids and cholesterol is recommended to reduce total cholesterol and LDL and there are several effective medications that may assist in correcting lipid abnormalities (NZGG & Ministry of Health, 2003). These medications include statins for lowering LDL (e.g. Lipex and Zocor), and fibrates to help increase HDL (e.g. Bezalip) (Shepherd, 1995). All the major risk factors including smoking, blood pressure, lipids and glycaemic control require special attention in people with diabetes.

**Table 1** •Optimal risk factor levels in people with diabetes

| Variable/Measure | Value | |
|---|---|---|
| **Total Cholesterol** | <4 mmol/L | |
| **LDL Cholesterol** | <2.5 mmol/L | |
| **HDL Cholesterol** | >1 mmol/L | |
| **TC:HDL ratio** | <4.5 | |
| **Triglycerides** | <1.7 mmol/L | |
| **Blood Pressure** | **Systolic Blood Pressure** | **Diastolic Blood Pressure** |
| People with diabetes or cardiovascular disease | <130 mm Hg | <80 mm Hg |
| People with diabetes and overt nephropathy, or other renal disease | Aggressive blood pressure control is recommended, usually two blood pressure-lowering agents including an ACE-inhibitor | |
| **HbA1c** | HbA1c as close to physiological levels as possible (aim for <7%) | |
| **Smoking Status** | Non-Smoking | |

•Adapted from: (Farmer, Pearson, & Strong, 2004; NZGG, 2003)

### *2.2.7 Pharmacological interventions for glycaemic control*

The treatment of type 2 diabetes has become increasingly sophisticated, with a wide range of pharmacological agents now available to assist people to lower their blood glucose. However, a key characteristic of type 2 diabetes is an inevitable decline in insulin secretion over time, which often results in the eventual loss of glycaemic control. Even with the use of oral anti-diabetic drugs (OADs), most patients will require insulin to correct persistent hyperglycaemia within 6 to 10 years of diagnosis (Wright, Burden, Paisey, Cull, & Holman, 2002). Further, in

a retrospective analysis of a large administrative pharmacy database (n=579,498), Boccuzzi et al. (2001) found considerable differences in patient compliance and persistence with pharmacological agents, as well as prescriber factors related to pharmacological agent selection, and the optimisation of therapy. Similarly, data from the UKPDS study has demonstrated that despite these advances in pharmacological treatment, the normalization of blood glucose for any appreciable period of time is seldom achieved (Turner, Cull, Frighi, & Holman, 1999). Limitations aside, pharmacological interventions, in conjunction with dietary and physical activity interventions, are an important facet of diabetes care and three groups of OAD medications are currently funded in New Zealand; b*iguanides, sulphonylureas, and alpha-glucosidase inhibitors*

#### *2.2.7.1 OAD Medications*

*Biguanides* (Metforman Glucophage, Metomin): Metforman is widely available and prescribed in New Zealand. Metforman is safe and effective in increasing insulin sensitivity, and may also slow absorption of glucose from the stomach and intestines, and act on the liver to attenuate glucose production (Boccuzzi et al., 2001; NZGG & Ministry of Health, 2003).

*Sulphonylureas* (Gliclazide and Glipizide): Sulphonylureas act on the pancreas to stimulate insulin production (while the pancreas is still able to do so). However, sulphonylureas are not very effective in patients with obesity, due to insulin resistance, but they may be effective in *combination therapy* with Metforman (Boccuzzi et al., 2001).

*Alpha-Glucosidase Inhibitors* (Acarbose): Alpha-Glucosidase Inhibitors act by slowing down and reducing the breakdown of complex carbohydrates into glucose within the stomach and

intestines (Boccuzzi et al., 2001).

#### *2.2.7.2 Insulin therapy*

The insulin available and funded in New Zealand is Novo Nordisk, and the range includes rapid, short, and intermediate acting insulin, and various pre-mixed insulin ratios (Farmer, Pearson, & Strong, 2004; NZGG & Ministry of Health, 2003). Early outcome studies employing intensive insulin therapy have clearly demonstrated the reduced incidence and delayed progression of diabetes complications in type 2 diabetes patients (U.K. Prospective Diabetes Study Group, 1998). Technological advances in insulin therapy (including slow-acting injections and insulin pumps) have facilitated the development of treatment regimens that are relatively easy for the patient to initiate and that may only involve the addition of a single daily insulin injection to a pre-existing oral pharmacological therapy (Riddle, Rosenstock, & Gerich, 2003).

In a recent synthesis of current empirical findings and clinical experience Garg, Dailey and Hirsch (2006) propose that a paradigm shift is required in the use of pharmacological agents in the treatment of type 2 diabetes: from that of 'reactive treatment' to that of 'aggressive prevention'. Garg et al. point to UKPDS evidence (U.K. Prospective Diabetes Study Group, 1995) that suggests that impaired glucose tolerance (IGT) may actually occur as early as 9 to 12 years prior to the diagnosis of type 2 diabetes, and by the time a diagnosis of diabetes is made, patients may have already lost nearly 50% of their beta-cell function, and may already have evidence of diabetes-related complications. Treatment with insulin plus oral pharmacological drugs results in improved glycaemic control, and an 'insulin-sparing' effect,

(compared with either insulin or OADs alone) (Riddle, Rosenstock, & Gerich, 2003). Garg et al. strongly suggest that it may often be necessary to add insulin therapy to existing oral regimens at a much earlier stage in the disease course of type 2 diabetes and that by using a combination of insulin plus OADs, near normal blood glucose levels can be safely pursued (Garg, Dailey, & Hirsch, 2006). While physicians and other health professionals remain challenged to manage adequately type 2 diabetic patients (given the associated complexities and real world variability), it is clear that oral pharmacological agents and insulin therapy will remain integral components of the effective treatment of type 2 diabetes (Boccuzzi et al., 2001).

### *2.2.8 Non-pharmacological interventions for glycaemic control*

Good glycaemic control is considered the salient goal of treatment (NZGG & Ministry of Health, 2003), as tight glycaemic control has been demonstrated to delay the onset and progression of diabetic microvascular and macrovascular disease (Turner, Cull, & Holman, 1996; U.K. Prospective Diabetes Study Group, 1998). Non-pharmacological management of diabetes involves modifying diet and physical activity behaviours and/or psychological states (Gimenez-Perez, Gonzalez-Clemente, & Mauricio, 2005). Physical exercise is considered to be a particularly beneficial component of good diabetes management, in that it increases glucose utilization, decreases insulin requirements, and can help to decrease body fat (Ross et al., 2000).

### *2.2.9 Complications*

#### *2.2.9.1 Acute complications*

Diabetic hyperosmolar non-ketotic coma (HONK) is a life-threatening acute metabolic complication of diabetes mellitus characterized by decreased consciousness, extreme dehydration (lack of water), and extremely high blood glucose levels, which are not accompanied by ketoacidosis (abnormal blood pH) (Stoner, 2005). The condition is usually seen in people with type 2 diabetes and may occur in those previously undiagnosed or in those who have improperly managed their medications, diet and hydration. Any illness that results in dehydration or that leads to a decrease in insulin activity can cause HONK. Normally the kidneys compensate for high glucose levels in the blood by excreting excess glucose in the urine. However, when water is scarce, the kidneys conserve fluid and glucose levels become dangerously high. The goal of treatment is to correct the dehydration, which will in turn improve the blood pressure, urine output and poor circulation, and the high glucose levels are treated with intravenous insulin, however the mortality rate remains high ranging from 14 - 58%. (Stoner, 2005).

#### *2.2.9.2 Chronic complications*

Poorly controlled blood glucose levels may result in many diabetic complications including cardiovascular disease, neuropathy (degeneration of the peripheral nervous system), retinopathy (a disease of the retina, associated with damage to the blood vessels of the retina), diabetic nephropathy (a disease or medical disorder of the kidney), diabetic foot disease (nerve damage, poor blood flow, tissue breakdown or ulceration and/or amputation), and erectile

dysfunction. Largely, diabetic complications are the direct or indirect result of abnormal changes in the microvascular system, however the exact mechanisms by which hyperglycaemia (elevated blood glucose levels) contributes to vascular damage are not fully understood (Swidan & Montgomery, 1998). Most cells in the body require the presence and action of insulin for glucose to gain entry into the intracellular compartment. However, 'vascular endothelial cells' of the retina, kidney, and nervous tissue are *insulin independent.* Endothelial cells line the entire circulatory system, from the heart to the smallest capillary. Endothelial cells are involved in many aspects of vascular biology, including the passage of materials into and out of the bloodstream and specialized 'filtering' functions. As endothelial cells are insulin independent, there is a free interchange of glucose from the extracellular to intracellular environment, regardless of insulin's presence or action. This diffusion of glucose into retinal, nerve and kidney microvascular endothelial cells allows normal cellular functions to proceed during the euglycaemic (normal blood glucose concentration) state. However, in the hyperglycaemic state (elevated blood glucose), excess glucose enters the cells and exceeds the cells' capacity to wholly metabolise glucose, which results in disequilibrium of metabolic process and the formation of damaging metabolic by-products (Swidan & Montgomery, 1998).

#### *2.2.9.3 Diabetic Cardiovascular Disease*

Excess morbidity and mortality in type 2 diabetes populations results largely from coronary heart disease, stroke and peripheral vascular disease, which are all attributable to accelerated atherosclerosis (the build up of plaques, narrowing and "hardening of the arteries") (Solomon, 1996). One of the most commonly recognized scenarios is coronary thrombosis (obstruction of a coronary artery) causing myocardial infarction (a heart attack) (McArdle, Katch, & Katch,

2001). Cardiovascular disease, including angina, myocardial infarction, ischaemic stroke, and peripheral vascular disease, accounts for a significant proportion of total mortality in most western countries. In New Zealand, cardiovascular disease is the leading cause of death, accounting for approximately 40% of all deaths (New Zealand Ministry of Health, 2001), and in the United States, cardiovascular disease accounts for 32% of total mortality (Centers of Disease Control and Prevention, 1997). Everyone with diabetes is classified at higher cardiovascular risk and morbidity and mortality from cardiovascular disease is two to five times higher in people with diabetes (New Zealand Ministry of Health, 2001). Approximately two-thirds of people with type 2 diabetes die from cardiovascular disease. Improved glycaemic control is associated with reduced cardiovascular morbidity and mortality. Prospective studies (UKPDS) have shown that a 1% reduction in HbA1c is associated with a 14% reduction in myocardial infarction, 16% reduction in heart failure and 12% reduction in ischaemic stroke (Sratton et al., 2000). Further, physical activity is a powerful modifier of cardiovascular disease (see also section 2.6 for a review of physical activity and diabetes). An early epidemiological study of coronary heart disease risk undertaken in the 1950s demonstrated that lack of physical activity was strongly related to coronary heart disease (Morris, Heady, Raffle, Roberts, & Parks, 1953). More than 50 years of cross-sectional and longitudinal research now confirms that increased physical activity imparts a protective effect against coronary heart disease and a 1987 review of 43 such studies found that lack of physical activity has a direct cause-and-effect relationship with cardiovascular disease, and people who live a sedentary lifestyle are at nearly twice the risk of developing cardiovascular disease than active individuals (Powell, 1987).

#### *2.2.9.4 Diabetic renal disease*

Diabetic renal disease is a clinical state of altered renal function, associated with degenerative structural changes in the kidney which may progress through deteriorating stages leading finally to end-stage renal failure. Disease progression is associated with a number of modifiable risk factors including hyperglycaemia, raised blood pressure, hyperlipidaemia (an abnormal blood lipid level) and smoking (McArdle, Katch, & Katch, 2001; Swidan & Montgomery, 1998).

#### *2.2.9.5 Diabetic eye disease (retinopathy)*

Diabetes is the most common cause of avoidable loss of vision in people of working age in New Zealand, however, retinopathy can be reliably detected by regular retinal screening (NZGG & Ministry of Health, 2003). Between 6 and 39% of people with type 2 diabetes already have retinopathy by the time they are diagnosed (U.K. Prospective Diabetes Study Group, 1998). Retinal laser photocoagulation is an outpatient procedure employed by retinal surgeons to cauterise abnormal blood vessels that are growing beneath the retina, to seal them from further leakage, in the hope of preventing further vision loss. Retinal laser photocoagulation does not restore lost vision, so it is critical that the eye be treated as early as possible in the course of the disease (NZGG & Ministry of Health, 2003).

#### *2.2.9.6 Diabetic foot disease*

Diabetic foot problems are a common complication of diabetes. Approximately half of all non-traumatic lower extremity amputations in New Zealand are performed on people with diabetes (diabetic gangrene) (NZGG & Ministry of Health, 2003). The diabetic foot can be defined as a

group of conditions in which neuropathy (abnormal nerve function), ischaemia (inadequate blood supply) and infection may interact and lead to tissue breakdown or ulceration, possibly resulting in amputation. In the majority of people with diabetic foot disease, diabetic peripheral neuropathy is present, resulting in altered sensation and/or complete loss of feeling in affected areas of the foot. In people with loss of sensation in the feet, minor trauma (caused for example by ill-fitting shoes) may go unnoticed, and be greatly exacerbated by continued walking on the insensitive foot, resulting in breakdown of skin and ulceration. Infection often complicates neuropathy and ischaemia, and can cause considerable damage in diabetic feet. Disease progression is associated with a number of modifiable risk factors including hyperglycaemia, raised blood pressure, blood lipid abnormalities, and smoking, thus, much morbidity is in theory preventable, by better disease management (NZGG & Ministry of Health, 2003; Turner, Cull, & Holman, 1996; W.H.O., 1999).

#### *2.2.9.7 Depression*

Depression is an important factor, which may influence how people manage their diabetes (Talbot & Nouwen, 2000). Depression is a significant contributor to New Zealand's total burden of disease, ranking fourth overall in the general population (New Zealand Ministry of Health, 2001) and depression is disproportionately common in people with diabetes and diabetic complications (Black, Markides, & Ray, 2003). The attenuation of depression, and the fostering of more positive emotional states are associated with better physical health (Salovey, Rothman, Detweiler, & Steward, 2000), and an improvement in glycaemic control (Black, Markides, & Ray, 2003). Antidepressant therapy with a selective serotonin reuptake inhibitor (SSRI) is a useful treatment in depressed people with diabetes, and antidepressant therapy may

improve glycaemic control (Lustman, Freedland, & Griffith, 2000). Additionally, cognitive behavioural therapy (CBT), psychotherapy and coping skills training programmes are all useful in treating depression in people with diabetes (Gonder-Frederick, Cox, & Ritterband, 2002; Grifn, Kinmonth, Skinner, & Kelly, 1998). CBT is a psychological treatment, which attempts to find and reconcile interactions between the person's thoughts, feelings and patterns of behaviour which may underpin their distress (Beck, 1973).

### *2.2.10 The economic and social cost of type 2 diabetes*

There are significant economic costs associated with the management of diabetes per se, and additionally, the many associated diabetic complications that an individual may develop over time. In New Zealand, there has as yet been no detailed cost analysis undertaken, however the Health Funding Authority (2000) estimated that hospital admissions for individuals with diabetes cost approximately $168 million during 1998/1999, and the more recent PriceWaterhouseCooper's report (2001) predicted that these costs would rise to over $1 billion by 2021.

### *2.2.11 Burden of disease: the social impact*

Further to the direct and indirect economic costs of type 2 diabetes are the effects of the disease on the physical, emotional, and social well-being of the individual. Burden of disease is a measure developed by the World Health Organisation as a means to provide a standardised comparative metric that reflects the social impact of different diseases (Tugwell & McGowan, 2006). Thus, the burden of disease can be compared across conditions to reflect the social

impact of a disease (or injury) on a population, including both fatal and non-fatal outcomes of the disease (or injury). The unit of measurement is the *disability adjusted life year* (DALY). The DALY combines data that represents 'years of lost life' (YLL) (an indicator of the social burden of fatal health outcomes, or 'quantity of life'), and 'years of life lost to severity adjusted disability' (YLD) (a measure of the burden of non-fatal health outcomes, or 'quality of life'). Thus, one DALY represents the loss of one year of *healthy* life (Prentice, 2002).

Estimating DALYs requires extensive epidemiological data including age, gender, ethnic group, social class, estimates of the disease incidence and duration, typical disability, and access to and effectiveness of current treatment. For many chronic conditions (including diabetes), much of the necessary epidemiological data are presently unavailable for New Zealand, however data from other countries (for example the AusDiab study 2003) and epidemiological modelling have been used to fill data gaps (New Zealand Ministry of Health, 2001). The most current burden of disease estimates for type 2 diabetes in New Zealand are based largely on 1996 data. In 1996, a total of 563,183 DALYs were lost by the New Zealand population as a whole, and more than 40 percent of these occurred in old age.

With respect to New Zealand's total burden of disease, diabetes is ranked fourth overall, and in 1996, diabetes directly accounted for 21,263 (3.8%) DALYs lost by the New Zealand total population. Further, diabetes contributes indirectly to both the first (ischaemic heart disease: 73 803 DALYs / 13.1%) and second (stroke; 30 111 DALYs / 5.4%) ranked causes (see Table 2).

**Table 2** •Disability adjusted life years lost, by top 5 specific causes, all persons, 1996.

| Rank | Specific cause | DALYS | % of total DALYs |
|---|---|---|---|
| **1** | Ischaemic heart disease | 73 804 | 13.1 |
| **2** | Stroke | 30 111 | 5.4 |
| **3** | Chronic obstructive respiratory disease | 27 848 | 4.9 |
| **4** | Diabetes | 21 263 | 3.8 |
| **5** | Depression | 20 497 | 3.6 |

Source: The Burden of Disease and Injury in New Zealand (New Zealand Ministry of Health, 2001).

### *2.2.12 Economic considerations for diabetes care interventions*

While the exact financial impact and return on investment of many aspects of diabetes care is unknown in New Zealand, intensive blood glucose control, control of blood pressure, diabetic retinopathy screening programmes and preventive foot care practices have been found to be cost-effective by economic studies, including the PriceWaterhouseCooper report (2001), the UKPDS study in the U.K. (1998) and Klonoff and Schwartz's (2000) economic analysis of interventions for diabetes (although most of these studies were performed in the 1970s and 1980s using non-experimental methods). More recently however, Goetzel, Ozminkowski, Villagra and Duffy (2005) reviewed eight studies reporting on diabetes disease management (DM) interventions and found mixed results. On the one hand, evidence suggested that large scale prevention programmes directed at pre-diabetic patients may cost more than they save, at least in the short term. On the other hand however, diabetes DM programmes directed at patients with active disease may produce savings and a positive return on investment. The researchers concluded that while additional studies are still needed, on balance, current evidence suggests that diabetes DM programmes should at least break even if treatment costs

are well managed (Goetzel, Ozminkowski, Villagra, & Duffy, 2005).

### *2.2.13 Summary/Future Directions/Implications*

Diabetes mellitus per se, if poorly controlled, tends to result in many secondary complications. These complications include an increased risk for heart attack, stroke, and peripheral vascular disease, and damage to the kidneys, eyes, nerves, and feet. Age is a significant and un-modifiable risk factor for type 2 diabetes and the ageing population, along with a changing ethnic profile, account for approximately two thirds of the projected increase in type 2 diabetes (Ministry of Health, 2002). During the period 2011 to 2051, the population aged above 65 years in New Zealand is forecast to increase to1.33 million people (Pink, 2004), and within this ageing population there will exist a considerable degree of insulin resistance, and insulin resistance is exacerbated by obesity, lack of physical activity and a high fat/high sugar diet: all hallmarks of New Zealand's “Westernised” and increasingly affluent society (Ministry of Health, 2002).

Physical exercise is considered beneficial because it increases glucose utilization, decreases insulin requirements and can help to decrease body fat (ACSM, 2000). The Ministry of Health has adopted the recommendations from the United States Surgeon General’s report (1996), which calls for individuals to engage in a minimum of 30 minutes of moderate intensity exercise per day. It is, however, fairly clear that for a variety of reasons, the majority of 'typical' New Zealanders simply fail to achieve adequate physical activity (New Zealand Ministry of Health, 2004e), further, the diabetic person may well have to overcome additional unique and challenging barriers when deciding to become more physically active.

There is now a plethora of findings in the literature which elucidate the pathway to change, and the potential to ameliorate the devastating 'down-stream' social and economic effects of type 2 diabetes, at an individual (micro) level and in the context of collective (macro-level) health and wellbeing. Whether New Zealand can perform better than the current, somewhat concerning predictions, is unknown. The idea that New Zealanders can resist the many powerful global influences to eat non-health promoting foods and to become less physically active and more obese, would, on the balance of evidence, seem unlikely. To counter such a worsening of New Zealanders' health will require considerable *thought* and *action*, underpinned by a substantial paradigm shift towards *health promotion* and *disease prevention* on a national scale.

## *2.3 The changing management of type 2 diabetes*

### *2.3.1 Introduction*

Type 2 diabetes is a chronic condition, progressive in nature, and often asymptomatic for several years before diagnosis. Early pre-stages in the disease trajectory, if undiagnosed and/or un-managed, are likely to progress to type 2 diabetes and the possibility of diabetes related illness and disability. Following diagnosis, the management of type 2 diabetes continues over a person's lifetime. One of the most significant advances in understanding of what might exemplify optimal diabetes care came with the release of the 1993 Diabetes Control and Complications Trial (DCCT) findings (DCCT Research Group, 1993). The DCCT was a controlled, prospective trial following more than 1,400 adults and adolescents with *type 1* diabetes over an average of 6.5 years. The study demonstrated that by maintaining tighter blood glucose control, type 1 patients could prevent or delay the onset of at least some of the devastating long-term complications of diabetes. Subsequently, studies of people with *type 2* diabetes have shown that prevention and/or delay of disease onset, along with the prevention and/or delay of the onset of diabetes related complications, is achievable through good management (Stratton et al., 2000; Turner, Cull, & Holman, 1996). The most comprehensive of these studies to date is the United Kingdom Prospective Diabetes Study (UKPDS); a 20-year trial which recruited 5,102 patients with type 2 diabetes in 23 clinical centres based in England, Northern Ireland and Scotland (Turner, Cull, & Holman, 1996). One of the major outcomes of the UKPDS was to quantify the relationship between blood glucose control and the relative risk of diabetes related complications. The results demonstrated that each 1% reduction of HbA1c (a measure of average blood glucose control) over 10 years is associated

with a 21% reduction in risk for any end point related to diabetes (Stratton et al., 2000). The UKPDS also demonstrated that diabetes management programmes, on average, have the modest but clinically significant effect on glycaemic control of 0.9% reduction in HbA1c (95% CI) over 10 years (U.K. Prospective Diabetes Study Group, 1998), and later studies have shown similar results including Norris, Lau, Smith, Schmid, and Engelgau (2002) 0.76% (95% CI) and Knight et al. (2005) 0.5% (95% CI).

Collectively, these studies demonstrate that large numbers of diabetes patients can in theory 'help themselves' by following often demanding and intensive (self-) management regimes. It has become clear however, that the life-style changes required to achieve optimal blood glucose control are bounded by many psycho-behavioural and environmental barriers (Gonder-Frederick, Cox, & Ritterband, 2002). Weight loss for example is often a major diabetes treatment goal, and behavioural scientists and the lay-person alike are well aware of the extreme difficulty people often experience in successfully maintaining weight loss over time (Jeffery et al., 2000; Shaw, O'Rourke, Del Mar, & Kenardy, 2005). Similarly, there are many barriers to maintaining optimal blood glucose levels, and it has been established that as few as 10% of type 2 patients are able to control their type 2 diabetes with diet and exercise alone (Gonder-Frederick, Cox, & Ritterband, 2002).

The traditional perception that health care professionals *control* diabetes care was derived from within the acute-care paradigm, and it can be argued that traditionally, the patient has been seen as 'the problem' (Anderson & Funnell, 2005). Current thought however, holds that effective diabetes care requires patients and health care professionals to collaborate and to

combine the care-professional's clinical expertise with the concerns, value hierarchies and resources of the patient. Such collaboration and patient enablement is emergent from within an *empowerment* paradigm (Anderson & Funnell, 2005; Feste, 1992; Lorig & Holman, 2003). The empowerment approach simply recognizes that patients are already responsible for, and in control of, their important diabetes management decisions, and it follows logically that the consequences of such decisions rest with the patient as well. The empowerment approach therefore requires health professionals to change from feeling responsible *for* patients to feeling responsible *to* patients.

The concept of self-management is inextricably linked to, and embedded in, the concept of lifestyle. This is reflected by non-communicable conditions such as cardiovascular disease, obesity and type 2 diabetes being commonly referred to by the lay-term 'lifestyle diseases'. In New Zealand, as in many western countries, interventions that emanate from within an empowerment paradigm, and which promote *lifestyle change,* are now considered foundational to the management and prevention of type 2 diabetes over time (New Zealand Ministry of Health, 2004b; New Zealand Ministry of Health & King, 2004; NZGG & Ministry of Health, 2003). Specifically, interventions which positively influence peoples' adoption of good nutrition, weight management, physical activity, self-monitoring of blood glucose (if appropriate), smoking cessation, stress reduction and the propensity to seek appropriate medical care, are now considered to be fundamental to attenuating disease progression (NZGG & Ministry of Health, 2003).

As the disease trajectory of type 2 diabetes is substantively modifiable by one's behaviours

during daily life, the self-management of one's lifestyle therefore forms the basis of effective diabetes control (also supplemented by pharmacological therapies as appropriate). The learning and adoption of self-management *skills* by the person is necessary to enable them to manage their diabetes effectively (World Health Organisation, 1998b).

The following review of the literature elucidates the evolution of the self-management construct, the tasks, skills and mechanisms of self-management and the effectiveness of self management interventions in the treatment of type 2 diabetes. The scope of the review excludes an analysis of the efficacy of pharmacological interventions per se, rather, focusing predominantly on patient education, patient behaviours, attitudes, and the concept of life-style, and how these elements of diabetes care may influence individual level self-management, health promotion, and community health.

### *2.3.2 Evolving treatment paradigms: acute care-to-empowerment*

Diabetes self-management remains an enormously complex process, influenced by a broad range of variables both within the person, the health care system and the community/environment. Despite advancing knowledge of the principles of self-management, it is suggested that a health professional centred *acute-care* paradigm of treatment is often *still* employed, and within such professional centred models attempts are often made to treat the disease, without considering and addressing the wellbeing of the whole person (Anderson & Funnell, 2005; Norris et al., 2002).

Grifn, Kinmonth, Skinner, and Kelly (1998) reviewed seven meta-analyses, one previous

review and 57 published controlled trials of educational and psychosocial interventions for adults with diabetes. The authors suggested that the failure of many interventions to address the psychosocial and emotional aspects of disease management is one of the main reasons why only about 7% of adults follow *all* of the behaviours (for example, seeking medical care, dietary modifications and physical activity regimes) as prescribed to them by health professionals. New Zealand statistics show that the uptake of services is variable and at best modest. For example, 2002 data reporting the up-take of the New Zealand National "Get Checked" programme (a free comprehensive annual medical check-up) showed that, of the total number of people estimated to have diagnosed diabetes, only 51% had a free check, only 35% of Māori people estimated to have diagnosed diabetes had a free check and up-take of the free check in some geographical areas was as low as 30% (Dawson & Andrews, 2003).

Largely, interventions that are grounded in the acute-care paradigm seek to address the problem of patient *non-compliance* to prescribed care regimes, by attempting to implement strategies that simply focus on the non-compliance issue, with little consideration of the wider context. Resultantly, there has been considerable variability in the effectiveness of such interventions in both the level of self-care achieved across different aspects of the regimen and of particular importance, the maintenance of self-care behaviours over time (Gonder-Frederick, Cox, & Ritterband, 2002). Anderson and Funnell (2005) suggest that traditional approaches (from within the acute-care paradigm) have assumed (incorrectly) that:

"(1) non-compliance is a valid and useful construct for understanding the behaviour of patients,

(2) the patient is the source of the problem and

(3) the solution to the problem of non-compliance is for patients to defer to the expertise (and authority derived from it) of health care professionals and follow the recommendations they have been given to change their behaviour" (p.154).

While few would disagree that diabetes care has progressed somewhat over time, healthcare delivery in this area may still substantively involve individual providers reacting to patient-initiated complaints and visits. In a (2002) review of the diabetes care literature, Norris et al. found that in many instances, care provision still appeared to be fragmented and/or disorganized and often focused predominantly on managing established disease states and complications, rather than addressing the broader determinants of health. The processes of acute-care service provision are generally short term, provider-directed and focus on pharmacologic and technologic interventions, with little attention to patient self-management behaviours or provider–patient interactions (Anderson & Funnell, 2005). While modern 'acute care' medicine effectively ameliorates many acute conditions, such healthcare delivery does not adequately address the needs of individual people or populations with type 2 diabetes (Norris et al., 2002).

Current models of diabetes care are derived from within a 'patient empowerment' paradigm (Anderson, Funnell, Barr, Dedrick, & Davis, 1991; Feste, 1992; Lorig & Holman, 2003). Feste (1992) describes the empowerment paradigm of patient care as being based on two fundamental beliefs. First, patients are responsible for making important and often complex decisions about their medical care, and second, it is patients themselves who experience the consequences of their self-management decisions, therefore patients should have the opportunity to become the primary decision-makers in their own care. The empowerment

approach recognises the expertise that people hold about themselves, and empowerment fosters independence, and the ability to apply newly learned skills in a range of future situations (Hays, 1995). Within an empowerment paradigm, an important function of the health-care professional is to prepare patients to make informed decisions about their own medical care. Fundamentally, patient education from within an empowerment paradigm should comprise, assisting people to exercise their freedom of self-determination and assisting people to make decisions which truly express their beliefs about themselves, the world, and the future (the 'cognitive triad') (Feste, 1992). With respect to freedom, self-determination, and individualised values, Hays (1995) points out however, that while many interventions profess to be value-neutral and patient-centred, it can be argued that no intervention is truly value-neutral, as all interventions (by definition) invariably value and seek to instigate change. Further, as in many domains of life, the dominant social group's values often direct the nature of such change, and are often assumed to be universal, often with little accord given to the needs and wishes of marginalised groups and individuals (Hays, 1995).

Anderson, Funnell, Barr, Dedrick and Davis (1991) suggest that empowerment can be conceptualised as 'diabetes-related psychosocial self-efficacy' and the fundamental goal of the empowerment approach to diabetes care is:

> "to enable patients to make informed decisions about their own diabetes care and to be fully responsible members of the health-care team" (p. 584).

Empowerment is a patient-centred approach that includes health-care providers listening to and addressing the patient's concerns, frequent contact with the patient, adequate support and

consistent follow-up. However, providing the continuity of treatment and support that is optimal, remains a major obstacle to facilitating the effective self-management of diabetes (Gonder-Frederick, Cox, & Ritterband, 2002). Deakin McShane, Cade, and Williams (2006) suggest that patient education, which is substantively congruent with the principles of empowerment, produces a therapeutic effect additional to that produced by all other intervention types. Lorig and Holman (2003) suggest however, that there are still relatively few health personnel with the specialised training required to teach adult patients within an empowerment model of adult education.

#### *2.3.2.1 Health personnel education and training*

Diabetes educators endeavouring to work within an empowerment paradigm require a specific set of *skills* and *attitudes,* such that they may facilitate individuals to gain the specific skills, attitudes and resources they need for effective self-care (Gonder-Frederick, Cox, & Ritterband, 2002). The World Health Organisation (WHO) coined the term *therapeutic education* to define patient education interventions that produce an additional therapeutic effect (World Health Organisation, 1998c). According to the WHO, there are sets of skills, attitudes, and behaviours that are requisite for healthcare professionals to provide true therapeutic education. The WHO (1998c) advocates that healthcare professionals:

- adapt their behaviour to the specificities of chronic illnesses
- communicate with the patient
- take into account patients' subjective experiences of the disease
- facilitate patient learning
- facilitate patients to self-manage their own treatment and way of life
- ensure mechanisms are in place for long-term patient follow-up

- evaluate the progress and any difficulties that patients may encounter
- adequately plan and evaluate teaching programmes that are aimed at patients
- organise and integrate healthcare and therapeutic education for patients within the clinical setting (World Health Organisation, 1998c).

Anderson et al. (1991) designed, implemented and evaluated a professional education programme to facilitate the acquisition and enhancement of the requisite skills and attitudes deemed necessary to educate patients within an empowerment paradigm. Anderson et al. demonstrated that (n=23) educators who participated in the programme made significant gains in their counselling skills, and demonstrated a positive change in attitude. Following the design and evaluation of their diabetes educator training programme, Anderson, Funnell, Fitzgerald, and Marrero (2000) devised and validated the Diabetes Empowerment Scale (DES), in an effort to quantify patient empowerment as an outcome measure. The DES is a measure of diabetes-related psychosocial self-efficacy and the DES factors elements of patient empowerment onto three sub-scales (1) *Managing the psychosocial aspects of diabetes* (2), *Dissatisfaction and readiness to change* and (3), *Setting and achieving diabetes goals*.

The researchers demonstrated both the positive outcomes from their empowerment specific educator training and the validity and usefulness of a measure of patient empowerment (the DES). Despite these advances in diabetes research and provider/patient education, the researchers noted that many 'acute-care' practitioners still view empowerment with scepticism and disbelief, and a common apprehension still persists - that shifting to an empowerment paradigm will simply "take too much time" (Anderson & Funnell, 2005).

#### *2.3.2.2 Empowerment and Lifestyle Change*

If one accepts the World Health Organization's view, that type 2 diabetes is substantively modifiable by lifestyle change (World Health Organisation, 1998b), then requisite to that change process must be an understanding of what lifestyle actually is. Further, one would need an understanding of how to practicably change an un-healthy lifestyle into a more healthy way of living, given that many of the determinants of health may well be beyond many peoples' control. Most lay-people in New Zealand probably now accept that a healthy lifestyle is ostensibly protective against the incidence and impact of adverse health outcomes. Health researchers have certainly known for more than 30years that many of the leading causes of death are potentially and significantly modifiable by social/environmental and individual lifestyle factors (U.S. Department of Health and Human Services, 2000; Woodward & McMichael, 2004; World Health Organisation, 1998b). However, to many, the exact 'form' of a healthy lifestyle and the ability to 'obtain' one, may still remain elusive.

The lifestyle construct was perhaps first formalized by Marc Lalonde within his landmark 'Lalonde Report' (Lalonde, 1974). Lalonde examined the structure of the Canadian health care system, the prevention of health problems, and the promotion of good health for Canadians. Lalonde identified the need for a conceptual framework within which the determinants of health could be grouped such that data sets were more amenable for analysis. Thus, the 'Health Field Concept' was developed, in which the health field was broken up into the following four broad elements;

> *(1)* "human biology, *(2)* environment, *(3)* lifestyle, and *(4)* health care organization" (Lalonde, 1974, p.31).

Lalonde (1974) developed definitions for each element within the Health Field Concept, and defined *lifestyle* as:

> "The aggregation of decisions by individuals which affect their health and over which they more or less have control. … Personal decisions and habits that are bad, from a health point of view, create self-imposed risks. When those risks result in illness or death, the victim's lifestyle can be said to have contributed to, or caused, his own illness or death" (p.32).

Subsequently, the World Health Organization (1998a) suggested that there is no one optimal lifestyle, and that lifestyle may be described as:

> "a way of living based on identifiable patterns of behaviour which are determined by the interplay between an individual's personal characteristics, social interactions, and socioeconomic and environmental living conditions" (p.16).

In a comprehensive and analytical review of the health promotion literature, Lyons and Langill (2000) explored the lifestyle construct and proposed a perhaps 'usefully simplistic' view: that the lifestyle construct is based on the premise that people generally engage in somewhat routinized patterns of daily behavior and that:

> "… lifestyle is a product of some combination of choice, chance, and resources (p.9).

Lalonde (1974) also affirmed that individual choice is certainly not outside the influence of human biology, including the physical body, genetic inheritance and mental processes. Congruent with this view, Lyons and Langill (2000) identified human biology as significantly

contributing to the difficulties many people experience when attempting behaviour change. Lyons and Langill (2000) point out that:

> "The human body finds sweet and fatty foods tasty, becomes easily addicted to certain chemicals, and seeks opportunities to rest. These biological characteristics cannot be easily overcome" (p.19).

#### *2.3.2.3 Self-Management*

There remain immense challenges to effective diabetes treatment, however advances in type 2 diabetes care continue, and the term *self-management* is now commonly used to describe modern type 2 diabetes care. The self-management construct emerged in the 1970s in the context of paediatric asthma research (Creer, Renne, & Christain, 1976), and was based in part on the early works of Albert Bandura (1968). Self-management attributes to the patient an 'active participant' role in his or her own treatment, which invariably involves a plethora of personal choices which collectively impact on a person's health status. It has been argued that unless a person is completely ignorant of healthful behaviours, it is impossible for that person *not* to self-manage, in some way or other, their own health (Lorig & Holman, 2003). Type 2 diabetes is therefore, necessarily, a self-managed illness in which the decisions most affecting the health and well-being of patients are made by the patients themselves, and these decisions are embedded in the routine activities of every-day living. Given the influences of human biology on human behaviour, effective self-management is always likely to be individually effortful and self-management requires a combination of specific and challenging cognitive and behavioural tasks.

Self-management has been defined to comprise three distinct management tasks and six self-management skills. The management tasks are; (1) medical management (such as taking medication, adhering to a specific diet or exercise programme), (2) role management (creating new meaningful behaviours or life roles), and (3) emotional management (learning to adapt emotionally to a chronic condition which may alter the individual's view of the future) (Corbin & Strauss, 1988). The self-management skills that a person may draw on to achieve their management tasks include, problem solving, decision making, resource utilisation, formation of a patient-provider partnership, action planning, and self-tailoring (Corbin & Strauss, 1988; Lorig & Holman, 2003) and these are discussed below.

*Problem solving:* Self-management is a problem-based process, and patients may improve their self-management by improving their problem solving skills. To self-manage effectively, patients not only need to find answers to their current problems, but also, patients need the skills to solve problems by themselves on an ongoing basis. The basic skills are, problem definition, generating possible solutions, solution selection/implementation and evaluation of results. These skills are usually evoked sequentially and are fundamental to the many generic problem-solving and/or decision making models that are often utilised in individual health behaviour change, health promotion, and business management settings (Green & Kreuter, 1991; Simon, 1960). As is common in health promotion settings, the 'problem' as defined by the health professional may not always be the same 'problem' as perceived by the patient. While there may well be common issues that generally relate to certain disease states, when attempting to facilitate patient care, health professionals should carry out a needs assessment to find out what issues and problems are most *salient* to the *individual* patient (Green & Kreuter,

1999; Lorig & Holman, 2003).

*Decision making:* Decision making is similar to, and often a component of problem-solving. Decision making in a self-management context however, relates more to the selection of 'every-day' management tasks from a 'menu' of options. Generally, these options comprise tasks for which the patient already has the requisite knowledge and which the patient can confidently perform (Lorig & Holman, 2003). One stereotypical example is a patient who periodically experiences knee pain while following an exercise programme that includes brisk walking. When the patient senses knee pain at a level previously experienced as detrimental, then the patient may draw on a 'menu' of options and knowledgably decide to switch to swimming for a few days to rest and recover his or her knee. Effective 'every-day' decision making requires patients to have enough information and knowledge, and a variety of response options, so that they can quickly and confidently select an appropriate course of action.

*Resource utilisation:* An important self-management skill is how to find and optimise one's use of available resources (Lorig & Holman, 2003). Generally, the effective self-management of chronic diseases requires the patient to be somewhat pro-active. Chronic diseases are 'lived' by the patient on a day to day basis, however, the daily health needs of an individual patient are likely to be somewhat more distal to the health-care professional's sphere of attention. Thus, a patient may have to actively peruse the resources that he or she needs at any one time. A patient needs to know not just *what* resources are available, but also the practical skills of *how* to search them out (Lorig & Holman, 2003). Health professionals should not automatically assume that patients can use the internet for example, or that they know how to

find a suitable nutritionist, podiatrist or fitness instructor.

*Formation of a patient-provider partnership:* Traditionally, within the acute-care paradigm, the primary function of the health care provider has been to diagnose and treat. For the effective treatment of chronic diseases however, the health care provider must act somewhat as an educator, participative partner, and professional supervisor. Formation of an effective patient-provider partnership is a shared responsibility, and it requires some specific skills including; establishing rapport, building trust, communicating clearly, and the accurate reporting and recording of any fluctuations in the disease course. Also central to an effective patient-provider partnership is a participative and collaborative approach to decision making and the evaluation and selection of appropriate treatment options (Lorig & Holman, 2003).

*Action planning:* Taking action involves resource mobilisation and implementation, and executing the changes as planned, using multiple strategies as required (Green & Kreuter, 1991). Action, as described within the now well disseminated 'Transtheoretical Model of Behaviour Change' (Prochaska & Di Clemente, 1984) involves for example, working out a plan and then initiating new behaviours. Thus, effective behaviour change is not simply 'deciding to do something', but enacting a specific and achievable action plan, that facilitates a person to reach specific short term (proximal) and long term (distal) behavioural/health goals (see section 2.9 for a review of goal theory). Thus, one of the most important skills needed for effective self-management is action-planning. Health professionals should not automatically assume that patients have the skills to set goals and formulate plans effectively, as many may not.

*Self-tailoring:* Self-tailoring occurs when one draws on all of one's self-management skills and knowledge, and applies the principles of behaviour and/or affective change to one's self, in response to changing circumstances and/or fluctuations in disease states (Lorig & Holman, 2003). Once a patient has learned the principles of self-management, he or she can make changes to his or her management regime at any time. For example, if an individual's glycaemic control becomes sub-optimal, then the individual may plan and implement changes in his or her physical activity, and/or nutrition, and then continue to self-monitor his or her blood glucose levels to provide feedback (evaluation). Alternatively, the individual may choose to discuss different medication options with his of her health-care provider. In self-tailoring, patients will invariably encounter, and be caused to *act* in, many situations that present multiple choices, yet no single 'correct' solution, and such choices will invariably interact reciprocally with a very individualised set of social, and environmental variables (Gonder-Frederick, Cox, & Ritterband, 2002).

#### *2.3.2.4 Self-Management mechanisms*

Broadly, the fundamental mechanism by which self-management is believed to act is via increasing *self-efficacy,* and the enhancement of individuals' self-efficacy is widely postulated to be a essential component of most, if not all, effective behaviour change interventions (Bandura, 1998; Locke & Latham, 2002; Lorig & Holman, 2003). A self-efficacy belief is a belief that one can perform the behaviour that produces a *specific* outcome (Bandura, 1977a). Consistent with the principles of Bandura's social learning theory, self-efficacy in one's ability to self-manage chronic disease/s may be increased by any combination of at least five specific methods including; (1) mastery experiences, (2) vicarious experiences (modelling), (3)

modifying/managing physiological and/or emotional states (encompassing correct interpretation of symptoms), (4) via imagery, and (5) by social persuasion (Bandura, 1977b, , 1986; , 1997). In a self-management context, the methods of mastery experience (including action planning and goal setting/achievement), vicarious experience (observing and learning from others similar to one's self), social persuasion, and re-interpretation of physiologic symptoms are generally the more useful. Social persuasion may occur for example, when participants in an education workshop feel compelled by their peers to actively engage in discussions or role-plays, and/or when peers provide encouragement and reinforcement of learning. Modifying/managing physiological and/or emotional states may be particularly useful in facilitating an increase in a person's self-efficacy. Many physiologic symptoms have multiple causes, and in some instances the disease state may be causal, however in other instances the symptom may be caused by a factor or factors not related to the disease at all, and over which the person may well have a measure of control. A person may be taught to re-interpret symptoms as 'useful' feedback, and to alter behaviour in ways that the person is confident will produce a specific outcome (Lorig & Holman, 2003). If a person interprets fatigue as wholly attributable to the disease state, then that person may consider fatigue to be non-modifiable. However, if the person re-interprets fatigue as *not necessarily* attributable to the disease state, and perhaps modifiable by exercise, then that person is likely to be more confident that his or her actions can ameliorate the fatigue state (i.e. increased self-efficacy), and therefore the person will be more likely to engage in exercise (Bandura, 1998).

#### *2.3.2.5 Self-management intervention goals and ingredients*

Essentially, the biopsychosocial goals of self-management have not changed significantly

since they were first articulated, and are generally stated as being, to optimise metabolic control (through the use of medication, blood glucose monitoring, diet therapy and exercise), to prevent acute and chronic complications and to optimise quality of life, within the available resources (de Weerdt, Visser, & van der Veen, 1989; NZGG & Ministry of Health, 2003). What has changed somewhat are the characteristic 'ingredients' or 'elements' of modern self-management programmes, and their increasing (yet still moderate) effectiveness in assisting people to reach their self-management goals. The New Zealand Management of Type 2 Diabetes Guidelines (NZGG & Ministry of Health, 2003) call for the adoption of interventions that focus on the main known risk factors for type 2 diabetes, and interventions that include; continuous education, intensive dietary and physical activity behaviour change programmes, goal setting, and intensive monitoring and screening programmes (NZGG & Ministry of Health, 2003). In particular, weight management is considered an important first-line dietary goal in the management of type 2 diabetes, as approximately 80% of type 2 diabetes patients are overweight or obese, and weight loss by any means improves insulin sensitivity.

#### *2.3.2.6 Elements of self-management interventions*

Since the 1930s, patient education has been foundational in the management of type 2 diabetes, and education-based interventions continue to be requisite to effective diabetes care. Early diabetes education tended to be didactic in nature, that is, delivered in lecture format, moralistic and prescriptive (Lorig & Holman, 2003). However, patient education interventions have evolved somewhat and are now more collaborative, participatory and empowering. Quality interventions now incorporate a range of educational and psychosocial elements that collectively produce both an educational effect and an additional therapeutic effect as well (see

Table 3 below) (Lorig & Holman, 2003). Several reviews of the diabetes care literature have supported the notion that patient education and skills training is beneficial and is related to positive outcomes (Deakin, McShane, Cade, & Williams, 2006; Norris, Lau, Smith, Schmid, & Engelgau, 2002; Norris et al., 2002; Padgett, Mumford, Hynes, & Carter, 1988; Steed, Cooke, & Newman, 2003; Whittemore, 2000). Norris, Nichols et al. (2002) noted however, that often, many of the studies reviewed are randomised control trials (RCTs), and while RCTs may be the 'gold standard' in many areas of health research, in the area of chronic disease management, RCTs are not always feasible nor are they necessarily the most advantageous of possible study designs. Norris, Nichols et al. point out that RCTs tend to focus on efficacy to the exclusion of factors that influence effectiveness. For example, the effectiveness of the promotion and dissemination of an intervention, the degree to which it reaches the target population, and how readily an intervention may be institutionalised, are factors often not reconciled by an RCT. RCTs often do not recognise and/or reconcile the complexity of the disease antecedents and the complexity of the outcomes.

Norris, Lau et al. (2002) highlighted that within the studies reviewed, there was a high degree of variability in the selection of outcome measures, and that the coding and/or descriptions of the various elements of the intervention/education programme is often inadequate and/or lacking sufficient detail. Such limitations make the direct comparison of intervention structures and their effectiveness somewhat problematic. Norris, Lau, et al. (2002) also questioned the generalisability of findings that were, in the main, derived from clinical settings, with few interventions having been delivered and evaluated within a wider community context.

Collectively, the reviews (Norris, Lau, Smith, Schmid, & Engelgau, 2002; Norris et al., 2002; Padgett, Mumford, Hynes, & Carter, 1988; Steed, Cooke, & Newman, 2003) identified a plethora of intervention elements that have been employed in a multitude of different combinations and contexts. Intervention elements were found to vary greatly; particularly with respect to the learning environment, adherence to sound learning theory, the content, the degree of patient interaction, and the degree to which patients' opinions, ideas, feelings, questions and decision making was instrumental in the learning process.

Padgett, Mumford, Hynes, and Carter (1988) conducted a meta-analysis of educational and psychosocial interventions in the treatment of diabetes, and grouped the 93 controlled studies reviewed (7451 patients) into eight broad categories: (1) didactic education, (2) enhanced education, (3) diet instruction, (4) exercise instruction, (5) self-monitoring instruction, (6) social learning/behaviour modification, (7) counselling, and (8) relaxation training. The researchers reported an overall mean effect size (ES) of $+0.51 \pm 0.11$, indicating moderate but significant ($P < 0.05$) improvements for all intervention subjects across all outcomes. Physical outcomes (such as HbA1c and BMI) and knowledge gain were most affected, followed by psychological status and compliance. Interventions that provided diet instruction, and those that involved social learning and behaviour modification showed the strongest effects (ES = $+0.68 \pm 0.58$ and ES = $+0.57 \pm 0.42$, respectively), and relaxation training the weakest (ES = $+0.30 \pm 0.74$). Padgett et al. (1988) reported however, that certain trends should be noted, particularly, that the effectiveness of many interventions appears to decrease dramatically over time. For example, the desired effects on subject weight loss decreased the most dramatically of all outcome measures, and a plateau of weight loss and/or weight gain at 12 month

follow-up was found in didactic education, self-monitoring, social learning interventions, and also in enhanced education. Padgett et al. summarised that their findings demonstrated that educational and psychosocial interventions *can* be effective components of patient care programmes, however maintaining improvements in outcomes over time remains challenging.

The outcome variable most commonly measured is metabolic control (usually measured as glycated haemoglobin HbA1c) (Padgett, Mumford, Hynes, & Carter, 1988). Norris, Lau, et al. (2002) reviewed 31 studies of diabetes care interventions (of 463 initially identified articles) and focused specifically on net changes in HbA1c, the relationships to follow-up interval, effect of baseline HbA1c, and the influence of intervention characteristics on HbA1c. Norris et al. found that on average the interventions decreased HbA1c by 0.76% more than the control group at immediate follow-up, by 0.26% at 1–3 months of follow-up, and by 0.26% at 4 months of follow-up. HbA1c decreased favourably with additional educator-to-participant contact time; and a decrease of 1% HbA1c was noted for every additional 23.6 h of contact time. Norris et al. concluded that self-management education improves HbA1c levels at immediate follow-up and that contact time is positively related to improved HbA1c. Congruent with Padgett et al's. (1998) findings, Norris et al. (2002) concluded that perhaps *the* most challenging phenomenon in the behaviour change arena is that the benefits of an educational intervention very often decline relatively quickly over time (1–3 months after the intervention), suggesting behavioural regression, or that the newly learned behaviours tend to change back over time. The -1% (HbA1c) to 24hr (contact time) relationship demonstrates that a considerable investment of time and resources is required to achieve clinically meaningful

changes in diabetics' metabolic control over time.

With the positive relationship between glycaemic control, education, self-management, and psychological interventions now well established (Gimenez-Perez, Gonzalez-Clemente, & Mauricio, 2005; Grifn, 1998; Norris, Lau, Smith, Schmid, & Engelgau, 2002; Norris et al., 2002; Padgett, Mumford, Hynes, & Carter, 1988; Sratton et al., 2000), Steed et al. (2003) searched the literature for studies that considered outcomes beyond just glycaemic control. Steed et al. examined the impact of education, self-management, and psychological interventions on psychosocial outcomes, including depression, anxiety, emotional adjustment, and quality of life. Steed et al. reviewed 36 studies, and categorised the studies as either education (EDUC), self-management (SM) or psychological (PSYCH). EDUC interventions were those where participants only received information. SM interventions were those where the goal was primarily to improve adherence by teaching practical or psychosocial skills specific to diabetes management. PSYC interventions were those where the goal was primarily to address negative mood states.

From the 36 studies reviewed, Steed et al. (2003) identified 12 common intervention components (see table 2) and found considerable overlap of components between SM and PSYCH interventions. Effectively, EDUC interventions were found to be a sub-set of SM and (to a lesser extent) PSYC interventions, as EDUC was identified in 75% of all studies reviewed. The second most common component was behaviour therapy, which was present in 57% of both self-management and psychological interventions. Skills training and group discussion were also frequently used in self-management interventions (41 and 48%

respectively).

Steed et al. stated that their initial intention had been to evaluate the efficacy of different intervention components on psychosocial outcomes, however, this proved not to be possible. As in previous reviews (Norris, Lau, Smith, Schmid, & Engelgau, 2002; Norris et al., 2002; Padgett, Mumford, Hynes, & Carter, 1988; Steed, Cooke, & Newman, 2003), Steed, et al. also encountered the reality of there being considerable variation in the definition, description and number of components included in any one study, and considerable overlap between the types of components used in different types of interventions. Self-management interventions were found to be very complex, with up to seven different components (mean number: 3) included in one intervention.

**Table 3•**Intervention components (adapted from Steed, Cooke, and Newman, 2003)

| Component | Description |
|---|---|
| **General education** | Basic provision of information, commonly using didactic techniques. |
| **General discussion** | Discussion between participants within a group. |
| **Skills training** | Teaching practical skills such as testing blood sugar and interpretation of results and meal planning; through demonstration and patient participation. |
| **Behaviour therapy** | Use of behavioural techniques such as goal setting, reinforcement, modelling, reward systems, and alteration of environmental cues. |
| **Problem solving** | Identification of problems or barriers to behaviour and strategies to overcome them (including both practical and psychosocial problems). The focus being on patient problem solving rather than problems being 'solved' by health care professionals. |
| **Cognitive therapy** | Teaching techniques to influence cognitions, e.g. challenging beliefs, considering the role of thoughts and emotions, counselling and psychotherapy. |
| **Social support** | Teaching techniques to specifically help participants improve social support, e.g. where to go for extra support, communication skills. |
| **Relaxation** | Actual practice of relaxation: may include imagery or distraction techniques. |
| **Biofeedback** | The use of biological feedback to assist relaxation (for example the galvanic skin response). |
| **Relapse prevention** | Discussion of how to maintain behaviour in the future and prevent relapses. |
| **Diet** | Participants being prescribed a specific weight loss plan as part of intervention. Advice on healthy eating. |
| **Exercise** | Specific exercise sessions as part of an intervention |

Both the Norris et al. (2002) and Padgett et al. (1988) reviews demonstrated that the positive short term effects of self-management interventions, when evaluated on glycaemic control alone, are often not retained, or are less clear in the longer term. In contrast Steed et al. reported that in general, the improvements in psychosocial outcomes did not appear to regress as notably over time, and that depression seemed to be particularly improved following psychological interventions, whilst quality of life improved more following self-management interventions. Steed et al. determined that improved psychological well-being and adherence to

self-management behaviours are positively related, however, due to the complexity of the interventions, the direction of causality remained unclear.

In conclusion, Steed et al. stated that their findings supported the use of both self-management and psychological interventions in diabetes care. The choice between these two types of interventions should in part depend on the population of interest, with psychological interventions being suited to improving negative mood states, and self-management interventions being more suited to improving compliance to self-management regimes. Further, Steed et al. added that there was no convincing evidence to further support the use of didactic education programmes alone, given both their relative lack of efficacy for improving glycaemic control (Norris et al., 2002; Norris, Engelgau, & Venkat Narayan, 2001) and their relative lack of usefulness in positively influencing psychosocial outcomes.

Knight et al. (2005) carried out a systematic review of the diabetes care literature and included studies that specifically engaged a systematic approach to care, including the use of guidelines, protocols, algorithms, care plans or systematic patient and/or provider education programmes. The studies selected were also required to classify and include more than one intervention component. In total, 24 RCTs or quasi-experimental studies were selected, involving 6421 patients over 3 to 30 months. Knight et al. (2005) reported an overall pooled result of 0.5 % reduction in HbA1c (95% CI). In a previous review of intervention components and component effectiveness, members of the same research team summarised that generally, programmes that include provider education, provider feedback, provider reminders, patient education, patient reminders, and patient financial incentives were associated with

improvements in provider adherence to guidelines and improved patient disease management (Weingarten, Henning, & Badamgarav, 2002).

In one of the most recent systematic reviews of the diabetes literature, Deakin, McShane, Cade, and Williams (2006) evaluated 13 papers, which reported on 11 studies of group-based diabetes education involving a total of 1532 participants. The researchers endeavoured to assess the effects of group-based patient-centred diabetes training on clinical, lifestyle, and psychosocial outcomes both in the short (four to six months) and longer-term (more than 12 months). The researchers also investigated whether the setting, the educator, the type of educational model, or whether the duration/intensity of a group-based education programme affects the outcomes.

Deakin et al. (2006) found considerable variety in programme structures, particularly variations in content, teaching pedagogy, outcome measures, and length of follow-up. The researchers also found a general lack of detail in the descriptions of intervention components and of the theoretical frameworks and models on which interventions were said to be based. For example, the educational model that was used to plan group-based education programmes was reported in only five studies. Although the educational model underpinning the programme was not always visible, Deakin et al. (2006) concluded that there is evidence that if the programme is based on *therapeutic patient education* (World Health Organisation, 1998c), is participatory, empowering, and based on adult-centred learning principles, then it is likely to be effective. Deakin et al. added that there was also evidence of an additional positive 'group effect' that was independent of the programme content. One controlled trial (Rickheim,

Weaver, Flader, & Kendall, 2002) assessed group versus individual diabetes education. The researchers delivered the exact same programme content in a group setting (the intervention group), and to the control group via successive intensive individual one-on-one sessions equating to the same contact time. Rickheim et al. (2002) demonstrated a significant 'group effect' with 'group' subjects achieving significantly better glycaemic control (P = 0.05) than those who had received their education via the one-on-one sessions.

Programmes were found to vary considerably in duration with the least intensive being three hours per year for two years, with the most intense education programme being 52 hours over one year. The researchers concluded that providing additional education sessions on an annual basis results in long-lasting benefits to health and psychosocial outcomes.

Various self-management tasks were included as outcome measures in six studies, such as physical exercise, foot care and self monitoring of blood glucose levels, and collectively, these studies demonstrated that the programmes resulted in clinically and statistically significant health outcomes. With respect to metabolic control, two of the studies assessed outcomes at two years and the results indicated that a reduction of 1.0% HbA1c (95% CI) was still apparent, and one study showed continued benefits at four years (1.6%; 95% CI). Five studies showed that by attending a group education programme, patients were able to significantly reduce their diabetes medication within 12-14 months.

Deakin et al. (2006) concluded that there is now no doubt that adults with type 2 diabetes, who participate in group based education/training programmes, demonstrate better diabetes control, increased diabetes knowledge, and have a reduced need for medication. Deakin et al. noted

however, that despite such findings, the exact *mechanisms* of action can be discussed, but not conclusively identified or operationalized.

#### *2.3.2.7 Guidelines for diabetes care education*

In an effort to reconcile the plethora of intervention types and components, many countries have now developed guidelines for diabetes care educational interventions. The International Diabetes Federation has produced international guidelines compiled from experts all around the world (DECS, 2003). The guidelines recommend that educational interventions should follow the format of established adult learning, including interactive learning, and be provided by appropriately trained health professionals, and take into account situational and cultural factors. Knight et al. (2005) suggest however, that provider compliance with recommended standards and guidelines is still, at best, modest. Patient education from within an empowerment paradigm increases self-efficacy as people gain the knowledge, skills, attitudes, and the self-awareness necessary to influence their own behaviours (Lorig & Holman, 2003). Such learning outcomes indeed sound optimal, however Anderson and Funnell (2005) argue, that despite guidelines being available, it is still difficult to get providers to teach self-management and true empowerment, as the acute care paradigm is so entrenched in the minds of health professionals.

### *2.3.3 Conclusion*

It is now clear that delaying the onset of type *2* diabetes, and preventing or delaying diabetes related complications, is achievable through good management (Sratton et al., 2000; Turner, Cull, & Holman, 1996), and also, that diabetes management interventions, on average, have a

modest but clinically significant effect on glycaemic control (U.K. Prospective Diabetes Study Group, 1998). Collectively, studies demonstrate that large numbers of diabetes patients can *in theory* 'help themselves' by following often demanding and intensive (self-) management regimes. It has also become clear however, that such management regimes are bounded by many psycho-behavioural and environmental barriers (Gonder-Frederick, Cox, & Ritterband, 2002). Further, patients often feel judged and blamed for not following the advice given by health care professionals, however that advice often involves aspects of lifestyle change that are very difficult to implement and sustain (Anderson, Funnell, Barr, Dedrick, & Davis, 1991).

Within the many domains of health-care and disease management, there is often a gap between what is recommended as best practice, and what is actually achieved. In New Zealand, the gap between recommended diabetes management and what is actually achieved it is not exactly known. It is suggested however, that in general, diabetes management could be improved significantly, as the up-take of the services and resources that *are* available is often low and variable across geographic locations and across the deprivation gradient (Ministry of Health, 2001).

In most western countries the prevalence of type 2 diabetes is rising in all age groups and impacting significantly on morbidity, health cost burden, and premature mortality. While there is a critical need for interventions that improve proximal outcomes for this large population, there is also an urgent need for early detection, and for interventions that address the many 'up-stream' determinants of health, such as our increasingly obesogenic-environments (Egger & Swinburn, 1997; Gonder-Frederick, Cox, & Ritterband, 2002).

Health researchers and health-care providers have responded to the many challenges to chronic disease care and treatment programmes have indeed evolved, although arguably with only modest vigour. Traditional perceptions of the patient as 'the problem', with health care professionals somehow 'controlling' diabetes with 'acute-care medicine', are slowly changing (Anderson & Funnell, 2005). Current thought recognizes that patients are already responsible for, and in control of, important diabetes management decisions, and that effective diabetes care requires patients and health care professionals to collaborate, combining the care-professional's clinical expertise with the concerns, value hierarchies, and resources of the patient. Such collaboration and patient enablement is said to be grounded in an *empowerment* paradigm (Anderson & Funnell, 2005; Feste, 1992; Lorig & Holman, 2003), and the empowerment approach requires health professionals to change from feeling responsible *for* patients to feeling responsible *to* patients.

While diabetes care *has* advanced considerably since the 1930s, there remains a paucity of evidence that empirically identifies the most beneficial intervention elements, how they are best combined, the exact mechanisms by which they operate, and the generalisability of clinical and experimental findings to 'real world' contexts. However, by making the most of an increasing body of knowledge, and implementing the interventions that *have* been shown to be effective, healthcare providers and administrators can go some way toward helping their organizations achieve patient goals, while using resources efficiently (Norris et al., 2002).

## *2.4 Physical activity, health and type 2 diabetes*

### *2.5 Introduction*

Supplemental to optimal nutrition and pharmacological agents, regular exercise is now considered one of the cornerstones in the management of patients with type 2 diabetes (Figure 1)(ACSM, 2000; Canadian Diabetes Association, 2003; Joslin, Root, White, & Marble, 1959; NZGG & Ministry of Health, 2003; Plotnikoff, 2006). Physical activity or 'exercise' is now recommended as an important non-pharmacological means to improve glycaemic control (Schneider, Amorosa, Khachadurian, & Ruderman, 1984; Thomas, Elliott, & Naughton, 2006), lipid profile (Poirier, Catellier, Tremblay, & Nadeau, 1996), diabetic cardiovascular health (Kohl, Gordon, Villegas, & Blair, 1992; Stewart, 2004), and insulin sensitivity (Rogers et al., 1988).

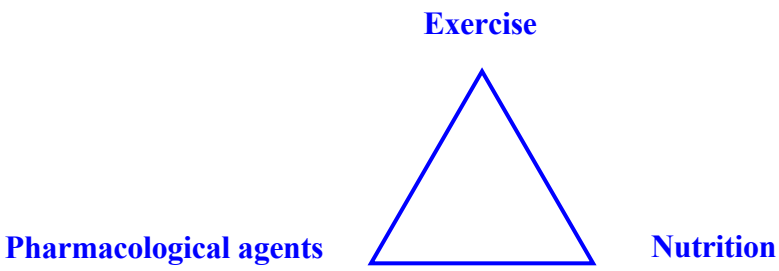



**Figure 1** •The cornerstones of type 2 diabetes management

Physical *inactivity* is now empirically authenticated as an independent risk factor for diabetes, as it is for the often interrelated conditions; cardiovascular disease (Kohl, Gordon, Villegas, & Blair, 1992; Stewart, 2004), obesity (Egger & Swinburn, 1997), and depression (Camacho, Roberts, & Lazarus, 1991; Paffenbarger, Lee, & Leung, 1994), and it is now well accepted that

increasing physical activity is strongly correlated with improved health.

It has become clear that the increasing prevalence of obesity (New Zealand Ministry of Health, 2004e) and a sedentary lifestyle (Graham, 2001) are inextricably linked to the increasing prevalence of type 2 diabetes in New Zealand (New Zealand Ministry of Health, 2001). It is now well established that obesity is highly correlated with, and a serious risk factor for type 2 diabetes (Gonder-Frederick, Cox, & Ritterband, 2002; U.K. Prospective Diabetes Study Group, 1995) and obesity is now being considered a pandemic due to its increasing prevalence in developed and developing countries. Further, obesity is now, to a greater extent, being seen as a product of increasingly 'obesogenic' environments (Swinburn, Egger, & Raza, 1999).

During the 1980s, the Ministry of Health contracted the Hillary Commission (now Sport and Recreation New Zealand) to research and report on the health status of New Zealanders, and to investigate the existing knowledge relating to the benefits of physical activity, including the effects physical activity may have in ameliorating cardio-vascular disease, obesity, type 2 diabetes and some cancers. Subsequently, the Hillary Commission's report (1998) recommended that there was a significant need to increase (from 1996 levels) the number of adults doing a minimum of 2.5 hours of moderate intensity physical activity each week, in particular, to increase the activity level of people currently doing very little or no physical activity. Further, the 'Graham Report' (Graham, 2001) highlighted the urgent need for national strategies to address the trend of decreasing physical activity levels among New Zealanders, and the imminent negative impact on population health status. Increasing physical activity (across all ethnicities) is now prioritised as the fourth ranked population health objective in the

Ministry of Health's 'New Zealand Health Strategy' (New Zealand Ministry of Health, 2004c).

The benefits of physical activity have been clearly demonstrated for the general population (Morris, Heady, Raffle, Roberts, & Parks, 1953; Morris, Kagan, & Pattison, 1966; Paffenbarger & Hale, 1975; Paffenbarger et al., 1986; Paffenbarger et al., 1993), and such benefits have now been demonstrated for people with pre-diabetic conditions (IGT and IFG) and for the type 2 diabetic population alike (DCCT Research Group, 1993; Paternostro-Bayles, Wing, & Robertson, 1989; Powell, 1987; U.K. Prospective Diabetes Study Group, 1995; UK Prospective Diabetes Study Group, 1998). The American College of Sports Medicine Position Stand on "Exercise and type 2 Diabetes" states that,

> 'Physical activity, including appropriate endurance and resistance training, is a major therapeutic modality for type 2 diabetes'(ACSM, 2000, p.1345).

The New Zealand Guidelines state that,

> "Physical activity is an integral part of lifestyle advice for people with diabetes"(NZGG & Ministry of Health, 2003, p. 18).

However, for the diabetic population, issues around such factors as appropriate exercise prescription, including modality, adherence and possible adverse consequences, may be somewhat less well defined and understood, and the linkages between theory and practice remain weak in most Western countries (including New Zealand) (ACSM, 2000; Brown et al., 2004; Myers, Edwin Atwood, & Froelicher, 2003). Further, much of the research on type 2

diabetes and physical activity has focused on glycaemic control, however physical activity is now considered salient in improving cardiovascular health (Kohl, Gordon, Villegas, & Blair, 1992; Stewart, 2004), and there is increasing evidence of a protective effect for psychological health as well (Camacho, Roberts, & Lazarus, 1991; Farmer, Locke, & Moscicki, 1988; Paffenbarger, Lee, & Leung, 1994).

It has been suggested that too often, physical activity is an underutilized therapy in the treatment of type 2 diabetes (ACSM, 2000; Brown et al., 2004; Myers, Edwin Atwood, & Froelicher, 2003) yet its contribution to wellbeing is potentially large. The benefits of physical activity may sometimes be underestimated by health professionals and patients alike. Presented here is an overview of current knowledge in the area of exercise and type 2 diabetes. From within this current body of knowledge, specific relevance to New Zealand is established where possible, and current treatment recommendations are examined.

## *2.6 Physical activity and health*

### *2.6.1 Definitions*

There are many terms commonly found in the literature to define physical activity including, *exercise*, *sport, recreation, occupational activity and household chores* (Shephard, 2003). There is however growing consensus as to the meaning of such terminology. Physical activity is said to comprise all types of muscular activity that increase energy expenditure substantially, and other terms may define sub-sets of physical activity (Bouchard & Shephard, 1994). For example,

> "*exercise* is a regular and structured subset of physical activity, performed deliberately and with special purpose such as preparation for athletic competition or the improvement of some aspect of health" (Shephard, 2003, p.197).

Like exercise, *recreational activities* and *household chores* vary widely in intensity and duration, but may contribute significantly to total weekly energy expenditure (Shephard, 2003). *Moderate* physical activity is generally defined as activity performed at an intensity of 3-6 times a person's resting metabolic rate and in practical terms, this is equivalent to the exercise 'intensity' of brisk walking for most adults (McArdle, Katch, & Katch, 2001).

### *2.6.2 Physical activity, health and longevity*

The importance of physical activity to health and longevity has been advanced through the writings of Galen some 2000 years ago. Galen advised that a lack of physical exercise was detrimental to health, however, over-exertion also was unwise (Nutton, 2002). In more contemporary times, classical infectious disease epidemiology has been adapted to the new problems of chronic, non-communicable diseases (Paffenbarger, Blair, & Lee, 2001). The early landmark epidemiological work of Morris et al. (Morris, Heady, Raffle, Roberts, & Parks, 1953; Morris, Kagan, & Pattison, 1966) and later Paffenbarger and Hale (Paffenbarger & Hale, 1975; Paffenbarger et al., 1986; Paffenbarger et al., 1993), have combined to provide convincing evidence in support of physical activity's beneficial effects on health in the general population and subsequently, in the diabetic population alike. Beginning in the early 1950s, Morris et al. began to study the differences in the cardiovascular health status of London bus drivers, and their slightly more physically active bus conductors. Morris et al. found that at the 9 year follow-up, bus conductors were 30% less likely to suffer coronary heart failure than the

less ‘occupationally physically active’ drivers. This simple study provided perhaps the first robust evidence of the relationship between physical activity levels and health.

Building on the earlier work of Morris et al., Paffenbarger set about confirming that by engaging in regular lifetime physical activity, people can reduce their risk of heart disease and live longer. In 1960, Paffenbarger and Hale (1975) began the landmark ‘College Alumni Health Study’; investigating the exercise habits of middle-aged and older men (n=10,269). Men who were 45 to 84 years of age in 1977, and had completed questionnaires in 1962 or 1966, and again in 1977, were subsequently classified according to changes in lifestyle characteristics between the first and second questionnaires. The study demonstrated that vigorous exercise predicted greater longevity, and as the energy expended increased, the risk of heart disease decreased. Thus, the researchers concluded that beginning moderately vigorous sports activity was associated with a 23 % lower risk of death than not taking up moderately vigorous sports. More recently, the researchers proposed that all-cause mortality may be reduced by up to 40% by engaging in the equivalent of three to five 60 minute sessions of moderate physical activity per week (Paffenbarger et al., 1993).

The College Alumni Health Study also provided evidence that for a given level of energy expenditure, the same positive effects occurred, regardless of whether the exercise was carried out in a single session or accumulated during shorter more frequent sessions (Paffenbarger et al., 1993). This accruing or cumulative approach to exercise has recently been termed (loosely) ‘Snack-tivity’, and is a recommended protocol for exercise in the general sedentary population and diabetic population alike (NZGG & Ministry of Health, 2003, p.22). For example, an

individual may engage in 3x10mins of exercise for effects similar to that of a single 30min bout of exercise.

### *2.6.3 Physical activity and the prevention of type 2 diabetes*

Physical activity is often recommended by physicians to patients with type 2 diabetes mellitus, primarily, because it increases sensitivity to insulin and for its positive effect on cardiovascular health, and physical activity has now been demonstrated as being effective in delaying and/or preventing the onset of type 2 diabetes. While the positive health effects of physical activity were being elucidated with respect to the general population, Helmrich, Ragland, Leung, and Paffenbarger initiated studies during the 1960s to specifically evaluate the health effects of physical activity within a type 2 diabetes context (Helmrich, Ragland, Leung, & Paffenbarger, 1991). The researchers used questionnaires to examine patterns of physical activity and other personal characteristics in relation to the subsequent development of type 2 diabetes. Within the group of 5990 male subjects, the disease developed in a total of 202 men during the follow-up period from 1962 to 1976. Leisure-time physical activity levels were found to be inversely related to the development of type 2 diabetes and the incidence rates declined as energy expenditure increased from less than 500 kcal to 3500 kcal. For each 500kcal increment in energy expenditure, the age-adjusted risk of type 2 diabetes reduced by 6 %, and importantly, this association remained the same when the data were adjusted for obesity, hypertension, and a parental history of diabetes (Helmrich, Ragland, Leung, & Paffenbarger, 1991). The researchers concluded that leisure time physical activity was inversely related to the development of type 2 diabetes and that the protective benefit is especially pronounced in

persons at the highest risk for the disease (Helmrich, Ragland, Leung, & Paffenbarger, 1991). A further study of diabetes prevention interventions (Knowler et al., 2002) compared the effectiveness of a lifestyle-intervention (including at least 150 minutes of *physical activity* per week and a goal of 7 % weight loss) with a pharmacological intervention (Metformin; 850 mg twice daily) in preventing or delaying the development of diabetes. The researchers randomly assigned 3234 'pre-diabetic' persons (mean age=51 years; mean BMI=34.0) to placebo, Metformin or lifestyle-modification groups, and the average follow-up was 2.8 years. Knowler et al. found that the lifestyle intervention reduced the incidence of type 2 diabetes by 58 percent and Metformin by 31 percent as compared with placebo. Knowler et al. (2002) concluded that lifestyle changes (including physical activity) and treatment with Metformin both reduced the incidence of diabetes in persons at high risk, and that the lifestyle intervention was more effective than Metformin (Knowler et al., 2002).

### *2.6.4 Acute effects of physical activity on glycaemic control*

When examining longitudinal physical activity studies, it can be unclear whether the beneficial effects of exercise on whole body insulin action occur via an indirect effect (for example reduced obesity and/or increased cardio-vascular fitness), or result from some direct effect on muscle tissue (and/or other tissues) itself. Rogers et al. (1988) provide evidence that exercise training promotes direct improvements in insulin action in skeletal muscle, resulting from specific intra-muscular adaptations to increased activity levels, rather than general systemic effects. Their study demonstrated clear beneficial effects, resulting from just 7 days of intense physical training. Rogers et al. (1988) investigated the effects of 7 days of intense exercise on

glucose tolerance in 10 men with abnormal glucose tolerance. As expected, the 7 days of exercise did not result in significant changes in body weight or aerobic fitness levels. An oral glucose tolerance test (OGTT) was performed before and after the 7 days of exercise and plasma glucose concentration at 2hrs averaged 15.3 mmol/l, and 9.3 mmol/l respectively representing a 36% reduction in the area under the glucose tolerance curve. In contrast to the response to 7 days of exercise, one bout of exercise did not result in an improvement in glucose tolerance. Rogers et al. (1988) concluded that regularly performed, vigorous exercise can be effective in decreasing insulin resistance and improving glucose tolerance, and that such benefits can occur rapidly and independently from other whole body adaptations in some individuals with pre-diabetes and mild type 2 diabetes. Further, such acute and transient improvements in glucose tolerance following each individual period of exercise may exert a cumulative positive effect on chronic glycaemic control (Schneider, Amorosa, Khachadurian, & Ruderman, 1984).

### *2.6.5 Chronic effects of physical activity*

#### *2.6.5.1 Long term glycaemic control*

The benefits of maintaining long term glycaemic control have been recognized for some time, and comprehensive longitudinal studies have now provided robust findings that demonstrate a cause and effect relationship between improved glycaemic control and better health outcomes (DCCT Research Group, 1993; Turner, Cull, & Holman, 1996; U.K. Prospective Diabetes Study Group, 1995). Further, studies have now concluded that physical activity or exercise is potentially effective in facilitating such improved glycaemic control, and researchers have

sought to examine the mechanisms by which this occurs. In an early study, Schneider, Amorosa, Khachadurian, and Ruderman, (1984) investigated the dynamics of glycaemic control in response to exercise training, three times per week for six weeks. Sedentary type 2 diabetic males (n=20) and 11 control subjects were matched for previous activity levels. The effects of the six week training programme on glycaemic control were assessed, and glycosylated haemoglobin levels decreased significantly in the diabetic patients, from 12.2% to 10.7%. OGTTs were also administered at 12hrs and 72hrs after selected exercise sessions. Glucose tolerance determined 72hrs after an exercise period showed only minimal improvement, however, plasma glucose levels were on average significantly lower at 12hrs than 72hrs after exercise. Schneider et al. (1984) proposed that an exercise programme can produce a significant decrease in glycosylated haemoglobin (HbA1c) levels in type 2 diabetic males, probably due largely to the cumulative effect of transient improvements in glucose tolerance which follow each individual period of exercise (Schneider, Amorosa, Khachadurian, & Ruderman, 1984). In considering this acute post exercise lowering of blood glucose, Poirier et al. (2000) suggest that the self-testing of blood glucose by type 2 diabetics may be useful in enhancing motivation. Knowledge about the degree of lowering that can be expected with exercise may help in motivating subjects to exercise regularly

#### *2.6.5.2 Cardio-respiratory fitness and all- cause mortality*

Cardio-respiratory fitness is an important determinant of health status for type 2 diabetics, and cardio-respiratory fitness is modifiable by exercise training (Kohl, Gordon, Villegas, & Blair, 1992). Kohl, Gordon, Villegas, and Blair, investigated the association between baseline cardio-respiratory fitness and all-cause mortality across the range of blood glucose levels in a

sample of 8,715 men (average age 42 yrs, average follow-up 8.2 yrs). Cardio-respiratory fitness was assessed by maximal-exercise treadmill testing. Intuitively, age-adjusted death rates indeed increased with higher levels of fasting blood glucose; however, the researchers demonstrated that regardless of glycaemic status, *fit* men had lower age-adjusted all-cause death rates than their *less fit* counterparts. For men with fasting blood glucose ≥ 7.8 mmol/l, the age-adjusted death rates per 10,000 person-years of follow-up in unfit and fit subjects were 82.5 and 45.9, respectively. When controlling for the risk factors of age, resting systolic blood pressure, serum cholesterol, body mass index, family history of heart disease, follow-up interval and smoking habit, the data showed a significantly higher risk of death (RR = 1.92 (95% CI 0.75-4.90)) due to all causes for *unfit* compared with *fit* men (Kohl, Gordon, Villegas, & Blair, 1992).

#### *2.6.5.3 Anti-hypertensive effects of aerobic exercise*

Hypertension is a serious health risk often associated with type 2 diabetes, and hypertension is 1.5-2 times more prevalent in the type 2 diabetic population (UK Prospective Diabetes Study Group, 1998). Lowering blood pressure in people with type 2 diabetes reduces cardiovascular risk and each 10mm Hg reduction in systolic blood pressure is associated with a 15% reduction in cardiovascular death over 10 years (Adler et al., 2000). It has been well documented that physical activity favourably alters blood pressure in those without diabetes (ACSM, 1993; Kelley & Kelley, 2001; Kelley & McClellan, 1994; Whelton, Chin, Xue, & Jiang, 2002), and although not as extensively researched, studies have demonstrated small to moderate absolute reductions in blood pressure in type 2 diabetic populations as well (Schneider, Khachadurian, Amorosa, Clemow, & Ruderman, 1992; Yeater, Ullrich, Maxwell, & Goetsch, 1990).

Yeater, Ullrich, Maxwell, and Goetsch (1990) examined the effect of a low-to-moderate-intensity walking programme on cardiovascular fitness. In a randomized control trial, subjects (n=16; mean age 56) were assigned randomly to a control group or an exercise group. The exercise group engaged in supervised sessions of 40-45 minutes of walking and/or slow jogging three times per week for two months. All subjects continued on their usual diets. The trained group showed a significant improvement in aerobic capacity (VO2max from 1.65 to 1.95 L/min.), resting systolic blood pressure decreased from 141 to 130 mm Hg, and resting heart rate decreased from 88 to 81 beats per minute. Yeater, Ullrich, Maxwell, and Goetsch concluded that a low-to-moderate level of aerobic training, independent of dietary changes, is an effective and feasible method of improving physical fitness and systolic blood pressure, in type 2 diabetic subjects.

In a comprehensive examination of the effect of aerobic exercise on blood pressure reduction Whelton, Chin, Xue, and Jiang (2002) conducted a meta-analysis of 54 random control trials, involving 2,419 previously inactive participants who exercised for between 2 weeks and 6 months. Whelton et al. demonstrated that regular aerobic exercise was associated with a significant reduction in mean systolic and diastolic blood pressure of 3.84 mm Hg and 2.58 mm Hg respectively. The reductions in blood pressure were independent of ethnicity, body mass index (BMI), initial blood pressure, aerobic exercise modality, frequency and intensity of the exercise. In an earlier meta-analytic review of randomized controlled trials in a non-diabetic population, Kelley and McClellan (1994) reported similar decreases of approximately 7 +/- 5 and 6 +/- 2 mm Hg for resting systolic and diastolic blood pressure, respectively. Whelton et al. concluded that the recommendation to walk for 30 minutes 3-4 times a week to

reduce cardiovascular risk and possibly lower blood pressure appears to be reasonable. However, the researchers noted that the trials with the longest follow-up (>24 weeks) demonstrated diminishing effects over time and the researchers recommended additional studies to identify ways to improve adherence to exercise programmes

#### *2.6.5.4 The effects of aerobic exercise on Lipid profiles*

Abnormally atherogenic lipid profiles are common in people with type 2 diabetes. The most common type of abnormality in type 2 diabetes is a combination of elevated triglycerides, reduced high-density lipoprotein (HDL-C) and elevated low-density lipoprotein (LDL-C)(ACSM, 2000; NZGG & Ministry of Health, 2003). Randomized, controlled trial findings demonstrate that moderate-intensity endurance training may increase the high-density lipoprotein (HDL) cholesterol by approximately 5% from baseline, decrease the concentration of low-density lipoprotein (LDL) cholesterol approximately 5%, as well as reducing triglycerides by approximately 4% in healthy, sedentary individuals (Halbert, Silagy, Finucane, Withers, & Hamdorf, 1999). Studies of those with type 2 diabetes found that after physical training, subjects showed desirable changes in triglycerides (Ruderman, Ganda, & Johansen, 1979), total cholesterol, high-density lipoprotein (HDL) cholesterol (Ruderman, Ganda, & Johansen, 1979) and total cholesterol ratio (Verity & Ismail, 1989). Increases in the aerobic power or the 'cardiovascular fitness' of people with type 2 diabetes is related to a less atherogenic lipid profile, which may in turn lessen the accelerated rate of atherosclerosis and related mortality rate (Kohl, Gordon, Villegas, & Blair, 1992; Yeater, Ullrich, Maxwell, & Goetsch, 1990).

While physical activity has been shown to result in favourable changes in blood lipid profiles, Kraus et al. (2002) demonstrated that in fact quite high amounts of moderate-intensity exercise over several months are needed in order to achieve the beneficial effects on cholesterol profiles. In a prospective, randomized study, Kraus et al. (2002) investigated the effects of the *amount* and *intensity* of exercise on lipoproteins. Kraus et al assigned 111 sedentary, overweight men and women with abnormally atherogenic lipid profiles to a control group (six month duration) or an exercise group (eight month duration). Subjects were encouraged to maintain their normal diets and to maintain their weight at baseline. Exercise subjects were placed in one of three exercise groups: high-amount–high-intensity exercise, low-amount–high-intensity exercise, or low-amount–moderate-intensity exercise. Kraus et al. demonstrated that the highest amounts of exercise resulted in the greatest improvements across a variety of lipid and lipoprotein variables. The greatest effects were seen with the highest amount of high-intensity exercise, however, the improvements were related to the total amount of weekly exercise rather than the intensity per se, and the lower-amount exercise groups always had better responses than the control group. Kraus et al. (2002) concluded, that in practice, the required amount of exercise equates to brisk walking or similar exercise, for at least 30 to 60 minutes almost daily, and the effects are independent of weight change.

While aerobic training has been shown to be effective in modifying blood lipoprotein profiles, the effect of resistance-training on the blood lipoproteins has not been researched as extensively. Halbert et al. (1999) suggest that resistance-training may not be as effective as aerobic training, with respect to favourably modifying HDL-cholesterol levels. Halbert et al.

suggest that this lesser effectiveness could be the relatively lower total energy expenditure that is generally associated with moderate-intensity resistance-training, as compared with aerobic training. The modality, intensity, duration and frequency of exercise training may all influence lipid and lipoprotein changes. Additionally, the lowering of dietary saturated fat intake, and body weight, can augment changes in lipid profiles in those with type 2 diabetes, who are participating in physical training (ACSM, 2000).

#### *2.6.5.5 Mental health*

Physical activity appears to promote psychological well-being and reduce feelings of mild to moderate depression and anxiety. A recent meta-regression analysis found that when compared with no treatment, exercise did reduce symptoms of depression in the short term, however, issues around inadequate methodology led the researchers to conclude that more good quality research on clinical populations with adequate follow-up is required to define the relationships more robustly (Lawlor & Hopker, 2001). Both endurance and resistance-training may improve mood and cognitive function, but it has not been established conclusively which mode of exercise is the most effective, and it is important to prescribe exercise that is appropriate, safe, and that the patient perceives as pleasant (ACSM & American Diabetes Association, 1997).

#### *2.6.5.6 Weight loss and weight management*

In a recent review of the literature Anderson, Kendall, and Jenkins (2003) reported that overall, studies demonstrated between 60% and 90% of type 2 diabetes cases are related to weight gain and/or obesity, and other researchers report similarly; that approximately 80% of type 2

diabetics are obese (Gonder-Frederick, Cox, & Ritterband, 2002; U.K. Prospective Diabetes Study Group, 1995). Considering the strong relationship between obesity and type 2 diabetics, it is perhaps surprising that obesity is not targeted more aggressively from a preventative perspective as moderate increases in physical activity and a weight loss of only 5% have been shown to reduce the risk of developing type 2 diabetes by 58% (Anderson, Kendall, & Jenkins, 2003).

Recent data from the U.S. for example, show that up to 58% of obese patients have never even had counselling for weight loss, and that obesity is often not considered a serious medical condition by doctors unless other disease risk factors are already present (Centers for Disease Control and Prevention, 2001). A recent questionnaire survey (Foster et al., 2003) of 5000 primary care physicians in the U.S. assessed physicians' attitudes toward obese patients and the causes and treatment of obesity. Six hundred and twenty physicians responded, and physical inactivity was rated as significantly more important than any other cause of obesity, followed by overeating and a high-fat diet. The treatment of obesity was rated as significantly less effective than therapies for 9 of 10 other chronic conditions, however, most respondents (75%), agreed that a 10% reduction in weight is sufficient to improve obesity-related health complications, and viewed a 14% weight loss as an acceptable treatment outcome. Foster et al (2003) concluded that practitioners are realistic about treatment outcomes but view obesity treatment as less effective than treatment of most other chronic conditions.

The difficulties experienced by individuals attempting to lose weight are well known, motivation and incentive need to be developed (Locke, 2001; Poirier, Catellier, Tremblay, &

Nadeau, 1996). While the 10-15% weight loss associated with improved obesity-related health complications may appear modest, persons with type 2 diabetes may not be able to exercise at a level that is required for significant weight loss to occur and body weight and body fat losses with exercise alone are often reported to be small (Poirier, Catellier, Tremblay, & Nadeau, 1996). Using calculations based on the 'energy cost' of various forms of aerobic exercise, Bryner, Ullrich, and Sauers, et al (1999) propose that to improve body weight and body composition, regular one hour sessions of moderate intensity exercise performed five or more times per week would appear to be necessary, and that this level of activity would need to be sustained for a period of years. The size of the weight-loss 'task' may well seem overwhelming or unrealistic to many obese individuals. However, considered self-reflection on *lifestyle* and *life-course* factors and a recollection of the time in years between being of normal BMI and the onset of obesity may allude to the fact that the reversal of an individual's obesogenic trend is not likely to be rapid or easily achieved. Clinical guidelines are now beginning to include revised physical activity recommendations that reflect a more accurate picture of what is actually required to achieve clinically significant weight loss outcomes. For example, The Canadian Diabetes Association guidelines (2003) now recommends that adults with type 2 diabetes should accumulate 4 hours of physical activity per week, with 150 minutes being of moderate intensity, and The American College of Sports Medicine (ACSM, 2000) now recommends that all persons with type 2 diabetes should also incorporate resistance-training into their physical activity programme, three times per week (see section 2.6.6.4). However, despite these recommendations, it would appear that there is still a large gap between recommended best practice and actual physical activity participation, not only

within the diabetic population but within the general population also. By way of illustration, Canadian data (Health Canada, 2002) suggest that 65% of individuals with diabetes are inactive according to public health guidelines (56% in the general population) and in the U.S., the majority (65.7%) of people with diabetes are not meeting national physical activity goals (Ford & Herman, 1995). In New Zealand, no such diabetes specific data are available, however, the 2002/03 New Zealand Health Survey reported, that in the general population, only 52.1% of adults were regularly physically active (30 minutes of moderate activity/most days of the week) and 13% reported being sedentary (defined as less than 30 minutes of physical activity per week) (Ministry of Health, 2004).

### *2.6.6 Exercise modalities*

#### *2.6.6.1 Aerobic exercise*

Aerobic training has long been considered an important treatment modality for individuals with type 2 diabetes (ACSM & American Diabetes Association, 1997). Indeed, aerobic exercise has been shown to improve cardiovascular fitness (Kohl, Gordon, Villegas, & Blair, 1992) and assist in decreasing blood glucose levels (Rogers et al., 1988; Schneider, Amorosa, Khachadurian, & Ruderman, 1984). Thus, activities such as walking, stair climbing, jogging, dancing, yoga, swimming, aqua-exercise and cycling are activities commonly recommended for patients with type 2 diabetes. Walking has been shown to be the most popular form of exercise for diabetic individuals (Ford & Herman, 1995) and as many of these patients are overweight and/or sedentary, such low-intensity/low impact activity would appear most appropriate, especially for those just starting to exercise. While low intensity/low impact

exercise is known to be beneficial, the exact shape of the dose-response curve is not entirely clear (Blair, Cheng, & Holder, 2001). Blair et al. suggest however, that in the frail, elderly and extremely sedentary, health advantages may readily occur from seemingly very low levels of physical activity.

#### *2.6.6.2 Aerobic exercise intensity*

Patients with type 2 diabetes are at greatly increased risk for cardiovascular disease. Although high intensity exercise training has been shown to decrease risk factors, the presence of obesity, older age, and a sedentary lifestyle make a high-intensity exercise programme a generally unrealistic choice of therapy in this population (Yeater, Ullrich, Maxwell, & Goetsch, 1990). While Blair et al. (2001) point out the appropriateness of low level physical activity for certain sedentary and/or elderly populations, a now consistent finding in the literature is that the largest health benefits appear to occur through engaging in moderate activity levels (Yeater, Ullrich, Maxwell, & Goetsch, 1990). Moderate physical activity is generally defined as activity performed at an intensity of 3-6 times a person's resting metabolic rate, or 3-6 units of metabolic equivalent (METs), and in practical terms, this is equivalent to the 'exercise intensity' of brisk walking for most adults. An exercise intensity of 2-4 METs is considered light, while intensive running (12 km/h) can require energy expenditures of 12 or more METs (McArdle, Katch, & Katch, 2001). A single MET is the baseline unit of energy expenditure for an individual and is somewhat variable between individuals due to differences in basal metabolic rates (BMR) and body mass, however, METs provide a useful and simple approximation of the rate at which exercise causes calories to be burned (McArdle, Katch, & Katch, 2001). The energy expenditure of brisk aerobic exercise is

estimated at 7kcal/min or 420kcal/hour, therefore three to five 60 minute sessions of moderate physical activity per week requires the expenditure of an additional 1260-2100 kcals of energy.

#### *2.6.6.3 Aerobic exercise duration*

Paternostro-Bayles, Wing, and Robertson (1989) studied the effects of various durations of low-intensity life-style activity on glycaemic control in a type 2 diabetic sample. The study examined the effects of three different durations of exercise (0, 20, and 40 minutes) while the intensity of the exercise was controlled at 50-55% the subject's age-predicted maximum heart rate. Glycaemic response to exercise was found to be positively related to the duration of activity, as 20 min of activity decreased blood glucose by 0.33 mmol/l, whereas 40 min decreased blood glucose by 0.88 mmol/l. The effect of exercise on glucose was maintained over a 30-min rest period but disappeared after a meal was consumed. Paternostro-Bayles et al. concluded that low-intensity life-style activity of long duration (20-40 min) produces a significant but modest decrease in glucose levels.

#### *2.6.6.4 Resistance-training*

A promising new recommendation for those with diabetes is resistance-training, however, it is suggested that at this time, resistance-training is still a very much underutilized form of physical activity (Plotnikoff, 2006). Some diabetes management guidelines now specifically recommend resistance-training (ACSM, 2000; American Diabetes Association, 2002; Canadian Diabetes Association, 2003), at this time, however, the New Zealand guidelines (NZGG & Ministry of Health, 2003) refer only to physical activity in generalised (aerobic) terms. Progressive resistance-training, in which the resistance against the muscle is gradually

increased over time, leads to gains in muscle mass which facilitates improvements in glucose disposal rate, glycogen storage capacity, insulin sensitivity and overall glycaemic control (Dunstan, Daly, & Owen, 2002; McArdle, Katch, & Katch, 2001).

One recent New Zealand study (Baldi & Snowling, 2003) investigated the effects of a moderate intensity resistance-training programme on glycaemic control in obese, type 2 diabetic men. Subjects (n=18) were assigned randomly to a 10-week resistance-training programme, or a non-training control group. The researchers reported several statistically and clinically significant outcomes including, decreased fasting glucose and insulin resistance, moderately decreased HbA1c, a 3.5% increase in fat free mass (muscle) and increases of between 25% and 52% for muscular strength and endurance. Adequate muscle mass and strength are necessary for performing the activities of daily living and a certain level of strength is a prerequisite for participation in many aerobic-type physical activities (Zacker, 2005). Baldi and Snowling (2003) demonstrated that the favourable changes to fasting glucose and HbA1c were inversely related to changes in fat free mass.

Resistance-training may be particularly suitable for those with mobility limitations, foot ailments, angina and poor balance, as well as those requiring a staged or mixed-approach to achieving the recommended levels of activity (Willey & Singh, 2003). Additionally, some diabetic individuals may perceive resistance-training as less daunting than going for a 30 minute walk, as this (relatively sedentary) population often associates aerobic exercise with shortness of breath, fatigue and possibly pain. Therefore, increasing exercise self-efficacy via performing resistance-training may result in the ability to begin performing aerobic activities

as well (Plotnikoff, 2006). In addition, resistance-training provides immediate feedback (for example, the amount just lifted or improvement since last workout) and this may be more gratifying and more motivating, than other forms of activity (see also goal theory section 2.9) (Plotnikoff, 2006). Further, Lillioja et al. (1987) suggest that some type 2 diabetics may have a limited capacity for the more traditional aerobic exercise activities. Lillioja et al. suggest that muscle fibre type, diffusion distance from capillary to muscle cells, or some associated biochemical change, may play a role in determining insulin action and the capacity for aerobic activity. A more recent study has also found this low maximal oxygen uptake (capacity for aerobic exercise) in patients with type 2 diabetes, compared with (matched) sedentary control subjects (Schneider et al., 1992). Performing resistance-training can provide a safe physiological stimulus with few complications and in some adults with specific clinical conditions (for example. severe peripheral neuropathy or recurrent foot ulcerations), resistance-training may be preferable to aerobic exercise (Dunstan, Daly, & Owen, 2002). Another advantage of resistance-training is that adherence to progressive resistance-training programmes may be significantly higher than that commonly achieved with aerobic training regimes. Adherence to aerobic exercise may fall to a low 10% over 12 months (Schneider, Khachadurian, Amorosa, Clemow, & Ruderman, 1992), however, Dunstan et al.(2002) suggest that adherence to resistance-training may be as high as 90%, over a four to six month period.

Despite the benefits and advantages of engaging in resistance-training, the majority of adults with type 2 diabetes do not partake in resistance-training programmes. In reporting on a Canadian population sample of 1193 diabetic individuals, Plotnikoff points out that only 12%

of individuals were weight-training or performing activities that would increase muscular strength (Plotnikoff, 2006, Table 1, p. 56). Given the positive attributes of resistance-training on diabetes management and its applicability despite the complications common to this condition, it would appear that resistance-training is a much underutilized form of physical activity. Plotnikoff (2006) suggests that much more research is necessary,

> "to understand the behaviour change processes of resistance training (in addition to aerobic-type activities) in this population, to guide the development and tailoring of effective and efficacious programs and strategies" (p. 58).

#### *2.6.6.5 Resistance-training prescription*

While resistance-training may be performed using body weight, elastic resistance devices and/or other 'every-day' items, typically, resistance-training is performed in a gym setting, using specialised equipment and often under the supervision of a fitness instructor. A typical strength-training programme involves one to three sets of several different resistance exercises targeting the major muscle groups (Baldi & Snowling, 2003). The number of repetitions of a particular motion are typically in the range of 8–15 per set and the weight or resistance used is typically increased progressively from initially low levels, to appropriately higher levels over a period of weeks (Baldi & Snowling, 2003; Dunstan, Daly, & Owen, 2002). The initial workload should generally be set at between 30-50% of the maximum load at which one single repetition can be performed (1 rep. max.). Repetitions should be performed in a moderately slow and controlled manner and full range of motion should be attempted if pain is not a limiting factor. Attention must be given to proper lifting technique and breathing patterns. Rest intervals between sets typically last between 1 and 2 minutes, allowing a strength-training

session to be completed in 20 to 30 minutes. As individuals become more proficient with resistance-training, compound, multiple-joint exercises (usually using free-weight or body weight movements) are generally recommended over single-joint, isolation-type movements. Compound exercises further develop strength, balance and coordination, which in turn may improve an individual's functional capacity in every-day tasks (Zacker, 2005). Strength-training may be performed up to 2–3 times per week. In accordance with the stimulus-recovery-adaptation principles of physical training (McArdle, Katch, & Katch, 2001), if the same muscle groups are to be trained in each session, then individual workout sessions should be performed on alternate days.

#### *2.6.6.6 Combined modalities*

Combined aerobic and resistance-training programmes may provide results which surpass either modality separately. A recent study of the effects of combined modality training produced several significant results. Tokmakidis, Zois, Volaklis, Kotsa, and Touvra (2004) investigated the short-term and long-term effects of a combined strength and aerobic training programme on glycaemic control, insulin action, exercise capacity and muscular strength in a group of women (n=9; mean age 55yrs) with type 2 diabetes. The women participated in a supervised training programme for four months, consisting of two strength-training sessions (of progressive intensity over time) and two aerobic-training sessions (moderate intensity at the beginning, and moderate-vigorous intensity after 2months). Glycaemic control (HbA1c), a 2-h oral glucose tolerance test (OGGT), exercise stress testing and maximum strength were measured at the beginning and after 4 and 16 weeks of the exercise programme. Significant improvements were observed in glycaemic control as HbA1c decreased significantly after

4weeks from 7.7% to 7.1% and after 16weeks of exercise training to 6.9%. Furthermore, exercise time and muscular strength improved significantly over the 16weeks, however, body-mass and body-mass index did not change significantly throughout the study. Tokmakidis et al. (2004) concluded that a combined training programme of strength and aerobic exercise could induce positive adaptations on glucose control, insulin action, muscular strength and exercise tolerance in women with type 2 diabetes.

#### *2.6.6.7 Safety considerations, adverse effects and limitations*

Exercise is frequently recommended in the treatment of type 2 diabetes, however, consideration should be given to factors that may contradict its usefulness and some precautions are warranted. Generally, the risk-benefit of exercise is highly favourable for most patients with diabetes (Stewart, 2004) and largely, serious complications that result from engaging in an exercise programme are rare (Schneider, Khachadurian, Amorosa, Clemow, & Ruderman, 1992). Schneider et al. suggest, based on their 10-yr experience with 255 patients enrolled in a comprehensive diabetes programme, that a regular aerobic exercise training programme can be safely and effectively used in an outpatient population with type 2 diabetes mellitus. Both aerobic and strength-training programmes have been demonstrated to be safe and effective in patients with chronic diseases, including diabetes and CVD (Zacker, 2005). However, people with type 2 diabetes often have significant diabetic complications and co-morbidities and individual patient variables must be taken into account when contemplating exercise prescription. Such contraindications include unstable angina, moderate or severe hypertension, uncontrolled dysrhythmias, congestive heart failure, myocardial ischaemia, poor left ventricular function, autonomic neuropathies and certain stages of retinopathy (Soukup,

Maynard, & Kovaleski, 1994; Stewart, 2004; Zacker, 2005). Patients with such complications, must be carefully evaluated, especially before initiating a strength or resistance-training programme (Zacker, 2005).

### *2.7 Conclusion*

Most people with type 2 diabetes have the potential to gain significant health benefits from engaging in regular physical activity. However, due to factors such as a lack of motivation or understanding, a lack of clear and appropriate recommendations, a lack of social support, limited access, physiological limitations, and/or a lack of encouragement from health professionals, physical activity is often an underutilised treatment modality (ACSM, 2000; Brown et al., 2004).

In diabetic people, regular exercise may significantly improve glycaemic control, as a result of the combined effects of glucose lowering during exercise, enhanced insulin sensitivity post-exercise and the general increase in insulin sensitivity resulting from training adaptations (Rogers et al., 1988). Additionally, improved insulin action and glucose tolerance in subjects exercising regularly can also be a function of systemic benefits of exercise such as weight loss, reduced free fatty acids or other factors (Schneider, Amorosa, Khachadurian, & Ruderman, 1984). Leisure-time physical activity levels are inversely related to the development of type 2 diabetes, and the incidence rates decline as energy expenditure increases from less than 500 kcal to 3500 kcal per week (Helmrich, Ragland, Leung, & Paffenbarger, 1991). In the treatment of type 2 diabetes, the exact dose-response relationship between 'amount of exercise' and the 'benefits gained' is not fully understood, however, treatment guidelines now

include similar recommendations. For example, Kraus et al. (2002) concluded that, in practice, the required amount of exercise equates to brisk walking or similar exercise for at least 30 to 60 minutes almost daily, and the Canadian Diabetes Association guidelines (Canadian Diabetes Association, 2003) now recommend that adults with type 2 diabetes should accumulate 4 hours of physical activity per week, with 150 minutes being of moderate intensity, and the American College of Sports Medicine (ACSM, 2000) now recommends that all persons with type 2 diabetes should also incorporate resistance-training into their physical activity programme, three times per week. Some diabetic people may have complications and co-morbidities that may limit their participation in regular exercise (Stewart, 2004; Zacker, 2005), however, even very low levels of exercise have been shown to bring health benefits, particularly for those most at risk (Blair, Cheng, & Holder, 2001). While self-management interventions targeted to change diabetes self-care behaviours usually include physical activity, adherence to exercise programmes is often limited and such interventions demonstrate, at best, modest efficacy (Padgett, Mumford, Hynes, & Carter, 1988; Schneider, Khachadurian, Amorosa, Clemow, & Ruderman, 1992), Based on the premise that the easier it is to maintain exercise then the more likely it is that people will do it, more research is needed to assess different types of exercise, the most suitable types of exercise for individuals with complications and co-morbidities , the most convenient modes of exercise, and other contextual factors. Research needs to focus on ways of increasing the sustainability of physical exercise, such that people may obtain the long term health benefits that regular physical exercise affords.

## *2.8 Optimism - pessimism*

### *2.8.1 Introduction*

In human behaviour, perhaps what is most fascinating is not that which is average but, rather, it is that which is improbable or seemingly against the odds. In the face of adversity, some individuals experience better outcomes than others, given similar circumstances and antecedents. Within the multiplicity of personality traits/states that might account for such differences are *optimism and pessimism*. Simplistically, optimists are people who, generally and in most domains of their life, expect good things to happen to them, conversely, pessimists generally expect bad things to happen to them. Dispositional optimism and pessimism (usually viewed as opposite ends of a continuum), are inextricably linked to goals and an individual's *global* belief that any such goals may or may not be attainable (Scheier & Carver, 1985).

During the 1930s-1960s, the pervading explanation for human behaviour had been that *all* behaviour was determined by the environment, as a function of how the environment *reinforces* a particular behaviour (Skinner, 1938). However, during the early 1970s, this so called *behaviourism* was challenged by an emerging *cognitive* view of human learning (Seligman, 1991). Maier and Seligman's (1975) ground breaking animal experiments demonstrated that when dogs were given electric shocks over which they had no *control*, the dogs would *learn* (cognitive) that nothing they did made any difference (helplessness), and in subsequent experiments these dogs would simply give up and cease further attempts to escape shocks. Maier and Seligman's experiments in *Learned-Helplessness* left behaviourism unable to explain the learned-helplessness response, as the learned-behaviour (doing nothing or

'giving up') was not a behaviour that had been reinforced during the experiments. Subsequently, studies of learned helplessness in human subjects (Abramson, Seligman, & Teasdale, 1978) demonstrated that approximately one in three of their human subjects were apparently 'immune' to learned-helplessness (resilient in the face of failure) and approximately one in ten subjects entered the experiments already helpless. The optimism-pessimism construct was formulated to explain this propensity toward, or alternatively 'immunisation' from, becoming helpless. Abramson, Seligman and Teasdale (1978) proposed that it is how people *explain* their failures that determines their propensity to learn helplessness and that this propensity toward, or conversely, immunisation from, helplessness is represented by their degree of optimism or pessimism. Abramson, Seligman and Teasdale proposed three dimensions of explanatory style, *permanence*, *pervasiveness* and *personalisation*.

*Permanence* refers to the perceived stability of the causes of bad events. The pessimist tends to believe that bad events will persist and the pessimist will tend to give up easily. The optimist, however, believes that the causes of bad events are temporary and thus the optimist will tend to persevere even in the face of failure (Seligman, 1991). *Pervasiveness* refers to how a person perceives the causes of bad events as either universal or specific. The pessimist tends to believe that the causes of bad events are universal and that bad events are likely to occur in all domains of life. Conversely, the optimist believes that the causes of bad events are specific, and thus, while the optimist may become deterred in one domain of life, the optimist is likely to persevere in all others (Seligman, 1991). Finally, *personalisation* refers to how a person perceives the causes of specific events as either internal (blaming one's self) or external (blaming others). The pessimist tends to blame him/herself for bad events (internal) and credit

others for any perceived successes (external). Conversely, the optimist tends to blame others for failure (external), however, unlike the pessimist, the optimistic style for explaining successes is internal, giving credit to oneself.

The following review of the literature examines the view that is already held by many lay people – that a positive outlook is helpful. More specifically, the degree to which an individual is optimistic about his or her future will influence how that individual responds and adapts when faced with an adverse health event. Further, while greater optimism has been demonstrated to act as a buffer against psychological ill health (Carver et al., 2005; Scheier & Carver, 1985; Steginga & Occhipinti, 2006), there is a growing body of evidence which suggests that it is positively associated with more favourable physical health outcomes as well (Carver, Lehman, & Antoni, 2003; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000).

Within the 'disease model' of human functioning, much is known of the many influences on, and determinants of, ill health and much can now be done to 'cure' ill health and, in theory (but not necessarily in practice), ameliorate unsupportive antecedents. Presented here is an overview of contemporary thought on the role of optimism from within a holistic or 'whole person' centred model of health and how greater optimism may relate to more favourable health outcomes, particularly with respect to chronic diseases.

### *2.8.2 Review of the literature.*

Although there is still a paucity of empirical evidence as to the exact *pathways* by which positive psychological states invoke physiologically protective effects, the evidence is

gathering to support the idea that in fact they do and that more positively oriented psychological states lead to more favourable 'whole person' health outcomes. The ability to remain, or even to learn to be more optimistic, even unrealistically optimistic, in the face of disease progression appears to be physiologically protective (Carver, Lehman, & Antoni, 2003; Reed, Kemeny, Taylor, Wang, & Visscher, 1994). A review by Taylor, Kemeny, Reed, Bower, and Gruenewald (2000) evaluated some of the more probable routes by which positive psychological states, including optimism, may exert favourable influences on disease progression and health outcomes. Taylor, et al. (2000) evaluated the three most supported routes, these being (1) individuals with optimistic expectations being more likely to engage in health promoting behaviours including increasing physical activity, reducing alcohol consumption and the appropriate use of available health care resources, (2) individuals with optimistic expectations being more likely to enlist greater social support and (3) positive psychological states, (including optimism), leading, in turn, to physiological states that are conducive to maintaining health ('the direct effect'). This pathway is essentially the inverse of the already established association between negative psychological states such as stress, anxiety and depression, and the resultant negative impact on neuro-immunological processes (Herbert & Cohen, 1993) and heart disease (Booth-Kewley & Friedman, 1987). A similar review by Salovey, Rothman, Detweiler, and Steward (2000) examined the mechanisms linking pleasant feelings with good health and added two further possible pathways, specifically, 'the information value of emotional experiences' and the psychological resources brought about by positive feelings and states'.

Presently, there are at two predominant perspectives on the optimism and/or pessimism

construct/s. The basic premise of the 'separate dimension perspective' is that people, to varying degrees, can be both optimistic and pessimistic at the same time. Conversely, the 'bipolar perspective' holds that optimism and pessimism lie on opposite ends of a bipolar continuum. Further, Kubzansky, Kubzansky and Maselko (2004) suggest that optimism and pessimism may relate differently depending on the particular health outcome variable/s of interest, for example, psychological health outcomes, as compared to physical/behavioural outcomes. Kubzansky, Kubzansky and Maselko (2004) also note the inherent paradox of how to define exactly what pessimism *is*, if it is not simply the opposite of optimism. Despite these differences in the way optimism and pessimism are commonly viewed and measured, it is generally considered that *expectations* for the future help determine peoples actions and experiences and, simply, optimism is the generalised expectation for "good" outcomes, and pessimism is the generalised expectation for "bad"(Carver & Scheier, 2003).

Congruent with many other psychological constructs, a contemporary view is that optimism is, or should be viewed contextually, that is, resultant behaviours and health outcomes are most likely a product of the person and the environment (reciprocal determinism), and as such, optimism is perhaps best defined as a 'quasi-trait', and optimism is malleable, and can be learned (Bandura, 1968; Csikszentmihalyi & Seligman, 2000). If one accepts the view 'that a positive outlook is helpful', and one wishes to apply such a concept to health care interventions that are efficacious, then a good understanding of the possible casual pathways between optimism and better health would be helpful. Expanded below are the five foremost pathways as reviewed by Taylor et al., (2000) and Salovery et al. (2000).

*(1) Optimism and health promoting behaviours:* The underlying premise of this pathway is that, to the extent that an individual holds good health as a desirable goal, the more optimistic the person then the more likely he or she will be to engage in positive health practices (Scheier & Carver, 1985, , 1992). Early evidence of this association was provided from a study of a cohort of men around the time of their coronary by-pass surgery (the CABS project) (Scheier et al, 1989). Each subject was interviewed one day prior to surgery, on the day of surgery, and at six month follow-up. Among the array of data collected was a measure of the individual's dispositional optimism-pessimism as measured by the Life Orientation Test (LOT) (Scheier & Carver, 1985). At the six month follow-up, optimists were significantly more likely to have resumed vigorous physical activity and to have normalised their lives, in general, across a greater number of domains. In an extension of the CABS study (Scheier et al., 1990), five year follow-up data provided information about the subjects' health habits. Optimists were more likely than pessimists to be taking vitamins on a regular basis, less likely to be eating unhealthy lunches (high fat) and were more likely to be engaged in a cardiac rehabilitation programme. The researchers concluded, that overall, optimists were more likely to be engaging in positive health behaviours than pessimists.

Again in the area of cardiovascular health, Shepperd, Maroto and Pbert (1996) demonstrated that dispositional optimism predicted greater success in making health behaviour changes that resulted in better health outcomes. The researchers conducted a longitudinal study of 22 patients participating in an 18 week cardiac rehabilitation programme. As part of the programme, all patients were assigned goals (for example, weight loss goals and physical activity goals) designed to decrease the risk of a cardiac event. Dispositional optimism, (as

measured by the Life Orientation Test at the outset of the programme), was demonstrated to predict success in making health changes associated with lowering the risk of coronary heart disease. Greater optimism was significantly associated with greater success in achieving lower levels of saturated fat, body fat, and global coronary risk, and with greater success in increasing aerobic capacity by the end of the programme. The researchers further illuminated the need for pro-active health promotion programmes and recommended that such programmes be specifically tailored to individual coping styles.

*(2) Optimism and the engagement of social support:* Much of the research investigating the psychosocial determinants of ill health has focused on the influence of negative psychological states on health outcomes. There is, however, a growing body of evidence which suggests that stressful life events may, in the presence of optimism, engender an array of positive outcomes including recognising and enhancing one's social relationships and establishing important personal priorities (Taylor, et al. 2000). Carver, Lehman, and Antoni (2003) conducted two studies of breast cancer patients from the Miami area to test whether dispositional pessimism predicted withdrawal from social activities and recreation. Firstly, in study (1), a cross-sectional sample of 235 breast cancer patients demonstrated that disruption of social and recreational activities correlated with pessimism as assessed concurrently 3-12 months after surgery. Secondly in study (2), however, 97 subjects participated in a longitudinal study and were assessed 4-8 weeks after surgery and subsequently at 6 and 9 month follow-up. Within the longitudinal sample, the researchers found that greater optimism predicted lower reports of illness-related disruption of social activities at each assessment during the year of the study. The researchers also noted that, unlike studies of diseases that follow a worsening course (for

example AIDS, rheumatoid arthritis, type 2 diabetes), the subjects in their breast cancer study were following a pathway toward wellbeing. Carver, Lehman, and Antoni noted that converging evidence alluded to a possible maladaptive or negative spiral involving personality (including dispositional pessimism), emotion and withdrawal from social supports and activities. The researchers concluded that pessimistic patients are at greater risk for future adverse health outcomes than patients who display dispositional optimism and that optimism promotes a continued engagement with positive life activities, despite a significantly threatening health event. Within the two study populations, optimists and pessimists' differences in subject social engagement was mediated by subjective experiences of distress and fatigue.

*(3) The 'direct effect' of emotional states on health.:* While there is a paucity of empirical evidence that links optimism to better health outcomes via overtly physiological pathways, there is much greater support for the inverse. As with many things in the domain of psychology, historically, by far the largest body of evidence is contextualised within a 'deficit model' of the human condition. That is, the negative influence that some unfavourable antecedent may exert on an individual's wellbeing (Seligman, 2002).

Negative affect refers to subjective distress and includes such aversive moods as anxiety, hostility, and depression. Affect is believed to be the 'proximal' psychological pathway through which psychosocial factors may influence physiological health. It is theorised that the association between strong emotions and physiological responses is grounded in human biology, more specifically, within an evolutionary/survival context (Carlson, 2004). Thus,

strong emotions trigger specific emotion-appropriate behaviours, such as the *freeze, fight or flight* response to *fear*. These emotion-appropriate behaviours are supported by, and enabled by, the responses of active physiological systems, including the release of hormones that regulate metabolic processes including immune system functioning. One such hormonal response is the release of the hormone cortisol and it is held that a chronically elevated cortisol level, in response to a person's chronic subjective distress, has an adverse effect on the immune system and a person's physiological health (Polk, Cohen, Doyle, Skoner, & Kirschbaum, 2005).

There is converging evidence which supports the proposition that, generally, negative emotional states are associated with unfavourable physiological functioning and positive emotional states are associated with healthier physiological functioning. This has been demonstrated in studies of cardiovascular risk (Booth-Kewley & Friedman, 1987), immune system functioning (Cruess et al., 2005; Herbert & Cohen, 1993) and adverse health outcomes in type 2 diabetes patients (Black, Markides, & Ray, 2003). Booth-Kewley and Friedman's (1987) review of the literature examining negative psychological states and cardiovascular risk led them to conclude, perhaps counter intuitively, that

> "the picture of a high coronary risk individual is not one of a busy, hurried, impatient workaholic, but rather, one of an individual with one or more negative emotions" (p.358).

A meta-analysis (Herbert & Cohen, 1993) indicated that clinical depression was associated with several large alterations in cellular immunity. The researchers reviewed 35 studies in

which clinical depression and functional indicators of immunity were assessed. However, not all of the studies were methodologically sound and/or had commonality in the measurement of reliable immune alterations. As a consequence of the various methodological discrepancies, the number of included studies was insufficient for an unequivocal conclusion, however, the studies did suggest a linear relation between the intensity of depressive affect and immune system functioning. These immune alterations included lowered natural killer cell activity *(r* = .28), and alterations in numbers of several white blood cell populations (rs = .11-.77). While it is not possible to examine a person's immune system and predict disease resistance or susceptibility, it is argued that the decreased immune function associated with depression would be related to increased susceptibility to immune-mediated diseases, for example cancer and infectious (including secondary complications of diabetes) or auto-immune diseases.

Cross-sectional laboratory studies have demonstrated that subjects who exhibit a tendency to experience positive emotions such as happiness, pleasure, and relaxation are more resistant to the common cold. Cohen, Doyle, Turner, Alper, and Skoner (2003) assessed three hundred and thirty-four healthy volunteers aged 18 to 54 years for their emotional styles at the time of exposure to a systematically administered respiratory virus. Those subjects who were assessed as having positive emotional styles demonstrated greater resistance to the virus (developing less severe illness), and those assessed as having negative emotional styles demonstrated a greater resultant severity of illness. While Cohen et al's laboratory studies demonstrated that emotional states can have an immediate effect on the immune system, they concluded that the degree to which chronic negative moods actually influence an individual's disease resistance or health status over time (in the real world) is not fully known (see also Herbert & Cohen, 1993b).

*(4) The information value of emotional experiences:* Peoples' behaviour, and how they interact with their environment, are salient determinants of their physical health (Fuchs, 1974; McKinlay, 1993; Minkler, 1999; United States Public Health Service. Office of the Surgeon General., National Center for Chronic Disease Prevention and Health Promotion (U.S.), & President's Council on Physical Fitness and Sports (U.S.), 1996). Integral to many theories of health behaviour and health behaviour change is the assertion that peoples' motivation for change is grounded in their *perception* of a dissonance between their actual and their ideal self (Ajzen & Fishbein, 1980; Festinger, 1957; Janz & Becker, 1984; Prochaska & Di Clemente, 1984). People rely on their emotions or recognition of certain physiological responses to emotions (as the case may be) as a source of information as to how successfully they are interacting with the world (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). Using Ajzen and Fishbein's 'Theory of reasoned action and planned behaviour' and Janz and Becker's 'Health belief model' as two examples, it can be seen that behaviour change is contingent on individuals' *perceptions* of such factors as their perceived health status, subjective norms, personal control, individual susceptibility/seriousness of a health threat (risk), and outcome expectations (Brewer, Weinstein, Cuite, & Herrington, 2004). The presence of, or perception of, physical symptoms (perhaps indicating susceptibility/seriousness of a health threat) is but one example of a factor that may motivate an individual to engage in a health promoting behaviour (Bandura, 1998; Janz & Becker, 1984). Individual's perceptions of these factors may vary depending on their mood, which accordingly, influences peoples' belief systems, which in turn tends to guide their behaviour: thus, there is a theoretical pathway between peoples' emotional states and physical health (Salovey, Rothman, Detweiler, & Steward, 2000).

The information value of emotional states may enhance an individual's efficacy for decision making, for example, regarding lifestyle choices and/or the decision to seek care. However, in some instances, positive emotional states (for example an 'overly' optimistic disposition) may influence an individual's perception of vulnerability and/or symptoms such that they are attenuated, and thus decrease that person's likelihood of seeking care (Salovey, Rothman, Detweiler, & Steward, 2000). Negative emotional states may also impede an individual's care-seeking. For instance, when an individual (of pessimistic disposition) is experiencing a stressful life event and at the same time, ambiguous physical symptoms of illness, then that individual may mistakenly attribute such physical symptoms as part of a 'normal' physiological stress response. Thus, negative emotional states may confound the individual's assessment of the need to seek care.

Perhaps the salient influence of negative affect on an individual's decision to seek care is the influence of mood on an individual's beliefs. Specifically, one's belief that one is capable of carrying out health-protecting behaviours and one's expectations that such behaviours will ameliorate illness, and/or be protective against the advancement of a particular disease course. Salovey and Birnbaum (1989) conducted laboratory studies on college students experiencing the flu or the common cold. Using an imagery-based mood induction procedure, students were induced into happy, sad or neutral mood states. Following mood induction, the subjects were assessed for their perceived physical symptoms, self-efficacy and outcome expectations regarding illness-alleviating behaviours. Salovey and Birnbaum (1998) demonstrated that, (1) compared to happy individuals, sad individuals reported more aches and pains and greater discomfort and (2) compared to sad individuals, happy individuals *perceived* themselves as

more able to engage in behaviours that were supportive of good health and (3) happy individuals perceived themselves as being less vulnerable to future negative events of illness as compared to the vulnerability perceptions of sad individuals. In essence, mood may influence an individual's assessment of information, information that an individual may use in the process of forming self-efficacy beliefs and outcome expectancies and thus, mood may influence health-seeking behaviour (Bandura, 1968, , 1997). Notwithstanding the instances when positive emotional states may decrease care-seeking, an aggregate of the above possibilities would tend to suggest that individuals experiencing positive emotional states will be more likely to correctly attribute physical symptoms of illness, process information more correctly, formulate decisions based on such information and thus carry out health-promoting behaviours and adhere to treatment recommendations more readily.

*(5) Psychological resources: optimism and coping:* One of the mechanisms whereby dispositional optimism may lead to physiological wellbeing is the manner in which optimists cope with stress. Scheier and Carver (1992) reviewed several studies of how optimists and pessimists cope with stress and reported some significant differences. For example, a group of undergraduate students was asked to recall the most stressful event that had happened to them in the last month and they were then assessed to illuminate their particular coping styles. The researchers found optimism to be positively correlated to problem-focused coping and positive reinterpretation and negatively correlated to denial and an attempt to distance oneself from the problem (Folkman & Lazarus, 1980). In summary, Scheier and Carver's review found optimists to display a dispositional tendency to rely on active, problem-focused coping and conversely, pessimists appeared to disengage from the goal or goals with which the stressor

was interfering and pessimists tended to use tactics such as denial. Optimists, generally, tend to be 'active copers' and tend to remain goal-engaged and life-engaged, whereas pessimists tend to be 'avoidant copers' with a propensity to 'give up' (Carver & Scheier, 2002).

#### *2.8.2.1 Learned optimism*

Human experiments in learned-helplessness demonstrated significant individual differences in peoples' susceptibility to helplessness, and it was proposed that people differ in the way in which they explain (to themselves) unfavourable events, and that peoples' different *explanatory styles* account for such differences in peoples' initial susceptibility to helplessness (Abramson, Seligman, & Teasdale, 1978). The optimism-pessimism construct is ordinarily considered to be relatively stable over time (Carver & Scheier, 2003). However, whereas Maier and Seligman (1975) demonstrated that helplessness could be learned, they also demonstrated that helplessness could subsequently be *un*-learned and similarly, it was proposed that it might be possible for pessimists to learn the skills of optimism and to permanently improve their quality of life.

Broadly, the techniques of learned-optimism aim to increase one's control over the way in which one perceives adversity and how one's habitual beliefs impact directly on emotion and action. While many 'self-help' formulas simply espouse the 'power of positive thinking', learned-optimism recognises that pessimists often hold negative beliefs that are simply not accurate, and that pessimists tend to *catastrophize* and self-blame. Learned optimism is principally concerned with accuracy (Seligman, 1991, , 2002).

The techniques of learned optimism draw heavily from the work of Aaron Beck (Beck, 1973;

Beck, Emery, & Greenberg, 1985) in the field of cognitive psychology, in particular the application of cognitive psychology to the treatment of depression. Two fundamental tools for changing one's interpretation of adversity are *distraction* and *disputation* and these skills have now been adapted into various interventions in many domains (Seligman, 1991, , 2002).

Distraction, or 'thought-stopping', refers to techniques that can be used to interrupt habitual thought patterns ('pattern-interrupts'). Distraction techniques include *attention shifting* (temporally focusing attention on an object or concentrating on an unrelated and/or pleasant thought) , *scheduling* (allocating a later time to process thoughts), and physical techniques (for example clapping of the hands, ringing a bell, or snapping a rubber band worn around the wrist) (Seligman, 1991, , 2002).

Disputation is essentially arguing with yourself or 'cognitive restructuring' (Beck, Emery, & Greenberg, 1985). Broadly, disputation involves distancing one's self from the problem, marshalling and evaluating relevant evidence, considering possible alternatives, considering the implications and the usefulness of held beliefs, and thus de-catastrophizing. All of these skills can be learned and applied habitually to increase quality of life (Seligman, 1991).

The optimism construct may appear to overlap with *self-efficacy*, which also may be learned (see also 2.9.5) (Bandura, 1968, , 1977a). There is, however, an important difference between optimism and self-efficacy and that difference is centred in how the outcomes are expected to transpire (Seligman, 1991). Self-efficacy is a construct in which the *self* as a causal agent is important, and people who have high self-efficacy believe that their personal efforts or skills

largely determine a favoured outcome. In contrast, the optimist holds that favourable outcomes result from the interaction of numerous intrinsic factors (for example, personal talents and skills), *as well as* many largely uncontrollable extrinsic factors, including social interactions, networks and pure chance. While the optimist has a generalised expectancy for favourable outcomes, the optimist understands the need to be actively involved in the matrix of influences on those outcomes (Carver & Scheier, 2003; Scheier & Carver, 1985; Seligman, 1991).

The application and evaluation of learned optimism as a component of wellbeing-promoting interventions is relatively new, and there is at this time, a paucity of empirical findings. However, recent studies have shown subjects' initial levels of optimism to be predictive of various health and quality of life outcomes *over time*, one example is superior recovery by more optimistic patients following breast cancer surgery, at 5-13 years follow-up (Carver et al., 2005). Carver et al (2005) point out that traditionally, many clinicians assume that patients' well-being relates primarily to medical variables, and that optimising medical variables is the primary pathway for enhancing well-being. Carver et al (2005) concluded that it was not medical variables, but core psychological variables (in this case optimism) that accounted for a very large proportion of the variance in the long-term outcomes of their subjects.

Given this apparent link between (initial) dispositional optimism and optimum health outcomes, interventions that enhance optimism may represent an increasingly important treatment component in many health-care settings. A recent study (Antoni et al., 2001) reported on one such intervention that was aimed at increasing patients' optimism. The study involved 100 early-stage breast cancer patients and produced a "rather remarkable" change in

the levels of general optimism at 12-month follow-up (Antoni et al., 2001, p.28). The intervention was delivered in a supportive group setting and patients met weekly for ten 2-hour sessions that included didactic material, role-plays and additional out-of-session assignments. The essentially cognitive-behavioural based intervention package included both problem-focused (e.g., active coping and planning) and emotion-focused (e.g., relaxation training, use of emotional support) coping strategies. Subjects were also taught how to increase their optimism, by replacing doubt appraisals with a sense of confidence, by means of cognitive restructuring (Beck & Emery, 1985).

The impact of the intervention was assessed on several outcomes: distress (mood disturbance, depressive symptoms, and thought intrusion and avoidance), perceptions of benefit from having breast cancer, and generalized optimism about the future. The intervention was shown to have reduced the prevalence of moderate depression but did not affect other measures of emotional distress. The intervention also increased participants' reports that having breast cancer had made positive contributions to their lives and it increased generalized optimism. There was also evidence of a differential effect, such that the intervention had its greatest impact on the women who were in greatest need of it, that is, those who were least optimistic about their future at the time of the first assessment were the ones whose levels of optimism increased most dramatically. This differential effect combined with the relationship between initial levels of optimism and quality of life outcomes over time (Carver et al., 2005) suggests that teaching patients the skills of learned optimism may be of great benefit in optimising quality of life in health-care settings.

### *2.8.3 Conclusion*

The apparent simplicity of the thesis 'that a positive outlook is helpful' almost undermines its salience. The evidence is gathering to buoy the notion that more positively oriented psychological states lead to more favourable 'whole person' health outcomes - the view that is already held by many lay-people. There is converging empirical evidence that optimism, mediated via multiple biopsychosocial pathways, promotes, maintains and is protective of good health. Freud (1953) held the view, perhaps often overlooked by 'modern medicine', that patients' expectations, "coloured by hope and faith, are an effective force, in all our attempts at treatment and cure" (p. 289). In many cases, at least to some degree, individuals' negative states are able to be ameliorated. The evidence supports the view that more *pro-active* health promotion programmes and interventions are needed, specifically, programmes and interventions that are tailored to individuals' current psychological states and that also seek to *improve* individuals' psychological states and build positive psychological resources, thus enhancing physiological processes and ultimately, individual's health outcomes.

## *2.9 Goal theory*

### *2.9.1 Introduction*

The empirical study of goals and how goals influence performance gained momentum in the early 1930s and 1940s. Early research by Mace (1935), in the field of educational psychology, examined the effects of goals on students' performance in calculation tasks. Lewin, Dembo, Festinger and Sears (1944) studied the goal-performance relationship in terms of *levels of aspiration* and focused on the influence that attainment or non-attainment of goals has on

future performance expectations and peoples' subsequent higher or lower level of goal selection respectively. Later, Ryan, a pioneer in the study of industrial psychology, further developed and formalised goal theory, and current goal theory is still grounded in Ryan's simple premise that *conscious goals affect action* (Ryan, 1958). This simple premise has since been extensively researched and further expanded upon, and a contemporary view is that goals determine the direction, intensity and duration of action (Locke & Latham, 1990). A goal is the object or aim of an action and can be expressed as a specific outcome, behaviour or performance and goals attainment is usually assigned a specific time frame (Locke & Latham, 1990).

The two most important aspects of goal theory are (1) the relationship between goal difficulty and performance and (2), the influence of goal specificity on performance. One of the most frequently and universally applied goals is the 'do your best goal'. Interestingly, when asked to 'do ones best', in fact most people do not do so (Locke, Shaw, Saari, & Latham, 1981). This somewhat cliché-like 'do one's best goal', although widely used by the lay-person and 'professional' alike, has no reference to any external measure and performance is therefore moderated to the level or standard that an individual *perceives* as reasonable. In the context of health, there is much variability in individuals' perceptions of what a goal of 'good health' might be and what steps one might need to take to achieve such a goal. The very term *health* undoubtedly means different things to different people, and each individual's construct of health will differ. Individuals will have differing expectations regarding their health status, their health needs, and their demands and wants, and these may also change over time. As there are many definitions of health, there will be great variations in peoples' health goals, and

these will be related to our values, the context, past experiences and how we view the world (Fuchs, 1998).

In the context of health behaviour and health behaviour change, goals would appear to be instrumental and of great importance to the process of actively seeking better health. Further, following a significant adverse health event, or during the management of chronic illness, greater goal-directedness is associated with higher levels of health promoting and health protective behaviours (Bandura, 1998; Heath, Larrick, & Wu, 1999; Hollenbeck, Williams, & Klein, 1989; Locke & Latham, 2002).

This review of the goal theory literature describes the nature of goals and goal setting, the mechanisms by which goals may operate and also how, increasingly, goal theory is prominent in the domain of health behaviour change and the maintenance of good health. While much of the goal research over the past 35years has come from within the fields of education, and industrial/organisational psychology, many of the founding principles of goal theory are somewhat generic and thus have much to offer in the context of setting goals for personal health behaviour, health promotion and the protection of wellbeing.

### *2.9.2 Goal definitions and structures*

Goals have been defined in various ways for example, "Goals are values applied to specific circumstances" (Locke, 2001, p. 303). Piaget (1981) states that goals (or interests) "represent the point of juncture between two distinct systems. It is where the system of valuations and the system of energetic regulation come together" (Piaget, 1981, p. 34). A goal can be seen as

simultaneously being an object to aim for and a reference standard by which success is measured. "Goal structures themselves are complex cognitive entities in their formation and then in their use for imposing meaning and direction on activities" (Lawrence & Volet, 1991, p. 152).

Whatever the chosen domain of human functions, goals affect performance via four foundational mechanisms; (1) the *directive* function (focusing and directing attention and effort), (2) the *energising* function (goals may increase the intensity of cognitive and physical effort), (3) by engendering *persistence* (goals may prolong effort) and, (4) by prompting *action* (via the indirect effects of increasing arousal) and fostering engagement in discovery and learning strategies (Locke & Latham, 2002). Thus, "Goals determine the direction, intensity and duration of action. Goals also affect cognitive processing and the use of task knowledge" (Locke, 2001, p. 304). Research conducted over the past 3 or 4 decades has elucidated many of the ways in which goals act to influence behaviour and many propositions have now been empirically tested, resulting in a plethora of literature covering well over 100 different domains of human performance including workplace (Locke, Shaw, Saari, & Latham, 1981), education (Mace, 1935), sport (Urdan & Mestas, 2006), and health (Strecher, Seijts, KoK, & Latham, 1995).

### *2.9.3 The goal difficulty - performance relationship*

Perhaps the most studied aspect of goal theory is the relationship between goal difficulty and performance. The finding that higher level goals lead to higher performance is one of the most replicated in the applied psychology literature (Locke & Latham, 2002). Performance is the

result of work over time, and when controlling for prerequisite skill/knowledge and goal commitment, the higher the goal then the higher the performance. With respect to goal difficulty, it is pertinent to distinguish between *task* difficulty and *goal* difficulty. In the context of goal theory, a task is considered as a unit of work to be accomplished and a difficult task is one that is hard to do because it requires considerable cognitive and/or physical effort. Within the goal setting literature, a *goal* refers to the attainment of a specified level of proficiency on a specified task (or tasks), usually within a specified time frame (Locke & Latham, 1990). For example, a person may have the health and fitness *goal* of achieving a 5kg weight loss in the next six weeks and may endeavour to achieve this by engaging in the *tasks* of brisk walking and swimming. In the previous example, the *tasks* themselves may not be perceived by the individual as being particularly difficult, however, the *goal level* may well be very difficult. It should be noted that the completion of just one task can be viewed as a goal in itself. If a person is committed to a goal (see goal commitment below) then his or her effort towards that goal will be proportional to what the goal requires. That is, an easy goal will stir only low effort and a hard goal will incite high effort (Locke & Latham, 1990). In a (1991) review of the literature, Locke and Latham reported that of 192 studies of goal difficulty, 91% of the studies found that higher goals produced higher performance.

### *2.9.4 The goal specificity - performance relationship*

Perhaps second only to difficulty, goal specificity has been shown to be a powerful predictor of performance. In Locke and Latham's (1991) review of the literature, the researchers reported that of 201 studies of goal specificity, 91% of the studies found that specific,

challenging goals produced higher performance than vague goals. Thus specific goals have been shown to regulate action much more consistently than non-specific goals and specificity also encompasses appropriateness, precision and/or relevance. For example, the goal "I am going to try and exercise more" is a non-specific goal, and as such, will be unlikely to appreciably regulate action. However, the goal "I am going to walk for 30minutes on Monday and Thursday mornings, starting today" is more likely to support action toward that goal. Specificity in goal setting usually requires an external measurable standard and in the previous example, the activity (walking) is to be performed for a measured time (30minutes) at a measured frequency (twice per week). Peoples' subjective assessment of what is 'enough' or 'their best' invariably leads to lower task performance than goals based on objective quantitative measures. For a given task difficulty, people working toward specific goals consistently outperform people who are 'doing their best' or people who hold other non-specific or vague goals (Locke & Latham, 1991).

While goal *difficulty, specificity* and *performance* are ostensibly related, not all goal theorists view goal difficulty and specificity as separate constructs. Heath, Larrick and Wu (1999) propose that goal specificity and goal difficulty are, in fact, one and the same thing. Heath, Larrick and Wu argue that traditionally, goal researchers have assigned one group of study subjects a specific challenging goal and instructed the other group to simply 'do your best', and invariably the 'do your best' goal (while non-specific) is assumed to be equally as challenging. Heath, Larrick and Wu call attention to the rather typical experimental methodology where the assigned 'hard goals' are set at a very high level which only about 10% of subjects can reach, whereas subjects instructed to 'do your best' typically self-set goal

difficulty at about the 50% level (Locke & Latham, 1990, p. 349). Thus, the goal specificity-manipulation can be interpreted as just another way of varying goal difficulty. However, to the lay-person, goal appropriateness, goal precision (or measurability) and/or personal relevance may better represent the goal specificity construct in the real world.

### *2.9.5 Self-efficacy*

To achieve a *goal*, one must have at least some belief in one's ability to do so. Perceived self-efficacy (or situation specific confidence) refers to the belief in one's ability. A Self-efficacy belief is a belief that "I can perform the behaviour that produces a *specific* outcome" (Bandura, 1977a; Maddux, 2001). Self-efficacy beliefs are not just limited to behaviour, however, as they may include beliefs relating to the self-regulation of one's cognitive processes and/or affective states and ones ability to influence one's environment (reciprocal determinism) (Bandura, 1968). Further, perceived self-efficacy may also be conceptualised as a generalised construct. *General self-efficacy* has been postulated to be the belief in one's competence to tackle a broad range of novel tasks, and to cope with adversity, and/or challenging encounters (Luszczynska, Gutiérrez-Doña, & Schwarzer, 2005). Luszczynska et al. studied the relationships between general self-efficacy and a variety of other psychological constructs, across five countries, involving 8,796 participants. The researchers found optimism, self-regulation, and self-esteem to exhibit the highest positive associations with general self-efficacy, whereas the highest negative associations emerged with depression and anxiety. Thus, perceived self-efficacy appears to be a universal psychological construct that accounts for variance within various domains of human functioning (Luszczynska, Gutiérrez-Doña, &

Schwarzer, 2005).

Importantly, self-efficacy has been demonstrated to affect peoples' choice of goal level, with higher self-efficacy being associated with higher level goals and hence higher performance (Bandura, 1968; Bandura, 1998). When faced with challenge and adversity, people will have little motivation to act with intensity and persistence unless they believe they can produce desired effects by their actions (Bandura, 1968; 1998). In the context of health, self-efficacy influences the adoption of healthy behaviours, the cessation of unhealthy behaviours and the maintenance of effortful behavioural changes (Maddux, 2001). Social cognitive theory postulates that we anticipate and develop expectancies using knowledge and past experience to form *beliefs* about future events and our abilities and behaviours (Bandura, 1986, , 1997). With respect to health behaviour change, appropriately focused health promotion and behavioural interventions may positively influence the level at which individuals set their goals, via increasing their self-efficacy. There are at least five methods of influencing and increasing a person's self-efficacy, including mastery experiences, vicarious experiences, imagery, verbal persuasion, and modifying/managing physiological and/or emotional states (Bandura, 1997).

Generally, the most effective method of building a strong belief in one's personal efficacy is via *mastery experience*. The resolute engagement in challenging yet achievable tasks and the consequent experience of success, builds a resilient sense of efficacy. Premature failures undermine it. A person who is helping another to cultivate their self-efficacy should therefore structure situations that are likely to enable success and avoid placing them in situations where they are likely to experience premature failure. The second most effective way of creating and

strengthening self-efficacy is simply by 'watching someone else do it'. Vicarious experiences are most effective when social models (people perceived as similar to oneself) demonstrate success at a challenging task by sustained effort. Competent social models (or role-models) transmit knowledge and teach observers effective skills and strategies and often can be seen to 'lead by example'. Imagery is yet another method that an individual may use to increase self-efficacy. By imagining oneself performing a task proficiently, one can boost one's belief to actually do so. Fourthly, peoples' self-efficacy may be enhanced by verbal persuasion: simply telling a person that they can do it fosters their belief in their ability to mobilise the effort, skills and knowledge needed to succeed. The fifth method of enhancing self-efficacy is to enhance peoples' psychological state/s. Reducing people's stress reactions and tensions (by teaching relaxation techniques for example), altering their negative emotional states (via cognitive therapy) and/or helping them to correctly interpret their physical states (for example, via bio-feedback) may all increase self-efficacy (Bandura, 1977a). Through any combination of these methods, individuals' self-efficacy may be increased. As high self-efficacy is strongly positively related to the setting of high goals (Locke, Shaw, Saari, & Latham, 1981), then, the stronger a person's perceived self-efficacy, the more likely they are to enlist and sustain the effort required to adopt and maintain health promoting behaviours (Bandura, 1998).

### *2.9.6 Feedback*

In practice, the relationship between goals and feedback is often very complex, however, what is clear is that neither goals nor feedback are particularly effective in the absence of the other (Locke & Latham, 1990; Locke & Latham, 2002). Feedback is instrumental to one's success in

progressing toward and/or reaching a chosen goal. Feedback may be in the form of 'knowledge of results' (KR) or 'knowledge of performance' (KP). KR provides information that allows one to keep track of progress (Locke & Latham, 1990). For example, if an individual holds and is committed to a specific weight loss goal, then his or her efforts may be modulated in accordance with current knowledge of results (feedback). Thus, the individual may weigh him/herself at regular intervals (feedback) and, if the individual's weight loss is proceeding according to schedule (goal), then the individual will tend to maintain his/her efforts at the current level. If the individual's rate of weight loss fails to meet the desired standard then, assuming continued goal-commitment, the individual is likely to increase his/her efforts and/or try new or additional strategies for weight loss.

People need standards by which to evaluate performance and three different types of standards have been identified, absolute, intrapersonal and normative (Elliot & McGregor, 2001). Absolute standards are defined by the task itself, for example, in the case of smoking cessation, the standard is 'no smoking'. Intrapersonal standards are those standards as devised and adopted by oneself, for example a specific body weight and/or shape that one perceives as appropriate and optimal for one's wellbeing. A normative standard compares one's performance to that of others, for example an individual may compare his or her body height/weight to a standardised height/weight chart to ascertain if he or she falls within 'normal' parameters. In yet another example, an athlete who wins a race will know that he or she performed better than all the other competitors in that specific event. In this case however, without an additional absolute standard, this feedback will not necessarily provide data as to how 'good' the performance was, compared to either the individual's personal best

performance or the performance of the wider athletic population.

Knowledge of performance (KP) is feedback on the strategies and specific behaviours that may collectively facilitate goal achievement (Locke, 2001). KP is usually provided by another person who provides extrinsic (augmented) feedback on any part of the task including incomplete attempts, effort, quality and technique (Metzler, 2000). For example, a physical activity instructor may advise an individual on his or her particular form or technique when performing an exercise, which in turn, may enhance progress toward an individual's overall fitness of weight-loss goal/s.

Sroufe, Egeland, Carlson and Collins (2005) provide far-reaching contributions to understanding how we become who we are following a groundbreaking 30year longitudinal study of both positive human development and maladaptation. Sroufe et al. demonstrated that attentive positive feedback from the mother (or primary caregiver) to the child during the first few weeks, months and years of development strongly predicted the developing child's self-regulation and *performance*, over a broad range of cognitive and behavioural domains, and well into adult life. Bandura (1998) offers the simple premise that "when people attend closely to their performance they are inclined to set themselves goals of progressive improvement" (p. 12).

### *2.9.7 Goal commitment*

Commitment has been defined as "a state of being in which an individual becomes bound by his actions and through these actions to beliefs that sustain the activities and his own

involvement"(Salancik, 1977b, p. 62). While the thesis that 'difficult goals' lead to higher levels of performance than do 'easy goals' is salient to all goal theory (Locke, Shaw, Saari, & Latham, 1981), it is, however, contingent on the additional and critical antecedents of self-efficacy (see above) and *goal commitment* (Locke & Latham, 1990). Like self-efficacy, commitment is a moderator of the goal difficulty-performance relationship. Goal commitment can be defined as "one's attachment to, or determination to reach a goal, regardless of where that goal came from" (Locke & Latham, 1990, p. 125) and it is now clear that if there is no commitment to a goal, then goal setting simply will not work. Goal commitment reflects one's determination to try for a goal and the persistence in pursuing it over time (Locke, Shaw, Saari, & Latham, 1981).

*Determinants of goal commitment:* Commitment to one's goals is contingent on two main factors (1) one must believe that the goal is important (and for a goal to be important, it must be tied to an important value), and (2) one must believe that one can make progress toward one's goals (self-efficacy) (Locke & Latham, 2002). If one accepts that commitment to difficult goals is salient to goal achievement, then, to this end, methods of increasing goal commitment become important in facilitating behavioural change. Simplistically, to achieve a difficult goal, a person must believe it to be important and commit to the goal. Across a range of goal theory literature, a number of personality and situational factors have been demonstrated to influence goal commitment, including but not limited to, peer group influence (including competition), publicness, incentives/rewards, goal conflict, self-efficacy, specificity, personal origin and volition (Bandura, 1968; Bandura, 1998; Hollenbeck, Williams, & Klein, 1989; Ingledew, Wray, Markland, & Hardy, 2005; Lewin, 1943; Lewin, Dembo, Festinger, &

Sears, 1944; Locke & Latham, 2002; Locke, Shaw, Saari, & Latham, 1981; Salancik, 1977a).

Hollenbeck, Williams, and Klein (1989) investigated some of these antecedents to goal commitment within an organisational context. The researchers recruited 201 employees from five local companies and the participants then nominated a goal that they were currently working towards. The participants then completed a Goal Perceptions Questionnaire in which they were presented with and rated, various descriptive statements (factored on 25 different scales) which might be used to describe their goal or target. With respect to commitment, the researchers confirmed their hypothesis that the degree to which individuals' *valued* their goals positively influenced goal commitment. Further, their data analysis demonstrated that a cluster of antecedents positively influenced goal value and thus goal commitment. Hollenbeck, Williams, and Klein concluded that, at least in their sample (and listed in descending order of effect size), high personal origin, high specificity, low conflict with other goals, high complexity, publicness and competition, all related positively with goal commitment.

#### *2.9.7.1 Publicness*

Publicness can be described as the extent to which an individual perceives that other people, particularly 'significant others', are aware of his or her goal/s. The influence of publicness on commitment to goals was demonstrated convincingly during Lewin's (1943) renowned work on changing the eating habits of domestic Americans around the time of World War II (1941-1945). At the time, much of America's meat production was being shipped overseas to feed soldiers and allies, leaving Americans potentially protein starved, unless they changed their food choices to include alternatives (that were generally perceived to be less desirable). Lewin

found that peoples' long-term acceptance and commitment to the goal "to eat alternative protein rich foods" was facilitated when people who had made a personal commitment to change were also publicly and socially reinforced for their behaviour. In general, people have a strong desire to appear rational and consistent in the eyes of others and people tend to resist changing an established course of action because doing so would make them appear inconsistent (Bandura, 1977b; Bandura, 1998; Salancik, 1977b). Because of the social nature of this process (i.e., the fear of appearing inconsistent to other people), publicness is a potentially useful and powerful 'tool' in the enhancement of commitment to health goals. For example, an individual who holds specific goals with respect to increasing physical activity may strengthen their own commitment to these goals by detailing them to their family members, workmates or an 'exercise partner' or 'buddy'. Further, goals that involve responsibility to others (for example an 'exercise partner') can enhance commitment by generating social pressure to 'follow through' (Bandura, 1968; Bandura, 1998).

#### *2.9.7.2 Personal origin*

A term often associated with goal setting is *volition,* or the extent to which an individual exercises free choice in the engagement of a particular behaviour. In a goal setting context, volition is closely associated with goal origin. Self-set goals (personal origin) imply greater volition than do assigned goals. Goals set by one's own free will are generally more psychologically binding than goals that can be attributed to external sources (Salancik, 1977a). However, even assigned goals involve volition because people may or may not choose to accept an assigned goal. People usually choose to obey legitimate authority figures, especially when the assigned goals are believed to be in the assignees' personal interest, and a clear

explanation and rational for the goal is given (Locke & Latham, 1990). For example, most people will accept health related goals that are assigned to them by their General Practitioners, such as the taking of a prescribed medication although, for a variety of reasons, they may not necessarily achieve that goal. Assigned goals may also enhance commitment if they provide normative information (suggesting what level of performance is possible and/or appropriate)(Locke & Latham, 1990), enhance self-efficacy (by implying the assignee is capable) (Salancik, 1977a), or provide the opportunity for an individual to gain a sense of achievement via mastery experience (Bandura, 1968, , 1997).

#### *2.9.7.3 Incentives*

Incentives are contingent desirable 'outcomes' that can be used to enhance goal commitment. Incentives and goals interact and increased commitment is contingent on the incentive being appropriately matched to the level of goal difficulty, the person's values (an incentive must be of value) and his or her goal orientation (Locke & Latham, 2002). With respect to goal level, if an incentive is attached to a goal at a performance level that is unrealistically high, then a person's self-efficacy and performance may drop as he/she realises that the goal (and hence the incentive reward) is beyond reach. When considering incentive type, if a person does not value the incentive, the incentive will be ineffective. For example, if 'saving money' is framed as an incentive for a person to stop smoking, yet the person in reality places great value on 'better health', then financial incentives alone will be unlikely to be effective. When considering goal orientation, a person who tends toward a mastery goal orientation may benefit more from incentives that are keyed to incremental increases in performance level, rather than the promise of a reward linked to overall goal achievement. For example, a person working toward a

weight loss goal may use incentives to enhance his or her commitment to the overall goal, by assigning incentive rewards to incremental weight loss steps along the way. In the context of health and the self-regulation of health promoting behaviours, Bandura (1998) proposes that self-set incentives help motivate people to expend the effort required to reach their goals. Bandura proposes that *self-set* incentives operate via the mechanism of 'anticipative affective reactions', or more simply, the anticipated satisfaction of desired (valued) accomplishments and the dissatisfaction with insufficient or undesirable actions (Bandura, 1998). Bandura summarises that, "people who reward their own attainments accomplish more than those who perform the same activities without self-incentives" (Bandura, 1998, p. 13).

#### *2.9.7.4 Competition*

Competition is a peer related factor that has been shown to increase individuals' performances and the likely pathway for the competition-performance effect is that it increases the level of, and commitment to, high goals (Locke & Latham, 1990). Competition may influence performance by providing people with feedback in relation to group norms, particularly when the results are public, so that individuals within the group can compare themselves to their peers (Elliot & McGregor, 2001). Congruent with the findings on *publicness,* within competitive situations, people often have a very strong desire to appear rational and consistent in the eyes of others, and people tend to set goals and strive for performance within a competitive situation so that they maintain a favourable 'outward' appearance (Bandura, 1977b; Bandura, 1998; Salancik, 1977b). Competition simultaneously contextualises a performance (rules and measures) and generates a normative standard/s by which individuals may evaluate their performance (Urdan & Mestas, 2006). Competition is a facilitator of

optimal performances in many activities, one obvious example is Olympic sports, where the 'outcomes' are directly related to the group norm performance level by the narrowest of margins. Competition may not always aid high performance however, as an excessive focus on competition does have the potential to undermine achievement if it produces unmanageable levels of anxiety, or if the competition is too weak (Urdan & Mestas, 2006). While bearing in mind this potential to undermine performance and the somewhat intrinsic basis for health behaviour change, competition may be beneficial to some to enhance commitment and the setting of high goals. A common example is a person's adoption of a competitive sporting event (as a distal goal) to enhance his or her commitment to his or her every-day exercise and nutritional behaviours.

#### *2.9.7.5 Goal conflict*

Goal conflict is commonly an internalised moderator of goal commitment and thus behaviour change. For example, most people contemplating smoking cessation are in conflict, because although they may hold the goal of improving their health, they may also have a psychologically vested interest in continuing to smoke (for example, the reduction of anxiety). Frequently, people who claim they want to change something in fact may not actually want to do so (Miller & Rollnick, 2004). Perhaps the most prevalent type of goal conflict, at least within behavioural change contexts, is what has been termed the *'double approach-avoidance'* conflict. This defines a conflict in which an individual is 'trapped' in a state of cognitive dissonance (Festinger, 1957) between two alternatives, each of which have salient positive and negative aspects and implications. When an individual shifts toward either alternative, there is a simultaneous shift in the salience of the diametrically opposed negative and positive aspects

and the dissonance is maintained. In lay-terms, a goal conflict (or ambivalence) occurs when a person is drawn to a situation (or person) but also repelled from it, both at the same time (Miller, 1983; Miller & Rollnick, 2002).

#### *2.9.7.6 Task complexity*

The strength of the goal-performance relationship generally diminishes as task complexity increases (Locke & Latham, 2002). When confronted with simple or familiar tasks, people generally engage whatever knowledge and skills they already have. However, as novel task complexity increases, the goal effect tends to become more dependent on one's ability to deliberately plan and develop new and appropriate *learning strategies* to facilitate goal achievement. Thus, compared to people with low self-efficacy, people with high self-efficacy are more likely to actively pursue and develop appropriate and effective learning/task strategies, when presented with a novel task goal (Wood & Bandura, 1989).

People learning new and complex tasks may benefit from the setting of proximal goals (see below), and by seeking proximal feedback. This feedback may help them to identify and limit any errors that are impeding their progress towards their goals. Framing the goal as a 'learning process' may facilitate the adoption of optimal learning strategies such that a person may acquire the knowledge necessary to perform the task. Conversely, if a complex task goal is framed ostensibly as a performance outcome goal, then such an 'outcome focus' may cause excessive anxiety that may actually interfere with the ability to acquire the knowledge and appropriate strategies to perform the task. In such a case, people may actually perform better if asked to simply to 'do your best' (Locke & Latham, 2002). While the setting of goals is

notably related to motivation, high goals requiring complex tasks and skills that are simply beyond one's ability are unlikely to be achieved (Locke & Latham, 1990).

### *2.9.8 The high performance cycle*

From within the field of industrial psychology, researchers proposed an explanation for what has been termed 'The High Performance Cycle'. This refers to the setting and achievement of high goals leading to the subsequent setting and achievement of even higher goals. Latham, Locke and Fassina, (2002) propose that their cycle reconciles the often observed upward spiral of performance, with the related goal level, satisfaction and self-efficacy constructs. Latham, Locke and Fassina's cycle is grounded in, and begins with, the already well established premise that the setting of high goals leads to high performance. Consequently, the achievement of high performance leads to rewards (intrinsic and/or extrinsic) and these rewards lead, in turn, to increased satisfaction and an increased perception of one's efficacy to overcome successfully even higher challenges, via the setting of even higher goals (Latham, Locke, & Fassina, 2002; Locke & Latham, 2002).

### *2.9.9 Goal orientation*

Goal orientation is a label used to describe the particular pattern of cognition and action that an individual evokes in their pursuit of either *mastery* (learning) or *performance* goals (sometimes termed a process/outcome orientation) (DeShon & Gillespie, 2005). Goal orientation is an important construct that may influence individuals' motivation and their propensity to change. *Mastery* orientation is characterised by an individual's tendency to set goals that invoke

learning the new skills necessary to increase one's competence at an existing task, or a new and/or more challenging task. *Performance* orientation is characterised by an individual's desire to 'do well' (the outcome) and to be positively evaluated by others (Phillips & Gully, 1997). Whether goal orientation is state-like or trait-like is still largely a point of conjecture. One perspective is to consider goal orientation as a stable trait (stable over situations and domains and/or over time), and conversely, goal orientation may be viewed as being state like (situation and domain specific). DeShon and Gillespie (2005) reconcile both perspectives and propose that, normal, 'within person' variability in personality-relevant behaviour is typically high on a daily basis, however, the central tendency of an individual's behavioural distribution ('typical behaviour') is rather stable over time. Therefore, *dispositional* goal orientation may usefully be described as a quasi-trait: a somewhat stable trait that can be modified by certain situational characteristics (DeShon & Gillespie, 2005). Thus, in situations where there are few environmental cues to guide behaviour, an individual may tend to revert to the goal orientation to which he or she is predisposed (his or her *dispositional* goal orientation). Conversely, when situational/environmental cues strongly suggest appropriate behaviours, then the individual may tend away from his or her predispositional goal orientation and may tend to adopt a *'domain specific'* or 'state like' goal orientation (DeShon & Gillespie, 2005).

A person's preferred goal orientation may be underpinned by early childhood experiences. The nature of parental feedback has been shown to influence individuals' goal orientation in later life. Researchers Elliot and McGregor (2001) demonstrated that subjects' retrospective reports on how their parents responded to their behaviour during childhood, predicted subsequent goal orientation on an undergraduate examination test task. Subjects, who recalled being subjected

to person-focused negative feedback, were more likely to hold performance-avoidance goals and mastery-avoidance goals (and a tendency to view failure as a negative event to be avoided) and subjects who recalled person-focused positive feedback tended to hold performance-approach goals (in an attempt to stand out as competent relative to a normative reference).

Whatever an individual's goal orientation may be, each goal *type* (mastery or performance) is presumed to represent a distinct perceptual-cognitive framework. Mastery and performance goals have been shown to lead to different patterns of processes and outcomes and goal orientation may be salient to explaining and influencing individual differences in the plasticity of behavioural responses (Ames, 1992; Dweck, 1999; Urdan, 1997). For example, engaging in adaptive versus maladaptive behaviours in the face of a potentially life changing health event. Furthermore, it is thought that individuals who are orientated toward mastery goals *believe* that their abilities are malleable and thus approach tasks with the objective of further developing their skills and abilities. For mastery orientated individuals, past experiences, even 'failures', are likely to be viewed as learning experiences, and provide valuable feedback that may facilitate still further skill development. Conversely, individuals who are oriented towards performance goals are more likely to interpret past sup-optimal performances literally *as* failures. These failures are likely to impact negatively on the individual's self-efficacy and self-concept, and failure may invoke reduced performance or even 'giving up' completely (Phillips & Gully, 1997).

In the past, much of the goal orientation research has focused on the two goal orientations: mastery goals and performance goals and opinion has at times been divided as to whether the

goal orientation is best conceptualised as a two factor construct or a bi-polar continuum (Dweck, 1986; Nicholls, 1984). However, more recent research has further deconstructed goal orientation into first a trichotomous (Elliot & Church, 1997), and still more recently, a four factor matrix (Elliot & McGregor, 2001). Elliot and Church conducted three experiments in which the academic goals of 180 undergraduate students in an introductory-level psychology class setting were evaluated using an achievement goal questionnaire. The researchers' aim was to validate their proposed 2x2 goal orientation matrix (figure 1) which assigns *valence* to both performance *and* mastery goals. Research indicates that people process most sensory information in terms of valence. In other words, whether a stimulus suggests a positive, desirable possibility (success) or a negative undesirable possibility (failure), and that this 'valence-based' processing is automatic and produces *immediate* approach or avoidance behavioural dispositions (Bargh, 1997). Thus, Elliot and McGregor (2001) applied the concept of valence to the *mastery* goal construct, further deconstructing mastery goals into mastery-approach and mastery-avoidance goals (as they had previously with the performance-goal construct, see Elliot & Church 1997).

To view mastery-*avoidance* goals as valuable in health promotion and chronic disease management is perhaps at first counterintuitive. Most lay people and many researchers alike, might assume that mastery-*approach* goals represent the 'gold standard' or 'ideal' form or type of goal: i.e., to achieve success, to achieve something of value. However, for many, in the domain of health and particularly chronic disease self-management, and/or simply 'ageing well', the mastery-avoidance goal construct may become increasingly salient (Elliot & McGregor, 2001). Some examples of the mastery-avoidance goal in a health context include: a

frail individual avoiding hazards that could lead to a fall, a type 2 diabetic striving to avoid secondary complications such as lesions and infections, a person in old age simply striving to avoid deterioration in performing daily tasks.

**Table 4** •The 2 X 2 achievement-goal framework. Goal *definition* and *valence* represent the two dimensions of competence. Thus, a*bsolute/intrapersonal* and *normative* represent the two ways that competence can be defined and *positive* and *negative* represent the two ways that competence can be valenced (Elliot & McGregor, 2001).

| | **Goal Definition** | |
|---|---|---|
| Valence | Absolute/intrapersonal (Mastery) | Normative (Performance) |
| Positive (Approaching | **Mastery-approach goal** | **Performance-approach goal** |
| Negative (Avoiding failure) | **Mastery-avoidance goal** | **Performance-avoidance goal** |

Elliot and McGregor (2001) summarised that mastery-avoidance goals represent a complex interaction of optimal and sub-optimal components: that is, mastery (need for achievement) and avoidance (e.g., fear of failure). In the setting of goals, or when facilitating goal setting in health promotion and/or behaviour change settings, one might choose to consider the *context* in which the goal is being set. Factors to evaluate may include the individual's past history and any apparent behavioural pre-dispositions, the individual's 'time of life', the individual's current health status, the individual's dispositional optimism and any relevant socio-cultural factors. Elliot and McGregor (2001) propose that, at times, mastery-avoidance goals may well have a more negative pattern of consequences than mastery-approach goals, especially among individuals who bring non-optimal motivational dispositions into optimally structured achievement settings. *However*, depending on context, such avoidance-goals may still be appropriate. Generally, 'ideal' goals elicit the greatest motivation for a desirable change and,

depending on the context, such goals may well be valenced as approach-goals (success) *or* avoidance-goals (avoiding failure).

### *2.9.10 Needs and values*

While all humans have similar fundamental needs (e.g., food, water, shelter, love) no two people hold identical value hierarchies. A "value" has been described as "that which one acts to gain and/or keep" (Rand, 1964, p. 16). Values represent individualised *preferences* that are held consciously or subconsciously to be advantageous to one's well-being. Values prioritise needs and are the most salient determinants of human action and the key to individual differences in motivation (Locke, 2001). To value oneself and to view oneself positively is said to be fundamental to human functioning (Maslow, 1968; Rogers, 1951, , 1957). Values help humans prioritise short and long term pleasures and a given behaviour is usually motivated by the interaction of multiple and sometimes conflicting values. Thus, people may pursue things that give them short-term pleasure, or short term relief from pain or discomfort, even when such pleasures may harm them in the long term (Locke, 2001).

Peoples' emotions may or may not accurately reflect conscious assessments of, or hierarchical prioritisation of their values. Different emotional states, impaired self awareness and errors of introspection may all lead people to behaviours that are not congruent with their subconscious value hierarchies (Locke, 2001). It has been suggested that most ill health and disease is actually the direct result of things people willingly do to themselves (Fuchs, 1998; Iglehart, 1990). In the example of a person who smokes, yet professes to value good health, it would appear that that person is perhaps weighting the value of short term relaxation and stress relief

more greatly than his/her conscious value of good health over time. Setting goals that are prioritised and that are based on conscious value hierarchies is critical to successful health behaviour change (Miller & Rollnick, 2004).

To pursue long-range values, Locke (2001, p. 304) summaries that one requires a continual act of focus on:

What one wants to achieve
The reasons one wants to achieve it
The goals to be set
The means to achieve them
How to prioritize conflicting demands
How to overcome obstacles and setbacks
How to attain, at the end, the value that one envisaged

#### *2.9.11 Goals as reference points*

A broader perspective on goal theory has been formulated from the integration of empirical findings relating to risk, gains and losses (from within the field of economics), and that of traditional goal theory. Heath, Larrick and Wu (1999) drew upon and expanded Kahneman and Tversky's (1979) Prospect Theory, in particular, (1) the principal that goals serve as reference points for gains and losses, that in turn alter peoples' subjective valuation of outcomes (the 'value function'), (2) the principle of loss aversion and (3) the principle of diminishing sensitivity.

Heath, Larrick and Wu propose (in part, not particularly divergent from traditional goal theory)

that whenever a person holds a specific point of comparison as psychologically salient, then that point will become a reference point or goal. People generate mental representations of their goals and the likelihood of achieving them, however, these subjective assessments of probabilities may be quite different from the objective truth and people are highly sensitive to how choices are presented or "framed" (Kahneman & Tversky, 1979). Thus, the value of an outcome may be defined in terms of gains and losses or positive/negative deviations from a reference point. Kahneman and Tversky (1979) drew upon extensive research in the field of economics and deduced that in fact people generally perceived losses as more painful than gains of equal magnitude, thus people are loss averse. The researchers proposed that people generally perceive losses to be approximately two to four times (typically 2.25 times) more painful than the equivalent gains would be perceived to be pleasurable (termed the coefficient of loss aversion). A coefficient of loss aversion of two, for example, implies that people who are below their goal by "*x*" will work twice as hard as when they are above their goal by the same amount "*x*". This gives rise to the asymmetry of slope (flatter above versus steeper below the reference point) to the "*S*" shaped 'value of outcome curve' in figure 1.

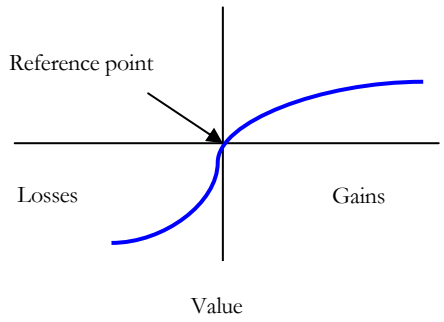



**Figure 2** •A typical value function. Its three main features are the reference point, loss aversion and diminishing sensitivity (Heath, Larrick, & Wu, 1999)

Heath, Larrick and Wu (1999) apply the third principle of Prospect Theory to a personal goal setting context: that of *diminishing sensitivity*. Diminishing sensitivity infers that psychologically salient outcomes (goals) have a smaller comparative (per unit of performance) impact when they are more distal (Tversky & Kahneman, 1992). This principle of diminishing sensitivity predicts that people should be willing to exert more effort toward their goal as they approach their goal and less effort as they move away. The diminishing sensitivity effect gives the curvature to the 'value of outcome' curve in figure 2. Thus, as people move near to their goals, they become more sensitive (motivated) to further movement toward their goal. Conversely, when people are far from their goals, they may not perceive that they are making much progress toward their goal (low sensitivity), and resultantly, they may experience low motivation and/or may fail to initiate any action at all. Heath, Larrick and Wu (1999) refer to this motivational hurdle as "the starting problem" whereby a goal that is set unrealistically high and/or distal, fails to influence motivation sufficiently to overcome the inertia of the status-quo. Traditional goal theory would describe this situation as simple failure to commit to a goal, however, (Heath, Larrick, & Wu, 1999) propose that people do usually commit to their unrealistic goal initially, however, in time the unrealistically high goal alters their values (value of outcome) and this in turn induces the 'starting problem' and failure to remain committed to the goal results (a manipulation of semantics perhaps).

#### *2.9.12 Proximal and distal goals*

Distal goals serve an orientating function and may facilitate persistence over time and proximal goals regulate effort and provide guidance in the present. *Intentions* are another

common category of 'lay-goals' and intentions arguably imply that a person is still less than fully committed to his or her goal. Intentions are essentially proximal goals that represent what an individual aims to do, or, a behavioural change an individual would like to effect (Bandura, 1998). For example, "I intend to start exercising once I have my medical clearance" is a proximal goal articulated as an intention. The concurrent distal goal may be something like, "I aim to bring my average blood glucose levels within recommended limits within six months". Congruent with Bandura's (1998) social cognitive theory, proximal goals are thought to facilitate task mastery which in turn enhances self-efficacy in an ascending positive spiral. Heath, Larrick and Wu (1999) take a different perspective on the mechanisms by which proximal goals may enhance progress toward a distal goal, i.e., proximal goals increase individuals' sensitivity to any incremental *progress* toward their distal goals by providing 'intermediately reference points'.

Proximal goals may enhance the psychological salience of each and every unit of performance, even when objectively, one unit of performance may contribute only a very small amount in the context of the overall distal goal. An experimental study by Latham and Seijts (1999) examined the effects of proximal and distal goals on the performance of a 'toy assembly task' by a group of 39 young adults. Latham and Seijts demonstrated that subjects who held proximal *and* distal goals far outperformed subjects who held 'do your best goals' and/or those who held only distal goals. Self-efficacy was shown to increase significantly with the addition of proximal goals and proximal goals tended to focus subjects' attention on the development of task appropriate strategies. In summary, the researchers demonstrated that concurrent proximal and distal goals far outperformed distal goals alone and they far outperformed 'do your best

goals' and no goals at all. A similar and related concept is embedded in Vygotsky's (1978) "Zone of Proximal Development", wherein a child's learning (the goal) is optimised when a teacher (or more capable peer) 'extends' the child's learning with feedback and direction that is pitched 'just ahead' (proximal goal) of the child's current stage of development. This same principle may also be applied to adults in their learning of new health-related behaviours. Thus, there is strong evidence for the setting of proximal *and* distal goals in the domain of health behaviour change, as well as many other domains of life.

### *2.9.13 The satisfaction-paradox*

Goals have been described as the point of inflection between *satisfaction* and *dissatisfaction* (Mento, Locke, & Klein, 1992). If one accepts Bandura's (1986) notion that self-satisfaction is a general goal held by most people, then people who set high standards must exert more effort and accomplish more to achieve satisfaction, compared to people who set low standards: thus, the 'satisfaction paradox'. Bandura (1986) describes goal-setting as a discrepancy creating process whereby a person cycles between equilibrium and dis-equilibrium. People set goals for themselves that create a discrepancy (dis-equilibrium) between their present reality and some specifically chosen future outcome. They then pursue their goal and thus re-establish a state equilibrium (for example, a new higher level of performance or a new behaviour). If it is more difficult to get satisfaction from high goals and satisfaction is generally desirable, why then does everyone not choose low goals? Why should people be generally inclined to set themselves goals of progressive improvement?

Mento, Locke, and Klein (1992) conducted eight experimental studies that investigated the

satisfaction levels of 114 undergraduate business students performing various cognitive tasks (which were set as specific goals), at three goal levels ranging from simple to difficult. Mento, Locke, and Klein (1992) suggested that the answer to the satisfaction-paradox lies in the complex interplay of one's self-concept, self-efficacy, and the *value* that one attaches to the many psychological and practical outcomes or 'rewards' that usually accompany the achievement of high goals. Conversely, people who set low goals may achieve success and satisfaction *more* easily and/or *more* often than those with high goals but they are also likely to have lower pride in their accomplishments and fewer psychological and practical rewards (Mento, Locke, & Klein, 1992).

Mento et al. (1992) summarised their findings and stated that there were two generalised explanations for the observed differences in their subjects' standard setting and subsequent satisfaction levels. Firstly, higher goals generally incur higher costs in terms of effort and/or sacrifice of many short term gratifications. People are not likely to set high goals if the pursuit of high goals is not part of their self-image and value-structure. Secondly, the subjects differed considerably in their self-efficacy to complete the various tasks. Differences in self-efficacy have been shown to affect performance via the influence that self-efficacy exerts on both goal choice and goal commitment (Locke & Latham, 1990; Locke, Shaw, Saari, & Latham, 1981). Locke and Latham (1990) describe goal choice as "a function of what the individual thinks *can be* achieved and what he or she *would like* to achieve or thinks *should be* achieved" (p. 122). In general, people adopt personal standards which are congruent with their self-concept. People are more likely to feel satisfaction from their accomplishments when they ascribe their successes to their own abilities, strategies and efforts, rather than to chance or special external

aids or supports (Bandura, 1968, , 1977a).

### *2.9.14 Summary/Conclusion*

The simplicity of the premise *conscious goals affect action* (Ryan, 1958) almost veils its salience. That goals determine the direction, intensity and duration of action (Locke & Latham, 1990) is perhaps the most versatile and helpful, yet perhaps underutilised concept in the self-management of our health. The finding that higher level goals lead to higher performance is important in health behaviour change and the maintenance of health promoting behaviours, as it is in other domains of life. Piaget's (1981) suggestion that peoples' *interests* represent the point of juncture between one's values and one's motivation is a potentially useful guiding principle for those facilitating and those engaged in lifestyle and health behaviour change. As demonstrated within the literature, without *commitment*, a goal is at best notional and without at least some degree of *interest* in a goal outcome, there can be no commitment. There have also been many other findings that may be usefully applied to the setting of effective goals, including the importance of self-efficacy, social modelling, satisfaction, competition, combining proximal and distal goals, feedback, specificity, goal orientation, publicness, volition and values, and all of these may be practicably applied within the domain of health.

Goals, however, are not generated in a vacuum. Peoples' goals for their own behaviour are dynamically influenced by both intrinsic and extrinsic expectations, and any pervasive messages being conveyed to them by their environment. These 'environmental cues' tend to be firmly embedded within our society and culture and at times they may act at the level of the subconscious. However, people *can* gainfully engage in goal-setting to achieve and maintain

optimal health. To do so, individuals must exercise volition and direct their efforts with intensity and persistence and counter the many pervasive messages and environmental cues that may lead away from optimal health. Because individualised value systems are just that, 'individualised', then in the domain of health, helping people to develop the goal-setting skills necessary for them to achieve the things that they value, is surely utilitarian.

# 3 METHODOLOGY

## *3.1 Research purpose*

The purpose of this research is to investigate the role that physical activity plays (or may play) in the self-management of type 2 diabetes, within a group of newly diagnosed diabetic patients in a metropolitan New Zealand health care setting/community. Further, the research seeks to elucidate how selected psychosocial constructs may influence a newly diagnosed type 2 diabetic patient's adaptation to this significant life event.

## *3.2 Research protocol*

Approval for this study was granted by the Upper South Ethics Committee B in accordance with the Ministry of Health's *Health Research Council of New Zealand* procedures. The application included approval from *The Health Sciences Centre University of Canterbury*, and *The Christchurch Diabetes Centre* (the host institution), and additionally, Māori consultation and approval was given by the Canterbury District Health Board's *Te Komiti Whakarite* (Māori Consultation Committee).

In addition, each subject signed an informed consent form after being given the opportunity to read the introductory letter and the subject information sheet (Appendix A) and after having the study explained by the principal researcher and having had any questions answered to the subject's satisfaction.

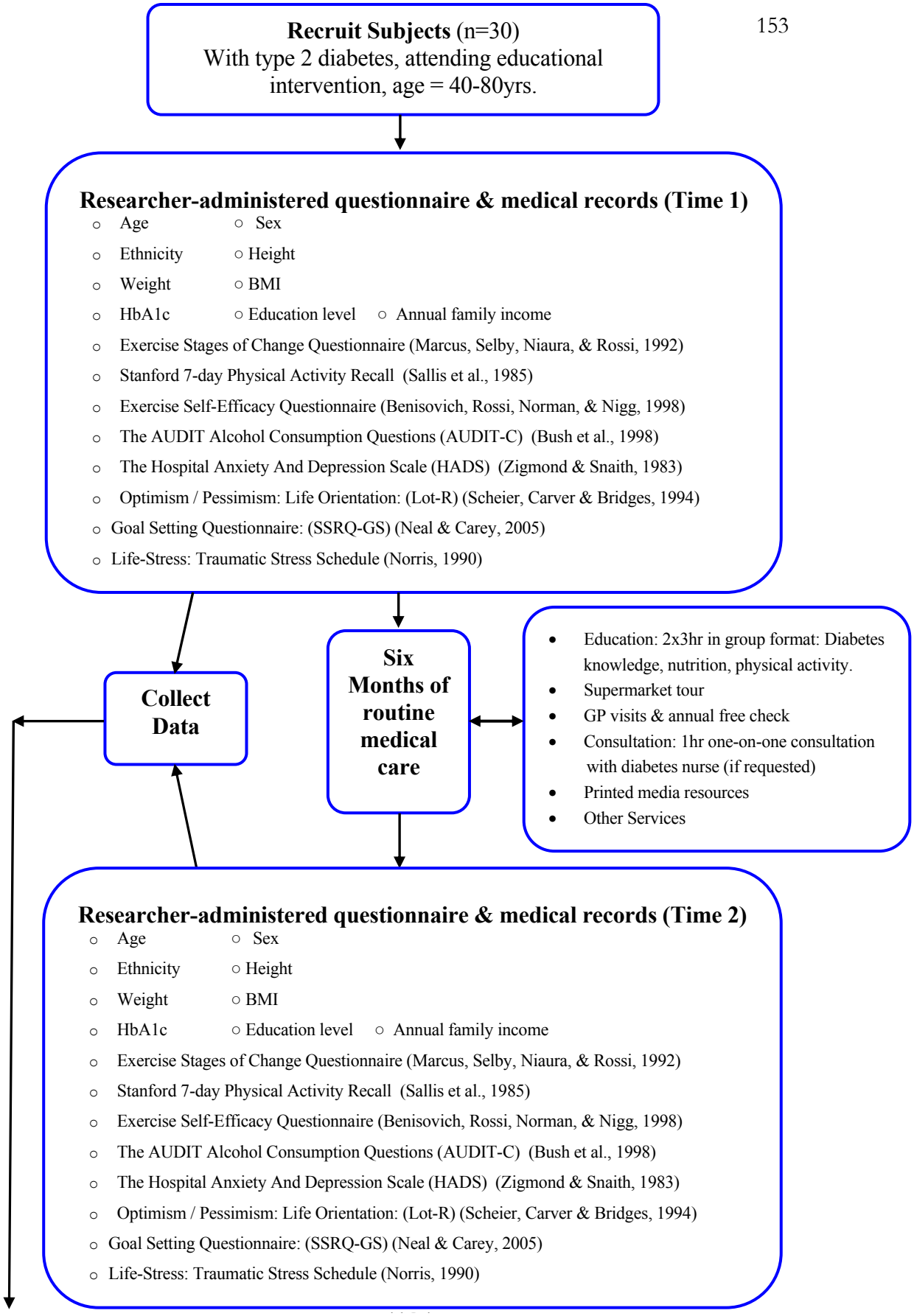
The study involved co-operation by individuals other than the researcher, for example staff at the Christchurch Diabetes Centre. Permission for the use of resources and/or facilities was

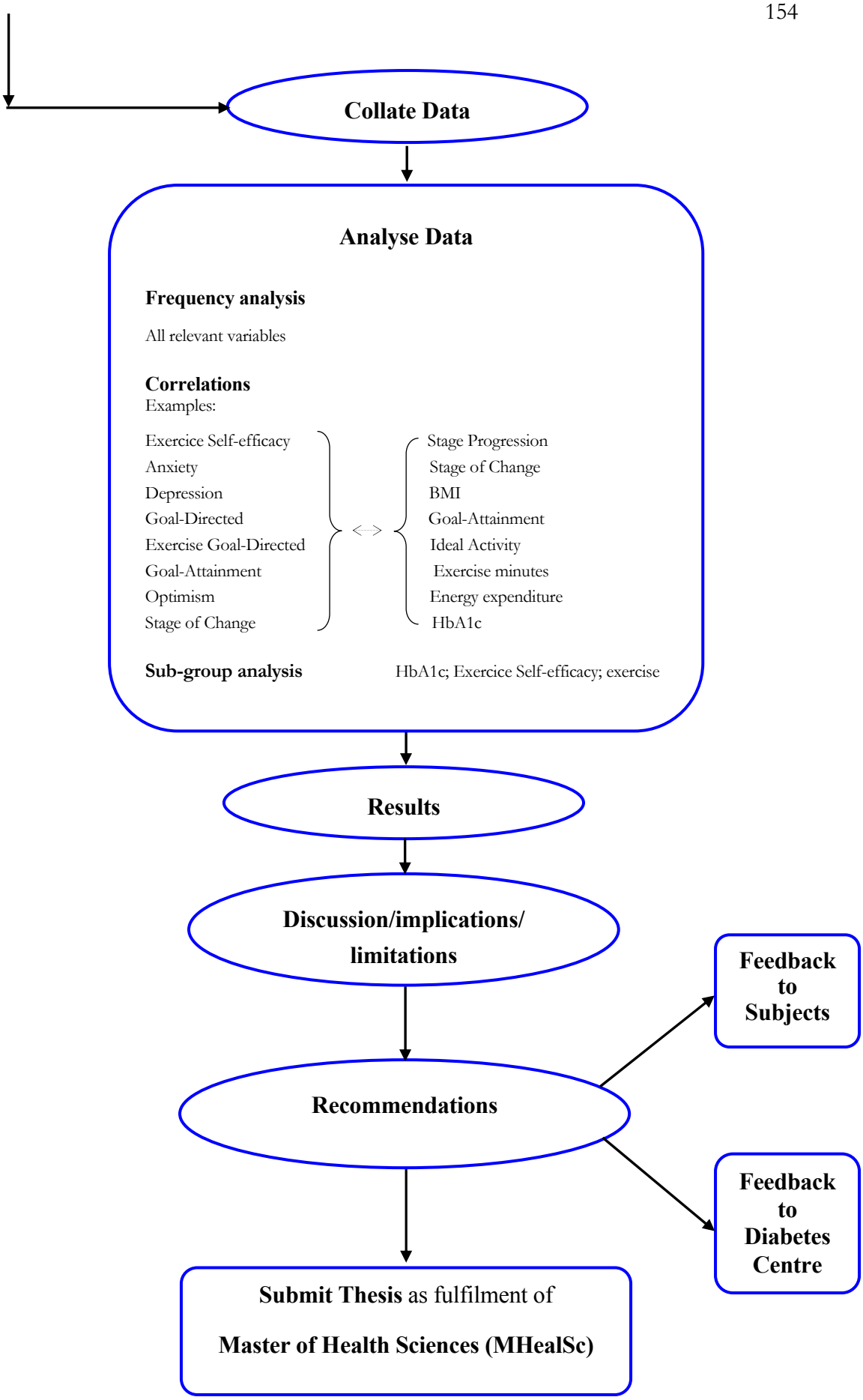
obtained and coordinated by the Diabetes Centre unit manager and diabetes educator, as appropriate.

### *3.3 Study Design:* Six month prospective observational cohort study

A researcher-administered retrospective questionnaire (appendix B) was completed with all subjects at 'baseline' (at the time of the first patient education seminar *or* within one month of diagnosis), and again at six month 'follow-up'. The questionnaire comprised validated instruments selected to measure the psychological/psychosocial parameters of interest, and simple biochemical measures and demographic data were also collected from the subjects. Additionally, two questionnaire items (see attached sample questionnaire: Section "I" Q1; Q2) elicited descriptive responses from the subjects that were recorded verbatim (appendix E) for qualitative analysis. Figure 3 outlines the study design diagrammatically.

**Figure 3** **Study design flow-chart**




Collate Data
Analyse Data
Frequency analysis
All relevant variables
Correlations
Examples:
Exercice Self-efficacy
Anxiety
Depression
Goal-Directed
Exercise Goal-Directed
Goal-Attainment
Optimism
Stage of Change
<->
Stage Progression
Stage of Change
BMI
Goal-Attainment
Ideal Activity
Exercise minutes
Energy expenditure
HbA1c
Sub-group analysis
HbA1c; Exercice Self-efficacy; exercise
Results
Discussion/implications/ limitations
Recommendations
Feedback to Subjects
Feedback to Diabetes Centre
Submit Thesis as fulfilment of
Master of Health Sciences (MHealSc)

## *3.4 Subjects*

### *3.4.1 Recruitment*

The study participants (subjects) were recruited from those individuals attending the Christchurch Diabetes Centre education seminars. The Christchurch Diabetes Centre is located at Christchurch Public Hospital and provides clinical, educational and other services to diabetes patients from the Canterbury district. Patients are referred to the Centre by their General Practitioners (GPs) or other community based health professionals, following a diagnosis of diabetes or pre-diabetic conditions. The Diabetes Centre provides specialized patient services that comprise a sub-set of 'routine medical care' for diabetic patients in the Canterbury region. As part of routine medical care, the Diabetes Centre conducts monthly education seminars which cover a range of topics including (but not limited to) pathophysiology, diet, exercise, medication, self-testing of blood glucose, and foot care. The education seminars are in the form of an interactive group lecture with the addition of a quasi-experimental practical demonstration of blood glucose reduction following a 10minute bout of light/moderate physical activity (performed to an extract of the Arthritis Foundation's armchair exercise video).

During the recruitment phase, a written introduction to the study (appendix A) was presented to all participants in the Christchurch Diabetes Centre group education seminars at their first meeting. An overview of the research project and a request for subject participation (recruitment) was presented by the researcher at their second seminar and the subject information sheet was provided for all the interested individuals. Subsequently, telephone

follow-up and the booking of interview times was conducted by the researcher approximately one week later, thus catering for those subjects who needed ample time to consider their potential involvement in the study.

Patients who attended the Diabetes Centre education seminars during the seven month recruitment period (1st March 2006 and 31st September 2006) were invited to participate in the study. In an effort to minimise selection bias, subjects were selected serially (i.e. consecutive patients who presented to the Centre) from those who met the inclusion/exclusion criteria (see below). Refusals were substituted by the next eligible patient until the recruitment period end-date was reached (as determined by the time and financial resource constraints of the Masters Thesis Research Project), at which time n=33. The degree to which the sample was representative of the wider population was established by comparison of the sample with Ministry of Health (2005) data. The sample was considered broadly representative of the wider Canterbury population. Of particular note is the low percentage of Māori, Pacific, and other minority ethnicities attending the education seminars, and subsequently recruited for the study. Only two study subjects described their ethnicity as Māori (one of these subsequently being lost to follow-up). No other minority ethnic groups were represented. Thus, the study group was considered to reflect both the lower proportion of Māori and Pacific people in the Canterbury region, and also the predominant trend of underutilisation of services by Māori and Pacific people, despite their significantly higher diabetes prevalence (Ministry of Health, 2002, , 2005). The recent Barnett, Pearce and Howes (2006) study investigated current provision and utilisation patterns for diabetes education in New Zealand. The researchers found that Māori and Pacific People were significantly under-represented in membership of diabetes societies

(accounting for only 2.8% of total membership), despite being in the order of 2.2 times more likely to develop the disease (Ministry of Health, 2005). This 2.8% representation in the diabetes societies matches closely the 3.3% representation in this current research study group. Barnett, Pearce and Howes (2006) emphasised that Māori and Pacific people comprise 8.2% of all persons actually *diagnosed* with diabetes in Christchurch and that this proportion may be as high as 30% in the most deprived deciles. In summary therefore, the current sample was considered adequate because it is representative of current service *utilization* patterns in Christchurch, however, it is acknowledged that the sample does not necessarily reflect the true *prevalence* patterns of diabetes in Christchurch (see section 5.2.10 for further discussion on limitations).

### *3.4.2 Inclusion criteria*

Those included in the study were individuals recently (within one month) diagnosed with type 2 diabetes between 1st March 2006 and 31st September 2006, who were entered on the Christchurch Diabetes Centre database, who attended the diabetes education programme, who were aged between 40-80years, who had no/minimal co-morbidity or physical disability that would preclude their engagement in regular physical activity, and were individuals who may benefit from physical activity and are physically able to engage in daily physical activity, and who were non-insulin dependent.

### *3.4.3 Inclusion criteria rationale*

In defining the study population, consideration was given to each of the above inclusion

criteria so as to delineate a reasonably homogenous population with respect to bio-chemical, physical, and diabetes knowledge parameters, so that the selected psychosocial correlates and exercise behaviours could be studied effectively. For the purpose of this study, the requirement for the participants to have the ability and capacity to engage in physical exercise is self evident. With reference to the remaining inclusion criteria, the factors underpinning the next two most salient considerations, 'time of type 2 diabetes diagnosis' and 'age,' are detailed below

When considering the management of diabetes it is first necessary to differentiate between *type 1 diabetes* and *type 2 diabetes*. While the two conditions share many pathophysiological features, they are in fact separate conditions, with differing antecedents, management strategies and outcomes (see glossary of terms for definitions). Type 2 diabetes was selected for this study as it represents approximately 90% of the diabetic population (New Zealand Ministry of Health, 2001), and the disease trajectory has been shown to be highly modifiable by 'lifestyle' factors including physical exercise behaviours (Turner, Cull, & Holman, 1996; U.K. Prospective Diabetes Study Group, 1995). With respect to *time* of diagnosis as a recruitment criterion, the intention was to gather baseline data as near to the time of initial diagnosis as practicable, i.e. as early in the disease trajectory as possible. It is emphasised that type 2 diabetes is a progressive disease, and one that is often asymptomatic for some years before diagnosis (W.H.O., 1999). Therefore, for each individual, the time of diagnosis will align idiosyncratically with actual disease progression and/or symptoms. The recruitment strategy was designed to search out diabetic patients as near as practicable to the time when they first became *cognisant* of their disease state. The purpose of this early data collection was

to minimise the likelihood of patients having already implemented cognitive and/or behavioural strategies in response to having been diagnosed with this potentially life-changing disease. Further, it was considered advantageous to recruit participants *after* the Diabetes Centre's education seminars thus controlling for diabetes education/knowledge levels, which, in all likelihood could otherwise have been variable. In summary, the recruitment strategy was designed to draw together baseline data that was as '*baseline'* as possible (see discussion chapter 5.2.10 for comment on recruitment limitations).

With respect to subject age, type 2 diabetes has also been defined as diabetes with *onset* in the 25–89 year age range (Ministry of Health, 2002), so this 25-89 year age range was considered as a starting point for this current study. However, this age range was narrowed downwards to exclude those over 80years to reduce the confounding effects of the typical, but not universal, decline in physical/functional capacity generally experienced by most people in their latter years. Further, the lower age limit was raised to 40 years for the purpose of narrowing the focus of the study to middle-to-late adulthood. The intention was to set the age range sufficiently wide to provide a large enough pool of potential participants from which to recruit, yet narrow enough to provide a sample representative of the specific *'developmental'* span wherein certain 'life-style' factors and/or behaviours may have become well established. Specifically, certain obesogenic behaviours may predispose a person to, and subsequently lead on to, the development of the so called 'life-style' diseases of obesity, hypertension and type 2 diabetes; such disease states tend to be progressive over time.

### *3.4.4 Exclusion criteria*

Those excluded from the study were individuals who had been diagnosed with type 2 diabetes before 1st Feb 2006, had been diagnosed with type 1 diabetes (or who were insulin dependent), had not attended the diabetes education programme, were aged < 40years or >80years, or had co-morbidity or a physical disability that would have precluded their engagement in regular physical activity or had been recommended by a health professional not to engage in physical activity.

## *3.5 Instruments and measures*

A battery of instruments was assembled into a retrospective 'researcher-administered questionnaire' (appendix B) that took approximately one hour to complete. Additional data comprised subject demographics and bio-chemical measures (subject's height, weight, and blood Haemoglobin A1c).

### *3.5.1 List of instruments*

(1) Exercise Stages of Change Questionnaire - Short Form (Marcus, Selby, Niaura, & Rossi, 1992).
(2) The Stanford 7-day Physical Activity Recall (7DPAR) (Sallis et al., 1985).
(3) Exercise Self-Efficacy Questionnaire - Short-Form (Benisovich, Rossi, Norman, & Nigg, 1998; Marcus, Selby, Niaura, & Rossi, 1992)
(4) The Alcohol Consumption Questionnaire (AUDIT-C) (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998).
(5) The Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983).
(6) The Life Orientation Test-Revised (Lot-R): (Scheier, Carver, & Bridges, 1994).
(7) The Short Self-Regulation Questionnaire - Goal Setting (SSRQ-GS) (Neal & Carey, 2005).
(8) The Traumatic Stress Schedule (Norris, 1990).

### *3.5.2 List of demographics*

(1) Age

(2) Sex

(3) Smoking: Current smoking was assessed with a simple yes/no response category.

(4) Ethnicity: Ethnicity was assessed using the 1992 Census question, as specified by the Ethics Committee for use in health research.

(5) Education: Education levels were assessed using the Education questions (Q279- 280) from the Life in New Zealand Questionnaire (1991)

(6) Income: Income was assessed using the Income question (Q293) from the Life in New Zealand Questionnaire (1991)

### *3.5.3 Bio-chemical measures*

(1) Height: The subject's height was measured with a tape measure and set-square, with the subject standing straight and against a wall, shoes removed. This method was portable and reduced any inaccuracies due to recall error, as not all subjects knew their own height.

(2) Weight: The subject's weight was measured (shoes off) using portable electronic scales provided by the researcher. Two measurements were taken and averaged. A correction factor of -300g was applied to the baseline weight measures (as deemed necessary on a case-by-case basis) to compensate for typical winter clothing as compared to typical summer clothing at follow-up.

(3) HbA1c: HbA1c was tested at baseline and at follow-up by an independent laboratory.

### *3.6 Administering the questionnaires*

The survey questionnaire was administered to each subject in a face-to-face interview. The face-to-face researcher-administered format was chosen to increase researcher/subject rapport, increase the accuracy of data collection and enhance subjects' recall of relevant information. The face-to-face format has been shown to increase accuracy of subject recall, particularly in the case of the Stanford 7-day Physical Activity Recall instrument which expressly encourages the interviewer to prompt the subject to elicit a fuller recall of physical activity events. The face-to-face format may also be considered as more culturally appropriate (Health Research Council of New Zealand, 1998) for some interviewees and ensures the subject (not another person) answers the questions him/herself. Interviews were conducted in a place/time situation suitable to the subject and this was generally in the subject's home.

#### *3.6.1 Questionnaire scoring and data entry*

Following each interview, the subject's questionnaire was scored using a template created in Microsoft Excel ®, specifically for the purpose (see example subject summary appendix C). The individual's data were then transferred to the main data-base also created in Microsoft Excel ®. The scoring and data entry were completed for each subject individually and as soon after the interview as possible so as to increase the accuracy of data entry by avoiding any cumulative errors arising from entering group data concurrently and to make the data entry process less arduous.

The completed Microsoft Excel ® data-base was imported into the SAS programme and initial *contents format*, *contents variables* and *attributes*, and *frequency outputs* were generated. To

determine the validity of the data, all the initial outputs were examined by the researcher to check for anomalies, particularly, missing data and any response values that were outside the response score parameters on any particular variable.

## *3.7 Data analysis*

### *3.7.1 Statistical procedures utilised*

#### *3.7.1.1 The Pearson coefficient*

The *Pearson coefficient* is the correlation coefficient employed to identify any relationships between the selected variables of interest. The *Pearson product-moment correlation coefficient* (*r*) is a measure of the relationship between two variables as measured on the same subject, thus, '*r'* is a measure of the *tendency* of the two variables to increase or decrease together. However, a strong correlation between two variables does not *necessarily* imply causation. Pearson product-moment correlation coefficients (*r*) range from -1 to +1 and a value of +1 describes a perfect positive relationship between the two variables, i.e. all the data points lie on the same line, increase together, and may be described by a linear equation. An '*r'* value of -1 defines an inverse linear relationship, whereby as one variable increases the related variable decreases. The square of *r* is typically used as a measure of the association between two variables. Consider the two variables '*x'* and '*y'* for example, if the coefficient *r* is 0.80, then 64% of the variance of '*y'* can be 'attributed to' or 'accounted for' by changes in '*x'* (Sterne & Davey Smith, 2001).

#### *3.7.1.2 Correlation and causality*

Generally, the demonstration of a correlation between variables does not imply causation, or the direction of causality. The limitation of *causal inference* is that it is impossible to *directly* observe causal effects (Holland, 1986). However, establishing a correlation between two variables *is* a necessary starting point for determining the nature of a causal relationship. For example, to investigate whether increased exercise self-efficacy leads to (causes) increased exercise participation, it is first necessary to establish if there is any correlation. If so however, any such correlation, however strong, does not *prove* that increasing a person's confidence to exercise will actually lead to increased exercise participation, or if the inverse happens to be true. Further, some other factor/s (or constellation of 'third variables'), for example education, age and/or body weight, may influence either confidence to exercise, exercise behaviours, or both. The terms *positive feedback*, *cumulative causation*, *self-reinforcement,* and *reciprocal determinism* describe another common causal relationship in which variable '*x'* may be the cause of variable '*y' at the same time* as variable '*y'* is the cause of variable '*x'*. For example, success in a weight-loss programme (variable '*x'*) may cause a person to make better food choices (variable '*y'*), and better food choices (variable '*y'*) may lead to success in a weight-loss programme (variable '*x'*).

While correlation does not establish causation, a demonstrably consistent correlation in the expected direction often suggests or increases the probability of some causal relationship. This may identify a starting point for further experimental research that 'rules out' or 'controls' for other possible false causes and confounders (Dixon & Massey, 1983). The

'gold standard' study design used for establishing causality is the randomized control trial (RCT). This design involves randomisation of the subjects to two or more groups and if the manipulation or *intervention* has a significantly large effect on the treatment group, as compared with no intervention in the control group, then it can be said that a causal effect is highly likely. Only when the data have been gathered by a robust empirical method can causality be established credibly (Haynes, 2006).

#### *3.7.1.3 Interpretation of the size of a correlation*

Interpretation of the size and importance of the correlations considered here was guided by the context and purpose of the study. Table 5 presents Cohen's (1888) guidelines for the interpretation of correlation-coefficients for psychological/social research. These guidelines were adopted as a basis for the interpretations and conclusions presented here (Cohen, 1988; Murphy & Myors, 2004).

**Table 5** •Interpretation of correlation coefficients

| Correlation | Negative | Positive |
|---|---|---|
| **Small** | −0.29 to −0.10 | 0.10 to 0.29 |
| **Medium** | −0.49 to −0.30 | 0.30 to 0.49 |
| **Large** | −1.00 to −0.50 | 0.50 to 1.00 |

#### *3.7.1.4 Statistical significance and the "p" value*

In statistics, a result is called "significant" if it is unlikely to have occurred by chance. Results that are statistically significant simply demonstrate that there is statistical evidence that there is an identifiable difference in a particular outcome, however, statistical significance does not

mean the difference is necessarily large, important or clinically useful in the real World. In statistical hypothesis-testing, the p-value is the probability of obtaining a result of at least the same value of a given data point, assuming the data point was the result of chance alone. Thus, the significance level is the probability that the null hypothesis will be rejected in error, when in fact it is true (termed a 'type 1 error' or 'false positive'). The significance of a result is referred to as its p-value; the smaller the p-value, the more statistically significant the result, and three common levels of significance are p=0.05(5%), p=0.01(1%), and p=0.001 (0.1%).

#### *3.7.1.5 Interpretation*

Critics of p-values point out that the criterion used to when deciding if an outcome is statistically significant is based on the somewhat arbitrary choice of level, (often set at 0.05), and that use of this 0.05 level shows a tendency to accentuate the positive (Sterne & Davey Smith, 2001). From an alternative perspective, if the arbitrary choice of level is too stringent, then the possibility exists for potentially important clinical differences to be classified as 'non-significant'. The possibility exists therefore for them to be ignored (type 2 error) while all other 'significant findings' might be assumed to be meaningful and useful (Edwards, Lindman, & Savage, 1963). Combining these two perspectives suggests that results should not necessarily be reported as significant *or* non-significant but that results should always be interpreted in the context of the enquiry and with reference to any other existing and relevant evidence. Sterne and Davey Smith (2001) stress that a 0.05 level of significance does not necessarily provide strong evidence, but it is reasonable to say that p<0.001 does and that the precise p value should always be presented in study results without reference to arbitrary thresholds.

In summary, a correctly applied level of significance that guides the appropriate interpretation of study data should serve to demonstrate whether the direction of a particular effect has been reasonably firmly established and whether the magnitude of any effect is of importance and/or potentially useful (Cox, 1982). Thus, the interpretation of the results gives due consideration to both the statistical significance per se and also to the context and purpose of the enquiry. Thus, no 'blanket' or 'arbitrary' statistically 'significant' level has been selected. As a guideline however, significance levels greater than 0.5 are considered to be providing no convincing evidence of a relationship, although when considering context, *r*s of > 0.05 may still be of interest because they may allude to methodological limitations or they may illuminate avenues for further research.

### *3.7.2 End points*

#### *3.7.2.1 Primary end-points*

(1) To investigate and demonstrate any relationships between physical exercise behaviours, selected psychosocial constructs and selected biochemical measures in type 2 diabetes patients, both initially at baseline (at the time of the first Christchurch Diabetes Centre - patient education seminar *or* within one month of diagnosis) and at six month follow-up.

(2) To identify constructs and/or measures from within the study questionnaire that might, in the future, be incorporated usefully into a 'predictive screening tool' for use in clinical practice and/or diabetes patient education contexts, which could facilitate improved patient engagement with physical exercise leading to improved patient outcomes.

#### *3.7.2.2 Secondary end-points*

(1) To correlate the subjects' self-efficacy for exercise behaviour with physical activity levels and biochemical measures, initially at baseline (at the time of the first Christchurch Diabetes Centre - patient education seminar *or* within one month of diagnosis), and at six month follow-up. Subjects high in Exercise Self-Efficacy are expected to be physically active and report significantly higher levels of physical activity (duration and/or intensity) than subjects tending toward low Exercise Self-Efficacy.

(2) To measure subjects' Optimism versus Pessimism (Life Orientation Test-Revised [Lot-R]) and to correlate life orientation with activity levels and biochemical measures, initially at baseline (at the time of the first Christchurch Diabetes Centre - patient education seminar *or* within one month of diagnosis), and at thesix monthfollow-up. Subjects high in optimism are expected to be physically active and report significantly higher levels of physical activity (duration and/or intensity) than subjects tending toward pessimism.

(3) To correlate the subjects' anxiety and depression levels with exercise behaviour, physical activity levels and selected biochemical measures, initially at baseline (at the time of the first Christchurch Diabetes Centre - patient education seminar *or* within one month of diagnosis), and at six month follow-up. Subjects moderately high in anxiety and depression are expected to report significantly lower levels of physical activity (frequency/duration and/or intensity) than subjects tending toward low anxiety and depression.

(4) To illustrate the subject group's distribution within the Transtheoretical Model (TTM), initially at baseline (at the time of the first Christchurch Diabetes Centre - patient education

seminar *or* within one month of diagnosis), and at six month follow-up.

(5) To undertake a qualitative analysis of subjects' self-reported physical exercise goals, barriers, enablers and the particular exercise modalities engaged in. Subjects who rate highly on 'goal-directedness' are expected to hold individualised and specific physical exercise health goals, be physically active and report significantly higher levels of physical exercise (frequency, duration and/or intensity) than subjects who do not set physical exercise goals in the management of their diabetes.

(6) To undertake a descriptive analysis of subjects' self ratings on goal-attainment, with respect to their physical exercise goals (as described at baseline), and progress toward their *perception* of "ideal" physical exercise for health.

### *3.8 Ethical issues*

(1) Patient confidentiality. Only the principal researcher and project supervisors had access to the raw data and/or clinical records during and after the study. Once scored, each individual's data were coded and subsequently identifiable by subject number only. No personally identifiable data are reproduced here, or will be published in the future. Study documents and subject questionnaires were stored within the principal researcher's locked office. Data were stored on the principal researcher's password protected personal computer. After completion of the study, data will be kept securely for 7 years by the University of Canterbury.

(2) Possible psychological stress/anxiety/depression may have resulted from the survey process highlighting actual/ideal discrepancies and/or ambivalence, (i.e. an individual's current

behaviour and health status being other than their perceived, or real, ideal). This risk was managed by the inclusion of The Hospital Anxiety and Depression Scale (HADS) within the questionnaire. The application to the Ethics Committee stated that any cases of depression as defined by the Hospital Anxiety and Depression Scale would be notified to the study supervisor, the appropriate Christchurch Diabetes Centre clinical team member and/or the subject's G.P. (if subject consent was given). Of the 33 subjects, none met caseness criteria for depression at follow-up, so no such notification proved necessary. Two subjects did score on the upper threshold for depression at follow-up, however, both subjects reported (unprompted and of their own accord) being already under their General Practitioner's care for mild-to-moderate depression. It should also be noted that the wording and terminology used when giving feedback on study findings to individual subjects was given due consideration by the researcher and supervisory team (see example "Individual Summary" report appendix G). The researcher endeavoured to minimise any possible adverse effects of 'labelling". For example, the term 'obese' was changed to the term 'very overweight/obese' to appear slightly less definitive. Further, individual summary reports were only provided to those subjects who requested them and the information letter accompanying each report reinforced to the subject that the report was intended to be non-judgmental. The reports did not classify scores or categories as either 'good' or 'bad', but reference was made to the relevant New Zealand standards and/or Ministry of Health guidelines and citations were included to guide subjects to the source literature, if they desired to access it.

## *3.9 Description of Instruments*

### *3.9.1 Exercise Stages of Change Questionnaire - Short form*

#### *3.9.1.1 Introduction*

The Transtheoretical Model (TTM) (Prochaska & DiClemente, 1982) is an integrative model of intentional behaviour change originally developed in the field of smoking cessation, however now widely applied across a range of problem behaviours (Prochaska & Di Clemente, 1984; Prochaska & DiClemente, 1982; Velicer, Prochaska, Fava, Norman, & Redding, 1998). The model endeavours to describe how people modify problem behaviour or acquire a new positive behaviour. The central organizing construct of the TTM is the *stages* of change. Proponents of the model proclaim the importance of the stage scheme because it represents a temporal dimension. Change implies phenomena occurring over time and this aspect has often been largely ignored by alternative theories of change. Behaviour change is often construed as an *event*, such as quitting smoking, drinking, or over-eating. Prochaska and DiClemente's (1982; 1984) TTM construes change as a *process* involving progress through a series of five stages:

(1) Pre-contemplation: is the stage in which people are not intending to take action in the foreseeable future (usually measured as the next six months).

(2) Contemplation: is the stage in which people are intending to change in the next six months.

(3) Preparation: is the stage in which people are intending to take action in the immediate future, usually measured as the next month. They have typically taken some significant action previously and may have a plan of action.

(4) Action: is the stage in which people have made specific overt modifications in their life-styles within the past six months.

(5) Maintenance: is the stage in which people are working to prevent relapse and continue their change. They do not apply change processes as frequently as do people in the action phase and they are less tempted to relapse and are increasingly more confident.

Additionally, during progression through these five stages, 10 different social and psychological processes of change are thought to be important and these processes interact (roughly sequentially) with stage progression. Briefly: consciousness raising → dramatic relief → environmental re-evaluation → social liberation → self-re-evaluation → stimulus control → helping relationships → counter conditioning → reinforcement management → self-liberation (Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Further, the constructs of Decisional Balance and Self-efficacy are integrated within the TTM. The Decisional Balance construct reflects the individual's relative weighting of the *importance* of the pros and cons (Velicer, Prochaska, Fava, Norman, & Redding, 1998), and the Self-efficacy construct is adopted from Bandura's self-efficacy theory (Bandura, 1977a), and represents a person's 'situation-specific' confidence that he or she can perform a particular behaviour to effect a desired outcome. Both decisional balance and self-efficacy are said to influence stage progression. A general premise regarding the application of the TTM is that to maximise effectiveness, an intervention should be tailored or 'stage-matched' to individuals within the target population, as individual's 'readiness to change' may differ (Prochaska & DiClemente, 1982). By way of example, it can be argued that there is little point in including a detailed exercise prescription programme in an education seminar for newly diagnosed type 2 diabetics, if it was found that all or most of the patients had yet to even contemplate change (*pre-contemplation*). Proponents of the TTM claim that interventions based on the model have

the potential to have both a high efficacy and a favourable cost-benefit ratio (Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Several instruments have been developed for assessing individuals' stages of change with respect to various different behaviours, including but not limited to, smoking, insufficient exercise, adoption of a low fat diet, alcohol abuse, weight control, medical compliance, and stress management (Velicer, Prochaska, Fava, Norman, & Redding, 1998). Two instruments have been designed specifically for exercise behaviours, namely the Exercise Stages of Change: Short Form (Marcus, Selby, Niaura, & Rossi, 1992) and the Exercise Stages of Change: Continuous Measure (24 item questionnaire) (Marcus, Selby, Niaura, & Rossi, 1992).

The Continuous Measure (24 item questionnaire) uses a 5-point Likert scale from 1 = Strongly Disagree to 5 = Strongly Agree, and subjects are asked to rate 24 questions. The short form asks subjects to select one of five categories that best describes their engagement in planned physical activity (see below), with respect to the following definition of regular exercise (common to both the Continuous and Short versions).

> "Regular Exercise is any planned physical activity (e.g., brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed 3 to 5 times per week for 20-60 minutes per session. Exercise does not have to be painful to be effective but should be done at a level that increases your breathing rate and causes you to break a sweat" (p.56).

*Question 1: Do you exercise regularly according to that definition?*

Response categories:

□ Yes, I have been for MORE than 6 months (= Maintenance)

□ Yes, I have been for LESS than 6 months (= Action)

□ No, but I intend to in the next 30 days (= Preparation)

□ No, but I intend to in the next 6 months (= Contemplation)

□ No, and I do NOT intend to in the next 6 months (= Pre-contemplation)

For the purpose of this study it was considered that the 24 item Continuous Measure would be too time consuming within the overall context of the subject's interview process, therefore, on this criterion alone the short version was chosen.

#### *3.9.1.2 Instrument selection*

In selecting the Exercise Stages of Change Questionnaire: - Short Form; several additional factors were considered.

#### *3.9.1.3 Validity*

The TTM has been widely accepted and applied across a range of behaviour modification contexts which has created a large body of literature, however, the TTM has recently generated considerable dialogue in the literature, much of it critical (for an overview see Adams & White, 2003, , 2005; for an overview see Bandura, 1998; Di Clemente, 2003, , 2005; Hodgins, 2005; Sutton, 2005; West, 2005). Criticism has been levelled at the underlying premises on which the model is based, the face validity of the model itself and the various instruments which purportedly measure stage assignment and further, the authentic usefulness of the model itself, particularly in the context of physical activity.

One of the aspects of the TTM that *has* empirical support is the predictive validity of the stages. It has been demonstrated, and is generally accepted, that people who are in a more advanced stage are more likely to have changed their behaviour at follow-up, than people in an earlier stage (Di Clemente, 2003, , 2005). Although as West (2005) points out, in this regard the TTM perhaps offers no more than simple common sense and stage progression is not necessarily accompanied by an increase in physical activity. For example, the passage from the action stage to the maintenance stage requires only the passage of an arbitrary period of time and does not necessarily require any increase in activity levels. However, as Hodgins (2005) suggests, the process of 'self-staging' may provide a useful change schema that may assist people to organise their thoughts about change, thus, self-labelling may be important in maintaining behaviour change.

In an earlier critique of the TTM, Bandura (1998) points out that the stages, or pseudo-stages as he describes them, are simply arbitrary subdivisions that attempt to partition 'differences in degree' into meaningful categories or stages. Bandura (1998) argues that the stages are simply descriptive of typical behaviour, and that the stages are only loosely linked to the determinants of the typical behaviour observed in any one particular stage. Bandura argues therefore, that stage-based interventions may not necessarily target the determinants of specific health behaviour/s appropriately. Bandura asserts that interventions must be tailored to the determinants of a given health behaviour, and that interventions must be matched to the individual's progression through the change process, not simply their movement through arbitrary stages. However, Bandura (1989) concedes that the TTM stage scheme may serve to

remind health professionals that some people in fact have little interest in changing their health behaviours, while others are more ready and more amenable to change. Like West (2005), Bandura suggests that this knowledge of 'readiness to change' offers little more than common sense. In response to such criticism, DiClemente (2005) proposes however, that the alternative views on the shortcomings of the TTM are

> "true only for those treating the model as a religion and not a heuristic model to explore the change process" (p. 1048).

With due consideration given to the alternative views and recent debate regarding the validity and usefulness of the TTM, it was still considered of interest to measure stage progression (in points per stage), and investigate any possible correlations with other selected outcomes, including optimism, self-efficacy and goal-directness. It has been argued that using the TTM is little better than asking simple questions about a person's exercise habits and attitudes toward exercise (Bandura, 1998; West, 2005). However, completing the Stages of Change-short form questionnaire is a relatively simple 'one question' procedure and, in this current study, the accompanying definition of regular exercise was considered to be potentially useful in establishing with the subjects a common perspective from which physical activity frequency, duration and intensity could be viewed. Investigating the usefulness and potential effect size of any particular stage-based intervention in a newly-diagnosed type 2 diabetic population is beyond the scope of this current study, however, the general usefulness of administering the Stages of Change-Short Form questionnaire as a screening tool in this population is of interest. It is as a heuristic model that the TTM is included here.

#### *3.9.1.4 Scoring*

Subjects select one of the five categories that best describes their engagement in planned physical activity. The stages are numbered from 5 (Maintenance) to 1 (Pre-contemplation). As Rossi (2000) recommends, the most simple approach to conceptualizing stage progression is to count the number of stages progressed as the outcome. For example, an individual who progresses from pre-contemplation to contemplation would receive a score of 1, while an individual progressing two stages from pre-contemplation to preparation would receive a score of 2, and regression to an earlier stage would be assigned a negative score.

#### *3.9.1.5 Summary*

The Exercise Stages of Change Questionnaire - Short Form, provides a definition or regular physical exercise that may be used to illustrate and quantify *one* particular perspective of planned physical exercise. Further, the TTM may serve to identify individuals who in fact have little interest in changing their health behaviours and also, those who may be more ready and more amenable to change. In a newly diagnosed type 2 diabetes population, 'self-labelling' may prove to be of therapeutic value, and it may also prove useful for diabetes educators to have a better understanding of patients' readiness to change so that educators are guided toward a better 'fit' between pedagogy and patient need.

### *3.9.2 The Stanford 7-Day Physical Activity Recall Questionnaire*

#### *3.9.2.1 Introduction*

Changes in physical activity levels were assessed with the now widely used *Stanford 7-Day Physical Activity Recall Questionnaire* (7D-PAR), as originally developed and validated by Blair and colleagues in 1985 for use in the Stanford Five-City Project (Blair et al., 1985; Sallis et al., 1985); a community based public health education trial. The 7D-PAR as used in this study assesses work, leisure-time, and sporting activities for the previous seven days. Specifically, the instrument requires individuals to recall the average number of hours and minutes per day spent sleeping and engaging in moderate, hard and very hard activities over the course of the previous seven days (a list of examples of activities in each category is provided). The time not accounted for within a 24-hour day is assumed to have been spent engaging in light activities. The 7D-PAR was 'researcher-administered', and while it typically required considerable cognitive effort by the participants, on average, the questions took only 10-15 minutes to complete.

For the purpose of scoring, the 7D-PAR assigns baseline units of energy expenditure to each class of activities. Energy expenditure is calculated using a standard measure commonly used in exercise physiology, the *metabolic equivalent* or 'MET'. A single MET unit is the baseline unit of energy expenditure for an individual, at rest (basal metabolism). METs are somewhat variable between individuals due to differences in basal metabolic rates (BMR) and body mass, however, METs provide a useful and simple approximation of the rate at which exercise causes calories to be burned (McArdle, Katch, & Katch, 2001). The 7D-PAR assigns the

following MET levels to five classes of activity: Sleep = 1 MET; Light = 1.5 METs; Moderate = 4 METs; Hard = 6 METs; and very hard Activity = 10 METs. Data is translated to energy values by assuming a standard value of 4.19 kJ/min (1 kcal/min) for basal metabolism (Sallis et al., 1985). The units of energy expenditure adopted for this current study are Kilocalories per kilogram per day (Kcal/kg/day), as this index removes the confounding effects of any variation in body weight between baseline and follow-up

The 7D-PAR utilizes a 7 day recall period and the resultant data has been demonstrated to be generally representative of typical activity patterns (Blair et al., 1998). Since relatively recent activity is more closely associated with health status than distant activity, it may not be necessary, or desirable, to obtain recall over longer periods, as provided by activity logs, or complex instruments with more lengthy recall periods (Blair, 1984). Of note with respect to representativeness, the 7D-PAR may, or may not adequately capture seasonal variation, depending on frequency/timing of administration. Further, during the early development of the instrument, the advantage was evaluated of asking participants to comment on the degree to which the last seven days were 'typical', along with subsequent adjustment of participants' data to compensate for any such variability. However, the researchers demonstrated that such adjustments did not prove to be useful, concluding that only in cases when the last 7 days was highly atypical should substitution be made for the previous 7 day period (Blair, 1984; Blair et al., 1998). In this study, whenever suspected and/or identified, such variability was minimised, by strict interview protocol and technique. Subjects sometimes attempted to select and substitute a more "favourably active week" from the previous few weeks, however, this was not permitted by the interviewer and the previous 14-7 day period was recorded only if the last

week was highly atypical (as per the interviewer instructions described in appendix F).

#### *3.9.2.2 Instrument Selection*

In selecting the 7D-PAR, several additional factors were considered.

Measuring individuals' habitual exercise patterns is difficult. Validation of methods is complicated by the fact that it is probably impossible to obtain a definitive 'gold standard' measurement (Blair, 1984). While the various self-report measures and logs remain very useful, some developing technologies do offer 'gold-standard' potential in the assessment of physical activity, including continuous heart-rate monitoring and the use of accelerometer motion detectors (Caltrac) (Richardson, Ainsworth, Jacobs, & Leon, 2001). Nevertheless, obtaining the truth about an individual's exercise habits remains challenging and validating an instrument or method that purports to estimate the truth is complex. The truth about individuals' physical activity levels is still not easily obtained with complete satisfaction (Blair, 1984; Richardson, Ainsworth, Jacobs, & Leon, 2001).

In selection of the 7D-PAR for this study, several alternative methods and measures were considered, including the direct measurement methods of continuous heart-rate monitoring, the use of accelerometer motion detectors or pedometers and laboratory measurement, as well as alternative questionnaires and diary methods. While all of the direct measure techniques are undoubtedly useful in other contexts, for the purposes of this study, all were excluded for reasons of cost, practicality and/or time. Further, and most importantly, most direct measure techniques are in effect an intervention, which is an inappropriate methodology in the context of this study design. Activity logs and diaries also may be viewed, to a greater or lesser extent,

as interventions. While the assessment of physical activity by questionnaire is not without problems (including problems of recall and accuracy of assessing the intensity of physical activities), the questionnaire method was chosen after considering the purpose of the enquiry and the available resources of time, funding, and knowledge. There is currently a plethora of questionnaires for the assessment of physical activity, and along with the Stanford 7-Day Physical Activity Recall Questionnaire (Blair et al., 1985), three of the more common questionnaires were considered, namely the *Baecke Questionnaire* (Baecke, Burema, & Frijters, 1982), the *Tecumseh Questionnaire* (Reiff et al., 1967), and the *Minnesota Leisure Time Questionnaire* (Taylor et al., 1878). The characteristics of the later three questionnaires precluding their use in this study are summarised: the Baecke Questionnaire was developed for use in a 19-31 years old population, the Tecumseh Questionnaire requires approximately 1-1.5hrs to complete, and the Minnesota *Leisure Time Questionnaire* is complicated to administer and assesses only leisure time activities (Blair, 1984; Shephard, 2003).

A major advantage of the 7D-PAR is that most people spend most of their waking hours in light activity and since light activity is simply obtained by subtraction, most individuals have only to account for relatively short blocks of time. For most individuals, the engagement in moderate, hard and very hard activities is relatively rare and reasonably easy to recall and specify (for example, planned sport or exercise routines, or specific occupational tasks) (Blair, 1984). It should be noted that the original 7D-PAR has undergone a series of revisions including a daily time-segmented version (i.e. morning/afternoon time blocks) (Pereira et al., 1997), however, the original version was considered sufficient for this study, as the average number of moderate, hard and very hard activity minutes/day was the primary measure of

interest (rather than energy expenditure per se), and the version used here provides this data adequately.

#### *3.9.2.3 Validity*

Construct validity (that the measure is correlated with variables known to be related to the construct purportedly measured by the instrument) of the 7D-PAR has been established through relationships with changes in objective measures of physical fitness such as laboratory tested aerobic exercise capacity and also percent body fat (Dishman & Steinhardt, 1988; Jacobs, Ainsworth, Hartman, & Leon, 1993). Convergent validity (that the instrument is related to other similar instruments to which it is theoretically be related) has been examined by comparing the 7D-PAR against time-matched activity logs (Taylor et al., 1984), direct observation, activity monitors, continuous heart rate monitoring and other self-report measures of activity (Blair et al., 1985; Dishman & Steinhardt, 1988; Taylor et al., 1984). For example, concurrent comparisons between the 7D-PAR and 7-day diaries or daily logs have been demonstrated to be positively correlated $r = 0.86$ for total activity (Dishman & Steinhardt, 1988). Taylor et al. (1984) reported significant weekday positive correlations for moderate activity ($r = 0.75$), hard activity ($r = 0.42$), and very hard activity ($r = 0.55$). Corresponding weekend positive correlations were: $r = 0.7$, $r = 0.63$ and $r = 0.90$, respectively. In a separate study within the Five City Project, Sallis et al. (1985) demonstrated group ($n = 64$) mean 2-week test-retest reliability of $r = 0.75$ ($p < 0.0001$) for moderate activity and $r = 0.83$ ($p < 0.0001$) for vigorous activity. Richardson et al. (2001) subsequently reported that one month repeatability correlation coefficients for total activity were $r = 0.60$ ($p \leq 0.05$) and $r = 0.36$ ($p \leq 0.05$) for men and women, respectively.

Richardson et al. (2001) offered further comment on the 7D-PAR based on their comprehensive 12 month comparative trial and review of various currently used physical activity survey instruments (the SAFE Study). Overall, the researchers concluded that the 7D-PAR was reasonably accurate in assessing typical levels of total and very hard activity in men, but was less accurate in women. Further, the 7D-PAR demonstrated a lesser and more modest association between the physical activity record and the lower intensity light, moderate, and hard activity levels. Collectively, nevertheless, studies have generally supported the validity and reliability of the 7D-PAR as a measure of physical activity in adults.

In selection of the 7D-PAR instrument for this study, the ability of the 7D-PAR to capture accurately low intensity physical activity was given due consideration, within the context of a six month prospective study, of newly diagnosed and largely overweight and/or obese type 2 diabetic adults. Richardson et al. (2001) noted that the 7D-PAR does not capture well the miscellaneous walking performed throughout the day. Miscellaneous walking (as opposed to more definitive/planned walking behaviour such as walking for pleasure and/or health) is one of the most difficult components of the physical activity spectrum to assess (Blair et al., 1985; Richardson, Ainsworth, Jacobs, & Leon, 2001; Taylor et al., 1984). While it may be important to be able to assess accurately miscellaneous walking and other lower intensity components of the physical activity spectrum in epidemiologic and other large population studies, within this study context, and its narrowly defined population, this limitation was considered less significant. Miscellaneous walking performed throughout the day and total energy expenditure per se, were not primary measures of interest, rather, changes in 'definitive/planned behaviour' and/or 'exercise' were of greatest interest.

It was considered that the light-moderate exercise categories would in fact be adequately accounted for by the 7D-PAR, as for most relatively sedentary, overweight/obese and/or older people, even light-moderate intensity physical activity is likely to engender the often salient features of higher intensity/vigorous physical activity, as may be experienced by fitter individuals. Specifically, these salient features include, a notably elevated perception of effort, elevated respiration rate, heart rate, perspiration rate and possibly a feeling of fatigue (McArdle, Katch, & Katch, 2001). Further, moderate intensity physical activity is likely to be performed relatively infrequently by a sedentary population (if at all), and often performance is scheduled or performed in a specific routine, all factors that aid in the subsequent recall of this type of physical activity.

In lay terms, and by way of example, if a sedentary and/or older person adopts a regular walking routine of 20 minutes brisk walking three times a week, then, although the intensity is perhaps only in the lower range of moderate, it is still likely to be perceived as relatively difficult (compared to no activity at all), and its routine and/or scheduled performance is likely to mean that it is easily recalled. It was concluded therefore, that the 7D-PAR will most likely record such light-moderate physical activity within a relatively inactive population.

#### *3.9.2.4 Summary*

The primary purpose for the use of the 7day recall was to illuminate intra-subject changes in the participation in moderate, hard and very hard physical activity levels (between the time of the initial interview and at six-month follow-up), rather than actual total energy expenditure per se. Thus, the degree to which any changes in exercise behaviour occurred was the focus of

enquiry, rather than an attempt to demonstrate any dose-response relationship between quantity of physical activity and health outcomes. Further, and of great importance with respect to the integrity of the study, the method employed to assess physical activity could not, in itself, constitute an intervention (as could be the case with physical activity diary logs).

While it has been demonstrated that the 7D-PAR is reasonably accurate in assessing usual levels of total and very hard activity, it is noted that the 7D-PAR may underestimate usual levels of lower intensity activity in general. However, the most notable of factors related to the accuracy of habitual physical activity assessment by questionnaire are: the nature of the physical activity performed (influencing the accuracy of recall) and the time period/frequency of physical activity assessment (representativeness) (Richardson, Ainsworth, Jacobs, & Leon, 2001). With respect to the former, it was considered that adoption of the 'researcher-assisted' interview process (rather than self-administered questionnaires) would enhance individuals' recall, as 'prompting' and the provision of examples of different activities has been shown to enhance accuracy (Blair et al., 1985; Sallis et al., 1985; Taylor et al., 1984). With respect to representativeness, the purpose of assessment by 7D-PAR primarily was to detect changes in *habitual* physical exercise. Thus, exclusive of sickness and/or an uncharacteristically rare disruption of daily routine, the 7D-PAR as administered should, in the main, capture physical exercise that is truly habitual, as opposed to that which is transient or occasional. Therefore, for the purpose of this study, and despite the limitations of the 7D-PAR as reported in the literature, the 7D-PAR was considered to represent an efficacious measure.

### *3.9.3 Exercise Self-Efficacy Questionnaire-Short-Form*

#### *3.9.3.1 Introduction*

Theories of behaviour usually include two fundamental components: the acquisition of knowledge and the performance of behaviours. Knowledge creates the precondition for change, however, in reality, people often consciously act in ways that are not in their best interests and this is particularly true in the case of health behaviours (Schunk & Carbonari, 1984). For example, a type 2 diabetic may continue to eat a high sugar/high fat diet, despite knowledge of the diet-blood glucose relationship and the long-term negative consequences of poor glycaemic control. Thus, to explain such incongruence, it is suggested that other variables must influence peoples' behaviour, and researchers have postulated that *self-efficacy* mediates the relationship between knowledge and action (Bandura, 1977a; Seligman, 1975).

> "Perceived self-efficacy refers to beliefs in one's capabilities to organise and execute the courses of action required to produce given levels of attainment" (Bandura, 1998, p.626).

Social Cognitive Theory (Bandura, 1968, , 1977b) postulates that efficacy beliefs are a major basis of action, and when faced with challenge and adversity, people will have little motivation to act with intensity and persistence unless they believe they can produce desired effects by their actions (Bandura, 1968; 1998). Further, high self-efficacy is strongly and positively related to the setting of high goals (Locke, Shaw, Saari, & Latham, 1981).

Many models of health behaviour change purport the importance of efficacy beliefs, including

the Theory of Reasoned Action and Planned Behaviour (Ajzen & Fishbein, 1980), The Health Belief Model (Janz & Becker, 1984), the Transtheoretical Model of Behaviour Change (TTM) (Prochaska & DiClemente, 1982), and Social Learning Theory (Bandura, 1986). The purpose of assessing Exercise Self-efficacy was to investigate any possible relationships between subjects' levels of exercise self-efficacy, and other selected measures and outcomes (particularly engagement in physical activity).

In selection of the Exercise Self-Efficacy Questionnaire-Short-Form (Benisovich, Rossi, Norman, & Nigg, 1998), consideration was given to a number of factors including the particular characteristics of the instrument, the context of the study, the purpose of the enquiry, and the available resources of time, funding, and knowledge. The Exercise Self-Efficacy 18 item and 6 item short form instruments (Benisovich, Rossi, Norman, & Nigg, 1998) were developed by the Cancer Prevention Research Centre (CPRC), with Dr. James Prochaska as CPRC director. The CPRC has developed a number of Self-Efficacy instruments across a range of health behaviours, including smoking, alcohol, coping with stress, and substance abuse. In the main, the instruments are integrated around the Transtheoretical Model of behaviour change (TTM), as developed at the CPRC. The Exercise Self-Efficacy 6 item short form instrument, and the full 18 item version from which it is derived, assesses exercise self-efficacy on the six subscales:

(1) negative affect ("I am under a lot of stress"*), (2) excuse making ("I feel I don't have the time"*), (3) must exercise alone ("I have to exercise alone"*), (4) inconvenient to exercise ("I don't have access to exercise equipment"*), (5) resistance from others ("I am spending time

with friends or family who do not exercise"*), and (6) bad weather ("It's raining or snowing"*). Note: * denotes the single questions selected from each sub-scale which form the six-item short form. The six item version (as used in this current study) asks participants to rate their confidence to perform planned physical exercise in potentially adverse circumstances. Participants rate their exercise self-efficacy on a five point Likert scale: 1 = Not at all confident 2 = Somewhat confident, 3 = Moderately confident, 4 = Very confident, and 5 = Completely confident.

#### *3.9.3.2 Validity*

In the initial development of the Exercise Self-Efficacy Scale, Marcus et al. (1992) recruited subjects (n=1063) from a Rhode Island division of a government agency (mostly blue-collar occupations), and the Exercise Self-Efficacy Scale demonstrated an internal consistency of .76, and test-retest reliability over a two week period of 0.90. Marcus et al. concluded that the self-efficacy measure was highly reliable and additionally, that it was significantly related to the Transtheoretical Model's 'stages' in the change process. In the main, the Exercise Self-Efficacy Scale demonstrated similar validity to a previously developed (17-item) measure of Self-Efficacy and/or Temptation for the maintenance of smoking cessation (Velicer, DiClemente, Rossi, & Prochaska, 1990). Additionally, Velicer et al. concluded that the consistency of results across different self-efficacy measures, methods and procedures, provides evidence of the strength and generalizability of the constructs involved.

#### *3.9.3.3 Instrument selection*

In selecting the Exercise Self-Efficacy Questionnaire-Short Form, several additional factors were considered.

To date, most self-efficacy instruments in the physical activity domain have been developed to measure confidence in one's ability to exercise (or be physically active) when faced with various barriers to being active. A selection of the available instruments was considered and the characteristics and advantages/disadvantages of each are briefly outlined below.

The Diabetes Empowerment Scale (DES) (Anderson, Funnell, Fitzgerald, & Marrero, 2000) is a 28-item measure of diabetes-related psychosocial self-efficacy. The DES assesses diabetes related self-efficacy across 3 subscales: Managing the Psychosocial Aspects of Diabetes, Assessing Dissatisfaction and Readiness to Change, and Setting and Achieving Diabetes Goals. The researchers provide evidence that the DES is a valid and reliable measure of diabetes-related psychosocial self-efficacy, however, the DES does not measure exercise related self-efficacy per se and therefore the DES was not selected.

Albert Bandura has conducted significant work in the development of self-efficacy scales and two of the instruments developed by Bandura are the MSPSE (Bandura, 1990), a self-report measure of perceived self-efficacy, and the 18 item Exercise Self-Efficacy Scale (Bandura, 2005). The MSPSE is a comprehensive 57 item self-report measure of perceived self-efficacy across nine distinct domains of self-efficacy. For each of the 57 MSPSE items, respondents are asked to rate their level of capability on a 7-point scale (from 1, not well at all, to 7, very well) in performing a given activity. The MSPSE was considered simply to be too long. The 18 item Exercise Self-Efficacy Scale describes to respondents a number of situations that can make it hard to stick to exercise regularly (3 or more times a week). Respondents are asked to rate (on a 0-100 scale) their degree of confidence that they can perform exercise on a regular basis.

Bandura's scale is similar to the Exercise Self-efficacy-short form questionnaire (Benisovich, Rossi, Norman, & Nigg, 1998), and assesses respondents' self-efficacy to overcome several perceived barriers to exercise. Namely, negative affect (for example, "When I am feeling depressed"), excuse making (for example "When I have too much work to do at home"), inconvenient to exercise (for example, "When visitors are present"), resistance from others (for example, "Without support from my family or friends"), and bad weather. The Exercise Self-Efficacy Scale also assesses respondents' self-efficacy with respect to injury, recovery from illness, personal and family problems and discomfort when exercising. The Exercise Self-Efficacy Scale appears to be a valuable instrument, however, due to its longer length (as compared to the Benisovich et al. short form questionnaire), the Exercise Self-Efficacy Scale was not selected. Further, the linkages between the CPRC developed Exercise Self-Efficacy Questionnaire-short form and the Exercise Stages of Change Questionnaire-short form, made the inclusion of these two instruments (together) the preferred choice.

Finally, The Stage-specific Self-efficacy Scale for Physical Activity (Mâsse, Heesch, Eason, & Wilson, 2006) was considered. This instrument is a 20-item/four sub-scale self-efficacy questionnaire designed to assess stage-specific self-efficacy (i.e. self-efficacy in moving from contemplation, preparation, action/maintenance and moving out of relapse). Mâsse et al. (2006) enrolled 226 women to participate in the Women On The Move study, and each participant completed the 20-item scale developed specifically for the study. Results indicated that the stage-specific self-efficacy scale had high internal consistency and that all items discriminated well, however, the preliminary analysis identified a number of areas within the Stage-specific Self-Efficacy Scale where revisions were indicated. The Stage-specific Self-

efficacy Scale for Physical Activity appears to be a potentially useful instrument for integration with future TTM based studies and interventions, however due to the evolving nature of the scale and the paucity of evidence supporting its practical application, it was not selected.

#### *3.9.3.4 Summary*

The Exercise Self-Efficacy Questionnaire-Short Form has been developed to measure confidence in one's ability to exercise, or be physically active, when faced with barriers to being active. It is postulated here that The Exercise Self-Efficacy Questionnaire-short form can be used to identify older adults who have low outcome expectations for exercise and subsequently, interventions can then be implemented and/or tailored specifically to strengthen these expectations and thereby improve exercise behaviour. The Exercise Self-Efficacy Questionnaire-short form has been selected here as it is short, easy to administer and score, and intergrates well with the (also selected) CPRC developed Exercise Stages of Change Questionnaire.

### *3.9.4 The Alcohol Consumption Questionnaire (AUDIT-C)*

#### *3.9.4.1 Introduction*

The Alcohol Use Disorders Identification Test-C (AUDIT-C) is an alcohol screen that can help identify individuals who are hazardous drinkers, or have active alcohol use disorders (including alcohol abuse or dependence) (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). The AUDIT-C was incorporated in the studys questionnaire and the data correlated to determine whether hazardous drinkers or individuals with active alcohol use disorders were more likely to have poorer diabetes outcomes than non-drinkers or non-hazardous drinkers: specifically, with respect to the capacity to self-manage their condition. The AUDIT-C was not however included here to investigate any *dose-response* relationship that may exist between alcohol consumption and any specific biochemical indices.

The AUDIT-C is a short version 3-item questionnaire based on the World Health Organization's AUDIT (Alcohol Use Disorders Inventory Test) (Babor, de la Fuente, Saunders, & Grant, 1989; Saunders & Aasland, 1987). The AUDIT is a 10-item questionnaire originally developed for identifying hazardous drinking and intended for use in primary health care settings. The shorter 3-item AUDIT-C questionnaire provides, in essence, a more brief and practical screen than the original AUDIT, and the AUDIT-C may be used in a range of health care settings (Bradley, Bush, & Epler, 2003; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998).

The AUDIT-C questions are:

Q 1: How often did you have a drink containing alcohol in the past year?

| | |
|---|---|
| Never | 0 points |
| Monthly or less | 1 point |
| Two to four times a month | 2 points |
| Two to three times a week | 3 points |
| Four or more times a week | 4 points |

Q2: How many drinks did you have on a typical day when you were drinking in the past year?

| | |
|---|---|
| 1 or 2 | 0 points |
| 3 or 4 | 1 point |
| 5 or 6 | 2 points |
| 7 to 9 | 3 points |
| 10 or more | 4 points |

Q3: How often did you have six or more drinks on one occasion in the past year?

| | |
|---|---|
| Never | 0 points |
| Less than monthly | 1 point |
| Monthly | 2 points |
| Weekly | 3 points |
| Daily or almost daily | 4 points |

The AUDIT-C is scored on a scale of 0-12 (scores of 0 reflect no alcohol use). In men, a score of 4 or more is considered positive, in women, a score of 3 or more is considered positive. The lower recommended cut-off for women reflects that generally, women develop problems due to drinking at lower levels of alcohol consumption than do men, due at least in part to differences in body mass, possible differences in metabolism and possible under-reporting due to greater stigmatization for women, as compared to men (Bradley, Bush, & Epler, 2003). Generally, the higher the AUDIT-C score the more likely it is that the patient's drinking is affecting his or her health and safety. It is noted that, as a function of the selected screening thresholds, an individual who consumes one drink per day will score positive on the AUDIT-C. However when the points are allocated from question one alone (and questions two and three are zero), then the result should be interpreted as drinking below the recommended limits, and not as hazardous drinking (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998).

The AUDIT-C is grounded in the American Psychiatric Association's (APA) diagnostic criteria for hazardous drinking, as per the Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition (DSM-III Revised) (APA, 1987). Hazardous drinking is drinking above the limits shown to increase a person's risk of injury and/or medical problems. The recommended limits for men are no more than 14 drinks per week, 4 drinks per session, and woman, no more that 7 drinks per week, 3 drinks per session. Drinking above these limits meet or exceed the criteria for active alcohol abuse or dependence according to the DSM-III Revised (American Psychiatric Association. & American Psychiatric Association. Work Group to Revise DSM-III., 1987).

The DSM-III Revised criteria are designed for a range of purposes including providing diagnostic and research thresholds. Different countries and organisations may have differing recommendations on safe drinking levels. The Alcohol Advisory Council of New Zealand (ALAC) recommends the following limits (based on the measure: one standard drink equals 10 grams of pure alcohol):

*In any one week, consume no more than:*

- 21 standard drinks (for men)
- 14 standard drinks (for women)

*On any one drinking occasion consume no more than:*

- six standard drinks (for men)
- four standard drinks (for women)

Adapted from: Alcohol Facts and Effects, ALAC (2004).

#### *3.9.4.2 Validation*

The AUDIT-C was originally validated for men only (Babor, de la Fuente, Saunders, & Grant, 1989; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998), however, later studies have now established the optimal cut-off threshold and validated the AUDIT-C for women as well (Bradley, Bush, & Epler, 2003). Bush, Kivlahan, McDonell, Fihn, and Bradley (1998) surveyed 9513 patients from 3 Seattle Veterans Affairs medical clinics, and of the 393 eligible patients, 243 completed all stages of the study. The patients completed a battery of questionnaires including: the 10 item AUDIT, the 3 item AUDIT-C, a retrospective drinking diary, a measure of readiness to change, and general questions about alcohol consumption. The patients also participated in a telephone interview on alcohol consumption patterns and an in-depth diagnostic interview based on Robins, Helzer Croughan, and Ratcliff's (1981)

Diagnostic Interview Schedule for the DSM-III Revised.

Using a cut-off of 3 points (out of 12 points), the AUDIT-C identified 90% of patients with active alcohol abuse or dependence, and 86% of patients with heavy drinking, however, the specificity was only 60%, i.e. a sub-optimal false positive rate of 40%. To determine the optimal specificity, a cut-off of 4 or more points was assessed and at this threshold, the AUDIT-C identified 86 % of people with heavy drinking and/or active alcohol abuse or dependence with a specificity of 72% (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). The third question of the AUDIT-C, "How often did you have six or more drinks on one occasion in the past year?" has also been evaluated separately. A report of ever drinking 6 or more drinks on any occasion in the last year was found to identify 79% of heavy drinkers and 81% of patients with active alcohol abuse or dependence (with only 17% false positives for heavy drinking and/or active alcohol abuse or dependence).

Bush et al. (1998) plotted 'area under receiver operating characteristic curves' (AUROCs) and analysed the characteristics of the AUDIT-C, to optimise the cut-off threshold and the sensitivity versus specificity relationship overall. AUROCs higher than 0.8 were considered excellent, and for men, the AUDIT-C demonstrated 0.891 (p=.03). Consequently, the threshold for men was set at 4 or more points and later research has validated the threshold of 3 or more points for women with an AUROC of 0.920 (Bradley, Bush, & Epler, 2003).

#### *3.9.4.3 Summary*

Primarily, the AUDIT-C was selected as it is highly related to the Alcohol Advisory Council of New Zealand's 'Drink Check Questionnaire' (as available at www.alcohol.org.nz/HelpTestYourDrinking.aspx), that questionnaire being essentially the original AUDIT. The AUDIT-C has been found to be an effective screening tool for alcohol abuse and/or dependence in men and women. Bradley et al. (2003) concluded that the third AUDIT-C question alone is a potentially useful medical interview screening tool for active drinking problems and the 3-item AUDIT-C is practical, valid, straightforward and easily integrated into general health questionnaires. Given the above findings, the AUDIT-C was incorporated here to investigate any possible relationships between a positive AUDIT-C score, and other selected patient measures and outcomes, both at the time of the patients' initial interviews and at the six month follow-up.

### *3.9.5 The Hospital Anxiety and Depression Scale*

#### *3.9.5.1 Introduction*

To consider health beyond the physical includes recognition of an individual's psychological health and any emotional components of an illness or disability. It has been demonstrated (although perhaps not widely accepted in the West) that an individual's physical and mental health are inextricably linked and may exhibit reciprocal causality (Cohen, Doyle, Turner, Alper, & Skoner, 2003; Cruess et al., 2005; Herbert & Cohen, 1993; Polk, Cohen, Doyle, Skoner, & Kirschbaum, 2005; Salovey & Birnbaum, 1989; Salovey, Rothman, Detweiler, & Steward, 2000; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). A measure of *depression* was included in this study as depression is currently ranked as the 4$^{th}$ largest contributor to New Zealand's total burden of disease (New Zealand Ministry of Health, 2001), thus, it was considered likely that some of the study participants would be experiencing some degree of depression, and that this may be associated with individual differences in self-management styles, health behaviours, and patient outcomes. Further, a measure of *anxiety* was desired, so as to investigate any coincidence of anxious and depressive symptoms in the patient population, and to investigate any relationships between different levels of anxiety at the time of the participants' first interviews and subsequent health behaviours and patient outcomes. Such anxiety and depressive states may result in different responses to treatment and different health related outcomes. While, various 'negatively' labelled emotional states and traits (for example trait anxiety) may well predispose individuals to poorer outcomes, it is perhaps possible that the influence of such 'negatively' labelled states and traits may potentially act favourably at times as well.

Illnesses may be entirely physical, or they may also co-exist with significant secondary emotional disturbances that may, or may not, be related to physical outcomes and/or disease trajectory. The identification of such cases of anxiety and depression by health practitioners (such as a diabetes nurse educator conducting a diabetes education seminar) would most likely depend on either the prior knowledge of patient history, or the presence of obviously distressing psychological symptoms and some disturbance of a patient's normal social functioning. However, these more severe symptoms, although common in psychiatric clinics, are less common in other hospital and outpatient clinics, therefore the detection of mild degrees of distress may be difficult in these contexts and may well be overlooked (Snaith, 2003; Zigmond & Snaith, 1983). Without screening, the identification of sub-clinical cases of anxiety and/or depression by those not specifically trained to do so is relatively unlikely; however, sub-clinical levels of anxiety and/or depression may not be unimportant with respect to changes in a person's health behaviours, health status and wellbeing.

The purpose of assessing anxiety and depression in this study was to investigate any possible relationships between subjects' levels of anxiety and depression and other selected patient measures and outcomes, both at the time of the patients' initial interviews and at the six month follow-up. For example, sub-clinical levels of anxiety and/or depression may be related to differences in peoples' acceptance of their diagnosis, their readiness to learn about their condition's management, and their readiness to change health behaviours. Knowledge of such relationships may be of benefit to diabetes educators and clinicians, such that the education process and disease management may be more accurately tailored to individual needs.

The Hospital Anxiety and Depression Scale (HADS) was developed by Zigmond and Snaith (1983) to provide clinicians and researchers with a reliable, valid, and practical tool for identifying and quantifying two common forms of psychological disturbances in medical patients: *anxiety* and *depression*. The HADS was specifically designed for use in general medical hospital outpatient clinics and Zigmond and Snaith paid particular attention to four salient aspects of its design to enhance its suitability for use in this particular setting. Firstly, the HADS is short, easy to administer and well accepted by patients. The HADS is a 14 item multi-choice questionnaire that takes only 2 to 5 minutes to complete. A short and simple written instruction at the introduction to the HADS directs the person to answer the questions to best indicate how they felt in "the past week". Each item is answered by the patient on a four point (0–3) response category, therefore the possible scores range from 0 - 21 for anxiety (7 items) and 0 - 21 for depression (also 7 items) (Snaith, 2003; Zigmond & Snaith, 1983). Secondly, in designing the HADS, Zigmond and Snaith intentionally omitted questions that related specifically to physical indicators of psychological distress (such as headache, fatigue, insomnia, weight loss), as this type of question could give rise to false positives if such symptoms were in fact due to an underlying medical illness. Thirdly, patients answer questions or rate statements relevant to *generalised* anxiety and depression, and severely psycho-pathological symptoms are not included as descriptors, as the HADS was not designed for making a specific *diagnosis* of major depression in medical or psychiatric patients (Zigmond & Snaith, 1983). Thus, the scale has been found to be more sensitive to mild forms of psychiatric disorders, thus avoiding the ‘floor effect’, (an insensitivity or inability of an instrument to measure a variable below a certain lower threshold) which is frequently observed

when psychiatric questionnaires are used with medical patients (Herrmann, 1997). Finally, it was intended that the HADS scores should not be over-responsive to transient fluctuations in mood state, which may occur, for example, in situations such as going to a clinic. The questions were also carefully structured such that the HADS scores generally respond well to mood changes that may occur over longer time-frames, such as during the course of a disease and/or its treatment. Indeed, it has been shown that the HADS is less stable than typical *trait* scales, and that the HADS does respond well to mood changes that occur over time (Bjelland, Dahl, Haug, & Neckelmann, 2002; Herrmann, 1997; Snaith, 2003).

#### *3.9.5.2 Validity*

The anxiety and depression sub-scales that comprise the HADS were designed to assess both the severity and 'caseness' (whether or not a score is within a defined or arbitrary range of interest) of anxiety and depression in medical patients. Validity, in this case, describes the degree to which the anxiety and depression sub-scales within the HADS actually measure the separate corresponding psychological constructs. In both the Herrmann (1997) and later Bjelland et al. (2002) reviews of the HADS (747 identified studies), any correlation between the HADS anxiety and depression subscales was found to be mainly due to a real coincidence of anxious and depressive symptoms in the patient populations studied, rather than a particular inadequacy of the instrument itself. Additionally, both the HADS subscales correlated well with other measures that have previously been validated (concurrent validity) and in broad terms, the HADS was found to demonstrate concurrent and discriminant validities in the range of 'satisfactory' to 'good' (Bjelland, Dahl, Haug, & Neckelmann, 2002).

With respect to sensitivity, specificity, and caseness, Zigmond and Snaith adopted the premise that mild psychiatric disorder cannot be considered to be either present or absent, but rather, it is more a question of degree. Thus, with consideration given to the above premise, Zigmond and Snaith (1983) purported that:

> "scales related to mood disorders are more in accord with reality if they provide score ranges which indicate the probable absence, possible presence, and probable presence of clinically meaningful degrees of the mood disorder" (p. 365).

Further, Zigmond and Snaith, did not assign specific cut-off scores for the categories 'probably absent', 'possibly present', and 'probably present', and there is no single standardised cut-off score for the HADS (although Zigmond and Snaith's initial research indeed evaluated the HADS at various different cut-off values). Zigmond and Snaith (1983) instructed that the cut-off scores used are best chosen with respect to the *purpose* of the enquiry. Specifically, if the research requires the inclusion of individuals who have a high probability of disordered mood, (thus only a low number of false positives being acceptable), then the cut-off set at the upper range of the 'possible' range should be used (i.e. 10/11 for each sub-scale). Conversely, if the research requires the inclusion of all 'possible' cases of disordered mood, (thus only a low number of false negatives being acceptable), then a cut-off at the lower range should be used (i.e. 8/9 for each sub-scale). Subsequently, cut-off scores for both subscales: 7/8 for possible and 10/11 for probable anxiety or depression have now been widely adopted (Bjelland, Dahl, Haug, & Neckelmann, 2002), with some researchers using a cut-off of 15 to denote severe cases (Snaith, 2003) (although the scale was arguably not designed for this purpose). Bjelland et al. (2002) reported that in most studies reviewed, an optimal balance between sensitivity and

specificity was achieved when caseness was defined by a cut-off threshold score of 8 or above, on both subscales, and 'area under receiver operating characteristic curves' (AUROCs) of approximately 0.80 were demonstrated.

Test-Retest reliability typically shows a high correlation, $r > 0.80$, after up to 2 weeks, however, this decreases with longer time intervals (Snaith, 2003). Thus, the HADS is stable enough to withstand situational influences, yet over longer time periods, the HADS should be sufficiently sensitive to respond to mood changes.

#### *3.9.5.3 Instrument selection*

In selection of the HADS for this study (ahead of several alternative instruments as reviewed below), consideration was given to a number of factors including the particular characteristics of the various instruments available, the context and purpose of the enquiry, and the available resources of time, funding, and knowledge.

Firstly, the method of the 'diagnostic interview' was considered. Generally, subjects are interviewed by an appropriately trained general practitioner, psychologist or psychiatrist using, for example, operational rules based on the DSM-III manual (American Psychiatric Association, 1982). However, this method is time consuming, requires trained expertise that was not readily available, and would probably have provided excessively detailed data. Diagnostic interviewing was not therefore selected for this study.

Secondly, consideration was given to the plethora of questionnaires available that are specifically designed for the assessment of anxiety and depression. A number of popular

instruments were considered including: *The General Health Questionnaire (GHQ)* (Goldberg, 1972; Goldberg & Bridges, 1987; Goldberg & Hillier, 1979), *The Hopkins Symptom Check List (HSCL-25)* (Parloff, Kelman, & Frank, 1954), *The Short Form 36 Health Survey (SF-36)* (Ware, Snow, Kosinski, & Gandek, 1993), The *Beck Anxiety Inventory, (BAI)* (Beck, Epstein, Brown, & Steer, 1988) *The Beck Depression Inventory (BDI)* (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) and *The 20-item Self Report Questionnaire (SRQ)* (Harding et al., 1980), and a brief synopsis of each is provided below.

The original 30-item General Health Questionnaire (GHQ) (Goldberg, 1972), although demonstrating similar sensitivity (86% ) and specificity (80%) to the HADS (on the anxiety and depression sub-scales), is generally considered multi-dimensional and measures more than just anxiety and depression, and the long-version GHQ was also considered to be too long for the current study. The revised short version (GHQ-12) (Goldberg & Williams, 1988) has been widely used for detecting psychological morbidity, however it is regarded as measuring only a single generalised dimension of psychological health, with higher scores indicating worse conditions (Goldberg & Williams, 1988)

The Hopkins Symptom Check List (HSCL-25) (Parloff, Kelman, & Frank, 1954) is a symptom inventory which measures symptoms of anxiety and depression. It consists of 25 items; 10 items for anxiety and 15 items for depression symptoms. It has been shown that the total score is highly correlated with severe emotional distress of unspecified diagnosis, and the depression score is correlated with major depression as defined by the DSM-III-R (APA, 1987). The sensitivity of the HSCL-25 for any present DSM-III-R psychiatric disorder is

reported to be 48% and the specificity 87% (Veijola et al., 2003). Given that the HSCL-25 is more appropriate for detecting major depression and severe emotional distress and that it is longer than the HADS, the HSCL-25 was not selected.

The Short Form 36 Health Survey (SF-36) (Ware, Snow, Kosinski, & Gandek, 1993) is a 36-item questionnaire assessing functional health-related quality of life in 8 domains: physical functioning, role limitations due to physical problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems, and mental health. Although popular, this questionnaire is best suited to in-depth studies of quality of life, for example the New Zealand Health Survey (Ministry of Health, 2004), and some researchers suggest additional use of a self-rating instrument for depression and anxiety such as the HADS, when the SF-36 is used as a quality of life measure (Foss & Dahl, 2002). The SF-36 was considered too long and too comprehensive for the current study, and was therefore not selected.

The Beck Anxiety Inventory (BAI) (Beck, Epstein, Brown, & Steer, 1988), a 21 item self-report checklist for anxiety symptoms, and the Beck Depression Inventory (BDI) (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), a 21 item self-report rating inventory (13 and 11 item short forms now available) measuring characteristic attitudes and symptoms of depression, both exhibit relevant floor effects, and unlike the HADS, contain items relating to physical indicators of psychological distress, and/or symptoms that could be due to an underlying medical illness. For the above reasons, and considering the resultant length of a questionnaire that combined the BAI and BDI, these scales were not selected for the current study.

The 20-item Self Report Questionnaire (SRQ) (Harding et al., 1980) is a 'case-finding' questionnaire for psychiatric disorders, This instrument was designed to study mental illness in primary care settings in developing countries. The SRQ's design purpose is detecting the presence or absence of psychiatric disorders and/or psychiatric morbidity (Harding et al., 1980), and thus was not considered a specific measure of the presence and degree of anxiety and depression, and the SRQ was subsequently not selected for the current study.

#### *3.9.5.4 Summary*

In the main, the HADS has been shown to perform well not only in hospital practice for which it was first designed, but in primary care patients and in the general population as well (Bjelland, Dahl, Haug, & Neckelmann, 2002). Given the above findings, the HADS was incorporated in this study to investigate any possible relationships between a positive score on the HADS and other selected patient measures and outcomes, both at the time of the patients' initial interviews and at the six month follow-up. The HADS was considered an excellent 'fit' for inclusion in the current study.

### *3.9.6 The Life Orientation Test-Revised (Lot-R)*

Presently, there are at two predominant perspectives on the measurement of optimism and pessimism. The basic premise of the 'separate dimensional perspective' is that people, to varying degrees, can be both optimistic and pessimistic at the same time and instruments designed from this perspective score individuals on separate subscales for both optimism and pessimism, for example the Optimism and Pessimism Scale (OPS) (Dember, Martin, Hummer, Howe, & Melton, 1989). Conversely, the 'bipolar perspective' holds that optimism and pessimism lie on opposite ends of a bipolar continuum and examples of instruments which measure optimism in this way are the Life Orientation Test (LOT-R) (Scheier, Carver, & Bridges, 1994) and the Attributional Style Questionnaire (Peterson et al., 1982) (as derived form Abramson, Seligman, and Teasdale's 1978 Learned Helplessness Theory). Kubzansky, Kubzansky and Maselko (2004) suggest that optimism and pessimism may be correlated to greater or lesser degrees, depending on the particular health outcome variable/s of interest (for example, psychological health outcomes, as compared to physical/behavioural outcomes). Kubzansky, Kubzansky and Maselko (2004) note the inherent paradox of how to define exactly what pessimism is, if it is not simply the opposite of optimism. Further, Chang (1998) poses the 'optimism-neuroticism hypothesis' and argues that much of the previous research that demonstrates the positive relationship between optimism and better physical and psychological health is, at least in part, due to an overlap with the personality trait neuroticism. Thus, (Chang, 1998) postulates that the reported health benefits of optimism may be better explained by its co-variation with neuroticism, although a more recent synopsis of the

optimism-neuroticism literature (Olason & Roger, 2001) found that the positive health outcome relationships appear to exist independently of the effects of neuroticism.

Despite these complex differences in the way optimism and pessimism are commonly viewed and measured, it is generally considered that *expectations* for the future help determine peoples actions and experiences and simply, optimism is the generalised expectation for "good" outcomes, and pessimism is the generalised expectation for "bad"(Carver & Scheier, 2003). The bipolar view of optimism and pessimism has been adopted: largely because the health outcome measures of interest incorporate a mix of psychosocial and physical measures and also in an effort to simplify data analysis. Thus, optimism and pessimism was assessed with the Life Orientation Test Revised (LOT-R) (Scheier, Carver, & Bridges, 1994). The LOT-R consists of six coded items plus four fillers. Three of the coded items are phrased positively (e.g., "In uncertain times I expect the best") and three are phrased negatively (e.g., "If something can go wrong for me, it will"). Each item was answered on a 5-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree).

The Lot-R is a revised version of the original LOT (Scheier & Carver, 1985). The original (and still commonly used) LOT is a brief 12 item self-report measure, originally designed to provide a uni-dimensional index, with a high score indicative of optimism and a low score of pessimism. However, following subsequent research involving the widespread application of the LOT, it was indicated that, in reality, a bi-dimensional model involving separate optimism and pessimism factors is more accurate (Chang, D'Zurilla, & Maydeu-Olivares, 1994). Subsequently, Scheier, Carver, and Bridges (1994) revised the LOT, and the uni-dimensional

LOT-R was developed to provide continuous distributions of scores. The two coping items as included in the original LOT were omitted, and the LOT-R focuses more on the expectations of good versus bad outcomes (Scheier, Carver, & Bridges, 1994). Factor analyses indicate that the LOT-R score may be used to represent whether a person is an optimist or pessimist (Carver & Scheier, 2002; Reilley, Geers, Lindsay, Deronde, & Dember, 2005). While optimists and pessimists are often referred to as two distinct groups, in reality however, people range from very pessimistic to very optimistic, with most people falling somewhere in between. The terms optimism and pessimism may best be used as a comparative between individuals or groups, as there are no defined thresholds or arbitrary cut-off scores within the LOT-R scale (Carver & Scheier, 2003).

An expanding body of research documents that the LOT-R is a sound and reliable predictor of behavioural and psychological outcomes (for examples see Scheiner & Carver, 1992, and Taylor et al., 2000 for overviews). Optimism, as assessed by the LOT-R, represents a generalized expectancy for good outcomes across multiple domains of life, rather than specific domains such as the health or occupational domains. The LOT-R uses somewhat abstract and generalised items, and therefore assumes that people can merge expectancies across multiple domains, and report accurately on their 'global' tendency to expect "good" or "bad" (Carver & Scheier, 2003; Scheier, Carver, & Bridges, 1994). expectations

#### *3.9.6.1 Validity*

Construct-validity for the LOT-R comes from studies showing that the scores are strongly correlated with physical and psychological well-being and relatively unrelated to measures of

social desirability (Scheier & Carver, 1992). The LOT-R demonstrates good internal reliability with a Cronbach'a alpha of 0.78 (Burke, Joyner, Czech, & Wilson, 2000; Scheier & Carver, 1985). The Cronbach'a alpha indicates the extent to which the test items can be treated as measuring the single latent variable of optimism (generally a reliability of 0.70 or higher being required before an instrument is adopted). Test-retest reliability has been shown to be adequate: $r = .79$ over a four-week interval (Scheier & Carver, 1985); $r = .60$ over twelve months; $r = .56$ over twenty-four months; $r = .79$ over twenty-eight months (Burke, Joyner, Czech, & Wilson, 2000). Convergent validity is demonstrated by the significant correlations with other constructs, for example depression, hopelessness, self-esteem, perceived stress, and locus of control (Scheier, Carver, & Bridges, 1994). In various populations, higher levels of optimism have been shown to be associated with better health outcomes during times of difficulty, such as coronary patients, breast cancer patients and college students under academic stress (reviewed by Scheier and Carver, 1992). Discriminant validity is demonstrated by low correlations between the LOT-R and other related measures (Burke, Joyner, Czech, & Wilson, 2000).

#### *3.9.6.2 Instrument selection*

In selection of the LOT-R for this study (ahead of several alternative instruments as reviewed below), consideration was given to a number of factors including the particular characteristics of the various instruments available, the context and purpose of the enquiry, and the available resources of time, funding, and knowledge.

The COPE complete version (60item) (Carver, Scheier, & Weintraub, 1989): The COPE

complete version incorporates 13 conceptually distinct scales, including for example: active coping, planning, seeking social support, positive reinterpretation and growth, and behavioural disengagement. The scales were based on specific theoretical arguments and previous research on coping tendencies and adaptive coping. For example the *active coping* scale measures a person's capacity for taking active steps to try to remove a stressor or to ameliorate its effects. One of the main aspects of Carver, Scheier, and Weintraub's (1989) research was to explore the possible existence of individual differences in preferred coping styles. With respect to this study, it may have been useful to probe specific aspects of the coping process in more depth, however, the COPE was considered to be significantly too long (at 60 items), with the potential to generate excessively dense data beyond the scope of this study.

Brief COPE (28 item) (Carver, 1997). The Brief COPE was created partly because researchers found the patients often became impatient at responding to the full instrument, and also, the original instrument contained certain redundancies that further added to the overall burden of assessment. Therefore, the original COPE was reduced to only 2 items per scale and some scales were combined and others omitted in order to shorten and refine the instrument overall. However, as was the case with the full COPE, the Brief COPE was still considered too long (28 items), with the potential to generate excessive data beyond the scope of this study, and neither of the COPE versions provided distinct optimism/pessimism scores.

The Attribution Style Questionnaire (ASQ) (Peterson et al., 1982): All current variants of the ASQ stem from the *Reformulated Learned Helplessness Theory* (Abramson, Seligman, & Teasdale, 1978). The ASQ consists of 24 hypothetical negative events and participants

attribute a cause for each event and make 7-point Likert ratings about their attributions along three explanatory style dimensions; internal/external, global/specific, and stable/unstable. The ASQ yields an overall explanatory style score and this score is interpretable as optimistic (a high score) or pessimistic (a low score). It is postulated that pessimism is associated with an 'attributional' or 'explanatory style' in which uncontrollable bad events are attributed to internal, stable, and global causes and conversely, optimism is associated with external, unstable, and specific causes (Abramson, Seligman, & Teasdale, 1978; Peterson et al., 1982; Seligman, 1991). A measure of individual differences in explanatory style scores may have been useful in this study, however, an in-depth analysis of explanatory style was not a primary focus of the current study. It was considered that the shorter and simpler LOT-R was more suitable than the longer and more complex ASQ instrument.

The Hopelessness Scale (HS) (Beck, Weissman, Lester, & Trexler, 1974): The Beck Hopelessness scale is a 20-item true-false self-report instrument that assesses the degree to which an individual holds negative expectations towards their future. The HS is described as a measure of pessimism (Beck, Weissman, Lester, & Trexler, 1974) and higher scores indicate greater pessimism or "hopelessness". The underlying assumption is that hopelessness can be objectively measured by defining it as a system of cognitive schemas (a mental set, representation, or set patterns of thinking) with inherently negative expectations (Beck, Weissman, Lester, & Trexler, 1974). In validation studies, Beck et al (1974) reported a Chronbach alpha of 0.93, and in a more recent review of various optimism/pessimism instruments, Young, Halper, Clark, Scheftner, and Fawcett (1992), found the scale to be unidimensional with strong item/construct relationships, however, the HS was found to be

relatively insensitive at lower levels of hopelessness. Hopelessness, as a measure of pessimism, has been shown to be a useful psychological construct and the HS has been used extensively for suicide risk assessment and prediction (Chang, D'Zurilla, & Maydeu-Olivares, 1994). However, for the purpose of this study, an instrument that also measures peoples' positive expectations for the future (optimism) was desired. Consequently, the HS was not selected.

The Optimism and Pessimism Scale (OPS) (Dember, Martin, Hummer, Howe, & Melton, 1989): The OPS consists of 18-item optimism and pessimism scales (incorporating 20 filler items in total). All 36 items are rated on a 4-point scale ranging from *strongly agree* to *strongly disagree*. The scale has been shown to be reliable, with alpha coefficients of .84 and .86 for optimism and pessimism (Dember et al., 1989), and test-retest reliability over a two week period was r = .75 for optimism and r = .84 for pessimism. However, in an investigation of the concurrent validity between the LOT-R and the OPS, Burke et al. (2000) found that the two instruments are not well related. Burke et al. offer the suggestion (although not empirically validated) that optimism and pessimism may well have *state* and *trait* components, and that the OPS scale is probably measuring state optimism and state pessimism, and the LOT-R may be more of a measure of trait optimism and trait pessimism. This would seem to be in accord with Carver and Scheier's (1985) view of optimism as the generalised expectation of "good" outcomes and pessimism as the generalised expectation of "bad". Further, in the Chang et al. (1994) review of the LOT, HS, and OPS, one of the main criticisms of the OPS is that it has a very broad focus and that the optimism and pessimism scales may be confounded by other constructs such as self-esteem, hope and life satisfaction (Carver & Scheier, 2003; Chang,

D'Zurilla, & Maydeu-Olivares, 1994). Chang et al. (1994) found that the OPS did not fit well with a two factor model of optimism and pesimism, but rather,

> "the OPS is a complex, multidementional instrument which is very difficult to interpret theoretically" (Chang, D'Zurilla, & Maydeu-Olivares, 1994 p.153).

For these reasons, in addition to the overall length of the OPS (36 items), the OPS was not selected for this study.

The Positive And Negative Expectancy Questionnaire (PANEQ) (Olason & Roger, 2001): When considering the measurement of optimism and pessimism, particularly in health settings, Olsen and Roger (2001) propose that their PANEQ represents an attempt to reconcile conflicting findings and to explore the relationships between optimism, pessimism, and negative and positive affect. Olsen and Roger (2001) constructed the PANEQ which yields three factors, labelled Negative Affect/Pessimism (NAP), Fighting Spirit (FS), and Positive Affect/Optimism (PAO), all of which showed high internal validity (coefficient alphas 0.903, 0.865, and 0.753 respectively) and high test-retest reliability ($r$ = 0.824, $r$ = 0.802, and $r$ = 0.819 respectively). Concurrent validity was based on comparisons with other measures of optimism/pessimism (LOT-R), positive and negative affect, generalised expectancy for success, satisfaction with life, and coping styles (for detail of the specific instruments see Olason and Roger 2001). Taken together, the results of the concurrent validation demonstrate a clear discrimination between the three PANEQ scales (Olason & Roger, 2001). Similar validity has now been established for the German version of the PANEQ, the PANEQ-G (Titzmann, Roger, Olason, & Greco, 2004). The authors propose that,

> "the emergence of the 'fighting spirit' scale provides a new and empirically distinct dimension of the optimism/pessimism construct which could prove invaluable in future research on persistence in both cognitively and emotionally challenging settings" (Olason & Roger, 2001 p.766).

The PANEQ, and in particular the inclusion of the 'fighting spirit scale', appears suited to this study, however due to the relative paucity of studies using the PANEQ to date, and its long length (48 items), the PANEQ was not selected.

#### *3.9.6.3 Summary*

In this study, the intention was to investigate any possible correlations between optimism and a number of psychosocial and physical health outcomes, rather than undertake an in-depth study of the bivariate or univariate model of optimism/pessimism, or of coping styles per se. Of the other instruments considered, the PANEQ (and in particular the inclusion of the 'fighting spirit scale') may prove to be useful in future research on health behaviour change, and the management of chronic diseases. However, due to the relative paucity of studies using the PANEQ to date and its long length (48 items), its use in a study of type 2 diabetes self-management probably represents a considerable (and potentially worthwhile) undertaking in itself. Therefore, the LOT-R was selected for this study as being practicably representative of the general area of inquiry.

### *3.9.7 The Short Self-Regulation Questionnaire-Goal Setting*

It has been suggested that

> "Goals determine the direction, intensity and duration of action" (Locke, 2001, p. 304), and the setting of higher goals leads to higher performance (Locke & Latham, 2002).

It was therefore considered of significance to measure the extent to which subjects routinely participated in goal setting for positive outcomes. Goal setting and goal-directed behaviour are salient processes of self-regulation and high levels of self-regulation allow a person to delay gratification in the short term to achieve desired outcomes in the future (Neal & Carey, 2005). Self-regulation questionnaires measure individual differences in motivation and/or the regulation of behaviour. The regulatory styles, while considered individual differences, are not "trait" concepts, for they are not particularly stable but neither are they "state" concepts, as they are more stable than typical states which tend to fluctuate easily as a function of time and context (Ryan & Connell, 1989). The Short Self-Regulation Questionnaire-Goal Setting subscale (SSRQ-GS) (Neal & Carey, 2005) was used to assess the degree to which subjects are *goal-directed* towards positive outcomes in times of adversity.

#### *3.9.7.1 Instrument selection*

Brown, Miller and Lawendowski (1999) developed the Self-Regulation Questionnaire (SRQ), a 63-item instrument to assess the seven dimensions or processes of self-regulation as previously expressed by Miller and Brown (1991). Miller and Brown proposed that seven different processes were central to self-regulation including: informational input, self-

evaluation, instigation to change triggered by perceptions of discrepancy, search for ways to reduce discrepancy, planning for change, implementation of behaviour change, and evaluation of progress toward a goal. The SRQ (and its subsequent revisions) was developed within the context of addictive disorders, specifically alcohol use and alcohol related consequences. The researchers investigated the practicability of measuring generalised self-regulation capacity and whether it might be applicable across a wider range of problem behaviours. More recently, Carey, Neal, and Collins (2004) extended the psychometric evaluation of the SRQ by evaluating the factor structure of the SRQ, the internal consistency of the resultant factor(s), and the convergent and discriminant validity. Results of their analysis did not support a seven-factor scale (as proposed by Miller & Brown, 1991), but instead indicated a single factor, on which 31 of the original 63 items loaded significantly. This led to the development of the 31-item short form of the SRQ (Carey, Neal, & Collins, 2004). The 31-item SSRQ correlated highly with the original 63-item SRQ ($r$ = .96) and showed good internal consistency (Cronbach alpha = .92).

#### *3.9.7.2 Validity*

In the most recent revision of the SSRQ, Neal and Carey (2005) further extended the psychometric evaluation of the SSRQ and found that the single-factor solution to the SSRQ was not fully supported, instead, a two-factor solution was demonstrated. Specifically, the item loadings indicated that one factor measures impulse control (SSRQ-IC) and the other measures goal-setting behaviour (SSRQ-GS). The SSRQ-GS comprises 10 items, each scored on a 5-point Likert scale (1 = strongly disagree - 5 = strongly agree), and item scores can be summed to create a total score. The SSRQ-GS items include for example: (Q1) “I usually keep track of

my progress toward my goals", (Q2) "I am able to accomplish goals I set for myself", and (Q4) "As soon as I see a problem or challenge, I start looking for possible solutions". Neal and Carey (2005) demonstrated that both factors were internally consistent and were moderately correlated ($r$=.55). The SSRQ-GS was found to have a Cronbach's alpha of 0.86. Support for convergent and discriminant validity of the SSRQ-IC was demonstrated by examination of their relationships with other questionnaires assessing related constructs, for example, The Self-Control Schedule (SCS) (Rosenbaum, 1980), a 36-item measure that assesses an individual's tendency to exert self-control when faced with certain types of problems, the Eysenck Impulsiveness Scale (EIS) (Eysenck, Pearson, Easting, & Allsopp, 1985), a 19-item scale that assesses difficulty controlling behaviour, and The Marlow-Crowne Social Desirability Scale (MCSD) (Crowne & Marlowe, 1964), a 13 item questionnaire designed to assess study participants' desire to be viewed in a positive light. The SSRQ-GS correlated with the SCS ($r$=.60) and the MCDS ($r$=.15) and both were significant and in the expected direction. The SSRQ-GS was also compared across the demographics of age, gender, class standing and ethnicity, and the analysis indicated no significant differences. Neal and Carey (2005) conceded however, that although their study demonstrated good validity for the impulse control subscale (SSRQ-IC), evidence for the convergent validity of the goal-setting sub-scale (SSRQ-GS) was, at the time, rather less developed. In addition, Neal and Carey acknowledged the potential for the SSRQ-GS to show some social desirability bias.

#### *3.9.7.3 Instrument selection*

In the main, goal theory research and the measurement of goal setting participation has predominantly evolved within the field of industrial and organisational psychology and

education. There are relatively few instruments designed to assess goal setting behaviours in other domains (perhaps with the exception of competitive sport). In selection of the SSRQ-GS for this study (ahead of other alternative instruments), consideration was given to a number of factors including the particular characteristics of the various instruments available, the context and purpose of the enquiry, and the available resources of time, funding, and knowledge.

*Alternative instruments considered*

The Goal Setting Questionnaire (Locke & Latham, 1984): Like most of the earlier instruments designed for measuring peoples' goal-setting participation, Locke and Latham's (1984) Goal Setting Questionnaire (GSQ) is an example of an instrument designed to measure goal-setting in the workplace. The GSQ is long, at 45 items, and many of the questions make specific reference to the workplace, the boss, external rewards and other workmates. As such, the GSQ was not considered suitable for use in a health behaviour context. Another example of an instrument for assessing the personal work goals of employees is the Work Concerns Inventory (WCI) (Roberson, 1989), which characterises work goals and goal choice on behaviour-relevant variables. The WCI was designed to measure how personal work goals influence organizational behaviour, and like the GSQ, was not considered ideally suited to the health promoting/ behaviour change context of this current study.

Of more relevance, Schiano-Lomoriello, Cury and Da Fonséca (2005) have developed the Approach and Avoidance Questionnaire for Sport and Physical Education (AAQSPE), a 21 item questionnaire to measure goal setting orientation on two sub-scales *approach* and *avoidance*, in a sport and exercise context. The questionnaire was designed and utilised by the

researchers to investigate goal achievement and the consequences and antecedents of the avoidance and approach goal orientations. This may be a useful dimension to investigate in future studies in health settings, however in this study a broader investigation of goal setting participation (rather than orientation) was desired, and the AAQSPE was not selected.

The Athletic Coping Skills Inventory (ACSI-28) (Smith, Schutz, Smoll, & Ptacek, 1995) contains seven sport specific subscales: coping with adversity (COPE), peaking under pressure (PEAK), goal setting/mental preparation (GOAL), concentration (CONC), freedom from worry (FREE), confidence and achievement motivation (CONF), and 'coachability' (COACH). The GOAL sub-scale contains items not dissimilar to the SSRQ-GS, for example: item 8 "I tend to do lots of planning about how to reach my goals" and item 26, "When I fail to reach my goals, it makes me try even harder". The entire questionnaire is longer and more detailed than the SSRQ-GS, and the ACSI-28 is generally sport specific in its focus, whereas for this study, a global measure of goal-setting was desired. Further the ACSI-28 has been criticised for appearing to measure coping efficiency rather than coping utilization (Gaudreau & Blondin, 2002). Consequently, the ACSI-28 was not selected.

#### *3.9.7.4 Summary*

Despite the relative newness of the SSRQ-GS instrument, and the relative paucity of studies applying the SSRQ-GS, the SSRQ-GS has been included as its divergence from previous industrial/organisational origins was considered desirable. Further, its development from within a health (problem) behaviour context suggests a good 'fit' with this study's objectives, as the items refer to goal setting behaviours in a global context and as such, the SSRQ-GS may

be more reflective of an array of self-management behaviours in general. Further, it is concise, at 10 items, and the 5-point Likert scale answer-format makes the SSRQ-GS easy to administer and score. The potential utility of the SSRQ-GS appears to be strong.

### *3.9.8 The Traumatic Stress Schedule*

#### *3.9.8.1 Introduction*

Good and bad events in peoples' lives can increase stress levels and make people more susceptible to illness and mental health problems (Holmes & Rahe, 1967). Extremely distressing or traumatic events are associated with over-utilization of medical services, increased rates of health complaints and physical disorders, a variety of somatic symptoms, and several diseases, including arthritis and diabetes (Golding, 1994). Norris (1992) studied the frequency and impact of 10 potentially traumatic events in a sample of 1,000 American adults. Norris found that, 69% of the adults surveyed had experienced at least one traumatic event in the course of their lives, including serious motor vehicle accidents, loss of a family member or friend, and physical assault. By definition, traumatic events evoke intense fear, helplessness, or horror (American Psychiatric Association, 1994) and exposure to trauma is a risk factor for various mental health problems, including intrusive distressing memories, nightmares, loss of interest in previously enjoyable activities, insomnia, and loss of concentration (American Psychiatric Association, 1994). The distinction between screening for traumatic events, and the measurement of stress levels per se is of note. Specifically, a screening instrument for traumatic events was included in this study in an effort simply to identify traumatic events and if necessary, to control for these events, (in particular any loss of interest in previously enjoyable activities such as the engagement in physical activity and/or other positive aspects of the self-management of type 2 diabetes). The measurement of stress levels per se was not attempted within the context of the current study. It was considered outside the scope of this current study to use structured interview schedules to

assess life stress in detail, and to quantify and correlate stress levels (i.e. varying degrees of magnitude) to other outcome variables.

Traumatic stress is a complex construct, and as a consequence, its assessment entails considerable practical difficulties including, but not limited to, the difficulty in arriving at a clear definition of trauma, the assessment of traumatic events across the lifespan, and the assessment of a broad range of both high and low magnitude stressors. Other issues include the relative merits of questionnaires or checklists versus interviews, especially with respect to time and resources, the clinical sensitivity of the format, test-retest reliability, and construct validity (Bromet, 1990).

#### *3.9.8.2 Instrument selection*

The Traumatic Stress Schedule (Norris, 1990) is a brief screening instrument for detecting traumatic stress in the general population. The scale is designed for use by lay-interviewers, and is not designed to tell investigators everything about a particular incident or a person's stress history but to provide core and essential information about the occurrence and impact of major traumatic events (Norris, 1990). The report period is designed to be flexible and in this study six months was selected. The Traumatic Stress Schedule asks about eight classes of traumatic events, within three domains: violent encounters with nature, technology, or humankind. Norris (1990) defined a violent event as:

> "one that (a) is marked by extreme and/or sudden force, (b) involves an external agent, and (c) is typically capable of arousing intense fear or aversion"(Norris, 1990, p.1706).

Such events share a number of common properties including being undesirable, unexpected and uncontrollable, and beyond what is normally experienced. Norris (1990) proposed that such events included:

> "(a) loss of a loved one through accident, homicide, or suicide; (b) having a motor vehicle accident serious enough to cause injury to one or more passengers; (c) robbery, a theft involving force or threat of force; (d) physical assault; (e) rape; (f) personal injury or property loss as a result of fire, severe weather, or disaster (either natural or technological); and (g) being forced to evacuate - or otherwise learning of imminent hazard in the environment" (Norris, 1990, p.1706).

In designing the Traumatic Stress Schedule, Norris considered the difficulties involved in evaluating the wide range of traumatic events that might occur outside of the seven categories already outlined. Further, Norris considered issues relating to the sole reliance on specific diagnostic criteria, as defined by the DSM-III R (1987). Thus, Norris included two supplemental general questions to identify more 'ordinary' stressors and to provide useful comparative data. The questions are intended to assess events which may not satisfy specific diagnostic criteria but are still perceived as shocking to the individual.

The first of the supplemental questions is somewhat subjective but still focused on extreme events: (Q8) "In the past six months, did you have some other terrifying or shocking experience?" The second supplemental question assesses events of a more ordinary yet still significant nature: (Q9) "In the past six months, has your life changed in an important way such as in your residence, job, or personal relations"?

The Traumatic Stress Schedule assesses life stress on two levels: firstly it identifies traumatic

events *occurrence* and secondly, with the use of 12 additional probing questions ('event probes') it assesses the *impact* of the particular event/s on the individual. Thus, once the occurrence of an event is established (arising from questions 1-9), the participant is probed and the event is evaluated on several dimensions, specifically: *loss* (of persons or property), *scope* (the extent to which others are affected), *threat* (threat to life and physical integrity), *blame* (victimization/self-blame), *familiarity* ('novice victims' versus 'experienced victims'), and *post-traumatic stress* (assessing the individual's response to the stressor). Therefore, for an individual who has recently experienced a traumatic event, up to 26 questions in total may be asked. Ultimately, the relevance of an event is some function of its *occurrence* and its *impact* (Norris, 1990). Norris notes however, that fundamentally, each of the eight classes of trauma is initially assessed by means of a single question and thus some traumatic events may be missed. As a crude estimate, Norris (1990) summed the reported rates of traumatic events occurring in the U.S. population from a number of different sources. Norris estimated that (conservatively) 8% of the U.S. adult population will experience one or more of the events detectable by the Traumatic Stress Schedule, within a given year. Knowing the base rate at which events currently occur in New Zealand would give an indication of whether the current sample is typical. However, in the current study, the data were simply used comparatively: to screen for changes in self-reported stressors that may have inhibited progress, or been perceived to be significant barriers to self-management, in particular the engagement in physical activity.

#### *3.9.8.3 Instrument selection*

In selection of the Traumatic Stress Schedule for this study (ahead of several alternative instruments as reviewed below), consideration was given to a number of factors including the

particular characteristics of the various instruments available, the context and purpose of the enquiry, and the available resources of time, funding, and knowledge. Of these considerations, the salient prerequisite for selection was that the instrument be short.

Firstly, the method of the 'structured interview' was considered whereby subjects are interviewed by an appropriately trained psychologist or other health professional, using operational rules or an interview schedule. However, this method is time consuming, requires trained expertise that was not readily available and would likely have provided excessively detailed data. Structured interviewing was not therefore selected for this study.

Further, it was not the intension of the study to investigate the stress levels of the subjects per se, or to obtain overly specific details of the nature of any particular traumatic event if reported (this was considered to be too intimate, potentially intrusive, and outside the scope and purpose of the study). It was, however, considered necessary to establish if any traumatic event reported had impacted significantly upon the individual, specifically, that he or she was significantly impaired in their self-management efforts and/or their progress toward better health outcomes. All of the alternative instruments (see below) were considered to be too long. In fact the Traumatic Stress Schedule was considered to be too long in its original form (including the 12 event probes). Consideration was given to the overall length of the survey questionnaire (incorporating the 7 other instruments, plus the demographic questions), and allocating up to 26 questions to life stress was judged as excessive. Therefore, the Traumatic Stress Schedule was adapted: the nine questions designed to identify traumatic events (occurrence) were included, and the 12 event probes were replaced by the single researcher-

created probe (un-validated): "Did this event significantly impact on your ability to manage your type 2 diabetes, in particular your efforts regarding physical activity, and your progress toward better health outcomes"? This 9 occurrence / 1 event probe format was considered to be adequate of the purpose of enquiry.

#### *3.9.8.4 Validity*

With regard to validity, a crucial question is whether or not individuals' reported recollections of traumatic events accurately correspond to actual events, and/or their real impact (if any). In order to establish the degree of correspondence between reported events and actual events, the researcher was forced to rely on the subjects' self-reports, as usually, no other direct or indirect source of corroboration was available. Further, as described above, the Traumatic Stress Schedule was not used in its full form but was reduced to the nine screening questions for 'occurrence' and the 12 event probes were replaced by the single researcher-created question (un-validated). Therefore, the adapted Traumatic Stress Schedule was used in this study as a 'coarse screen' for occurrence/impact only, rather than a validated instrument for detecting and quantifying life stress per se.

*Alternative instruments considered:*

A wide range of instruments is available for the measurement of quite specific types of traumatic stress, within various different populations. There is perhaps no ideal single instrument for all situations. Perhaps the most widely studied context for life trauma is War-zone exposure, with instruments being initially developed for male Vietnam veterans (see Watson, Juba, & Anderson, 1989 for a review). War-zone measures range widely in length and

scope and are generally well validated, however the general context was not considered suitable for this study.

Childhood trauma instruments, for example the Childhood Trauma Questionnaire (Bernstein et al., 1994), and adult physical and sexual assault questionnaires, for example the Abusive Behaviour Inventory (Shepard & Campbell, 1992), typically incorporate a wide range of questions, and use continuous rating scales to help quantify the extent of perceived stress. Again, the particular focus of these instruments made them unsuitable for the purpose of the current study.

Comprehensive Measures: In addition to the Traumatic Stress Schedule, one other instrument which comprehensively assesses trauma across the lifespan was considered, namely The Social Readjustment Rating Scale (Holmes & Rahe, 1967). The Holmes and Rahe Social Readjustment Rating Scale is based on the premise that increased stress levels make one more susceptible to illness and mental health problems (Holmes & Rahe, 1967). Holmes and Rahe developed a 'do-it-yourself' stress test and allocated points to a wide ranging 43 item hierarchy of potential stressors; ranging for example from "Death of a Spouse" 100 points, to "Christmas" 11 points ("Personal injury or illness" = 53 points). An individual simply sums the points allocated to every 'event list' item that he or she has experienced in the last 12 months (including multiple occurrences of the same event). The objective of the Social Readjustment Rating Scale is to identify possible factors that may be contributing to an individual experiencing stressful events (and thus potentially increasing their susceptibility to illness). The Holmes and Rahe scale factors in the relative weight that can be attributed to

various stressors. Holmes and Rahe (1967) estimated that 35% of those with a score below 150 will experience an illness or accident within two years, while those with a score between 150 and 300 have a 51% chance, and those with a score over 300 have an 80% chance of a significant illness or accident. While the Social Readjustment Rating Scale is comprehensive, easy to score and relevant to a general health context, at 43 items, it was considered too long and time consuming for use in this study, and the information collected would potentially be too comprehensive, thereby generating redundancies in the data.

#### *3.9.8.5 Summary*

A short screening instrument, The Traumatic Stress Schedule (Norris, 1990) was adapted for inclusion in the study questionnaire, in an effort to detect the occurrence and impact of traumatic events that may have negatively influenced individuals' engagement in previously enjoyable and/or health promoting activities (for example engagement in physical activity and/or other aspects of the self-management of type 2 diabetes). Subjects were screened for exposure to traumatic events comprising "violent encounters with nature, technology, or humankind".

The Traumatic Stress Schedule was adapted to retain the nine questions designed to identify traumatic events (occurrence), however the 12 event probes were replaced by a single researcher-created probe (un-validated). This 9 occurrence/1 event probe format was considered to be adequate and practicable of the purpose of the enquiry.

# 4 RESULTS

## *4.1 Introduction*

The Methodology Chapter outlined the current study design, the various instruments and measures used, the method by which data was collected from the 30 study participants, and how it was subsequently scored, collated and finally analysed. To recap on the latter, the researcher-administered questionnaires were processed to provide sub-scale scores that were then converted to individual subject summary-reports. These individual subject's summary reports were then entered into the main Microsoft Excel ® study data spreadsheet. Additionally, individual subject's responses to 'long answer' questions were recorded, as articulated, for subsequent qualitative analysis. Results presented here were computed using the *Statistical Analysis System* 'SAS9®' software (2004) which enabled the computation of both the descriptive statistics and the correlational statistics presented in this results chapter.

This Results Chapter comprises three distinct and inter-related sub-sections, namely (4.2) the *descriptive results* (including the sociodemographic and clinical profiles of the subjects, the biochemistry results, the psychosocial/psychometric results, and the descriptive and qualitative results relating to the subjects' self-management behaviours), (4.6) the *correlational results* (including data in summary and table formats). Perhaps most importantly, Figures 25, 26, and 27 which collectively provide an illustrative overview of the contextual basis for the reporting of the study findings. Figures 25, 26, and 27 provide a 'quick reference' that may be used both initially and subsequently throughout this results chapter and also throughout the following Discussion Chapter.

## *4.2* Descriptive statistics: *sociodemographic and clinical profiles*

### *4.2.1 Biographic and family background*

Thirty three individuals were interviewed at baseline, however, three individuals did not participate at follow-up, thus n=30. One subject declined to participate in the second interview, and the other two were unresponsive and/or lost to follow-up. Approximately half the subjects were female (46.67 %) and half male (53.33 %). All subjects, except one (97 %), chose "New Zealand European" to describe their ethnic origin. One subject chose Māori to represent his ethnic origin (another who chose Māori as their ethnicity was lost to follow-up). The age of the subjects ranged from 41 to 80 years with a mean of 61.46 years. Half of the subjects were 62 years and below.

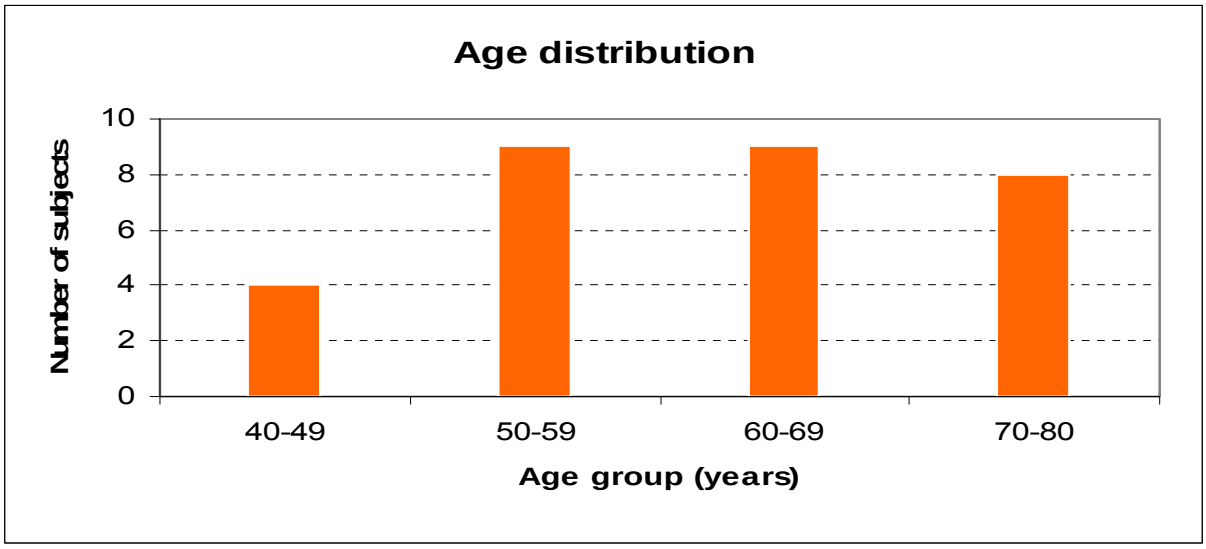



**Figure 4•**The frequency distribution of subject's age at the time of their diagnosis with type 2 diabetes. Mean age = 61.46 years.

### 4.2.2 *Education*

Education levels were assessed using the education questions (Q279-280) from the Life in New Zealand questionnaire (1991). Approximately one quarter of the subjects (26.67 %) did not hold an academic qualification equivalent to or including School Certificate. Thirteen percent completed School Certificate, approximately one quarter (26.67 %) held a trade or technical qualification and three subjects stated they had a university degree. Figure 5 illustrates subjects' highest education levels.

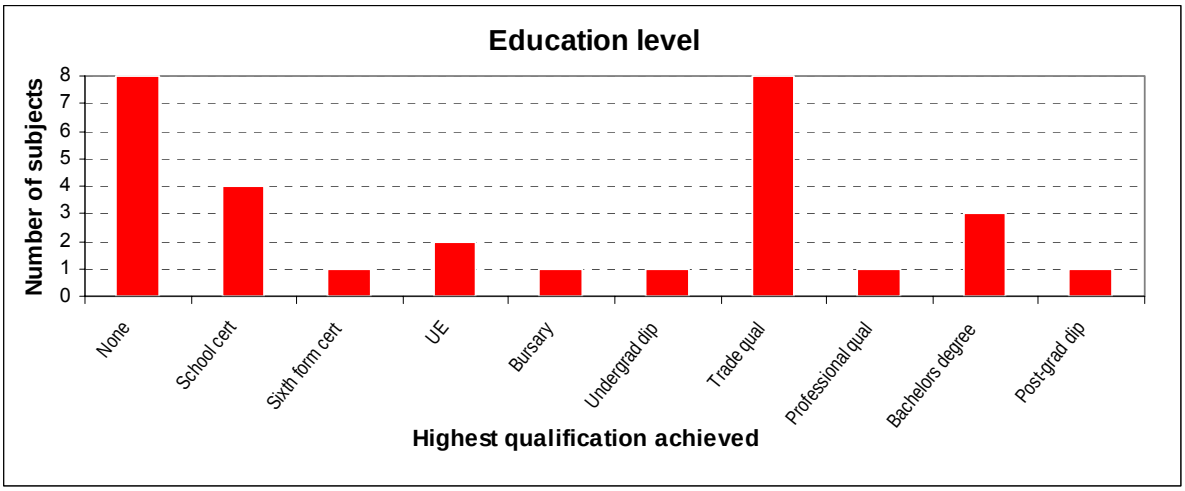



**Figure 5** •The frequency distribution of subjects' highest level of school and/or higher education as assessed by questions 279-280 from the Life in New Zealand questionnaire (1991).

### 4.2.3 *Annual family income*

Income was assessed using the income question (Q293) from the Life in New Zealand questionnaire (1991). Approximately half of the subjects (44 %) indicated that their gross household income was $25,000 or less, 33 percent, indicated that their income was between $30,000 and $50,000 and 17 percent indicated that their income was between $50,000 and $100,000. Figure 6 displays the subjects' levels of income.

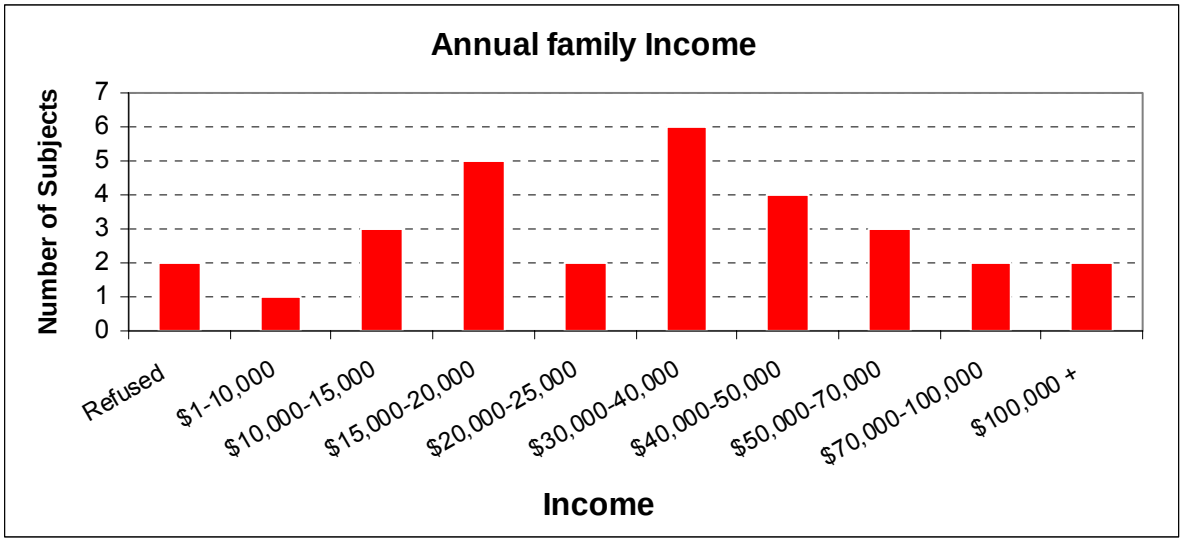



**Figure 6** •The frequency distribution of subjects' annual family (household) income as assessed by question 293 from the Life in New Zealand questionnaire (1991).

### *4.2.4 Co-morbidity*

Three subjects reported having another medical condition that prevented them managing their diabetes as well as they would like. One stated excessive weight as an impediment to physical activity (weight 126kg/BMI 50.91), one has vision impairment, and one has a leg amputation above the knee (not diabetes related). However, all three subjects reported that while their disability was barrier, it did not *prevent* them from engaging in some form of appropriate physical exercise.

### *4.2.5 Smoking status*

Nearly all the subjects (93.3 %) reported that they currently did not smoke cigarettes. Of the two subjects who said they intended to give up smoking (at baseline), neither had given up at follow-up, despite both reporting quit attempts within the foregoing six month time period.

#### *4.2.6 Alcohol consumption*

Three quarters (76.6 %) of the participants reported drinking alcohol and self-reports of alcohol consumption ranged from 0.23 standard drinks per week to (approximately) 24 to 30 standard drinks per week. At baseline, eight subjects reported drinking alcohol at levels exceeding the recommendations (classified by the AUDIT-C as hazardous drinking) and at follow-up, this had reduced to six subjects. The group-mean Audit-C scores were 2.66 (SD 2.42) at baseline reducing to 2.43 (SD 2.28) at follow-up. For female drinkers, the mean Audit-C scores decreased from 3.0 to 2.71 and for male drinkers, from 3.5 to 3.3 between baseline and follow-up.

### *4.3 Descriptive statistics: biochemistry results*

#### *4.3.1 HbA1c*

All the participants in the study were referred to MedLab South for a glycated (or glycosylated) haemoglobin test (HbA1c), at both baseline, and at six month follow-up. An HbA1c test is a laboratory measure that reflects a person's average blood glucose concentration over the previous 2-3 months. In the normal 120-day life span of the red blood cell, glucose molecules join haemoglobin forming glycated haemoglobin. In individuals with poorly controlled diabetes, increases in the quantities of these glycated haemoglobin are noted. In biochemical terms, the goal of diabetes management is to achieve HbA1c as *physiologically* normal as possible, preferably less than 7.0% (normal population 4-6%). Note that HbA1c is not specified for the diagnosis of diabetes (NZGG & Ministry of Health, 2003). Figure 7 displays the subjects' HbA1c levels at baseline.

One participant failed to present for his initial HbA1c test and another subject did not present at follow-up. The group-mean HbA1c at baseline was 6.75 percent (range 5.7-9.8 %). The group-mean HbA1c at follow-up was 6.19 percent (range 5.4 - 7.1 %). Thus, between baseline and follow-up, the group-mean HbA1c reduced by a clinically significant 0.56 percent (UK Prospective Diabetes Study Group, 1998). However, only six of the participants had baseline HbA1c levels exceeding 7 percent (7 % or less being considered good blood glucose management). Grouped together, these six subjects' mean HbA1c at baseline was 8.6 percent (range 7.2-9.8 %) and at follow-up was 6.55 percent (range 5.4-7.1 %). Thus, between baseline and follow-up, the sub-group-mean HbA1c reduced by a large 2.05 percent.

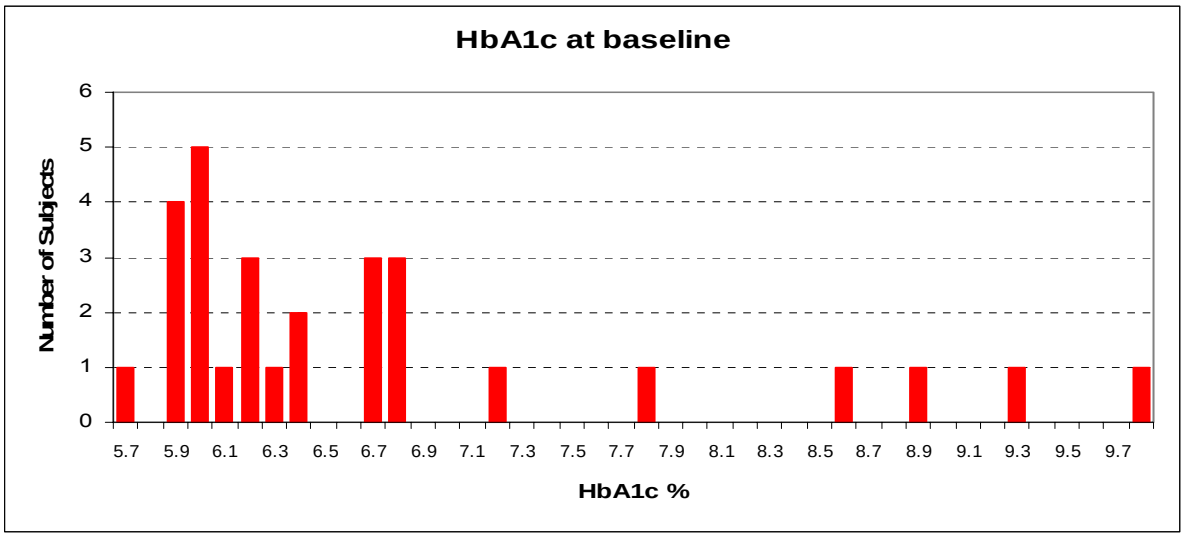



**Figure 7** •The frequency distribution of subjects' HbA1c levels at baseline. Note that 24 of 30 subjects HbA1c levels were below 7% at baseline (further, none exceeded 8% at follow-up).

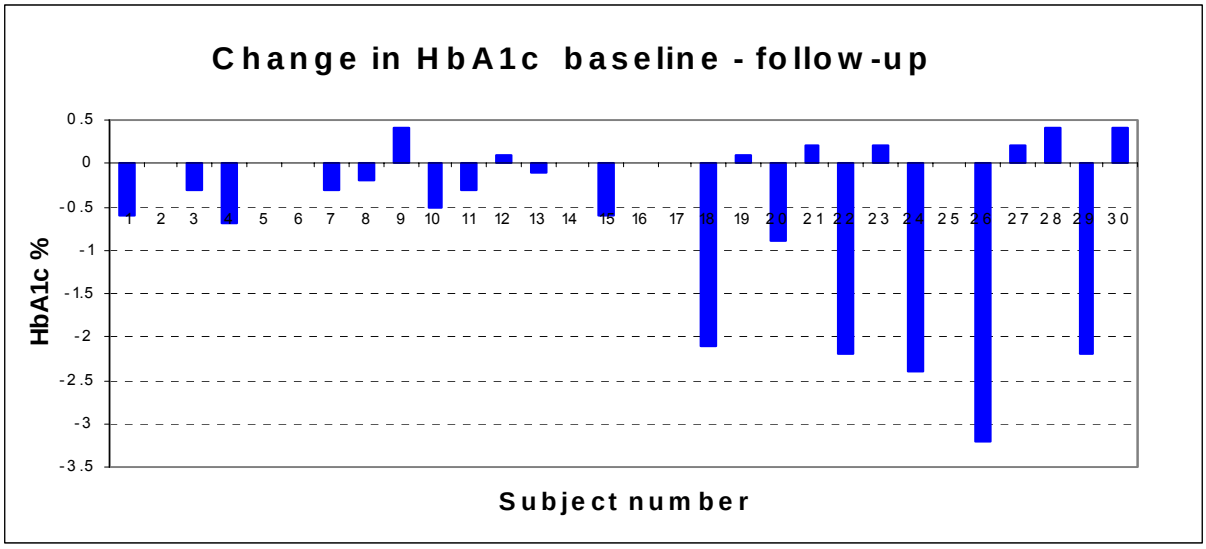



**Figure 8** •The change in individual subject's HbA1c levels between baseline and follow-up. Note the units for the HbA1c measure are 'percent', this is not describing the subject's 'percentage change' in this measure, or any reference to an optimal range (see 2.2.6 for defined ranges).

#### *4.3.1.1 HbA1c sub-group analysis*

A brief sub-group analysis was carried out with respect to subjects' HbA1c test results at baseline. A threshold HbA1c level of 7% was selected to categorize subjects into either a 'Low' HbA1C group (HbA1C ≤ 7%, n=24) or a 'High' HbA1C group (HbA1C > 7%, n=6). Descriptive statistics were calculated for each group's baseline *Goal-Directed* (global), *Optimism*, *Exercise Self-Efficacy*, *Anxiety*, *Depression* and *BMI* scores. Additionally, descriptive statistics were calculated for each group's follow-up *Goal-Directed* (global), *Optimism*, *Exercise Self-Efficacy*, *Anxiety*, *Depression* and *BMI* scores, and the change between baseline and follow-up exercise minutes/day. The results are displayed in Table 6 below. Note that additional statistical analysis was not possible due to the small sample size in the 'High' HbA1C group (n=6), however, the *exercise self-efficacy* and *change in exercise minutes/day* data is 'suggestive' of a departure from independence (the data of note appear in bold and underlined within the table).

**Table 6** •Descriptive statistics representative of the sub-group analysis of the 'Low' HbA1c group (HbA1c ≤ 7%, n=24) and the 'High' HbA1c group (HbA1c > 7%, n=6).

| Variable | High HbA1C | Low HbA1C | ALL |
|---|---|---|---|
| | n=6 | n=24 | n=30 |
| Goal-Directed (global) at baseline | 39.8 | 38.9 | 39.10 |
| Optimism at baseline | 21.5 | 22.1 | 21.1 |
| Exercise Self-efficacy at baseline | **22.7** | **20.4** | 20.9 |
| Exercise Self-efficacy at follow-up | **22.1** | **19.6** | 20.1 |
| Anxiety at baseline | **9** | 6.9 | 7.4 |
| Depression at baseline | 4.6 | 4.5 | 4.5 |
| Change in exercise min/day | **+6.6** | **+1.1** | 2.2 |
| BMI at baseline | **33.4** | 30.9 | 31.4 |
| BMI at follow-up | 30.6 | 30.8 | 30.7 |

### *4.3.2 Medication*

At baseline, six subjects had already been prescribed oral anti-diabetic medication (Metforman) by their GPs. Four out of the six subjects were among those with the largest reductions in HbA1c between baseline and follow-up and one recorded the largest reduction at -3.2 percent (see Figure 8). The six subjects taking oral anti-diabetic medications had a mean reduction in HbA1c levels of 1.3 percent (range 0-3.2%). Additionally, these six subjects also had a baseline-mean BMI level of 37.2 Kg/m², notably above the group-mean of 31.43 Kg/m². The sample size (n=6), on which this sub-group analysis is based is too small to perform additional statistical procedures, however these simple data are congruent with current recommendations for the use of Metforman as a first line oral therapy in overweight/obese people with type 2 diabetes (NZGG & Ministry of Health, 2003).

### *4.3.3 Body-Mass and Body Mass Index*

All the participants in the study were weighed and their height measured, both baseline and at six month follow-up. The group-mean body mass at baseline was 88.89 Kg. (SD 26.42Kg range 54.5-126 Kg.). The group-mean body mass at follow-up was 85.64 Kg. (SD 9.60Kg, range 50.8-128.6 Kg.). Thus, between baseline and follow-up, the group-mean body mass reduced by 3.25Kg. BMI was calculated using the formula BMI = body mass (in Kilograms) / height² (in metres). Figure 9 displays the subjects' baseline and follow-up BMIs. The group-mean BMI at baseline was 31.43 Kg/m² (SD 7.34 Kg/m², range 18.8-50.95 Kg/m²). The group-mean BMI at follow-up was 30.73 Kg/m² (SD 7.46 Kg/m², range 17.57-51.36 Kg/m²). There was a very large range of BMI values and between baseline and follow-up, the group-mean BMI reduced by 0.7 Kg/m².

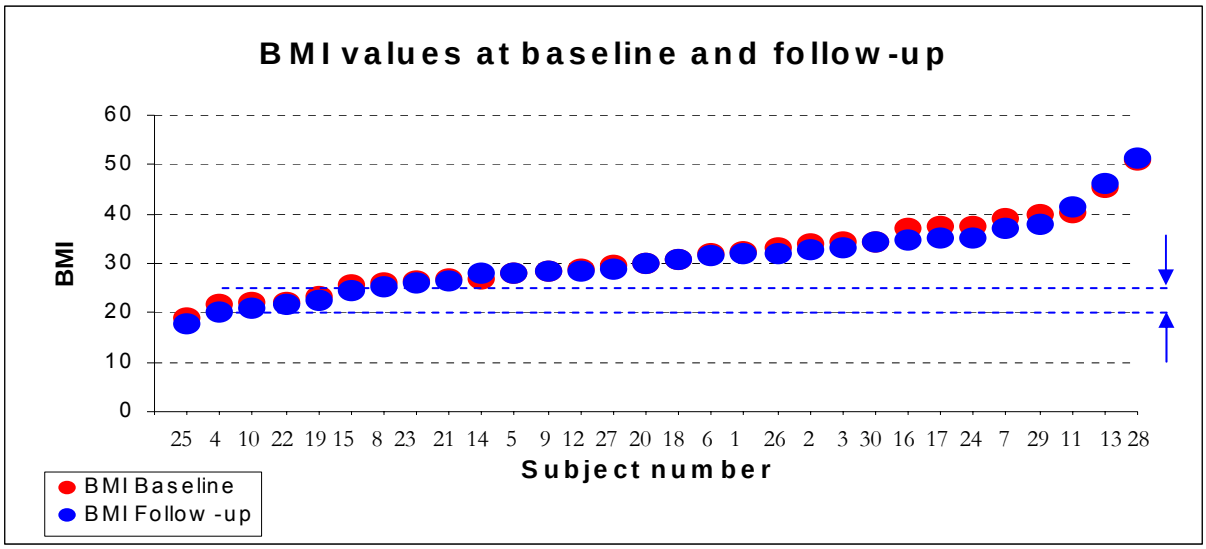



**Figure 9** •Individual subject's BMIs at base line and follow-up. Subjects are arranged in ascending BMI order to best display the range of subject BMIs. Subject numbers displayed on the 'x' axis cross-reference appropriately to other graphs in this section. The arrows on the right-hand 'y' axis depict the normal BMI range for the New Zealand European population, and 26 subjects' BMIs are outside of this normal range.

### *4.4 Descriptive statistics: psychosocial and psychometric assessment*

All subjects completed a battery of psychosocial/psychometric assessments in a researcher-administered questionnaire format. Questionnaires were subsequently scored as per the seven individual instruments' methods and scoring procedures, and the data from each instrument are summarised below.

#### *4.4.1 Optimism*

Optimism scores from the Lot-R (Scheier, Carver, & Bridges, 1994) were summed and all fell within the possible 6-30 points range. The group-mean optimism score at baseline was 21.96 (SD 5.35, range 10-30). The group-mean optimism score at follow-up 22.00 (SD 5.44, range 9-29). Thus, between baseline and follow-up, the group-mean optimism score remained relatively constant (a 0.04 point increase). Figure 10 shows that the optimism score frequency distribution is positively skewed at follow-up (more so than at baseline) with most respondents falling between the scores 21-30.

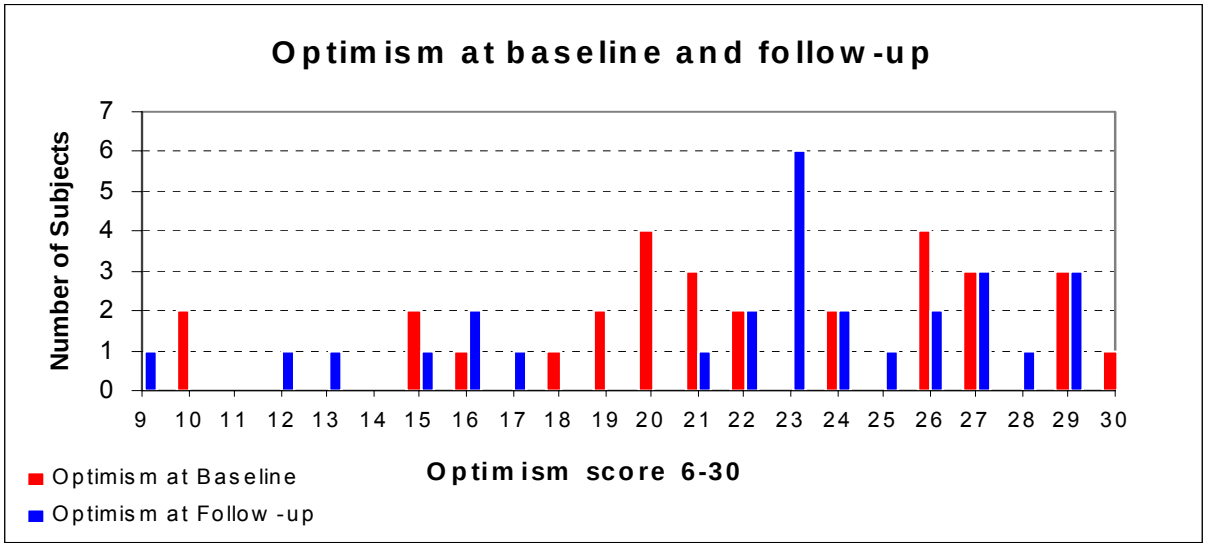



**Figure 10** •The frequency distribution of subjects' *optimism* scores at baseline and at follow-up, as assessed by the Life Orientation Test-Revised (Scheier, Carver, & Bridges, 1994). The optimism score frequency distribution is positively skewed at follow-up.

### *4.4.2 Goal-directed*

Goal-directed scores from the SSRQ-GS (Neal & Carey, 2005) were summed and all fell within the possible 10-50 point range. The group-mean goal-directed score at baseline was 39.10 (SD 6.74, range 15-49). The group-mean goal-directed score at follow-up was 39.07 (SD 5.98, range 26-50). Thus, between baseline and follow-up, the group-mean goal-directed score remained relatively constant (a 0.03 point decrease). Figure 11 shows that the goal-directed score frequency distribution is positively skewed at baseline and at follow-up, with most respondents falling between the scores 35-45.

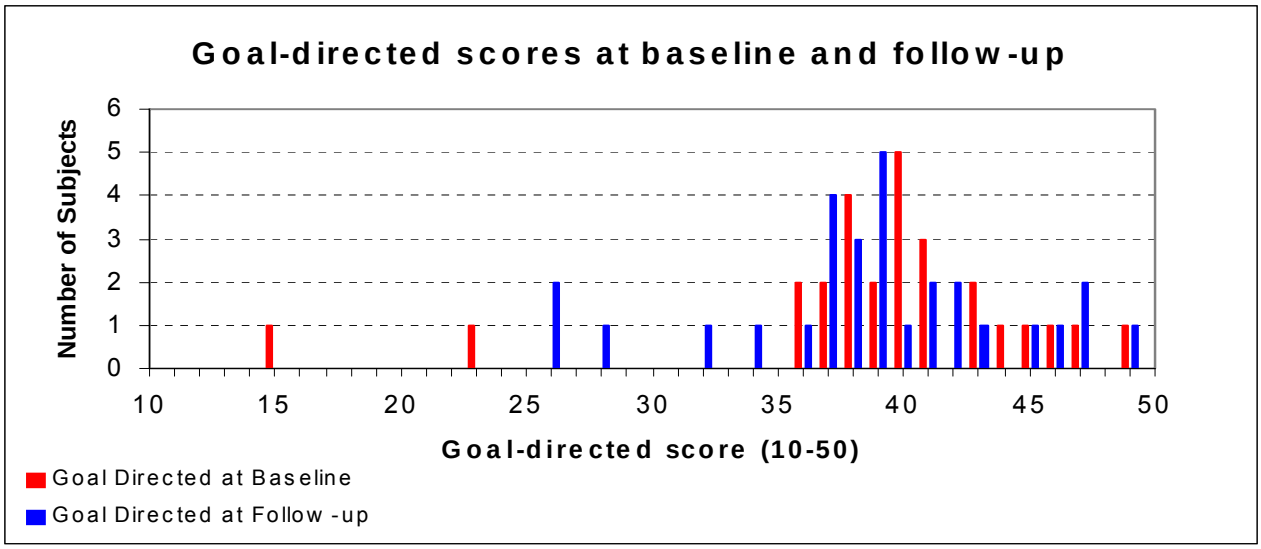



**Figure 11** •The frequency distribution of Subjects' *goal-directed* scores as assessed by the SSRQ-GS (Neal & Carey, 2005), at baseline and at follow-up. Note the distribution is positively skewed at baseline and at follow-up, with most respondents falling between the scores 35-45.

### *4.4.3 Exercise self-efficacy*

Exercise Self-Efficacy scores were derived from the Exercise Self-Efficacy Questionnaire-Short-Form (Benisovich, Rossi, Norman, & Nigg, 1998). Exercise self-efficacy scores were summed and all fell within the possible 6-30 point range. The group-mean exercise self-efficacy score at baseline was 20.86 (SD 5.29, range 7-29). The group-mean exercise self-

efficacy score at follow-up was 20.10 (SD 6.5, range 8-30). Thus, between baseline and follow-up, the group-mean exercise self-efficacy score remained relatively constant (a 0.76 point decrease).

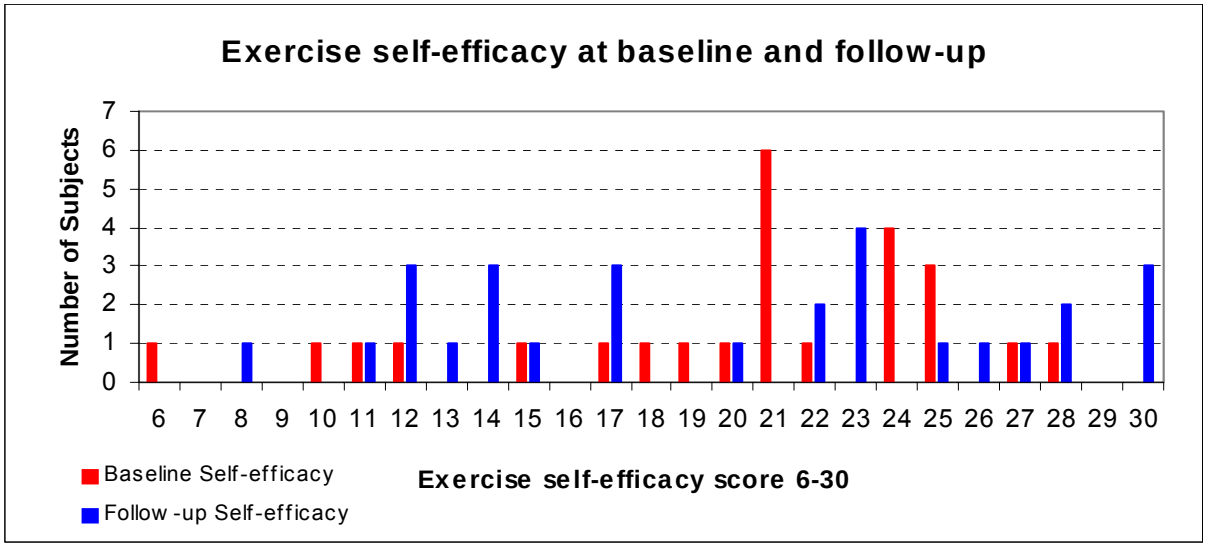



**Figure 12** •The frequency distribution of subjects' *exercise self-efficacy* at baseline and at follow-up, as assessed by the Exercise Self-Efficacy Questionnaire-Short-Form (Benisovich, Rossi, Norman, & Nigg, 1998).

### *4.4.4 Anxiety*

Anxiety was measured using The Hospital Anxiety and Depression Scale (HADS) - Anxiety subscale (Zigmond & Snaith, 1983). Each item was answered by the respondent on a four point (0–3) response category, therefore for the seven anxiety items, the possible scores range from 0-21. Anxiety scores were summed and all fell within the possible 0-21 point range. The group-mean anxiety score at baseline was 7.36 (SD 4.62, range 0-16). The group-mean anxiety score at follow-up was 6.8 (SD 4.3, range 0-17). Thus, between baseline and follow-up, the group-mean anxiety score decreased by 0.56 points.

Caseness (whether or not a respondent is classified as anxious) is a function of the cut-off

score (or threshold score) selected, which is, in itself, a function of the purpose of the particular enquiry, and is not specifically defined within the HADS instrument (Snaith, 2003). Table 7 depicts the respondent's anxiety and depression scores, as assessed at baseline and follow-up, and the caseness of the respondents at three different thresholds. Specifically, an anxiety score ≤8 denotes non- caseness, an anxiety score of 8-11 denotes possible caseness, an anxiety score >11 denotes probable caseness and an anxiety score >15 denotes severe cases of anxiety, and these thresholds are those most commonly adopted for research purposes (Bjelland, Dahl, Haug, & Neckelmann, 2002). Figure 13 displays respondents' anxiety and depression scores at baseline only.

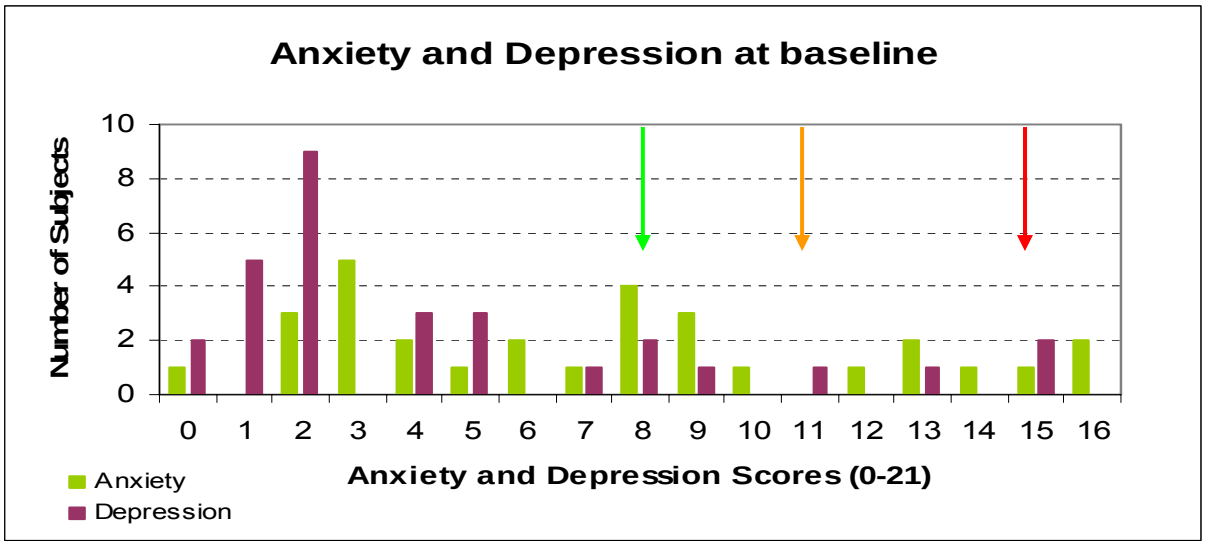



**Figure 13** •The frequency distribution of subjects' anxiety and depression scores at baseline, as assessed by the HADS (Zigmond & Snaith, 1983). The green, amber, and red arrows depict the anxiety thresholds that are those most commonly adopted for research purposes: specifically, an anxiety/depression score ≤8 denotes non-cases, an anxiety/depression score of 8-11 denotes possible caseness, an anxiety/depression score >11 denotes probable caseness, and an anxiety/depression score >15 denotes severe cases of anxiety.

### *4.4.5 Depression*

Depression was measured using The Hospital Anxiety and Depression Scale (HADS) - Depression subscale (Zigmond & Snaith, 1983). Each item was answered by the respondent on a four point (0–3) response category, therefore for the seven depression items, the possible scores range from 0-21. Depression scores were summed and all fell within the possible 0-21 point range. The group-mean depression score at baseline was 4.53 (SD 4.33, range 0-15). The group-mean depression score at follow-up was 3.5 (SD 3.7, range 0-12). Thus, between baseline and follow-up, the group-mean depression score decreased by 1.03 points.

Caseness (whether or not a respondent is classified as depressed) is a function of the cut-off score (or threshold score) selected, which is in itself, a function of the purpose of the particular enquiry and is not specifically defined within the HADS instrument (Snaith, 2003). Table 7 depicts the respondent's depression scores and the caseness of the respondents at three different thresholds. Specifically, a depression score ≤8 denotes non- caseness, a depression score of 8-11 denotes possible caseness, a depression score > 11 denotes probable caseness, and a depression score >15 denotes severe cases of anxiety, and these thresholds are those most commonly adopted for research purposes (Bjelland, Dahl, Haug, & Neckelmann, 2002).

Note: Ethical approval for the current study was granted subject to reasonable steps being followed to minimise the possibility of participants suffering adverse psychological harm during the research process. Thus, a depression score >15 was adopted in this current study to denote (probable) severe cases of depression, although the HADS is not specifically designed to provide a definitive diagnosis of major depressive disorders (Snaith, 2003). In accordance with the Ethics Committee requirements, screening respondents for depression caseness at the

>15 point level was implemented at baseline and at follow-up. Scores were evaluated; however, the two high scoring subjects both reported that they were already under the care of their GPs with respect to their level of depression and this therefore satisfied the Ethics Committee reporting requirements. Subsequently at follow-up, no respondents reached caseness at the >15 point level.

**Table 7** •The number of respondents reaching caseness at three commonly selected thresholds, as assessed by the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983).

| Anxiety & Depression threshold-score | Anxiety Baseline | Anxiety Follow-up | Depression Baseline | Depression Follow-up |
|---|---|---|---|---|
| *≥8* | 19 | 22 | 25 | 26 |
| *8-11* | 4 | 2 | 2 | 2 |
| *≥11* | 7 | 6 | 3 | 2 |
| *Total* | n=30 | n=30 | n=30 | n=30 |
| *Sub-total for >15* | 3 | 2 | 2 | **0** |

### *4.4.6 Traumatic stress*

It was not the intention of this study to investigate the stress levels of the subjects per se, or to obtain overly specific details of the nature of any particular traumatic event/s if reported. It was, however, considered necessary to establish if any traumatic event reported had impacted significantly upon the individual, such that he or she was significantly impaired in their self-management efforts and/or their progress toward better health outcomes. The Traumatic Stress Schedule (Norris, 1990), was adapted for inclusion in the current study questionnaire as a

coarse screen for traumatic stress, thus, subjects were screened (only) for exposure to traumatic events comprising "violent encounters with nature, technology, or humankind".

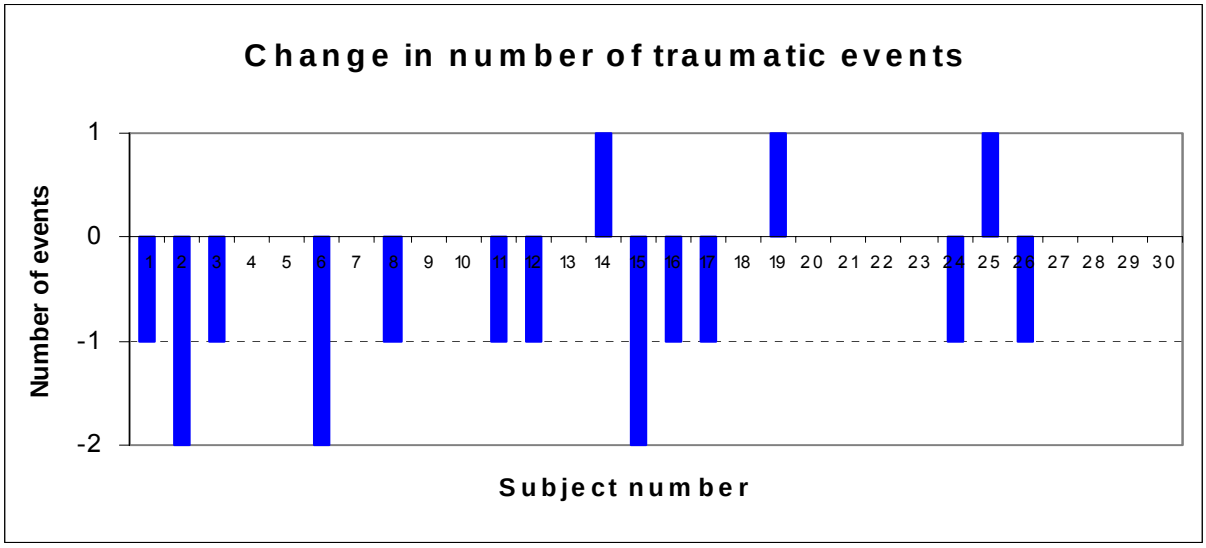



**Figure 14** •The change in the number of traumatic events reported by individual subject's, between baseline and follow-up, as assessed by the (researcher-modified) Traumatic Stress Schedule (Norris, 1990), and utilizing a six-month report period.

The respondents answered each of the nine traumatic stress items using a yes/no response category format, therefore the possible scores ranged from 0-9 and all total scores fell within the possible 0-9 range. The group-mean traumatic stress score at baseline was 0.53 events (SD 0.63, range 0-2). The group-mean traumatic stress score at follow-up was 0.33 events (SD 0.60, range 0-2). Thus, between baseline and follow-up, the group-mean traumatic stress score declined by 0.2 stressful events. Ten respondents stated that having been newly diagnosed with type 2 diabetes was a significant and stressful event, thus, the diagnosis of type 2 diabetes was reported by ten respondents as an event *occurrence*. However, when these respondents were probed as the *impact* of this particular event, only seven respondents still scored positively on this particular item. Further, as the report period was set at six months, scores relating to the

diagnosis of type 2 diabetes 'dropped out' by follow-up. Similarly, scores that related to other 'one-off' events (for example a family bereavement or moving house) also became zero at follow-up. Thus, only 'new' events (that also had significant impact) scored at follow-up. Generally therefore, traumatic stress scores declined between baseline and follow-up. Only three subjects' traumatic stress scores increased between baseline and follow-up. All of these subjects reported a net increase in traumatic stress of one point (event), however, when probed further, all respondents reported that while their stress levels may well have increased (via an increase in occurrence and/or impact), this increase did not negatively influence their engagement in previously enjoyable and/or health promoting activities (for example, engagement in physical activity and/or other aspects of the self-management of type 2 diabetes). It should be noted that 'being stressed at work' or having time pressures and deadlines at work are not assessed by the Traumatic Stress Schedule, as these stressors are considered 'normal stressors' consistent with daily life. By definition, the Traumatic Stress Schedule only assesses extreme, undesirable, unexpected and uncontrollable events that are beyond what is normally experienced (Norris, 1990).

#### *4.4.7 Exercise stage of change*

Exercise stage of change was measured using the Exercise Stages of Change: Short Form Questionnaire (Marcus, Selby, Niaura, & Rossi, 1992). The questionnaire asks subjects to select one of five categories (listed in section 3.9) that best describes their engagement in planned physical activity, with respect to the following definition of regular exercise:

> "Regular Exercise is any planned physical activity (e.g., brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed 3 to 5 times per week for 20-60

> minutes per session. Exercise does not have to be painful to be effective but should be done at a level that increases your breathing rate and causes you to break a sweat" (p.63)

Thus, subjects (in reality) responded therefore with reference to the *minimum* frequency, duration and intensity criteria as defined by the above definition, specifically, 20 minutes of moderate intensity planned physical activity (exercise), three times per week. Each response category cross-references to each of the TTM stages of change (described in 3.9.1). At baseline, no subject reported being in the *pre-contemplation* stage and the scores therefore ranged from 2-5. At baseline, nine subjects reported being in the *maintenance stage* (seventeen at follow-up), a further nine subjects reported being in the *action* stage (seven at follow-up), ten subjects reported being in the *preparation* stage (five at follow-up), and the remaining two subjects reported being in the *contemplation* stage (one at follow-up). Figure 15 displays each subject's stage 'position' at baseline and at follow-up, and Figure 16 shows the subject's net positive stage progression between base line and follow-up. Only one subject regressed (a one point negative stage progression) between baseline and follow-up. The group-mean stage of change score at baseline was 3.38 (SD 0.95, range 2-5). The group-mean stage of change score at follow-up was 3.5 (SD 0.88, range 2-5). Thus, between baseline and follow-up, the group-mean exercise stage of change score increased by 0.38 stages. A 'part stage' is not a practicably useful unit of change, however, it may be used comparatively and is therefore stated here to indicate the subject group's mean direction of change (positive), and the net magnitude of that change.

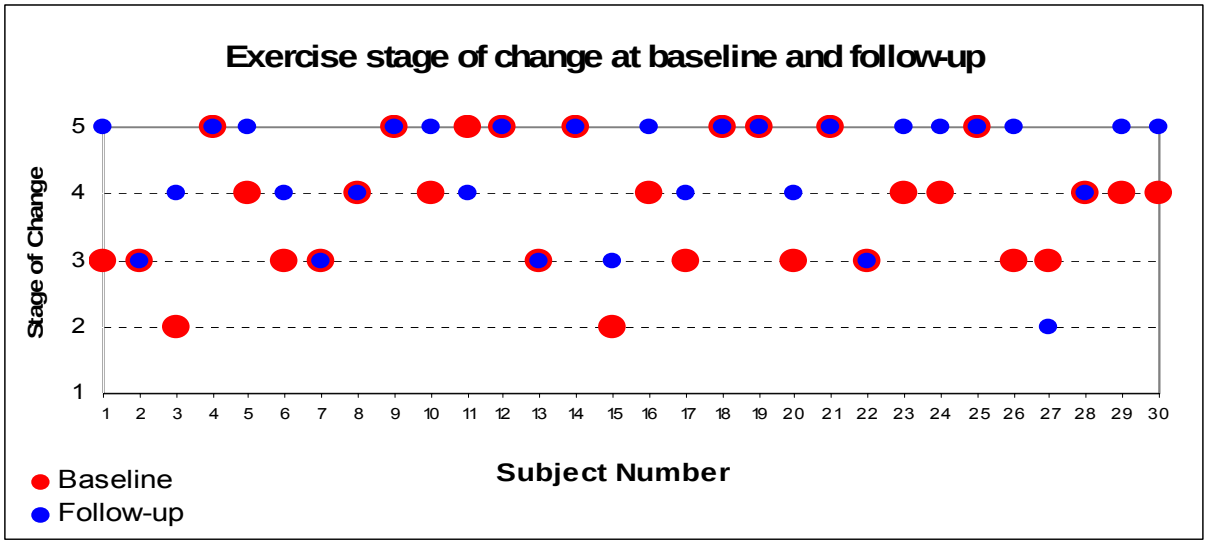



**Figure 15** •Individual's exercise stage of change at baseline and at follow-up, as assessed by the Exercise Stages of Change: Short Form Questionnaire (Marcus, Selby, Niaura, & Rossi, 1992). Stage of change: 5= Maintenance, 4= Action, 3= Preparation, 2= Contemplation, 1= pre-contemplation.

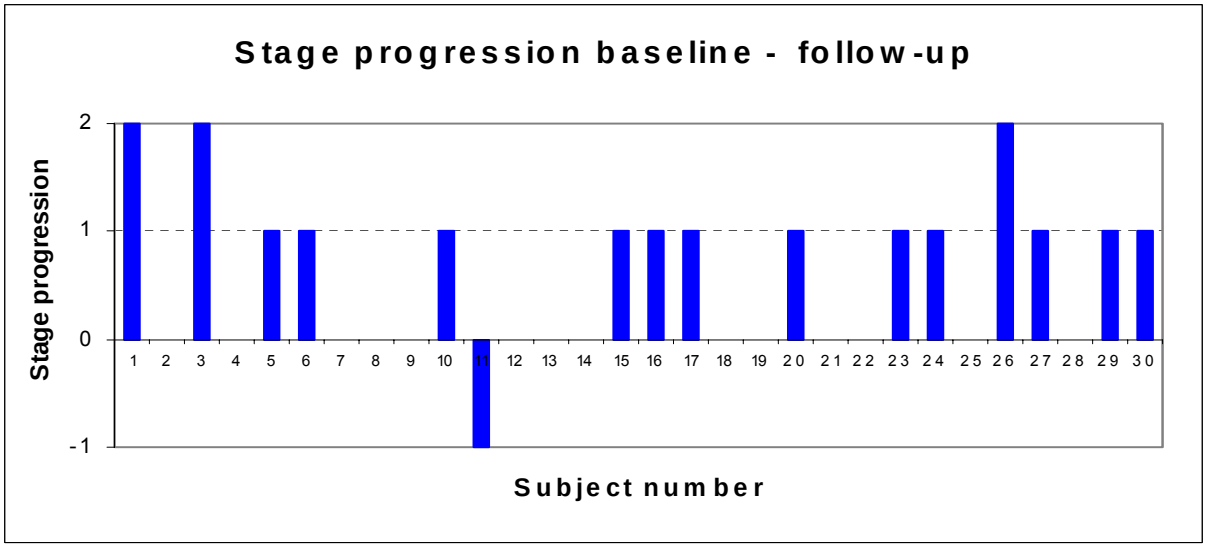



**Figure 16** • Individual's *stage progression* between baseline and follow-up, as assessed by the Exercise Stages of Change: Short Form Questionnaire (Marcus, Selby, Niaura, & Rossi, 1992). Note that 29/30 subjects either remained in their baseline exercise stage of change, or made positive stage progression during the six month report period.

## *4.5 Descriptive statistics: self-management behaviours*

### *4.5.1 Physical activity*

Both physical *activity* levels and physical *exercise* levels were assessed with the Stanford 7-day Physical Activity Recall Questionnaire (7DPAR) (Sallis et al., 1985), and Figure 21 illustrates a comparison of both physical activity levels (energy expenditure) and physical exercise levels (for example sports) at follow-up. The 7DPAR was researcher-administered, and this provided the opportunity to record individual's average total physical activity levels per day (which includes occupational, household activities, and sports activities)(Figure 17), and individuals' exercise behaviours (being planned physical activity for the improvement of fitness and health (see section 3.9 for further clarification)(Figures 17,18,19). The detail recorded in the physical activity assessment makes it is possible to report subject's exercise levels, exercise modalities, and to estimate subject's total daily energy expenditure (which additionally factors in hours of sleep per night and light activities). For the calculation of daily energy expenditure, the time (hours) spent in each category (sleep-light-moderate-hard-very hard) is multiplied by a standard calorific value (based on intensity) to yield total energy expenditure per kilogram of body weight. Data are translated to energy values by assuming a standard value of 4.19 kJ/min (1 kcal/min) for basal metabolism (Sallis et al., 1985). Thus, energy expenditure is reported here as Kilocalories per kilogram per day (Kcal/kg/day), as this index removes the confounding effects of weight. At baseline, the group-mean energy expenditure was 34.32 Kcal/kg/day (SD 1.5, range 31.9-39.1). The group energy expenditure at follow-up was 34.36 Kcal/kg/day (SD 1.5, range 31.5-39.1). Thus, between baseline and follow-up, the group-mean energy expenditure per day remained

essentially unchanged (+0.04 Kcal/kg/day).

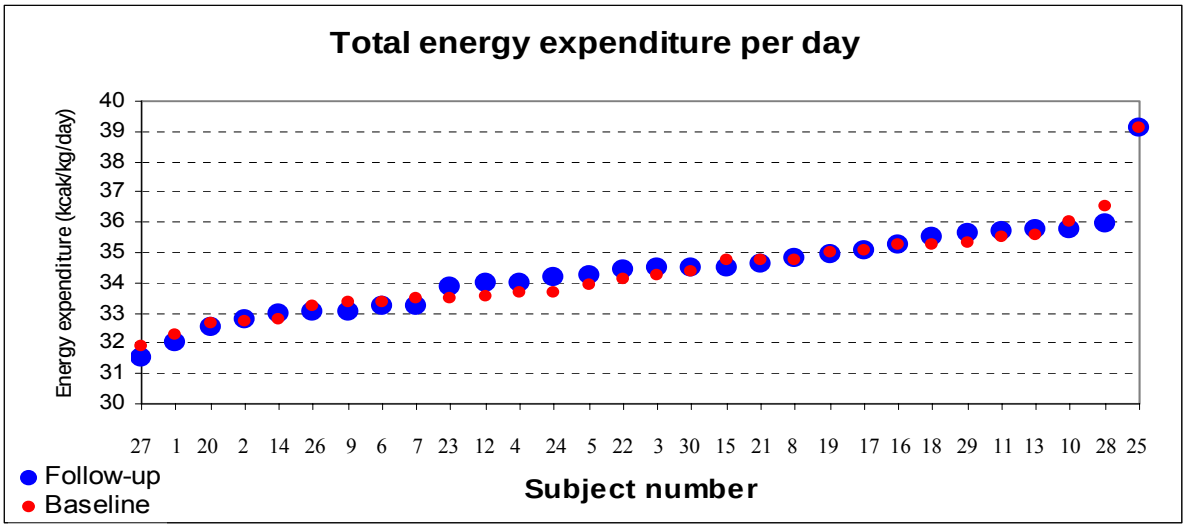



**Figure 17** •Individual's total energy expenditure per kilogram, per day (kcal/kg/day): at baseline, and at follow-up, as assessed by the Stanford 7-day Physical Activity Recall Questionnaire (Sallis et al., 1985). Note: Subjects are arranged in ascending *energy expenditure* order to best display the range of subjects' energy expenditure. Subject numbers displayed on the 'x' axis cross reference appropriately to other graphs in this section.

In addition to the total energy expenditure data, subject's participation in moderate, hard, and very hard intensity *exercise* was assessed for the previous 7-days, and these data are reported in 'minutes of equivalent moderate exercise per day'. Exercise (at least in the context of this current study), is

> "a regular and structured subset of physical activity, performed deliberately and with special purpose such as preparation for athletic competition or the improvement of some aspect of health" (Shephard, 2003, p.197).

Each subject's 7D-PAR questionnaire was analysed, and the data relating to exercise frequency (if performed deliberately), exercise duration, exercise modality and exercise intensity were collated. Exercise data reported here are 'exercise modality', 'minutes of

equivalent moderate exercise per day', and 'change in minutes of equivalent moderate exercise per day'. With respect to intensity, no subject reported engaging in 'very-hard' physical exercise and only 4 subjects reported engaging in hard exercise, with most subjects (n=23) only engaging in moderate intensity exercise. Where a subject did report hard exercise, a multiplication factor of 1.5 was applied to convert minutes of hard exercise to minutes of moderate exercise (given that the 7D-PAR assigns an energy cost of 4 METs to moderate exercise, and 6 METs to hard exercise).

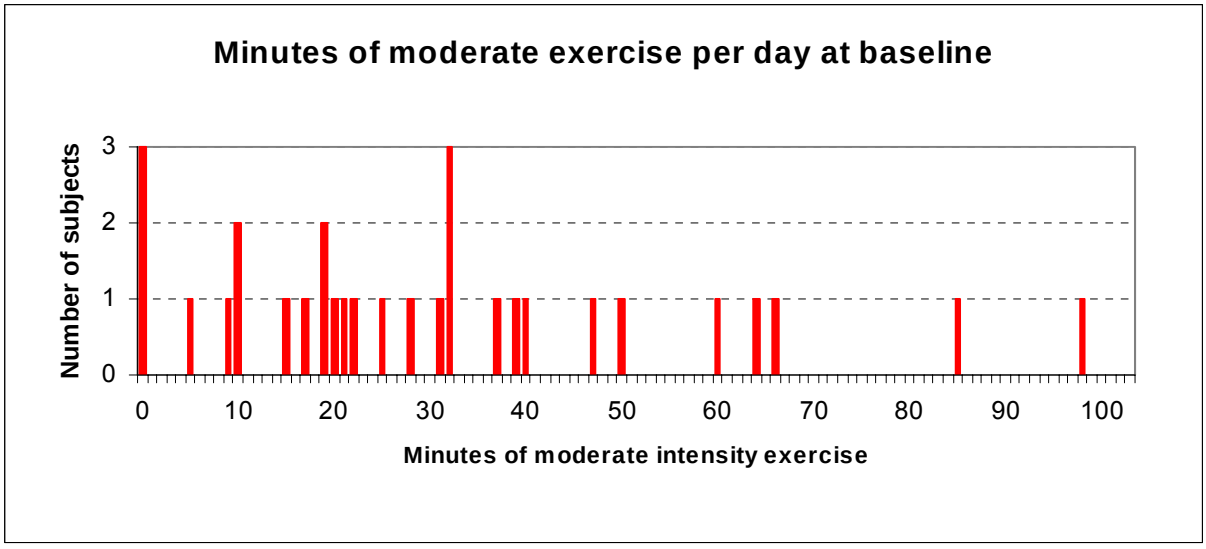



**Figure 18** •The frequency distribution of subject's average minutes of moderate intensity (or equivalent) physical exercise per day at baseline. At baseline, less than half of the subjects (46 %) reported engaging in thirty minutes or more of moderate physical exercised per day, three subjects reported engaging in no moderate physical exercised per day, and seven subjects reported engaging in ten minutes of less.

Figure 18 illustrates that at baseline, most subjects (90 %), engaged in at least some moderate equivalent physical exercise per day in the week preceding assessment. Three subjects ([BMI=34.1]; [BMI=45.3]; [BMI=30.9]) did not engage in any physical exercise at baseline, nor did they engage in any physical activity at follow-up. The group-mean minutes of moderate equivalent physical exercise per day at baseline was 31.1 minutes (SD 34.49, range 0-98). The group-

mean minutes of moderate equivalent physical exercise per day at follow-up was 33.54 minutes (SD 26.36, range 0-98). Thus, between baseline and follow-up, the group-mean minutes of moderate equivalent physical exercise per day increased by 2.44 minutes or 7.8%.

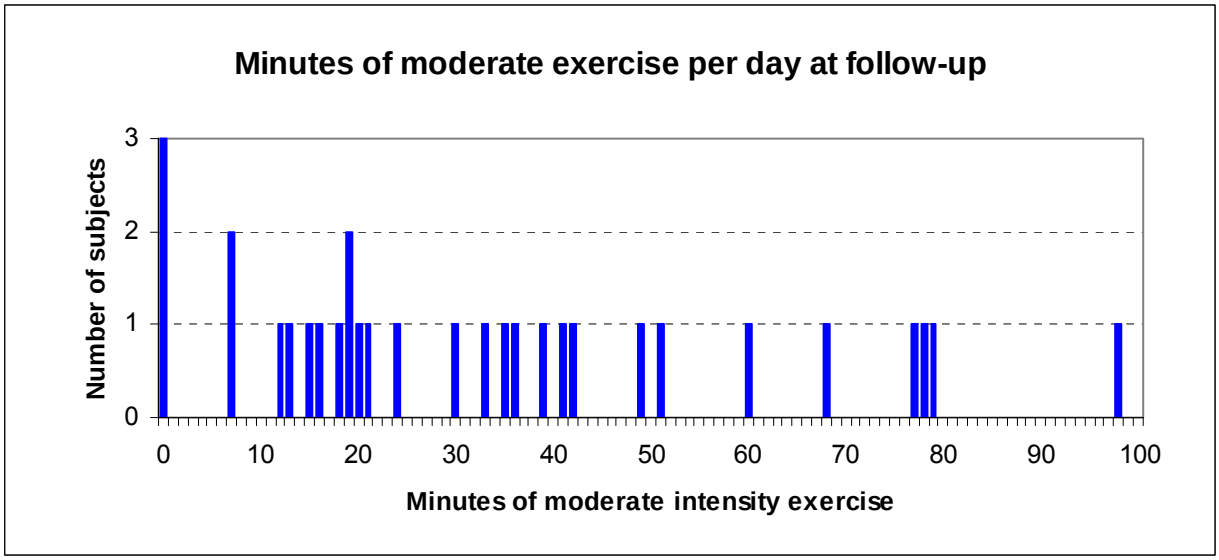



**Figure 19** •The frequency distribution of subject's average minutes of moderate intensity (or equivalent) physical exercise per day at follow-up. At follow-up, half of the subjects reported engaging in thirty minutes or more of moderate physical exercised per day, three subjects reported engaging in no moderate physical exercised per day, and five subjects reported engaging in ten minutes of less.

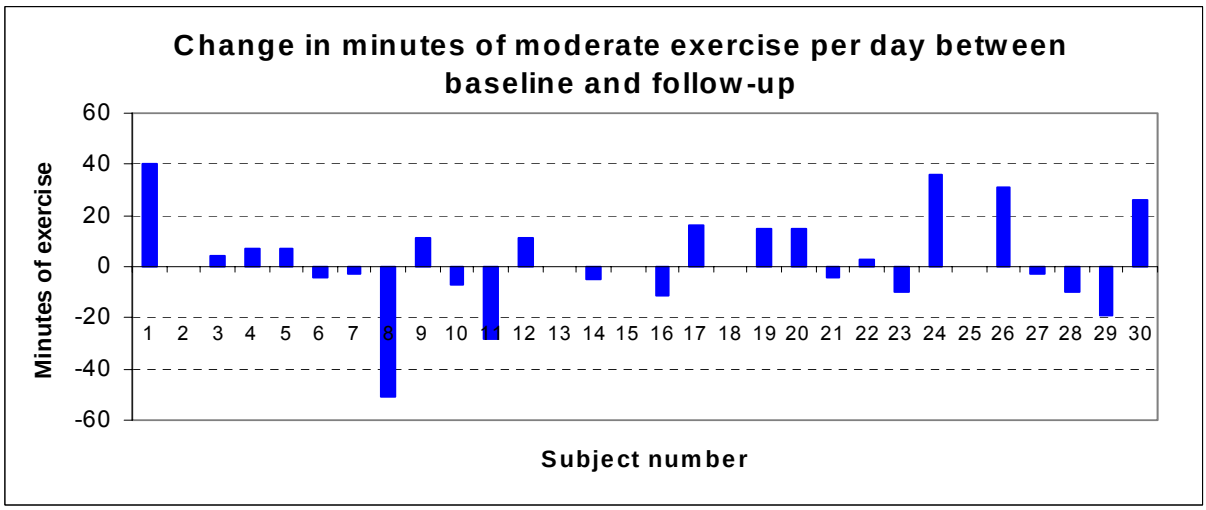



**Figure 20** •Individual subject's change in average minutes of moderate intensity (or equivalent) physical exercise per day between baseline and follow-up.

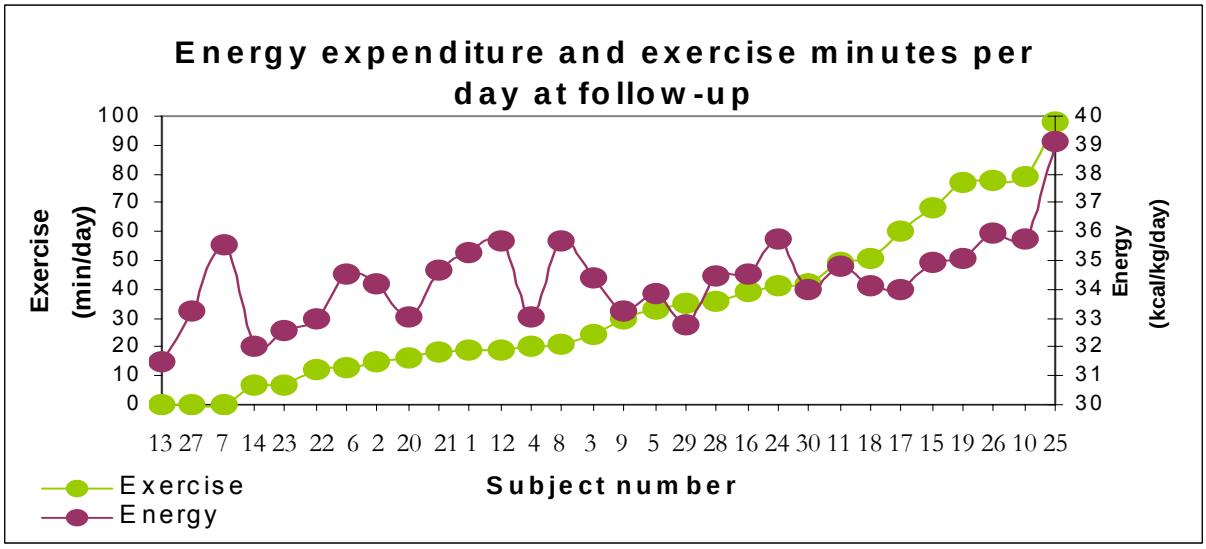



**Figure 21** •The relationship between subject's average minutes of moderate equivalent exercise per day (exercise) and their total energy expenditure per kilogram of body weight per day (energy). Both *exercise* and *energy expenditure* are strongly related (r=0.63; p=0.0002). However, the measure of *energy* factors in subject's hours of sleep per day and their hours of moderate physical activity (for example occupational tasks and housework) that is *additional* to exercise: exercise being defined as "a regular and structured subset of physical activity, performed deliberately and with special purpose such as preparation for athletic competition or the improvement of some aspect of health". Thus, while the correlation between *exercise* and *energy* is strong, some individuals reported a high participation in *exercise* activities yet they reported being relatively non-energetic in their occupations and around the home, and for others, the inverse was true. Note: subject numbers are arranged as referenced to ascending order of exercise minutes, if arranged in ascending order of energy expenditure, then the subject number order would differ.

#### *4.5.1.1 Exercise modality*

Physical activity levels were assessed with the Stanford 7-day Physical Activity Recall Questionnaire (7DPAR) (Sallis et al., 1985). The 7DPAR was researcher-administered and, in addition to the energy expenditure and physical exercise data reported above, the assessment also provided the opportunity to record individual's exercise behaviours, specifically the different types (or modalities) of activity that the individual subjects engaged in as part of their exercise regime (exercise being planned physical activity for the improvement of fitness and health). Frequency counts were performed and the top five most popular forms of

exercise are presented in Table 8. The exercise modalities listed are those in which subjects participated on an 'at least weekly' basis. Note: Some subjects participated in more than one activity per week, therefore the cumulative frequency exceeds 100%.Walking was by far the most universal exercise modality with 80% of respondents indicating that walking was their main form of physical exercise. Swimming and/or Aquacize was the next most popular exercise modality (16% of respondents), followed by cycling (13.3%), and various forms of indoor exercises (10%). Golf is included in the data as walking (three subjects), however it is noted that it may well involve pulling a golf cart and additionally, the whole-body muscular activity of driving the ball will most likely result in levels of energy expenditure that are higher than walking.

**Table 8** •The five most reported exercise modalities. Note: Some subjects participated in more than one activity per week; therefore the cumulative frequency exceeds 100%

| Exercise Modality | Percentage of subjects engaging in each modality |
|---|---|
| Walking/Hill Walking/Tramping | 80% |
| Swimming/Aquacize | 17% |
| Road Cycling/Mountain-bike | 14% |
| Exercise in the home, including 'arm-chair' exercises, yoga, and bounding on a mini-tramp | 10% |
| Gym-work including resistance-training | 10% |

### *4.5.2 Exercise goals*

#### *4.5.2.1 Exercise/physical activity goal-directness*

During the baseline interviews, subjects were asked the question "To what extent do you have physical activity goals with respect to your health, in particular the self-management of your type 2 diabetes"? (Section I: Physical Activity Goals Q1). The respondents were probed to ensure that these goals were related specifically to physical activity rather than for example, dietary changes or changes in blood glucose self-monitoring behaviours. Respondents answered on a 5-point Likert scale (number of responses in parenthesis) ranging from: (1) I have no health goals [n=0]; (2) I know what I perhaps should be doing [n=2]; (3) I intend to make some changes [n=6]; (4) I have some general health goals [n=9]; (5) I have some specific health goals that I am working toward [n=13]. Thus, in response to this question, slightly less than three quarters (73 %) of subjects reported that they had already formulated various health goals. At follow-up, 0 respondents answered (1); 1 respondent answered (2); 5 respondents answered (3); 7 respondents answered (4); and 17 respondents answered (5). Thus, at follow-up, more than three quarters (80 %) of subjects reported that they had formulated various physical activity/health goals, compared to 73 percent at baseline.

#### *4.5.2.2 Physical activity goal descriptions*

During the baseline interviews, subjects were asked the question "Can you please describe to me as much as you can about your physical activity goals with respect to your health, in particular the self-management of your type 2 diabetes"? (Section I: Physical Activity Goals Q2). Subject's goal descriptions were recorded (see appendix E), and subsequently read back

to the subject for confirmation of accuracy. Respondents were specifically *not* prompted to elaborate on, or list, specific goal fundamentals (for example specificity or achievability). Goals were recorded only as articulated by the respondents. Subject goals were subsequently analysed for specific and challenging elements, and in total, less than half (48%) of goals that had been set included specific *and* challenging elements to the goal. Note: in addition to physical activity/exercise goals, subjects also tended to state nutritional and/or other self-management goals as well. While these 'other' goals were recorded, they have not however been included in the results or analysis.

#### *4.5.2.3 Exercise goal-attainment*

At follow-up, subjects were read back the goals that they had set during the baseline interview and subjects were instructed to rate their progress toward achieving these goals. Subjects were asked: "Can you please rate the physical activity goals you described at our first interview on a 0-10 scale for 'Goal-achievement' (0 = not achieved → 10 = achieved; N/A = no longer a goal) (Section I, Question2). Figure 22 (note 1) displays the distribution of subject's goal-attainment scores at follow-up (mean score 6.7, SD 2.97). One third of the respondents rated their overall progress towards their physical activity goals at 50% or less. Two thirds of respondents reported that they rated their overall progress towards their physical activity goals between 50% and 100%.

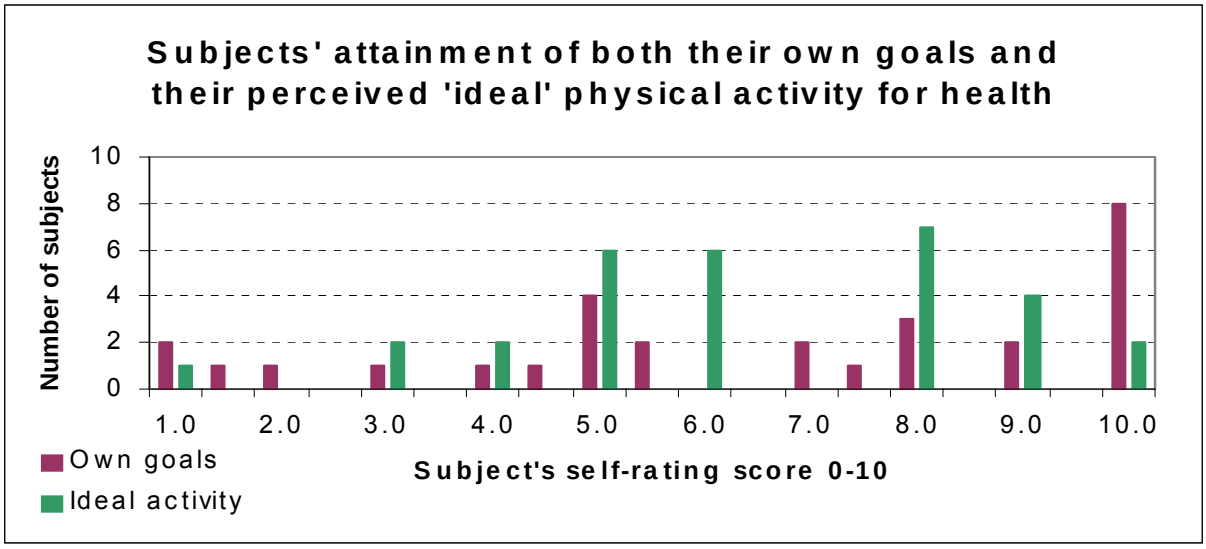



**Figure 22 • (1)** The distribution of subjects' self-rated goal-attainment scores at follow-up. Subjects self-rated their progress towards achieving the physical activity goals that they held current at baseline. Goal-attainment was scored on a 0-10 scale and goal scores were averaged across all goals set. Goals that subjects reported they no longer held current (at follow-up) were rated 'not applicable' and were excluded. **(2)** The distribution of subject's self-rated attainment of their perceived 'ideal' physical activity for health. Using a 0-10 scale, subjects' self-rated their *actual* level of physical activity as compared to the physical activity level that they themselves perceived would be '*ideal*' and individually appropriate.

#### *4.5.2.4 Perceived ideal physical activity for health*

After subjects self-rated their progress toward achieving their own physical activity goals, subjects were asked "Overall, how would you rate your progress toward your idea of 'ideal' physical activity for health" (Section I, Question2a). Subjects were instructed to answer with reference to what they perceived to be 'ideal' for themselves, considering all factors, and not being influenced by what others might propose to be 'ideal'. Using a 0-10 scale, subjects self-rated their *actual* level of physical activity as compared to the physical activity level that they themselves perceived would be '*ideal*' and individually appropriate, and Figure 22 (note 2) displays the frequency distribution of the subjects' scores.

#### *4.5.2.5 Barriers and enablers for physical exercise*

All subjects answered question Q2b. "What one thing would help you most to reach your 'ideal' level of physical exercise"? Their statements were recorded verbatim and examples are reproduced below in Table 9.

**Table 9** •Examples of subjects' reported 'enablers' for maintaining and/or increasing their physical exercise participation.

- "When I get to the point of employing more good staff so that I can free up more time for myself". "When I can cut back the overseas travel"
- "A mild winter will help me get out and keep up my exercise"
- "To be able to stay at it a bit longer; to build endurance"
- "Willpower" meaning 'motivation', which comes from within. "To overcome a certain degree of laziness at times. "I need someone to 'egg me on' a bit sometimes"
- "To be able to maintain the goal now"
- "Learning to put myself first more often"
- "Somebody to walk with me to accompany me"
- "Less hours of work" and "good weather and a good location/environment"
- "Progressing my walking so my body is not sore, as I get sore legs when I walk for too long
- "If something went wrong with my body that gave me a big incentive to get more active"
- "Time and motivation. I actually have to organise my time better to allow me to do the things I want to do. Being able to just say 'no I am off' and making a conscious effort to make the time"
- "Gain confidence in myself (generally) which will give me confidence to go out and exercise. I have a real sense of wanting to increase my self-worth and I want to make progress on this. The more fun I have, the more progress I make"
- "If someone would help me and support me and do the exercise with me"
- "Reduce my time spent at work, which I intended to do last year, but I still have to achieve this"
- "Better weather conditions for walking"
- "It would help if we both motivated each other to get out and do the walking together"
- "Having a partner that would do some of this activity/exercise with me, some of the time, would help"
- "More time for me and less time at the business"
- "Generally, to maintain my exercise as I am going now"

- "Temperature. Temperature affects the fit of my prosthesis and cooler temperatures suit me best"
- (1) "Some company. It is lonely out there on your own doing the exercise"

  (2) "Money to pay for equipment/fees"

  (3) "Having less back pain would make it easier to exercise and it would be more enjoyable"

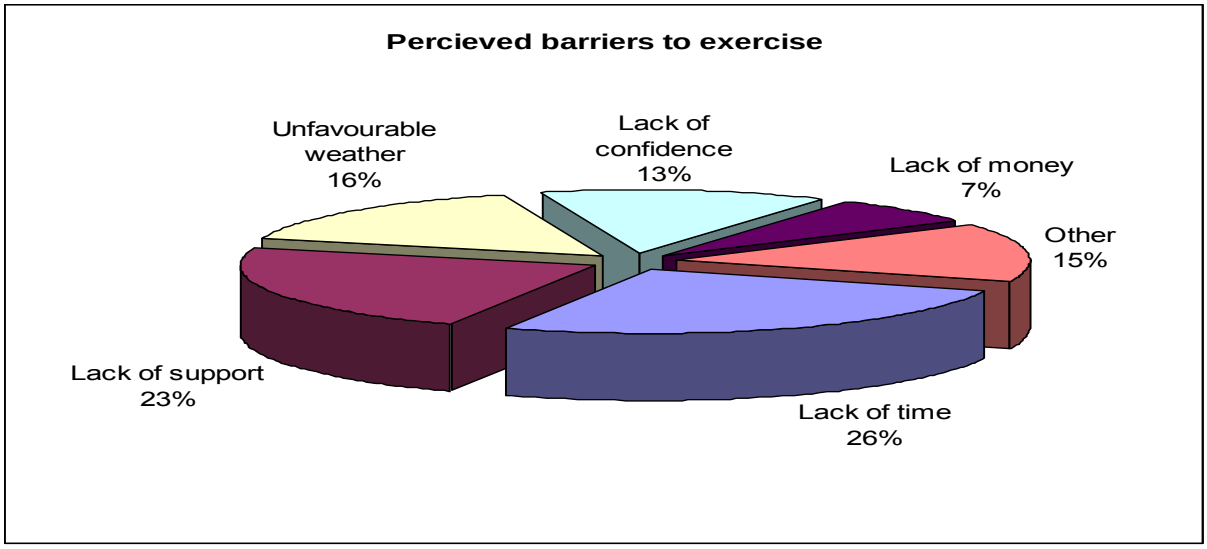
  (4) "Being able to buy good clothing and gear to exercise in which is in my size e.g. sports bra and swimwear"
- "It is just the circumstances, I am involved in other social activities and these take time. My life is varied and I am happy with my physical activity"
- "If I had more time I might exercise more. I have more responsibilities now, and other things can be distracting and take up time"
- "Weather and time make the most difference to my walking activity. In the winter I probably don't walk as much as I should"
- "Keeping fit and keeping an active mind, mixing socially, and exercise to keep living longer and healthy with a positive attitude. Stimulating the brain!"
- "My self-motivation is what keeps me going. I have a lot more confidence to do things and if I want to, I just do it! It is all for my benefit"
- "Maintaining my routine is the key to keeping up my exercise in the future"
- "Improvements in my general health"
- "Continuing to reduce my weight"

Subsequently, the subjects' responses to question Q2b were analyzed by the researcher, and the implied *'salient perceived barrier'* to planned physical exercise was extracted (with reference also made to the interview notes for supporting comments). For example, *"If someone would help me and support me and do the exercise with me"* was scored as "Lack of an exercise partner", and *"Reduce my time spent at work, which I intended to do last year, but I still have to achieve this"* was scored as "Lack of time to exercise". A frequency count was then used to rank the top five *perceived barriers to planned physical exercise* as expressed by the subject group, and these are displayed in Table 10 and Figure 23 below.

**Table 10** •The five most reported barriers to planned physical exercise, as expressed by the subject group

| Perceived barriers to exercise | Percentage of subjects who perceive this barrier |
|---|---|
| **Lack of time to exercise** | 26% |
| **Lack of social support; lack of an exercise partner** | 23% |
| **Unfavourable weather** | 16% |
| **Lack of confidence to exercise; low self-esteem; body image** | 13% |
| **Lack of money** | 6.6% |

**Figure 23** •The five most reported barriers to planned physical exercise



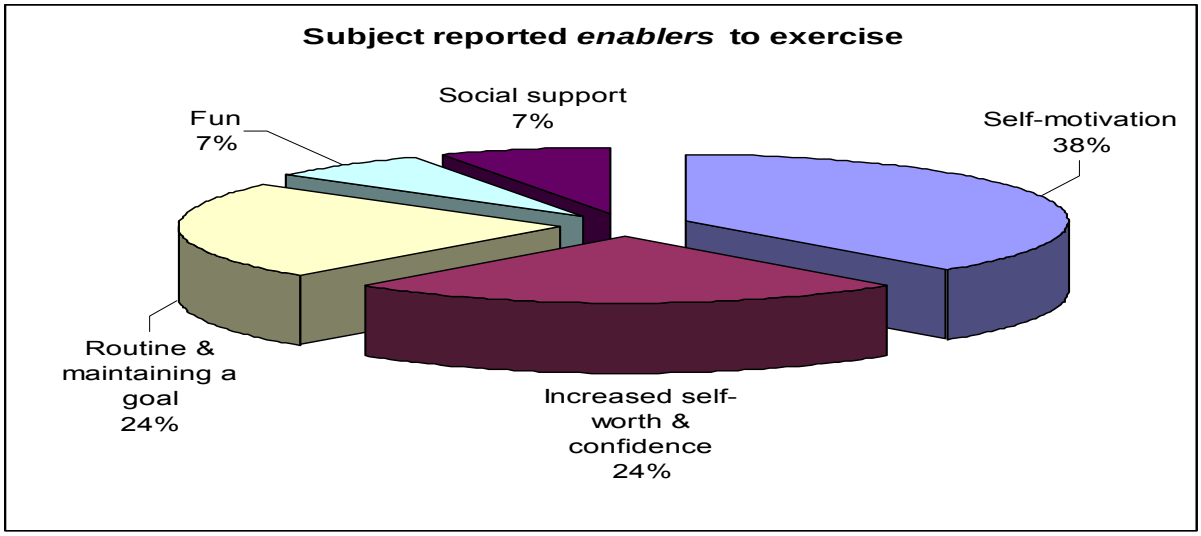

Further, the subjects' responses to question Q2b were analyzed by the researcher, and the *enablers* to planned physical exercise were extracted (with reference also made to the interview notes for supporting comments). At follow-up, several of the subjects reported that a number of positive factors now aided them in maintaining and/or striving towards their

physical activity goals. These enablers were grouped into related categories and a frequency count was then used to rank the top five *reported enablers to physical exercise,* as expressed by the subject group and these are displayed in Table 11 and Figure 24 below.

**Table 11** •The top five categories of enablers that subjects considered were already assisting them to maintain or strive towards their planned physical exercise

| Current enablers to exercise | Percentage of subjects who experience this enabler |
|---|---|
| **Self-motivation: willpower: positive attitude: conscious effort** | 16% |
| **Increased self-worth: increased confidence** | 10% |
| **Routine: maintaining a goal** | 10% |
| **Fun** | 3% |
| **Social support** | 3% |

**Figure 24** •The five most reported enablers to planned physical exercise



## *4.6 Correlational statistics*

### *4.6.1 Introduction*

In general statistical usage, *correlation* refers to the departure of two variables from independence, or the degree to which two variables are related and if so, whether they are positively or inversely related. The relationship between several of the variables measured in this current study are presented below. Study data were imported to SAS directly from the study data base (Microsoft Excel ®), after the completion of questionnaire scoring. For the purpose of clarity, those variables selected for the following correlational analysis where assigned abbreviated names that are intended to represent easily understandable descriptors of the reported measures. Each variable name and its definition, may be found listed alphabetically in the main glossary (p. xv), and is described fully in the methodology section (3.5).

### *4.6.2 Correlational results*

All of the relevant and significant correlations derived from the study data are presented below. Each numbered listing includes a description of the relationship, the associated Pearson's Correlation Coefficient (*r*), and the statistical significance (p value). Note that each description's listing number cross-references to the less detailed summary Table 12. None of the correlations approaching, but not reaching, the 0.05 level of significance are listed. Further, the following variables could not be demonstrated to be statistically related to subjects' number of moderate exercise minutes per day at follow-up: ***Goal-Directed*** (global); ***Optimism***;

***Education***; ***Anxiety***; ***Depression***; ***HbA1c***. However, all of the relevant *and* significant correlations derived from the study data are grouped and presented below.

#### *4.6.2.1* ***Age***

(1) Subjects' **Ages** were moderately inversely related to **Anxiety** ($r$=-0.50; p=0.005)

(2) Subjects' **Ages** were moderately inversely related to **Depression** ($r$=-0.48; p=0.01)

#### *4.6.2.2* ***Education***

(3) Subjects who reported a high level of **Education** at baseline also reported being generally more active (high **Energy expenditure)** at follow-up than those who reported lower Education **levels** at baseline ($r$=0.36; p=0.05). Follow-up Energy expenditure is weakly related to Education level.

#### *4.6.2.3* ***Exercise self-efficacy***

(4) Individuals' **Self-Efficacy** at baseline was inversely related to their **BMIs** at baseline ($r$=-0.40, p=0.03)

(5) Subjects who reported high **Exercise Self-Efficacy** at baseline also reported a more advanced **Stage of change** at baseline, as compared to those who reported low self-efficacy initially ($r$=0.41, p=0.03)

(6) Subjects who reported high **Exercise Self-Efficacy** at baseline later reported a more advanced **Stage of change** at follow-up, as compared to than those who reported low self-efficacy initially ($r$=0.48, p=0.006)

(7) Subjects who reported high **Exercise Self-Efficacy** at baseline later reported being generally more active (high **Energy expenditure)** at follow-up, as compared to than those who reported lower Exercise Self-Efficacy initially ($r$=0.38; p=0.04)

(8) Subject's **Self-Efficacy** at baseline was inversely related to their **BMIs** at follow-up ($r$=-0.43, p= 0.02)

(9) Subjects who reported high **Exercise Self-Efficacy** at baseline later reported being engaged in a relatively high number of **Exercise minutes** per day at follow-up, as compared to than those who had reported lower Exercise Self-Efficacy initially ($r$=0.46; p=0.01)

(10) Subjects who reported high **Exercise Self-Efficacy** at baseline also reported being more **Exercise Goal-directed**, as compared to than those who had reported lower Exercise Self-Efficacy initially ($r$=0.55; p=0.004)

(11) Subjects who reported high **Exercise Self-Efficacy** at baseline had also reported being engaged in a relatively high number of **Exercise minutes** per day at baseline, as compared to than those who had reported lower Exercise Self-Efficacy initially ($r$=0.54; p=0.002)

(12) Subjects who reported high **Exercise Self-Efficacy** at follow-up also reported a more advanced **Stage of change** at follow-up, as compared to than those who reported low self-efficacy at follow-up ($r$=0.62, p=0.0003)

(13) Subject's **Self-Efficacy** at follow-up was inversely related to their **BMIs** at follow-up ($r$=-0.39, p=0.04)

(14) Subjects who reported high **Exercise Self-Efficacy** at follow-up had also reported being less depressed at baseline. **Self-Efficacy** at follow-up was inversely related to subject's initial levels of Depression ($r$=-0.36, p=0.05)

(15) Subjects who reported high **Exercise Self-Efficacy** at follow-up also reported being generally more active (high **Energy expenditure)** at follow-up, as compared to those who reported low Exercise Self-Efficacy at follow-up ($r$=0.59; p=0.001)

#### *4.6.2.4 **Anxiety***

(16) Subjects who reported high levels of **Anxiety** at baseline also had higher **BMIs** at baseline relative to individuals who reported lower levels of Anxiety at baseline ($r$=0.50, p=0.005)

(17) Subjects who reported high levels of **Anxiety** at baseline also had higher **BMIs** at follow-up relative to individuals who reported lower levels of Anxiety at baseline ($r$=0.45, p=0.01)

(18) Subjects who reported high levels of **Anxiety** at baseline also reported that they had lower **Income** relative to subjects who reported lower levels of Anxiety at baseline ($r$=-0.53, p=0.002)

(19) Subjects who reported high levels of **Anxiety** at baseline also reported that they felt generally less **Optimistic** about the future, as compared to subjects who reported lower levels of Anxiety at baseline ($r$=-0.67, p=<0.0001)

(20) Subjects who reported high levels of **Anxiety** at baseline also reported less **Stage Progression** between baseline and follow-up, as compared to subjects who reported lower levels of Anxiety at baseline ($r$=-0.22, p=<0.04)

(21) Subjects who reported high levels of **Anxiety** at baseline also self-rated their **Exercise Goal-attainment** at follow-up less highly than subjects who reported lower levels of Anxiety at baseline ($r$=-0.40, p=0.02)

#### *4.6.2.5* ***Depression***

(22) Subjects who reported high levels of **Depression** at baseline also reported a less advanced **Stage of change** at follow-up, as compared to than those who reported low levels of Depression at baseline ($r$=-0.38, p=0.05)

(23) Subjects who reported high levels of **Depression** at baseline also reported low **Exercise Self-Efficacy** at follow-up ($r$=-0.36; p=0.05)

(24) Subjects who reported high levels of **Depression** at baseline also had higher **BMIs** at baseline relative to individuals who reported lower levels of Depression at baseline ($r$=0.56, p=0.001)

(25) Subjects who reported high levels of **Depression** at baseline also had higher **BMIs** at follow-up relative to individuals who reported lower levels of Depression at baseline ($r$=0.57, p=0.001)

(26) Subjects who reported high levels of **Depression** at baseline also reported that they had lower **Income** relative to subjects who reported lower levels of Depression at baseline ($r$=-0.43, p=0.02)

(27) Subjects who reported high levels of **Depression** at baseline also reported that they felt generally less **Optimistic** about the future, as compared to subjects who reported lower levels of Depression at baseline ($r$=-0.56, p=0.001)

(28) Subjects who reported high levels of **Depression** at baseline also reported low **Exercise Self-Efficacy** at baseline ($r$=-0.56; p=0.001)

(29) Subjects who reported high levels of **Depression** at baseline also reported a large difference between their actual levels of daily physical activity, and the level of physical activity that they perceived as being **'Ideal' Activity** for health ($r$=-0.46, p=0.01)

(30) Subjects who reported high levels of **Depression** at baseline also reported high levels of **Anxiety** at baseline ($r$=0.80, p=<0.0001)

(31) Subjects who reported high levels of **Depression** at baseline also reported less **Stage Progression** between baseline and follow-up, as compared to subjects who reported lower levels of Depression at baseline ($r$=-0.32, p=0.05)

(32) Subjects who reported high levels of **Depression** at baseline also self-rated their **Exercise Goal-attainment** at follow-up less highly than subjects who reported lower levels of Depression at baseline ($r$=-0.50, p=0.005)

#### *4.6.2.6 Optimism*

(33) Subjects who reported high levels of **Optimism** at baseline also reported being more **Goal-directed** (global) at baseline, as compared to than those who had reported lower levels of Optimism initially ($r$=0.82; p=<0.0001)

(34) Subjects who reported high levels of **Optimism** at baseline also reported that they had higher **Income** relative to subjects who reported lower levels of Optimism at baseline ($r$=0.48, p=0.01)

(35) Subjects who reported high levels of **Optimism** at baseline also reported high **Exercise Self-Efficacy** at baseline ($r$=0.40, p=0.03)

(36) Subjects who reported high levels of **Optimism** at baseline also reported more **Stage Progression** between baseline and follow-up, as compared to subjects who reported lower levels of Optimism at baseline ($r$=0.46, p=0.01)

(37) Subjects who reported high levels of **Optimism** at baseline also self-rated their **Exercise Goal-attainment** at follow-up more highly than subjects who reported lower levels of Optimism at baseline ($r$=0.39, p=0.03)

#### *4.6.2.7 Exercise goal-directed*

(38) Subjects who responded as being more **Exercise Goal-directed** at baseline also reported engaging in a relatively high number of **exercise minutes** per day at follow-up as compared to subjects who reported being less Exercise Goal-directed at baseline ($r$=0.49, p=0.005)

(39) Subjects who responded as being more **Exercise Goal-directed** at baseline also reported a relatively small difference between their actual levels of daily physical activity, and the level of physical activity that they perceived as being **'Ideal' Activity** for health, as compared to subjects who reported being less Exercise Goal-directed at baseline ($r$=0.57, p=0.001)

(40) Subjects who responded as being more **Exercise Goal-directed** at follow-up also reported more **exercise minutes** per day at follow-up, as compared to subjects who reported being less Exercise Goal-directed at baseline ($r$=0.56, p=0.001)

(41) Subjects who responded as being more **Exercise Goal-directed** at follow-up also reported a relatively small difference between their actual levels of daily physical activity, and the level of physical activity that they perceived as being **'Ideal' Activity** for health, as compared to subjects who reported being less Exercise Goal-directed at follow-up ($r$=0.56, p=0.001)

(42) Subjects who responded as being more **Exercise Goal-directed** at follow-up also self-rated their **Exercise Goal-attainment** at follow-up more highly, as compared to subjects who reported being less Exercise Goal-directed at follow-up ($r$=0.75, p=<0.0001)

#### *4.6.2.8* ***Goal-directed (global)***

(43) Subjects who reported being more **Goal-directed** (global) at baseline also reported low levels of **Anxiety** at baseline ($r$=-0.57, p=0.001)

(44) Subjects who reported being more **Goal-directed** (global) at baseline also reported low levels of **Depression** at baseline ($r$=-0.38, p=0.04)

(45) Subjects who reported being more **Goal-directed** (global) at baseline also reported more **Stage Progression** between baseline and follow-up, as compared to subjects who reported lower levels of Goal-directedness (global) at baseline ($r$=0.47, p=0.01)

(46) Subjects who reported being more **Goal-directed** (global) at baseline also reported that they had higher **Income** relative to subjects who reported lower levels of Goal-directedness (global) at baseline ($r$=0.46, p=0.01)

#### *4.6.2.9* ***Ideal activity***

(47) Subjects who, at follow-up, reported a relatively small difference between their actual levels of daily physical activity and the level of physical activity that they perceived as being **'Ideal' Activity** for health, also reported being generally more active (high **Energy expenditure)** at follow-up, as compared to those who reported a relatively larger difference between their actual levels of daily physical activity and their 'Ideal' ($r$=0.36; p=0.05)

(48) Subjects who, at follow-up, reported a relatively small difference between their actual levels of daily physical activity and the level of physical activity that they perceived as being **'Ideal' Activity** for health, also reported engaging in a relatively high number of **exercise minutes** per day at follow-up, as compared to those who reported a relatively

larger difference between their actual levels of daily physical activity and their 'Ideal' (*r*=0.64; p=0.0001)

(49) Subjects who, at follow-up, reported a relatively small difference between their actual levels of daily physical activity and the level of physical activity that they perceived as being **'Ideal' Activity** for health, also self-rated their **Exercise Goal-attainment** at follow-up more highly than those who reported a relatively larger difference between their actual levels of daily physical activity and their 'Ideal' (*r*=0.80; p=<0.0001)

#### *4.6.2.10* ***Exercise minutes***

(50) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at baseline also reported high **Exercise Self-Efficacy** at follow-up (*r*=0.74; p=<0.0001)

(51) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at baseline also reported lower **BMIs** at baseline relative to individuals who reported engaging in a relatively low number of exercise minutes per day at baseline (*r*=-0.42, p=0.02)

(52) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at baseline also reported a more advanced **Stage of change** at follow-up relative to individuals who reported engaging in a relatively low number of exercise minutes per day at baseline (*r*=0.52, p=0.003)

(53) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at baseline also reported engaging in a relatively high number of **exercise minutes** per day at follow-up (*r*=0.74, p=0.0001)

(54) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at baseline also reported being generally more active (high **Energy expenditure)** at follow-up (*r*=0.72; p=<0.0001)

(55) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at baseline also reported being generally more active (high **Energy expenditure)** at baseline (*r*=0.58; p=0.0001)

#### *4.6.2.11* ***Energy expenditure***

(56) Subjects who reported being generally more active (high **Energy expenditure)** at baseline reported being generally more active (high **Energy expenditure)** at follow-up (*r*=0.68; p=<0.0001)

(57) Subjects who reported being generally more active (high **Energy expenditure)** at follow-up also reported a more advanced **Stage of change** at follow-up, relative to individuals who reported being generally less active ($r$=0.49, p=0.01)

(58) Subject's **BMIs** at baseline were related to their **BMIs** at follow-up ($r$=0.94, p=<0.0001)

#### *4.6.2.12* ***Exercise minutes***

(59) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at follow-up had presented with lower **BMIs** at baseline relative to individuals who reported engaging in a lesser number of exercise minutes per day ($r$=-0.42, p=0.02)

(60) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at follow-up presented with lower **BMIs** at follow-up relative to individuals who reported engaging in a lesser number of exercise minutes per day ($r$=-0.53, p=0.003)

(61) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at follow-up also reported a more advanced **Stage of change** at follow-up, relative to individuals who reported engaging in a lesser number of exercise minutes per day ($r$=0.62, p=0.0003)

(62) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at follow-up also reported being generally more active (high **Energy expenditure)** at follow-up, as compared to individuals who reported engaging in a relatively low number of exercise minutes per day at follow-up ($r$=0.63, p=0.0002)

(63) Subjects who reported engaging in a relatively high number of **exercise minutes** per day at follow-up had also reported being generally more active (high **Energy expenditure)** at baseline, as compared to individuals who reported engaging in a relatively low number of exercise minutes per day at follow-up ($r$=0.41, p=0.05)

#### *4.6.2.13* ***Exercise goal-attainment***

(64) Subjects who self-rated their **Exercise Goal-attainment** at follow-up relatively highly also presented with lower **BMIs** at follow-up as compared to individuals who self-rated their Exercise Goal-attainment at follow-up relatively poorly ($r$=-0.55, p=0.002)

(65) Subjects who self-rated their **Exercise Goal-attainment** at follow-up relatively highly also reported being generally more active (high **Energy expenditure)** at follow-up, as compared to individuals who self-rated their Exercise Goal-attainment at follow-up relatively poorly ($r$=-0.55, p=0.002)

(66) Subjects who self-rated their **Exercise Goal-attainment** at follow-up relatively highly had also reported being more highly **Exercise Goal-directed** at baseline, as compared to individuals who self-rated their Exercise Goal-attainment at follow-up relatively poorly ($r$=0.37, p=0.05)

(67) Subjects who self-rated their **Exercise Goal-attainment** at follow-up relatively highly had also reported engaging in a relatively high number of **exercise minutes** per day at follow-up, as compared to individuals who self-rated their Exercise Goal-attainment at follow-up relatively poorly ($r$=0.69, p=<0.0001)

### *4.6.3 Correlational diagrams*

The following three figures (Figures 25, 26, and 27), diagrammatically represent the above correlations and the Pearson's coefficients '*r*' and statistical significance 'p' values are show on the diagram for each relationship. Figure 25 displays the more significant correlations that relate selected *personal characteristics,* as assessed at **baseline**, with selected *cognitive and behavioural* outcome variables, as assessed at **follow-up**. Figure 26 displays the more significant correlations that relate selected *demographic*, *physical, psychological, cognitive, and behavioural characteristics,* as assessed at **baseline**. Further, Figure 27 displays the more significant correlations that relate selected *physical, psychological, cognitive, and behavioural characteristics,* as assessed at **follow-up**. In each of Figures 25, 26, and 27, for the purposes of clarity, only the more relevant and statistically robust correlations are presented diagrammatically, and other correlations of lesser relevance and/or significance are listed in summary Table 12.

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**Figure 25** •Significant correlations relating selected ***personal characteristics***, as assessed at **baseline**, with selected ***cognitive and behavioural*** outcome variables, as assessed at **follow-up**. Note: Pearson's Coefficients '*r*' and Statistical Significance 'p' values are shown for each relationship. For the purposes of clarity, only the more relevant and statistically robust correlations are presented here, correlations of lesser relevance and significance are listed in Table 12.

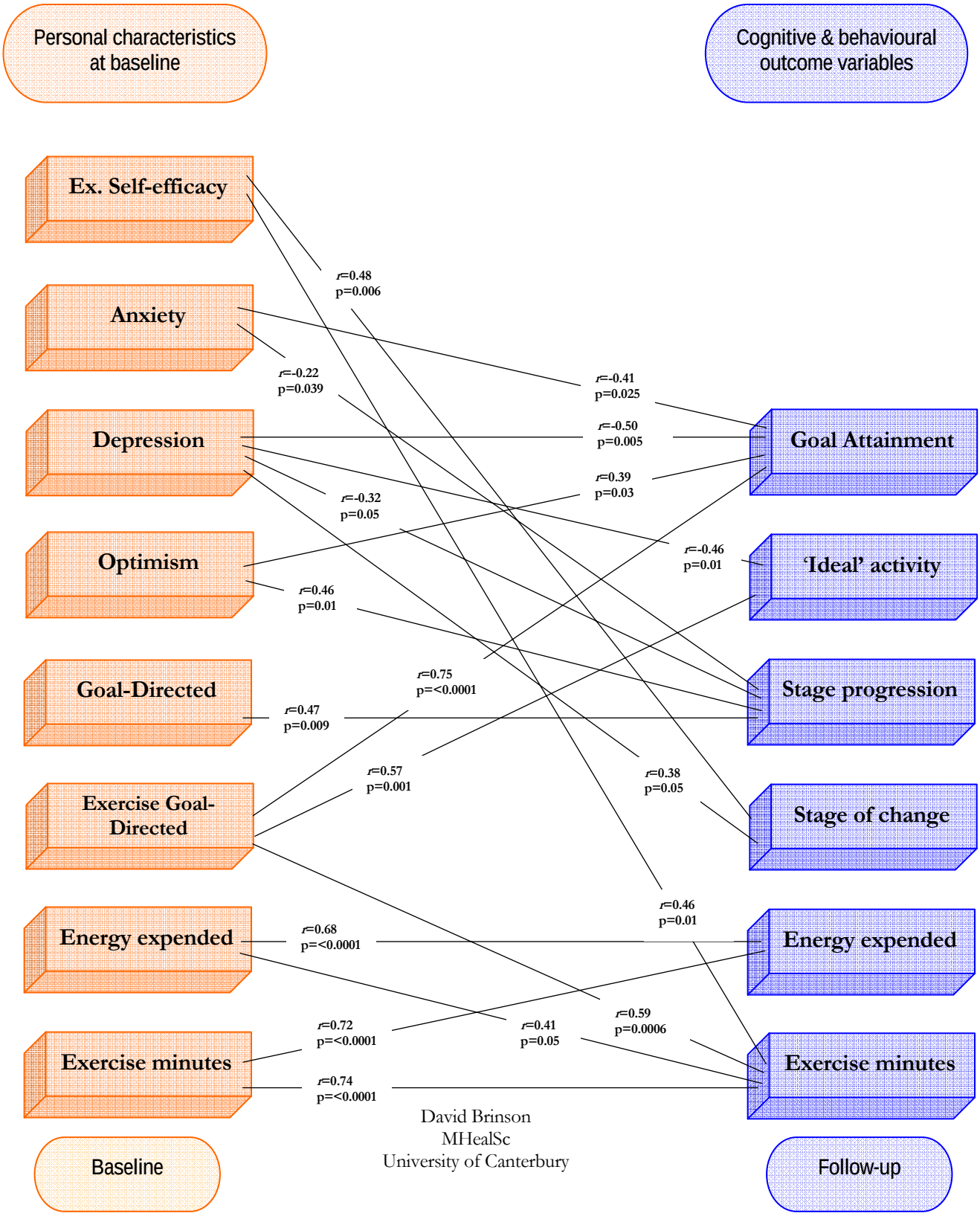


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**Figure 26** •Significant correlations relating selected ***demographic***, ***physical, psychological, cognitive, and behavioural characteristics***, as assessed at **baseline**. Note: Pearson's Coefficients '*r*' and Statistical Significance 'p' values are shown for each relationship. For the purposes of clarity, only the more relevant and statistically robust correlations are presented here, correlations of lesser relevance and significance are listed in Table 12.

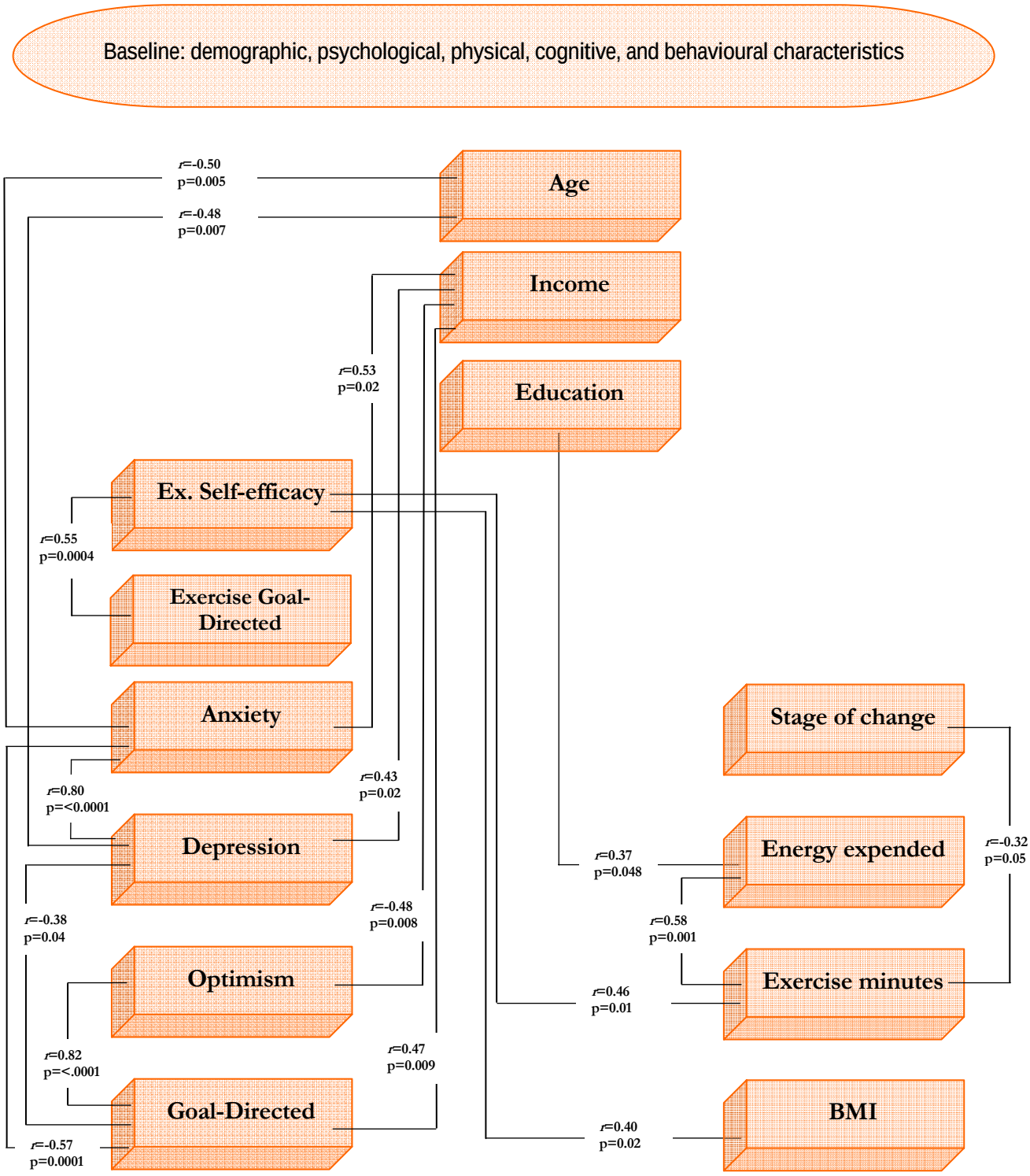

**Figure 27** •Significant correlations relating selected ***physical, psychological, cognitive, and behavioural characteristics***, as assessed at **follow-up**. Note: Pearson's Coefficients '*r*' and Statistical Significance 'p' values are shown for each relationship. For the purposes of clarity, only the more relevant and statistically robust correlations are presented here, correlations of lesser relevance and significance are listed in Table 12.

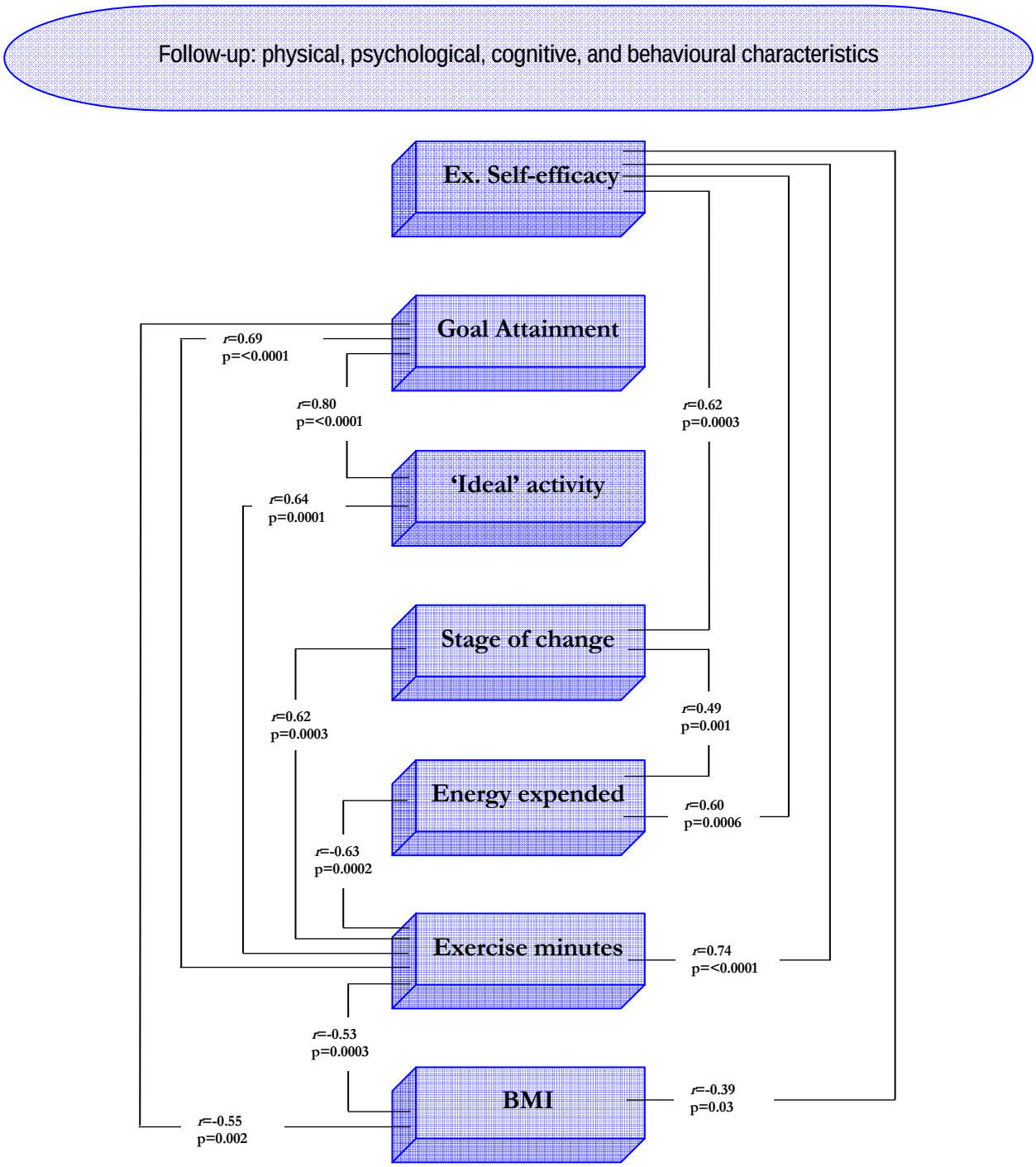

**Table 12** •Complete list of correlations reaching or exceeding the p=0.05 level of significance. Note: the order in which the variables are grouped in the table simply provides for easier reference to Figure 25, 26 & 27 as such, the variables are not listed in any '*r*' of 'p' value rank order.

| (Correlation #) | Variable | Variable | *r* | p value |
|---|---|---|---|---|
| 1. | Age | Anxiety at Baseline | -0.50 | 0.005 |
| 2. | Age | Depression at Baseline | -0.48 | 0.01 |
| 3. | Education | Energy expended/day at follow-up | 0.36 | 0.05 |
| 4. | Ex Self-Efficacy at Baseline | BMI at Baseline | -0.40 | 0.03 |
| 5. | Ex Self-Efficacy at Baseline | Stage of Change at Baseline | 0.41 | 0.03 |
| 6. | Ex Self-Efficacy at Baseline | Stage of Change at Follow-up | 0.48 | 0.006 |
| 7. | Ex Self-Efficacy at Baseline | Energy expended/day at follow-up | 0.38 | 0.04 |
| 8. | Ex Self-Efficacy at Baseline | BMI at Follow-up | -0.43 | 0.02 |
| 9. | Ex Self-Efficacy at Baseline | Exercise minutes at Follow-up | 0.46 | 0.01 |
| 10. | Ex Self-Efficacy at Baseline | Exercise goal-directed at Baseline | 0.55 | 0.004 |
| 11. | Ex Self-Efficacy at Baseline | Exercise minutes at Baseline | 0.54 | 0.002 |
| 12. | Ex Self-Efficacy at Follow-up | Stage of Change at Follow-up | 0.62 | 0.0003 |
| 13. | Ex Self-Efficacy at Follow-up | BMI at Follow-up | -0.39 | 0.04 |
| 14. | Ex Self-Efficacy at Follow-up | Depression at Baseline | -0.36 | 0.05 |
| 15. | Ex Self-Efficacy at Follow-up | Energy expended/day at follow-up | 0.59 | 0.001 |
| 16. | Anxiety at Baseline | BMI at Baseline | 0.50 | 0.005 |
| 17. | Anxiety at Baseline | BMI at Follow-up | 0.45 | 0.01 |
| 18. | Anxiety at Baseline | Income | -0.53 | 0.002 |
| 19. | Anxiety at Baseline | Optimism at Baseline | -0.67 | <0.0001 |
| 20. | Anxiety at Baseline | Stage Progression Baseline/Follow-up | -0.22 | 0.04 |
| 21. | Anxiety at Baseline | Goal-Attainment (Exercise) | -0.40 | 0.02 |

| | | | |
|---|---|---|---|
| 22. Depression at Baseline | Stage of Change at Follow-up | -0.38 | 0.05 |
| 23. Depression at Baseline | Ex Self-Efficacy at Follow-up | -0.36 | 0.05 |
| 24. Depression at Baseline | BMI at Baseline | 0.56 | 0.001 |
| 25. Depression at Baseline | BMI at Follow-up | 0.57 | 0.001 |
| 26. Depression at Baseline | Income | -0.43 | 0.02 |
| 27. Depression at Baseline | Optimism at Baseline | -0.56 | 0.001 |
| 28. Depression at Baseline | Ex Self-Efficacy at Baseline | -0.56 | 0.001 |
| 29. Depression at Baseline | 'Ideal' Activity (perceived) | -0.46 | 0.01 |
| 30. Depression at Baseline | Anxiety at Baseline | 0.80 | <0.0001 |
| 31. Depression at Baseline | Stage Progression Baseline/Follow-up | -0.32 | 0.05 |
| 32. Depression at Baseline | Goal-Attainment (Exercise) | -0.50 | 0.005 |
| 33. Optimism at Baseline | Goal-directed (global) at Baseline | 0.82 | <0.0001 |
| 34. Optimism at Baseline | Income | 0.48 | 0.01 |
| 35. Optimism at Baseline | Ex Self-Efficacy at Baseline | 0.40 | 0.03 |
| 36. Optimism at Baseline | Stage Progression Baseline/Follow-up | 0.46 | 0.01 |
| 37. Optimism at Baseline | Goal-Attainment (Exercise) | 0.39 | 0.03 |
| 38. Exercise Goal-directed at Baseline | Exercise minutes at Follow-up | 0.49 | 0.005 |
| 39. Exercise Goal-directed at Baseline | 'Ideal' Activity (perceived) | 0.57 | 0.001 |
| 40. Exercise Goal-directed-Follow-up | Exercise minutes at Follow-up | 0.58 | 0.006 |
| 41. Exercise Goal-directed-Follow-up | 'Ideal' Activity (perceived) | 0.56 | 0.001 |
| 42. Exercise Goal-directed-Follow-up | Goal-Attainment (Exercise) | 0.75 | <0.0001 |
| 43. Goal-directed (global) at Baseline | Anxiety at Baseline | -0.57 | 0.001 |
| 44. Goal-directed (global) at Baseline | Depression at Baseline | -0.38 | 0.04 |
| 45. Goal-directed (global) at Baseline | Stage Progression Baseline/Follow-up | 0.47 | 0.01 |
| 46. Goal-directed (global) at Baseline | Income | 0.46 | 0.01 |
| 47. 'Ideal' Activity (perceived) | Energy expended/day at follow-up | 0.36 | 0.05 |

| | | | |
|---|---|---|---|
| 48. 'Ideal' Activity (perceived) | Exercise minutes at Follow-up | 0.64 | 0.0001 |
| 49. 'Ideal' Activity (perceived) | Goal-Attainment (Exercise) | 0.80 | <0.0001 |
| 50. Exercise minutes at Baseline | Ex Self-Efficacy at Follow-up | 0.74 | <0.0001 |
| 51. Exercise minutes at Baseline | BMI at Baseline | -0.42 | 0.02 |
| 52. Exercise minutes at Baseline | Stage of Change at Baseline | 0.52 | 0.003 |
| 53. Exercise minutes at Baseline | Exercise minutes at Follow-up | 0.74 | 0.0001 |
| 54. Exercise minutes at Baseline | Energy expended/day at follow-up | 0.72 | <0.0001 |
| 55. Exercise minutes at Baseline | Energy expended/day at Baseline | 0.58 | 0.0001 |
| 56. Energy expended/day at Baseline | Energy expended/day at follow-up | 0.68 | <0.0001 |
| 57. Energy expended/day at Baseline | Stage of Change at Follow-up | 0.49 | 0.01 |
| 58. BMI at Baseline | BMI at Follow-up | 0.94 | <0.0001 |
| 59. Exercise minutes at Follow-up | BMI at Baseline | -0.42 | 0.02 |
| 60. Exercise minutes at Follow-up | BMI at Follow-up | -0.53 | 0.003 |
| 61. Exercise minutes at Follow-up | Stage of Change at Follow-up | 0.62 | 0.0003 |
| 62. Exercise minutes at Follow-up | Energy expended/day at follow-up | 0.63 | 0.0002 |
| 63. Exercise minutes at Follow-up | Energy expended/day at Baseline | 0.41 | 0.05 |
| 64. Self-rated Goal-Attainment | BMI at Follow-up | -0.55 | 0.002 |
| 65. Self-rated Goal-Attainment | Energy expended/day at follow-up | 0.36 | 0.05 |
| 66. Self-rated Goal-Attainment | Exercise goal-directed at Baseline | 0.37 | 0.05 |
| 67. Self-rated Goal-Attainment | Exercise minutes at Follow-up | 0.69 | <0.0001 |

# 5 DISCUSSION

## *5.1 Introduction*

Central to this thesis is the belief, well supported by the research reviewed in chapter two, that improved self-management is essential if progress is to be made in addressing the increasing personal and societal burden of diabetes. This study sets out to illuminate the interrelationships between personal characteristics, psychosocial variables, and the role that physical activity plays, or may potentially play, in the self-management of type 2 diabetes. The hypothesised link between psychosocial variables and outcome measures for recently diagnosed type 2 diabetes patients has been confirmed, however, this conclusion must be set within the context of both the limitations of the study and its implications.

It is emphasised that the following discussion and the ensuing implications are generally multi-level, thus implications at the micro level (the level of the individual) may in many cases be extrapolated to the meso-level (including organisations, group education and clinical practice) and still further to the macro-level (including health policy, health systems, broader social policy, and the global environment). While the discussion *is* predominantly concentrated within the micro level (as this is the level at which the study was conducted), the implications and recommendations for diabetes educational and/or clinical contexts are outlined and discussed, and the main limitations of the study are discussed also. Further, the broader social and health policy implications are discussed within the following chapter as they arise and these are also reviewed within the summary and conclusion. For convenience, the study purpose and aims, and the research hypothesis are summarised and re-stated below.

### *5.1.1 Research purpose*

The stated purpose of the investigation was twofold, firstly, to investigate and to further expand the knowledge base in the area of type 2 diabetes management, with a specific emphasis on understanding how a group of newly diagnosed type 2 diabetic patients have integrated *physical exercise* into their daily lives as a component of their diabetes self-management. The second purpose of the investigation was to generate recommendations that may facilitate individuals, communities, health professionals, health promoters and policy analysts in the task of matching high risk populations to the available resources and interventions optimally, in the context of a contemporary 'real world' urban environment. To this end, one particular focus of the enquiry was to investigate individualised characteristics and/or psychological and psychosocial factors that might be predictive of better health outcomes, and how screening for such characteristics in community health care settings might be usefully incorporated into future educational, psychological, and behavioural interventions.

### *5.1.2 Research hypothesis*

"Greater optimism, exercise self-efficacy and goal-directedness, and lower life stress and anxiety/depression, measured at the time of an individual's diagnosis with type 2 diabetes, will be associated with higher levels of physical activity, and more clinically normal scores on biochemical measures, at 6 months follow-up".

### *5.1.3 Research aims*

The study aims are to demonstrate correlations between certain psychosocial, behavioural and

biological determinants of health, and the self-management behaviours of newly diagnosed type 2 diabetes patients, and how any such determinants, antecedents and individual differences may change over time. Specifically, the psychosocial constructs comprise optimism, exercise self-efficacy, goal-directness, stage of change, anxiety and depression, and traumatic stress, and the biochemical measures are HbA1c and BMI, and the behavioural outcomes are subjects' physical activity levels and physical exercise participation.

### *5.1.4 Overview*

Physical activity and limitations of the measurement of habitual physical activity are discussed initially (and also subsequently in relation to many of the other study variables). The baseline correlations considered to be the most important and relevant to the discussion have been grouped into six clusters of variables and summarised below in Table 13. Generally, the groupings are organised around each of the 'personal characteristics' that were measured at baseline, and related outcome variables are also listed to comprise each grouping. Figures 25; 26; 27 illustrate the complexity of the relationships found in the current study, and it is suggested that they be reviewed as required to clarify the way in which each group of allied relationships fit within the overall schema. Reference to these figures also serves to illustrate how a number of other correlations may be convergent on a particular outcome variable under discussion, however, if such 'other' relationships are weak or somewhat peripheral, then such relationships may not necessarily form part of the central discussion (although they may still be discussed elsewhere). Because the purpose of the enquiry is to investigate individualised factors and/or characteristics that might be predictive of better health outcomes, most of the

correlations discussed relate baseline variables to follow-up variables, or baseline variables to other baseline variables. This perspective is considered most representative of the functionality of any potentially useful screening tool or future screening process that might be developed for use in diabetes care settings. In many cases, these relationships are considered collectively, to demonstrate the nature of a particular cluster of baseline characteristics and, with reference to the literature, how they may possibly interact with respect to causality. Note: The variable names and the measures used in the current study are all listed and defined within the main glossary of terms commencing on page xv.

**Table 13** •The groupings of relationships that are specifically discussed in detail within this section

| | |
|---|---|
| **(1) Exercice self-efficacy at baseline:** | →Exercise minutes at follow-up, *r*=0.46; p=0.01<br>→Energy expenditure at follow-up *r*=0.59; p=0.001<br>→Stage of change at follow-up *r*=0.48; p=0.001<br>→BMI at Follow-up *r*=-0.43; p=0.02<br>→Optimism at baseline *r*=0.40; p=0.03<br>→Exercise Goal-directed *r*=0.55; p=0.0004 |
| **(2) Anxiety at baseline:** | →Depression at baseline *r*=0.80, p=<0.0001<br>→Goal-attainment *r*=-0.40; p=0.02<br>→BMI at Follow-up *r*=0.45; p=0.01<br>→Goal-directed (global) *r*=-0.57; p=0.001<br>→Optimism at baseline *r*=-0.67; p=<0.0001 |
| **(3) Depression at baseline:** | →Goal-attainment *r*=-0.50; p=0.005<br>→Stage of change at follow-up *r*=-0.38; p=0.05<br>→Self-efficacy at follow-up *r*=-0.36; p=0.05<br>→Goal-directed (global) *r*=-0.38; p=0.04<br>→Optimism at baseline *r*=-0.56; p=0.001<br>→BMI at Follow-up *r*=0.57; p=0.001 |
| **(4) Goal-directed global:** | →Optimism *r*=0.82; p=<0.0001<br>→Stage progression *r*=0.47; p=0.01<br>→Exercise minutes at follow-up *r*=0.49; p=0.005 |
| **Exercise goal-directed:** | →Ideal activity *r*=0.57; p=0.001<br>→Goal-attainment r=0.75; p=<0.0001 |
| **Goal-attainment:** | →Exercise minutes at follow-up r=0.69; p=<0.0001<br>→Energy expended/day at follow-up r=0.36; p=0.05 |
| **(5) Optimism at baseline:** | →Goal-attainment *r*=0.39; p=0.03<br>→Stage progression *r*=0.46; p=0.01 |
| **(6) Stage of change at follow-up:** | →Exercise minutes at follow-up, *r*=0.62; p=0.0003 |

## *5.2 Discussion*

### *5.2.1 Physical activity*

#### *5.2.1.1 Introduction: the assessment of habitual physical activity*

Participants' physical activity levels were assessed using the Stanford 7-Day Physical Activity Recall Questionnaire (7D-PAR). The 7D-PAR assesses work, leisure-time, and sporting activities that relate to the previous seven days and in addition, the type of physical activity and/or exercise modality is also recorded. Specifically, the instrument requires individuals to recall the average number of hours and minutes per day spent engaging in sleep, moderate, hard, and very hard activities, over the course of the previous seven days. The 7D-PAR is perhaps most commonly used for the assessment of group-mean total energy expenditure per day, also, for assessing changes in this energy expenditure over time, and for comparative studies of energy expenditure and measures of calorific (dietary) intake. Indeed the 7D-PAR was used to assess these variables in the Five City Project for which it was designed (Sallis et al., 1985). Further, as the 7D-PAR requires the interviewer to record the occurrence, intensity, duration and *mode* of the physical activity reported, it is subsequently possible to extract the data that describe physical '*exercise*', as a sub-set of the total physical '*activity*' data. In this study, such a differentiation was made to allow the subsequent analysis of participants' physical *exercise* behaviours to be independent of their total activity (energy expenditure) and thus, to permit a wider range of correlational relationships to be examined. Further, both the Exercise Stage of Change questionnaire (Marcus, Selby, Niaura, & Rossi, 1992) and the Exercise Self-efficacy scale (Benisovich, Rossi, Norman, & Nigg, 1998) specifically relate to intentional, planned physical *exercise*, therefore the reporting and analysis of 'minutes of

moderate intensity physical exercise' provides for a better 'fit' with these other scales and also with the guiding ethos of the study.

#### *5.2.1.2 Considerations, compromises and limitations*

*Representativeness:* Obtaining the truth about an individual's physical activity behaviours is not easily achieved and it has been suggested that a lack of representativeness is *the* major potential limitation to the use of questionnaires in the assessment of habitual physical activity (Blair, 1984; Richardson, Ainsworth, Jacobs, & Leon, 2001) and in this study, this indeed appeared to be the case. In this study, enhancing representativeness was considered to be especially important and every attempt was made to maximise the integrity of the data. Variability was minimised whenever suspected and/or identified by adhering to the 7D-PAR interview protocol and technique guidelines (Taylor et al., 1878) (appendix F). Evaluative studies have investigated the important issues around representativeness, including recall error, seasonal variation, atypical report periods, and socially desirable responding. In general, substitution of report periods other than the previous 7-days and/or the manipulation of data in an effort to 'typify' responses, has not proved to be useful (Blair, 1984; Blair et al., 1998). On several occasions during this study, subjects did indeed attempt to select and substitute a more "favourably active week", however, this was generally not permitted by the interviewer and the previous 14-7 day period was recorded only if the last week was *highly atypical*, for example in the case of illness and when the respondent was resolute that the substituted week was *highly typical* of 'routinizied' behaviour.

*Timing of the baseline assessment:* Another limitation of the study concerns the temporal proximity of individual's baseline interview and their initial diagnosis with type 2 diabetes, and where this point of diagnosis lay on any individual's disease trajectory. It is noted, that type 2 diabetes is a progressive disease and one that is often asymptomatic for some years before diagnosis (Gonder-Frederick, Cox, & Ritterband, 2002), therefore, for each individual, the point of diagnosis invariably aligned idiosyncratically with their actual disease progression and/or symptoms. Therefore, the recruitment strategy for the current study was designed to search out type 2 diabetic patients as near as practicable to the point in time when they first became *cognisant* of their disease state. The purpose of this early data collection was to minimise the likelihood of patients having already implemented cognitive and/or behavioural strategies in response to having been diagnosed with this potentially life-changing disease, and thus maximising the likelihood of accurately measuring any such changes over time. A number of respondents reported (anecdotally) that they *had,* however, already commenced at least some amount of physical activity since their diagnosis (and thus prior to the baseline interview), when previously they had been sedentary. These 'pre-assessment' changes in activity levels were not specifically measured and they were also missed by the 7D-PAR, which only assesses current (i.e. the past 7-days) 'habitual activity', rather than providing retrospective data over longer time-periods. Thus, the full magnitude of the mean change in physical activity between baseline and follow-up was attenuated by an unknown value. On reflection, it may have been helpful to also administer a physical activity instrument with a longer recall period specifically for this purpose. However, it has been demonstrated that long report period retrospective instruments are subject to significant recall errors (Blair et al.,

1985; Taylor et al., 1984; Taylor et al., 1878), and this may have simply confounded the baseline data further. Logically, it was only possible to identify and assess patients post-diagnosis and thus every effort was made to make the initial assessment as close to the time of diagnosis as possible. Due to various time lapses between GPs visits, lab reports, follow-up consultations and the referring of patients to the education seminars, there was, in all probability, some degree of distortion of the initial physical activity assessment and therefore the observed change in activity between baseline and follow-up. This was difficult to quantify and not easily resolved.

*Ceiling effect:* When considering the magnitude of the relationships between exercise and the other selected study variables, it was also recognized that a possible 'ceiling effect' may have attenuated some of the statistical relationships. Specifically, ten subjects reported that they were already engaging in 30 minutes or more of physical exercise at baseline, therefore, depending on what criteria one adopts for defining 'enough' exercise, these ten people may have already been at their ceiling and thus their 'actual' exercise levels matched their perception of an 'appropriate' exercise level. Therefore, for these participants, *maintaining* exercise levels over time may have been their primary outcome goal, rather than striving to *increase* exercise levels, as was the case for a number of others.

*Social desirability bias:* Social desirability bias, or the inclination for subjects to respond in a manner that they perceived would be viewed favourably by others, may also have confounded the physical activity data. It may have been useful to include a measure of social desirability, such as the Marlow-Crowne Social Desirability Scale (MCSD) (Crowne & Marlowe, 1964).

The MCSD is a 13 item questionnaire designed to assess study participants' desire to be viewed in a positive light. However, how any identifiable 'socially desirable responding' could have been reconciled with the data in this current study is uncertain. The sample size was not sufficiently large to have simply excluded subjects found to be engaging in significant amounts of socially-desirable responding and the degree to which subject responses could have been recalibrated to compensate for any such socially-desirable responding is not specifically known for the measures used. Therefore, in this study, endeavouring to minimize socially-desirable responding at the source was considered to be the most practicable strategy. To this end, subjects were 'cross-examined' somewhat during the interview process. Specifically, subject's follow-up responses were cross-referenced with their baseline responses. At the time of the follow-up interview, the researcher ensured subject 'blinding' to their baseline responses initially, however, after responding at follow-up, subjects were then asked to comment on their past activity. Subjects were asked "…so how does that [your current physical activity] compare to what you would have been doing six months ago?", and the individual subject's responses were checked for any incongruence. Discussion around this question often prompted subjects to revise their responses at follow-up (however to maintain validity, the baseline data remained necessarily unchanged). However, Salancik (1977a) points out that people who have made their goals public (for example to the researcher at baseline) will have a strong desire to demonstrate consistency and congruence between their 'publicized' baseline goals and their follow-up behaviours. Therefore, it is suggested here that socially desirable responding at follow-up may still have been sufficiently pronounced to 'disguise' an actual decrease in physical activity over the follow-up period. While 'holding subjects accountable' did reduce

the degree of social desirability bias at follow-up, it almost certainly did not eliminate it.

#### *5.2.1.3 Physical activity: key findings*

*Physical activity levels:* (1) Depending on the criteria applied, physical activity levels were, on average, inadequate for supporting optimal health in the context of the current study population. (2) It appeared that subjects generally *overestimated* their physical activity levels (intentionally or otherwise) and this is congruent with other findings as reported in the literature (Blair, 1984; Blair et al., 1985; Richardson, Ainsworth, Jacobs, & Leon, 2001; Shephard, 2003). (3) There was essentially no change in reported mean activity levels, between baseline and follow-up. The group-mean *energy expenditure* per day remained essentially unchanged over the report period (+0.04 Kcal/kg/day), and the group-mean minutes of moderate equivalent physical *exercise* per day increased by only 2.44 minutes from 31.1 minutes/day to 33.54 minutes/day, and this 2.44 minutes increase is not statistically significant. While this 30 minutes of moderate physical exercise per day is arguably a meaningful amount of activity (certainly better than no activity), it must be taken in the context of the measurement limitations inherent in the current study (as described above) and also in the overall context of the known limitations to the assessment of habitual physical activity by questionnaires, as discussed in the literature (Shephard, 2003) and summarised here. Further, current physical activity recommendations for weight loss and type 2 diabetes management range from at least 30 minutes to more than 90 minutes per day of moderate intensity physical activity, including resistance/strength training, with 60 minutes being a typical recommendation (ACSM, 2000; Canadian Diabetes Association, 2003; Knowler et al., 2002; NZGG & Ministry of Health, 2003; Paffenbarger et al., 1993; Paternostro-Bayles, Wing, &

Robertson, 1989). Thus, depending on the selected criteria, the level of physical activity reported by many of the participants in the current study may be less than half that which is required to facilitate the biochemical and psychological changes necessary to support optimal health. These changes include, but are not limited to, major weight reduction (required in 80-90% of cases), improved glycaemic control, increased aerobic capacity, increased muscle mass and strength, improved mood including lowered anxiety and depression, and increased optimism, happiness, and well-being (ACSM, 2000; NZGG & Ministry of Health, 2003). As already stated, obtaining the truth about an individual's physical activity behaviours is not easily achieved (Blair, 1984; Richardson, Ainsworth, Jacobs, & Leon, 2001), thus demonstrating physical activity *trends* more accurately generally requires follow-up periods of 12-36 months (as well as enhanced measurement techniques) (Shephard, 2003). Thus, the relatively short follow-up period of this current study is acknowledged as a significant limitation in this respect.

*Subject errors in quantifying intensity and duration:* Physical activity, unlike smoking for example, is a *very* complex behaviour. While smoking behaviours indeed have a variety of unique causal antecedents (for example various addictive and/or psychological dimensions), the outcome measure is dichotomous, that is, 'smoking' or 'non-smoking' (although in some cases 'cutting down' may be regarded as a meaningful outcome). Physical activity behaviours however, are usually represented by at least four variables including intensity, frequency, duration, and modality. While each of these behavioural outcome variables are easily assessed in controlled situations (for example an exercise laboratory), in a 'real world' context, the accurate assessment of the interaction of these four variables is difficult in the extreme

(Fogelholm & Kukkonen-Harjula, 2000; Shephard, 2003; West, 2005). In the current study, subjects often appeared to be under a misconception as to the actual intensity of their activity and time they spent exercising. To use playing golf as an example, three hours at the golf course might be reported as three hours of moderate physical activity, however when probed (for example "…now lets think about the actual time spent walking rather than the total time spent at the golf course"), the response might be revised down to an hour and a half, and then when asked "… how much of this time was actually spent walking and playing at a moderate intensity", then the assessment might be revised downward still further. When questioned in a non-threatening yet explorative tone, subjects invariably 'down-rated' their initial estimations and reports of their moderate minutes of physical activity. Further, while walking was the most reported moderate intensity exercise modality, there appeared to be great variability in subject's understanding of exactly what moderate intensity walking is, or more to the point, the meaning of moderate intensity in general. Subjects who reported strolling, stopping, or 'a slow leisurely walk for pleasure' were questioned as to whether this activity met the threshold energy expenditure of *moderate*. While it was difficult to quantify within the study, some respondents clearly indicated an inadequate understanding of exercise intensity, as evidenced by either their descriptions of their pace, and/or their description of the route travelled, time taken, and/or stops made during the 'exercise' period. Thus, variability in the respondents' assessment of their physical activity *intensity* and *duration* may also have limited the overall accuracy of the physical activity data.

*Other findings and relationships:* The psychological constructs, of optimism and goal-directness did not appear to be as strongly related to physical exercise levels per se as was anticipated, however, these relationships may have been attenuated by the limitations of the physical activity assessment (particularly at the time of the initial assessment). However, there were moderate to strong relationships between physical activity levels and other study variables including goal-directness, exercise self-efficacy, stage progression and BMI and these relationships are reported in the results section and they form an important part of the discussion below.

Both *exercise* and *energy expenditure* were demonstrated to be strongly related ($r$=0.63; p=0.0002), however, there was variability in the proportion of total energy expenditure that was accounted for by exercise specifically. The assessment of *energy* expenditure in the current study factored in subject's hours of sleep per day and their hours of light moderate, hard and very hard household and occupational tasks as well as their hours of physical exercise. Figure 21 illustrates the relationship between subject's average minutes of moderate equivalent exercise per day and their total energy expenditure per kilogram of body weight per day. While the correlation between *exercise* and *energy* is strong, it is evident that some individuals reported a high participation in *exercise* activities yet they reported being relatively non-energetic in their occupations and/or around the home, and for others, the inverse was true. Thus, it might be helpful for health professionals and diabetes educators to consider these individual differences. Specifically, individuals may well have differing needs and priorities with respect to physical activity and they may have specific and individualised limitations as to the areas of their lives in which modifications to activity levels can practicably be effected.

Further, it has been reported (Fogelholm & Kukkonen-Harjula, 2000) that in many studies there are significant inconsistencies in the relationships between *exercise*, energy input (dietary) and energy balance. Specifically, engagement in a specified amount of *exercise* (while accurately controlling for dietary intake) often does not result in the magnitude of weight loss that the calculated negative energy balance would predict. The proposed explanation is that compensation by decreased general physical *activity* during the *non-exercise* parts of the day (and/or increased dietary intake) explains why many exercise/weight loss regimes fail to demonstrate predicted results (Fogelholm & Kukkonen-Harjula, 2000). Addressing this possible phenomenon in a diabetes educational seminar may prove to reduce this 'decompensation' by highlighting the importance of maintaining and/or increasing *all* forms of energy expenditure (as well as optimising nutritional factors), as all energy expenditure contributes to a persons overall energy balance.

Interestingly, people who *had* adopted structured exercise since baseline didn't engage as thoughtfully in recalling general activity at follow-up as they had previously at baseline. This was evidenced by respondents failing to report the lifestyle tasks at follow-up (compared to their baseline records) that one could reasonably assume they were still performing (for example vacuuming, mowing the lawns, digging the garden). It appeared that respondents were happy to simply recall *exercise* minutes (once they had some to recall) rather than having to construct a 'picture of activity' from lifestyle tasks. Thus, anecdotally, subjects were more cognizant of their exercise behaviours (and thus changes therein) than they were of their general activity levels and it is suggested here that exercise minutes should be promoted (whenever appropriate) ahead of general physical activity in a type 2 diabetes educational

context. Therefore, with reference to the nature of the exercise versus energy expenditure relationship, and the possibility of total energy expenditure decompensation as discussed above, it is suggested here that promoting an increase in non-specific general physical activity (over exercise) may overemphasise the value of these non-specific exercise tasks and thus attenuate peoples' perception of the seriousness of their disease state and resultantly, this may tend to de-escalate their actions.

#### *5.2.1.4 Recommendations for future interventions*

As previously discussed, study participants appeared to demonstrate a poor understanding of physical activity in general, its importance to health, and the more specific aspects of exercise intensity, duration, frequency and modality. It is suggested that educating patients in these fundamentals is an important task. Experiential education in the actual use of heart-rate monitors, pedometers, and treadmill exercise may be useful in a group educational context, to actually demonstrate to subjects the real nature of moderate intensity activity. Additionally, practical instruction in a wide range of appropriate exercise and sporting activities (beyond just walking) could be included.

It is suggested that there is value in educating patients in the differences between general physical activity and exercise. Specifically, that the two are not necessarily the same, in terms of the motivational and goal-setting strategies that may be successfully applied. Exercise is a great deal more 'definable' than general activity and it can be structured to have a dichotomous outcome (i.e. the exercise session was completed or not completed), thus it is easier to receive feedback on ones progress, and to experience other beneficial outcomes such as fun,

enjoyment, social interaction and satisfaction. Framing exercise in this way may make it much easier for people to be become more intrinsically motivated and to get pleasure from being physically active, rather that simply viewing physical activity as an arduous self-management task.

#### *5.2.1.5 Summary and recommendations for future research*

In summary, the 7D-PAR demonstrated moderate adequacy for the purpose of the enquiry. With respect to future research, controlling for social desirability bias, increasing the representativeness of physical activity assessments, and developing more inclusive and temporally proximal recruitment strategies (relative to the point of diagnosis) are considered to be the main challenges for future research in this domain. It is suggested that in future research, combining two or three assessment methods would enhance the richness and accuracy of the data. For example, combining activity logs, structured questioning of participants' habitual physical activity, and random or comprehensive continuous heart-rate monitoring would greatly enhance the representativeness of the data. Obviously however, such rich data collection requires considerable recourses and necessitates considerable complexity with respect to data analysis. It is suggested that in future research, structured interviewing and physical activity diaries may be more useful than attempting to assess physical activity levels per se. It is noted however, that such measurement techniques may in effect constitute an intervention (via the feedback they provide to the participant) and as such these techniques are generally unsuitable for prospective observational studies and more creative study designs need to be developed.

#### *5.2.1.6 Conclusion*

While the current study specifically focused on physical activity, it is important to also acknowledge the significance of dietary changes, given that for optimal health, the two are ***inextricably*** linked. Exercise training without dietary changes typically produces only modest results (Fogelholm & Kukkonen-Harjula, 2000), and adherence to both exercise and dietary changes is particularly problematic in obese people (Wing, Venditti, Jakicic, Polley, & Lang, 1998). Educational interventions should therefore strive to integrate these two determinants of the energy-balance equation more closely, and emphasise the critical role each plays in achieving better health.

It is tempting to take the current study's physical activity data at face value, and to conclude that subjects' actual physical activity levels meet the New Zealand recommendations (NZGG & Ministry of Health, 2003) of 30 minutes of moderate intensity physical activity per day. However, in aggregate, the evidence suggests that such a conclusion would be unfounded, and in addition, this recommended level of physical activity is arguably too low to facilitate optimal health in this specific diabetic population.

Perhaps *the* salient task for future interventions is to change patients' perceptions of the seriousness of their condition, and also the seriousness with which patients' need to engage in their self-management tasks. Self-management education interventions should assist patients to explore and develop these perceptions such that they may more closely parallel the realities of their condition and its management, thus making clear and reinforcing the importance of one's future actions.

### *5.2.2 Exercice self-efficacy*

The results of the current study show that exercise self-efficacy is inter-related with many of the variables studied, thus exercise self-efficacy emerges as a very important psychological construct, and one that is among those central to the subjects' relationships with physical activity and exercise. Exercise self-efficacy at baseline was found to be moderately positively related to subject's engagement in moderate intensity physical exercise at follow-up ($r$=0.46; p=0.01) (also at baseline), moderately positively related to optimism ($r$=0.40; p=0.03), and moderately inversely related to depression ($r$=-0.36; p=0.05). A recent study of self-efficacy and its correlates, involving 8,796 participants in five countries, found similarly, that optimism was among the highest positive associations and depression was among the highest inverse associations (Luszczynska, Gutiérrez-Doña, & Schwarzer, 2005). Further, exercise self-efficacy was found to be strongly positively related to total energy expenditure/day ($r$=0.59; p=0.001), a more advanced stage of change ($r$=0.48; p=0.001), and inversely related to BMI at follow-up ($r$=-0.43; p=0.02) (similar relationships are also true for exercise self-efficacy at follow-up). In this current study, the group-mean exercise self-efficacy score at baseline was 20.86 (SD 5.29, range 7-29, on a 6-30 scale) and at follow-up, the group-mean exercise self-efficacy score was 20.10 (SD 6.5, range 8-30). At baseline, seven subjects scored below the median score and this increased to 13 at follow-up. When considering this wide range and distribution of exercise self-efficacy scores, it is evident that many of the subjects had relatively low exercise self-efficacy scores at baseline, and more so at follow-up. To achieve their physical activity goals, patients must have at least some belief in their ability to do so (Bandura, 1977a; Maddux, 2001), thus the strong correlations between exercise self-

efficacy and exercise minutes ($r$=0.46; p=0.01), and exercise self-efficacy and energy expenditure at follow-up ($r$=0.59; p=0.001) were indeed expected results. Whether there is an exercise self-efficacy/physical activity 'threshold' in patients with type 2 diabetes is not known, however those subjects with high levels of exercise self-efficacy clearly achieved more physical activity. This relationship does not prove causation in this specific context, however, there is a plethora of empirical data reported in the health and behavioural literature that has established similar casual and/or cumulatively casual relationships (Bandura, 1977a, , 1977b, , 1986; Luszczynska, Gutiérrez-Doña, & Schwarzer, 2005; Maddux, 2001). Social learning theory would suggest that patients with low exercise self-efficacy could benefit from certain intervention strategies that specifically target the enhancement of this personal characteristic. Bandura's application of social learning theory to health and health behaviour change encompasses an expansive body of work, and it is suggested here that the already proven methods by which self-efficacy can be enhanced could be applied successfully within a New Zealand community type 2 diabetes educational context.

#### *5.2.2.1 Implications for interventions*

There are at least five methods of influencing and increasing a person's self-efficacy, including mastery experiences, vicarious experiences, verbal persuasion, imagery, and modifying/managing physiological and/or emotional states (Bandura, 1997), and the first three are briefly discussed here.

Generally, the most effective method of building a strong belief in one's personal efficacy is via *mastery experience*. The engagement in challenging yet achievable tasks, and the

consequent experience of success, builds a resilient sense of efficacy, while premature failures undermine it (Bandura, 1998). There was a much stronger relationship between exercise self-efficacy and exercise minutes at follow-up than was evident at baseline ($r$=0.74; p=<0.0001, compared to $r$=0.46; p=0.01 respectively), and it is suggested here that this reflects the positive effects of mastery experiences, thus, as participants continued to have successes with maintaining exercise adherence, their self efficacy increased also, in a cumulative causative relationship. Therefore a person who is facilitating another to cultivate their self-efficacy should structure situations that are likely to enable success, and avoid placing them in situations where they are likely to experience premature failure. The second most effective method of creating and strengthening self-efficacy is by simply 'watching someone else do it'. Vicarious experiences are most effective when *role models* (people perceived as similar to oneself) *demonstrate* success at a challenging task. In a diabetes education context, competent role models (including lay-people) could be engaged to teach other patients practical skills and strategies to enhance their engagement with physical activity and these skills and strategies could easily be tailored to individual patient's needs. Further, twenty three percent of the respondents stated either that a lack of social support or the lack of an exercise partner was a significant barrier to their engagement in physical exercise, and role modelling could be extended into the community, at low cost, by the development of walking groups and/or various other types of physical activity groups or clubs. Thirdly, peoples' self-efficacy may be enhanced by verbal persuasion: simply telling a person that they can do it fosters their belief in their ability to mobilise the effort, skills and knowledge needed to succeed. Traditionally, diabetes management education seminars have tended to 'tell patients what to do', rather than

encouraging them that they can actually do it (Anderson, Funnell, Fitzgerald, & Marrero, 2000; Feste, 1992).

#### *5.2.2.2 Self-efficacy and goal setting*

Importantly, self-efficacy has been demonstrated to affect peoples' choice of goal level, with higher self-efficacy being associated with higher level goals and hence higher performance (Bandura, 1968; Bandura, 1998). This was indicated in the current study by the strong relationship demonstrated between exercise self-efficacy and exercise goal-directness ($r$=0.55; p=0.0004) and further, those participants who reported that they were more exercise goal-directed at baseline reported engaging in a greater number of exercise minutes at follow-up, as compared to those participants who were less exercise goal-directed initially ($r$=0.49; p=0.005). The subject's levels of exercise self-efficacy did appear to influence the adoption of healthy exercise behaviours and the maintenance of effortful behavioural changes, and this is congruent with a large body of existing evidence (Bandura, 1968; Bandura, 1998; Bandura & Locke, 2003; Maddux, 2001). Although it was not statistically possible to establish the exact nature of the causal relationship between exercise self-efficacy and subjects' engagement with physical exercise (due to measurement and other methodological limitations as already discussed 5.2.10) anecdotally, it did appear that exercise self-efficacy scores in the upper quartile were 'required' for both the initiation and maintenance of physical exercise.

#### *5.2.2.3 Summary*

Social cognitive theory postulates that we anticipate and develop expectancies using knowledge and past experience to form efficacy *beliefs* about future events and our abilities

and behaviours (Bandura, 1986, , 1997). With respect to health behaviour change, appropriately focused health promotion and behavioural interventions have the potential to positively influence the level at which individuals set their physical activity goals and subsequently their goal achievement, via increasing their self-efficacy.

It is suggested here that future research is required to develop more precise measures of exercise self-efficacy, which could be utilized by health professionals and health educators in outpatient settings, and that might provide guidance regarding a patient's self-efficacy profile, their specific efficacy needs, and the particular mechanisms of building self-efficacy to which individual patients would respond most gainfully.

### *5.2.3 Anxiety and depression*

Anxiety and depression are generally considered to be separate yet related constructs (Beck, Emery, & Greenberg, 1985), and in this current study, anxiety and depression were, as expected, strongly related at baseline ($r$=0.80, p=<0.0001) and similarly at follow-up. Hence, for the purposes of this discussion, anxiety and depression are discussed concurrently, with any notable differences being highlighted as appropriate. Further, it is important to note that the *severity* of the anxiety and depression reported here is, in the main, sub-clinical. The Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) predominantly measures sub-clinical levels of anxiety and depression. The HADS was not designed to diagnose major anxiety or depressive disorders, rather, the HADS was designed to measure anxiety and depression levels that range from low to moderate, that is, anxiety and depression that would not *necessarily* meet DSM IV criteria, and in all likelihood would go undetected in general circumstances. Very high HADS scores (> 15) do indicate levels of anxiety and depression approaching or possibly exceeding diagnostic criteria (Bjelland, Dahl, Haug, & Neckelmann, 2002; Zigmond & Snaith, 1983), however, no subjects were within this range at follow-up. The results of the current study demonstrate that low-to-moderate levels of anxiety and depression were quite prevalent within the study population, however, relatively few respondents reported 'probable caseness' (see Table 7 for a summary). The group-mean anxiety score at baseline was 7.36 (SD 4.62, range 0-16) and the group-mean depression score at baseline was only 4.53 (SD 3.7, range 0-12). Thus, the study group could be described as having a relatively high prevalence of low level anxiety and depression. Even at these low levels however, anxiety and depression was demonstrated to relate significantly to a number of

the other variables measured in the study, including optimism, goal-directness, goal-attainment, stage of change, exercise self-efficacy, and BMI.

When considering anxiety alone, two correlations were notably strong, specifically, anxiety at baseline was strongly inversely related to baseline goal-directness (global) ($r$=-0.57; p=0.001) and optimism at baseline ($r$=-0.67; p=<0.0001). Additionally, respondents who reported higher levels of anxiety at baseline also stated at follow-up that they had made less progress towards their physical activity goals as compared to those respondents who reported lower levels of anxiety at baseline ($r$=-0.40; p=0.02). Further, both higher anxiety and depression levels were related to higher BMIs at follow-up ($r$=0.45; p=0.01 and $r$=0.57; p=0.001 respectively).

When considering depression, the relationships were similar to those observed for anxiety (depression being related to goal-directedness $r$=-0.38, p=0.05; goal-attainment $r$=-0.50, p=0.005; optimism $r$=-0.56, p=0.001), however depression was also moderately inversely related to exercise self-efficacy at follow-up ($r$=-0.36, p=0.05), and exercise stage of change at follow-up ($r$=-0.38; p=0.05). In the case of both anxiety and depression, the relationships with exercise minutes/day and total energy expenditure per day did not reach statistical significance, although both were in the expected (inverse) direction. Whether this lack of statistical significance is truly representative of the anxiety/depression versus physical activity relationship, or whether this lack of statistical significance is a factor of the limitations of the measurement of physical activity, is not clear. However, taken collectively, these data suggest that anxiety and depression may impact more directly on those factors that influence an individual's capacity to problem-solve, cope, plan and set goals, and the potentially negative

influence of higher anxiety and depression levels on these antecedents may, in turn, impede individuals' progress through the change process. By way of example, social phobias and low mood (even at mild sub-clinical levels) may impact on an individual's capacity to seek the social support that may be afforded by joining a gym, club, or a walking group. More research beyond the scope of this current study is required to define these causal relationships more robustly.

#### *5.2.3.1 Conclusion*

While it could be argued that these results are somewhat 'as expected', it is perhaps noteworthy, however, that the levels of anxiety and depression reported in the sample were relatively low, and yet there were nonetheless strong relationships with a number of the other variables studied. It is likely that the levels of anxiety and depression reported in this study population may not have been as high, or fully representative, of the wider diabetes population (due to certain selection biases associated with volunteerism as discussed below 5.2.10). It is suggested therefore that the assessment of and the appropriate *management* of patient's anxiety and depression levels is a potential area of importance with respect to preparing people with diabetes for change.

### *5.2.4 Goal-directedness*

Both a measure of global (or dispositional) goal-directness, the Short Self-Regulation Questionnaire - Goal Setting subscale (SSRQ-GS) (Neal & Carey, 2005), and an additional researcher designed question (that related specifically to exercise behaviour), were included in the study questionnaire. The results of both are discussed here concurrently to convey the overall relationships found between goal-directness and a selection of the study variables.

The SSRQ-GS was used to assess the degree to which subjects were *goal-directed* towards positive outcomes in times of adversity. In addition to the inverse relationships with anxiety and depression already discussed, *goal-directness* (global) was strongly positively related to optimism ($r$=0.82; p=<0.0001), and moderately positively related to advancing (positive) stage progression ($r$=0.47; p=0.01).

Further, it was hypothesised that individuals' levels of goal-directness (among other personal individualized differences, including *exercise goal-directness*) would be statistically related to their participation in moderate intensity physical exercise and their general physical activity levels. Subsequently, despite the relationships with optimism, stage progression, anxiety, depression, and income already stated, no statistically significant relationship was demonstrated between goal-directness (global) and physical activity per se (although higher exercise goal-directness *was* positively related to a higher number of minutes of physical exercise per day at follow-up $r$=0.49; p=0.005). A large body of work in the field of health behaviours and health behaviour change *has* however demonstrated that goals *are* instrumental and of great importance to the process of actively seeking better health. Further, during the

management of chronic illness, greater goal-directedness has been shown to be associated with higher levels of health promoting and health protective behaviours (Bandura, 1998; Heath, Larrick, & Wu, 1999; Hollenbeck, Williams, & Klein, 1989; Locke & Latham, 2002), therefore, to address the inconclusive findings of this current study, a number of possible explanations are discussed below.

Firstly, it is uncertain whether the group-mean goal-directed (global) score at baseline was sufficiently high to influence exercise behaviour, that is, whether a linear dose-response relationship exists, of whether some (perhaps relatively high) goal-directedness threshold applies to physical activity. The group-mean goal-directed score at baseline appears somewhat high at 39.10 out of 50, with most respondents falling between the scores 35-45. However, the practical significance of this positively skewed frequency distribution is uncertain, and the distribution of goal-directness within the New Zealand general and/or diabetic population is not known.

Secondly, the sub-optimal *quality* of participant's practical goal setting, independent of their *propensity* to set goals, is another possible explanation for the lack of interdependence between goal-directness and exercise behaviours. When reporting their physical activity goals, less than half (46%) of the respondents articulated goal statements that were (subsequently) assessed as containing both personally *challenging* and *specific* goal elements. It is widely accepted that the two most important aspects of effective goal-setting and goal achievement are (1) the relationship between goal difficulty and performance and (2), the influence of goal specificity on performance (Lewin, Dembo, Festinger, & Sears, 1944; Locke, Shaw, Saari, & Latham,

1981). Thus, it is proposed here that for most (54%) of the subjects who did articulate physical activity goals, the *quality* of their self-set goals may well have been inadequate to positively influence their actual engagement in physical activity and/or exercise.

A lack of goal specificity was the most common observable 'failing' of the subjects' goals. For example "Do a bit more exercise, do more walking with friends" is an example of a subject's goal that lacks specificity (and challenge). One of the most frequently and universally applied goals is the 'do your best goal', however, when asked to 'do ones best', in fact most people do not do so (Locke, Shaw, Saari, & Latham, 1981). Conversely, the example "To make sure that I exercise <u>every day</u>: *brisk walking 1x40min/day* and to <u>maintain this over time</u>" is an example of one respondent's 'high quality' goal, which can be seen to include both specific (italicised) and challenging (underlined) goal elements. One could argue that it may have been difficult for respondents to articulate their goals fully and accurately 'on the spot', however, anecdotally, the obviously more highly skilled 'goal setters' within the study group tended to demonstrated ease and clarity in describing their goals, including the specific and challenging elements.

With consideration given to established goal theory, and with reference to the subject's goals as articulated, recorded, and subsequently analysed, it is suggested here that subject's poor goal setting skills may have attenuated the magnitude of the expected relationship between goal-directness and subject's actual engagement in moderate intensity physical exercise per day at follow-up. Further, participants' subjective assessment of what is 'enough physical activity', in all likelihood, contributed to lower task performance than if their goals had been based on objective quantitative measures, and it is suggested here that many respondents did

not appear to fully understand the concepts of exercise intensity and duration quantitatively. Thirdly, with respect to *exercise/physical activity goal-directness*, it is acknowledged that the measure employed in this current study comprises merely one researcher designed question (see 4.4.2), and this was un-validated. However, the primary purpose of including such a question was to invoke subject accountability (with respect to their subsequent responding), and to stimulate and prompt subjects' responses when they were asked to describe their physical activity goals. It is important to note that subjects were not asked to *formulate* physical activity goals (and they were given no time to do so), but simply to *articulate* them. The secondary purpose of the 'exercise goal-directed' question was to investigate whether any significant relationships emerged between exercise goal-directness and the other study variables and whether exercise goal-directness might be a potentially useful construct (as distinct from global or dispositional goal-directness), with respect to predicting exercise behaviour. If so, it is suggested that the development and validation of a more comprehensive instrument might be a valuable addition to those instruments already available in the field.

*Other findings and relationships:* Exercise goal-directedness *was* demonstrated to be positively related to subject's self-rated progress towards the level of physical activity that they perceived to be *'ideal'* $r$=0.57; p=0.001, exercise minutes /day at follow-up $r$=0.49; p=0.005, and subject's self-rating of their progress towards their own physical activity goals (*goal-attainment*) $r$=0.75; p=<0.0001. To augment this discussion on goal-directness, two additional relationships with *goal-attainment* are outlined, specifically, (1) subjects who self-rated their exercise *goal-attainment* at follow-up relatively highly also reported being generally more physically active at follow-up ($r$=-0.55, p=0.002) (as compared to individuals who self-rated

their exercise goal-attainment at follow-up relatively poorly), and (2) subjects who self-rated their exercise *goal-attainment* at follow-up relatively highly also reported engaging in a relatively high number of *exercise minutes* per day at follow-up ($r$=0.69, p=<0.0001) (as compared to individuals who self-rated their exercise *goal-attainment* at follow-up relatively poorly). The exercise goal-attainment scores were calculated from subjects' self-ratings of their progress towards achieving their physical activity goals, as held current at baseline. The results of the current study are congruent with Ryan's (1958) simple premise that 'conscious goals affect action' and the data does suggest quite some specificity with *exercise* behaviours. Thus, it is suggested here that there is a strong argument for further research to formulate and validate an exercise goal-directedness instrument that is specific to a diabetes self-management context, and also to delineate further the mechanisms of causality between exercise-goal setting and exercise goal-attainment, in order to enhance the process of intervention development and tailoring.

Returning to the relationship between global goal-directedness and positive stage progression, it is acknowledged that the importance of this relationship depends on one's acceptance of the stage of change construct per se, its validity, and whether it is practicably useful in a chronic disease management-physical activity context. West (West, 2005) suggests that it is not, while others (Di Clemente, 2005; Hodgins, 2005) still attest its usefulness as a guiding framework, but acknowledge the stage of change construct's limitations as both a predictive tool and/or a *universally* valid outcome measure (see also further discussion on the exercise stage of change construct, section 4.4.7).

The strong relationship between global goal-directness and optimism ($r$=0.82; p=<0.0001) was expected, as by definition, optimists generally utilize more effective 'active coping' styles than pessimists, and active coping incorporates both problem solving and goal setting strategies and skills (Seligman, 1991, , 2002). However, goals are more complex than simple intentions and goals without commitment, task knowledge, and social support may not necessarily translate into physical activity: such is the complexity of physical activity behaviours and the strong influence of evolutionary, developmental, environmental, and cultural cues (Gluckman & Hanson, 2006; Lalonde, 1974; West, 2005).

#### *5.2.4.1 Summary and implications*

It has been demonstrated repeatedly that goals determine the direction, intensity and duration of action, but that without *commitment*, a goal is at best notional, and without at least some degree of *interest* in a goal outcome, there can be no commitment (Locke, 2001). Further, it has also been demonstrated beyond doubt that the setting of higher goals leads to higher performance (Locke & Latham, 2002). With consideration given to these fundamental principles of goal theory, and also to the quantitative and the qualitative results of the current study, it is suggested here that the study participants did not perform their goal-setting tasks as well as they might have, despite being relatively goal-directed at baseline.

Thus, drawing on and expanding Locke's generic summary guide to pursuing long-range values (Locke, 2001, p. 304), the following list summaries a number of important facets of goal theory that could be effectively integrated into future diabetes education interventions and which could, it is proposed, meaningfully increase individuals' success at achieving improved health outcomes.

(1) *Facilitating individual patients to develop a clear idea of what they want to achieve.* For example, individuals' 'wants' may include the distal goals of weight loss, improved functional capacity, greater enjoyment in later life, increased social interaction, as well as more proximal goals such as improved glycaemic control, and also physical activity goals that include the elements of modality, duration, intensity, and duration.

(2) *Facilitating individual patients to develop a clear understanding of the reasons for wanting to achieve (their goals)*. Using physical activity as an example, one study participant described his reasons for pursuing his goals as "exercising to keep fit and live longer, and healthy, with a positive attitude. Stimulating the brain!"

(3) *Educating individual patients in the 'mechanics' of goal-setting, and facilitating individual patients to develop the actual goals to be set*. For example, physical activity goals that will help them to achieve what they set out to achieve.

(4) *Assisting individual patients to identify and develop the means to achieve their goals.* That is, identifying the actions, strategies, supports, and enablers that are required to achieve one's (physical activity) goals.

(5) *Assisting patients to form stronger commitments to their goals.* Including, education in the importance of self-efficacy, role modelling, satisfaction, competition, proximal goal-setting, feedback, specificity, goal orientation, publicness, and volition.

(6) *Educating individual patients in how to prioritise conflicting demands*. For example, the conflicting demands of time spent working versus the time available to exercise.

(7) *Educating patients in how to overcome barriers and setbacks*. For example, developing an active coping style including goal-setting and problem solving skills, and self-evaluation.

(8) *Assisting patients to enhance their motivation.* Generally, helping patients to learn how to become more intrinsically motivated toward attaining those things in life that are personally valued; however idiosyncratic they may be. Expressed using Piaget's (1981) terminology, to help people identify the importance of the *point of juncture* between their *system of valuations* and their system *of energetic regulation.*

#### *5.2.4.2 Conclusion*

Appropriate education and assistance could enable patients with type 2 diabetes to gainfully engage in goal-setting and to achieve and maintain better health, however, to do so, individuals must exercise volition and direct their efforts with intensity and persistence to counter the many pervasive messages and environmental cues that may lead a person away from healthy behaviours and thus optimal health.

### *5.2.5 Optimism*

Participants' optimism was measured both at baseline and at follow-up by the administration of the Life Orientation Test-Revised (Lot-R) (Scheier, Carver, & Bridges, 1994). In addition to the strong inverse relationships with anxiety ($r$=-0.67; p=<0.0001) and depression ($r$=-0.56; p=0.001), and the positive relationships with *goal-directness* (global) ($r$=0.82; p=<0.0001) and *exercise self-efficacy* ($r$=0.40; p=0.03) already discussed, optimism was also positively related to greater (positive) *stage progression* ($r$=0.47; p=0.01) and to *goal-attainment* (subject's self-rating of their progress towards their own 'self-set' physical activity goals) ($r$=0.39; p=0.03). The optimism construct is discussed below in the context of how it relates to physical activity and health, stage progression and goal-attainment and additionally, the optimism-self-efficacy relationship is further expanded.

As was the case with goal-directness, it was also hypothesised that individuals' levels of optimism would be statistically correlated to their level of participation in moderate intensity physical exercise, and their levels of general physical activity also. However, no statistically significant relationship was demonstrated between optimism and physical activity per se, although relationships with exercise *stage progression, exercise self-efficacy,* and *goal-attainment* were demonstrated. The limitations to the measurement of habitual physical activity (already discussed) may have attenuated any direct relationships with physical activity. It is suggested in the literature (Carver, Lehman, & Antoni, 2003; Seligman, 1975; Seligman, 1991, , 2002; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000) that optimism may act somewhat *indirectly* on the antecedents to optimal health, via multiple pathways and this appears to be paralleled in this study. Further, even newly diagnosed patients with the highest

levels of optimism may still take quite some time to develop the strategies and skills to manage their chronic condition effectively, and subsequently demonstrate tangible health outcomes.

The optimism-pessimism construct was originally formulated to explain people's *propensity* toward, or alternatively 'immunisation' from becoming helpless in the face of adverse circumstances. Abramson, Seligman and Teasdale (1978) proposed that it is how people *explain* their failures that determines their propensity to learn helplessness, and that this propensity toward, or conversely, immunisation from helplessness is represented by their degree of optimism or pessimism. Although there is still a paucity of empirical evidence as to the exact *pathways* by which optimism positively influences physical health outcomes, the evidence is gathering to support the idea that in fact it does (Carver, Lehman, & Antoni, 2003; Reed, Kemeny, Taylor, Wang, & Visscher, 1994). Briefly, the three most supported pathways are (1) individuals with optimistic expectations being more likely to engage in health promoting behaviours including increasing physical activity, reducing alcohol consumption and the appropriate use of available health care resources, (2) individuals with optimistic expectations being more likely to enlist greater social support and (3) optimism leading directly to physiological states that are conducive to maintaining health ('the direct effect', or the inverse of the stress versus impaired neuro-immunological function relationship) (see also section 2.8.2 for a more detailed discussion on these and other pathways) (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000).

While it was certainly not possible to identify these pathways distinctively within the context of the current study (or in fact if optimism specifically exerted any influence through them),

the relationships that were demonstrated are congruent with at least the first pathway listed above. Participants who demonstrated more optimistic expectations did demonstrate greater positive stage progression between baseline and follow-up, as compared to those participants who were less optimistic. Thus, optimism may well influence patients' exercise behaviour indirectly. The Transtheoretical Model would predict that those individuals who were closer to maintenance at any point in time were more likely to have changed their behaviour when followed up (Di Clemente, 2003, , 2005; Reed et al., 2005). In considering the relationship between optimism and positive stage progression, it is acknowledged that the importance of this relationship depends on one's acceptance of the stage of change construct per se, its validity, and whether it is practicably useful in a chronic disease management-physical activity context. As already suggested within the previous discussion on goal-directness, there is considerable debate regarding the Transtheoretical Model's compatibility with the complexities of physical activity behaviours. However, the aspect of the model that does receive most empirical support is that already stated, i.e. that individuals who are closer to maintenance at any point in time are more likely to have changed their behaviour when followed up (Reed et al., 2005), and this was apparent in the current study, as demonstrated by the strong positive relationship between subjects' stage of change at follow-up, and their engagement in exercise behaviour ($r$=0.62; p=0.0003). Thus, despite the wider limitations of the Transtheoretical Model, the results of the current study do suggest that the exercise stage of change measure could be usefully included in a patient screening tool to provide an indication of patients' initial position on the change continuum and with reference to other measures such as optimism, this could contribute usefully to a comprehensive needs assessment process.

The positive moderate relationship between optimism and exercise self-efficacy ($r$=0.40; p=0.03) was as expected. Seligman (1991) notes the apparent overlap between optimism and *self-efficacy*, but also points out the important difference between the two constructs, that is, self-efficacy is a construct in which the *self* as a causal agent is important, while optimism is a construct which is essentially defined by the nature of people's *generalised expectancies* for the future and/or their 'explanatory style'. It is certainly not possible to determine the direction of causality from the current study findings, as an increase in one's exercise self-efficacy could lead one to become more optimistic, or being more optimistic (and having a more active coping style) may lead to increased exercise self-efficacy. However, it is likely that intervention components that focus on building either optimism or exercise self-efficacy may in fact increase both.

There was also a positive association between optimism and self-rated goal-attainment ($r$=0.39; p=0.03). It is not clear if optimism was causal, or in fact whether highly optimistic participants actually achieved more, however, they did *perceive* their progress toward their self-set physical activity goals as being greater than those participants who were less optimistic (again this may show optimism working through more indirect pathways). It could be argued that this perceived goal achievement embodies a degree of *task mastery,* and both the positive influence mastery experiences have on building self-efficacy and the cumulatively causal nature of this relationship are supported by strong empirical findings (Bandura, 1998; Bandura & Locke, 2003). It is suggested therefore, that although the relationship as demonstrated in this current study is relatively weak, it is by no means unimportant.

Also, it is uncertain whether the group-mean optimism score at baseline (21.96 out of 30, SD 5.35, range 10-30) was sufficiently high to influence exercise behaviour directly, that is, whether a linear dose-response relationship exists, or whether some (perhaps relatively high) optimism threshold applies to physical exercise. In general, the literature reports no such threshold, however, most studies measure outcomes in terms of more generalised long term health status, or some psychological or biochemical facet thereof, rather than in terms of behavioural outcomes as specific and complex as physical exercise. Further, the significance of the positively skewed frequency distribution is uncertain. Scheier, Carver, and Bridges (1994) note that optimism is in fact positively skewed in most populations, at least to some degree, and the distribution of optimism within the wider New Zealand population is not known. It is plausible that those Diabetes Centre attendees who volunteered to participate in the current study may have been more optimistic than those attendees who chose not to participate. Resultantly, the effects of optimism may not have been wholly representative of the wider diabetic population.

#### *5.2.5.1 Summary/Conclusion*

Taken collectively, the current study data and findings as reported in the literature suggest that optimism may impact on physical health outcomes somewhat indirectly via those factors that influence an individual's coping capacity, and their capacity to problem-solve, plan, and set goals, rather than on their actual (task) performance in executing these goals (which tends to be influenced more directly by self-efficacy and goal commitment, see discussion 2.9.7). Conversely, the negative influence of pessimism on these antecedents may in turn impede individuals' progress through the change process.

The ability to remain, or even to learn to be more optimistic, even unrealistically optimistic, in the face of disease progression appears to be physiologically protective (Carver, Lehman, & Antoni, 2003; Reed, Kemeny, Taylor, Wang, & Visscher, 1994). While currently the mechanisms of action are not fully understood, there is a growing body of converging evidence that supports the inclusion of intervention strategies aimed at fostering patients' optimism, within a self-management educational context. The techniques of learned optimism (see section 2.8.2) and indeed the fundamentals of *positive psychology* (addressing 'wellbeing', and *adaptive* rather than *maladaptive* processes) could potentially be integrated into type 2 diabetes educational interventions in New Zealand. Given the progressive nature of type 2 diabetes, it is suggested here that this is an area of importance, not only with respect to preparing patients for initial change, but also with respect to empowering patients to effectively self-manage over time.

### *5.2.6 Stage of change*

Several facets of the Transtheoretical Model (TTM) (Prochaska & DiClemente, 1982) and the exercise stages of change construct have already been discussed previously (4.4.7) in relation to exercise self-efficacy, depression, goal-directness and optimism. Presented here is a brief discussion on the merits of the TTM's use in the current study and also a summation of its limitations as they applied specifically in this context.

The TTM endeavours to describe how people modify 'problem' behaviours or acquire a new positive behaviour. The central organizing construct of the TTM is the *stages of change*, and proponents of the model proclaim the importance of the stage schema, because it represents a temporal dimension. The context of the current study departs considerably from the context in which the TTM was developed, namely smoking cessation and as already discussed, the application of the TTM in a physical activity context has drawn much debate. Perhaps the most relevant limitation (to the use of the exercise stage of change instrument in this current study) is that the *duration-frequency-intensity* parameters (exercise load) as defined by the instrument do not necessarily match current diabetes management recommendations, or individualised patient need. The exercise stage of change instrument (Marcus, Selby, Niaura, & Rossi, 1992) as used in the current study differentiates the response categories with a stage 'period' of six months and an exercise 'load' of a minimum 20 minutes of moderate intensity physical exercise, at least 3 times per week. There are a plethora of exercise *duration-frequency-intensity* parameters that are recommended for various populations (see section 2.6 for further discussion). In New Zealand, the most widely acknowledged exercise prescription is that of

30min of moderate intensity activity on most days, or to quote Sport and Recreation New Zealand's catch phrase "Push Play, 30 minutes a day" (New Zealand Ministry of Health, 2002a). This exercise prescription was derived from the 1996 Surgeon General's report, which has been widely disseminated and adopted (in principal if not in practice) throughout the Western world. The fact that the exercise stages of change instrument differentiates the response categories with a much lower exercise load than that currently recommended for the general population does not in its self make it incorrect, rather it highlights the issue of representativeness when using scales with arbitrary thresholds or categories. Obviously, the higher one sets the threshold for caseness, the fewer respondents will fall into the upper categories. The threshold chosen therefore is a compromise between sensitivity and representativeness, and this ultimately determines the usefulness of the instrument in any particular application. Further, West (2005) draws attention to the fact that stage progression may occur without any accompanying increase in physical activity, simply by maintaining a fixed activity level over time (Note that in the current study, stage of change at follow-up *was* associated with increased exercise minutes, $r$=0.62; p=0.0003). The level at which the exercise load threshold is set must be meaningful for such 'progression' to really represent a positive behavioural outcome. Figure 15 illustrates that the stage of change data was subject to a noticeable *ceiling effect.* Specifically, nine participants were already in the maintenance phase at baseline, therefore these participants could not demonstrate further positive stage progression, and this may have attenuated some of the statistical relationships. Thus, the particular threshold selected to differentiate the stages also effectively raises or lowers this 'ceiling'.

#### *5.2.6.1 Summary/ implications*

It is concluded here that the relatively low threshold employed in the exercise stages of change instrument did still provide useful study data and the correlations did demonstrate meaningful relationships in the context of the current observational study. However, it is suggested that if the instrument was to be utilised in a diabetes educational context, then the exercise threshold should be adjusted upward to be more representative of what is considered appropriate physical exercise for optimal diabetes self-management. Despite the TTM's apparent shortcomings and the models limitations in fully explaining exercise behaviour, the TTM is still considered here as a potentially useful tool to aid in the tailoring of exercise and educational interventions in a type 2 diabetes context. What differentiates the TTM from other behaviour change models is that it is a *stage* model, with a *temporal* dimension and if nothing else, its use may serve to remind health professionals of the fact that some people have little interest in changing their health behaviours, while others are more *ready* and more amenable to change (Di Clemente, 2005). The TTM may also be adopted as a learning tool or framework to help educators describe to patients how change *can* occur over time, and it has also been suggested that benefit may be derived from 'patient self-identification' with the various stages (Di Clemente, 2005). Further, it highlights that some (more advanced) patients may well require a different set of strategies for the continued self-management of their diabetes, as compared to those patients who are just embarking on the change process.

### *5.2.7 Alcohol*

The Alcohol Use Disorders Identification Test-C (AUDIT-C) (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998) was incorporated in the current study questionnaire to investigate whether hazardous drinkers or individuals with active alcohol-use disorders were more likely to have poorer diabetes outcomes than non-drinkers or non-hazardous drinkers. The AUDIT-C was not, however, included to investigate any dose-response relationship that may exist between alcohol consumption and any specific biochemical indices. While it is suggested that excessive alcohol consumption *is* often related to maladaptive behavioural outcomes (via the mechanism of impaired self-regulation) (Brown, 1998; Brown, Miller, & Lawendowski, 1999; Miller & Brown, 1991), in this study, there were no such significant relationships demonstrated between alcohol consumption and the other study variables. Alcohol consumption did not appear to be related to, or influence, any motivational factors in the adoption of exercise and/or general physical activity. Generally, however, hazardous alcohol consumption was not characteristic of the study participants and alcohol consumption did in fact decrease slightly between baseline and follow-up.

### *5.2.8 Body Mass and Body Mass Index*

#### *5.2.8.1 Brief results*

The group-mean body mass was 88.89 Kg at baseline and 85.64 Kg at follow-up. Between baseline and follow-up, the group-mean BMI reduced by 0.7 Kg/m² from 31.43 Kg/m² to 30.73 Kg/m². Only four subjects recorded BMIs within the normal range, thus 26 subjects were overweight, obese, or morbidly obese. Figure 9 displays the individual subject's baseline

and follow-up BMIs.

#### *5.2.8.2 Implications*

BMI is a useful screening measure for type 2 diabetes and BMI is more accurate at approximating body fat than is measuring body weight alone. However, BMI has some limitations. BMI overestimates body fat in people who are very muscular (not common in a diabetic or pre-diabetic population) and underestimates body fat in people who have lost muscle mass, and the relationship between BMI and body fat varies somewhat with age, gender, and ethnicity (NIH, 2000). However, for adults, BMI *is* a good predictor of a *population's* disease risk therefore, when considering issues at a population level, BMI is a considerably more useful outcome measure than body weight alone (NIH, 2000). Many short term (six weeks to six months) studies do not necessarily show significant weight loss as an outcome measure (Fogelholm & Kukkonen-Harjula, 2000), and while none was necessarily expected in this study, the group-mean body mass did reduce by 3.25Kg, and the group-mean BMI by 0.7 Kg/m². The W.H.O's. Obesity Taskforce (1998) suggests however that the minimum magnitude of weight reduction associated with (physical) health enhancing effects is in the order of 5%, thus by the W.H.O's criteria, this 3.25Kg reduction is not overly significant. Changes in body composition may occur independently of body mass, as lean tissue mass may increase in response to physical activity, in particular resistance-training. Therefore, in some instances, a patient's weight may actually stay the same, or even increase, while his or her percentage of body fat is decreasing (i.e. a change in body composition but not necessarily body weight) (McArdle, Katch, & Katch, 2001). It is suggested here that it would be helpful for patients to be educated in this phenomenon, as additional weight gain despite

commencing an exercise regime could have negative consequences on patient motivation. Changes in body composition (associated with weight reduction) proportionately consist of approximately 75% fat and 25% fat-free mass, and a 1kg change in body weight is equal to approximately 7000kcal (Fogelholm & Kukkonen-Harjula, 2000). Thus, a negative energy balance of 670-1000kal/week is required to achieve a 5-8kg weight loss over the period on one year (McArdle, Katch, & Katch, 2001). Thus, significant weight loss should occur in the presence of an appropriate negative energy balance, given a sufficiently long time period, and despite any underlying increases in muscle mass that may also occur. Again, it would be helpful for patients to be educated in these facets of weight management, particularly the significantly long time periods that are realistically required to effect meaningful changes in body mass and body composition outcomes.

#### *5.2.8.3 Conclusion and recommendations*

Reductions in body mass and BMIs are intervention outcomes that can reasonably be expected to transpire, given appropriate lifestyle changes (that favourable alter energy balance), and appropriately long time frames. The screening and monitoring of BMI by health professionals (both at the public health and individual levels) is important from a policy/medical management perspective, and additionally from a patient motivational perspective. While BMI is a useful screening tool for individuals, and as a general guideline to monitor trends in population health, it should be remembered that by itself, it is not diagnostic of an individual patient's health status. However, it *is* recommended here that individuals should be educated in the *body weight/body composition* versus *health* relationship, and they should be encouraged to actively utilise this feedback to facilitate the ongoing self-tailoring of their management

strategies. Patients need to understand how increased physical activity and more optimal nutritional choices influence the magnitude of the *body weight/body composition* versus *health* relationship over the longer time frames (i.e. years rather than months).

### *5.2.9 HbA1c and sub-group analysis*

All the participants in the study were referred to MedLab South for a glycated (or glycosylated) haemoglobin test (HbA1c), at both baseline and at six month follow-up. Figure 7 displays the individual subject's HbA1c levels at baseline, and Figure8 displays the individual subject's change in HbA1c levels between baseline and follow-up. In biochemical terms, the goal of diabetes management is to achieve an HbA1c as close to physiologically normal as possible, preferably less than 7.0% (normal population 4-6%) (NZGG & Ministry of Health, 2003).

In fact, the group-mean HbA1c at baseline was only 6.75 percent (range 5.7-9.8 %) and the group-mean HbA1c at follow-up was only 6.19 percent (range 5.4 - 7.1 %). Thus, between baseline and follow-up, the group-mean HbA1c reduced by a clinically significant 0.56 percent (U.K. Prospective Diabetes Study Group, 1998). It is of note that only six of the participants had baseline HbA1c levels exceeding 7 percent and overall, it is suggested that these low initial HbA1c results indicate that most patients had been diagnosed rather early relative to their disease progression, and those patients who did return higher HbA1c results at baseline had, in the main, made significant progress when re-assessed at follow-up. Thus, the HbA1c data were confined by a distinct 'floor effect', and the usefulness of this particular measure (beyond that of descriptiveness) was attenuated by a notable lack of

variability as the majority of scores were near the minimum possible value expected in this population. Therefore further correlational analysis was not possible in this study as the HbA1c data failed to distinguish between the participants scoring at or near the bottom, or floor, of the test range.

However, a brief *descriptive* sub-group analysis was carried out with respect to subjects' HbA1c test results at baseline (full results are displayed in Table 6). A threshold HbA1c level of 7% was selected to categorize subjects into either a 'Low' HbA1c group (HbA1c ≤ 7%, n=24) or a 'High' HbA1c group (HbA1c > 7%, n=6). Descriptive statistics were calculated for selected baseline and follow-up variables. Only the *exercise self-efficacy* and *change in exercise minutes/day* data are reproduced here in Table 14 and the data are 'suggestive' of a departure from independence.

**Table 14** •Descriptive statistics representative of the sub-group analysis of the 'Low' HbA1c group (HbA1c ≤ 7%, n=24) and the 'High' HbA1c group (HbA1c > 7%, n=6).

| Variable | High HbA1c n=6 | Low HbA1c n=24 | ALL |
|---|---|---|---|
| Ex Self-efficacy at baseline | **22.7** | **20.4** | **20.9** |
| Ex Self-efficacy at follow-up | **22.1** | **19.6** | **20.1** |
| Change in exercise min/day | **+6.6** | **+1.1** | 2.2 |

These differences between the *'High' HbA1c* group and the *'Low HbA1c'* may, in theory, be explainable by the Health Belief Model (HBM) (Janz & Becker, 1984). The HBM suggests that the likelihood of a person changing their health behaviour is related to the interaction of four factors, namely, the person's perceptions of the *seriousness* of their condition, their perceptions of their *susceptibility* to potentially serious consequences, their beliefs regarding the *benefits* of taking action, and their perception of the magnitude of any *barriers* to taking

that action. One of the challenges that health professionals face when attempting to motivate type 2 diabetes patients is that the disease is often asymptomatic for many years, and resultantly, patients often display a distinct lack of urgency regarding its treatment. To hypothesise, the high HbA1c results that these six subjects received at baseline may have provided them with sufficient feedback on the *seriousness* of their condition and their *susceptibility* to complications and thus the nature of the *threat*. Table 14 shows that the '*High' HbA1c* group increased their mean minutes of physical exercise per day by +6.6 minutes compared to the *'Low HbA1c'* group's +1.1 minutes per day, thus representing a greater degree of behaviour change. In summary, these data are certainly consistent with the fundamental premise of the HBM, however, the sample sizes and resultant lack of statistical power preclude any robust finding. It is suggested, however, that more research should investigate possible methods to increase patients' perceptions as to the seriousness of type 2 diabetes, and such findings could provide invaluable guidance to policy analysts, health professionals, and diabetes educators.

### *5.2.10 Study limitations*

*Follow-up period:* A salient limitation of this study is the relatively constrained time interval between baseline and follow-up. Due to the time constraints of the one year full time academic programme, it was decided that six months was the maximum follow-up interval practicable. It is acknowledged here that this relatively short time interval (given the nature of the study) may not wholly reflect the concepts of 'long term' or 'over time', which is, the day-to-day management of a chronic disease for the person's remaining life-span. However, the sample

cohort could be re-surveyed at appropriate intervals in the future (for example at 12,18,24,36 months) to examine further the correlations investigated here. While six months would once have been considered quite adequate, it is now a more commonly held view that 12 months or more is required to demonstrate 'long term' effects. Short follow-up periods may not adequately capture the behavioural 'regression' that is often associated with exercise and weight-loss interventions and this remains a major challenge for programme evaluation (Fogelholm & Kukkonen-Harjula, 2000) .

*Dietary changes and medication effects:* Dietary changes, total calorific intake, and medication effects were not controlled for, therefore changes in BMI and HbA1c are only indicative of an individual's change in behaviours in general, however, the individual levels of physical activity are reported and form a useful part of the energy balance body mass equation. The measurement of dietary changes and controlling for the effects of various medications was considered to be beyond the scope and resources of this study, and outside the specific focus on physical activity.

*Recruitment limitations:* Several factors negatively influenced the rate at which the recruitment phase of the study progressed and consequently the eventual sample size. Firstly, the initial recruitment round was not commenced until May 16th 2006 due to delays in the ethics approval process. The application was lodged on 21st March 2006. The researcher received a letter on April 22nd 2006 advising that approval for the study had been given subject to four minor methodological items that the researcher was required to resolve. The researcher made the amendments to the study design/application as suggested and re-submitted the application

within two days (April 24th 2006). Sign off was not received until May 16th 2006, and recruitment commenced later that day. Secondly, up-take from within the education seminars was variable and on average lower than anticipated, ranging from approximately 30% to 75%. Thirdly, due to staffing and temporary systems changes, the number of patients scheduled to attend the Diabetes Centre education seminars and the frequency of the seminars was lower than projected. The June seminar was attended by only 7 patients, and the July and August seminars were cancelled. Collectively, these limitations resulted in only 33 of the intended 40 subjects being recruited before it was necessary to cut-off recruitment to allow for sufficient time to complete the research project (bearing in mind the six-month follow-up interval).

*Selection bias via volunteerism:* Generally, volunteering is described as helping others without receiving any tangible rewards and volunteerism is usually associated with *altruism* or the selfless concern for the welfare of others. However, it is argued that while people can exhibit altruistic *behavior*, they cannot have purely altruistic *motivations* and volunteers are at least to some extent motivated toward furthering their own interests (Batson, 1991). Therein lays the possibility for a selection bias. Specifically, the subject group may not be fully representative of the wider type 2 diabetic population with respect to their inherent or 'background' levels of self-motivation. Thus, the patients who did volunteer may be more motivated in general than those eligible Diabetes Centre education seminar attendees who *did not* volunteer to participate in the current study, and therefore they may be more motivated in general as compared to the wider type 2 diabetic population.

*The Hawthorne effect:*The 'Hawthorn effect' (Mayo, 1933) is an experimental effect in the

direction expected, that turns out, however, to have no causal relationship within the theoretical basis of the intervention, but is instead (apparently) due to the effect on the participants of simply knowing that they are being studied (Mayo, 1933; Roethlisberger & Dickson, 1939). Improvements or changes in subject behaviour in the current study may have resulted from the mere fact that subjects knew they were being studied. Subjects may have adopted 'pleasing the experimenter' as a goal, and this may have resulted in changes in their motivation.

### *5.3 Summary of key findings*

The key study findings are reported below. The findings are listed in essentially the same order in which they were discussed within this chapter and for brevity and clarity, each is summarised and generalised to provide only a brief synopsis, however, in each case, more detail and the relative study findings and the supporting literature may be referred to within this chapter, as required.

- The level of physical activity reported in the current study was significantly less than that which is required to facilitate the biochemical and psychological changes generally considered necessary to support optimal health.

- Many participants clearly indicated an inadequate understanding of exercise intensity and it appeared that participants generally *overestimated* their physical activity levels (intentionally or otherwise) and the amount of time they actually spent exercising or being generally physically active.

- There was essentially no change in mean activity levels between baseline and follow-up. The group-mean *energy expenditure* per day remained essentially unchanged over the report period (+0.04 Kcal/kg/day), and the group-mean minutes of moderate physical *exercise* per day increased by only 2.44 minutes between baseline and follow-up.

- Exercise self-efficacy emerged as an especially important psychological construct and one that appears to be among those central to the participants' relationships with physical activity and exercise.

- There were moderate to strong relationships between physical activity levels and goal-directness, exercise self-efficacy, stage progression; and BMI.

- Some participants reported a high participation in *exercise* activities yet they reported being relatively non-energetic in their occupations and/or around the home and for others, the inverse was true. Anecdotally, participants were more cognisant of their *exercise* behaviours (and thus changes therein) than they were of their general activity levels.

- The study group demonstrated a relatively high prevalence of low level anxiety and depression, and even at these low levels, anxiety and depression was significantly inversely related to a number of the other variables measured in the study, including optimism, goal-directness, goal-attainment, stage of change, and exercise self-efficacy.

- For most of the respondents (54%), the *quality* of their self-set goals (as analysed by the researcher) appeared to be inadequate to positively influence their actual engagement in physical activity and/or exercise. Generally, the study participants did not perform their self-set physical activity tasks as well as they might have, despite being relatively goal-directed at baseline.

- Optimism appeared to impact on physical health outcomes somewhat indirectly, perhaps via those factors that influence an individual's coping capacity, and their capacity to problem-solve, plan, and set goals, rather than on their actual (task) performance in performing physical exercise.

- The ability to remain, or even to learn to be more optimistic, even unrealistically optimistic, in the face of disease progression appears to be physiologically protective. While currently the mechanisms of action are not fully understood, there is a growing body of converging evidence that supports the inclusion of intervention strategies aimed at fostering patients' optimism, within a self-management educational context. The techniques of learned optimism (see section 2.8) and indeed the fundamentals of *positive psychology* (addressing 'wellbeing', and *adaptive* rather than *maladaptive* processes) could potentially be integrated into type 2 diabetes educational interventions in New Zealand. Given the progressive nature of type 2 diabetes, it is suggested here that this is an area of importance, not only with respect to preparing patients for initial change, but also with respect to empowering patients to effectively self-manage over time.

- The group-mean BMI at baseline was 31.43 Kg/m² and the range was 18.8-50.95 Kg/m². Only four subjects were in the normal range with one being underweight and the remainder being overweight or obese.

- The group-mean HbA1c at baseline was only 6.75 percent (range 5.7-9.8 %) and the group-mean HbA1c at follow-up was only 6.19 percent (range 5.4 - 7.1 %) and at follow-up the group-mean HbA1c had reduced by a clinically significant 0.56 percent. It is of note that only six of the participants had baseline HbA1c levels exceeding 7 percent, and overall it is suggested that the low initial HbA1c results indicate that most patients had been diagnosed relatively early in the disease trajectory.

### *5.4 Implications and recommendations for clinical practice*

A number of key implications and recommendations for clinical practice are reported below. The recommendations are listed in essentially the same order in which that were discussed within this chapter. For brevity and clarity, each has been summarised and generalised somewhat to provide only a brief synopsis. In each case, these implications and recommendations have been discussed in more detail within this chapter, and the relative study findings and the supporting literature may be referred to from within the discussion and the

literature review chapters as required. The following recommendations are intended to provide clinicians and diabetes educators with a range of mechanisms or methods that may be useful in positively influencing those determinants of an individual's health that are *modifiable* and that a clinician or diabetes educator could reasonably and practicably include in his or her type 2 diabetes treatment schema.

- Perhaps *the* salient task for future interventions is that of changing patients' perceptions of the seriousness of their condition and also the seriousness with which they need to engage in their self-management tasks. Self-management education interventions should assist patients to explore and develop these perceptions so that they more closely parallel the realities of their condition and its management, thus making clear and reinforcing the importance of one's future actions.

- Some individuals reported a high participation in *exercise* activities yet they reported being relatively non-energetic in their occupations and/or around the home, and for others, the inverse was true. Thus, it might be helpful for health professionals and diabetes educators to consider these individual differences. Specifically, individuals may well have differing needs and priorities with respect to physical activity, and they may have specific and individualised limitations as to the areas of their lives in which modifications to activity levels can practicably be made. Addressing these issues overtly in a clinical and/or diabetes educational context may serve to highlight the importance of maintaining and/or increasing *all* forms of energy expenditure.

- It is suggested that there is value in educating patients in the differences between general physical activity and exercise. Specifically, that the two are not necessarily similar in terms of the motivational and goal-setting strategies that may be successfully applied. Exercise is to a large extent more easily 'definable' than general activity, and it can be structured to have a dichotomous outcome (i.e. the exercise session was 'completed' or 'not completed'), thus it is easier for patients to receive feedback on their progress, and to experience other beneficial outcomes such as fun, enjoyment, social interaction, and satisfaction. Framing exercise in this way may make it much easier for people to be become more intrinsically motivated and to get pleasure from being physically active, rather that simply viewing physical activity as an arduous self-management task. Further, promoting an increase in non-specific general physical activity (over exercise) may overemphasise the value of these non-specific exercise tasks (which are difficult to quantify in terms of energy expenditure) and thus attenuate peoples' perception of the seriousness of their disease state and resultantly, this may tend to de-escalate their actions.

- To achieve their physical activity goals, patients must have at least some belief in their ability to do so. The already proven methods by which self-efficacy can be enhanced could be applied successfully within a New Zealand community type 2 diabetes educational context. Briefly, these methods include mastery experiences, vicarious experiences, verbal persuasion, imagery and modifying/managing physiological and/or emotional states (Bandura, 1997).

- In a type 2 diabetes education context, competent role models (including educated lay people) could be engaged to teach other patients practical skills (including goal setting) and strategies that may enhance their engagement with physical activity, and these skills and strategies could be tailored to individual patient's needs. Further, such role modelling could also be extended into the community, at low cost, by the development of walking groups and/or various other types of physical activity groups or clubs.

- Low to moderate levels of anxiety and depression were prevalent within the study group, and anxiety and depression correlated strongly with a number of known determinants of sub-optimal health. It is suggested therefore that the assessment and the appropriate *management* of patients' anxiety and depression is a potential area where significant progress could be made, by enhancing the effectiveness of existing and future interventions (notably non-pharmacologically interventions for low to moderate anxiety and depression), and thus facilitating better health outcomes.

- The ability to remain, or even to learn to be more optimistic, even unrealistically optimistic, in the face of disease progression appears to be physiologically protective. The techniques of learned optimism (see section 2.8) could potentially be integrated into type 2 diabetes educational interventions in New Zealand. Given the progressive nature of type 2 diabetes, it is suggested here that this is an area of significant importance, not only with respect to preparing patients for initial change, but also with respect to empowering patients to effectively self-manage over time.

- Patient self-monitoring of body weight (and/or hip/waist ratio) is an important source of feedback. It is suggested here that individuals' should be educated in the *body weight/body composition* versus *health* relationship, and they should be encouraged to actively utilise this feedback to facilitate the ongoing self-tailoring of their management strategies.

- All the participants reported barriers to engaging in physical activity, and it is suggested here that incorporating discussion and participative problem solving in a clinical and/or educational context will help patients to rationalise these barriers, and assist patients to formulate and 'take home' practical solutions.

- Finally, paralleling the principles of good health promotion in general, interventions need to be flexible enough to accommodate that which an individual perceives as being his or her greatest need, and this may or may not be specifically related to diabetes management per se. Overall, more benefit may come from at least acknowledging (with empathy) any and all identified barriers to an individual's wellbeing, even if action on all such barriers is not currently practicable.

### *5.5 Implications for policy*

Traditionally there has been a tendency to apply a 'one size fits all' approach to interventions at the micro-level, particularly, within what might be termed 'routine medical care' (Fuchs, 1974, , 1998; McKinlay, 1993; Minkler, 1999). For example, the provision of hospital based services tends to assume that all individuals will have equitable opportunity, access, understanding, motivation and perceptions of the services available. Often, traditional routine medical care has failed to accommodate adequately individual differences in readiness to change, willingness to change, cultural appropriateness, barriers to equitable access to health care, and a myriad of other socioeconomic, cognitive and psychological antecedents to health behaviour change (Fuchs, 1998; New Zealand Ministry of Health, 2002b; New Zealand National Advisory Committee on Health and Disability, 1998; New Zealand Public Health Advisory Committee, 2004). Advances in clinical practice, based on recent and emerging research, *are* now beginning to address these issues.

This investigation, and the ensuing discussion, strives to draw together and illuminate a number of facets of type 2 diabetes self-management that demonstrate good potential for development, and which could impact favourably on a health system's capacity to manage this increasingly problematic pandemic. In particular, the findings illuminate the wide contextual variability among patients who are suffering from the same chronic condition and also, the implications of utilising appropriate and sufficiently detailed pre-assessment of individuals' psychological profiles and individualised characteristics, and thus their likely engagement with and adaptation to the challenges of the change process. The challenge for the health system

therefore, is to include flexibility and plasticity into future policy at all levels, such that resources may be customized or tailored to better meet individual need.

The intended outcome of this investigation was to generate recommendations that may facilitate individuals, communities, health professionals, health promoters and policy analysts in the task of optimally matching high risk populations with the available resources and interventions, specifically within a metropolitan New Zealand diabetic population and with a specific emphasis on the integration of *daily physical exercise.* Much work is still needed at a socio-ecological level, well beyond the scope of this study. However, it is suggested that the application of simple fundamentals, for example building personal strengths, may be applied efficaciously at all levels of policy, intervention, and self-management, thus enhancing the quality and cost-effectiveness of care, and assisting people to form stronger commitments to being physically active over a lifetime. It is of course commonly accepted that great importance should be placed on diabetes prevention, and it would appear that 'up-stream' socio-political policy holds the key to curtailing the intergenerational perpetuation of diabetes related ill health (Gluckman & Hanson, 2006; McKinlay, 1993), again, this is essentially beyond the specific scope of this current study, however, it is suggested that the necessity to consider the wide contextual variability among individuals firmly applies.

## *5.6 Recommendations for future research*

- Further research should investigate possible methods to enhance patients' perceptions of the seriousness of type 2 diabetes, and such findings could provide invaluable guidance to policy analysts, health professionals, and diabetes educators.

- It is suggested that further attention be directed toward individualised tailoring of programmes that recognise the unique barriers of New Zealand's' older (ageing) population, such as those described by the study participants, for example a lack of social support and lack of confidence to exercise.

- Research on both individual and group-mediated self-management education interventions should examine how they may benefit from more intensive, collaborative, problem-solving, goal-setting and social-cognitive learning models of behaviour change, including a specific focus on building individuals' exercise self-efficacy and dispositional optimism.

- Studies should incorporate follow-up periods greater than 2 years, as well as increasingly sophisticated and sensitive measures of physical activity.

- Further research should explore the relative benefits of promoting structured *exercise* over an increase in non-specific general physical activity. Research should answer the following question: Does emphasising the importance of non-specific physical activity tasks (as compared to structured exercise) attenuate peoples' perception of the seriousness of their disease state, and does this result in a de-escalation of their actions over time?

- It is suggested here that there is a strong argument for further research to formulate and validate an 'exercise goal-directedness' instrument that is specific to a diabetes self-management context, and also to delineate further the mechanisms of causality between exercise-goal setting and exercise goal-attainment. The findings of such research may prove useful to future intervention development and tailoring.

- The final challenge proposed is research that examines viable ways of linking all of the above findings to the development of interventions aimed at population-based health promotion activity programmes.

### *5.7 Concluding comment*

The study's results highlight that even small population shifts in the psychosocial correlates of physical activity studied have the potential to alter behaviour in a positive direction and this has the potential to enable benefits to the health system, even if the positive shifts in health status of individuals are somewhat variable and somewhat less profound. According to McKinley (1993) the pathway to improved population health is through planned socio-political change. The more up-stream an interventions acts, then the greater the overall influence small cumulative individual differences impart on a population's health. Favourably modifying the epidemiology of a disease is *the* ultimate intervention goal.

Finally, guided by the findings of this study, as well as by the literature reviewed, the researcher offers three concluding comments on the management type 2 diabetes in New Zealand.

(1) At the micro-level, individual patients need to become serious with themselves and recognise the inevitability of the disease's progression, if left un-checked. Patients need to become pro-active and consciously embrace behaviour change as a process, and become serious about what is really required to make a significant difference to their future health status and future quality of life.

(2) At the meso-level, health professionals and health educators themselves need to be increasingly more cognisant of the need to impress on patients the seriousness of type 2 diabetes, as they endeavour to deal with this escalating problem. Practically, this includes, but is by no means limited to, increasing the enthusiasm and energy with which they impress upon patients the need for health behaviour change, facilitating patients' exercise self-efficacy, addressing patients' anxiety and depression even when demonstrated at sub-clinical levels, teaching patients how to increase their levels of optimism, including the techniques of self-

disputation and positive self-talk, teaching practical goal-setting skills and enhancing goal-commitment by including the application of feedback, publicness and competition, teaching effective problem solving skills, providing practical instruction and demonstration on how to be active (whether it be Nordic walking, swimming, Yoga, or whatever), and helping people to seek out and/or form strong social support groups that perpetuate healthy behaviours and optimal health well-being. Finally, health practitioners should be mindful of unintentional institutionalised racism and any other forms of discrimination, and individuals and systems should be focused to provide equitable health-care for all.

(3) At the macro level, 'socio-health' policies need to address the environmental and cultural factors that are currently impacting negatively on New Zealand's physical and psychological health, in our increasingly diverse population, with its differential diabetes prevalence. Previously, type 2 diabetes has been a condition predominately associated with old age, however, this is no longer the case and type 2 diabetes is now increasingly prevalent in children and young people also. The increasing diversity of the population necessitates an increasingly diverse set of policies and actions. In particular, ongoing changes in the ethnic and cultural profile of New Zealand's population, and the changing age structure of the population, dictate that in health care, 'one size does not fit all'. Issues such as the cultural appropriateness of health services, poverty and sub-optimal maternal and post-natal nutrition, smoking, the advertising of high calorie dense foods to children, the epidemic of television watching, and the decline in lifestyle and occupational physical activity are all examples that embody the complexities and inter-relatedness of a range of determinants that impact on the Nations health. Perhaps most saliently, macro level socio-health policies need to address any access barriers to equitable health-care, and macro level socio-health policies need to address those factors that continue to support sub-optimal nutrition *and* those factors that support people's general propensity to seek rest.

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# 7 APPENDICES

## *7.1 Appendix A*: Subject information letter and Consent form


**Subject Information Sheet**

Research project:

**"Physical activity and type 2 diabetes"**


**Introduction**

The presence of disease or disability affects *quality of life*. For many people, the process of ageing often results in some decline in one's ability to carry out the routine activities of daily life. In New Zealand, non-infectious (or "Lifestyle") diseases like coronary heart disease, obesity and diabetes, are becoming much more common. For many, later life may be accompanied by extended periods of disease and disability, and the associated high demands on health resources.

**Research Aims:** This research project aims to investigate physical activity levels and the health status of individuals diagnosed with **Type 2 Diabetes**, both soon after diagnosis and at six month follow-up. The research also aims to measure a number of personality characteristics, and knowledge, which may influence a person's Type 2 Diabetes self-management.

**Research Purpose:** The purpose of this research is to gather information that may assist individuals, communities, and health professionals in the task of providing a better match between health care programmes and services and those who need help. This research is particularly interested in anything that may assist people to form stronger commitments to their self-management behaviours over a lifetime.

**Who is eligible for inclusion in the study?** The study requires approximately 40 participants and you must satisfy the following inclusion/exclusion criteria to participate in the study.

- **Inclusion criteria:** Individuals recently diagnosed with type 2 diabetes after 1st Feb 2006 and attended/attending the diabetes education programme. Age: 40-75yrs. No/minimal physical disability or limitation that would preclude the engagement in regular physical activity. Individuals who are physically able to engage in daily physical activity. Non-insulin dependent.

- **Exclusion criteria:** Age under 40years, age over 75yrs, type one diabetes, diagnosed before 1st Feb 2006. Any individual who has been recommended by a health professional ***not*** to engage in physical activity, or not physically able to engage in physical activity. Insulin dependent.

**Your Role:** Firstly, your participation in the study would be entirely confidential and all your information and contributions to the study would be entirely anonymous and the information secure. Further, should you volunteer to participate in this research project you would be taking part of your own free will, and you could withdraw from it, at any time and for any reason, without your medical care or legal rights being affected in any way.

Your participation in this study would include being interviewed by the researcher and this interview would follow a standard questionnaire format, and the interview would take place at a location suitable to you (for example, your home, the University of Canterbury). You would be encouraged to have a support person/Whanau/family member present if you wished.

The interview would take approximately one hour and would be repeated six months later. During this interview you would be asked to complete some quality of life questionnaires. The questionnaires are made up of multiple choice type questions in which you are asked to tick the box of the appropriate or 'best choice' response option. You would be asked to complete the questionnaire following the simple instructions provided. In some sections of the questionnaire, assistance would be provided and your answers would be recorded for you. You would not have to answer all of the questions and/or you could withdraw from the interview at any time.

Your participation would also include researcher access to your medical records for the purpose of obtaining some basic personal/health information (including, age, sex, height, weight and HbA1c (a measure of long-term glucose control as obtained by a blood test). Your participation in the study would also require that you could provide an HbA1c test result obtained to coincide with the timing of the initial interview/questionnaire and another just prior to the six-month follow-up interview/questionnaire. This would require you to *independently* and *voluntarily* visit your General Practitioner (GP) or other appropriate health care provider during routine care *Or* alternatively, special arrangements may be made that suit your needs, for example home visits by the blood test laboratory nurse. The cost of these blood tests (and, if required, related travel & parking costs) will be met by research project funding.

**Benefits to you:** Participation in the study will not result in any payments or gifts; however any travel, parking or blood test expenses will be reimbursed if required. Participation in the study may benefit you personally in the form of feedback on the information that you provide in the initial and six month follow-up questionnaire, and feedback on the outcomes of the study in general. It is

hoped that some of this information and the study outcomes will assist you (and others) in the management of your Type 2 Diabetes over time.

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**Consultation:** This study has been planned in consultation with the Christchurch Diabetes Centre. The support of the centre is gratefully acknowledged.

**Supervision:** This project is being undertaken under University of Canterbury Health Sciences Centre supervision.

Supervisors:

- Prof. Andrew Hornblow, Director, Health Sciences Centre. (Ph. 364 7628)
- Dr Ray Kirk, Deputy Director, Health Sciences Centre.

**Further information:** For further information about your participation in this study, or any questions that you might have during the course of this study, please don't hesitate to contact me.

- David Brinson [Student: Masters of Health Sciences, University of Canterbury]
  Phone: Home: 366 1598 or 027-281 4997

  e-mail: david.brinson@xtra.co.nz

If you have any queries or concerns regarding your rights as a participant in this study you may wish to contact:

- Health and Disability Advocates

| | | |
|---|---|---|
| Telephone: | Christchurch | 03 377 7501 |
| or South Island except Christchurch | | 0800 377 766 |

Other local service organisations, for your information,

- Diabetes Society Christchurch
  Ground Floor AEQ Building
  61 Cambridge Tec.
  Christchurch
  Telephone: 379 5121

  Diabetes Life Education
  Telephone: 379-9480

- MEDLAB South Ltd.
  137 Kilmore St Christchurch
  Telephone: 363-0824

Project Researcher

David Brinson

David Brinson
MHealSc
University of Canterbury

Health Sciences Centre University of Canterbury

# Consent Form

for participation in the research study:

**"Correlates of physical activity and type 2 diabetes"**

**Name of Researcher:** David Brinson [Student: Masters of Health Sciences, University of Canterbury]

**Request for Interpreter**

| | | | |
|---|---|---|---|
| English | I wish to have an interpreter. | Yes | No |
| Māori | E hiahia ana ahau ki tetahi kaiwhaka Māori /kaiwhaka pakeha korero. | Ae | Kao |
| Cook Island | Ka inangaro au i tetai tangata uri reo. | Ae | Kare |
| Fijian | Au gadreva me dua e vakadewa vosa vei au | Io | Sega |
| Niuean | Fia manako au ke fakaaoga e taha tagata fakahokohoko kupu. | E | Nakai |
| Samoan | Ou te mana'o ia i ai se fa'amatala upu. | Ioe | Leai |
| Tokelaun | Ko au e fofou ki he tino ke fakaliliu te gagana Peletania ki na gagana o na motu o te Pahefika | Ioe | Leai |
| Tongan | Oku ou fiema'u ha fakatonulea. | Io | Ikai |

Please tick to confirm

- ☐ I have read and understand the information sheet for the above research study.
- ☐ I have had the opportunity to ask questions about the research study, and to discuss it with Whanau/ family and friends and have had time to consider whether to take part.
- ☐ I understand the purpose of the research study, and how I will be involved.

- ☐ I understand, and accept, that if I take part in the research study I may not gain any direct, personal benefit from it.

- ☐ I understand, and accept, that my participation in the study may prompt me to reflect on and evaluate my current health status and lifestyle choices.

- ☐ I understand that all information collected in the research study will be held in confidence and that, if it is presented or published, all my personal details will be removed.

- ☐ I give permission for responsible individuals from the University of Canterbury or the Christchurch Diabetes Centre to have access to my blood test results and/or questionnaire notes where it is relevant to my taking part in the research. This is on the understanding that no personal details which might identify me will be presented or published without my permission.

- ☐ I give permission for responsible individuals from the University of Canterbury or the Christchurch Diabetes Centre to forward my personal information, as gathered during this study, to my General Practitioner if appropriate or at my request.

- ☐ I confirm that I will be taking part in this research study of my own free will, and I understand that I may withdraw from it, at any time and for any reason, without my medical care or my legal rights being affected.

- ☐ I understand that I may decide, at a later date, not to undergo one or both blood tests. I understand that this will not cause me to be excluded from the study.

- ☐ I know who to contact should I have any questions whatsoever about the study or my participation in the study.

I _____ (please print full name) consent to take part in the above research study.

Signed [Subject]

_____Date_____

Person taking consent/Researcher

_____Date_____

**Researcher Contact Details:**

Name: David Brinson
Phone: Home: 366 1598 0r 027-281 4997
e-mail: david.brinson@xtra.co.nz

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**Supervision:** This project is being undertaken under University of Canterbury Health Sciences Centre supervision.

Supervisors:

- Prof. Andrew Hornblow, Director, Health Sciences Centre. (Ph. 364 7628)
- Dr Ray Kirk, Deputy Director, Health Sciences Centre.

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Subject Identification Number for this research study**:** ……

## *7.2* Appendix B: Study Questionnaire (sample, follow-up)

David Brinson
MHealSc
University of Canterbury


# Follow-up Questionnaire

Correlates of physical activity and Type 2 Diabetes self-management 2(PA-T2D)

| Subject |
|---|
| |
| Date |
| 0 |

## Introduction

Research Purpose: This research aims to collect and analyse information that will assist individuals, communities, health professionals, health promoters and policy analysts in the task of matching the best diabetes care to the individual person. Specifically, assisting people to form stronger commitments to being physically active over a lifetime, as an effective component of type 2 diabetes prevention and self-management by New Zealand adults. This questionnaire aims to gather information relevant to the individual's predisposition to, adoption of and continued engagement in physical activity post diagnosis of Type 2 Diabetes and at six month follow-up.

## Section A: Personal/Medical details (To be partially completed by the researcher prior to interview)

This section records your personal/demographic information and selected items from your medical records.

| | | |
|---|---|---|
| Name | | |
| Subject study I.D. number | | |
| Weight | | kilograms |
| Smoking | Yes | No |
| Relevant Medication/s | | |
| HbA1c | | |

## Section B: Exercise readiness

From the Exercise Stages of Change – Short form questionnaire (Marcus, Selby, Niaura, & Rossi, 1992; Prochaska & Di Clemente, 1984).

Regular Exercise is any *planned* physical activity (e.g., brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed *3 to 5 times* per week for *20-60 minutes* per session. Exercise does not have to be painful to be effective but should be done at a level that increases your breathing rate and causes you to break a sweat.

Question 1: Do you exercise regularly according to that definition?

- Yes, I have been for MORE than 6 months. ☐
- Yes, I have been for LESS than 6 months. ☐
- No, but I intend to in the next 30 days. ☐
- No, but I intend to in the next 6 months. ☐
- No, and I do NOT intend to in the next 6 months. ☐

## Section C: 7-Day Physical Activity Recall

From the Stanford 7-Day Recall Physical Activity Questionnaire (Sallis et al., 1985).

Now I would like to know about your physical activity during the past 7 days. But first, let me ask you about your **sleep habits**.

1. On the average, how many hours did you sleep each night during the last 5 weekday nights (Sunday-Thursday)? (Record to nearest quarter hour).

| Hours | Minutes |
|---|---|
| | |

2. On the average, how many hours did you sleep each night last Friday and Saturday nights?

| Hours | Minutes |
|---|---|
| | |

**Exercise**

Now I am going to ask you about your physical activity during the past 7 days; that is, the last 5 weekdays and last weekend, Saturday and Sunday. We are not going to talk about light activities, such as slow walking, light housework, or non-strenuous sports such as bowling, archery, or softball. Please look at this list (Card 4), which shows some examples of what we consider moderate, hard, and very hard activities. (Interviewer: Hand subject list and allow time for the subject to read it over). People engage in many other types of activities, and if you are not sure where one of your activities fits, please ask me about it.

3. First, let's consider moderate activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these moderate activities or others like them?

| Hours | Minutes |
|---|---|
| | |

4. Last Saturday and Sunday, how many hours did you spend on moderate activities and

| Hours | Minutes |
|---|---|
| | |

what did you do? (Probe: Can you think of any other sport, job, or household activities that would fit into this category)?

5. Now let's look at hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these hard activities or others like them? Please tell me to the nearest half-hour.

| Hours | Minutes |
|---|---|
| | |

6. Last Saturday and Sunday, how many hours did you spend on hard activities and what did you do? (Probe: Can you think of any other sport, job, or household activities that would fit into this category?).

| Hours | Minutes |
|---|---|
| | |

7. Now let's look at very hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these very hard activities or others like them? Please tell me to the nearest half-hour.

| Hours | Minutes |
|---|---|
| | |

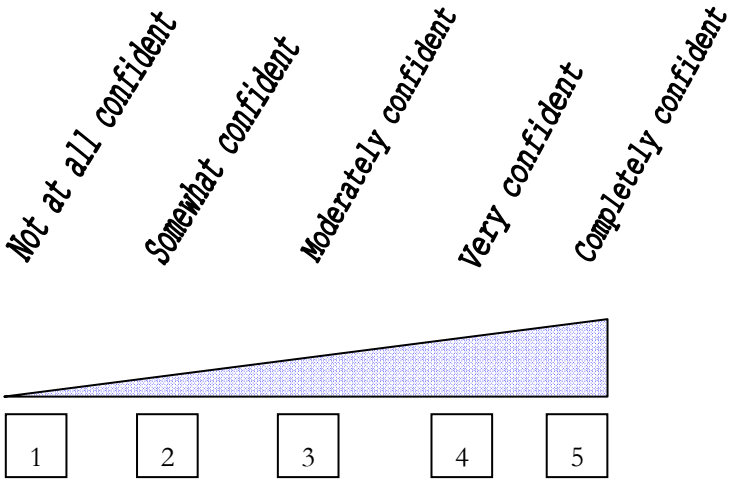
8. Last Saturday and Sunday, how many hours did you spend on very hard activities and what did you do? (Probe: Can you think of any other sport, job or household activities that would fit into this category?)

| Hours | Minutes |
|---|---|
| | |

## Section D: Exercise Confidence

From the Exercise Self-Efficacy Questionnaire (6 item short form) (Benisovich, Rossi, Norman, & Nigg, 1998; Prochaska & Di Clemente, 1984).

This part looks at how **confident** you are to exercise when other things get in the way (Reminder: 'Exercise' in this context is planned physical activity such as brisk walking, swimming etc). Read the following items enter in the box the number that best expresses how each item relates to you in your leisure time. Please answer using the following 5-point scale.




Q1: I am under a lot of stress

Q2: I feel I don't have the time.

Q3: I have to exercise alone

Q4: I don't have access to exercise equipment

Q5: I am spending time with friends or family who do not exercise

Q6: It's raining or snowing

## Section E: Alcohol

From the AUDIT Alcohol consumption Questions (AUDIT-C) (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998).

The next three questions relate to your consumption of alcohol.

Q 1: How often did you have a drink containing alcohol in the past year?

Never ☐
Monthly or less ☐
Two to four times a month ☐
Two to three times a week ☐
Four or more times a week ☐

Q2: How many drinks did you have on a typical day when you were drinking in the past year?

1 or 2 ☐
3 or 4 ☐
5 or 6 ☐
7 to 9 ☐
10 or more ☐

Q3: How often did you have six or more drinks on one occasion in the past year?

Never ☐
Less than monthly ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

## Section F: Emotions

From the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983).

This section is designed to help us to know how you feel. Read each item and put an X in the box next to the reply which comes closest to how you have been feeling in the **past week**. Please put a cross in only one box for each item. Don't take too long over your replies; your immediate reaction to each item will probably be more accurate than a long thought out response.

1. I feel tense or `wound' up

| | |
|---|---|
| | Most of the time |
| | A lot of the time |
| | From time to time, occasionally |
| | Not at all |

2. I still enjoy the things I used to enjoy

| | |
|---|---|
| | Definitely |
| | Not quite as much |
| | Only a little |
| | Hardly at all |

3. I get a sort of frightened feeling as if something awful is about to happen.

| | |
|---|---|
| | Very definitely and quite badly |
| | Yes but not too badly |
| | A little but it doesn't worry me |
| | Not at all |

4. I can laugh and see the funny side of things

| | |
|---|---|
| | As much as I always could |
| | Not quite so much now |
| | Definitely not so much now |
| | Not at all |

5. Worrying thoughts go through my mind

| | |
|---|---|
| | Not at all |
| | Not often |
| | Sometimes |
| | Most of the time |

6. I feel cheerful

| | |
|---|---|
| | Definitely |
| | Usually |
| | Not often |
| | Not at all |

7. I can sit at ease and feel relaxed

| | |
|---|---|
| | Nearly all the time |
| | Very often |
| | Sometimes |
| | Not at all |

8. I feel as if I am slowed down

| | |
|---|---|
| | A great deal of the time |
| | A lot of the time |
| | From time to time but not too often |
| | Only occasionally |

9. I get a sort of frightened feeling, like `butterflies' in the stomach

| | |
|---|---|
| | Not at all |
| | Occasionally |
| | Quite often |
| | Very often |

10. I have lost interest in my appearance

| | |
|---|---|
| | Definitely |
| | I don't take as much care as I should |
| | I may not take quite as much care |
| | I take just as much care as ever |

11. I feel restless as if I have to be on the move

| | |
|---|---|
| | Very much indeed |
| | Quite a lot |
| | Not very much |
| | Not at all |

12. I look forward with enjoyment to things

| | |
|---|---|
| | As much as I ever did |
| | Rather less than I used to |
| | Definitely less than I used to |
| | Hardly at all |

13. I get sudden feelings of panic

| | |
|---|---|
| | Very often indeed |
| | Quite often |
| | Not very often |
| | Not at all |

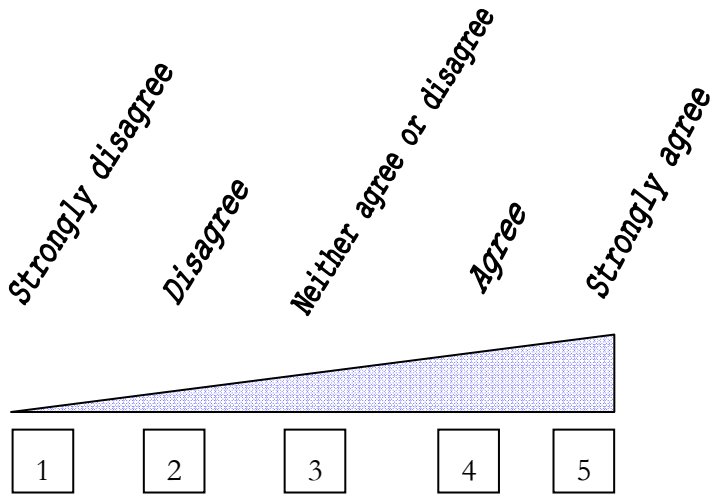
14. I can enjoy a good book or radio or TV programme

| | |
|---|---|
| | Often |
| | Sometimes |
| | Not often |
| | Very seldom |

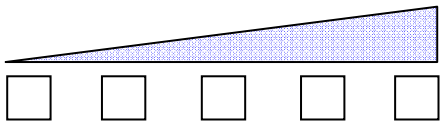
## Section G: Optimism

From the Life Orientation Test-Revised (Lot-R): A measure of Optimism versus Pessimism (Scheier, Carver, & Bridges, 1994).

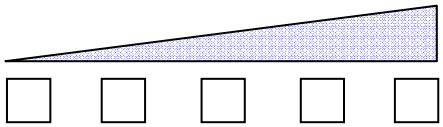
This section looks at the degree to which you expect positive outcomes, even when things are hard. Please indicate the extent of your agreement with each statement on the following 5-point scale *(Circle your answer)*



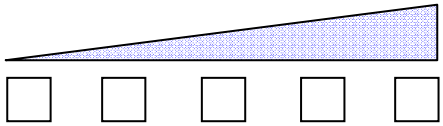

Q1: In uncertain times I usually expect the best



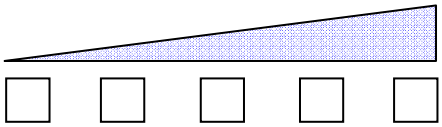
Q2: It's easy for me to relax.



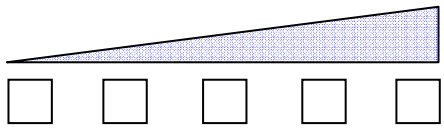
Q3: If something can go wrong for me, it will.



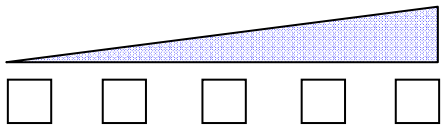
Q4: I'm always optimistic about my future.



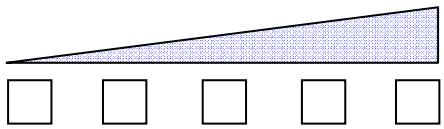
Q5: I enjoy my friends a lot.



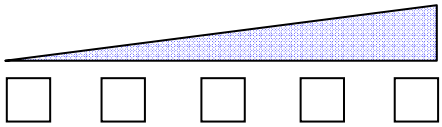
Q6: It's important for me to keep busy.



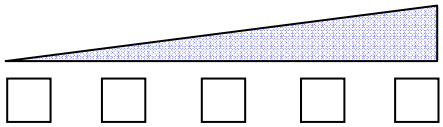
Q7: I hardly ever expect things to go my way.



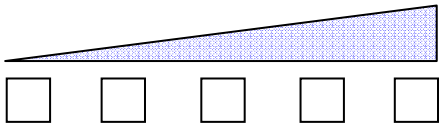
Q8: I don't get upset too easily.



Q9: I seldom count on good things happening to me.



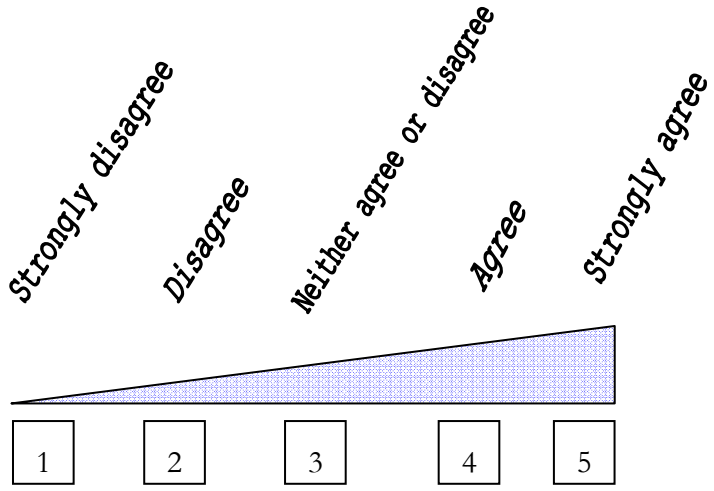
Q10: Overall, I expect more good things to happen to me than bad.



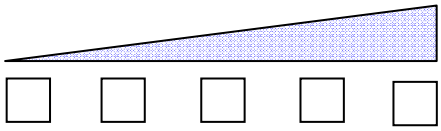
## Section H: Goal setting

From the Short-form Self-Regulation Questionnaire- Goal Setting (SSRQ-GS) (Neal & Carey, 2005).

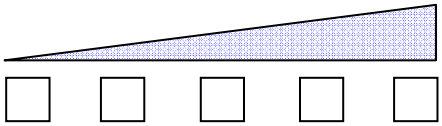
This section looks at the degree to which you goal-directed toward positive outcomes, even when things are hard. Please indicate the extent of your agreement with each statement on the following 5-point scale *(Circle your answer)*



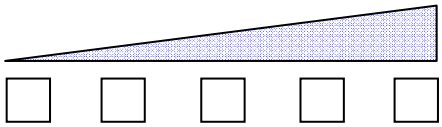

Q1: I usually keep track of my progress toward my goals.



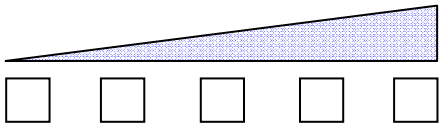
Q2: I am able to accomplish goals I set for myself.



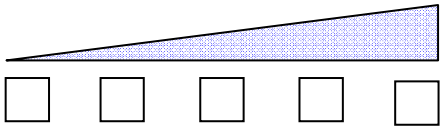
Q3: I have personal standards, and try to live up to them.



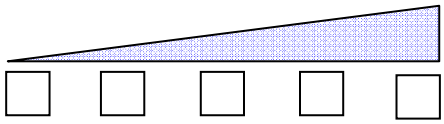
Q4: As soon as I see a problem or challenge, I start looking for possible solutions.



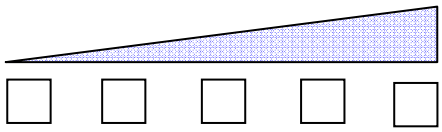
Q5: (R) I have a hard time setting goals for myself.



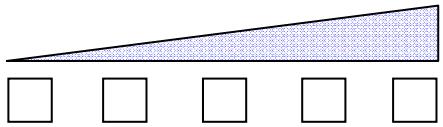
Q6: When I'm trying to change something, I pay a lot of attention to how I'm doing.



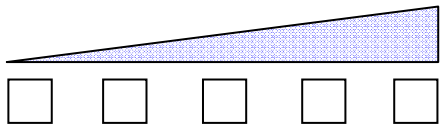
Q7: I have trouble making plans to help me reach my goals.



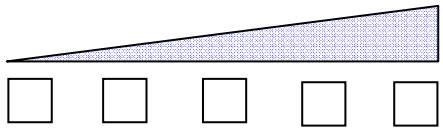
Q8: I set goals for myself and keep track of my progress.



Q9: If I make a resolution to change something, I pay a lot of attention to how I'm doing.



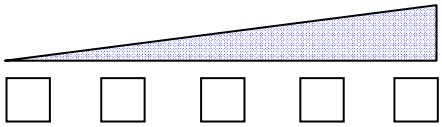
Q10: I know how I want to be



## Section I: Physical Activity Goals

This section asks about any physical activity goals.

Q1: To what extent do you have physical activity goals with respect to your health, in particular the self-management of your type 2 diabetes? (Card 4)



Q2: Can you please rate the physical activity goals you described at our first interview on a 0-10 scale for 'Goal-achievement' (n/a = no longer a goal, 0= not achieved ⇨ 10= achieved)

Researcher to attach time-one goals in the box below

Q2a. Overall, how would you rate your progress toward your idea of 'ideal' physical activity for health? (0-10 scale)

Q2b. What one thing would help you most to reach your 'ideal' level of physical activity?

--

## Section J: Life Stress

Adapted/simplified from the Traumatic Stress Schedule (Norris, 1990).

This section is asking you if your have, in the last six months, experiences an event that is outside the range of usual human experience that would be markedly distressing to almost anyone (for example serious injury).

Q1: In the past six months, did anyone take something from you by force or threat of force, such as in a robbery, mugging, or hold-up?

Q2: In the past six months, did anyone beat you up or attack you?

Q3: In the past six months, did anyone make you have sex by using force or threatening to harm you? This includes any type of unwanted sexual activity.

Q4: In the past six months, were you in a motor vehicle accident serious enough to cause injury to one or more passengers?

Q5: In the past six months, did a loved one die because of an accident, homicide, or suicide?

Q6: In the past six months, did you suffer injury or property damage because of fire, severe weather, or a natural or manmade disaster?

Q7: In the past six months, were you ever forced to evacuate from your home of did you otherwise learn of an imminent hazard in your environment?

Q8: In the past six months, did you have some other terrifying or shocking experience?

Q9: In the past six months, has your life changed in an important way such as in your residence, job, or personal relations? If more than one change, think about the one that was the most important for you.

Probe Question: "Did this event significantly impact on your ability to manage your type 2 diabetes, in particular your efforts regarding physical activity, and your progress toward better health outcomes"? To be asked if "yes" is answered to any of the Qs 1-9.

Sum

**Certification**

I hereby certify that this is a true and accurate record of an interview conducted by me at the time and with the person specified.

Interviewer's name _____

Date: ___/____/_____

Interview Duration: _____ minutes

Interviewer Sign: _____

## *7.3 Appendix C:* Subject score sheet (sample)

## Example score sheet

**Table 15** •Example of a subject's follow-up score sheet summary table using Microsoft Excel®

| Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sex | | | | | | 0 | M=0, F=1 |
| Age | | | | | | 55 | yrs |
| Ethnicity | | | | | | 1 | |
| Height | | | | | | 1.65 | m |
| Weight | | | | | 90 | 87 | kg |
| BMI | | | | | 33.05 | 31.1 | kg/m² |
| HbA1c | | | | | 9.8 | 7.2 | mmol/l |
| EDUC | | School=S; Higher=H | | | | H07 | highest |
| Income | | | | | | 10 | |
| Smoking | | | | | | 0 | N=0, Y=1 |
| Daily Energy expenditure | | | | | 33.2 | 35.75 | Kcal/kg/day |
| Stage of Change | Maintenance | FALSE | FALSE | FALSE | FALSE | | Stage |
| Ex. Self-Efficacy | | | # | | 9 | 23 | 6-30 scale |
| Alcohol | Men: x ≥ 4 = positive | | | | 7 | Positive | 5 |
| | Women: x ≥ 3 = positive | | | | | Positive | |
| Anxiety | | False or Anxiety | | | 10 | FALSE | 5 |
| Depression | | False or Depression | | | 8 | FALSE | 0 |
| Optimism | | | | | 22 | 27 | 6-30 scale |
| Goal-directed (global) | | | | | 40 | 42 | 10-50 scale |
| Goal-directed (exercise) | | | | | 4 | 5 | 0-5 scale |
| Stress screen | | | | | 1 | 0 | events |

## *7.4 Appendix D: Subject reported enablers for physical exercise*

**Subject reported enablers for physical exercise**

"When I get to the point of employing more good staff so that i can free up more time for myself". "when I can cut back the overseas travel".

"A mild winter will help me get out and keep up my exercise".

"To be able to stay at it a bit longer; to build endurance"

"Willpower" meaning 'motivation', which comes from within. "To overcome a certain degree of laziness at times. "I need someone to 'egg me on' a bit sometimes.

"To be able to maintaining the goal now"

"Learning to put myself first more often".

"Somebody to walk with me to accompany me"

"Less hours of work" and "good weather and a good location/environment"

"Progressing my walking so my body is not sore, as I get sore legs when I walk for too long

"If something went wrong with my body that gave me a big incentive to get more active".

"Time and motivation. I actually have to organise my time better to allow me to do the things I want to do. Being able to just say 'no I am off' and making a conscious effort to make the time"

"Gain confidence in myself (generally) which will give me confidence to go out and exercise. I have a real sense of wanting to increase my self -worth and I want to make progress on this. The more fun I have, the more progress I make"

"If someone would help me and support me and do the exercise with me".

"Reduce my time spent at work, which I intended to do last year, but I still have to achieve this".

"Better weather conditions for walking"

"It would help if we both motivated each other to get out and do the walking together".

"Having a partner that would do some of this activity/exercise with me, some of the time,

would help”

“More time for me and less time at the business”.

“Generally, to maintain my exercise as I am going now”.

“Temperature. Temperature affects the fit of my prosthesis and cooler temperatures suit me best”.

“Some company. It is lonely out there on your own doing the exercise”.

“Money to pay for equipment/fees”

“Having less back pain would make it easier to exercise and it would be more enjoyable”

“Being able to buy good clothing and gear to exercise in which is in my size e.g. sports bra and swimwear”

“It is just the circumstances, I am involved in other social activities and these take time. My life is varied and I am happy with my physical activity”.

“If I had more time I might exercise more. I have more responsibilities now, and other things can be distracting and take up time”.

“Weather and time make the most difference to my walking activity. In the winter I probably don’t walk as much as I should”.

“Keeping fit and keeping an active mind, mixing socially, and exercise to keep living longer and healthy with a positive attitude. Stimulating the brain!”

“My self-motivation is what keeps me going. I have a lot more confidence to do things and if I want to, I just do it! It is all for my benefit”.

“Maintaining my routine is the key to keeping up my exercise in the future”.

“Improvements in my general health”

“Continuing to reduce my weight”

## 7.5 *Appendix E:* Subjects' goals at baseline

**Subjects' goals at baseline**

-Walking every day if possible for one hour if possible.
-To do as much as I can
-To try to get swimming

-Buy the armchair exercise video and do exercises 2-3 times per day and progress to the 'level 2' video when improved coordination
-Follow the recommendations for diet as per the education seminar
-Have a one-on-one session with the intuitionalist.

-Do a bit more exercise, do more walking with friends
-Swimming one morning per week with an aqua class
-Hoping to find out where I am with blood sugars and bring them within acceptable levels
-Knowing what I and cannot eat. Have a one-to-one session with nutritionist
-Lose a bit of weight 2-3kg

-Walking more often for 30min-1hr 30min (depending)
-Include Yoga
-Drink more water
-Improve diet

-Exercise to lose weight
-Improve physical wellbeing
-Improve appearance, re-weight and body image
-Learn to enjoy exercise as recreation

-Change in diet to reduce sugar
-Reduce weight, would like to be below 95kg
-To do activities at an intensity that makes me sweat (maintaining this) in some form or other.

-Weight loss

-Increase exercise, as in the last year I have not done enough exercise

-Healthy eating

-Need to get fit for walking on an overseas trip in the next 5 weeks

-Be able to get onto walking machine (treadmill)

-Was walking two days per week but had an injury of the knee and cant walk

-Was going to the gym two years ago but stopped going because of the knee and lack of time

-Swimming: Love it but time is the thing. I like to do lengths. I need to schedule in time that suits when not busy. I need to find out when quiet and when the lanes are open.

-Re-focus on something that works for my knee.

-Hydro-therapy pool. I may be able to get a programme that increases fitness without aggravating knee. I want to find out about this possibility.

-I started from doing nothing, now cycling is my major exercise and I intend to do as much as I can. 40min per day would be ideal but a bit hard to maintain. Now I am doing 3-4 times per week.

-Walking: put in a lot more walking. Intend to do more walking starting in summer time.

-Intend to maintain exercise as family history of diabetes

-Play more golf (has not been time due to work schedules)

-Eating well, even if too much. Control intake, even if a bit overweight I can neutralize it a bit with exercise.

-Brisk walking for exercise, every day plus a set of muscular exercises (am doing this now)

-Get blood circulating and respiration up.

-Walking more now and at a brisker pace and put in much more effort.

-Started chair exercises

-Aquacise: now at a harder pace

-Thinking of joining a gym, not decided

-Much more conscious of intensity of exercise and paying attention to making even more effort.

-Have found much more enjoyment from exercising

-I am now parking car a way away from where I am going and walking there and back

-Taking the stairs instead of the lift

-Lose weight

-Exercise daily by brisk walking

-Sleep more

-Getting back to riding my bike

-Involving more physical activity with my son (help him lose some weight too)

-Long-term goal is to get back to jogging

-Long-term goal is to play for a social hockey team

-Get back to dancing

-Hill walking, I like to do it on my own and I would love to be able to climb up the Bridal Path.

-Improve body image

-Join a tramping club and do regular tramping

-Continue with gym and increase regularity up to two times per week

-Continue with biking at present level two to three times per week.

## *7.6 Appendix F:* Interviewer instructions for the 7-Day recall

# The 7-Day Physical Activity Questionnaire: Interviewer instructions/questionnaire/scoring

## Interviewer instructions for the 7-Day recall interview *

### Interviewing Technique

Your technique should limit bias, and you should try to keep the interview from becoming tedious. It may be difficult for participants to remember their past week's activity. Some may not try very hard, and others may get bogged down in details. You should strive to achieve a happy medium. You should control the pace of the interview; extraneous talk should be avoided. If participants are going into excessive detail, you should remind them that they need not account for every minute but that an average or estimate is expected. You might ask, "How much time in general?"

It is important to remember that most of the participants you see will spend the vast majority of their waking hours in light activity. Many tiring and unpleasant household or occupational tasks do not have a very high energy cost. Clerks in a store, for example, may be on their feet all day and may feel fatigued, but the energy cost is in the light category. An exception to this example would be time spent in stocking shelves, which probably would be moderate activity. Also, for most occupational tasks that require at least moderate energy expenditure, it is important to accurately determine the time spent in the activity. In the stock clerking example, even though a person might do that activity for an entire shift, it probably would not equal 8 hours. You should try to subtract time spent on lunch, breaks, and the like.

### Interviewing Suggestions

You will be handing people lists of moderate, hard, and very hard activities. We have found it easier to give them all three lists to look at once, before we ask them any questions about their activity level in the past 7 days.

*Explain the following things before you hand them the list of activities* (otherwise, they may not attend to what you are saying because they'll be too busy looking at the list):

1. They are to think of the past 7 days. Stress that this is a recall of actual activities for the past week, not a history of what they usually do.

2. Weekdays and weekends will be treated separately. You may even help them figure out which days to include; for example, Monday through Thursday this week and Friday of last week would comprise the past 5 weekdays.

3. Weekdays include evenings as well.

4. We are not considering light activities, such as deskwork, standing, slow walking, light housework, softball, archery, bowling, and the like.

5. They should also consider types of activities that are not included on the lists but are similar in strenuousness.

*Mention the following things before you ask them questions about their activity level:*

1. You will ask them questions about each category of activities separately (because people tend to give stream-of-consciousness reports of their week).

2. You may ask them if the amount of activity they report is more, less, or about the same as usual (because people tend to be defensive, exaggerate the numbers, or offer rationales for low activity levels). This may enable the participants to give more accurate estimates of their activity level.

*While they are reporting the frequency with which they engage in various activities, be aware of the following:*

1. Don't let them sidetrack you.

2. You may wish to ask them about their weekends first. This enables them to practice giving you the information you need in a smaller block of time.

3. Check if the amount of time they are reporting is per weekend, per week, or per day. Someone may say, for example, "I did one hour of digging this past weekend," when what is really meant is, "I did one hour of digging each of the two days this past weekend."

4. Some people have trouble recalling or pinpointing the moderate to very hard activities they have engaged in the past 7 days. In such cases, try to cue them by asking, for example, "How about any housework that made you work up a sweat; do you take stairs at work; do you walk briskly to work; did you participate in any sports, any vigorous family activities; did you do any vigorous home repair or gardening?"

5. Some people have trouble quantifying the amount of time they spent doing moderate, hard, or very hard activities. In such cases, break down all of their activities into specific events and ask them how long they did each activity. Then sum up the amount of time relevant to each category. Finally, ask them if they agree with your calculations.

6. If you are unsure of the strenuousness of an activity that they may have participated in, ask them to describe the physical effort involved-for example, what does the activity entail, what other activity is it comparable to, do they work up a sweat? We have found that walking and running provide good frames of reference for classifying other activities. Everyone should be familiar with the relative intensity of brisk walking, which is at about the midpoint of the moderate activity category. Therefore, if some other activity subjectively seems to be about as strenuous to the individual as walking briskly, then the activity should be coded as moderate. Running at any speed falls into the very hard category. If some activity seems about as strenuous to the individual as running, classify the activity as very hard. If the activity in question seems harder than walking but not as strenuous as running, place it in the hard category. Be careful to be certain that the activity in question is performed continuously for at least 5 minutes. Some activities may be quite strenuous, but if they are performed intermittently, the overall energy cost may place them in the moderate category. A good example of this is weight lifting.

7. If the last week was totally atypical-for example, in the hospital or in bed, or involving a family crisis, a work crisis, or travel-it is permissible to go to the previous week for the survey. Do not take this action lightly; use it only in unusual circumstances.

8. If a person has weekdays instead of weekends off from work (for example, Tuesday and Wednesday instead of Saturday and Sunday), count the days off as weekends for purposes of the survey.

9. Be sure that the time reported for an activity was actually spent doing the activity. Being at the pool for 2 hours but only swimming for 15 minutes, for example, should be recorded as 15 minutes, not 2 hours. Working in the garden all day Saturday (8 hours) should mean actually working for 8 hours. Do not count the time on breaks, rest periods, meals, and the like.

10. For most activities, the rate at which they are performed can make a huge difference in the energy cost. It is possible to play singles tennis, for example, so as not to move around very much and not spend much energy. The rate of digging, for another example, could make the MET cost range from 3 to 12. Try to get some indication of how hard they are working at a particular task (Taylor et al., 1978).

* The following *interview instructions* are copied from:

Taylor, H. L., Jacobs, D. R., Schucker, B., Knudsen, J., Leon, A. S., & Debacker, G. (1978). A questionnaire for the assessment of leisure time physical activities. *Journal of Chronic Diseases, 31*, 741-755.

## The 7-Day Physical Activity Questionnaire #

Now I would like to know about your physical activity during the past 7 days. But first, let me ask you about your **Sleep Habits**.

3. On the average, how many hours did you sleep each night during the last 5 weekday nights (Sunday-Thursday)? (Record to nearest quarter hour).

| Hours | Minutes |
|---|---|
| | |

4. On the average, how many hours did you sleep each night last Friday and Saturday nights?

| Hours | Minutes |
|---|---|
| | |

**Exercise**

Now I am going to ask you about your physical activity during the past 7 days; that is, the last 5 weekdays and last weekend, Saturday and Sunday. We are not going to talk about light activities, such as slow walking, light housework, or non-strenuous sports such as bowling, archery, or softball. Please look at this list (Card 4), which shows some examples of what we consider moderate, hard, and very hard activities. (Interviewer: Hand subject list and allow time for the subject to read it over). People engage in many other types of activities, and if you are not sure where one of your activities fits, please ask me about it.

3. First, let's consider moderate activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these moderate activities or others like them? Please tell me to the nearest half-hour.

| Hours | Minutes |
|---|---|
| | |

4. Last Saturday and Sunday, how many hours did you spend on moderate activities and what did you do? (Probe: Can you think of any other sport, job, or household activities that would fit into this category)?

| Hours | Minutes |
|---|---|
| | |

5. Now let's look at hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these hard activities or others like them? Please tell me to the nearest half-hour.

| Hours | Minutes |
|---|---|
| | |

6. Last Saturday and Sunday, how many hours did you spend on hard activities and what did you do? (Probe: Can you think of any other sport, job, or household activities that would fit into this category?).

| Hours | Minutes |
|---|---|
| | |

7. Now let's look at very hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these very hard activities or others like

| Hours | Minutes |
|---|---|
| | |

them? Please tell me to the nearest half-hour.

8. Last Saturday and Sunday, how many hours did you spend on very hard activities and what did you do? (Probe: Can you think of any other sport, job or household activities that would fit into this category?)

| Hours | Minutes |
|---|---|
| | |

# The (updated) 7-Day Physical Activity Questionnaire, the Worksheet for Calculating Daily Energy Expenditure, and the List of Activities Shown to Participants During 7-Day Physical Recall Interview are adapted from:

Blair, S. N. (1984). How to assess exercise habits and physical fitness. In J. D. Matarazzo, N. E. Miller & S. M. Weiss (Eds.), *Behavioral health: A handbook of health enhancement and disease prevention* (pp. 424-447). New York: John Wiley & Sons.

## Worksheet for Calculating Daily Energy Expenditure

**Table 16** •Example of worksheet for calculating daily energy expenditure using Microsoft Excel®

| | | | |
|---|---|---|---|
| Daily hours of sleep | | 7.5 | hrs |
| Total Energy @ 1 MET | | 7.5 | |
| Daily hours of MODERATE activity | | 0.52 | hrs |
| Total Energy @ 4 METs | | 2.08 | |
| Daily hours of HARD activity | | 0 | hrs |
| Total Energy @ 6 METs | | 0 | |
| Daily hours of Very Hard activity | | 0 | hrs |
| Total Energy @ 10 METs | | 0 | |
| Daily hours of LIGHT activity | | 15.98 | hrs |
| Total Energy @ 1.5 METs | | 23.97 | |
| Body Weight Kg | | 96 | kg |
| Total Kilocalories/kg/day | Kcal/Kg/day | 33.55 | |
| Total Energy expenditure/day | cal. | 3220.8 | |

## List of Activities Shown to Participants During 7-Day Physical Recall Interview

### Moderate Activities

**Occupational Tasks:**
1. Delivering mail or patrolling on foot
2. House painting
3. Truck driving (making deliveries-lifting and carrying light objects)

**Household Activities:**
1. Raking the lawn
2. Sweeping and mopping
3. Mowing the lawn with a power mower
4. Cleaning windows

**Sports Activities (actual playing time):**
1. Volleyball
2. Ping Pong
3. Brisk walking for pleasure or to work (3 mph or 20 min/mile)
4. Golf-walking and pulling or carrying clubs
5. Callisthenic exercises

### Hard Activities

**Occupational Tasks:**
1. Heavy carpentry
2. Construction work-doing physical labour

**Household Tasks:**
1. Scrubbing floors

**Sports Activities (actual playing time)**
1. Doubles tennis
2. Disco, Square, or Folk dancing

### Very Hard Activities

**Occupational Tasks:**
1. Very hard physical labour-digging or chopping with heavy tools
2. Carrying heavy loads, such as bricks or lumber

**Sports Activities (actual playing time)**
1. Jogging or swimming
2. Singles tennis
3. Racquetball
4. Soccer

## *7.7 Appendix G:* Individual subject summary report (sample)

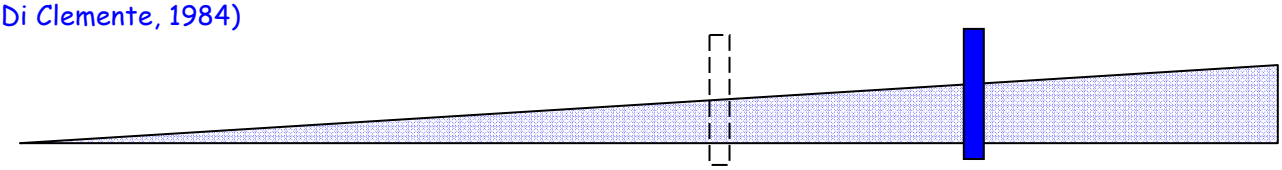
| | | |
|---|---|---|
| UNIVERSITY OF CANTERBURY<br>Te Whare Wānanga o Waitaha<br>CHRISTCHURCH NEW ZEALAND | **Individual Summary** **Date: 20/11/06**<br>**Name: Sample** | **Research Project**<br>Physical activity &<br>Type 2 Diabetes |

Individual Summary: This individual summary presents to you the information as recorded from your first and follow-up interviews. Comparing scores and goals from the first interview may be of interest to you, and perhaps assist you, as you work toward being physically active and successfully self-managing type 2 diabetes. **Please note:** this summary is not intended to *judge* what is "good" or "bad", rather, the summary is intended to *highlight* any changes and/or progress that may have occurred over the last six months.

**Note:** The marker indicates your 'Time 1' score and the marker is at 'Follow-up'

**Exercise readiness:** An indication of your participation in regular exercise.

Exercise Stages of Change Questionnaire (Marcus, Selby, Niaura, & Rossi, 1992; Prochaska & Di Clemente, 1984)

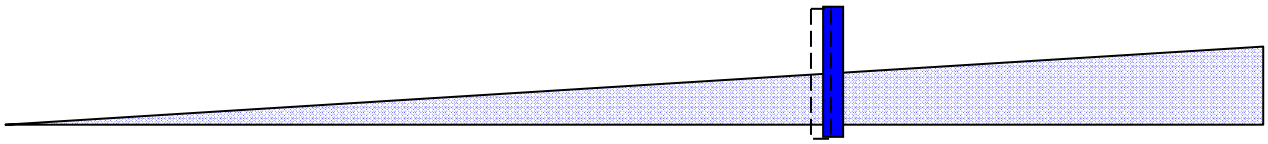


Pre-contemplation | Contemplation | Preparation | Action | Maintenance

**Note:** This scale represents your stage of planning and/or engagement with a regular exercise routine; to promote wellbeing as a part of every-day life.

David Brinson
MHealSc
University of Canterbury

**Body Mass Index (BMI):** An index of your body weight to height ratio.



20 Normal ⇨ 25 Overweight ⇨ 30 Very overweight/Obese ⇨ 50

**Note:** Based on the New Zealand Ministry of Health's classification of body weight/height categories for the general adult population [Note, for Māori and Pacific People: BMI greater than 32 = very overweight/obese]

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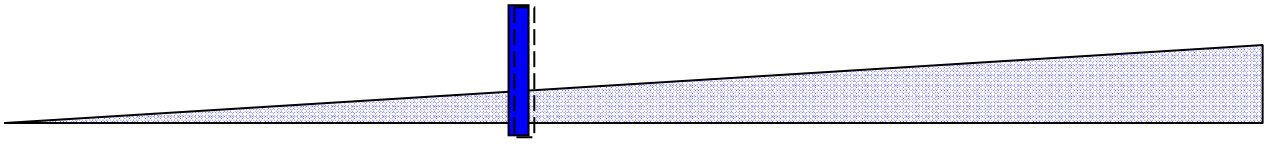
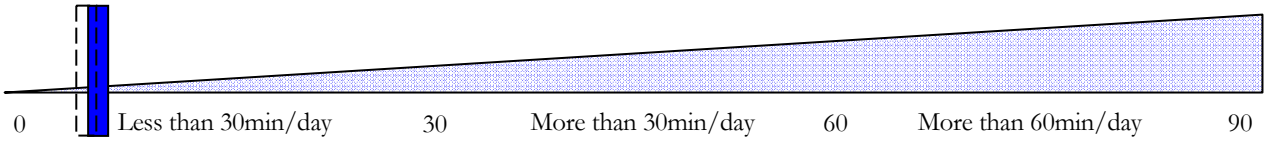
**HbA1c:** Gives an indication of your average blood glucose levels over the last three months (Note: this number is not equivalent to a glucose reading. It measures the percentage of haemoglobin in your red blood cells with glucose attached).



4% Normal ⇨ 6% **Good Control** ⇨ 7% Consider additional action 8% ⇨ Additional action required

**7-Day Physical Activity Recall:** Approximate average minutes of moderate exercise/day.

From the Stanford 7-Day Recall Physical Activity Questionnaire (Sallis et al., 1985).

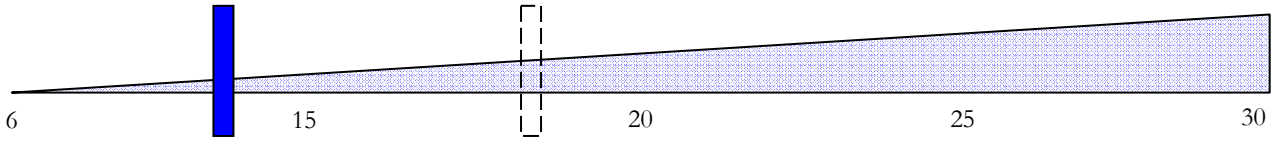


0 Less than 30min/day 30 More than 30min/day 60 More than 60min/day 90

---

**Exercise Confidence:** How confident you are to exercise when other things get in the way

From the Exercise Self-Efficacy Questionnaire (Benisovich, Rossi, Norman, & Nigg, 1998; Prochaska & Di Clemente, 1984).

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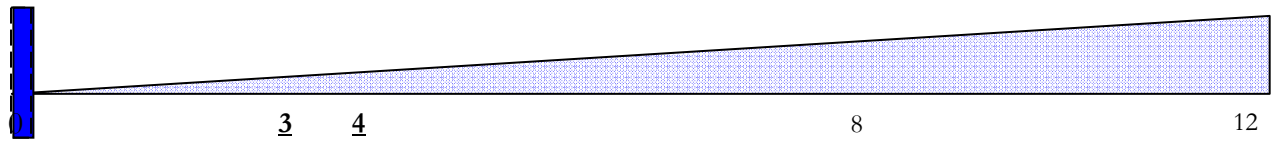
**Alcohol:** Alcohol consumption score.

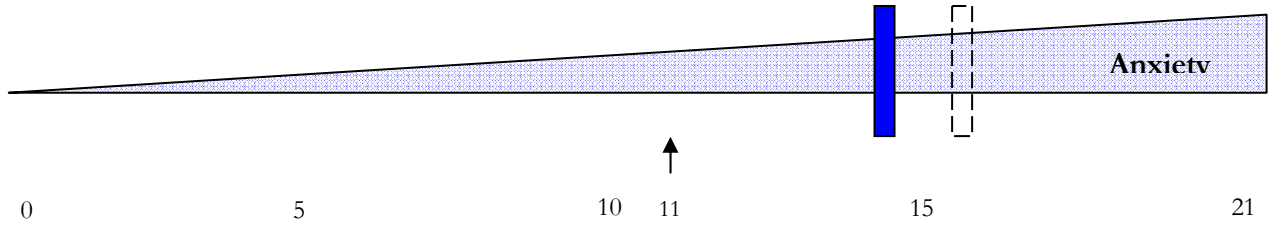
From the AUDIT Alcohol consumption Questions (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998).

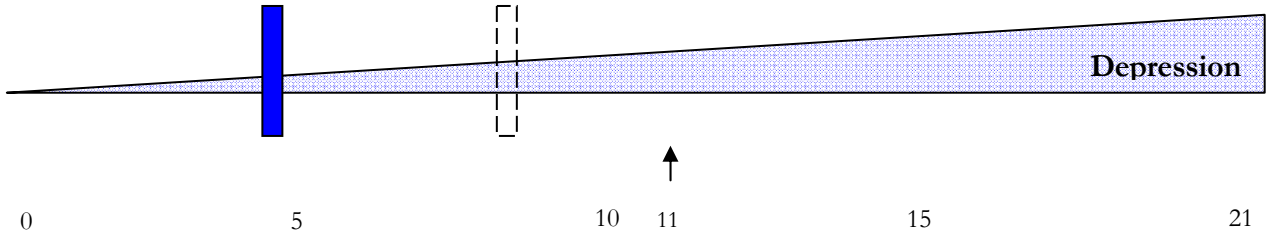



**Note:** The New Zealand Ministry of Health recommends that a score of **4 or less** is optimum for males, and a score of **3 or less** is optimum for females.

**Emotions:** How you reported that you were feeling in the week prior to each interview.

From the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983).




**Note:** The authors of the Hospital Anxiety and Depression Scale suggest that a score of **11 or greater** may indicate a significantly elevated level of anxiety of depression, as compared to the general population.

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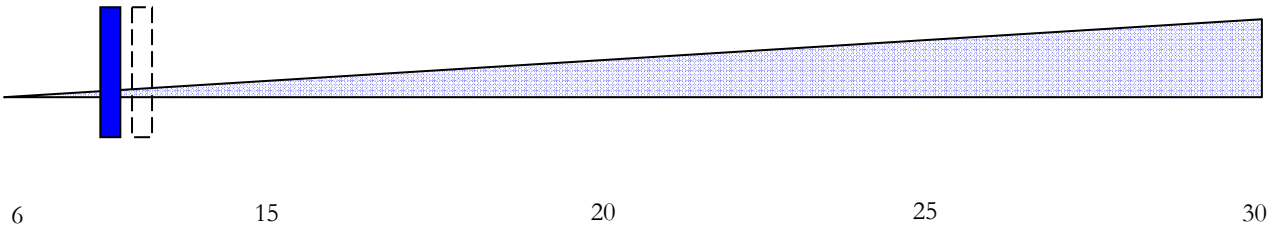
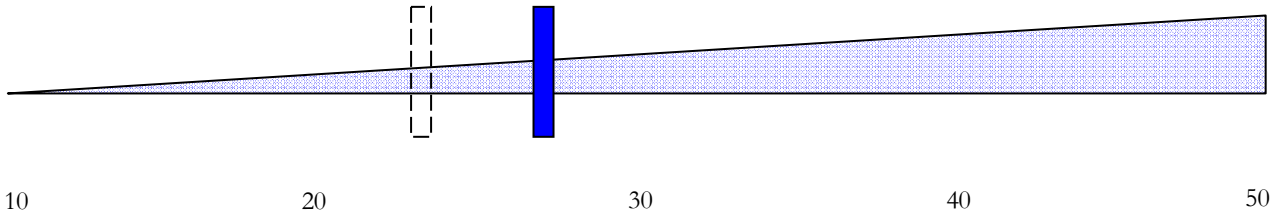
**Optimism:** The degree to which you expect positive outcomes, even when things are hard.

From the Life Orientation Test-Revised (Scheier, Carver, & Bridges, 1994).



**Goal setting:** The degree to which you goal-directed toward positive outcomes.

From the Short-form Self-Regulation Questionnaire- Goal Setting (SSRQ-GS) (Neal & Carey, 2005).




**Physical Activity Goals:**

Your physical activity goals as described at your first interview, and rated by you on a 0-10 scale for 'Goal-achievement', at the time of the second interview.

**Goal Achievement:** n/a = no longer applicable; 0 = not achieved ⇨ 10 = achieved

| | |
|---|---|
| 1 | Buy the armchair exercise video and do exercises 2-3 times per day and progress to the 'level 2' video when improved coordination |
| 5 | Follow the recommendations for diet as per the education seminar |
| 10 | Have a one-on-one session with the intuitionalist. |
| | |

- Overall, you rated your progress toward your physical activity goals as 6 out of 10
- The change that would help you most to make more progress toward your physical activity goals is: *"I would love someone to write out recipes just for me that are low carbohydrate and I would probably stick to it"* and *"If something went wrong with my body that gave me a big incentive to get more active"*.

David Brinson
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